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Humber River Hospital in Toronto achieves LEED Gold certification

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May 2017
Volume 58, No. 3

features

departments

Next issue:
Water treatment, transit solutions, environmental remediation, structural steel and more.

on topic

Keeping Score

In early April I was introduced to the klimaaktiv building standard initiative, the government of Austria's home-grown rating system for sustainable buildings. The introduction came at a half-day event hosted by the Austrian Consulate General and Sustainable Buildings Canada in downtown Toronto.

The program shared insights into "green" building projects in Austria including a close look at the Vienna University of Technology (TU Wien) "plus-energy" high-rise building, an 11-storey facility with solar panels on the roof, southeast and southwest-facing facades along with energy recovered from the elevator system, and heat recovery from its server room.

Completed in 2014, the site reportedly generates more energy (61 kWh/m^2) than it consumes (56 kWh/m^2). The project scored 1000 out of 1000 points to achieve klimaaktiv Gold status, and also 986 of a possible 1000 points in the Austrian Sustainable Building Council (ÖGNB) total quality building (TQB) certification.

Like many European countries, the building industry in Austria has been very active in the sustainability movement, and like here certification claims are valued by building owners and serve as marks of achievement by design and construction teams.

Closer to home we are all more familiar with the LEED rating system among others including the UK-based BREEAM (first launched in 1990), BOMA BESt (Canada) and the Green Globes (U.S.) certification.

There is also Passive House, recognized the world over as a rigorous standard for air-tight building envelope design, high insulation levels, and fresh air encouraged through high-efficiency heat recovery ventilation systems.

In all ways Canadian buildings today are being built or retrofit to meet new standards and owners proudly show off their high grades.

Earlier this year Canada Green Building Council (CaGBC) announced there are now over 1 billion sq. ft. of LEED registered projects in Canada. In the 2016 calendar year 406 LEED projects were certified, bringing the country's total to 2,990—LEED Gold making up 42% of our projects.

Firms across Canada are making Olympian efforts, like gymnasts, to ace the required elements on the judges scorecards and striving beyond silver and gold to reach platinum levels of performance.

Canada now has four LEED V4 certified projects, meeting a higher standard, and later this month CaGBC will be sharing its all-new net zero carbon standard with the world at its Zero Carbon Summit on May 30, part of the group's national conference taking place in Vancouver.

Unable to share specifics about the standard yet, CaGBC identifies a zero carbon site as a highly-efficient building that procures or produces carbon-free renewable energy in an amount sufficient to offset its carbon emissions.

A call for pilot projects to join the program was made earlier this year, and there are some zero emission projects already underway in the country.

Like the Austrian "plus-energy" building example, momentum in the movement to reach beyond current sustainable building certification standards is a move in the right direction, with more teams striving for top marks.

Doug Picklyk

FOR PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE

CANADIAN CONSULTING engineer

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CEO

R.V. Anderson group accepts Willis Chipman Award at 15th annual Ontario Consulting Engineering Awards.

AWARDS

Toronto Stormwater Management System wins in Ontario

The Willis Chipman Award, the premier award at the annual Ontario Consulting Engineering Awards Gala, was presented to R.V. Anderson Associates Ltd. for its work on the East Bayfront Stormwater Management System in Toronto.

In total the Consulting Engineers of Ontario recognized 12 engineering projects at its 15th Awards Gala.

Four Awards of Excellence were handed out to: Dillon Consulting for Boyne Trunk Sanitary Sewer; Mulvey & Banani International for Oakville Trafalgar Memorial Hospital – Power Distribution System; Robinson Consultants for for Greenbank Road Watermain; and WSP for David Braley and Nancy Gordon Rock Garden.

Six Awards of Merit were given to: AECOM, Arup, DST Consulting Engineers, Hatch, Smith + Andersen and Parsons.

McIntosh Perry Consulting Engineers was given a Creative Solutions Award for using detection dogs to preserve endangered wildlife species.

Doug Hinton receives ACEC-BC Lifetime Achievement Award

The Association of Consulting Engineering Companies British Columbia (ACEC-BC) handed out its top award, the Lieutenant Governor's Award for Engineering Excellence, to Ausenco Engineering Canada for its base isolation seismic upgrade of Vancouver's Lord Strathcona Elementary School.

Seven Awards of Excellence and 9 Awards of Merit were handed out at the Association's 28th Annual Gala, as well as The Meritorious Achievement Award, presented to Doug Hinton, P.Eng. of Hatch for lifetime contributions to engineering, the industry and the community. The Young Professional Award was handed out to Zahra Pirani, P.Eng. of CH2M HILL Canada Ltd.

Awards of Excellence went to: Ausenco Engineering Canada (2), AECOM Canada, CH2M Hill Canada, McElhanney Consulting Services, and SNC-Lavalin (2).

The Awards of Merit were claimed by: AES Engineering, Associated Engineering (B.C.), COWI North America, CTQ Consultants, Knight Pièsold, PBX Engineering (2), SNC-Lavalin (joint with WSP Canada, McMillen Jacobs Associates & Tetra Tech EBA), and WSP Canada.

continued on page 8

COMPANIES

SNC-Lavalin adds WS Atkins to create $12B company

SNC-Lavalin Group has acquired UK-based WS Atkins plc for $3.6 billion. Atkins is a consultancy offering design, engineering and project management, with a stong position across the infrastructure, transportation and energy sectors. The company has operations in the U.S., Middle East and Asia, together leading positions in the UK and Scandinavia. With roots back to 1938, Atkins has 18,000 employees The merger creates a $12.1 billion company with 53,000 employees.

SgurrEnergy rebranding as Wood Group

As of early May the renewable energy and grid integration consultancy SgurrEnergy (with offices in Vancouver, Toronto and Montreal) formally rebranded as Wood Group. The Scottish-based company has been part of the $5B Wood Group's business since 2010.

BUILDINGS

Google's Kitchener office LEED v4 certified

The 100,0000 sq. ft. Google Office Phase 1 in Kitchener, Ontario has achieved LEED v4 Silver (ID+C), making it only one of four LEED v4 certified projects in the country. The project prioritized indoor air quality, with high levels of outdoor air ventilation provided, achieving 30% over the ASHRAE 62 standard.

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Metro Vancouver

Rendering of the Lions Gate Secondary Wastewater Treatment Plant.

WASTEWATER

ADApT Consortium wins Vancouver wastewater treatment plant contract

Metro Vancouver awarded the contract for the new Lions Gate Secondary Wastewater Treatment Plant to ADApT Consortium at a cost of $525 million.

The ADApT team (Acciona Infrastructure, Dialog Design, Amec Foster Wheeler, TetraTech) will design and construct the new plant, which will provide secondary sewage treatment services to a population of about 200,000 residents of three municipalities and two First Nations on the North Shore. The plant will be situated on a 3.5-hectare site located in the District of North Vancouver.

Construction on the LEED Gold project is expected to begin this spring with completion slated for December 2020. The existing wastewater treatment plant will be decommissioned beginning in 2021 and the lands turned over to the Squamish Nation.

Hamilton pushing forward with $106M biosolids project

The City of Hamilton has signed an agreement with the Harbour City Solutions consortium to move forward with the municipality's new facility to treat the biosolids resulting from the city's wastewater treatment process.

This public-private-partnership is supported through funding from PPP Canada for the design, building, finance, operation and maintenance of a facility that will take the organic materials that result from the waste-

continued on page 10

COMPANIES

Entuitive Leadership team grows

Among 15 recent personnel announcements, four employees were named as Principals at Entuitive, including: Brian Shedden, Mike Hillcoat, Randy Thesen and Toby Maclean. New senior associates include Chongsong Yu, David Fox and Ian Washbrook. Associates include Fred Miles, Monica Darroch, Nick Berci, Paul Tomasik, Peter Olendzki, Saleem Haq, Sanja Buncic and Tom Greenough.

Consolidation in precast concrete

Con Cast Pipe, a manufacturer of precast concrete drainage products based in Puslinch, Ontario (just south of Guelph), has acquired Hy-Grade Precast Concrete in St. Catharines, Ontario. Con Cast now has operations in Puslinch, Oakville and St. Catharines. The new acquisition adds product solutions to its service offering including modular buildings, utility vaults, highway and security barriers, as well as retaining, security and privacy walls.

Letter to the Editor

In reference to the very useful article in the March/April 2017 edition, titled "Engineers are easy targets for frivolous lawsuits" (P.33), the article effectively summarizes issues frequently overlooked by consulting engineers.

There is a reference to an "engagement letter" which I assume is meant to be the contract between the client and the engineer.

The author of the article may not be aware that ACEC has been most active in this regard, having commissioned and delivered a course on standard contracts for various types of assignments.

DFS (Design Firm Seminars), a group of which I am a founding member, have developed the course for ACEC. ACEC has standard forms which include all the items mentioned in the article, and then some, including exhaustive checklists for scopes of work and texts covering insurance issues.

The contract forms were developed by senior practitioners, with competent legal advice.

Regards,
Ben Novak P.Eng., MCP., Dip.BA

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water treatment process and turn them into pellets to be sold for fertilizer or fuel.

Harbour City Solutions, the selected proponent for the project, is a consortium of companies that will create the designs, obtain financing, and oversee the construction of the facility. Synagro, headquartered in Baltimore, Maryland, is the lead member and majority equity holder in the consortium, while other Canadian-based members Bird Construction and Maple Reinders will jointly design and construct the Hamilton facility. Design partners include Andritz and Cole Engineering. Synagro will be responsible for oversight, long term operation and maintenance of the facility, as well as beneficial use of the product.

INFRASTRUCTURE

CSA incorporating climate change adaption to infrastructure standards

CSA Group in partnership with the National Research Council (NRC), will be incorporating strategies for addressing climate change into existing and new Canadian standards and codes.

The initiative includes seven climate change adaptation projects to be completed before April 2019 as part of NRC's climate-resilient core public infrastructure program. Codes affected include electrical, highway bridge design, durability of buildings, flood proofing and mitigation, wastewater treatment and fenestration standards.

ENERGY

Amec Foster Wheeler awarded Bruce Power contract

Bruce Power

An aerial view of the Bruce Power site.

As part Bruce Power's life extension program, the company has awarded Amec Foster Wheeler (AFW) a contract to provide detailed design of feeder cabinets and feeder instrumentation for the Unit 6 feeder replacement program.

Feeder Cabinets add coverage to the fuel channels and provide thermal insulation during operation. AFW will also provide input to procurement packages, technical and installation specifications and design change notices.

The contract falls under AFW's existing strategic supplier master services agreement with Bruce Power for the provision of a range of engineering and project management services.

CHAIR'S MESSAGE

The role of consulting engineers in sustainable design

"Sustainability" is one of the construction industry's most talked about but probably least understood words. Its meaning is often blurred by various interpretations. The concept of sustainability embraces:

- Innovation and transferability (progress)
- Resource and environmental performance (green planet)
- Ethical standards and social inclusion (people)
- Economic viability and compatibility (prosperity)
- Context and aesthetic impact (place)

The federal government is committed to infrastructure that protects communities and supports Canada's ongoing transition to a clean growth economy. The recent budget has reaffirmed the Government's plan to invest over $20 billion over 12 years to support green infrastructure and advance Canada's efforts to build a clean economy, including initiatives that will support the implementation of the Pan-Canadian Framework on Clean Growth and Climate Change.

Canadian consulting engineers will continue to be challenged to design infrastructure in a sustainable manner. Yet it will be important we not get caught up in the details and processes and actually see the forest for the trees. Green and sustainable construction is as much about a mindset of how we think in design as it is about checklists, procedures, and processes. In Newfoundland, the people and culture have sustained an existence of survival for centuries off the barren, windswept land, and the unforgiving sea. We had no choice but to live off the land and sea; reusing, recycling and sustainability was the way of life. So, as a practicing consulting engineer raised in this province, I design projects inherently in a sustainable manner that considers simplicity and common sense practicality. As leaders in the construction industry, consulting engineers should consider that we are not only designers but also have a much higher role and level of responsibility. We need to participate in Canada's political and regulatory arenas and play a leadership role in building a green and sustainable economy.

RICHARD TILLER, M.ENG., P.ENG., FEC
CHAIR, ACEC BOARD OF DIRECTORS

MESSAGE DU PRÉSIDENT DU CONSEIL

Le rôle des ingénieurs-conseils dans l'écoconception

Si le mot « durabilité » est au nombre des vocables les plus souvent prononcés dans l'industrie de la construction, c'est peut-être aussi le plus mal compris. Son sens est souvent flou en raison d'une série d'interprétations. Le concept de durabilité englobe les aspects suivants :

- L'innovation et la transférabilité (le progrès)
- Les ressources et la performance environnementale (une planète verte)
- Des normes éthiques et l'inclusion sociale (les gens)
- La viabilité et la compatibilité économiques (la prospérité)
- Le contexte et l'effet esthétique (le lieu)

Le gouvernement fédéral s'est engagé à financer des infrastructures qui protègent les collectivités et qui aident le Canada à effectuer la transition vers une économie axée sur la croissance écologique. Le récent budget réitère l'intention du gouvernement d'investir plus de 20 milliards de dollars sur 12 ans afin de favoriser l'infrastructure verte et de soutenir les efforts déployés par le Canada en vue de privilégier une économie axée sur la croissance écologique, ce qui comprend les initiatives qui permettront de concrétiser le Cadre pancanadien en matière de croissance propre et de changement climatique.

On continuera de demander aux ingénieurs-conseils du Canada de concevoir des infrastructures passant l'épreuve de la durabilité. Par contre, il faudra faire attention de ne pas s'arrêter aux détails et aux procédures et ne pas laisser un arbre nous cacher la forêt. En matière de construction écologique et durable, la façon de penser la conception est toute aussi importante que l'aptitude à suivre des listes de vérification, des procédures et des processus. À Terre-Neuve, depuis des siècles, la population comme la culture survivent, et ce, malgré l'aridité de terres balayées par les vents et les caprices d'un océan impitoyable. Nous n'avions d'autre choix que de vivre de la terre et de la mer – réutiliser, recycler, faire durer était un mode de vie. Par conséquent, à titre d'ingénieur-conseil en exercice qui a grandi dans cette province, je conçois des projets intrinsèquement durables, misant sur l'aspect pratique de la simplicité et de la durabilité. En tant que chefs de file de l'industrie de la construction, les ingénieurs-conseils doivent se rappeler qu'ils ne sont pas seulement des concepteurs, ils ont un rôle et un niveau de responsabilité beaucoup plus élevés. Nous devons en effet agir sur la scène politique et réglementaire du Canada et assumer un rôle de leadership pour créer une économie verte et durable.

RICHARD TILLER, M.ING., ING. P., FIC
PRÉSIDENT DU CONSEIL D'ADMINISTRATION

By Jenny Kidby, Director, Talent & Leadership Development, Grant Thornton LLP

How have you engineered your firm's future?

Strategies for engaging young managers and instilling an owner's mindset

When people believe their employer is committed to their personal and professional success, their engagement, loyalty and productivity tend to rise. Here are some ways for you to create this type of environment:

- Provide opportunities to connect deeply with colleagues and the work they are doing. This fosters a sense of community in the workplace and shows people how their work supports a bigger purpose.
- Ensure people have a development plan that clarifies how they can progress. As part of this, create experiences to stretch people so they can maximize their learning. One way we do this at Grant Thornton is by pairing our future partners with an internal coach who can help them develop as a whole person, not just professionally. Tapping into this gives people permission to bring all their talents and perspectives to their work, enhancing their connections with clients and colleagues.
- Provide regular feedback. For younger generations weaned on instantaneous social 'likes', the workplace can feel like a feedback vacuum. At Grant Thornton, we provide 'confidence building feedback' frequently as part of our performance management process—forward-looking feedback focused on strengths to help people grow over time.
- Focus more on experiential learning than on formal workshops, and pair managers with a coach, mentor or buddy who can help them both extract and apply the learning. The key is for people to start asking, what decision would I make if I were an owner today? Sometimes we need to act ourselves into a new way of thinking.
- Help managers understand that what got them 'here' may not get them 'there' as owners. Highlight how strengths, if overused, can derail them and supplement with tools like 360 questionnaires to make them more deeply aware of what drives their behaviour. As an owner, everything you do is amplified for the rest of the organization to see, and people pick up on these cues as the way we do things around here—which makes it imperative to bring unconscious behaviours to light.
- Connect potential future owners with a range of current owners to help them grasp the difference between being an employee and an owner, and develop a growth mindset.
- Encourage others to share their perspectives rather than expecting managers to know it all. No one has all the right answers and most people need input from diverse sources to even get clear on what the issues are. As an owner, you need to create an environment that fosters trust and focuses more on outcomes (such as client value and exceptional client service) and how our people are growing than inputs (time spent on a client).

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Association of Consulting Engineering Companies – Canada (ACEC-Canada), 420-130 Albert Street, Ottawa, ON, K1P 5G4, tel: (613) 236-0569, fax: (613) 236-6193, info@acec.ca, www.acec.ca. ACEC Member Organizations: Association of Consulting Engineering Companies – British Columbia, Association of Consulting Engineering Companies – Yukon, Consulting Engineers of Alberta, Association of Consulting Engineering Companies – Northwest Territories, Association of Consulting Engineering Companies – Saskatchewan, Association of Consulting Engineering Companies – Manitoba, Consulting Engineers of Ontario, Association of Consulting Engineering Companies - Québec, Association of Consulting Engineering Companies – New Brunswick, Consulting Engineers of Nova Scotia, Association of Consulting Engineering Companies – Prince Edward Island, Consulting Engineers of Newfoundland and Labrador.

Budget 2017 reaffirms government commitment to infrastructure, but ACEC wants more progress in getting projects underway

On March 22nd, Minister Bill Morneau tabled his second budget, *Building a Strong Middle Class*, which reaffirmed the government's commitment to infrastructure. However, there was very little new funding related to infrastructure that had not already been identified in either the 2016 budget or the *Fall Economic Statement*. The budget document itself also lacked hoped-for details on Phase 2 spending, the Canada Infrastructure Bank and other programs important to the success of the consulting engineering sector. "We're supportive of this government's commitment to infrastructure" states John Gamble. "We had hoped that there would be more of a roadmap of how we're going to get there. We had hoped more of the implementation details would have already been worked out." It is expected that further details will be provided by Infrastructure Canada in the weeks and months ahead.

In the past year, ACEC-Canada President and CEO John Gamble advocated predictable and timely infrastructure investment when meeting with Minister Sohi and MPs on the House of Commons Transport, Infrastructure and Communities Committee. This would support the government's goal of strong fiscal growth and permit consulting engineering firms and municipalities to make better informed business decisions. Unfortunately, Budget 2017 suggests that the roll out of Phase 2 funding, which will now have to await another round of negotiations with the provinces, is still some months away. This is a concern for the sector considering the 10% to 15% drop in their workforce over the past five years. "The government is looking for infrastructure to grow the economy and create wealth and revenue. We don't want to push that too far down the road," said John Gamble during a post-budget media interview. As design work required for major projects takes place at least a year before shovels break ground, the need for details regarding how and when the $60 billion promised in Phase 2 will flow will continue to be the primary message ACEC-Canada delivers to Government in the coming weeks and months.

The budget did, however, commit to a timeline for the Canada Infrastructure Bank, first announced in the *Fall Economic Statement*. The government has given itself an end of year deadline for this new tool that will support large scale infrastructure projects. It is noteworthy that the Infrastructure Bank's mandate will include data collection to improve knowledge on the state of municipal and provincial infrastructure; it is applauded by ACEC as a sound practice to identify infrastructure needs and measure effectiveness.

The budget also confirmed the National Trade Corridor Fund is another initiative, along with the infrastructure bank, that was a welcome initiative from the *Fall Economic Statement*. This is precisely the type of investment that stimulates the economy through the creation of more jobs and helps Canada be competitive with the US and internationally. It is also the type of investment that helps fund softer infrastructure projects such as community centres and social housing, which are also necessary for healthy vibrant communities. ACEC-Canada looks forward to further details on the fund in the coming months. Another area that was vague in this year's budget was the carbon tax. In order for businesses to make informed decisions, clarity around the intent of the carbon tax is critical to Canada's competitiveness.

On balance, and with some patience, it appears this could be a positive budget for most of the consulting engineering sector. To this end, ACEC will continue to work with the government on operational aspects of the budget to ensure that its successful implementation is effective, efficient and timely for ACEC members, their clients and Canadians.

The 2017 Budget continues commitments to infrastructure made in the previous budget and Fall Economic Statement including:

- The creation of an Infrastructure Bank that will invest $35B over 11 years in loans, with $5B for public transit;
- $20.1B over 11 years for public transit projects through bilateral agreements with provinces and municipalities;
- $12.9B in green infrastructure;
- $2B over 11 years for rural and northern communities;
- $2B over 11 year for a New Trade Corridors Fund with an additional $5B through Infrastructure Bank loans;
- A New Canadian Centre on Transportation Data;
- The budgetary balance is expected to show deficits of $23.0 billion in 2016–17 and $28.5 billion in 2017–18.

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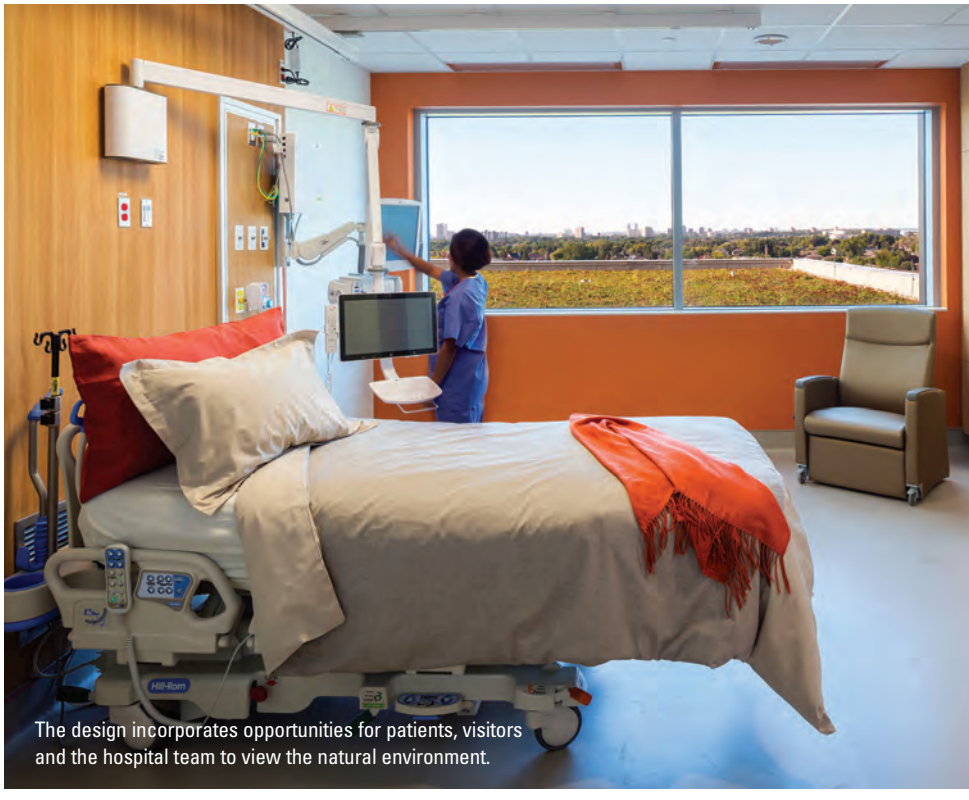
Toronto's **Humber River Hospital** incorporates technology and efficient design to make it one of the 'greenest' hospitals in the country.

THE DIGITAL

Innovation is at the root of Humber River Hospital (HRH), one of Canada's largest healthcare infrastructure projects which incorporated efficient planning, creative environmental design and technological ingenuity, all critical to the project's three guiding principles: being lean, green and digital.

HRH comprises a 14-storey inpatient tower and two 6-storey podiums housing 656 inpatient, and a total of 6000 rooms. The $1.8-billion, 167,225 m^2 facility provides acute care services to over 850,000 people in northwest Toronto including emergency services, cancer treatment, dialysis, women and children's health services, and mental health for both inpatient and outpatient programs.

The large scope of the project and an accelerated construction phase of 43 months meant that the upper floors were still being designed as the lower ones were being built.



The design incorporates opportunities for patients, visitors and the hospital team to view the natural environment.

Humber River Hospital in Toronto achieved LEED Canada NC v2009 Gold certification—

HOSPITAL

By Troy Greene, P.Eng. & Will Hu, WSP Canada Inc.

Photos courtesy of HDR Architecture, Inc.; © 2015 Dan Schwalm/HDR

The rigorous construction schedule was met by streamlining design, quality control processes, and development of shop drawings with Revit modeling, as well as by introducing flexibility in the design process to accommodate modular designs.

The building is designed to operate with reduced water and energy consumption—33% and 40% less, respectively, from LEED and ASHRAE baselines. Upon completion, HRH became North America's first fully digital hospital where all patient care processes are designed to be paperless.

Creative with concrete

The theme of innovation continues in the concrete structure of the building: the lack of permanent expansion joints makes this project unique.

Normally, with buildings of this size, expansion joints or pour gaps are used to allow shrinkage. Instead of permanent expansion joints, temporary movement joints were used.

Once the concrete contracted, the slabs were connected to complete the floor diaphragm. This preserved the structural integrity during construction while eliminating the need for expensive expansion joint hardware.

In order to address settling and geotechnical variables, the foundation also had to be unique in design. By employing two different systems, a raft slab for the tower and 5,500-mm wide strip footings for the podiums, construction was able to proceed in a timely manner, enhancing efficiency.

Automated Guided Vehicles (AGVs) are a unique feature of HRH. The vehicles, capable of handling up to 600-kg loads, transport food, linens, medications, and other supplies. The structural issue was ensuring the floor flatness and deflection were in line with the AGV requirements.

Another challenge was in designing a precast concrete panel wall system that significantly reduced the construction schedule. The use of precast concrete meant that while the cast-in-place concrete structure was rising on site, the precast panels were being cast concurrently in the factory. This method allowed for installation via cranes, which minimized the need for exterior scaffolding, further reducing construction time.

The building uses 12,000 m^2 of precast concrete as part of its 33,400 m^2 exterior envelope. Not only selected for its aesthetic capabilities but also its ability to support the rigorous functional requirements—including sound transmission, thermal efficiency, durability and ease of construction—the precast concrete panel wall system provided traditional rain screen performance.

Naturally comforting

Counting over 3,400 staff, almost 600 physicians and 650 volunteers,

Open spaces around the campus feature native adaptive vegetation and walking paths.

HDR Architecture, Inc.; © 2015 Dan Schwalm/HDR

the wellness of the facility's occupants is a major priority. That is why the design incorporates many opportunities for patients, visitors and the hospital team to immerse in the natural environment.

Visible green roofs were installed on 50% of the roof space throughout the campus. And the open spaces around the campus feature native adaptive vegetation and walking paths. Internally the hospital is supplied with 100% fresh outdoor air, with no air recirculation.

Energy wise

HRH is designed to be among the most energy efficient hospitals of its size in North America, at 40% below ASHRAE 90.1-2007. Adding to increased energy savings are automated climate and lighting controls; condensing boilers, high-efficiency chillers, variable-speed drives and pumps throughout, the use of heat recovery chillers to provide low temperature heating; efficient duct design to reduce static pressures, exhaust air heat recovery, a high-performance building envelope that includes increased insulation levels in the roof and walls, and one of the largest installations of electrochromic windows in the world (almost 26,000 sq. ft.); and a lighting design featuring energy efficient lighting including LED's which provides a building average lighting power density of 0.75W/sq. ft. Low-flow plumbing fixtures were incorporated into the building design, resulting in 33% potable water use reduction compared to the LEED baseline.

While the site features a number of pedestrian-oriented landscaped areas, the plants selected were chosen to ensure minimal water demands. All irrigation is provided by a rainwater harvesting system that collects rainwater from the roofs, expected to save approximately 450,000 litres of potable water each year.

Benefits of green

HRH has been designed for tomorrow; it is built to meet the requirements for Tier 1 of the City of Toronto's Green Standard (TGS) and has achieved LEED Canada NC v2009 Gold certification.

In addition to operations being paperless, green practices during the build included the diversion of 95% of construction waste from the landfill; the use of low volatile organic compound materials for adhesives and sealants, paints and coatings, and carpets; and other environmentally focused practices.

The building operation is being continually monitored and tweaked, with the goal of achieving an energy use intensity (EUI) of 348 ekWh/m^2 per year. CCE

Humber River Hospital Project Team	
Owner:	Humber River Hospital
Design-Builder:	PCL Constructors Canada
Architect:	HDR Architecture Associates
Sustainability Consultant:	MMM Group Ltd., a WSP Company
Structural Consultant:	WSP Canada Inc.
Mechanical/Electrical Consultant:	Smith + Andersen
Other key players:	Plan Electric (electrical contractor); Modern Niagara Toronto (mechanical contractor); A.M. Candaras Associates (civil engineer); Flynn Canada (roofing installation); LiveRoof (green roof supplier).

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THE DIFFERENCE IS IN THE DETAILS

By Smith + Andersen

Mechanical, electrical, communications and security design for Humber River Hospital.

Alina Cornea Architectural Photography

The heat recovery chillers are central to the energy strategy at Humber River Hospital.

Due in large part to innovations made to the design of the heating, cooling, ventilation, plumbing, and lighting systems, Humber River Hospital (HRH) exceeds the energy efficiency requirements of the Model National Building Code by 49%. During the design process, several options were proposed for each building system, and each option was examined by energy modelers to depict not only immediate compliance with the energy target, but also long-term operational savings. Thanks to this collaborative process, the team was able to implement numerous innovative measures—including efficient air handling, extensive heat recovery, active control of electrochromatic glass, and the provision of 100% outdoor air—in the most effective way, surpassing the initial team target of LEED Silver to ultimately achieve LEED Gold.

Maximizing Mechanical Efficiency

HRH utilizes an integrated heating and cooling plant, complete with highly-efficient ventilation equipment and distribution, as well as airside enthalpy recovery. This plant includes four heat recovery chillers as the building's main source of heating and cooling. These chillers use excess heat, which has been rejected by the building's chilled water system from 24/7 loads, to produce useful heat for the building's heating water system to serve reheat coils, perimeter heating, and a central heating glycol system that serves air-handling unit heating coils. The coils recover additional heat, which is re-directed to the building's chilled water system and used to produce additional heat.

HRH also includes 100% outdoor air throughout the building. Normally, this level of air circulation would drastically increase the energy consumption of a building. However, the design team examined and implemented several methods allowing the design to reduce energy requirements while still utilizing 100% outdoor air. Some of these methods included: increasing air-handling equipment sizes, using highly-effective energy recovery wheels, and installing high-efficiency fans. The team provided high levels of system redundancy for air-handling units servicing critical building areas (such as the operating rooms and critical care departments), and this contributed to a further reduction in energy consumption by HVAC systems.

Ensuring Electrical Flexibility

In order to meet the heavy operational demands of a health care facility of this size, all electrical systems were designed with a high level of redundancy. Thanks to dual-incoming high voltage utility feeders, medium voltage synchronized generators, four medium voltage double-end substations, and nine low voltage emergency/normal distribution risers, HRH has the flexibility needed to accommodate both current and future needs. An extensive load management system allows the entire hospital to be backed-up by generators in non-peak times, while the 2N centralized UPS configuration and 2N UPS distribution enable the system to meet the extreme uptime requirements of the Information Communications and Technology (ICAT) backbone.

Detailed power monitoring and metering were also integrated with the Building Automation System (BAS) as part of an extensive measurement and verification plan for the health care centre. This measure provides precise energy monitoring of the building, and will allow HRH to easily track the success of future energy efficiency measures. A complex fire alarm system acts as a reliable hub for all life safety elements, including

an active and passive smoke control system to maximize safety during a fire emergency.

Achieving Excellence through Integration

In addition to mechanical and electrical design, Smith + Andersen designed the infrastructure which interconnects various systems to support full integration of digital systems at North America's first fully digital hospital.

A common network was implemented by the construction team to enable communication between clinical, business, building, information technology and security systems. Some of the unique integrated healthcare systems include nurse call, wireless tracking and wireless mobile devices. Sharing information allows control, monitoring, and metering of building systems by facilities, operations, and even patients. Enhanced coordination between all of these systems enables the interoperability necessary to support improved operational workflows and systems efficiencies throughout the entire building.

A clear example of the benefit this integration provides is the active control of the electrochromatic glass—the largest successful implementation in North America. Both the mechanical and electrical design made effective use of this enhanced building envelope, which reduces solar gain during peak cooling times. The window control defaults are set to increase solar gains in the winter, and decrease solar gains in the summer—efficiently using the light available to heat the building (thereby reducing the heating and cooling required from the HVAC system).

The information technology design also integrates with these windows, allowing patients and staff to take full control of their immediate environment. Through a control system on the patient bedside computer terminal, patients and staff can adjust both the lighting of the room and the amount of light transferring through the window. This measure assisted the design team in achieving a lighting power density 46% lower than standard requirements.

As a member of Greening Health Care, HRH's energy use data has been continuously collected since the facility first opened. Based on a comparison of the hospital's energy intensity to that of a similar Ontario acute care facility for the years 2012, 2013, and 2014, HRH is on track to be the most energy-efficient acute care facility in Ontario. CCE

THE NATURAL FEELING

By Doug Picklyk

The green roof on the Humber River Hospital is the largest of its kind in North America.

The green roofs, visible from patient rooms, encourage healthy recoveries.

LiveRoof Ontario

Covering 140,000 sq. ft., the green roof installed on sections of the Humber River Hospital (HRH) in Toronto is the second-largest green roof installation in Canada and the largest modular green roof system in North America.

"It certainly was a challenge to have that many modules ready all at once," recalls Kees Govers of LiveRoof Ontario, the grower of the materials used on the project.

Unlike a green roof where base materials are laid down in succession and the vegetation matures and grows into the layers, with a pre-grown modular system a vertical slice of established growth is transferred from a nursery to the site. "You have mature planting the day it's installed," says Govers,

The HRH system is made up of one-foot x two-foot trays, four inches deep. Averaging around 4,000 to 5,000 sq. ft. per day, the green roof installation process, handled by Flynn Canada, took around two months in total.

The modular system can speed up the installation and from an engineering point of view, each module is basically the same, so engineers know exactly how much load will be imposed on the roof. The system also met the wind uplift resistance required for the healthcare facility.

Green healing

A standard practice for buildings seeking LEED certification, and mandated in some municipalities, green roofs benefit air quality, help reduce heat loads on roofs, and are effective for storm water management (the 140,000 sq. ft. green roof on HRH can manage up to 630 m^3 of water).

Aside from the sustainability elements, green roof coverage on all surfaces visible from patient rooms was a design requirement for the HRH. Providing views of natural growth is part of biophilic design, a process encouraged in healthcare facilities where research indicates patients surrounded by nature experience faster recovery times.

Plantings

As part of the installation, an irrigation system was put in place. According to Govers, the intent was only to use it during the first two years if required, and after that it's simply an emergency back up in case of drought.

The plantings are all herbaceous perennials, so there's only soft tissue with no brown and woody materials developing. Every winter the plantings go partially dormant with new growth emerging in the spring. A part of the building's sustainability mandate, the green roof system is designed to provide many years of carefree regeneration on a building where healing and renewal is a daily occurrence. **CCE**

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Solar panels on green roofs can, through good design provide spaces for a more diverse native floral community, which in turn benefits biodiversity.

Green Roofs & Solar: THE ULTIMATE COMBINATION

By Jelle Vonk, ZinCo Canada

Green roofs and solar photovoltaic (PV) panels have become important tools for the sustainable design and construction community. Installing plants on roof tops provides many benefits including storm water management, reduction of the urban heat island effect, and improving air quality. Their recognized advantages have led many cities in North America, such as Toronto, to begin mandating them by law. Solar panels are becoming more common as energy saving solutions.

In high-density cities, rooftops are the best option to install green space or solar PV panels. However, quite often they are fighting for the same roof space. This raises the question: Why not use them together on the same roof?

Could the two systems work together to enhance the benefits that each system provides, or would the solar panel affect the performance of the green roof or vice versa?

In order to find answers to these questions, a three-year research test was conducted in Germany. During the test, three solar PV panels where installed on the test roof. Panels 1 and 2 were installed on a bituminous waterproofing membrane, one on a low and one on a high mounting frame. Panel 3 was installed on an extensive green roof with a high mounting frame.

Temperature moderation

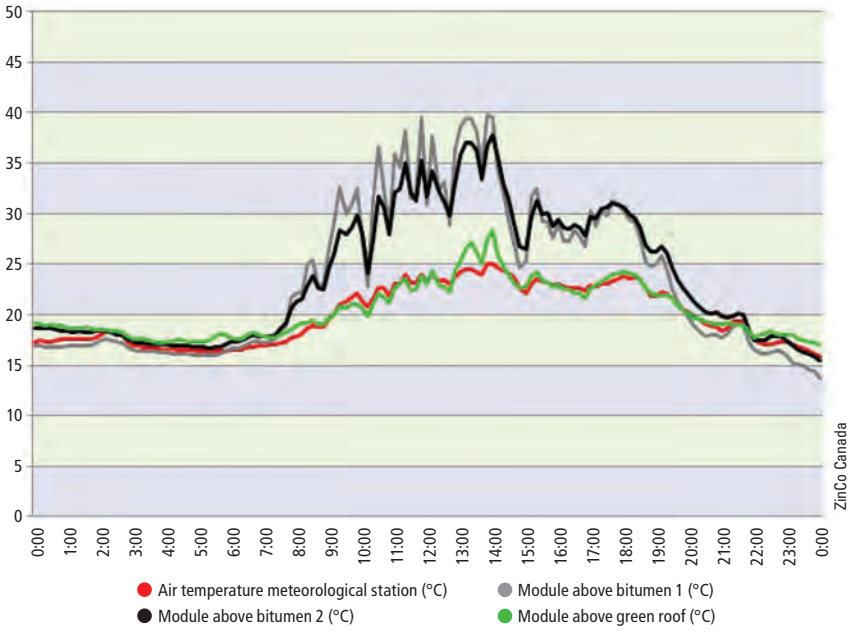
The efficiency of photovoltaic panels depends on their temperature. The greater the temperature of the panel, the lower the level of efficiency because of an increase in electrical resistance. The standard performance of a solar module is stated by the manufacturer in reference to 1000 Watt/m^2 irradiance at 25°C cell temperature and an air mass (AM) of 1.5 and is specified as maximum power output in Watts Peak (Wp). The temperature coefficient for the output shows how the power output changes per Kelvin deviation from the standard test temperature of 25°C. This coefficient depends on the product and is approximately 0.5%/K.

ZinCo Canada

This means, for example: a solar module heated up to 65°C, whose maximum power output is 200 Wp, will generate 0.5%/K x 40 K = 20% less output. Therefore, only 200 W minus 20% = 160 W of electricity will be generated.

In practice, the temperature of a PV panels increases considerably due to solar radiation, and this is compounded by the hot surface of the roof, for example dark bituminous waterproofing membrane, which can easily lead to temperatures of up to 90°C.

The three-year research test has shown that the temperature of Solar PV Panel 3, installed on the green roof, remained closest to the air temperature, while the Solar PV panels on the bitumen membrane were considerably warmer. The result was a difference of 4% higher efficiency annually for solar panel 3 on the



This temperature graph illustrates how the temperature of the solar panel on the green roof, Module 3, remains consistently close to the air temperature, whereas the Modules on the bitumen membrane become significantly warmer.

ZinCo Canada

green roof versus that of solar panels 1 and 2 on the bituminous waterproofing membrane. Depending on the size of the solar facility, this increase of 4% in output can be significant in financial terms.

Green mass

Another benefit of combining solar and photovoltaic is that the green roof can be used to ballast the solar array against wind uplift. While traditional systems are ballasted with heavy concrete blocks (resulting in high point loads) or are fastened to the roof deck (resulting in penetrations through the waterproofing membrane with a higher risk of leakage), with a green roof, the solar array can be anchored to the green roof assembly. Engineered wind calculations are required to determine the amount of ballast weight required.

Biodiversity

In 2013, the city of Toronto added a biodiversity guide component to its green roof by-law. Green roofs have the opportunity to create habitat and enhance biodiversity in the urban fabric of the city. There are three design factors that have been linked to the creation of biodiverse green roofs.

First, is the variation in depth, topography and composition of growing media.

As the depth of growing media increases, the opportunity to promote biodiversity also increases, simply because a greater range of plant species and plant types can be accommodated. Secondly, there is diversity in vegetation. Maximizing the diversity of plant species and plant life forms has many benefits, increasing the opportunities for pollination, food, shade, nesting, perching and nutrients for flora and fauna.

Thirdly is to create niche spaces for organisms. The use of structures is a simple approach that can be used to manipulate and increase the utilization of the roof as habitat, all of which help to create different microclimates and microhabitats, which may lead to greater species diversity.

The combination of green roof and solar is sometimes called BioSolar. The 'Bio' element of the Biosolar focuses on the provision of biodiversity on green roofs through the use of solar panels.

Solar panels on green roofs can, in fact, through good design, provide nice spaces for a more diverse native floral community, which in turn benefits biodiversity, especially pollinators. The solar panels create shade and block the rain on particular areas on the roof. This creates a pallet of diverse growing conditions and microclimates for a wide variety of plant species and microorganism.

Combining solar PV panels with a green roof is very complementary, and they are not only beneficial for each other but also for the building, the owner, the city and the surrounding environment. You have "double green" on one roof. CCE

Jelle Vonk is the business manager of ZinCo Canada Inc. He has a Bachelor of Science degree in Landscape Architecture and Land Development from VanHall Larenstein University of applied sciences in the Netherlands. He has over 15 years of green roof experience in Europe and Canada and has worked on many green roof projects including the Vandusen Visitors Centre in Vancouver, the Waterpark RBG head office in Toronto and the Bank of Canada in Ottawa.

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By Elaine Carr, P.Eng.,
LEED AP, Williams Engineering

BIOMASS

Renewable Energy in the Northwest Territories

Whenever the average Canadian thinks of renewable energy, their mind tends to immediately turn to solar and wind power, but a recent discussion paper by Alternatives North shed some light on how incomplete the renewable energy picture would be without considering the less glamorous and shiny of the renewable energy options.

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One renewable energy option that is especially prominent in the north is biomass energy. In a recent study (A 100% Renewable Energy NWT by 2050 — Starting the Conversation), Alternatives North hired a consultant to analyze how the Northwest Territories (NWT) could get off of non-renewable energy using only technologies that are available and could be implemented today.

The somewhat surprising outcome of this study and report was that even if the NWT went 100% renewable, the percentage of the energy represented by solar and wind could represent less than 5% of the pie. In the 2050 envisioned in this report, 58% of the energy used in the NWT could come from wood and wood pellets.

Although the results may seem surprising to some, it makes sense given how and where the NWT consumes energy. There are two major factors that influence the aforementioned outcome. First, the majority of the energy used in the NWT is not used to power lights, electronic devices, or other equipment, rather a larger percentage of the energy used in non-industrial applications is required for heating.

The north gets cold, and so it takes more energy to heat homes and commercial buildings than to keep the lights on and electronics running. This brings us back to solar and wind energy drawbacks. Except for the proportionately small use of direct solar heating ("solar thermal") that can be used to provide you with a hot shower when the sun is shining, wind and solar energy projects convert the renewable energy into electricity (through wind turbines and solar panels).

If what you need is heat, not electricity, converting wind or solar to electricity and then to heat is an option, but a fairly expensive one. As of today, most building heat in the north relies on a fuel that can be stored for long periods of time, delivered by barge or truck, and is available during the long winter season when the sun is not shining and the wind is not blowing. Therefore, finding a replacement for this type of fuel is a key component to minimizing the north's reliance of fossil fuels.

Currently in the NWT, the majority of heating systems burn heating oil (or propane and natural gas in select locations) to directly generate heating for homes and busi-

Top: Getty Images

nesses. This is where biomass comes in. Like fossil fuels, wood pellets and wood chips and even cord wood can be transported, stored, and can last many months in storage until needed. Unlike fossil fuels, wood chips, when or if ever spilled, will not cost anyone an enormous amount of money to clean up. Leftover wood chips could even be used in the spring as mulch for landscaping.

The second factor that makes replacing fossil fuels with renewable wood products so attractive has been the low cost. This, combined with their direct ability to replace the status quo of a stored heating fuel that can be burned in a boiler or furnace for small and large applications, has made wood a popular choice.

The cost of heating a home in Yellowknife with wood pellets has been found to be 20% to 50% less than the cost of heating that same home with standard home heating oil. The realized cost savings combined with having a more positive impact on the environment has inspired many building owners to install wood pellet biomass boiler systems.

Another major factor when it comes to looking at renewable energy options for the north is the very large and spread out nature of the population and infrastructure. There is a lot of space, not a lot of people, and the small clusters of people and buildings that do reside here can be quite far away from each other. This has two major implications: one, it takes quite a bit of energy to get people and things to where they need to go in the north; and two, there are not a lot of gas stations along the way.

In addition, there's a high probability that there may not be any roads that you can access depending on which community you may need to get to. As a result, more energy is used to get around than in southern urban areas. Since some northern communities are not accessible by road, the north uses a significant amount of jet fuel for air travel, as well as motive diesel fuel for trucks driving the winter roads and all-weather roads where these exist. This is where the study introduced the idea of replacing jet fuel with biofuel, a burnable oil product that is derived from plant materials instead of from fossil fuels. Biofuels were also seen as a viable alternative for mining equipment operation (heavy machinery) that

Unlike fossil fuels, wood chips, when or if ever spilled, will not cost anyone an enormous amount of money to clean up.

currently burn motive diesel, and for long-distance road transportation.

Another renewable energy source that gets a lot of attention is the existing and potential hydroelectric power in the NWT. Like wind and solar, hydro generates electricity, not heat, but it has the advantage of being a fairly large part of the NWT's energy portfolio already due to the hydroelectric dams that were historically put in place to support the mining sector. This has an added benefit over wind and solar because traditional dams have a built-in energy storage device in the form of a reservoir or lake. Moving forward, hydroelectric will continue to play a part in the renewable energy plan for the NWT.

What will 100% renewable energy in the NWT look like? I might ride my electric bike home from my wood pellet heated office at the end of a day, smelling something like french fry oil burning instead of diesel exhaust from the cars on the road, then heat my dinner in an oven powered by the hydroelectric dam, and throw some wood in my wood stove. Then I might have a nice bath in water heated off my wood pellet boiler.

Really, that doesn't sound like it would have to wait until 2050 at all. In fact, a person can do most of those things today — except maybe for smelling french fry oil on the streets instead of diesel exhaust. That one may take a little bit of work yet. **CCE**

Williams Engineering has been designing biomass boiler systems and has been involved in studies around the use of biomass heating systems in the NWT since 2006. Elaine Carr has been involved with the design and installation of many wood pellet boiler systems over the last decade. She has also held the volunteer position of president of the NWT Biomass Energy Association.

(This article originally appeared online on the #GreatEngineering blog at williamsengineering.com)

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FLYING high

Five-year-old Brunswick Engineering is taking off with investment in UAVs.

By Doug Picklyk

This past February when the Oroville Dam in California (the tallest dam in the U.S. at 235 metres high) experienced failures to its main and emergency spillways, engineering and construction teams converged at the site to assess and begin repairing the damage. Among those called into duty was Stephen Perry, P.Eng., founder of Brunswick Engineering in Saint John, New Brunswick.

"The site looked like a bomb had hit it," recalls Perry, who was called in to pilot a sophisticated unmanned aerial vehicle (UAV) prototype to survey areas that were not safely accessible any other way.

"There were 300-foot cliffs straight down where the concrete spillway used to be," says Perry.

It was the manufacturer of the UAV, Infinite Jib from Schomberg, Ontario, who contacted Perry because of his experience operating the company's systems.

"The topography of the site was very difficult, although similar to New Brunswick, with very steep abrupt slopes, sloping bedrock, and trees everywhere."

After arriving on a Thursday, Perry flew the UAV around the required area Friday and part of Saturday, and by Saturday evening the Department of Water Resources in California had full 3D models to work with. "It was a stressful, exciting, experience," he says.

Photos courtesy of Brunswick Engineering

Top: The UAV used to survey the Oroville Dam site in California.
Above: Founder of Brunswick Engineering, Stephen Perry, with one of the company's UAVs.

The company

Perry started Brunswick Engineering in 2012 to provide geotechnical and civil engineering services to Atlantic Canada. Born and raised in Saint John, he graduated from UNB Fredericton, and after school worked at a local Fredericton consulting firm, eventually opening their Saint John division. Then after a stint working at a paving company, Perry returned to consulting engineering by opening his own business.

Starting up alongside one engineering tech, he's been growing every year and is now up to two full-time engineers, one junior geological engineer, five civil techs, and a couple of senior engineers on contract.

It was a contract requiring field inspections and surveying along natural gas pipelines that led him to invest in the company's first $48,000

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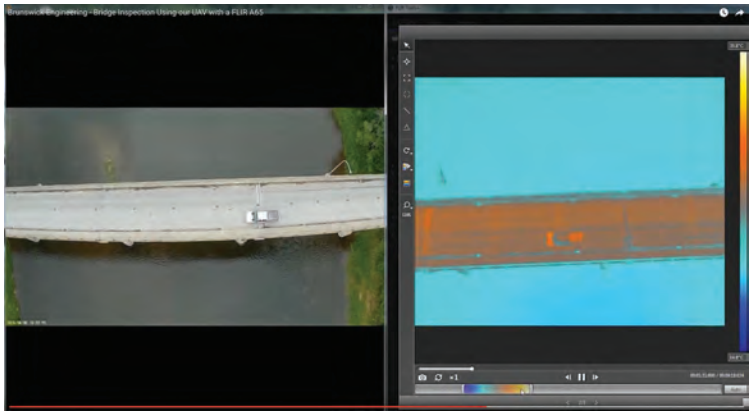
entry-level UAV in December 2015.

Less than six months later the second UAV, a more expensive $80K model was on order. This version, equipped with a computer on board, allowed different sensors and equipment to be installed on the craft, opening up new opportunities.



On *YouTube* a video shows aerial inspections with a camera and FLIR A65 of a concrete bridge deck which could be used to help identify areas of distress in concrete structures.

Business growth

The company's UAV services of aerial mapping and surveying have taken off. "It's our fastest growing division right now," he says, and the company is preparing to order a top-of-the-line unit, the same one he flew in Oroville.

"The third one will further expand our capabilities and make us the only ones on the East Coast with that level of technology."

As it is, Perry and his team have been educating the local market on the potential for the technology. "What we're doing with UAVs isn't something you can't do with other technology, but we can get to angles, heights and inaccessible locations faster and safer than traditional methods."

In open spaces he is able to survey a quarter of a square kilometre in 15 minutes, so in an hour a square-km can be surveyed with points every square centimeter.

He's done flat roof inspections at a large shopping mall, and surveyed the stockpiles at local mines. "They like the speed, and the ability to do it safely."

They've met with the department of transportation, power companies, landfills, municipalities and private developers. "Once you explain what you've been able to do for others, people begin to come up with their own applications."

They've also launched a YouTube UAV channel, demonstrating some of the work they've been doing.

UAV Opportunity

The UAV mapping is a door opener for the engineering side of his business. "We get in on the survey and then we'll continue offering engineering services to manipulate the data and create surfaces and actually do design drawings. It's a natural fit for us."

Aside from the technology he's also investing time to research new opportunities. Besides aerial photography, he's also installed a Flir thermal camera, and he's investigating the potential for detecting gases for energy and industrial applications.

He's also exploring the use of light detection and ranging (LIDAR) sensing technology (like he used in Oroville) for more precise measuring, opening up new possibilities like surveying the ground topography of heavily forested areas without having to clear cut.

"It's been an interesting year and a half, and we're trying to stay on top of things," says Perry, noting that the demand for his services has exploded in the past year. "If I knew then what I know now, I would have bought the high-end UAV from the start."

Operating in a relatively small market, Brunswick Engineering is doing what it can to separate itself from its competitors, and according to Perry, the opportunities being opened up by the UAV services are making things quite interesting. **CCE**

By Todd Busch, P.Eng., Pinchin Ltd.

ACOUSTICAL EFFECTS OF WINDSCREENS ON INFRASOUND MEASUREMENT

Two municipalities in Ontario, Kincardine and Grey Highlands, have sponsored measurements of infrasound in the vicinity of future wind-turbine sites.

These measurements were motivated by public concerns over exposure to infrasound. These concerns are at odds with the conventional wisdom on the subject found among people in the scientific realm and engineering professions.

Although the sponsored work demonstrated that infrasound energy is present, both natural and man-made, the final reports did not attempt to associate increased infrasonic energy with increased complaints and adverse health effects. Following is a discussion around how accurate measurements can be made to contribute further knowledge to this unresolved public-health question.

Infrasound is very low-frequency sound, in the range from 0 Hz to 20 Hz, that is outside of the normal audio range of human hearing (i.e., audible sound), which extends from 20 Hz to 20,000 Hz. Such low-frequency sound has been associated with public-health complaints in the vicinity of operating wind turbines. These complaints typically associate the acoustical energy at the blade-pass-frequency of a wind turbine's rotating blades as they pass the wind-turbine mast as the source of the adverse health effects. Such blade-pass frequencies will vary with the rotational speed of the turbine as they respond to fluctuating wind conditions and are typically within the frequency range from 0 Hz to 1 Hz.

We have reviewed the technical requirements for doing such work and have found that an essential issue for accurate measurement involves the selection of a so-called "wind screen." A wind screen is typically an open-cell foam sphere that is placed onto a microphone in order to reduce the deleterious effects of wind blowing across the microphone capsule. The wind itself in this case can create electrical signals within the instrumentation that mimic sound waves that are incident onto a microphone.

Conventional spherical wind screens are often either 60 mm or 90 mm in diameter. In the absence of a wind screen, inaccurate measurements of sound can result due to the interaction of moving air with a microphone, since the passing wind creates "phantom" noise data that is not representative of the sound present at the microphone.

A wind screen may be effective at mitigating the generation of "phantom" noise but also presents itself as a barrier to sound waves reaching the microphone, which is another problem related to measurement accuracy. The wind screen itself creates reductions of the apparent amplitudes of the real sound waves that are present. We have noted that conventional wind screens may be suitable for measurements of audible sound while being inadequate for acquiring reliable infrasound data.

This is due to the progressive worsening of "phantom" wind-induced noise at low frequencies where errors can be much worse at 1 Hz than, for example, 100 Hz, with the result being an inaccurate measurement.

We have reviewed the alternatives to conventional wind screens and found three custom-fabricated options in the scientific literature on the subject that have documented performance in terms of infrasound measurement:

- Semi-porous shrouds developed by NASA;
- "Double" wind screens comprised of two layers of open-cell foam separated by an air void; and
- Techniques for more-or-less burying the microphone in the ground and covering the hole with a permeable material.

Although these approaches are all suitable for reducing the creation of "phantom" noise, the known techniques themselves, once again, obstruct the arrival of sound waves at a microphone. Furthermore, the scientific research on the interactions of infrasound with such wind screens does not necessarily explore what is occurring at the lower end of the infrasound spectrum at frequencies of significance to the blade-pass frequency of a wind turbine.

Although there are notable improvements in performance for reducing the generation of so-called "phantom" noise at a microphone there is still the obstruction that the wind screens and alternative techniques present to sound waves themselves. This implies that the accuracy of the infrasound amplitudes that are present will be compromised.

Furthermore, among the effective approaches for improving the accuracy of infrasonic measurements, including either a wind screen or alternative techniques, there remains the technical problem of whether or not sound at audible frequencies can be measured concurrently.

At this time, the answer to that question would seem to be "no" due to questions of accuracy: although improved infrasound measurement is possible, the implementation of these options for reducing "phantom" noise do not allow for concurrent measurement of audible sound. As such, separate microphones and instrumentation must be used that implement different methods of installation with different wind screens. **CCE**

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Top: iGetty Images

1. SPX Cooling Technologies' line of Marley MD factory-assembled counterflow cooling towers now includes the model 5017, a 12-ft. by 14-ft. box size offering 324 to 554 nominal tons of cooling per cell. The induced draft counterflow cooling tower design requires less plan area than crossflow cooling towers for many HVAC and light industrial duties.
www.spxcooling.com

2. Trimble has released the S5 Ti-M total station, designed as a cost-effective solution scalable for monitoring projects of any size. It's suited for the monitoring of buildings above tunnel construction and close to excavation sites, as well as monitoring the subsidence of road surfaces and embankments.
www.trimble.com/Infrastructure/Total-Stations

3. Stronghold Coating Systems is introducing MM1018, a polymeric metal material that provides 100% force fit gap compensation for the repair of concrete and steel bridges, power plants and utility construction projects, offshore drilling rigs, wind turbines, and other demanding high-load, critical environments.
www.strongholdone.com

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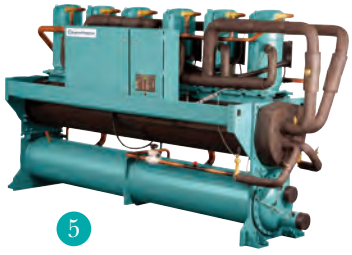
4. Ventacity Systems' VS3000 RT heat recovery ventilation system provides 3,000 cfm maximum flow rate to fulfill indoor air quality requirements in commercial buildings of up to 40,000 sq. ft. The system also features pre- and post-heater elements, which allow for operation in colder conditions. Its counterflow aluminum heat exchanger provides up to 93% heat recovery, and its programmable controller can adjust ventilation rates and core bypass volume based on building conditions such as CO2, VOC and occupancy levels.
www.ventacity.com

5. Quantech's QWC3 water-cooled scroll chillers (from 50 to 200 tons) feature a large operating envelope, producing chilled water from 15°F to 59°F while using condenser water from 64°F to 125°F. The system's onboard communications support BACnet (MS/TP) and Modbus.
http://www.quantech-hvac.com/



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GRUNDFOS

Montreal Hospital Meets City Regulation, Flow and Constant Pressure Requirements with Industry Leading Grundfos Booster

Quebec's largest hospital; Hôpital Maisonneuve-Rosemont part of CIUSSS de l'Est-de-l'Île-de-Montréal had gone ahead with a piping project upgrade adding back flow preventers and city water meters in order to meet the City of Montreal's potable water regulation. Within their investment budget Hôpital Maisonneuve-Rosemont made the decision to update the pressure boosting system as well. The existing system was not only long past its prime, it was having operational issues. Also, hospital occupants were often complaining of flow and pressure fluctuations that were causing operational problems for hospital equipment that requires steady water pressure.

Grundfos' Francois Seguin worked with consulting engineer Tetra Tech on the selection and design of the new pressure boosting system that would replace the existing centrifugal steam driven constant speed two pump system. Tetra Tech recommended install of a properly sized Hydro MPC-E (CUE) 4CR32-3-2 10hp 3x575v system that would feed present hospital building water demand, and future dialysis pavilion.

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

- It's a fully integrated system ideal for water supply and pressure boosting in in multi-story and municipal buildings. The system was designed to accommodate the hospitals broad range of flow requirement, and so that 3 CR's will meet 100% of the demand while the forth remains on standby.
- The system is based on the industry's most efficient, reliable and highly adaptable CR vertical inline multistage pump range.
- The MPC controls the parallel connected pumps, as well as the speed of the individual pumps. It alternates between lead and lag pumps, ensuring equal run hours on all of the pumps. Built in pump curve data identifies if it's more efficient to operate two pumps at slower speed, rather than one pump at full speed.
- The VFD (variable frequency drive) located in the MPC adapts to variations in water flow, allowing the CR's to continuously regulate speed while maintaining pre-set constant pressure. It allows the pumps to run only when demand is detected, extending the lifespan of the pumps, decreasing energy consumption, and reducing maintenance costs.
- The MPC's BUS communication guarantees integration into a management system for monitoring and control at a distance.
- The system comes preassembled for easy installation, is factory tested prior to delivery, and requires minimal to no maintenance.

B2 Tuyauterie Industrielle installed the Hydro MPC Booster in December 2016 and was very impressed with the quick and easy install, commissioning and plug-and-pump operation. Hôpital Maisonneuve-Rosemont is very satisfied with the system, and especially impressed with its user-friendly controls. It was important that Hôpital Maisonneuve-Rosemont have a high performance pumping solution with low life cycle costs, and the Grundfos Hydro MPC Booster system is proving to be the best choice.

Grundfos is the world's largest manufacturer of pumps and pumping systems. Grundfos' Canadian headquarters is located in Oakville, Ont. 1-800-644-9599, www.grundfos.ca

Specifier's Literature Review

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The New Stone Age

Picco Engineering, located just north of Toronto, is celebrating its 25th anniversary in the consulting engineering business. Started by Mike Picco as a structural engineering firm, the company has evolved into a specialist in stone consulting for high-profile national and international projects. Growing from a one-man operation to a team of over 40, we spoke with Picco about the development of his business.

How did you get introduced to stone?
I was exposed to natural stone during my first job out of school [McMaster University Engineering, class of 84]. It was a precast company that did some stone cladding work. Then I worked at a structural engineering firm with a few stone cladding clients.

One of those companies approached me to develop an in-house engineering and drafting department for their exterior stone cladding division. I worked with them for about four years until the early 90s when work tailed off and I was laid off.

You started your own business in 1992, what was your plan?
I started out locally with general residential engineering, and I also started reaching out to companies in the stone cladding business. In the first couple of years I did all of the drafting, engineering and accounting, and as the business started to grow I hired one drafter out of college and it really ramped up from there. We still have three pillars to the business: local residential and structural engineering, which together account for about 30%; and stone consulting which is global and accounts for 70%.

How did you grow the business?
I saw an opportunity specializing in stone. It was a growing sector, and there wasn't a lot of knowledge in the market. I started exhibiting at Stone Expo, the industry show run by the Marble Institute of America (MIA). I met people and started doing work for some U.S. companies, landing a couple high-profile jobs. That gave us credibility and we grew from three people to 10.


Mike Picco, founder of Picco Engineering, specialists in stone engineering.

After a few years I started sponsoring the MIA Awards Luncheon, I figured I could meet all of the major players. And two years ago I was elected to the MIA Board of Directors (a five-year term).

Who are your primary customers?
Our primary contracts are with stone installation contractors, but we're getting more involved with architects and becoming part of the primary design team, helping source and specify materials.

How large do you see the company becoming?
For me personally, I'm satisfied with the size of the company, but I have to continue to grow the company to provide opportunity for the employees. If there is nowhere for them to grow, you're going to lose good people.

Was identifying a niche critical to your growth?
Yes, and I love that part of the business—the natural stone and the history behind it. It's become a passion for me. You have to love what you do, and if you do I think you're going to drive your own success.

How would you describe your personal management style?
I coached hockey until my son outgrew the sport, and I like to run the company similar to coaching a team. I often reference John Wooden (famous UCLA basketball coach), and he developed the pyramid of success, it's the building blocks of building a strong team. Everyone here has a pyramid on their desk and we refer to that in our day-to-day activities, in how we approach clients and how we deal with challenges.

Are there projects you've worked on that bring a smile to your face?
There are so many, but a couple that stand out include the Ark of Return at the United Nations in New York. It's the first permanent memorial erected at the UN. Another is the Canadian Museum for Human Rights in Winnipeg. We were involved from the beginning with the renowned architect Antoine Predock. We went to Spain with him to help select the stone.

What trends get you excited today?
The advent of building information modeling, BIM, has allowed architects to get much more creative, and they are pushing the limits, which we really welcome. It drives more challenges and pushes us to innovate. So those are the types of projects that we love to get involved with, and we've got a BIM innovation team making sure we can facilitate the challenges that are going to be out there. **CCE**

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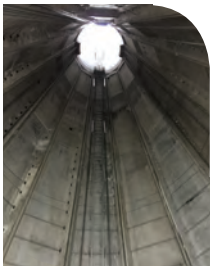

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