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JUNE/JULY 2017

# CANADIAN ■ CONSULTING engineer

## Drinking Water UPGRADE

Sherbrooke's J.M. Jeanson plant  
improves efficiency and quality

PLUS:

Reclaiming Barrie's landfill

Tunnelling the Eglinton Crosstown



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J.-M. Jeanson drinking water treatment plant in Sherbrooke, Quebec. Photo courtesy exp. See page 10



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## Community Watch

On June 1 a judge in Sault Ste. Marie, Ontario spent four hours verbalizing the verdict that ultimately acquitted the former engineer charged in connection with the tragedy at the 2012 Algo Centre Mall roof collapse in Elliot Lake. The roof-top parking deck that caved in led to two deaths and over 20 injuries.

The man who had declared the roof structurally sound was up on three charges of criminal negligence. According to reports, the judge explained it is conceivable the former engineer did not believe there were structural issues and ultimately his understanding was “poor judgment” not malice.

The challenge for the engineering profession in this case has been one of reputation management. The engineering licence of the man had been suspended at the time that he inspected the mall in 2012, making it clear that he was not a member of the engineering community, but the fact that he was at one time an engineer does tarnish the brand.

The Ontario Society of Professional Engineers, the advocacy body for the engineering profession in Ontario, is responsible for enhancing the reputation of engineers and was quick to issue a statement regarding the decision.

Within the statement the OSPE said:

“We encourage action on ongoing continued improvements that will help reinstate the public’s confidence in the profession, including the implementation of mandatory continuous professional development for all practising engineers in Ontario, and certification for structural engineers.”

And

“OSPE believes that additional resources should be allocated for enforcement of the [Professional Engineers] Act to support proactive follow up by the regulator and ensure that those with suspended licences cannot continue to conduct work under the pretense that they are a qualified engineer.”

Mandated training for active professionals is a respected tradition among many other professions, yet training of professionals only goes so far.

The fact that the evaluation on that mall was performed by a non-licensed former engineer should increase the public awareness to the necessity of ensuring their work is done by actively licensed, certified, engineers

The OSPE’s statement suggests the role of regulation and enforcement in Ontario lacks the necessary resources. Clearly it is in the best interest of the entire engineering profession to play a part and be vigilant of dishonourable practices.

The challenge of monitoring the activities of non-professionals, or those who refrain from adhering to the standards of their profession, requires a more active watchdog. Perhaps that’s a responsibility that calls upon a strong, united, community to work with each other and respect the greater calling of their profession.

As engineers in the field, being an active part of the community and living up to the standards of the profession is a powerful responsibility.



Doug Picklyk

# CANADIAN CONSULTING engineer

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**EDITORIAL PURPOSE:** Canadian Consulting Engineer magazine covers innovative engineering projects, news and business information for professional engineers engaged in private consulting practice. The editors assume no liability for the accuracy of the text or its fitness for any particular purpose.

**SUBSCRIPTIONS:** Canada, 1 year \$62.17. Single copy \$8.00 Cdn + taxes. (HST 86717 2652 RT0001). United States U.S. \$62.17. Foreign U.S. \$62.17.

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ISSN: 0712-4996 (print), ISSN: 1923-3337 (digital)

**POSTAL INFORMATION:** Publications Mail Agreement No. 40065710. Return undeliverable Canadian addresses to Circulation Dept., Canadian Consulting Engineer, 80 Valleybrook Drive, Toronto, ON Canada M3B 2S9.

**PRIVACY:** From time to time we make our subscription list available to select companies and organizations whose product or service may interest you. If you do not wish your contact information to be made available, please contact us. tel: 1-800-668-2374, fax: 416-510-5134, e-mail: vmoore@annexbizmedia.com, mail to: Privacy Officer, 80 Valleybrook Drive, Toronto, ON Canada M3B 2S9.

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photo: courtesy AFG



(l-r): Réal Laporte, president Hydro-Québec equipment and shared services; Denis Fortin, partner and project leader, CIMA+; and Denis Robitaille, general manager, Fiducie du patrimoine culturel des Augustines (project owner)

Below: Members of the ACEC-MC Keystone award-winning AECOM team with the award sponsor.

**AWARDS**

**CIMA+ wins Visionary Award at 15<sup>th</sup> Grands Prix du Québec**

The Association of Consulting Engineering Companies—Quebec (AFG) held its 15<sup>th</sup> Grands Prix du Québec consulting engineering awards on Monday, May 15 in Montréal.

The AFG presented awards in 10 categories, including the Visionary Award for the top project that went to CIMA+ for Le Monastère des Augustines project (in the building mechanical/electrical category). The project involved the restoration of North America's oldest monastery.

Other Awards of Excellence went to: SDK and Associates in the structural category; BBA (2 awards) in both the energy and environmental categories; CIMA+ in the industrial category; Parsons in the transportation category; Stantec in the civil infrastructure category; and Norda Stelo in the international category.

Mentor of the Year was awarded to Ronald Julien, P.Eng., of AECOM, and the young professional award (Le prix Relève) went to Jonathan Vigneault, P.Eng., of Bouthillette Parizeau.

**AECOM takes Keystone Award**

Over 200 guests attended the 18<sup>th</sup> Annual Awards of Excellence in Consulting Engineering for the Manitoba chapter of ACEC held April 18 at The Met in Winnipeg.

ACEC-MB handed out 10 project awards, and AECOM Canada

Ltd. took home the prestigious Keystone Award for its Eureka Nunavut – Water and Sewer in the Far North project completed for Public Works and Government Services Canada. The multi-disciplinary project provides upgraded sewer and water systems for the high arctic weather station, located in Eureka, Nunavut on the 80<sup>th</sup> parallel.

Since treated effluent can only be discharged for two months a year, the project will supply 22 months of raw water storage, with accommodation for up to 2.4 meters of ice and temperatures as low as -55°C.

AECOM also won an Award of Excellence and Award of Merit in the Environmental category. Other Awards of Excellence were handed out to Teshmont Consultants in the energy resource development category; KGS Group in the municipal and water category; and WSP Canada in the building engineering category. Other Awards of Merit went to KGS Group, Stantec (2) and TREK Geotechnical.

A Lifetime Achievement Award was presented to David Krahn, P.Eng.,



photo: courtesy ACEC-MB

**COMPANIES**

**Leader for exp's railway division**



Steeve Rousseau

Exp has named Steeve Rousseau to the newly-created position of senior vp, railway. Rousseau will grow exp's presence in the railway sector and build a team of professionals.

Rousseau brings over 25 years of experience in managing major design-build projects in the engineering and construction sectors.

**New Look for WSP**

In early May Montreal-based WSP Global Inc. introduced a new logo and brand identity, the move marks the coming together of over 85 companies in the last five years. The branding is designed to evoke WSP's future-focused identity.



"Our new brand was created with the input of our clients and employees worldwide," said Alexandre L'Heureux, president and CEO of WSP. "It is a direct reflection of what we have accomplished, where we are today and our vision for the future." The new logo and branding were developed in collaboration with Montreal-based global brand consultancy Sid Lee.

of Dillon Consulting, and the Rising Star Award went to Dana Bredin, P.Eng, of WSP Canada.

### Exp-Stantec-CIMA+ Consortium wins Montreal bridge contract

A consortium made up of engineering firms exp, Stantec and CIMA+ has been awarded a contract by the ministry of transportation, sustainable mobility and transport electrification (MTMDET) to prepare preliminary and definitive pre-project studies, plans and specifications, as well as preliminary and definitive schedules, for the Île-aux-Tourtes Bridge, located on the western tip of the Island of Montreal and spanning the Lake of Two Mountains between Senneville, and Vaudreuil-Dorion.

The project mandate includes providing the engineering services needed to support the MTMDET in moni-

toring and maintaining the existing structures of the Île-aux-Tourtes Bridge in order to ensure the safety of users.

The primary objective is to plan work on the existing structures over a five-year period in order to maintain traffic safely until the 50-year-old bridge is fully replaced over a projected 10-year horizon.

#### BUILDINGS

### CaGBC launches Zero Carbon Building Standard



The Canada Green Building Council (CaGBC) officially launched its Zero Carbon Building Standard at a press conference in Vancouver on May 29. The new standard assesses carbon use

in commercial, institutional, and multi-family buildings in Canada, and it was designed to be applicable for many types of new and existing buildings across the country.

It is also the only program of its kind to make carbon reductions the key indicator for building performance.

“While there is no doubt that Canada’s building sector has been dramatically transformed over the last two decades, the time has come to be bolder and more ambitious,” said CaGBC president/CEO Thomas Mueller.

Prior to the launch, CaGBC announced a list of 16 sustainable building projects across Canada that are taking part in the Zero Carbon Building Pilot Program. The participating projects will inform further development of the standard over a

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two-year period.

The full requirements of the new standard can be downloaded at [cagbc.org/zerocarbon](http://cagbc.org/zerocarbon). Project registration for the standard will open September 5, along with full pricing and additional program details.

**EVENTS**

**Smith + Andersen's EcoJam rocks Toronto, plants Trees**



photo: Rafael Correa/Smith + Andersen

James Mallinson of Perkins + Will rockin' and Jive Talkin' at EcoJam 2017.

On Thursday, April 27, the Mod Club in downtown Toronto was rocking as Smith + Andersen and Footprint hosted the fifth annual EcoJam, a rock show featuring musicians from within the local architecture, engineering and construction industry.

Funds raised through sponsorship and ticket sales from the event go to Forests Ontario, a not-for-profit organization dedicated to the re-greening of Ontario.

"We planted 3,463 trees and also gave away thousands of bee-friendly wildflower seeds," notes EcoJam organizer, Lana MacInnes of S+A.

Since the first show in 2013, the event has raised enough funds to directly contribute to the planting of well over 10,000 trees.

Event sponsors this year included: EllisDon, B+H Architects, Diamond Schmitt Architects, Entuitive, Guild Electric, PCL Agile, Plan Group, Perkins + Will, RJC Engineers, Quadrangle and Zeidler.

The sold out show, held during earth week, featured 14 bands covering a broad range of classics and modern hits.

Performers at the show represented a range of industry firms including: Bentall Kennedy, B+H, CS&P, Diamond Schmitt, Dialog, EllisDon, Entuitive, HOK, Humphries, IBI Group, Montgomery Sisam, Moriyama & Teshima, Norr, PCL, Perkins+Will, Quadrangle and more.

**Toronto's 18<sup>th</sup> Canstruction**



photo: David Crowder Photography

Winner of most cans and people's choice, "We CAN Unite" by IBI Group.

In mid-May 18 teams of professional engineers, architects, designers and students took part in the 18th annual Canstruction Toronto competition, where teams build structures out of non-perishable food products, with the building materials ultimately donated to the food bank. In all 50,000 pounds food were sculpted into statues this year.

The 2017 winner for best original design went to Aercoustics Engineering Ltd. Awards were also presented for structural ingenuity (Blackwell Structural Engineers); best use of labels (Turner Fleischer Architects); best meal (Echologics); and most cans (IBI Group). IBI also won the people's choice award. To see more visit [facebook.com/canstructionTO](http://facebook.com/canstructionTO).

**Entuitive hosts appreciation event**

On June 1, Entuitive hosted a client appreciation and industry knowl-

**COMPANIES**

**Arup Appointments**

Among 42 recent personnel appointments announced by Arup, there were nine Canadian mentions including new associate principals with the firm: Jackie Coburn, airport planner and architect with Toronto's aviation planning team; Henry Jeens, a civil engineer in Arup's Toronto office; Omid Nakhaei, architect in Toronto's buildings transit group; Ken Sissakis, structural engineer in Toronto; and Justin Trevan, digital technology consultant in Toronto. New associates with the firm include: Mike Durtnall; Carolyn Poirier; and Kirsten Warren, all in Toronto; and Ben Voelker in the St. John's office.

edge event at the Shangri-La Hotel in Toronto combining a casual atmosphere with an educational component.

Calling the event Moving Forward, the guest speaker was Leslie Woo, chief planning officer with Metrolinx. Woo encouraged attendees to take advantage of this time when investment in transit infrastructure is high, because "political tides shift." In building out transit, she insists that design is key, keeping sustainability and climate resilience in mind.



Leslie Woo, chief planning officer with Metrolinx, speaking at Entuitive event in Toronto.



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# ADVANCED DRINKING WATER TREATMENT

The re-making of the J.-M. Jeanson Drinking Water Treatment Plant in Sherbrooke achieves economic and environmental goals.

By exp Services



The primary membrane filtration room, and the membrane train.

The introduction of innovative technologies have led to a drinking water solution for the City of Sherbrooke, Quebec that exceeds existing provincial regulations, has room for higher capacity and delivers clean water in a more sustainable method than in the past.

The J.-M.-Jeanson drinking water treatment plant in Sherbrooke required updating to meet provincial quality standards and it needed to be able to service a growing population.

The engineering design team was challenged with upgrading an existing, relatively small, facility to maintain costs, while also managing the construction process without disrupting service to the existing population of over 150,000 residents.

## A three-link chain

A feasibility-study, laboratory-analysis and pilot-test reports and results led to the development of a treatment chain for an enlarged and restored new-generation plant. The plant would be treating lake-drawn water using pressure-driven membrane microfiltration, with a 0.1-micron porosity, followed by very-high-frequency ozonation and chlorination, while ultimately emitting a very small quantity of wastewater.

The upgraded Sherbrooke plant, commissioned in February 2015, is now one of a few plants in North America equipped with a secondary membrane filtration system, and when installed was operating the world's largest very-high-frequency ozonation system.

As a result of its upgrade, the J.-M.-Jeanson plant can now supply residents with a flow of approximately 100,000 m<sup>3</sup>/day.

## Microfiltration solution

Completed at an under-budget cost of \$31.4M, the modern plant includes the largest drinking water membrane filtration system in Quebec. To minimize the footprint because of the small space available on the site, the design of the system with its different components was implemented over two floors, with only 1,165 m<sup>2</sup> added to the 1,350 m<sup>2</sup> of the rehabilitated existing facility.

Laboratory testing conducted on source water drawn from Memphrémagog Lake showed that processing the lake's lightly-loaded water using conventional treatment methods failed to produce flocs large and dense enough to settle and be removed.

On-site pilot tests conducted using hollow fibre micro-



Exterior of the addition to the J.-M. Jeanson drinking water treatment plant in Sherbrooke, QC.

All photos courtesy exp

filtration membranes led to the selection of pressure-driven microfiltration technology from New York-based Pall Industries. The primary membrane filtration system transforms raw water without coagulant agent added into drinking water using nine membrane trains, including one for redundancy.

The dirty waters from the backwash of the primary membranes are also treated. This dirty water is collected and treated by the unique secondary membrane filtration system, independent from the primary system.

It's this water that is reused to backwash the primary system. In conventional processes, drinking water produced by the plant is used for backwashing. The use of the secondary membrane filtration system is an advanced sustainability process that reduces the waste of fully-treated drinking water and providing savings over the long run.

Part of the design team challenge was also minimizing discharge to the sewer to avoid having to expand the local wastewater treatment facility.

### Ozonation

The very-high-frequency ozone generation technology, from Pinnacle Ozone Solutions out of Florida, is a compact system that allows for easy maintenance, and it doesn't require the addition of nitrogen to generate ozone from pure liquid oxygen.

This ozone generating process also differs from low-frequency or medium-frequency ozone generators in many ways including: requiring less space; providing better ozone production rates while reducing stress on the dielectrics; the absence of stainless steel tanks is a long-term advantage as a recurring problem associated with

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low- and medium-frequency systems comes from the degradation of tank welds by nitric acid formed during the production of ozone.

As the second link in the treatment chain, the ozonation process further increases the water clarity, helps cut down trihalomethanes (carcinogenic compounds), tastes and odours in the water, and provides an efficient treatment of cyanobacteria (blue-green algae) and related cyanotoxins, while also contributing slightly to the disinfection.

**Cleaner chlorination**

The final step in the process, chlorination, is the only chemical treatment used at the facility. And the plant was able to replace gaseous chlorine (highly toxic) with liquid

chlorine, providing an improvement to the overall safety. The facility is located next to the main campus of the Université de Sherbrooke, so safety concerns extend beyond the facility itself to its close neighbours.

**Efficiency**

In all, the complete system is a highly-automated process, including 1,200 alarm points in membrane filtration alone, where control and operations are possible using tablet computers near the equipment, and they provide complete and ongoing monitoring of the process.

The system is also optimized for energy efficiency, using variable-frequency drive starters and the very high-frequency ozonation. The equipment is capable of meeting demand, without exceeding it.

Other sustainability features include: heat recovered from engines is used to heat the facility; the plant's white roof contributes to reducing the heat island effect; a retention basin with a flow regulator is used to manage runoff from facility roof and parking lots; and exterior lighting was designed in accordance with Mont-Mégantic International Dark Sky Reserve guidelines and with a commitment to fight light pollution.

**Minimal waste**

One of the facility's prime accomplishments is the very small quantity of wastewater that is generated in the overall water treatment process. There is a marginal 0.4% discharge to sewer (compared to typical values ranging from 5-10%). The waste, which is transferred to the wastewater treatment facility in the form of concentrated sludge, eliminated excess strain on the local wastewater treatment facility, which was one of the design team's objectives.

The City of Sherbrooke is now distributing drinking water of a quality that surpasses current Quebec regulatory standards, with an average turbidity of only 0.011 NTU, a value that is almost 10 times below the 0.1 NTU maximum.

Considering that its performance exceeds current regulatory requirements, the plant will continue to meet regulatory requirements as standards increase.

**CCE**



Top to bottom right: Mobile tablets are used to monitor the systems; Five 200hp primary supply pumps and pre-sieving in the basement; The very high frequency ozone generators; Pump room serving the secondary membrane filtration and washing of the membranes.



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# RECLAMATION & RE-ENGINEERING

Landfill mining in Barrie, Ont., achieves an 18-year capacity increase and allows for installation of improved environmental controls.

By Paul Dewaele, P.Eng.,  
Golder Associates, and  
Sandra Brunet, City of Barrie

In 2008, the City of Barrie's municipal solid waste landfill had a licensed volume of 3,900,000 m<sup>3</sup> and was slated for closure in 2017.

The landfill covers an area of 18.6 hectares and extends to a peak thickness of 30 metres. Originally designed as a natural attenuation facility, leachate seepage to the groundwater and impacts to an adjacent stream resulted in environmental risk and compliance issues.

Groundwater control systems consisting of a drain (gallery) and purge wells were constructed to intercept leachate impacts and discharge to the City's wastewater treatment plant.

An updated landfill design was developed involving reclamation, or "mining", of waste in the western two thirds of the landfill, and re-engineering of the site to incorporate a

liner and leachate collection system (LCS) as well as a landfill gas collection system and flare. The project was undertaken to address environmental compliance and reduce the period and collection rate of the groundwater control systems.

## Landfill mining

Landfill reclamation refers to the process whereby the existing waste fill is excavated, screened to remove the daily cover soil and then the remaining large waste fraction is re-landfilled using a greater level of compaction and less soil cover than had originally been used. The screened daily cover is referred to as "fines", whereas the remaining waste component is referred to as "overs".

While the primary intent of the project was to reduce environmental

impact, it was also expected to result in a recovery of air space, thus extending the operational life of the landfill. During a pilot study, frequent and detailed surveys of the excavated and waste fill areas were combined with weigh-in-motion measurements.

The in-place density of the excavated waste was 1,310 kg/m<sup>3</sup>; the apparent density of the re-compacted over-size fraction was 1,280 kg/m<sup>3</sup>, as compared to a typical compacted waste density of 750 kg/m<sup>3</sup>. The mining operations were staged in three large phases, covering the south, central and northern parts of Cell 2 and 3.

Nearly 1,630,000 m<sup>3</sup> of waste was excavated between 2009 and 2015, representing 44% of the total licenced landfill volume. Approximately 20% of the waste was re-landfilled without



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screening, including asbestos and newer waste which exhibited high odours during excavation.

The fines component averaged 53%. In some areas, large wood stumps and construction concrete rubble and a substantial proportion of tires were encountered. Wire and industrial fabric served as the greatest operational challenge slowing down the processing.

The waste materials in the newer part of the landfill consisted of more



Above: Construction of lined waste cell.  
Left: The waste screening operation.



consisting largely of paper and fibre and plastic (7%). The fines quality largely meets Ontario Table 2 standards for final cover material, although boron and copper are occasionally slightly elevated.

Elevated electrical conductivity is observed, consistent with leaching of salts from the waste.

“uniform” waste and contained few tires or material that affected screening; as a result, the overall daily production increased.

The waste screening operations were undertaken using two 2.1 m diameter, 10-m-long rotating drum (trommel) screens with 52-mm openings. These screens were typically staged at the base of a waste slope and excavation operations were adjusted to push or occasionally transport waste to the screens.

The heavy equipment used in the operations typically included two to three large excavators with thumbs, two D-6 bulldozers and four articulated haul trucks (25 to 35 tonnes). The production rate for each screen averaged approximately 140 m<sup>3</sup>/hour over the project period.

Odour control and assessment of

the potential for air quality impacts, notably relative to the nearest residences located 250 m away, was a significant part of the project planning and implementation.

Sampling of the landfill gas and of air quality upwind and downwind of the landfill indicated that there were no anticipated exceedances of the regulatory standards or health impact standard related to the reclamation process.

The City implemented regular odour inspections surrounding the site, and site operations were adjusted as required to ensure minimal impact to residents.

### Fines analysis

On a weight basis, the fines consisted primarily (74%) of fine-grained sand, followed by dry combustibles (15.4%)

Based on a risk assessment approach, the quality of the runoff from the site is not expected to adversely impact surface water quality.

### Environmental benefits

The installation of the liner and LCS captures leachate and limits further impacts to the underlying groundwater flow. Once the existing plume in the aquifer under the landfill is captured by the purge well system and subsequently shut down, the flows to the wastewater treatment system will be reduced.

Furthermore, the cost of operating the active purge well system will end, and the leachate collection will be limited to gravity drainage of the LCS and gallery.

A landfill gas collection and flaring system was installed in the



rates and population growth predictions, the total lifespan of the landfill is calculated to extend to 2035, or an 18-year gain.

This gain represents increases resulting from (i) re-use of the fines component as daily cover, (ii) greater density of compaction of the in-place

materials and (iii) reductions in waste disposal rates achieved since the reclamation project began. **CCE**

*Paul Dewaele, P.Eng., is a senior waste engineer with Golder Associates in Barrie. Sandra Brunet is the manager of environmental operations for the City of Barrie.*

reclaimed portions of the waste in order to reduce the effects of greenhouse gas emissions. This system is currently collecting and flaring approximately 340 m<sup>3</sup>/hr of landfill gas, and it is predicted that a maximum collection rate of up to approximately 500 m<sup>3</sup>/hour may be achieved.

On this basis, and considering current approaches to funding of LFG power generation projects, installation of a 500 to 850 kW generator is considered feasible.

#### Airspace gain

In 2004, it was predicted that the Barrie Landfill would be filled to capacity by 2017. A total of approximately 742,200 m<sup>3</sup> of fines were produced during the reclamation process; this material is re-used as daily cover during the placement of the overs from the reclamation process and the incoming waste, as well as interim and final cover.

In 2009, prior to reclamation, the remaining airspace was approximately 815,000 m<sup>3</sup>; the remaining airspace at the end of reclamation in 2015 was 1,144,550 m<sup>3</sup>. Based on the current annual waste disposal

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Tracking the Metrolinx Eglinton Crosstown tunnel project in Toronto.

By Doug Picklyk

# TWIN Tunnels

On Monday, March 13<sup>th</sup> the first parts of two massive tunnel boring machines (TBMs) began emerging to the surface of Eglinton Avenue, just east of Yonge Street, in Toronto. The two TBMs had travelled 3.2 km east-to-west, leaving behind twin concrete tunnels that will envelop one section of the Eglinton Crosstown, Toronto's new 19-kilometre light rail transit (LRT) that is scheduled to become operational in 2021.

The Crosstown will include 25 stations along Eglinton Avenue with a central 10 km underground section incorporating 12 of the stations. In total, four identical TBMs were acquired for the Crosstown project to tunnel the 10-km stretch. Metrolinx, the government agency created to coordinate and integrate public transportation in the Greater Toronto and Hamilton Area, purchased the machines.

Manufactured by Caterpillar Tunneling Canada, each tubular machine was 10-metres long (32.8 feet), with a

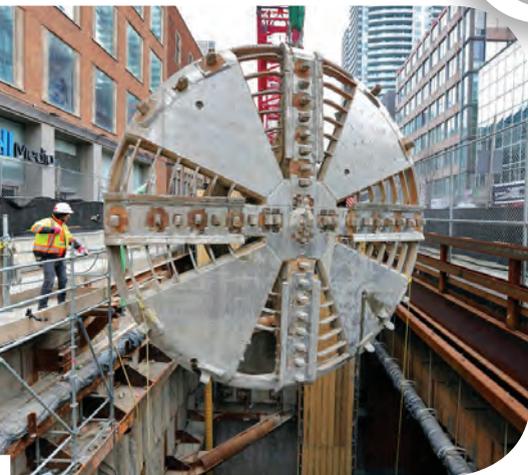
diameter of 6.5-metres (21 feet) and weighing over 400-tonnes.

The machines were custom made to perform in the existing soil conditions, identified by the geotechnical baseline report (GBR) prepared ahead of the tunnelling ground-work.

"The GBR is basically a pictorial of the ground, water table and useful information to let the contractor know what's in store," explains John Brown, construction lead for tunnels and cross passages with the construction management team responsible for the east section of the tunnel project.

The tunnel drives, located between 16 and 20 metres beneath Eglinton Avenue, were below the water table. The TBM's ordered were earth pressure balance machines, says Sal Santoli, manager civil infrastructure with Metrolinx, in order to deal with the depth of the job.

"It's technology that controls the face pressure while excavating, so you're not removing material at a rate greater than permissible for ground



*Top:* An Eglinton Crosstown tunnel boring machine prior to launch for the western portion of the drive. *Centre:* Extraction of the TBM on Eglinton Avenue, just east of Yonge St., following its 3.2-km drive. *Bottom:* One of four Eglinton Crosstown TBMs.

conditions in that area. That could cause settlement of the road surface above,” explains Santoli.

“Generally the pressure wasn’t very high, reaching 2.5 to 3 bar, and in most cases it was 1.5 to 2 bar. So that’s the kind of pressure you want to maintain to avoid ground movement, settlement and the like.”

The TBMs were very sophisticated, automatically adapting to changing conditions. Equipped with pressure sensors, they monitor and report in real time.

“We had some interesting ground to mine through, but there was nothing unexpected,” notes Brown. “We knew we were going to hit saturated granular material and dry clay material.

“When you’re sending the TBM ahead you want it to react to the dry material and make it wetter, and when you’re going through wetter conditions, you are injecting materials to

stiffen the ground up to make it the perfect medium for mining.”

He explains there were daily surface monitoring meetings to discuss the active zones (50 m ahead and behind of the TBM) for any movement or trends of ground shifting. A precaution taken to ensure there is no threat of sinkholes or earth movement.

Having four highly-automated machines straight from the factory was reassuring. “When you’re tunnelling you don’t have a reverse gear,” says Brown. Other technology features included monitoring of grout injection while tunnelling to fill the gap left between the diameter of the excavating machine and the diameter of the concrete rings left behind. The soil/muck weight is also measured as it’s extracted through a conveyor on the machine. Over the course of the project 1,165,000 cubic metres of muck was removed.

### Precast concrete segments

Within the TBMs trailing shield the operators build and connect the precast segments that make up the segmentally lined twin tunnels. Each ring built is made up of six 1.5-metre-wide segments.

The tunnel boring machine advances by utilizing thrust rams to push off each newly installed precast ring.

Each segment of the precast concrete was embedded with an RFID code, which allows tracking of every piece to identify when it was manufactured and where it’s located in the tunnel to address any potential issues down the line. Each machine on the west side alone installed 25,674 precast concrete tunnel segments, which formed 4,279 rings.

### Cross passages

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transit tunnels is escape routes for passengers in the case of an emergency evacuation. At fixed intervals in each Crosstown tunnel are cross passages that link one tunnel to the other, and emergency exit buildings (EEBs). An EEB is a shaft that drops down over the tunnels, with a staircase leading up and a small building at the ground level with an emergency exit door.

### Headwalls

Before the tunnelling began the early works design included installing jet grout walls, headwalls, for each end of the underground stations along the line. The TBMs then mined through these walls creating a seal between the wall and the tunnel precast rings to prevent ingress of water when the hole for the station is excavated between them.

For tunnelling, the headwall also provided an area where the TBM operators could drive into the walls and create a resting place allowing them to perform regular tool inspections at the machine's cutting head without risking settlements of the road at the surface.

### Mining drives

The twin-tunnelling project ultimately created two concrete tunnel tubes with inner diameters of 5.75 m located less than 5 metres apart. The entire project was divided into three drives, or earth pressure balance tun-

nelling portions, explains Santoli.

The first tunnelling contract, awarded to Crosstown Transit Constructors (Obayashi Canada, Kenny Construction Company, Kenaidan Contracting and Technicore Underground), was made up of two portions. It started at a launch shaft about 6.4 km west of Yonge Street (Black Creek Drive) and travelled east. The first TBM launched in June 2013, and the second machine set off about six weeks after that. The launch times are staggered to avoid ground movement with the machines operating side by side.

### The leapfrog

The first section ended when the TBMs approached the existing Toronto Transit Commission (TTC) Eglinton West subway station around the end of 2014.

The Crosstown will run below the existing subway line at Eglinton West and the risk of tunnelling below an operational transit line was avoided.

An extraction shaft was created on one side of the subway station and a launch shaft on the other. The contractor extracted the TBMs and placed them, one at a time, on a specialized self-propelled modular trailer to transport them about 100 metres across the road to the launch shaft.

Precautions were required to move the extreme weight over the existing transit station box, so a small bridge deck was fashioned across the road-

way. "The load was suspended across both ends with pillars so there would be no load transmitted to the TTC box itself," explains Santoli.

The move was done over a weekend, and although it required the closing of a heavily travelled expressway, the event went smoothly. "On this project we had a very engaged community and we worked closely to provide regular updates, and I think that was an important aspect," adds Santoli.

Both machines were lowered into the second launch shaft and re-launched beginning in June, 2015. They completed their drive by May 2016 and are both currently parked underground where the Yonge/Eglinton LRT station will be built. The machines will be extracted when the station is being excavated.

### The East portion

The 3.2 km east section of the project was contracted to Aecon Dragados Joint Venture. A launch shaft was excavated east of Brentcliffe Road, west of the Don River, and the two TBMs were lowered into the shaft in several pieces that were bolted together and mining started in October 2015, heading west towards Yonge Street.

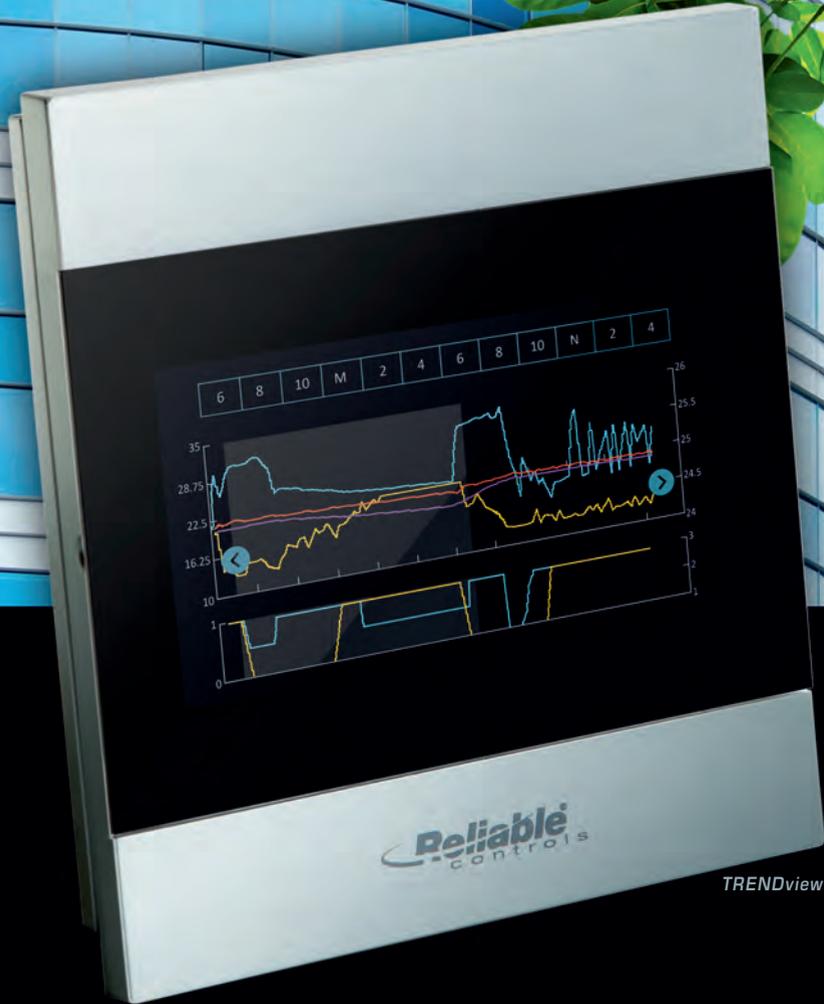
The tunnel goes slightly uphill, so it is set to a gradient that is suitable for the trains, while the station areas are flat.

On both the east and west drives, the tunnels remain relatively straight, no curves of any magnitude. The average production rate, on the west was 14 m/day, and the east was slightly faster.

"We finished our tunnelling in 11 months, but the extraction shaft wasn't yet ready, so the machines were parked until the extraction of both machines this past March and April," says Brown, who was in attendance when the TBMs were pulled out in pieces and shipped away. **CCE**

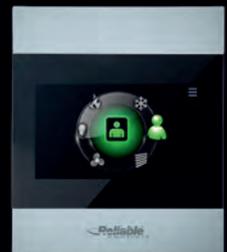
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# STYLISH Steel

The CF Toronto Eaton Centre pedestrian bridge gets a makeover.



A rendering of the new Toronto Eaton Centre (TEC) pedestrian bridge.

On April 10 Cadillac Fairview unveiled the design for a new pedestrian bridge linking the landmark CF Toronto Eaton Centre with the flagship Hudson’s Bay and Saks Fifth Avenue stores in the heart of Toronto.

“Beyond the simple utility of construction of a bridge across Queen Street, this pedestrian bridge will serve as a unique architectural icon and impressive space in its own right,” said Wayne Barwise, executive vice president, development, with Cadillac Fairview in the announcement.

The CF Toronto Eaton Centre is celebrating its 40<sup>th</sup> anniversary this year, and approximately 2 million people use the pedestrian bridge annually.

UK-based architects WilkinsonEyre designed the new structural steel bridge that will be encased in floor-to-ceiling glass panels with multiple spiraling angles and etched bronze cladding panels.

The original pedestrian bridge, designed in 1978 by Zeidler (in association with B+H) was taken down on the Victoria Day long weekend (May 21-22), and Zeidler is playing the role of executive architect on this project.

The structural engineering is being handled by Read Jones Christoffersen. The design and build of the bridge was assigned to seele canada Inc., the Canadian subsidiary of the German-based façade construction company seele, while the Walters Group of Hamilton, Ontario was sub-contracted by seele for fully modelling a cambered profile and supplying the main structural box girder supporting the architecturally exposed structural steel (AESS) ribs and façade created by seele.

According to Walters Group structural steel’s high strength to weight ratio made it an efficient material to span the length of the bridge. It can also be contoured with relative ease to match the various twists and turns required by the design.

In fabricating the box girder, a weathering steel (Grade A588) was used since in the design the box girder’s voids are used as ventilation ducts, and given the risk of moisture weathering steel provides a level of resistance that regular mild steel wouldn’t.

Fabrication of the 95 tonne box girder began in Jan 2017 and was completed in early May. The 36.6-m x 4-m box girder was constructed as one fully-welded assembly.

The bridge twists from one end to the other, so the vertical and torsional camber was controlled by using a shop geometry fixture modelled to match the specific requirements of the bridge.

The cambering accounts for the deflection of the bridge under its full weight. After the box girder was shipped to the site, a further 130 tons (approx.) of glazing and secondary steel framing supplied and installed by seele increases the weight of the bridge to approximately 220 tons.

At publication, the bridge is still a work in progress being assembled at ground level around the corner from its final location. The girder was placed atop two temporary support towers designed for the full working load on the bridge.

Upon completion this fall, the bridge will be placed on a modular transport vehicle, moved to its location and raised hydraulically to its final position.



## Eaton Centre Pedestrian Bridge Design Team

<b>Owner:</b>	Cadillac Fairview
<b>Architect:</b>	Wilkinson Eyre Architects (Design) Zeidler Partnership (Executive)
<b>Contractor:</b>	PCL Constructors Canada
<b>Structural Engineer:</b>	Read Jones Christoffersen Ltd.
<b>Electrical &amp; Lighting:</b>	Mulvey & Banani International
<b>Mechanical Engineer:</b>	Mitchell Partnerships Inc.
<b>Other:</b>	seele Canada (façade), Walters Group (girder)

rendering: Wilkinson Eyre Architects



# Question today *Imagine tomorrow* Create for the future

We must all hold ourselves accountable for tomorrow. For us, that means creating innovative solutions to the challenges the future will bring. Can we design a place where our communities can thrive?

What if we can?

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Consider a competitive-bid situation. The client has narrowed the field down to two proposals, which are now sitting on her desk. One is from a large, well-known firm her company has used many times before. The other is from a mid-size firm she hasn't worked with before, but she's heard good things about it.

What would cause the client to take a professional risk and give the nod to the mid-size firm? Even a significant price disparity won't make up the difference, if she is concerned about the career-limiting consequences of making the wrong choice.

To see how the smaller firm can level the field, consider a saying common in the past century: "Nobody ever got fired for buying IBM."

Big Blue's mainframe computers might have been pricey, and its legendary blue-suited sales reps sometimes had a bit of an attitude, but IBM was seen as the safe choice in the mysterious new world of computers—a choice that any mid-level manager could defend.

It's the same with some large engineering firms today—the competitive playing field sometimes seems slanted in their favour. They're the "name brand" on the top of a proposal, just like IBM's logo was found on many winning bids. Many clients see them as the safe choice, just as IBM used to be.

But there is a way for small to mid-size firms to develop that same "safe choice" aura that IBM built. Do this though a two-punch process I call, "inform and persuade."

### Building awareness

To see how the "inform" part of this works, consider the buying process from the client's viewpoint. They may try hard to be aware of all the firms that may be able to work on their type of project, but if they don't commission engineering projects on a frequent basis, they may not have an extensive network of firms. And, your firm might have added service



By Carl Friesen

lines, such as soil mechanics or noise and vibration, and is now capable of doing a wider range of projects.

This means that your firm must reach out, informing potential clients of its current capabilities, and you must go further by demonstrating to the prospective client that the firm has members who are recognized authorities in their field.

If "inform" is an intellectual exercise, "persuade" is all about emotion. You want to convince the prospective client that their project is safe with your firm, and that you'll make them look good.

Another part of persuading is giving the prospect the backup they need to convince their colleagues and superiors that choosing your firm, versus a larger name brand, is defensible.

Put simply, you're looking for a way to make prospective clients aware of your firm and what it offers,

and then to persuade them your firm is a safe choice, one that will help make them look good.

### Solving problems, accessing opportunities

One of the best ways to show your firm has what it takes is to, well, show it.

You can do this best by creating information and making it available through articles published in their business and professional media, speeches at their professional gatherings, your own blog or newsletter, and newer technologies like LinkedIn posts and videos.

But don't make the classic mistake of choosing topics based on "what I want to tell you." Rather, your focus should be on creating content around "what you need to know."

Do this by demonstrating your firm's abilities to help your prospective client solve problems that are pressing on them right now, or help-

G



-size firm the “safe choice.”

Getty Images

ing them access opportunities they need to seize on right now.

You're best to start with the “problem” side of that, because people are more likely to take action to avoid a problem they fear, rather than an opportunity. So, think of the problems that are pressing for the people you want to serve. Particularly, think of new developments, because people are naturally inclined to pay attention to what's new.

This involves a three-step process:

1. Learn about their world: Think of new regulations they may be facing, such as environmental, health and safety, public security, or financial standards. You may need to burrow into the world of the people your firm wants to serve. To do this, read their trade media, magazines, association websites, and blogs. Attend their industry conferences, or at least, look at the conference programs

online to see the topics listed for their plenary sessions and workshops.

Get to understand their competitive landscape. Many industries are being disrupted by automation and the “gig economy” (think Uber and Fiverr).

As well as problems, think of the opportunities that your ideal clients are facing—ways they can expand into new markets, how new materials technologies can help them build structures they only imagined before, or the new worlds opened up by 3D modeling.

2. Understand how your solution meets their issues: Next, get a clear idea of how your firm's service offerings meet the pressing problems and opportunities facing your ideal clients. To do this, you need to switch your thinking from “service lines we offer” to “client issues that we help solve.”

3. Create content that shows your firm's abilities: Your final step is to show your abilities by creating genuinely useful information, like the aforementioned blog posts, articles, speeches and videos.

For example, a few years ago I worked with a noise engineer who told me that his province's home-warranty program had recently expanded the factors it was covering for high-rise condominium developments. The warranty would now cover noise issues. If the buyers of the unit found that noise from neighbors' appliances, noise from HVAC systems, the elevator, and other sources exceeded regulated levels, they had a claim under their warranty.

So I helped the engineer create an article for a condo builders' publication on how to work with a noise engineer to reduce the potential causes of noise, and to achieve a positive report on the noise inspection.

This article is an example of looking at a firm's service offering—noise engineering—as a solution to a new problem faced by the client, which was the new provision in the home warranty program.

### Become a known and trusted source

Creating useful content that showcases your firm's areas of expertise is a way to build awareness, so that our hypothetical decision-maker at the start of this article will at least consider a smaller firm's bid carefully.

Thought leadership marketing is also a way to build credibility for your firm. Be seen as an authoritative expert in your chosen areas of practice. This increases your “safety factor” in the eyes of your client, so that your firm becomes the defensible choice.

**CCE**

*Carl Friesen is the founder of Thought Leadership Resources, helping business professionals build their profile as subject-matter experts. Learn more at [www.ThoughtLeadershipResources.com](http://www.ThoughtLeadershipResources.com).*

GRUNDFOS

## National Real Estate Management Co. Attains Energy Conservation & ROI Goals with Grundfos Pump Audit and Retrofit of Two Toronto Towers

Canadian Real Estate Investment Trust (CREIT) company owns, has shares in, and manages over 150 industrial, retail and office properties in urban areas all over Canada. Two office towers in particular located in downtown Toronto had existing oversized booster pump systems that were over 15 years old. Both systems were running at extremely low efficiency, and had been having numerous operational and maintenance issues. CREIT Director, Property Management; Joe De Faria wanted an assessment of the current system's efficiency and reached out to Grundfos for an energy efficient solution that would have an aggressive return on investment.

Grundfos Sales Manager; Janusz Kic worked with MAC Energy Solutions & Building Services to conduct an extended eight day pump audit that would profile the existing system's flow, pressure and power consumption. Data collected revealed that the systems in each of the towers were operating at constant speed with no capability of varying speed with the change of water demand in the buildings. Pressure reducing valves were also being used to regulate the fluctuation in pressure, which was cause for a significant waste of energy. More specifically two pumps in the South tower were shut completely off, while the third pump remained on manual, and both pumps in the North tower were on auto.

Once the results were analyzed Grundfos proposed installation of a "right-sized" Hydro MPC-E CUE 3CR10-8 7.5HP 3x575V BoosterpaQ system in each of the towers. The South towers projected annual energy consumption is 8,928 kWh, a savings of 92% and over \$14,000 annually, with an estimated payback period of 3 years. The North towers projected annual energy consumption is 7,457 kWh, a savings of 96%, and over \$25,000 annually, with an estimated payback period of just over 1.5 years.

The Hydro MPC (multi pump controller) BoosterpaQ was chosen for the following reasons:

- The system is designed for domestic cold water boosting variable flow applications in multi-storey buildings.
- CR pumps are the best foundation for the system. They have the highest efficiency in the market and are extremely reliable. Just two pumps will meet 100% of the demand, while the other pump remains on standby.
- The MPC alternates between lead and lag pumps ensuring equal run hours on all of the pumps. It's built in pump curves identify if it's more efficient to operate two pumps at a slower speed, rather than one pump at full speed.
- The VFD (variable frequency drive) located in the MPC reduces speed to match flow demand. It allows the CR's to continuously regulate speed while maintaining pre-set constant pressure. It also allows the pumps to run only when demand is detected, extending the pump's lifespan, decreasing energy consumption, and reducing maintenance costs.
- The system come preassembled, is tested prior to delivery, and requires minimal maintenance.
- The control panel allows for communication with the building's automation system.

Grundfos proved to be the top choice. The pump audit indicated factual energy savings versus the competition simply sizing and selecting based on the existing system's original design duty conditions. Also, the projected ROI was much quicker when compared to the competition's promise, and Grundfos offered a more accurate pump selection. Northern Air Environmental Technologies completed the South tower install in February 2017, and the North tower install shortly after in April. The systems have been working flawlessly ever since. Both system replacements qualify CREIT for a total projected incentive rebate of \$27,026 from Toronto Hydro.



Article by Melissa Almonte of Grundfos. Headquarters Tel: 1-800-644-9599. Visit: Grundfos.ca

# Specifier's Literature Review



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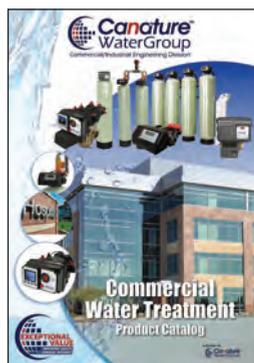
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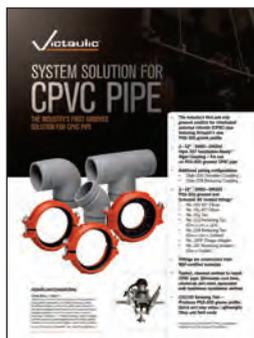
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Bosch Thermotechnology has unveiled the new Climate 6000 AH semi-custom commercial air handler series, providing commercial and industrial customers with improved indoor air/environmental quality by the introduction of outside air, and removal of undesired exhaust air or large-space comfort conditioning. Horizontal unit configurations range from 800 to 38,000 CFM, while vertical configurations are available in 800 to 4,000 CFM. [www.boschheatingandcooling.com](http://www.boschheatingandcooling.com)



The new FLIR ONE Pro, smartphone thermal camera, has a ruggedized design that is drop tested to 1.8 meters. Combining FLIR's MSX with FLIR's video signal processing technology, VividIR, the FLIR ONE Pro delivers

the highest thermal image quality and clarity of all FLIR ONE generations. The units are available for both iOS and Android devices. [www.flir.com](http://www.flir.com)

A new line of dedicated outside air systems (DOAS) from the YORK brand of Johnson Controls, includes a range of 100% outside air units and mixed-air units. With heat



pump operation and water source operation, as well as a hot water heat option, the new air systems deliver more combinations of heating and cooling than before. The systems also feature an internal energy recovery wheel that pre-conditions outside air and reduces heating and cooling loads by transferring energy between the exhaust airstreams. [www.york.com](http://www.york.com)

Victaulic has released updates for its Tools for Revit 2018, with enhanced pipe routing and fabrication features. Updates include new preloaded content and templates, additions to 'Pipe Tools' that enable users to automatically tag pipe according to multiple parameters; added 'Pipe Type Import Tool' that reduces file size, removes duplication and more. [www.victaulicsoftware.com](http://www.victaulicsoftware.com)

### Mueller acquires HeatLink

Calgary-based HeatLink Group Inc. and its affiliated PEX-a tubing manufacturing facility PexCor Manufacturing Company Inc., have been acquired by U.S.-based Mueller Industries Inc.

Heatlink's co-owners Manfred and Garry Schmidt will continue to lead the Canadian operation. HeatLink and PexCor will complement products that comprise the piping systems group of Mueller Industries.

[www.heatlink.com](http://www.heatlink.com)

### Uponor Canada Grand Opening



(l-r) Brent Noonan, vp sales, North America; Bill Gray, president North America; and Charlie Harte, general manager, Canada.

On June 1 Uponor celebrated the grand opening of its new Canadian headquarters in Mississauga, Ont. Merging its sales and marketing team with its eastern distribution centre for commercial PEX piping, the newly-designed space includes a hands-on customer experience centre and a training room able to accommodate up to 50 attendees for educational events. "This investment is a firm signal of our commitment to the Canadian market," said Bill Gray, Uponor North America president.

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# Embracing BIM

Although the concept of digital building models have existed for over 30 years, the momentum for full-scale adoption of building information modeling (BIM) is growing as companies in all sectors of building design and construction get on board.

We spoke with Raza Tanveer, associate electrical engineer with DIALOG in Toronto to assess one engineer's views on the state of BIM in the consulting engineering business today.

The University of Alberta graduate moved into the building design and consulting sector about six years ago and works as a project manager and lead designer.

**"It's part of a whole other field that's connected to BIM—automation, artificial intelligence—and there's a lot of room for exponential changes to the industry."**

**– Raza Tanveer**

## *What sparked your interest in BIM?*

I still remember the first time someone introduced the concept of BIM to me here in Toronto. I was immediately hooked. The idea that elements in a traditional drawing could be parametric, and that data is stored in a database is such a powerful concept.

It became apparent to me immediately that there were all kinds of things we could theoretically do if those so-called "dumb lines" in CAD were suddenly smart objects.

## *Clearly you consider yourself a BIM champion?*

I'm not a BIM expert, but I think that it adds a lot of value, and as a process manager I understand how it works.

## *What have you done in BIM?*

When I joined DIALOG my first BIM project was a very large hospital, new construction. I joined from the design development phase right through to

contract documents and now we're in construction administration, and we've been using BIM steadily. It's really an integral part of the process.

## *What role do you play in BIM?*

Leading the design, I had a team of people working on the modeling, but I found myself having to learn it very quickly to be that conduit between the senior engineers and leadership team and the designers working day-to-day in BIM.

It's complicated software and it's the younger engineers who are building up that expertise. On the other hand, the classic engineering experience is held within the senior leaders.

So there's a bit of a gap there, and I think it's very valuable for that middle level of people to really embrace it and get hands on.

## *So BIM is still finding its way in the industry?*

Senior leadership is very familiar with the CAD world. Even if they don't use it day-to-day, they can estimate how much time it will take to do a certain pass.

With BIM it's a new world. So for me it was very valuable to be able to bridge that gap and say, "this is a lot easier than you think," or "we can't quite do that yet."

## *Is there a push to adapt BIM?*

DIALOG has actually invested a fair bit in both acquiring and developing BIM talent within our firm, as well as making it a habit to not only use it for the larger marquee projects where it's expected but even small projects.

## *What challenges still exist?*

It makes so many things better. I think our team is now at a place where we would prefer to do things in BIM over CAD given the choice.

It takes time and effort to get there, because it can be quite daunting at first. And I think that's where a lot of people tend to hesitate, because their first experiences might be a little rough. But looking at the long view, there's a lot of benefit.

## *What are some advantages?*

You can really cut down on the level of administrative tasks that you've had to do traditionally, and that way you really get to focus on the design—the engineering.

## *Is having in-house BIM knowledge a competitive advantage?*

If you're doing renovation work or small projects there may not be a lot of impetus to move to BIM.

But for any new build the push is moving to BIM, and then when it comes to doing renovations on those buildings they're going to be giving you a BIM model. It's moving there very quickly. It's not a competitive advantage for firms—it's a necessity.

## *Where do we go from here?*

Because it's database driven and there's an API which allows us to write code, scripts and plug-ins, that opens up a world of possibilities.

Now you're not just hiring an electrical engineer to do design, you're hiring a programmer. That's a shift we've started to see.

It's part of a whole other field that's connected to BIM—automation, artificial intelligence—and there's a lot of room for exponential changes to the industry.

If we can have self-driving cars, we can certainly move a lot closer to automating some common engineering tasks.



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