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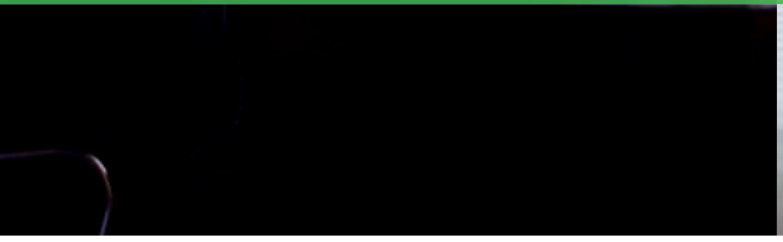

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Life Is On | Schneider Electric

Cover: Telus Sky Tower, Calgary, artist's rendering. Image: BIG/DIALOG. See story, p. 14.

Cogeco Amphitheatre, Trois-Rivières, Que. See story p. 24.

December 2016
Volume 57, No. 7

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Next issue:
University student centres, smart grids, concrete rehabilitation, and BIM.

on topic

The world changes as it turns

The surprise election of Donald Trump south of the border has really shaken up the world, setting it on an unpredictable and, some feel, scary course. What we can be sure of is that we will see change.

When people retire they often reflect on the changes they have seen in the world over the course of their careers. At the risk of sounding like a typical old-timer, I'm following the pattern. For this my last editorial comment I felt bound to record the trends I've seen shaking up the world of consulting engineers in Canada over the last 30 years that I've been an editor on construction magazines (the last 19 years with CCE).

One obvious change is corporate globalism. When I started with CCE, consulting engineering companies were smaller and much more like studios. It was a simple thing to call and speak directly to the partners. That culture has faded as countless small and medium-sized firms have been gobbled up by large international companies. The culture of a global company is inevitably less personal and more restrictive, controlled by corporate policies set in head offices thousands of miles away.

The built landscape itself has changed dramatically. Thirty years ago Post-Modernism was at its heyday One of the first buildings that fascinated me was the Mississauga City Hall with its peaks, pediments and solid walls. Architects subsequently reverted to Modernism, but now we're seeing another escape from the rectangle, especially in tall towers with more curvaceous and tactile profiles (see pp. 10 and 14). We've also seen walls and walls of glass condominium towers spring up everywhere, despite their energy costs — see p. 16.

Environmentalism has completely transformed engineering in the pages of this magazine, if not entirely in the wider world. The buildings we publish today are almost all LEED or otherwise green-certified. Transportation and other big infrastructure projects take great pains to reduce their impacts. This curatorial role is a far cry from the days when engineers saw their role as manipulating and dominating the landscape.

Then there's technology. Rows of men bent over drafting tables have given way to rows of people staring at computer screens. Two-dimensional CAD is giving way to virtual BIM models and fly-through videos that let you experience a project before it's built. Information is available instantly and communication is seldom by phone. We're all tuned into the Web, reliant on the Cloud. Time and space seem compressed. Simultaneously we're all more strapped for time, pushed to work longer hours, more impatient with our tools and with each other.

We should be cautious when embracing a super-technological world. As the consulting engineers told me for the article on Engineering Education (p. 22), it's not enough for new graduates to be computer whizzes who can churn out solutions in a flash. They still have to be able to think logically. They have to be able to see the bigger picture if they are going to become consulting engineers who truly add value to their companies, projects and society at large.

Bronwen Parsons

FOR PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE

CANADIAN CONSULTING engineer

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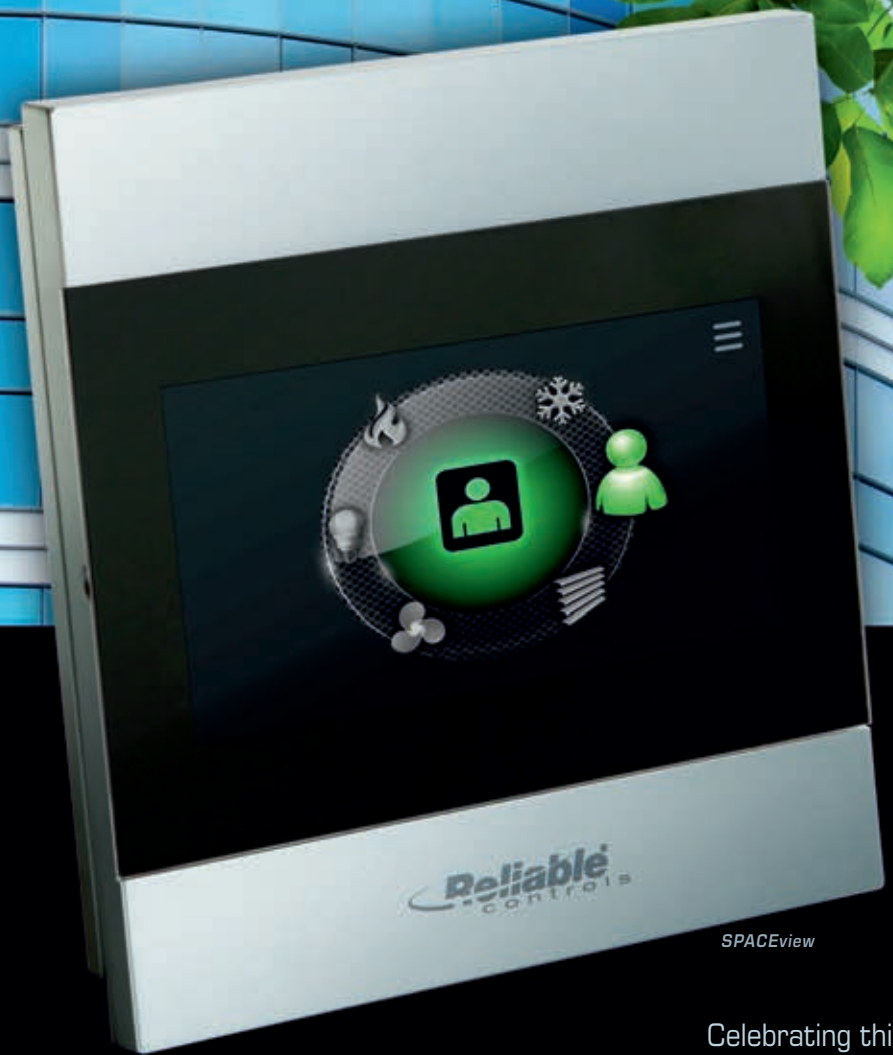

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TRANSPORTATION

Evergreen Line in Vancouver opens

Metro Vancouver's latest extension to its light rapid transit network opens in December, giving the city the longest fully automated and driverless rapid transit system in the world.

The new Evergreen Line stretches 11 kilometres long, with seven stations. It connects to the existing LRT at Lougheed Station, where a third platform was added. From there it goes on to Burnaby, Port Moody, Port Coquitlam and Coquitlam. The line includes a 2-km bored tunnel between Coquitlam and Port Moody, as well as grade and elevated portions.

At a cost of $1.43 billion, the project was designed and constructed by EGRT Construction, a consortium of SNC-Lavalin, Graham Building Services, International Bridge Technologies, Jacobs Associates, Rizzani de Eccher, S.E.LI. Canada and MMM (WSP).

It is expected to carry 70,000 passengers a day by 2021. The project was funded by the governments of Canada, B.C. and Translink.

TRANSPORTATION

Teams qualify for 67-km Montreal REM network

Two consortia have been qualified to bid on the engineering for the massive Réseau électrique métropolitain (REM) transit project in Montreal. On November 10 CDPQ Infra, the infrastructure subsidiary of Caisse de dépôt et placement du Québec, announced that Groupe NouvLR and Kiewit-Eurovia would be invited to submit proposals for the infrastructure engineering, procurement and construction (EPC) contract for the light rail network.

CPDQ Infra.

REM on Champlain Bridge, Montreal.

The electric, fully automated network will extend 67 kilometres, linking downtown Montreal, South Shore, West Island, North Shore and the airport. It will have underground and elevated sections, with 24 stations and four branches.

The Groupe NouvLR team involves SNC-Lavalin, Dragados, Aecon, Pomerleau, EBC and AECOM. The Kiewit-Eurovia team includes Kiewit, Eurovia, WSP and Parsons.

Studies project that the network will carry over 120,000 people a day.

continued on page 8

INFRASTRUCTURE

PM's infrastructure bank

Prime Minister Justin Trudeau met several pension and other big investor groups in downtown Toronto in November. During the "unprecedented" meeting Trudeau promoted the proposed Canadian Infrastructure Bank. The government will seed the fund with $35 billion and is hoping that private investors will provide four times that amount.

WORLD

Trump optimism

Commentators looking for hope after the surprise election of Donald Trump as U.S. president said investors will flock to Canada to find a more stable home for their money. Some P3 builders are also hoping for opportunities south of the border because Trump has promised to build more roads, ports etc.. However, when campaigning, Trump trumpeted buy-in-the-U.S. policies.

BUSINESS

Manitoba joins NWPTA

Manitoba has joined B.C., Alberta and Saskatchewan to create a large, barrier-free trade and labour market — one that catches consulting engineering services within its purview. The New West Partnership Trade Agreement (NWPTA) requires governments to have an open and non-discriminatory procurement process for projects (mostly over a $75,000 threshold) so that companies from the other provinces can participate.

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Ontario Wood Council

St. Elias Ukrainian Catholic Church, Brampton, Ont.

AWARDS

Ontario Wood Awards announced

The 2016 Ontario Wood WORKS! Design Award winners were announced on November 15. Among the winners was the St. Elias Ukrainian Catholic Church in Brampton, modeled after the architectural style known as "Boyko" from western Ukraine. Designed by Zimmerman Workshop Architecture + Design and Moses Structural Engineers, the heavy-timber structure is 75 ft. high, with copper-clad domes that are a hybrid of glulam, stick frame and curved plywood. The largest of the five domes weights almost 20 tons.

Michael Baldinelli

Other winners included the Upper Thames River Conservation Authority Community Conservation Centre in London (Randy Wilson/Hastings & Aziz); First Ontario Performing Arts Centre, St. Catharines (Diamond Schmitt/Blackwell); Templar Flats, Hamilton (Lintack/Strick Baldinelli Moniz), Rock Garden Visitor Centre, Royal Botanical Gardens, Hamilton (CS&P/WSP); Woodland Public School, North Bay (Mitchell/WSP); La Ruche Lab, Ottawa (La Cité); and the Chippewas of Nawash new elementary school (MMMC/Blackwell). The Engineer award went to Michael Baldinelli of Strik Baldinelli Moniz.

ENVIRONMENTAL

Clean-up begins at Eldorado site

Trucks started carrying low-level radioactive waste from one of the most notorious sites in Canada in November.

The site at Port Granby in Clarington, on the shores of Lake Ontario, contains waste generated between 1930 and 1988 during the radium and uranium refining operations of Eldorado Nuclear. Eldorado was first a private corporation and then a Crown corporation.

The 450,000 cu.m of waste is being carried 700 metres north on a specially built road to a long-term storage facility designed by AECOM and built by AMEC-CB&I Joint Venture. The storage mound has a highly engineered base liner system.

The clean-up is one of two at the former Eldorado waste sites. The second is at Port Hope, 15 kilometres further east, where a long-term storage facility is still under construction. The Port Hope site has the largest volume of historic low-level radio-active waste in Canada.

Both sites are being remediated by the Port Hope Area Initiative (PHAI) office, led by Canadian Nuclear Laboratories on behalf of Atomic Energy of Canada.

Craig Hebert, general manager of PHAI, said on November 1: "Today we are witnessing history, as we begin the final chapter in addressing this long-standing environmental issue."

The work in Port Granby will take three years, after which the mound's cover system will be constructed, expected to be in 2021.

ENERGY

Framework for Zero Carbon Buildings

The Canada Green Building Council (CaGBC) has released a Zero Carbon Buildings Framework. CaGBC worked with Integral Group in Vancouver who consulted 40 organizations and reviewed nine international net zero building approaches.

The framework has five components, including metrics for: greenhouse gas intensity calculated using regional emissions factors; energy intensity; peak energy demand; an embodied carbon metric (to recognize the importance of building material lifecycle impacts); and a requirement that renewable energy be generated on-site or procured directly.

ENERGY

ASHRAE issues new energy standard 90.1

ASHRAE has published a revised version of its ANSI/ASHRAE/IES Standard 90.1-2016, Energy Efficiency Standard for Buildings Except Low-Rise Residential Buildings. The 2016 version's technical changes cover the building envelope, lighting and mechanical systems.

The mechanical system changes include a first-time requirement for large electric driven chilled water plants to be monitored for electrical energy use and efficiency.

Canadian Manufacturing at its Finest

Bibby Foundry in Ste-Croix, Quebec

Manufacturing is the cornerstone of the Canadian economy. Bibby-Ste-Croix employs over 500 team members in their Quebec foundries who are responsible for the production of cast iron soil pipe and fittings used in drain, waste and vent (DWV) plumbing systems, as well as street castings, manhole frames and covers, and municipal road castings. For each job Bibby creates, there are three additional jobs created within the community which contributes to the overall economic growth of the country. The company is privately owned and dates back to 1921.

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ONE BLOOR

A glass podium meets the busy street corner.

The striking architecture of a 76-storey condominium tower at the corner of Yonge and Bloor makes its mark in an upscale area of midtown Toronto. The structural, mechanical and electrical engineers describe their contributions to the design.

Currently nearing completion, "One Bloor" sits on one of the prime sites in mid-town Toronto, at the southeast corner of Yonge and Bloor Streets. The 76-storey tower holds 700 units on a one-acre site. It is close to the sophisticated designer shops along Bloor Street West and in Yorkville, and also at the intersection of the city's two main subway lines.

Designed by Hariri Pontarini Architects for Great Gulf, the tower rises above a striking six-storey glass podium which fronts onto the busy sidewalk with retail stores and a mid-block public walkway. The building's architecture is characterized by undulating forms. On the Bloor Street side the glass walls of the podium curve around, and a vertical strip patterns the tower's façade, culminating in a sloped roof. The architects wanted the building to contrast with the many modernist, rectangular buildings in the area.

On the sixth and seventh floors, i.e. at the roof of the podium, there are green spaces, spa facilities, and two pools. — CCE

STRUCTURAL ENGINEERING

By Paul F. Ast, P.Eng., and Jeff Vivian, P.Eng., Jablonsky Ast and Partners

The original owners of the site of One Bloor Street East lost ownership in the upheaval of the 2008 financial crisis. The current owner, Great Gulf, proceeded with design and construction in 2009. Our firm had been involved with the design of the pre-2008 structure and was selected to provide structural design for the building that is being completed today.

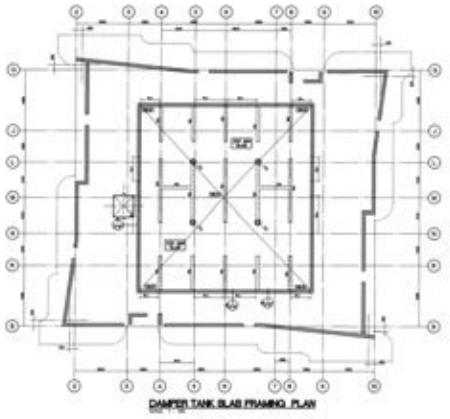
The prestigious location resulted in high demand for units, which led to the need for structural changes to enable more efficient and desirable unit layouts. The original height of the building of 65 stories was increased twice: first to 70 storeys and finally to 76 storeys.

There are in principal three important aspect of design in these "Super Height" buildings:

- Performance of the structure for the comfort of inhabitants;
- Load transfer from the upper residential occupancy to the lower floors used for retail;
- Foundation design to provide controlled settlement of the building;

Performance of structure for the comfort of inhabitants

The total (final) height of the structure at the highest roof of 257.3 m and minimum width of the tower in plan of 27.5 m yield a height-to-width ratio of 9.36. The wind tunnel testing carried by Gradient Wind Engineering resulted in the top inhabited floor (76th) to be 24 Milli-g's, well over the accepted maximum of 18 Milli-g's. A dynamic damper in the form of a sloshing water tank was designed by the wind engineers to reduce the acceleration to 18 Milli-g's. The size of this damper located in the 78th floor is 18 m x 19.5 m in plan and 4 m in depth (see drawing).



Jablonsky Ast

Load transfer from residential occupancy to retail

The typical plan of the tower above the transfer at the 8th floor consists of a combination of a linked core, corridor tube and shear wall at the demising lines between apartments. The thickness of the shear walls was varied from 400 mm (to the 12th floor), to 350 mm in the remaining floors. The thickness of the core walls was 350 mm for the entire height of structure. The transfer of the shear walls structure to retail (9 x 9 m grid) was accomplished at the 8th floor by 2300-mm deep transfer beams and an increased size and rigidity of the core.

Foundation design providing controlled settlement of the building

The load bearing capacity of soil at SLS as specified by the geotechnical consultants, McClymont & Rak Engineers, was 1000 KPa at the final level of the P6 basement.

The foundation mat within the footprint of the tower specified at 2200 mm thickness was found to create excessive dishing at the centre, which would have a negative impact, potentially causing deformation of the upper floors of the tower.

To reduce this centre settlement, a total of 21 caissons of 1300 mm diameter of total length 19 to 24 m were socketed to shale rock for a minimum of 5 m.

continued on page 12

The tower's undulating curves create a playful facade.

Rendering by Harin Pontarini Architects/Matt Hallett/Ben Rahn

Rendering by Matt Hallett/Harin Pontarini Architects

continued from page 11

MECHANICAL & ELECTRICAL DESIGN

By Steven Little, P.Eng., Able Engineering

When initially looking at the building design, there were several issues that needed to be taken into account prior to laying out the mechanical and electrical systems for the building. With the height of this project, the systems needed to account for: occupancy of the various uses; overall system efficiency; stack effect and thermal expansion of the various piping systems.

Heating and cooling: multiple stand-alone systems

Rather than provide a traditional single plant located at the top of the building with pressure break heat exchanges to deal with the excessive pressures of a super tall building, the building was designed with multiple complete stand-alone systems for various sections. On the third floor there is a mechanical room that contains the equipment for levels 3 to 40 of the condominium; there is a second complete system in the mechanical penthouse serving the condominium units on levels 41 to 75. Then there is a third system (heat pump) that serves the retail components of the project (in the basement, ground and second floors). This third plant was located on the second and third floors.

The condominium suites are heated and cooled using a four-pipe fan coil system. Each of the four pipe fan coil plants consist of condensing heating boilers, centrifugal chillers, and dedicated heat recovery chillers. To provide maximum efficiency the boilers are all high-efficiency condensing (operating at 94% rated efficiency). With the use of multiple condensing boilers, the water distribution temperature in the heating system was designed to be lower than a typical fan coil system, allowing the boilers to operate in the condensing range (for optimum boiler efficiency). The suite fan coils were selected to operate with the appropriate heating coils to ensure the proper delta T is maintained.

Because the heating water temperatures are operating at condensing temperatures 49° C (the temperature varies based on an outdoor air reset schedule), a dedicated heat recovery chiller (DHRC) could be used for the shoulder seasons. When there is simultaneous demand for both heating and cooling in the building, the DHRC will operate. The DHRC rejects the heat from the cooling system loop back into the heating system rather than through the cooling tower into the atmosphere, thus maximizing the overall system efficiency. This strategy also allows the larger centrifugal chillers to shut down under small part loads to maximize efficiency, and allows the primary cooling towers to be shut down during the winter. In addition, the hydronic systems use variable speed pumping for all pumps throughout the building reducing motor horsepower during partial load situations.

Ventilation, LEED and lighting

All the suites have self-contained energy recovery ventilators (ERVs). This not only improves the overall system efficiency, but it also helps reduce the impact of the stack effect of a building of this size. Each ERV recovers energy from the building exhaust, improves the suite indoor air quality, and reduces the amount of outdoor air supplied to the corridor (reducing the overall building energy consumption).

In a condominium most of the amenity areas are not occupied during the day. In the larger amenity areas, a combination of ERV's and HRVs are used to provide the required ventilation. Using a demand based system, with the use of CO2 sensors in the various rooms to control the operation of the ERV/HRV's, we were able to reduce the overall energy usage in the space.

The building is targeting LEED certification, so it has other green building features, including water conservation. By selecting all low-flow fixtures we are able to reduce the potable water consumption by over 30%. In addition all the irrigation for the landscaping, i.e. the gardens on the podium roof, will come from rain captured from the roof and stored in a cistern located in the first basement level.

Electrically, we were able to reduce lighting power densities by specifying more efficient lighting, while working with the artist, interior designer and landscape architect to make their artistic vision a reality. All common areas have occupancy sensors installed to minimize energy usage. CCE

One Bloor Project Team	
Owner/developer:	Great Gulf Pacific Group
Architect:	Hariri Pontarini Architects
Structural engineers:	Jablonsky, Ast and Partners (Paul F. Ast., P.Eng., Jeff Vivian, P.Eng.)
Mechanical-electrical engineers:	Able Engineering (Steven Little, P.Eng., Peera Butrsingkorn, P.Eng)
Wind tunnel testing:	Gradient Wind Engineering
Geotechnical consultant:	McClymont & Rak Engineers
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Developer	Great Gulf Homes
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Architect	Bjarke Ingels Group
Developer	Westbank Developments
Structural engineer	Glotman Simpson

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TELUS SKY TOWER

In Calgary a new tower is rising 58 storeys to transform the city skyline with a distinctive curved and textured facade.

Under construction in the heart of downtown Calgary, the Telus Sky Tower will be the city's third tallest building when completed in 2017. The 58-storey, 221-metre structure will be shorter only than the Bow, which was completed in 2012 at 237 metres, and Brookfield Place which is also currently under construction at 247 metres.

Located at the 7th Avenue and Centre Street, the Telus Sky tower has a distinctive profile that narrows as it rises and has a distinctive "pixelated" façade on the north and south sides. Architects Bjarke Ingels Group of Copenhagen and DIALOG of Calgary have designed the building to curve and incline on two different arcs roughly at the point where the building changes from office to residential floors. In addition, the smooth glass cladding on the lower commercial floors transforms into a three-dimensional composition of protruding apartments and balconies in the residential suites above.

There are seven levels of below grade parking, three floors of commercial and retail uses, then 28 floors of office space. The floors above consist of 326 residential suites. The lower floors will include a restaurant, health club and 5,500 sq.ft. public amenity space.

STRUCTURAL ENGINEERING – Unique Geometry

By Anthony El-Araj, P.Eng., Glotman Simpson

The structural framing of the tower's unique geometry of pixelated expression and slab terracing required attention in order for the structure to function seamlessly within the multi-use spaces. We achieved this by avoiding interior columns, and instead placing them around the perimeter, making them equally spaced to match the pixelation bays.

At 58 storeys, the tower's 3.6 length-to-width ratio also made it susceptible to cross wind dynamic accelerations that could exceed occupancy comfort levels. Also, since the terracing is not uniform along the north and south faces, it imposed a structural twist or torsion.

Far left: Artist's rendering of the tower with its "pixelated" surface formed by irregular protruding balconies. Left: The tower visualized among other skyscrapers in downtown Calgary.

BIG/DIALOG

These issues are resolved through the lateral load resisting system. We designed a unique shearwall layout for the entire building that provided adequate stiffness and strength for the induced loading demands from both the wind and the horizontal thrust loads of the "walking" columns. The shearwalls included walls that framed the elevator bank on the office levels, and wing walls that sit on columns below.

At the tower's parking levels, we used ultra-high strength concrete, 110 MPa, and composite structural steel and concrete columns to reduce the size of the structure and maximize the number of parking stalls in the tight space provided.

MECHANICAL ENGINEERING – District Energy and Displacement Ventilation

By Jason Edey, Reinbold Engineering Group

The office portion of the tower is being designed for LEED Platinum certification. It is estimated to consume 30% less energy than similar buildings.

The office and residential component are both connected to the Enmax District Energy System. District energy systems are inherently efficient because of their scale. This one serves buildings in the East Village district and downtown Calgary, distributing hot water through underground pipes in a closed-loop system to heat exchangers in the individual buildings.

The tower's office floors have displacement ventilation systems, where ventilation air is supplied from central heat recovery air handlers that supply tempered fresh air, and recover heat from stale exhaust air. The ventilation air is fed through underfloor plenums to two-pipe cooling-only fan coil units, then rises by convection through floor diffusers into the space. The system gives maximum thermal comfort to the occupants and minimizes noise. Architecturally an underfloor system allows for clear ceilings with maximum height and more efficient lighting.

The ventilation air is ducted directly into individual zones, where sensors manage the air flow and indoor air quality — all connected to a central building automation system. Thermal losses at the exterior of the building on the office floors are addressed by specially designed VAV perimeter hydronic radiation troughs that are installed flush with the raised floor system.

The residential suites have four-pipe horizontal fan coil units with ECM motors that meet the heating and cooling loads, while reducing fan energy during partial loads.

Rainfall will be collected from the level 60 roof and re-used for the roof top gardens. The rest of the building — including the suite balconies — will have the storm water piped internally to a storage tank in the parkade, a practice which is not typical in the city of Calgary.

Grey water will be collected and treated for use in the urinals and water closets up to level 6 on the commercial floors, all helping to reduce the water use.

ELECTRICAL ENGINEERING – One Backbone, Added Intelligence

By Gary Rhode, Integral Group

We were tasked with integrating all the building systems into one communications backbone. The systems can then be controlled and synchronized through a central building automation system (BAS) to achieve maximum energy efficiency and effectiveness.

Good design for mechanical and electrical systems is not enough any more; without good information on what is happening in the building, decisions cannot improve. The vision for the Sky Tower is to have all systems connected for real time information and control. Reaching this vision requires adding analytics or intelligence to inform the operator and occupants what they need to know about the performance throughout the building's useful life.

Integrating systems in this way requires the design team disciplines to collaborate and integrate their designs from the beginning. This project has buy-in from the owners down and we believe the approach will maximize the comfort of its occupants.

The building has many other sustainable features, such as the lighting system, which is all LED and uses addressable lighting controls. Half the roof area supports a PV solar array that produces 32,000 kWh/yr and feeds directly into the building's power systems. On the other half of the roof is a landscaped garden surrounded by high glass walls. CCE

Telus Sky Tower Design Team	
Owner-client:	Westbank Projects
Architects:	Bjarke Ingels Group and DIALOG
Structural:	Glotman-Simpson (Anthony El-Araj, P.Eng.)
Mechanical:	Reinbold Engineering Group (Edward Lazar, P.Eng.); Allstar Mechanical Group (Jeff Wilson)
Electrical, energy modelling, LEED	Integral Group (Gary Rhode, Ali Nazari, Kevin Welsh)
Supplier:	Armstrong Pumps (pumps)

CONDOMINIUMS & RESILIENCE

CCE

By Liam O'Brien, P.Eng., Ph.D., and Ted Kesik, P.Eng., Ph.D.

Typical condominium towers leave residents vulnerable during power emergencies. This research shows what design features could improve their "passive survivability."

Multi-unit residential buildings (MURBs) such as high-rise condominium developments, have an inherent sustainability edge over the detached houses that were so central to the North American dream during the last half of the 20th century. MURBs have a heat-conserving form and contribute to urban intensification, which economically supports efficient public transit. Their carbon-shedding characteristics outweigh the net energy impact of a reduced surface area to collect solar energy.[1]

MURBs can also help buck the unfortunate trend where improvements to the energy efficiency of detached, single family homes are being largely offset by increasing floor areas.[2] Moreover, in Canada's major cities, where condos are the dominant new housing form, they represent one of few viable home ownership options for younger urban adults launching their careers.

But the inherent benefits of condominium buildings are not being fully realized. These buildings often fail to provide resilience against unforeseen, but ever more frequent, power outages and mechanical and electrical system failures. Much like a car with no gas, these buildings become largely unusable without energy. A prolonged power outage can leave their occupants without heating, cooling, outdoor air, light and water, or force them to evacuate when their suites become unbearable. The growing aging population demographic is especially vulnerable to being stranded if elevators fail in high-rise buildings.

Floor-to-ceiling glazing — so what's the problem?

Condo buildings tend to be covered in floor-to-ceiling glazing — a strategy that would not have been advanced without the privilege of cheap energy, especially if the builder was responsible for energy costs past the point of sale. Homebuyers want — or think they want — oversized windows because otherwise the units would feel like cramped, dark caves. The more sensible alternative to have larger suites with more exterior wall exposure with punched windows, as in traditional apartment buildings, is not as profitable when it comes to selling the units.

But we know from daylighting theory that beyond about a 40% window-to-wall ratio (WWR) there is only a marginal improvement in how much daylight is available inside the unit. What's more, we conducted a long-term photographic study of a so-called fully glazed

building in Ottawa and found that the window shades were typically closed 60-85% of the way on average. In a neighbouring building with reasonably sized punched windows (about 30% WWR) people keep the shades closed only half as much. This begs the question: why are we building condos with these expansive, seldom-used, window walls?

Windows are typically less than 20% as insulating as opaque walls. This means they transfer heat about five times as quickly as walls and become the weakest link in the building envelope, especially when mechanical systems fail to operate. From a comfort perspective, a little understood fact is that building occupants are very sensitive to surface temperature because of the radiant heat loss from our bodies to these surfaces.The sensed operative temperature is about half influenced by surface temperature and half by air temperature. So without a steady stream of cooled or heated air aimed at the fully glazed exterior walls, the perimeter of fully glazed condos may not be comfortable enough to enjoy — particularly with low-performance windows.

How do these fully glazed buildings pass through energy codes? The answer is: loopholes that violate the spirit of the codes. The first loophole is a prescriptive path that limits the overall building window-to-wall ratio, but does not prevent windows from being poorly positioned from a comfort or energy perspective. The energy and comfort implications of positioning all the glass in principal rooms are grave. In a field study of 20 condos across Ottawa, we found that a common complaint was that glazing was inappropriately positioned within units.[3] One fully-glazed bedroom was so cramped that the homeowner had to brush up against frigidly cold glass to get into bed. Another had a fully-glazed bathroom with a toilet that was like a throne positioned to address the masses below. The more common loophole to achieve expansive window areas that are not permitted under the prescriptive path is to use the performance path, since it allows the use of high-efficiency HVAC and lighting to trade off against poor efficiency building envelopes. As we will see later, this approach exacerbates the resilience problem.

Thermal bridging makes things worse

Contrary to common belief, glazed sections of condos are not the worst for thermal performance. At least they contain a continuous thermal break — in the form of a gas fill between the glass panes. In contrast, perimeter metal framing and concrete slabs often extend right from the "warm" side to the cold side of a wall, as illustrated in Fig. 1. A comprehensive study[4] by Morrison Hershfield showed that current modelling methods greatly overestimate the insulating efficiency of typical window/wall constructions in condos. As a result, homeowners, tenants, and society as a whole, shoulder the burden of a large stock of condos that perform much worse than the code intended. Sadly, 21st century condos do not perform any better than the stock of 1960s and 70s high-rise apartment buildings. What other consumer product has not advanced in its energy performance over the past 50 years?

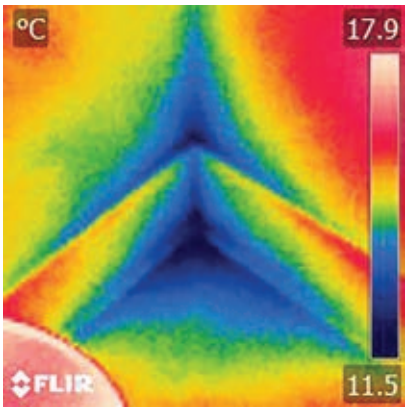
Aside from the everyday energy and comfort implications of poor envelope design, underwhelming resilience should also be of great concern. Resilience is a virtually neglected concept until disaster strikes as it did during Toronto's long ice storm and power outage of December 2013. Even if this ice storm did not directly cause death from exposure to cold, there were reports of carbon monoxide-caused deaths because people started generators or barbecues in their garages.

Passive survivability — two condos compared

One of the most relevant building resilience metrics is "passive survivability" (PS). PS is the length of time that a condo, or any type of building, remains between 15 and 30°C after a power or system failure. PS is best evaluated during the coldest and warmest periods of a typical year, which happens to be when failures are more likely to occur anyway.[5]

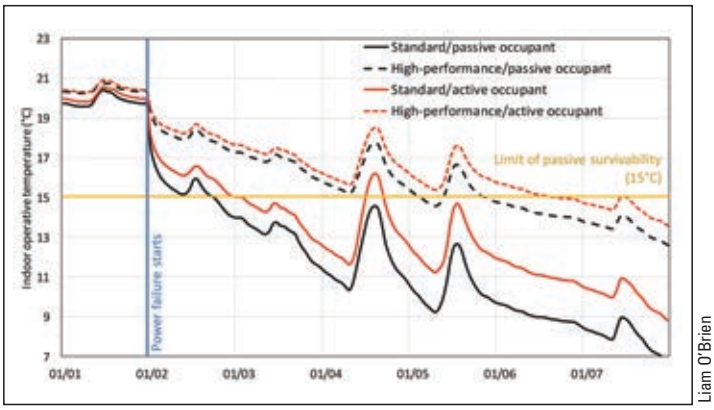
Building performance simulations are a useful tool to evaluate passive survivability because design mistakes are not expensive to identify as we can test artificial scenarios before real disaster strikes. But in reality, the vast majority of simulation use worldwide is to demonstrate code compliance — an application which rarely influences design.

To demonstrate passive survivability, we examined two south-facing condo designs in Toronto (standard and high-performance) and two occupant types (passive and active). The standard design has a window that takes up 80% of the exterior wall (south-facing), and the remaining wall meets code minimum requirements if traditional, one-dimensional heat transfer paths are assumed. The high-performance condo has a 40% window-to-wall ratio with triple-glazing and thermally broken window frames and balcony. Both units have a two-metre



Source: Isis Bennet

Figure 1. Thermal image of the interior surface of an exterior corner of a new condominium building, showing thermal bridging at the floor slab and corner and at the connection of the walls.



Liam O'Brien

Figure. 2. Graph showing operative temperature response for suites with different building envelopes and occupant behaviours.

deep balcony that extends the entire width of the unit. The active occupants open and close the operable windows and the reflective interior shades. The passive occupants do little to improve their comfort, and standard modelling assumptions are made about how they behave.

We looked at these two condos' operative temperature response over one week starting January 1. The weather was cold and fairly cloudy, though there was some useful solar radiation a few days later. The results shown in Figure 2 show the operative temperature response in the condo for the four combinations that result from the building envelope and occupant types.

The metric shows that the high-performance unit retains heat more than two days longer compared to the standard unit — regardless of the occupants' activeness. The difference on the first day in particular is quite significant in that the high-performance unit remains above 17°C — a temperature which many frugal homeowners use as a standard heating setpoint.

One of the most profound findings of our research is the significance of providing occupants with ample opportunities for adaptation, which tends to rival the importance of a high-performance envelope. Operable windows, effective window blinds that can control solar gains through favourably oriented windows, and the possibility to bundle up or strip down, greatly alleviate discomfort and improve passive survivability. These features are simple to offer, and yet they are often overlooked. Instead, the typical current situation is that windows open only slightly, window blinds are selected for aesthetics rather than their ability to reject solar gains, and fishbowl-like condos preclude stripping down for all but a minority of exhibitionists. The interested reader can find more details on this simulation in the published study.[6]

What do we need to do next?

It is not prudent to engineer buildings where passive systems (building envelopes) are compromised by trade-offs against active systems (HVAC, lighting, etc.) because only passive systems provide shelter when power outages occur. Building performance simulations can help designers provide a reasonable level of resilience by supporting them in improving passive survivability while greatly enhancing thermal comfort.

As we move toward a low carbon economy and adapt to climate change, engineers should advocate for positive changes that make for more resilient buildings, such as:

- Promoting measures for resilience in building codes;
- Imposing more rigorous heat transfer modeling through facades, such that thermal bridging is not neglected and the effective thermal resistance of assemblies informs design decisions;
- Eliminating loopholes that allow violations of the spirit of the code, such as trading off building envelope efficiency against HVAC and lighting systems efficiency.
- Educating homebuyers about building performance and the resilient features to seek out; also educating them on how to manually control window blinds and operable windows to their full potential; and
- Designing buildings to be more usable and operable so that occupants do not helplessly and passively try to cope with discomfort or even dangerous conditions.

Given Canada's population growth projections and future trends for urban intensification, we will see thousands of MURBs constructed in cities across Canada during the 21st century. It is critical that we improve the quality, energy efficiency and resilience of what will become the dominant form of housing for city dwellers so that this stock of housing becomes a legacy, not a liability. **CCE**

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By Manasi Koushik, P.Eng., MBA, EP (CEA)
and Steven Booth, C.E.T., LEED AP, Pinchin

BOMA BEST – Version 3.0

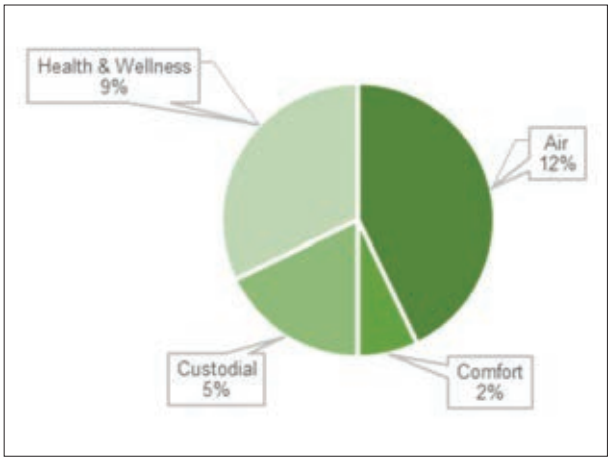
The next generation of building certification programs is putting much more focus on indoor air quality and occupant health.

Addressing health and wellness, occupant comfort, and productivity is a key component of a variety of up and coming building certification programs.

The WELL Building Standard, for example, has made steady gains into the building certification market, with projects registered in Canada and 279 registered worldwide since its release in 2015. The WELL Standard is certified by the Green Business Certification Incorporation (GBCI) which is also the certification body responsible for certifying LEED buildings. WELL is designed to work with LEED buildings and is supported and promoted by GBCI and the Canada Green Building Council.

The U.S. federal government's GSA (General Services Administration) and CDC (Centers for Disease Control and Prevention) with the Center for Active Design are in the process of launching the Fitwel building certification process. These new certification systems are also focused on improving employee health and wellness, thereby increasing overall productivity.

BOMA Canada (Building Owners and Managers Association) has a building certification program that recognizes excellence in energy and environmental management and performance in commercial real estate. BOMA BEST has long been a go-to building certification standard with respect to energy and environmental sustainability for building types such as office buildings, enclosed shopping centres, open air retail, light industrial, multi-unit residential and healthcare facilities.



Graph of % breakdown of IAQ categories within BOMA Best V3.

BOMA BEST widens its reach

Reflecting aspects of the new wellness standards, the new version of BOMA BEST widens its focus and considers occupant health and wellness as a key priority. Significant changes to BOMA BEST V3 are the expansion from 14 to 16 BEST Practices and 6 to 10 key areas of environmental performance and management. The BEST Practices are the minimum requirements to achieve BOMA certification. A building can increase the number of points to achieve higher levels of certification by improving on the 10 key areas of environmental performance and management.

New BEST Practice requirements include an Indoor Air Quality (IAQ) Monitoring Plan, Hazardous Chemical Products Management Plan, Green Cleaning Program and a Hazardous Building Materials Management Program, which now includes Silica.

The 10 key areas of environmental performance and management for V3 are:

- Energy
- Water
- Air Quality
- **Comfort***
- Health & Wellness
- **Purchasing***
- **Custodial***
- Waste
- Site
- **Stakeholder Engagement***

* new

Important to note is that three out of the four new categories involve an aspect of IAQ action and awareness. These changes ensure that in addition to energy and water conservation, occupant health and comfort take centre stage.

Focusing on the requirements for office buildings under BOMA V3, there are typically 1,000 points that can be awarded to buildings. The IAQ categories: air, comfort, custodial and health and wellness in combination account for 28% of the overall achievable points. In comparison, energy and water sustainability account for 30 to 35% of all achievable points. The percentage breakdown of each category is shown in the graph at left.

IAQ Monitoring Plan

BOMA BEST V3 ensures that an IAQ Monitoring Plan

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is present in all certified buildings. The BEST Practice is closely in line with industry best practice. This includes setting standards for common indoor air quality contaminants, setting a schedule for HVAC inspection and maintenance, creating a preventative maintenance plan, developing a response procedure should IAQ concerns arise, and finally, training for building staff on IAQ issues. This type of IAQ management plan along with IAQ testing and assessment can help avoid potentially costly indoor air quality problems down the road.

Legionella and Radon

Two other areas of IAQ where the requirements of BOMA BEST V3 have increased include Legionella and radon. Legionella in potable water systems and cooling towers presents a risk to occupants when that water is aerosolized at faucets, showers and in the cooling tower drift. Radon is a gas that is naturally occurring throughout Canada and, being both colourless and odourless, is not detectable without testing. BOMA has added these new criteria:

– the implementation of a Legionella Bacteria Control Management Program compliant with ASHRAE 188 and the Public Works and Government Services Canada's "Control of Legionella in Mechanical Systems"; and

– testing for radon and the implementation of mitigation measures where there are exceedances above the Health Canada action limit of 200 Becquerel's per cubic metre.

The final destination

Although BOMA BEST continues to be focused on sustainability initiatives, based on how the points are weighted within the BOMA BEST assessment, it is clear that IAQ management and practices account for a large percentage of the overall points.

The BOMA Best V3 guideline and questionnaire can be found at http://bomacanada.ca/bomabest/resourcesupdates/v3guide/ CCE

Manasi Koushik, P.Eng., MBA, EP (CEA) and Steven Booth, C.E.T., are with Pinchin. The Pinchin Group of Companies is based in Mississauga, Ontario and has provided engineering, consulting, testing and project management services related to environmental management and health and safety since 1981.

By Bronwen Parsons

ENGINEERING GRADUATES

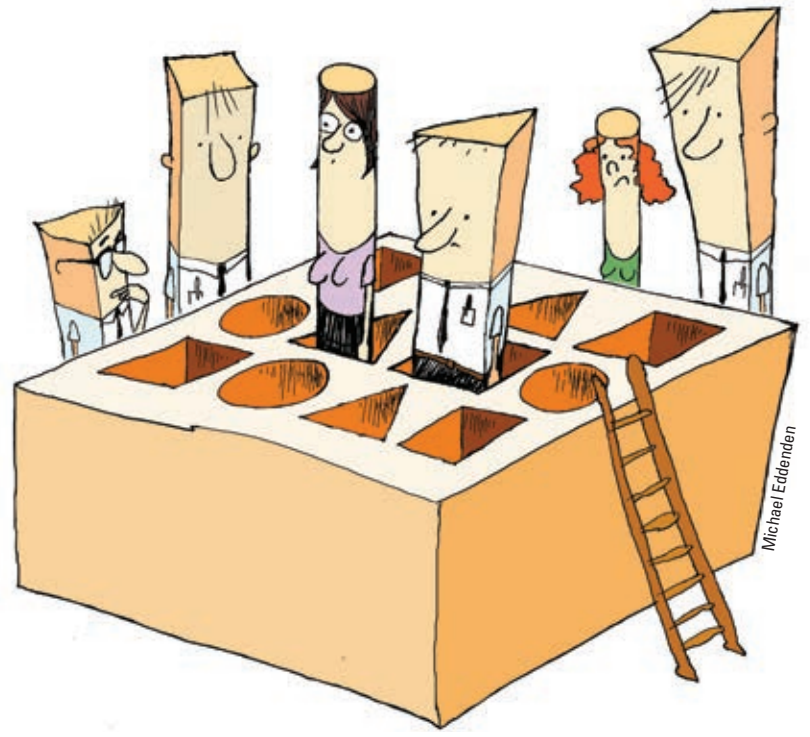
Do they fit the bill?

When consulting engineering companies hire new graduates they need them to be productive quickly. But are the universities preparing students for this role?

For consulting engineering companies it's critical that the graduates they hire become productive quickly. "After all, we're not a teaching organization, we're a business," said one consulting engineer. Firms need new employees to get up to speed quickly so that they can work on projects and generate billable hours.

Over the past 20 years universities have been tailoring their curricula to try to make engineering students more "design-ready." Professor Douglas Ruth, P.Eng., Ph.D, of the University of Manitoba is a former dean of engineering and currently an NSERC Chair in Design Engineering. He explains that 20 years ago the universities realized that students weren't being well equipped for careers in practice, so schools and the Canadian Engineering Accreditation Board launched the Capstone Design courses. Today those courses are mandatory. They involve the students in real-life projects and give them experience in working on practical problems in teams. Another initiative of approximately 20 years ago was the introduction of NSERC Design Chairs at the universities.

But perhaps the greatest impact has been the growing number of internship and co-operative programs which allow students to gain extended periods of work experience with companies.



Michael Eddenden

The benefits of co-ops

After the educational changes, how do consulting engineering companies find engineering graduates today? Do the graduates they hire fit the bill? Do they have the right skills? Are they quickly becoming productive members of the team?

An informal and unscientific poll on *Canadian Consulting Engineer*'s website would suggest the answer is No. Over 80 per cent voted negatively to the question.

But that's not the opinion of engineers we spoke to. They all speak highly of the co-op programs, for example. Tom Atkins, P.Eng., located in Regina, is vice president of buildings with mega-company Stantec. He says: "Like many companies in the consulting engineering industry, we take on students for either internships or co-op programs. I think these programs are positive, both for the employer and for the student, because they both get to try out one another and the industry. In general, anybody who has participated has been very happy with the results."

Kent Lane, P.Eng., director of corporate affairs with CBCL, agrees. He says that CBCL takes on around 10 to 12 co-op students a year, which gives them a good window to see how well the person fits in. The company is multi-disciplin-

ary engineering and environmental firm based in Halifax with 300 employees in Atlantic Canada.

At R.V. Anderson & Associates (RVA) based in Toronto, vice-president Vincent Nazareth, P.Eng., says that in addition to interns, they hire between five and 10 new graduates a year for permanent positions. Specializing in environmental and infrastucture engineering, the company has eight offices in Ontario and Atlantic Canada.

Confidence and communication

In the past, engineering graduates were often criticized for having poor communication skills, but Nazareth has seen a change. "Going back 20 years I found that many graduates lacked basic writing skills. I was correcting their English in letters and reports. I have found matters have improved considerably. It's not perfect, but it's better."

Lane too has noticed that graduates today are more communicative and "a little more self-confident." The confident ones "bubble to the top," he says when it comes to selecting people to take on.

Professor Ruth sees it from both sides: "When we do surveys of students as to what is the most important thing they should learn, it is always this: 'science basics and math.' But ask the employers, and it's always 'communications, communications, communications.'

"I always ask them, 'Think back to when you graduated.... How good a communicator were you?' What most people are looking for is a 22-year old with 20 years of experience. They don't remember that communication is a skill and it takes years to get good at it."

"Having said that," Ruth continues, "when I sit and watch the Capstone project presentations I see young adults with incredible presentation skills, with a mastery of Powerpoint, staging, presence, everything.... But we can do better."

Bonnie Elliott, senior HR advisor at CBCL, says it would be "fantastic" if students were taught more business courses, especially in how to manage client relations. This is a "huge part of delivering projects in consulting engineering," she says.

As for computer skills, Elliott and Lane find that graduates today do have exposure at university to the newest 3D design tools, which is important. But even so, once they are working they need to learn the specialized software programs that apply to the particular type of work they're doing (for example special structural design software, stormwater modelling software, etc.).

Any university engineering training can only go so far. "I think it would be fair to say," comments Atkins, "that the technical training of an engineer in the consulting industry is quite specific to the area of the consulting business they go into. [Whereas] in large part the schools are teaching fundamentals that are not necessarily directly applicable to what the consultants are doing."

He continues: "What graduates do come out with is basic engineering, basic problem solving skills. It's the problem solving skills that are paramount in the workplace."

People who can think

For Nazareth too basic problem solving skills are the most important: "You can teach anyone, anything at any time. But if you don't have an individual who can think, who has a logical process in their thinking, you're stuck."

"The graduates we have hired in the past seven to 10 years have been extremely well rounded," Nazareth continues. "They have been able to step into the roles that we've asked them to do. And as far as their technical skills are concerned, what they haven't had, they have picked up quickly."

The coveted graduate is also one who can fit into a company's "culture." If the atmosphere in the office is easy-going and sociable, then the graduate must feel comfortable in that kind of world.

Asked if RVA has policies on hiring women or visible minorities, Nazareth says, "No. We don't believe in quotas. We hire people on the basis of their qualifications. It doesn't matter who they are. We're looking for their skills in our screening process." One year, for example, five out of seven people they shortlisted for internships were women. The company also has a good track record of hiring engineers from outside Canada — including himself: "If you come here it's like the United Nations," he says laughing.

Consulting engineering firms are looking for the "best of the best" among the graduates, but they're in fierce competition with other sectors such as manufacturing and government. Only five per cent of all engineering graduates go into consulting engineering.

As for the graduates who are hired and don't work out, Atkins says it's usually because they don't understand the nature of the consulting business and come with unreal expectations. "It's a fairly demanding industry," he says. "It's not always 9 to 5. [Also] I think some underestimate the amount of job-specific learning that they're going to have to do."

Professor Ruth's advice is that consulting firms should become more involved with the universities, teaching courses on practice issues like liability, helping in Capstone design courses, and possibly sponsoring more engineer-in-residence programs.

If students can have more occasions to interact first-hand with consulting engineers, then surely more of them will realize that it's a great industry in which to work. CCE

ENGINEERING AWARD: 1
Queen-Richmond Centre, Toronto

The downtown complex consists of two historic buildings organized around an atrium, with an 11-storey office tower supported above them on a "tabletop." The tabletop platform is seven storeys in the air and was a significant design challenge given the enormous loads involved.

The solution was a "mega delta-frame" support system inspired by children's jacks. Each mega delta frame consists of two stacked, rectangular-based, space-frame pyramids, with the top pyramid inverted. The apex of both pyramids meet at the centre in a node 40 ft. high. The system aligns each of the corners of the frames directly beneath the office tower columns above, providing a direct load path for the gravity loading. This massive support system is exposed as a feature of the glass atrium.

Each frame consists of 1-metre diameter steel legs, with a 2-inch steel thickness, pressure filled concrete and a 17-ton cast steel node. Each mega delta frame can support forces of 80,000 kN, the equivalent of the weight of 400 transport trucks. (The project won the 2015 Canadian Consulting Engineering Schreyer Award, see CCE, Oct-Nov, 2015, p. 22.)

Stephenson Engineering

Project team:
Stephenson Engineering (structural engineer), Allied Properties REIT (owner), Sweeny & Co. (architects), Eastern Construction, Walters Group, CastConnex.

ARCHITECTURAL AWARD: 2
Cogeco Amphitheatre, Trois-Rivières, Quebec

Located on the St. Lawrence River, this indoor-outdoor theatre has 3,300 indoor seats and accommodates 5,500 on a grassy section behind the bleachers.

The architecture is characterized by a huge 80 x 90-metre exposed metal roof resting on eight thin columns 5.9 m high. The structure seems to "float" on the landscape. The coveted lightness of the steel , as well as the rapidity of its execution, were important factors in the choice of material.

Each high column consists of six bent steel plates to form a cylinder 850 mm in diameter. The columns are a composite of the steel with high-strength concrete of 45 MPa that gives them an increased stiffness without risk of buckling. The columns take over the gravity loads of the roof as much in compression as in tension.

The metalwork of the roof is fabricated in a crisscrossing of trusses, thus giving the structure a bidirectional response to its behaviour under the action of gravity, wind and seismic loads.

Project team:
Stantec/DPHV (structural engineer), Paul Laurendeau/Francois Beauchesne (architects), City of Trois-Rivières (owner), Canam-Buildings, Genifab, Montacier.

The Canadian Institute of Steel Construction (CISC-ICCA) announced the winners of its 2016 National Steel Design Awards on October 5 in Toronto, celebrating excellence in steel design and construction. The national awards are given every two years and are drawn from the regional winners, although selected in a separate judging process. For more details, see https://news.cisc-icca.ca

Harbourside

Photo: Marc Gibert / adeccom.ca

Winners in the 2016 Canadian Institute of Steel Construction National Awards demonstrate the imagination and creativity of structural engineers.

4 CISC winners

BRIDGE AWARD: Vimy Memorial Bridge 3 (formerly the Strandherd-Armstrong Bridge), Ottawa

The bridge across the Rideau River has a 133-ft. wide deck cross section, comprising four general purpose and two turning lanes, two transit lanes, two cycling lanes, and sidewalks.

The design separated the roadways from each other and from the sidewalks on each side, creating three open-air slots within the bridge. The slots accommodate the triple steel tubular arches along the 410-ft. main span. The arches support the supspended deck using inclined hangars. The design is the first of its kind in North America.

The river is a designated UNESCO world heritage site, which meant strictly controlling the construction's environmental impacts. An innovative method allowed 90% of the steel superstructure to be erected on temporary supports on the east approach and then launched into place across the river. For the installation the ends of the arches were tied in a "bow string" horizontal post-tensioned cable system and supported on dollies.

Project team: *Parsons (design engineer), Harbourside Engineering Consultants (erection/construction, quality assurance engineer), City of Ottawa (owner), Horseshoe Hill Construction, Montacier, Cherubini Metal Works, Tenca Steel Detailing, Freyssinet.*

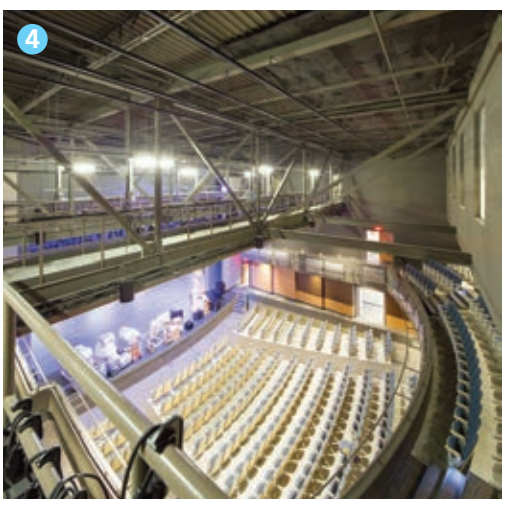
SUSTAINABILITY AWARD: 4 Jeanne and Peter Lougheed Performing Arts Centre, Camrose, Alberta

The 44,200-sq.ft. theatre was built with a focus on sustainability, including having a large solar PV array on the flytower.

The main performance chamber, which seats 550 people, had to be designed for acoustic separation. It is enclosed on three sides with a cast-in-place load bearing concrete wall, while the ceiling consists of a concrete topping over steel deck, supported by short span open web steel joists (OWSJ). These in turn are supported on custom 24-m span steel trusses. The trusses also support the catwalks and lighting equipment below.

The 22-metre fly tower was a design challenge. In order to minimize the size of the structural members to fit within the theatre designer's wall system, "two-way" framing was incorporated in the tower's west wall. This structure uses both vertical columns and horizontal beams as a means for sharing the lateral wind loading and thereby reducing the overall member sizing and quantities. CCE

Project team:
Read Jones Christoffersen (structural engineers), BR2 (architects), Clark Builders, Whitemud IW, Canam



RJC

By Debbie Cox

Managing Community Relationships

Most large projects have to undergo extensive public consultations in order to win approval. Here's advice on how to effectively handle these delicate community and stakeholder encounters.

sharply_done/iStock

These days the public expects to have a say in decisions that affect them. And public opinion matters. Government decision-makers look for evidence that the proponents have engaged in meaningful consultations with neighbours and stakeholders before granting approval for capital projects to proceed.

Since projects have been delayed or even cancelled due to public outrage, project managers are bringing social risk experts onto their project teams in the planning and design stages. Project managers recognize that early missteps can create long term challenges that are difficult or impossible to mitigate.

"Engineers aren't trained to read stakeholders and identify their values," says Timothy Phelan, P.Eng., project manager and vice-president with Opus International consultants in Kelowna, B.C. "Engineers tend to jump into the solution space without understanding people's underlying values."

In many cases, the perfect technical solution isn't the perfect solution for all stakeholders. The most efficient road alignment may significantly impact local homes and businesses. A large mining project that brings local contract and employment opportunities may also bring transient workers who disrupt the local economy and add stress to community health and social services. A new health care facility delivers much-needed health services, but also risks displacing its vulnerable and marginalized neighbours. Many stakeholders resist engineering projects because they are apprehensive the project will harm waterways, farmland and natural habitat.

Taking a planned approach

Too often project teams go through the motions of engaging communities without identifying how they will incorporate public comments into project design and decision-making. True stakeholder consultation identifies key areas where community input is required, documents and considers community comments, and reports back to the community on how its input has influenced the project.

Different projects require different levels of engagement. Designing and building a bridge and road network in a populated and congested urban environment requires a high level of engagement with many different individuals and groups. Working from a comprehensive communication and consultation plan mapped to the stages of the project, the team may hold face-to-face meetings, open houses, public forums and working sessions where stakeholders actively participate in planning and design. On less complex projects, community notification and public information sessions may be enough.

In the experience of Phelan and other project engineers, a professional and planned approach to stakeholder engagement saves time and money, and results in better decisions.

"The community knew more than we did about the area," Phelan says about a community consultation

they held to determine a preferred water pipe alignment. "They [the community] were familiar with the species that were there and where the springs were located. We may have made the same decision, but it happened faster because they provided us with the local knowledge."

Tips on managing expectations

Its important for engineers and technical leaders to remember that large projects planned to be built in or near communities usually impact someone's home, business or recreation area. Here are a few pointers to help make a good first impression:

- Start early. Reach out to the neighbours as soon as you have a project. Tell them what your team is thinking and ask for their thoughts well before all the details have been worked out.
- Ask questions and listen to the answers. If you are doing all the talking, you are missing a valuable opportunity to understand the community and identify ways to adjust your project to reduce local concerns.
- Try to keep the conversation based on the community's interests and values. Ask: What do you like about your community? What elements of your neighbourhood do you value? What do we need to know as we begin to plan our project?
- Keep creating opportunities to build trust and positive relationships. Show up, even when you don't want something, and keep people informed, even when you don't have a lot of news to share.

Finding rhythm and symmetry in seemingly chaotic human social environments requires recognizing patterns and using that information to predict issues and forge relationships. Diplomacy, clear and accurate information, and respectful consultation and engagement are essential. They help to build durable, trust-based relationships that pave the way to mutually beneficial social and economic outcomes. **CCE**

Debbie Cox is a social risk and social impact specialist who works with communities and organizations. President of James Laurence Group in Vancouver, she has worked on large and complex infrastructure and resource projects across a variety of industries. Visit www.jameslaurence.com.

Specifier's Literature Review

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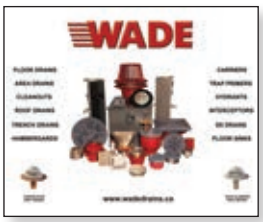

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products

2017 AHR Expo Innovation Awards

The winning products for the 2017 Air-Conditioning, Heating, Refrigerating Exposition (AHR Expo), to be held January 30 to February 1 in Las Vegas, have been announced.

Below are some of the winners related to HVAC&R systems for larger buildings.

Building automation — Danfoss Enterprise Services. A cloud-based platform specifically for retail food stores, it monitors compressors, refrigerant levels, etc.

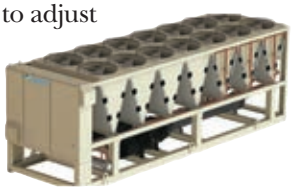
Cooling — Daikin Applied Pathfinder Air-cooled Screw Chillers with Variable Volume Ratio (VVR) Technology. The system allows the chiller to adjust its internal compression ratio as water and air temperatures fluctuate.

Green building — Carrier Dual Stage Relief Economizer (DSRE) for light commercial rooftop units. Combines a traditional economizer with a means of relieving building prssure without a power consuming device.

Indoor air quality — Nortec GS Series CS Humidifier. A gas-fired, isothermal humidifier with direct building management integration.

Refrigeration — Danfoss CTM Electrical Controlled Transcritical Multi Ejector. For warm-climate CO_2 food retail applications. Energy recovered from the gas cooler is used to increase gas pressure in parallel compressors.

Ventilation — Titus Helios Digital Diffuser. Device powered by ambient light and sunlight, using a wireless solar cell. Suitable for hospitals, offices, educational facilities, etc.



Daikin Pathfinder chillers.

For a full list of the Innovation Award winners visit http://ahrexpo.com

To find out more about the AHR Expo and ASHRAE Winter Conference, visit www.ahrexpo.com and www.ashrae.org

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Prompt Payment

Bruce R. Reynolds and Sharon Vogel of Borden Ladner Gervais led an independent expert review of the Ontario Construction Lien Act this fall. One of their recommendations was for a 28-day payment period.

Vogel (left) and Reynolds. "The evidence that we have considered indicates that the 28 day period that we have recommended is a reasonable balance."

In September the Attorney General of Ontario released the report "Striking the Balance: Expert Review of the Construction Lien Act." The independent report was by a team led by construction law experts Bruce R. Reynolds and Sharon Vogel of Borden Ladner Gervais in Toronto.

The report's recommendations are said to be "significant" and will inform coming new legislation in Ontario. The potential changes in Ontario are also being looked at carefully by other provinces.

This article is part of a longer interview published on November 23 at www.canadianconsultingengineer.com, in which Vogel and Reynolds also talked about their recommendations for changes to the Lien Act and dispute resolution mechanisms.

Q. How will your recommendations on promptness of payment affect consulting engineers?

Bruce: We recommended a Promptness of Payment approach which would include an obligation on the part of an owner to pay a general contractor within 28 days of the general contractor's submission of a proper invoice. The term "proper invoice" is very important in this context. It means, if this becomes law, that the engineer or architect who is working for the owner to certify payment will have to complete that certification process within a period of time that may be shorter than is currently the case on some projects.

Q. How much shorter, typically?

Bruce: It depends upon the contractual provisions. Right now freedom of contract applies and we are aware of examples where the owner has 45 days within which to administer the payment process. We're recommending,, amongst many other things, that the payment period be 28 days maximum following delivery of a proper invoice. The recommendation ... would apply notwithstanding any contractual provisions to the contrary.

Q. Won't it meant that the prime consultants will have to work a lot more quickly to certify payments?

Bruce: Well, we're not experts in engineering or architecture, but where a professional previously had a month and a half to perform certain functions, and is then required to perform that same function within a month if our recommendation becomes law, then it may be necessary for them to identify new approaches that will allow the certification to occur more rapidly.

There are other jurisdictions, I hasten to add, where the same functions are required by law to be performed within much shorter periods. There are states and large cities in the United States where legislation or policy requires these same functions to be performed within 15 days, for example. The evidence that we have considered indicates that the 28 day period that we have recommended is a reasonable balance.

Sharon: We're cognizant of the need to give the payment certifiers sufficient time to review the work performed and evaluate it. So over the course of our consultation meetings we did meet with representatives of the engineering community, including the consulting engineers, who provided us with a very good submission.

Q. Looking at it another way, does the shorter payment procedure mean that an engineer who is subconsultant to an architect would be paid more quickly?

Bruce: Yes. The owner would also have 28 days within which to pay the prime consultant. And the companion recommendation is that either the general contractor, or in this instance the prime consultant, would have to pay the people at the next level down in the contractual structure within an additional seven days. **CCE**

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