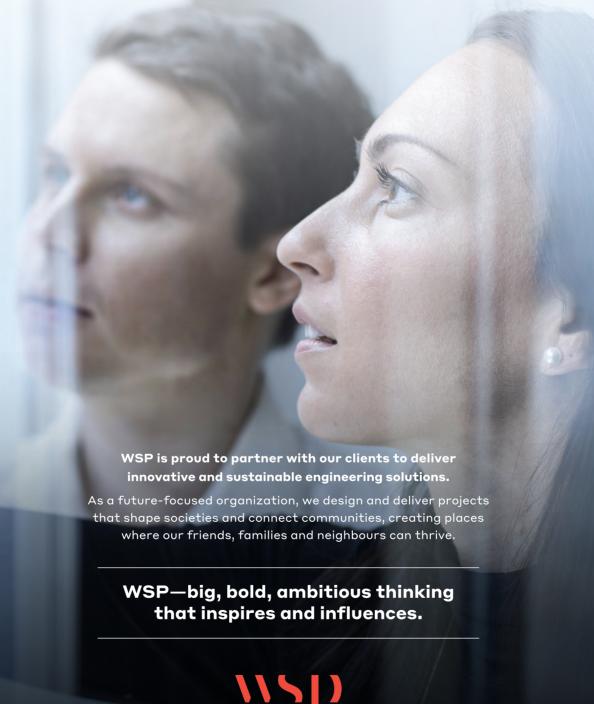


Question today Imagine tomorrow Create for the future



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Cover: Rendering of the mass timber Google Canadian headquarters in Sidewalk Labs proposal for Toronto's Quayside development. (credit: Picture Plane for Heatherwick Studio for Sidewalk Labs) See page 31



See page 23

departments

Comment	4
Up Front	6
ACEC Review	11
Products	30



Next issue:

51st Annual Canadian **Consulting Engineering** Awards.

August/September 2019 Volume 60, No. 5

features

Standing Tall. An award-winning tall tower project in downtown Toronto incorporates new innovative Canadian-designed damping technology. By Doug Picklyk	15
Be Prepared. Understanding the implications of the CAN/ULC S1001-11 standard for integrated systems testing of fire protection and life safety systems. By Dana Honsberger, P.Eng., LRI Engineering	20
Power Play. New utility-owned microgrid in North Bay, Ont. is the first of its kind in Canada. By Paul McMullen, S&C Electric Company	23
Canadian Women in Engineering Academia and Industry. Early findings from a collaborative research study by York University and the University of Waterloo. By Natalie Mazur, Bronwyn Chorlton, Jennifer Ellingham, and John Gales, P.Eng	26

on topic

LEGAL

New Federal Prompt Payment ... What It Means for Engineers. By Jonathan Martin, Miller Thomson. 29

CONVERSATIONS

Future City Planning. Insights from Stantec contributors into Sidewalk Labs' Toronto development plan. 31

CANADIAN I CONSULTING

Editor

Doug Picklyk (416) 510-5119 dpicklyk@ccemag.com

Senior Publisher

Maureen Levy (416) 510-5111 mlevy@ccemag.com

Media Designer

Andrea M. Smith

Contributing Editor

Rosalind Cairneross, P.Eng.

Fritarial Advisors

Bruce Bodden, P.Eng., Gerald Epp, P.Eng., Chris Newcomb, P.Eng., Laurier Nichols, ing., Jonathan Rubes, P.Eng., Paul Ruffell, P.Eng., Andrew Steeves, P.Eng.

Circulation Manager

Aashish Sharma (416) 442-5600 ext. 5206 asharma@annexbusinessmedia.com

Account Coordinator

Cheryl Fisher (416) 510-5194 cfisher@annexbusinessmedia.com

Vice President/Executive Publisher

Tim Dimopoulos (416) 510-5100 tdimopoulos@annexbusinesmedia.com

Scott Jamieson

CANADIAN CONSULTING ENGINEER

is published 7 times per year by Annex Business Media 111 Gordon Baker Road, Suite 400, Toronto, ON M2H 3R1 Tel: (416) 442-5600 Fax: (416) 510-6875 or (416) 442-2191

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Capitalizing on Innovation

n one of my first weeks as editor of this magazine I reached out to members of the existing editorial advisory board to ask for any trends or story ideas we should be covering in

vations from within consulting engineering firms themselves.

Andrew Steeves, P.Eng., was forthcoming about how there is much talk about the importance of innovation in the areas of business and technology, yet often the magazine's articles tended to focus on innovative technologies developed by equipment suppliers and applied by consultants—but not on inno-

He shared his own experience of working for 30 years with a consulting firm that supported the R&D that ultimately led to patented technology in water and wastewater treatment. The result was a spin-off company based in Fredericton, NB that now does work around the world.

He also pointed to other Canadian consulting engineering firms that have made breakthroughs in human resources and leadership development, and he was sure there are other examples to be found across the country.

I have always kept those thoughts in mind when conducting research for new articles, but until recently I wasn't finding the innovations I thought would be out there. Engineering firms are always solving problems for clients, but I was searching for the companies that were developing products they could sell along with their valuable services.

Finally, in this issue I think I've come close. The Viscoelastic Coupling Damper is a solution for high-rise buildings that can enhance both the wind and seismic performance of tall buildings by adding damping elements in place of reinforced concrete coupling elements. The award-winning technology emerged from the collaborative efforts of consulting engineers in practice and researchers at the University of Toronto, and the technology is working today in a new tower in downtown Toronto (read more p.15).

Also in this issue we learn more about the technology innovations that are being proposed by Google's sister company, Sidewalk Labs, in its development plan for Toronto's Quayside neighbourhood along Lake Ontario.

Sidewalk Labs was founded "to combine forward thinking urban design and cutting-edge technology to radically improve urban life." When you're part of a US\$137 billion U.S. conglomerate there's room for a little forward thinking and R&D spending.

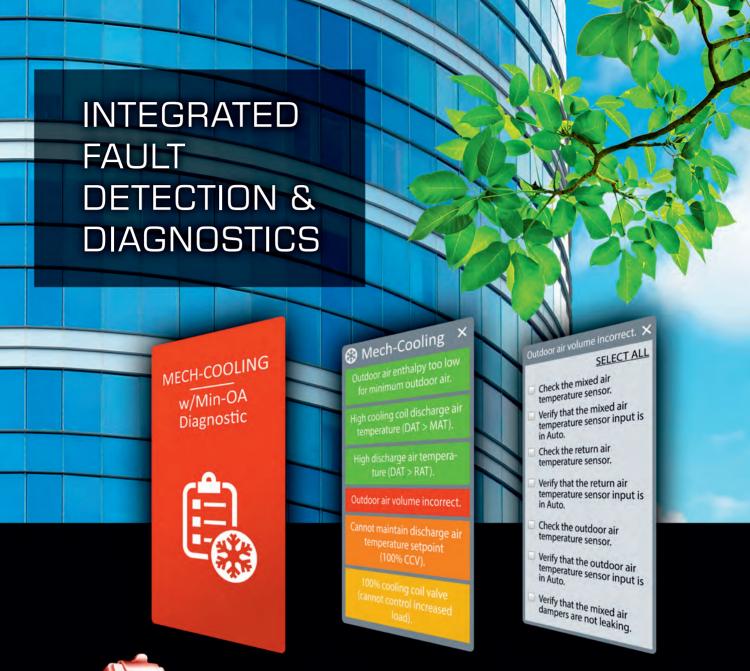
In June Sidewalk Labs released its draft Master Innovation and Development Plan, and it acknowledges a long list of Canadian design and technical consultants including about a dozen engineering firms.

The proposal presents grand new ideas. It will be the world's first all mass timber neighbourhood. It calls for low carbon energy and an advanced power grid. It will have smart waste management built into the infrastructure, and unobtrusive underground logistics using robotic vehicles to shuttle goods. And there will be ubiquitous connectivity—free WiFi for everyone.

While the innovations that will eventually emerge from this development may not lead to new commercialized products for local consulting engineering firms, they will provide a world stage and springboard for our firms to be recognized as smart city experts for years to come.

www.canadianconsultingengineer.com August/September 2019

Doug Picklyk





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Rendering of the new Fast + Epp headquarters, a four-story mass timber/steel hybrid structure.

COMPANIES

New Headquarters for Fast + Epp

Shovels are in the ground for a new four-storey mass timber home office in Vancouver, B.C. for structural engineering specialists Fast + Epp.

After 30 years in their current Kitsilano location, the firm is moving closer to transit and using a new materialsefficient building design which will include:

- a pre-fabricated, hybrid mass timber and steel superstructure
- electro-chromatic glass
- CLT firewall prefabricated with exterior finishes
- Tectonus an earthquake-resistance technology will anchor the CLT shearwalls and will be a first in North America.

"The entire Fast + Epp team is really proud of this new office design. It's allowing us to experiment with features and structure that are at the forefront of what we do as a firm, and gives us the freedom to be practical and thoughtful, yet also adventurous," said Paul Fast, P.Eng., of Fast + Epp in a company release.

SNC-Lavalin reorganization

SNC-Lavalin interim CEO Ian Edwards announced that the firm is exiting the lump-sum turnkey contracting business, even withdrawing from some projects, and has reorganized its poorly performing oil & gas, mining & metallurgy, and infrastructure construction segments into a separate business line called SNCL Projects.

Going forward the firm may divest its resources segment or transition it to a services-based business.

Also under the reorganization, all other business segments including EDPM (engineering, design & project management), nuclear, and infrastructure services now fall under SNCL Engineering Services.

MTE Consultants grows in Southwestern Ont.

With established offices in Burlington, Kitchener, Stratford and London, Ontario, MTE Consultants has recently been growing its capacity and service offering in the London area with the recent acquisitions of two London-based consulting firms, BioLogic and Hastings & Aziz.

BioLogic is an environmental consulting firm that provides aquatic and terrestrial ecosystem services, while Hastings and Aziz is a structural engineering firm led by principals Karl Buczkowski, P.Eng., Jeffrey Reid, P.Eng. and James Gillett, P.Eng.

COMPANIES

RJC Leadership news







Kevin MacLean



.lames Munro



Mark Ritchie

Earlier this year RJC Engineers announced the appointment of four new principals to its leadership teams across the country: Michael Blackman, P.Eng., Kelowna (structural engineering/ building science & restoration); Kevin Maclean, P.Eng., Toronto (structural engineering); James P.Eng., Vancouver Munro, (structural engineering); and Mark Ritchie, P.Eng., Calgary (structural engineering).

S+A's newest Principals

Smith + Andersen has welcomed Elaine Guenette, P.Eng., and David Hultman, P.Eng., as new principals of the firm, Guenette resides Ottawa and Hultman is based in Vancouver. Guenette has been with S+A her entire career. while Hultman joined in 2011.



Elaine Guenette



David Hultman



Initial rendering of the early design for the new JLR headquarters in Ottawa.

New J.L Richards office to emphasize Wellness

J.L. Richards & Associates (JLR) has announced plans to design and construct a new high-performance, green office building to replace its current Ottawa facility.

The notional renderings of the engineering, architecture, and plan-

ning firm's new space depict a fivestorey, 50,000 sq. ft. building with a strategic mid-rise built form situated along the Queensway, Ottawa's main east-west corridor.

Strategic pockets of greenspace and outdoor seating areas surround the building, specifically selected to promote wellness and provide natural spaces for staff.

"The design process will continue over the coming months as we address the different features related to sustainability, such as the important renewable energy components and the high-performance building envelope," explains Sébastien Racine, an associate and senior architect with JLR and the project manager for the new office development. "In the meantime, I can say that our integrated design process specifically targets user

wellness and sustainable design components in achieving technology-driven, user-friendly spaces that encourage collaboration."

Ecora acquires Omega

Ecora Engineering & Resource Group based in Kelowna, B.C. has acquired Omega & Associates Engineering, a civil and structural engineering firm with offices in Chilliwack and Surrey, B.C.

Originally launched in 2010 as a forestry and environmental services firm, Ecora now has locations across the province offering a full spectrum of consulting services in engineering and natural resources

LRI Engineering expands into Alberta

Toronto-based fire protection engineering specialists LRI Engineering



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Inc., with offices in Toronto, Ottawa and Montreal, is expanding into Alberta with the opening of a new branch office in Calgary.

This is the second branch office opened by the firm this year, following the announcement of its new practice in Montreal this April.

Pageau Morel launches Creative Solutions team



Roland Charneux (left) and Jacques Lagacé lead Pageau Morel Creative Solutions team.

Montreal-based Pageau Morel has launched a Creative Solutions team, consisting of Roland Charneux and Jacques Lagacé, both recognized leaders who have directly influenced the consulting engineering industry in Canada in the fields of energy efficiency and sustainable development.

This duo will serve as mentors, references, and advisors while supporting the technical development of the firm's staff to strengthen the quality assurance of its projects and promote leading-edge design.

TRANSPORTATION

Montreal's Samuel De **Champlain Bridge Opens**

The Government of Canada officially inaugurated the Samuel De Champlain Bridge, the new toll-free link between Montreal and the South Shore.

Construction of the 3.4km bridge, which spans the St. Lawrence River between the communities of Montreal and Brossard, took just over four years to complete and required the efforts of more than 2,000 individuals, including more than 1,600 construction workers at the height of construction.

The new crossing, which was

designed and built to last 125 years was the result of a public-private partnership between Infrastructure Canada and Signature on the St. Lawrence—a consortium made up of:

- SNC-Lavalin
- ACS Infrastructure Canada
- HOCHTIEF PPP Solutions North America
- Dragados Canada
- Flatiron Construction Canada
- MMM Group
- TY Lin International
- International Bridge Technologies

The role of Independent Engineer on the project was undertaken by Ramboll and Stantec; the two firms oversaw the design conformity and overall quality of the project

The conceptual design and architectural framework were developed by Arup Canada and Poul Ove Jensen of the firm Dissing+Weitling with the collaboration of Provencher Roy and in consultation with an Architectural Quality Panel consisting of l'Ordre des architectes du Québec, l'Ordre des ingénieurs du Québec, Mission Design, Heritage Montréal, Ville de Montréal and Infrastructure Canada.

ENERGY

Infrastructre Bank broadens portfolio

The Government of Canada and Canada Infrastructure Bank are committing a total of \$71.1 million in funding to further explore VIA Rail Canada's proposal for High Frequency Rail in the Quebec City-Toronto Corridor. This is the third rail-related investment by the CIB, the first two were the \$1.28 billion backing of Montreal's Réseau express métropolitain (REM); and \$2 billion for Ontario's GO Expansion – On Corridor project.

More recently, CIB committed to a collaboration with the Lulu Island Energy Co. to develop a new district energy project in Richmond, B.C.

The new project will expand the City's district energy systems from 3.6 million to more than 50 million sq. ft.

COMPANIES

NORR's new CEO

The NORR group has named Brian Gerstmar president and CEO. Gerstmar succeeds Victor Smith, who steps down as CEO after 15 years.



Gerstman

Spencer leads HH Angus health division

Kim Spencer, P.Eng., a principal with two decades as a manager and mechanical engineer with HH Angus now leading the firm's Health



Kim Spencer

Division, its largest service group.

Rudd Retires

On June 30, Kerry Rudd, P.Eng., stepped down as CEO of Associated Engineering, retiring after 37 years with the organization. As part of the planned transition, Martin Jobke, P.Eng., who became president in January 2018, has added the CEO title. Rudd remains involved as Chair of the Board.

New GM at NOR•EX

Al Fitzgerald, P.Eng., is now general manager of NOR•EX Engineering, a member of the Associated Engineering group of companies. Based in Kamloops, Fitzgerald is also the national practice leader, Ice Engineering. Also, Dana Woodworth is now national practice leader, community resilience, with NOR•EX.

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CHAIR'S MESSAGE/ MESSAGE DU PRÉSIDENT DU CONSEIL

ACEC encourages members to speak up on behalf of the industry



CEC is working hard to ensure the voice of consulting engineering is heard in the upcoming fall election. To this end, we're implementing a comprehensive election plan, including a website that puts the value of infrastructure at the forefront of our election priorities.

Through their work, consulting engineers generate economic opportunities, create safe and sustainable communities, and help protect the environment. Increasing awareness of this — the important role consulting engineers play in our daily lives — will further amplify the profile of our industry and its interests. That's where ACEC-Canada needs your assistance. We want to ensure our message is heard by all candidates, from all parties, from coast to coast; this is an essential part of our election plan. The more people who speak up about the importance of infrastructure to the social, economic, and environmental quality of life of Canadians, the more our message will spread awareness to candidates in every riding across Canada.

We encourage the consulting engineering sector to get

involved and join our efforts to ensure timely infrastructure investments remains a top election priority. ACEC members and all Canadians are encouraged to visit our election website to find out more about the critical need to accelerate the delivery of infrastructure funding, the importance of creating a national right of way to connect communities and markets, and to learn more about ACEC's advocacy on infrastructure. The site allows visitors to send a form letter to all candidates in their riding, including incumbent Members of Parliament, to tell them how infrastructure investments improve every aspect of our economic, social and environmental quality of life.

Additionally, you can also share our election priorities through your social media networks using #InfrastructureTheRightWay. Within your own communities you can also attend candidate debates and speak up on behalf of our industry by raising the importance of timely infrastructure investment done the right way.

To view our election website please visit: www.investinfrastructure.ca

> MICHAEL SNOW, P.ENG., ING., M.A.SC. CHAIR, BOARD OF DIRECTORS, ACEC-CANADA

L'AFGC invite ses membres à prendre la parole au nom de l'industrie

'AFGC travaille d'arrache-pied pour s'assurer que la voix du génie-conseil soit entendue pendant la campagne qui débouchera sur des élections, cet automne. Pour ce faire, nous sommes en train de mettre en œuvre un plan d'action exhaustif prévoyant, entre autres, la création d'un site Web qui souligne les priorités qui sont les nôtres pendant la période électorale avec, au premier chef, les infrastructures.

Grâce à leur travail, les ingénieurs-conseils créent des débouchés économiques, des collectivités sûres et durables et contribuent à la protection de l'environnement. Pour rehausser le profil de notre industrie et défendre ses intérêts, il est important de sensibiliser le public et les politiciens au rôle de premier plan des ingénieurs-conseils dans notre quotidien à tous. C'est pourquoi l'AFGC-Canada a besoin de votre aide. Nous voulons veiller à ce que notre message parvienne aux candidats de tous les partis, d'un bout à l'autre du Canada. C'est un volet essentiel de notre plan d'action pendant les élections. Plus il y aura de gens qui parleront de l'importance de l'infrastructure pour la qualité de vie sociale, économique et environnementale des Canadiens, plus les candidats de toutes les circonscriptions canadiennes seront sensibilisés aux priorités qui sont les nôtres.

Nous invitons donc le secteur du génie-conseil à se joindre à nos efforts visant à s'assurer que l'investissement

opportun dans l'infrastructure demeure au nombre des grandes priorités pendant les élections. Les membres de l'AFGC et tous les Canadiens sont encouragés à se rendre sur notre site des élections pour se renseigner sur la nécessité absolue d'accélérer le financement des infrastructures, sur l'importance de créer un réseau national d'emprises qui reliera les collectivités et les marchés, et sur le travail réalisé par l'AFGC pour défendre le dossier des infrastructures. Le site Web permet aux visiteurs d'envoyer une lettre à tous les candidats de leur circonscription, y compris aux députés en exercice au Parlement, afin de les sensibiliser au fait que les investissements en infrastructure améliorent tous les aspects de notre qualité de vie économique, sociale et environnementale.

De plus, vous pouvez faire part de vos priorités pendant la campagne électorale en envoyant le mot-dièse #Infrastructureenbonnevoie aux membres de vos réseaux dans les médias sociaux. Au sein de votre collectivité, vous pouvez aussi participer aux débats des candidats et prendre la parole publiquement au nom de notre industrie pour souligner l'importance d'investissements opportuns dans des infrastructures bien faites.

Notre site Web est accessible à l'adresse suivante : www.investinfrastructure.ca

> MICHAEL SNOW, P.ENG., ING., M.SC.A. PRÉSIDENT, CONSEIL D'ADMINISTRATION, AFG-CANADA

Election 2019: Making the value of infrastruct

The October federal election will be critical for Canada's economic, social and environmental viability. ACEC-Canada is already working on educating the candidates on our election priorities.

Our Election Priorities

Accelerating delivery of infrastructure funding to improve communities & drive the economy While it is a welcome and sound investment, the Federal Government's \$180-billion commitment

to infrastructure through the Investing in Canada plan is behind schedule. These investments are critical to strengthening the economy and Canada's competitiveness. They are also critical to improving the social and environmental quality of life for Canadians.

ACEC-Canada has recommendations that will help accelerate and more evenly distribute investments over the next decade so that communities and owners of infrastructure can make informed decisions and realize the maximum possible benefits from these investments. These recommendations can be viewed at www.investinfrastructure.ca.

Creating a national right of way that connects Canadians, communities, and markets

Communities need important nation-building projects approved with far more certainty.

Canada must establish a national network of infrastructure corridors to accommodate multiple

assets, including roadways, railways, pipelines and communication projects. A nationwide network of these corridors would connect all regions of Canada, helping address social and environmental concerns,

while allowing progress and economic growth.

This bold nation-building project has been under consideration for over 50 years but needs leadership to make it happen.

ACEC-Canada is prepared to work with the Federal
Government and its stakeholders to make this vision
a reality. This map incorporates a suggested
corridor (yellow), that would connect with Canada's
existing rights of way (blue).

Map: Andrei Sulzenko and G. Kent Fellows, "Planning for Infrastructure to Realize Canada's Potential: The Corridor Concept," School of Public Policy, University of Calgary, SPP Research Papers, Vol. 9, Issue 22, May 2016.

#InfrastructureTheRightWay

ure a top priority

Help amplify ACEC-Canada's voice by supporting our efforts. There are many ways you can get involved and help make the value of infrastructure a top priority.

ACEC launches #InfrastructureTheRightWay election campaign

ACEC is working to ensure the voice of the consulting engineering industry is heard in the upcoming fall election. We're implementing a comprehensive election plan, including the microsite www.investinfrastructure.ca, that puts the value of infrastructure at the forefront of our election priorities. The site features:

Platform Analyses & Information

Analyses of the platform commitments related to infrastructure of each major party will be available as the platforms are released. We encourage you to visit www.investinfrastructure.ca to view these analyses.

Additional material on ACEC's advocacy activities related to accelerating infrastructure investments and creating a national corridor, as well as reference material including our recommendations, media coverage, and social media shareables are also available on the site.

Candidate Contact

Visit www.investinfrastructure.ca to send a form letter to candidates in your riding demonstrating your support for accelerated infrastructure investments and how they improve every aspect of our economic, social and environmental quality of life.





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- NEW FRAMEWORKS FOR THE FINANCING OF MAJOR PROJECTS
- MOVING CANADA'S ENERGY & NATURAL RESOURCE SECTORS FORWARD
- ELECTION 2019 WHAT THE RESULTS MEAN FOR CANADA & OUR INDUSTRY

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The 63-story YC Condos building is a tall slender building with a world's first damping system.

oronto continues to be the crane capital of North America. The most recent Rider Levett Bucknall Crane Index places the Ontario capital well above other cities on the construction front, a title Toronto has held since 2017. As towers continue to climb in the city, structural innovation also continues to grow and develop.

In April of this year the YC Condominiums tower, a new 63-storey development located at the bustling downtown intersection of Yonge St. and College Ave, received international acclaim when it was honoured with the 2019 Council of Tall Buildings and Urban Habitat (CTBUH) Award of Excellence in the structural engineering category, presented to RJC Engineers, project structural engineers, and Kinetica.

In addition, the damping technology used in this tall tower project, the Viscoelastic Coupling Damper (VCD) designed by Toronto-based Kinetica, won the top 2019 CTBUH Innovation Award.

The Tower

YC Condominiums, developed by Canderel, rises some 664 feet (202.2 metres), standing out along a tall building corridor of the city. The tower is located on a challenging site for design and construction, surrounded by roadway setbacks on three sides and a heritage building on the other. Its relatively small lot footprint (38m by 48m) related to its height gives it an 11-to-1 slenderness ratio.

Designed to be a reinforced concrete building, due to its height, the tower required a supplemental damping system to mitigate wind effects. And in order to maintain the desired condo layouts of the architectural concept, the tower required a damping solution with minimal overall impact on the design.

Early wind tunnel studies by RWDI revealed that a bi-level tuned sloshing damper tank could be used to reduce wind effects on the building. A liquidfilled tank positioned at the top of the

buildings

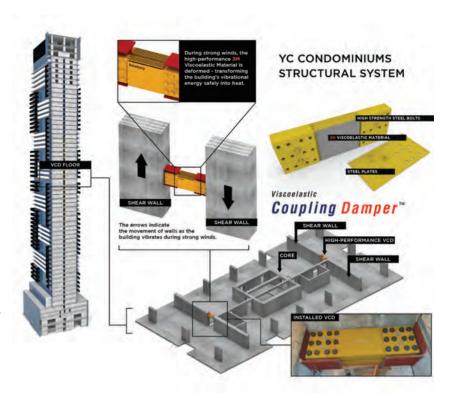
building would absorb vibration energy from the structure through the sloshing of the water, dissipating the motion effects on the building.

However, water tanks require valuable floor space that would compromise the tower design, especially for the luxury penthouse suites.

This led RJC Engineers to the Kinetica VCD solution, which is ultimately incorporated in place of structural concrete beams which does not impact the architecture of the building, and frees up space for the mechanical systems and sellable space on the top levels of the condo tower.

The VCD

Early research and development of the innovative Viscoelastic Coupling Damper (VCD) technology dates back to a collaboration between the University of Toronto and structural engi-







Top: Rigid steel placeholder to be replaced with a VCD unit. Bottom: A VCD unit in place.

neers at Toronto-based Yolles in the early 2000's. Today the VCD technology rests with Kinetica, a company operating independently and led by Michael Montgomery, P.Eng., who worked on the development of the technology for over 10 years as a PhD student and researcher with U of T professor Constantin Christopoulos, P.Eng., who also advises with Kinetica.

Tibor Kokai, P.Eng., a principal with RJC Engineers (formerly with Yolles) was also around during the early stages of the R&D of the technology, and his familiarity with the system helped foster the YC Condominium involvement.

The VCD system includes layers of a viscoelastic high-damping material developed by 3M that displays viscous and elastic restoring forces, providing efficient coupling to structural members and damping to the structure.

While this damping material has been used in over 300 tall buildings in multiple configurations dating back to 1969, when it is combined with the VCD it results in significanty enhanced damping properties for high-rises.

The actual VCD systems are manufactured by Nippon Steel Engineering







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buildings



Damping unit concealed in drywall.

Co. and 3M Japan, where the viscoelastic layers are sandwiched between steel plates, which are bolted to steel beams and then ultimately anchored to reinforced concrete on site.

The YC Condominium tower's structural system consists of a coupled shear-wall lateral load-resisting system, in combination with a small reinforced concrete core. The VCDs are located in the middle third of the tower, replacing the coupling beams that are most heavily loaded. As the building deforms due to lateral loads (caused by wind and/or earthquake) the viscoelastic high-damping material deforms and dissipates the vibrational energy.

The VCDs connect planar shear walls (shear walls along the same grid) over the corridors and are ultimately boxed in drywall, thus they are invisible once the project is complete.

All other coupling beams on floors above and below the VCDs are structural steel for ease of construction, which is also a Toronto first, to provide an optimal balance of stiffness and shear capacity throughout the height which maximizes the damping produced by the VCDs.

Clean finish

During construction, temporary rigid steel sections were inserted as placeholders during the casting of the reinforced concrete and then removed and replaced with the VCD units.

As mentioned, once the structural framework was compete, the walls and beams were finished with drywall completely concealing the VCDs from view.

Since the dampers are integrated into the shear wall system of the building, they do not impact the architectural design, and the VCD performance does not require any maintenance or tuning over the entire life of the structure.

Ultimately the system helped simplify construction while improving human comfort on all floors of the tower by controlling wind or earthquake-induced vibrations of the building.

Ultimately the VCD systems provided an innovative and superior space-saving damping solution for one of the latest condo towers erected in Toronto.

The building boom in the city continues, the latest count seeing some 120 active cranes across the city, more than doubling the next nearest locations in North America.

The crane at the YC Condos project may be gone, but this new tower and its innovative damping solution represents a landmark for future structural design in the city and for tall towers worldwide. CCE



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Planning for integrated fire protection and life safety systems testing.

By Dana Honsberger, P. Eng. LRI Engineering

t's 3:30 pm on a Friday afternoon and you have just learned that the fire alarm system and the elevators are not providing the correct sequence of operation when the smoke detector on the 21st-floor elevator lobby is activated.

The Authority Having Jurisdiction (AHJ) is going to be at the site on Monday morning to test the building fire protection and life safety systems. You're concerned there might be other systems that might not be working together as designed. Does this sound familiar?

The building code for your project states that the commissioning for all of these integrated systems must be performed as a whole to ensure the proper operation and interrelationship between systems, but no one seems to have documentation that this commissioning has been done.

You ask yourself whether you should have all of the fire protection and life safety systems teams work throughout the weekend testing all interconnections between systems, or whether you fix the problem on the 21st floor and hope for the best come Monday when the AHJ arrives?

Thankfully, CAN/ULC-S1001 has been developed to assist in the planning, testing and reporting of these integrated systems so you are never left in this type of situation again.

Since the publication of the 2015 National Building and Fire Codes of Canada, the CAN/ULC-S1001-11, Standard for Integrated Systems Testing of Fire Protection and Life Safety

Systems, has been referenced. The standard prescribes the methodology for verifying and documenting that all interconnects between systems provided for fire protection and life safety functions are installed and operate in conformance with their design criteria. Some of these systems include fire alarms, fire pumps, automatic sprinklers, elevator recall and alternate recall sequences, automated and/or manual smoke controls, etc.

For provinces that do not use the National Building and Fire codes, their codes may have similar references to the commissioning of life safety and fire protection systems. Where it is not already provided in provincial codes, specific reference to the CAN/ ULC-S1001 standard is anticipated in upcoming amendments and publications of these codes.

The CAN/ULC-S1001 Standard was developed to satisfy the requirement for the commissioning of life safety and fire protection systems referenced in the 2010 National Building Code of Canada (NBC) and the National Fire Code of Canada (NFC) which stated "Where life safety and fire protection systems are installed to comply with the provisions of this Code or the NBC/NFC, the commissioning of these integrated systems must be performed as a whole to ensure the proper operation and interrelationship between systems."

In the past, individual fire protection and life safety systems were installed and tested in accordance with their design criteria and referenced standards. However, these systems were commonly verified in isolation. CAN/ULC-S1001 validates the correct integration between systems.

The following summarizes steps to take into consideration when planning for integrated systems testing, whether in new construction or an existing building.

New Construction

During construction, planning for integrated systems testing is vital. An integrated testing coordinator will need to be designated to work with the design professional(s) to obtain documentation detailing each interconnection between the fire protection and life safety systems.

The integrated testing coordinator has to be knowledgeable and experienced in the design, installation, and operation of fire protection and life safety systems. The information obtained from the design professional(s), installing contractor(s) and verifying party(s) includes, but is not limited to, fire protection and life safety systems sequence of operations during normal and emergency conditions, written confirmation of acceptance testing, confirmation that the systems have been installed in accordance with the design and are ready for the integrated systems testing, and confirmation of measures for ensuring occupant safety throughout the testing.

Historically, in the absence of integrated testing requirements, typical construction schedules did not provide time for integrated systems testing and reporting. Now, the integrated testing coordinator needs to be involved in the early stages of project construction to assist with planning the schedule to complete integrated systems testing and reporting near the end of construction and prior to occupancy.

Even though each system is expected to be individually tested by their respective design professionals, installing contractors, and verifying parties before the integrated systems testing, it should not be assumed the systems are functioning in accordance with the design. Where it is determined that a sequence of operation does not function as designed, or equipment requires adjustment/modifications, sufficient time is needed to make corrections to the systems and to allow for additional time to retest and complete the final report.

Where a building is occupied in phases, an integrated systems testing plan is to be developed for the entire building, also considering that integrated systems tests will be required for each occupancy. When integrated systems testing has been completed in occupied phases, the system integrations are not required to be retested provided ongoing construction does not impact previously tested system integrations.

The integrated systems testing requires the coordination of multiple participants to be present. This can include, but is not limited to, the integrated testing coordinator, design professionals, installing contractors, and verifying parties. Where required, the integrated testing coordinator is to provide sufficient notice to the AHJ of the testing plan to allow them to witness the integrated systems testing.

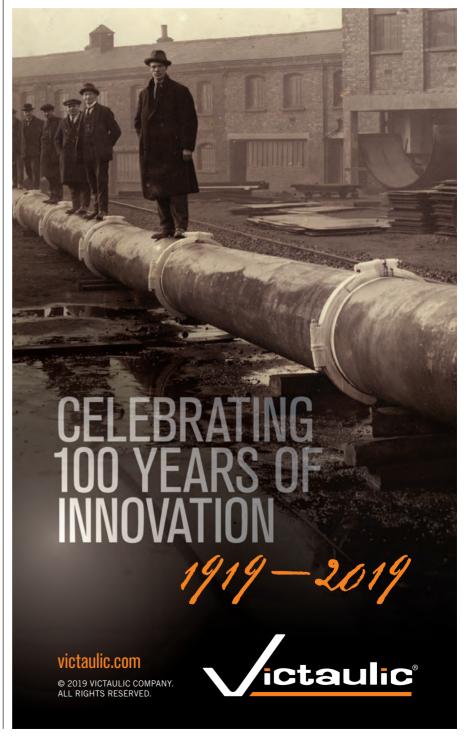
Existing Buildings

Retro-Integrated Systems Testing for existing buildings provides requirements for the testing of existing fire protection and life safety systems which did not undergo integrated system testing during the initial installation. While new construction allows access to design professionals, installing contractors, and verifying parties,

existing building owners and operators are frequently faced with the challenge of uncovering historical documentation to provide valuable information.

Another problem is determining how fire protection and life safety systems are integrated and intended to perform. Often, the original design and operation parameters of systems are no longer available, and current operators are unable to confirm the current sequence. Modifications to systems over time can also make it difficult to determine the changes that might have occurred to the sequence of operations and testing parameters.

Testing in existing buildings also requires a procedure for notifying occupants about the tests and how it



buildings

could impact them.

Tests in the evenings typically work in commercial and office buildings, but in residential buildings daytime hours are usually less invasive. Mixeduse buildings pose the biggest timing challenge. Also, the participants required to attend the testing need a detailed plan to keep things on track.

When integrated systems have not been tested recently, equipment that might have functioned correctly during the previous test might be inoperative at the time of testing. Part of the planning phase needs to include time for equipment repairs and to allow additional time to reschedule the completion of testing.

Final Report

CAN/ULC-S1001 requires that the integrated systems testing plan and the testing results be documented into an integrated system testing report. The report must include, but is not limited to, the integrated systems testing plan, initial and re-tested integrated systems testing forms, and system documentation collected from the design professionals, installing contractors and verifying parties during the implementation phase.

The report is intended to be used, maintained and updated over the life cycle of the fire protection and life safety systems. The integrated systems testing plan will be used both as the benchmark for ongoing testing and as a reference of system interconnections.

Periodic Integrated systems testing

Where mandated by the local governing Building and Fire Codes, or other legislation or contract requirements, integrated systems testing shall be performed one year after the completion of the initial testing. Subsequent tests are to be conducted at intervals not exceeding five years.

Moving Forward

The CAN/ULC-S1001 standard provides the guideline on how to plan, conduct and document integrated systems tests.

Now is the time to consider the implications that integrated systems testing will have on the completion of a project, identify the integrated testing coordinator and start the planning process. For complex buildings, the development of the plan, preparing the testing documents, providing the documents to the various parties for both the pretesting and final testing requirements, together with preparation of the final report and acceptance by the authorities will take time, but it will save time in the future. **CCE**

Dana Honsberger, P. Eng. is the Systems Engineering Manager at LRI Engineering Inc., a fire protection engineering firm with offices in Calgary, Toronto, Ottawa and Montreal.

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POWER PLAY

New utility-owned microgrid in North Bay, Ont. is the first of its kind in Canada.

orth Bay, a city with 51,000 residents in northeastern Ontario is home to the country's first utility-scale microgrid system, an electricity producing network that serves to offset load from the main grid for local activity facilities while also providing a resilient solution for the city, powering an emergency shelter in the case of adverse events.

The new Community Energy Park, operated by North Bay Hydro Services, is a microgrid that brings together distributed energy resources (DERs) to supply electricity and heat to North Bay's YMCA Aquatic Centre and Memorial Gardens hockey arena, as well as power for lighting the Thomson Park sports field.

North Bay Hydro Services has been involved in the development of other cogeneration projects in recent years, including a methane-capture gas plant at the local Merrick Landfill site, and a combined heat and power project at the North Bay Regional Health Centre.

The new 789kW Community Energy Park delivers power through two 360HP/265-kW combined heat and power (CHP) natural gas generators, a 250 kW/274 kWh lithium-ion battery energy storage system (BESS), and a 2kW solar flower.

The "brain" of the microgrid operation is S&C Electric's GridMaster Microgrid Control System. The con-

Ribbon cutting, July 10th, at the new North Bay Community Energy Park

WELCOME TO THE COMMUNITY ENERGY PARK

COMMUNITY

SOME TO THE COMMUNITY ENERGY PARK

COMMUNITY

Respectively

August/September 2019

Canadian Consulting Engineer 23



The self-contained 2G combined heat and power plant housing two 265kW natural gas generators.

troller manages the DERs to ensure generation and load are balanced appropriately. The controller continuously monitors the status of the DERs and assesses the microgrid's capability to operate as an independent island. It also monitors the main grid's supply voltage, allowing the control to detect an outage.

The North Bay microgrid project was first announced in May of 2017 with construction beginning in 2018. Because the Community Energy Park powers the arena for North Bay's major junior hockey team, the microgrid's construction and testing couldn't interfere with the team's games and practices.

As the project was underway, North Bay Hydro Services wanted to add more features to the microgrid to optimize its performance and efficiently use sustainable resources. S&C's engineering team designed the system to integrate the desired and required features. One interconnection requirement limited the microgrid to only feeding power to

the community facilities, and not exporting to the system.

When the microgrid is in grid-tied mode it can initiate a transition to islanded mode either manually or automatically. Also, while in grid-tied mode, the microgrid can perform a seamless transition in the event of a grid-side fault or loss of voltage, ensuring the Community Energy Park's load can ride through a momentary or sustained outage without any interruption.

The controller supports two different responses during a momentary outage. If the microgrid DERs are online and the system can transition seamlessly to islanded operation, the controller sets the protective relays to respond promptly to system events by tripping the interconnection breaker and initiating islanded operation. This enables the microgrid to ride through certain system events that would otherwise cause a momentary outage.

The seamless unplanned islanding has been demonstrated to successfully operate during system tests and actual system events after commissioning.

Alternatively, if the microgrid is not in position to seamlessly transition to islanded operation, the microgrid controller sets the relays to trip the DERs offline during system events, ensuring DER contributions to system faults are cleared. After the DERs are tripped offline, the microgrid controller allows upstream utility reclosing and restoration to re-energize microgrid loads. If the utility source does not return, the microgrid controller will black start and initiate



On-site containers house the "brain" of the operation, the S&C GridMaster Microgrid Control System, and the lithium-ion battery energy storage system (BESS).

islanded operation.

Another microgrid controller feature is managing the DER Power Flow, where the microgrid controller manages the power output of the microgrid's generation sources in both grid-tied and islanded modes of operation.

In anticipation of an approaching storm for example, the control system can charge the battery storage system to an optimum state of charge to maximize the time the system can operate islanded, if required.

Multiple benefits

The Community Energy Park provides multiple benefits to the community. The microgrid connects to both the local aquatic centre, which has fitness facilities, a pool, and other recreational services, and to the local hockey arena, which has many rooms and rinks. As the park's system produces electricity, heat by-product is captured and then transferred to the facilities.

Local mechanical/electrical consulting engineering firm, Piotrowski Consultants, was involved with taking the heat from the CHP into both buildings, distributing and maximizing the use of the heat. The heat warms the aquatic centre's pool and aids in the ice-resurfacing process for the hockey rink.

The battery energy storage system performs key functions in the microgrid system. The CHP generators function optimally within a limited range of power output. The microgrid controller commands the BESS to charge or discharge to allow the CHP generators to operate in their optimal range.

Furthermore, the efficient CHP generators have a limited power ramp rate and cannot accommodate the rapid changes in power output required during a microgrid "black start". The battery can change power output rapidly and will dynamically adjust its power output to support the CHP generators during changes in load and when the microgrid is "black-starting".



The Smartflower, supplied by nu-nrg.ca, provides renewable electricity to the microgrid.

The microgrid's design allows for future expansion of generation, loads, or new features that may become necessary as the system evolves or as new technology emerges. Another feature is secure remote access, which allows S&C to provide immediate assistance if required.

The project performance confirms that up to 87% of the electricity requirements for the microgrid's buildings can now be met by on-site generation, along with 55% of its heating needs. The estimated greenhouse

gas environmental impact is a 450-ton reduction in CO₂ emissions annually.

As for the community, residents now have a place to go not only for shelter during a time of crisis, but also for recreation.

As the electricity grid shifts from large, centralized power plants to smaller distributed generation with more hybrid-fueled systems, the Community Energy Park microgrid represents an example of what the future grid will be. For North Bay, that future is now.



Throughout 2019 Canadian Consulting Engineer explores the topic of diversity in the industry through a series of articles called Point of View: stories designed to get readers thinking about their profession, their day-to-day workplace and maybe seeing their surroundings through a new lens.



By Natalie Mazur, Bronwyn Chorlton, Jennifer Ellingham, and John Gales

Early findings from a collaborative research study by York University and the University of Waterloo into factors that are discouraging women from staying in engineering.

For decades, the challenge of recruiting and retaining women in engineering and other STEM fields has been well-documented. Women in engineering have remained the minority across their careers, from the time they enter their undergraduate degree and throughout their time practising. This has prompted several initiatives to encourage more women to enter the profession, and in particular initiatives that target recruitment of women into engineering.

One example is the 30 by 30 campaign set out by Engineers Canada, which strives to have 30% of newly-licensed engineers be women by the year 2030. Outreach to school-aged women, informing them about the engineering profession, and encouraging them to enter the profession are extremely important. It is critical that women (and all students) understand what the engineering profession actually is and know they are welcome to join.

Once women have decided to enter an undergraduate engineering program, however, the issue at hand changes from encouraging them to study engineering, to ensuring the environment they are entering is conducive to their retention. While recruitment initiatives are undoubtedly very important for working towards a gender balance in the engineering profession, it is equally as important to ensure that the women that have entered stay.

A person's first significant insight into engineering begins, usually, during an undergraduate degree. In this environment, the people who will impact their experience most heavily are professors and instructors. If these positions are filled overwhelmingly by men, it may paint a picture to students of who ultimately becomes successful as academics. It is notable that, in research, professors and instructors have been reported to be the second-most common sources of intimidation of students in engineering, especially towards students in upper years (Mazur, Chorlton, & Gales, 2019).

Peers have been found to be the most common sources of intimidation, but as professors and instructors often hold a great deal of influence over the culture of the institution, there may be a link between the behaviour of the students and the behaviour of professors (which should be explored through future research and analysis).

Professors need to take some responsibility in correcting any discriminatory words or actions they observe, which may alleviate some of the intimidation caused by peers. Thus, it is



important that students have strong female role models in this setting as well as non-female faculty who are sensitive to diversity issues. This necessitates the retention of women who are already in these positions of authority, and the support of other women who may wish to join.

Women in undergraduate studies already see more discouragement than men (Mazur, Chorlton, & Gales, 2018). This has consequences for how many women will pursue engineering beyond the undergraduate degree, and what preconceived notions may have developed as women enter their professional careers.

Workplace retention

For graduates who enter the professional sector, many different factors will tie into how well they are enjoying their experiences in this setting—such as the people they are working with and the work environment, to name just a couple of examples.

Generally, employees report that the people they work with are respectful and supportive, especially their peers. When employees are encouraged to collaborate with others, they are more likely to report intending to stay on track in their current position and beyond (see Figure 1). *

This trend is identical for women and men. However, a trend that differs between men and women is the respect employees receive from their juniors. Women receive less respect from their juniors (1.67/3.0 – where 1 is "A Little Respect", 2 is "An Adequate Amount of Respect", and 3 is "Much More Respect than Expected") than men do (2.16/3.0). This may make leadership roles more frustrating for women in industry and therefore discourage them from pursuing higher-level roles, leading to career stagnation and abandonment.

Women in industry can feel more connected to the community of engineers when they have someone in the field who inspires them. If role models do not exist in higher-level positions, women may become disconnected from the industry and there is potential for them to leave.

If engineers in industry or in academia are not enjoying their careers, they may choose to switch from one to the other. Many of the challenges and issues that women are facing, however, appear to be similar in both sectors, and switching from industry to academia or vice versa may not necessarily remedy the situation.

As an example, collaboration has been linked to retention in both industry and academia. Figure 1 shows industry-specific results, but the graph for academia is near identical. Furthermore, for those who become parents, there is still an issue of job security when returning from leave.

Women are significantly more worried than men about keeping their job and their specific assignments when returning from an extended leave, where 66% of women surveyed in academia indicate that they worry about this sometimes, compared to 22% of men who indicate that they worry sometimes or often. Women in industry are worried that their leadership roles will be passed onto others or that their previous assignments will be reassigned, forcing them to start over when returning to work.

Women in academia are worried about how their leave will factor into grants and funding, as their productivity will be reduced. Those in industry who are not confident that their company will provide support for returning from a leave are much more likely to indicate that they intend to leave engineering, as shown in Figure 2 (next page).

New Research and Recommendations

There are many unique experiences that women are facing as they progress through their engineering careers. At York University, in collaboration with the University of Water"Women in industry can feel more connected to the community of engineers when they have someone in the field who inspires them . . ."

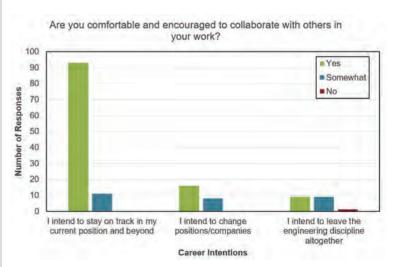


Figure 1. Responses by industry members to the question, "Are you comfortable and encouraged to collaborate with others in your work?", sorted according to career intentions.*



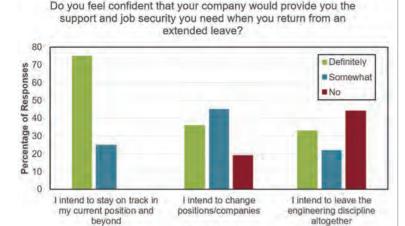


Figure 2. Responses to the question, "Do you feel confident that your company would provide you the support and job security you need when you return from an extended leave?", with answers sorted by career intention.

Career Intentions

"... If role models do not exist in higher-level positions, women may become disconnected from the industry and there is potential for them to leave."

loo, a multi-year study is being conducted by the authors in an attempt to understand what factors are discouraging women from staying in the profession. Once identified, these negative influences and experiences can be alleviated, promoting the retention of women in the engineering profession.

So far, several surveys have been distributed to undergraduate students at five institutions, as well as to women in professional and academic sectors. This survey, at the time of writing, is being expanded to capture the experiences of graduate students, as well as students in co-op programs.

Once well documented, a timeline on women's experiences can be created, enhancing our understanding of what factors may be causing women to leave the profession.

There are many ways in which men, women, and others who are currently in academic or industry positions can enhance the experiences of women, to the benefit of everyone else as well. For example, it is clear from our research that men worry about their career prospects when returning from a parental or extended leave. Having explicit policies in place to help re-integrate those who have taken leave would benefit everyone who wants to grow their family. These policies should be well communicated.

Peers and coworkers make up a significant part of the work culture created by a company or institution. Their behaviour towards others, especially towards minoritized persons, can significantly impact those minoritized persons' choices to remain in the field. Running occasional workshops or training on diversity, such as unconscious bias training, can help create a more welcoming atmosphere where employees are encouraged to collaborate respectfully with one another.

Overall, we recommend that people who hold authority (e.g., team leads, managers, supervisors, instructors) take care to be good role models for their juniors, regardless of gender. Transparency and communication can go a long way to motivate everyone.

It is uplifting to see many of the recruitment initiatives for students in Kindergarten to Grade 12. Many of these outreach programs will likely be successful in encouraging women to begin an undergraduate engineering degree. Once these students have entered engineering, everyone plays a part in creating an inclusive environment which will promote retention. From undergraduate studies to the end of one's career, it is clear that issues remain in terms of welcoming women and other minoritized persons in to the engineering field. However, we are at a point in time where we are seeing increased interest in change as well as the introduction of policies for inclusion that are working to keep everyone motivated and interested in their work.

There are several changes that need to be made in the engineering community before we can reach true equity, but many of the initiatives being pushed so far show promise for the future.

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- *Data on industry and academia reported in text and in figures is from the joint York University/University of Waterloo Retention of Women in Engineering Research Project

New Federal Prompt Payment ... What It Means for Engineers

n June 21, 2019, the Parliament of Canada passed the Federal Prompt Payment for Construction Work Act (the "Act"). Though not yet in force, it will apply to construction projects on lands or immovables owned by the federal government, with the exception of leased federal lands or immovables, where the construction project is being undertaken by the lessor.

Types of work that fall under the Act include any work that will improve the value, productivity or useful life of a building. The Act, however, excludes maintenance or repair work performed to prevent normal deterioration or to maintain the normal, functional state of the real property or immovable.

Although not specifically mentioned in the Act, the services of engineers will presumably, in accordance with the existing case law for builders' lien legislation, be covered by the Act so long as the engineering services provided are directly related to the construction of an improvement.

The new legislation is meant to work in tandem with provincial prompt payment legislation and the Governor in Council will have the power to exempt the application of the Act, or certain portions of the Act, for federal construction projects in provinces with satisfactory prompt payment legislation of their own.

The Governor in Council will also have power to exempt the application of the Act to specific projects. Whether the Act or provincial prompt payment legislation applies to a given project will be an important inquiry to undertake prior to submitting a bid.

As is the case in the recently passed Ontario and Saskatchewan prompt payment legislation (the "provincial legislation") the payment cycle under the Act will revolve around the issuance of a monthly "proper invoice" from the general contractor to the owner.

From there, the owner must follow a set timeline for objecting to any work submitted for payment through a notice of non-payment, or pay the entirety of the invoice in no less than 28 days from the date of the proper invoice.

Payment then flows down the construction pyramid in seven-day increments. The Act also includes similar interim adjudication provisions as the

It will be important for consulting engineers to be aware of the new federal and provincial prompt payment legislation and adapt their billing practices accordingly.

provincial legislation, although the timelines, as well as the specific disputes subject to adjudication, have been left to the government to determine through as yet un-enacted regulations.

Adjudication is intended to provide for a quick interim determination of payment disputes. Decisions of the adjudicator will be enforceable in the same way as a court or arbitrator order. Interest on amounts found to have been wrongfully withheld will also be due and owing as of the date payment was due. The rate of interest will be either as set out in the contract

or, at minimum, at a rate prescribed through regulation.

While under the provincial legislation, adjudicators will be able to take on an active and investigative role by hiring experts and conducting whatever investigation of the premises they deem necessary to resolve the dispute; under the federal Act, the powers of adjudicators remain to be defined through regulations. The timelines for interim adjudications are intended to be very quick and will favor well-organized parties with sound document management processes.

It will be important for consulting engineers to be aware of the new federal and provincial prompt payment legislation and adapt their billing practices accordingly. If they have been hired directly by the owner, they should ensure that their invoices comply with the legislative requirements of a proper invoice.

Because the nature of engineering services is often not conducive to monthly billing cycles, they may also wish to negotiate a different billing cycle with owners, which the Act permits. Although there is no obligation in the legislation for subcontractors to follow a specific billing cycle, engineers retained by a general contractor should exercise their right to be informed as to when proper invoices are being sent to the owner in order to know when they can expect payment of their invoices. Specific contractual language detailing when the engineer's invoices are due and which proper invoice will include the payment for these invoices, is also advisable.

Jonathan Martin, is the editor of the Miller Thomson western Canada construction law newsletter "Breaking Ground." jomartin@millerthomson.com.

ENERGY

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3D IMAGING



Leica Geosystems BLK2GO handheld imaging laser scanner uses two-axis LiDAR, SLAM (simultaneous localization and mapping) and edge computing technologies to scan complex spaces efficiently and quickly. Its compact design allows access to challenging spaces, and when used with the iOS app, users can get live feedback. blk2go.com



Grundfos Growing

Grundfos Canada, the Canadian operation of the Danish-based pump manufacturer, held a ceremonial ground breaking of a \$3.5 million expansion at the firm's Oakville, Ont. headquarters, effectively doubling the warehousing capacity of its current site, a move Simon Feddema, president Grundfos Canada, anticipates will contribute to the goal of doubling the firm's Canadian business.



Daikon Roadshow in Canada

The Daikin HVAC Innovation Roadshow trailer set up in Toronto on July 18th attracting some 500 mechanical engineers, contractors and others allied to the field. HTS Engineering hosted the event along with educational seminars. Other Canadian stops of the Daikin Roadshow this year included Dartmouth, Moncton, Ottawa, Saskatoon and Regina.

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Rendering of a proposed interior pedestrian walkway at Quayside.

n June 24th Waterfront Toronto released the draft Master Innovation and Development Plan proposed by Sidewalk Labs (an Alphabet company—also owners of Google) for the city's 12-acre Quayside neighbourhood. The complete MIDP is available at quaysideto.ca.

The 1,500-plus-page three-volume Plan is still under review, and despite media reports of data collection and privacy concerns, the underlying infrastructure plan is intriguing.

The proposal includes modular mass timber buildings, smart waste collection, sustainable low-energy powersystems, underground freight delivery, storm-water management and much more. In developing the Plan, Sidewalk Labs consulted with multiple engineering firms including Golder, Integral Group, Kerr Wood Leidel, Mulvey & Banani, RWDI, Stantec, W.F. Baird and WSP, among others.

To gain some first-hand insights into the Plan, we reached out to con-

tributing experts from Stantec including: Dave Sauve, vice president, Ont. GTA; Mike Voll, global sector leader, smart technologies; Angelo Ligotti, senior principal; and Manoj Singh, principal, senior waste management engineer.

Can you briefly explain the proposed distributed energy system?

[Mike Voll] The distributed energy system is comprised of an advanced power grid that will use solar energy, waste energy, battery storage, and time-based energy pricing to reduce reliance on the main Toronto Hydro grid during periods of peak demand.

The idea is to make an all-electric community affordable. Electricity produced by anerobic digestion of organic waste, solar PV, or shifted using energy storage, is used directly by the community hosting it rather than relying exclusively on the main utility grid. In the same way, thermal energy

produced from sources of waste heat, along with geoexchange wells, is used directly by the buildings and facilities that host these thermal assets rather than relying on natural gas supply.

Would each building be an energy island?

[Mike Voll] Stantec and Sidewalk Labs have envisioned a flexible distribution feeder system in collaboration with Toronto Hydro, which can not only "island" a neighborhood in the event of a grid event, but can also "island" each individual building for further resiliency. Buildings will have on-site backup generators, potentially fueled by bio-diesel, to provide emergency services, such as elevators and hot water, for multiple days.

Do the costs of PV and battery technology need to keep dropping to make this feasible?

[Mike Voll] By starting small and scalable, we can manage the capital



Rendering of the proposed Quayside neighbourhood.

costs of building out a local smart grid, right-sizing investment and lowering costs to consumers. Applying technologies that use energy more efficiently will also be a key aspect of the power grid at Quayside, enabling active and automated control of energy.

It is envisioned that 75% peak electricity load will be serviced by battery storage and solar PV to reduce the use of grid power at costlier and more GHG intensive peak times.

There are currently electricity programs in Ontario that already make energy storage feasible for large electricity users and these programs will be utilized in conjunction with the home, building and office "energy schedulers" envisioned by Sidewalk Labs for this development.

Can you describe how the pneumatic waste system would operate?

[Manoj Singh] Alongside Sidewalk Labs, our team designed Quayside's utility systems to be adaptable, resil-

ient, and able to adjust to technological change. The management of urban solid waste through underground pneumatic infrastructure is an important component of this strategy. By adopting a pneumatic waste system at Quayside, we can improve air quality, eliminate waste truck traffic and noise on main streets and increase the environmentally friendly operations of the waste collection process.

A Pneumatic Waste Collection System (PWCS) uses gravity chutes and compressed air flowing through a network of underground pipes to convey waste at high speeds of up to 70km/h from source inlets to centralized processing areas, or terminals.

Typical PWCS terminals have an operational radius of up to 2km. For a development the size of Quayside, one 400m² terminal is expected to be required to service the development. This number considers projected daily collection quantities as calculated by Stantec and assumes three separate waste streams are received—organics, co-mingled recyclables, and trash.

The PWCS terminal at Quayside would have at-grade truck access and is proposed to be co-located with other services in the base of a building on Parcel 1. Organics, recyclables and trash received at the terminal would be compacted into separate sealed containers and transported by trucks to off-site facilities for processing.

PWCS infrastructure would be built in at Quayside. Visitors and residents would separate and dispose of their waste via user interface "smart chutes" in all buildings. The conceptual design for Quayside also includes five public realm PWCS inlet locations and one maintenance inlet. At every location, groups of inlets could be provided for the source separation of trash, organics, and dry recyclable waste streams. Each inlet would be connected to the underground PWCS pipe network, which could be directly buried or contained within Quayside's Stantec-designed prefabricated Open Access Channels.

continued on page 34

Specifier's Literature Review



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Underground tunnels (for the waste system as well as freight handling) are a central feature of the plan. What are the challenges and solutions of tunneling infrastructure in a water-adjacent location like this?

[Angelo Ligotti] Our designs are based on a basement tunnel system that includes freight, and a precast concrete Open Access Channel that contains power, utilities, gas as required, and potentially pneumatic

there are numerous projects that the team will learn from to manage groundwater.

Beyond water issues, the design of the tunnels will open up several other challenges such as conflicts with typical utilities, construction in structurally poor soil and legal issues when tunnels span multiple properties. We are looking forward to working with Sidewalk Labs to produce a tunnel design that will solve each of these interesting challenges.



Called Toronto Tomorrow, this rendering is a vision of Toronto's developed waterfront in 2050.

waste. This means maintenance and upgrades can be undertaken without major surface disruption on the street.

The obvious challenges will be mitigating shallow groundwater during construction and designing a permanent waterproof tunnel system. These are items that we have discussed at a high level during this conceptual phase of the project but will need to spend a lot of time detailing in future phases.

The same challenges will be experienced for all building basements within the development. Luckily, there has been considerable development along Toronto's waterfront in recent years so

The communities of the future need a utility system that is flexible and adaptable in order to be resilient, and able to adjust to technological change. We can do this while minimizing disruptions to the places people use.

Can you share insights on how the proposed thermal energy grid would operate?

[Mike Voll] The thermal grid, developed by Kerr Wood Leidal Consulting Engineers, would rely on clean energy sources to heat and cool buildings. At the building level, waste heat generated by wastewater would be repurposed to provide energy for heating and domestic hot water systems. For additional needs, buildings could draw from a hot and chilled water loop at the site level, generated by a mini heat pump plant that can exchange geothermal energy via underground wells.

A neighborhood loop of the thermal grid would connect all of the site plants and allow for the transfer of energy among sites. It would also be designed to incorporate other largescale clean energy sources in the future, such as heat recovered from sewage stations

What single innovation of the proposed development plan has you most excited?

[Dave Sauve] Infrastructure forms the framework of a city—it's made up of the building blocks that determine how a city serves people, moves people, and provides opportunities for people. The infrastructure design at Quayside gives us the opportunity to look at infrastructure in a whole new way, that puts people at the centre of the design.

The proposed underground freight system may be the aspect that best represents that. Online commerce is booming, and delivery frequency is increasing-just look at Amazon's two-hour delivery. This puts more traffic on the roads and at the curb, clogging transportation systems and our public realm.

At Quayside, Sidewalk Labs is looking at how you can take freight underground. The proposed design has all goods arriving first through an urban consolidation centre. Autonomous freight vehicles would then travel in underground tunnels to deliver parcels to their final destinations. Surface roads can remain clear for a people-first public realm, while important packages arrive on time. And, like all components infrastructure Quayside, the freight system design would be flexible and scalable, so that it can evolve and adapt to changing needs and technologies.



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