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2017 AWARDS

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October/November 2017
Volume 57, No. 6

Cover: Port Mann Water Supply Tunnel, Vancouver, B.C., winner of the Schreyer Award. See page 22

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Next issue:
Cultural/entertainment buildings, HVAC, IAQ, and design copyright.

on topic

Rewarding Experience

This was my first year managing the Canadian Consulting Engineering Awards process, gaining exposure to the work accomplished by Canadian firms from coast to coast, and I must say it was truly a pleasure.

The entire activity opened my eyes to the breadth of projects being done by consulting engineers, and I'm personally inspired by the way every project entered into the awards this year in one way or another provides some forward-looking environmental benefit.

I also felt privileged to be in the room as our jury of experienced and knowledgeable professionals shared their technical insights, swapped opinions on specific details, and in some cases helped me by revealing the true innovation showcased in the top award-winning projects this year.

These national awards bring prestige to firms within our consulting engineering community, but it's important that the general public also becomes aware of the hidden ingenuity behind the important infrastructure and beautifully built environment that surrounds them.

While some the of 20 Award of Excellence winning projects showcased in this issue will be landmarks in their communities for years to come, others show their brilliance through behind-the-scenes intelligence that keeps critical operations running smoothly, provides sustainable sources of power, or improves community safety.

I think it's especially pertinent that this year's top prize, the Schreyer Award, went to a project that resides primarily underground. The Port Mann water supply tunnel provides an earthquake-resilient supply of drinking water to an area with a growing population and corresponding demand.

While the residents south of Metro Vancouver may not be aware of the technical hurdles overcome in order to provide a stable flow of safe water to their homes and businesses, the engineers involved in making the project come to life understand the long-term implications work like this has.

I'm learning that it's that behind the scenes role that consulting engineers relish. Make things great, but don't bother anyone with the details. In the Port Mann project for example, the exit shaft sits in a Coquitlam park, but part of the objective was to keep it "invisible" to park users.

I'm glad that as part of this issue we've been able to include a gallery that puts some faces to the names behind these award-winning projects (p. 70-72). To all of this year's winners, and those people working on the projects that will be featured in these awards in the years to come, as a member of the general community that benefits from the work you do: Thank you.

Doug Picklyk

FOR PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE

CANADIAN CONSULTING engineer

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ENGINEERING
TOMORROW

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(source: Mirvish+Gehry Toronto)

Model of proposed Mirvish+Gehry Towers

BUILDINGS

Great Gulf acquiring Mirvish Gehry towers

Ed Mirvish Enterprises has announced the sale of the site of the proposed Mirvish+Gehry project in the heart of Toronto's downtown Entertainment District to Great Gulf.

"I am pleased to have concluded a transaction with Great Gulf that will see the realization and fulfillment of my vision for Mirvish+Gehry Toronto," said David Mirvish, president, Ed Mirvish Enterprises, in a release.

The development will feature the tallest residential structures in Canada, comprised of two towers of 82 and 92 storeys anchored by a multi-level podium. The site is zoned for mixed use including retail, office, institutional, hospitality and condo suites.

"It will be Toronto's first internationally acclaimed development from one of the world's most celebrated architects, Frank Gehry," said Great Gulf Homes president Christopher Wein, in the release.

"It's a magnificent development opportunity and aligns well with our vision to build iconic state-of-the-art developments. Toronto is truly a global city and this development will continue to build our reputation on the world stage. The entire team at Great Gulf is excited to work with Frank Gehry to realize the bold vision and legacy of David Mirvish."

Photo courtesty Emily Carr University

Emily Carr University, Wilson Arts Plaza

Emily Carr University opens new campus

Almost two-and-a-half years after breaking ground, the new campus for the Emily Carr University of Art + Design in Vancouver has opened. The 92-year-old institution relocated to the east side of downtown Vancouver to a purpose-built facility designed by Diamond Schmitt Architects.

The 290,000 sq.ft. building is open and accessible. "The building's design creates a multitude of places both indoors and out for informal gathering, presentation, making and remaking, which is at the heart of Emily Carr's multidisciplinary arts learning," said Donald Schmitt, principal, Diamond Schmitt in a media release .

The highly sustainable building incorporates an array of energy and water-saving measures. It captures views of the Vancouver skyline and the coastal mountains from many vantage points, including terraces and workshops, and the fully glazed, north-facing painting and drawing studios on the fourth floor.

At ground level, the transparent façade reveals sightlines into the building and highlights galleries and other public elements of the campus.

The team for this Public Private Partnership (P3) includes Chernoff Thompson Architects, the Government of British Columbia and Ellis Don Construction Company. The structural consulting engineer was Bush, Bohlman and Partners. Mechanical engineering firm was Rocky Point Engineering, and electrical consultant was WSP Canada.

COMPANIES

Martin Jobke to be president of Associated Engineering

Martin Jobke

As of Jan.1, 2018, Martin Jobke, P.Eng. becomes president of the Associated Engineering group taking over from president/CEO, Kerry Rudd, P.Eng., who held the position for 11 years and will remain CEO.

A civil engineer with 33 years of experience, Jobke joined the firm in 1987 and most recently was vp and general manager of the B.C. operation.

Mark Dvorak named president/COO of exp

Mark Dvorak

Following the retirement of president/co-CEO Vladimir Stritesky on July 31, Mark Dvorak became president and COO with exp.

Dvorak has been COO since April 2016. With over 20 years experience he has moved from staff engineer, to a sr. project manager, to vp transportation for U.S. central operations.

Stritesky became president/CEO in 1995, and exp has since grown from a regional Ontario firm to a global organization with over 100 offices across North America. He will remain advisor to the CEO, Ivan Dvorak.

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Lethbridge College.

Lethbridge College.

Lethbridge College new trades and technology centre

Lethbridge College has opened its expanded trades and technologies centre. At close to 170,000 sq. ft., the new facility, designed by Diamond Schmitt Architects in association with Sahuri + Partners, is one of the largest buildings in the southern Alberta city.

The College set a high bar for energy-efficient design with a "net zero utility cost to operate" goal for the new facility.

"Energy modeling, user input and process loads were analyzed and a comprehensive array of passive and active sustainable design features were implemented that allowed us to exceed the target," said Dan Gallivan, associate, Diamond Schmitt, in a company release. "Solar control, efficient glazing and minimizing the area of the building envelope enhanced building performance so that it is now positioned to achieve a high level of LEED certification."

Eighty light tubes embedded in the undulating roof in addition to clerestory windows provide a high level of natural light to the large program areas.

The facility is designed to be a learning tool. A variety of building techniques and materials such as structural concrete and steel, glulam timbers, masonry and curtain wall glazing allow instructors to demonstrate construction methods and performance.

"The building itself is beautiful and has already become a showcase piece on campus, but the practical applications and technological benefits that it will provide to students is the most exciting part of this project," said Dr. Paula Burns, Lethbridge College President and CEO in the media release.

Credits: architects: Diamond Schmitt / Sahuri + Partners; (structural) Entuitive; (mechanical) The HiDi Group; (electrical) SMP Engineering; LEED consultant: WSP Canada.

BRIDGES

BC halts Massey Bridge project for another review

The BC Ministry of Transportation and Infrastructure is proceeding with an independent technical review of the George Massey Tunnel corridor. The current procurement process has been cancelled and the project will not be budgeted for in the government's capital plan until a solution has been identified.

The review will focus on which option would be best for the corridor, be it the proposed 10-lane bridge, a smaller bridge or tunnel.

On October 4, 2016 the government invited three pre-qualified teams to participate in the RFP stage to design, build, partially finance and operate the project. Terms of the RFPs dictate that each of the two final bidding teams will be paid up to $2 million to help offset expenses.

The Province has spent approximately $66 million on the estimated $3.5-billion project. An environmental review was completed earlier this year.

COMPANIES

Saverio Parrotta elected vp with J.L. Richards

Saverio Parrotta

J.L. Richards & Associates (JLR) named Saverio Parrottato to the position of vice president. Parrotta has over 25 years of engineering and project management experience. He joined JLR in 1998 as a senior civil engineer and became an associate in 2006. Most recently, he served as director-in-charge of JLR's Sudbury and North Bay offices, as well as the Industrial & Mining Division. In his new role he will be responsible for the day-to-day management of the firm's operations and allocation of resources.

Parsons' Joanne McCall named Toronto Infrastructure Market Leader

Joanne McCall

Parsons appointed Joanne McCall, sr. vp, to the position of market leader for the Greater Toronto Region. McCall oversees regional business development in civil/structural, transport, systems, and industrial divisions.

She has more than 23 years of experience in infrastructure planning, design, management, and construction, both in North America and overseas.

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LEGAL

Ontario contractor fined $5,000 for unauthorized use of professional engineer's seal

The Professional Engineers Ontario (PEO) anounced that on September 15, Dole Contracting Inc. of Woodbridge, Ontario, was convicted of breaching the Professional Engineers Act by the Ontario Court of Justice and fined $5,000 for use of a professional engineer's seal.

Dole was retained as the contractor for a building retrofit in Toronto in April 2015, and was working under the the project architect.

As part of the project, Dole was responsible for the demolition of a non-loadbearing cinder block partition wall. Dole was required to install temporary shoring, for which a professional engineer was needed to prepare drawings and review its installation. The partition wall was demolished without temporary shoring or the involvement of a professional engineer.

A Dole employee submitted two letters to the project architect stating the temporary shoring had been installed and had been reviewed by a professional engineer. These letters bore a professional engineer's seal without the affected professional engineer's knowledge or consent.

Dole was convicted of two offences relating to use of the seal.

COMPANIES

RWDI expanding in Guelph and investing in new technologies

Rowan Williams Davies & Irwin Inc. (RWDI) is investing in new technology at its Guelph, Ontario facility including three wind tunnels and open channel water flume technologies to establish one of the world's most advanced centres for wind tunnel research and rapid prototyping and modelling.

Ontario is partnering with RWDI, investing up to $1.73 million, and the federal government also announced a repayable contribution of up to $4.5 million as part of an overall investment by the company valued at $41.14 million. The project is scheduled for completion in 2021.

ENVIRONMENT

CaGBC report recommends nationwide retrofit strategy

A new report released by the Canada Green Building Council (CaGBC) delivers a roadmap for reducing greenhouse gas emissions from large buildings (office towers, recreation centres, hospitals, arenas and schools) across the country.

Developed by WSP for CaGBC, the report *A Roadmap for Retrofits in Canada* demonstrates the role existing buildings play in realizing Canada's low carbon future. The report provides recommendations to retrofit large buildings that will contribute to achieving a reduction in GHG emissions of at least 30% by 2030, with the potential to reach 51%.

Among its key findings, the Roadmap concludes that:

- office buildings, shopping malls, universities, and arenas constructed between 1960 and 1979 represent the age class with the largest opportunity for carbon emissions reductions.
- Alberta and Ontario currently emit the most carbon and therefore have the greatest potential for reducing emissions.
- all provinces will need to prioritize recommissioning for large buildings (between 25,000 and 200,000 sq.ft) and deep retrofits for older buildings (over 35 years old) to meet the target.

COMPANIES

James Chopty to lead WSP Canada Oil & Gas

WSP Canada has appointed James Chopty as national business line executive for oil & gas, responsible for providing leadership, client development and strategic direction for the oil and gas business line nationally and will be part of WSP's Canadian leadership team, working from WSP's Calgary office.

WATER

Faster, cheaper, test for E. coli in drinking water

Researchers at the University of Waterloo have invented a fast, affordable way to test drinking water for E. coli.

Unlike current tests that cost about $70 and can take up to three days, the Waterloo invention uses paper strips similar to those in litmus tests to produce results in less than three hours at a cost of 50 cents.

Now being refined by Glacierclean Technologies, the test could improve water safety in remote or rural areas of the developed world and reduce testing costs for municipal treatment systems.

Researchers targeted E. coli—the culprit in Walkerton, Ontario in 2000—because it is an indicator organism of water contamination.

Glacierclean, which already sells mobile water kits to detect E. coli for about $5 a test, hopes to have its strips, known as the DipTest, on the market within nine months.

CHAIR'S MESSAGE

Celebrating Excellence

In this issue of *Canadian Consulting Engineer*, 20 outstanding projects from across Canada are celebrated for their innovation, their complexity, as well as their social, economic and environmental benefits. They were recognized for their achievement at the Canadian Consulting Engineering Awards gala, presented jointly by ACEC-Canada and *Canadian Consulting Engineer* in October, the culminating event of the ACEC national leadership conference.

These featured award-winning projects, and indeed all the 50 projects submitted for consideration, are just a sample of the enormous contribution that consulting engineering companies in Canada make in a variety of fields. Every year, more creative, innovative, and ingenious projects are submitted as consulting engineers tackle complex challenges and create opportunities for their public and private-sector clients.

In November the award-winning projects will be further recognized during the #20DaysofExellence campaign. I encourage you to follow the campaign on Twitter and Facebook and to share the posts with your own social network to help us further celebrate excellence in Canadian consulting engineering from the past year.

ACEC also recognized Wayne Clifton, one of the most esteemed leaders in the Canadian consulting engineering community, with the coveted *Beaubien Award*. This is the highest honour bestowed to an individual for their lifetime contributions to the Canadian consulting engineering industry. The *2018 Allen D. Williams Scholarship* was also presented that evening to Michael Walker, a rising star in our industry. *The Chair's Award*, bestowed annually by the ACEC Chair, was awarded to Enrico Vink, Managing Director of FIDIC, and David Raymond, President and CEO of ACEC-US, for their exceptional contribution to consulting engineering over their careers.

I would like to take this opportunity to express our thanks to the jury members who committed countless hours to reviewing the project submissions. A special thank you to our partner Canadian Consulting Engineer magazine, with whom we look forward to continuing our collaboration and expanding this important national program. Most importantly, I would like to thank all the firms that participated in this year's awards program.

TODD G. SMITH, P.ENG
CHAIR OF THE BOARD OF DIRECTORS, ACEC-CANADA

MESSAGE DU PRÉSIDENT DU CONSEIL

Les Prix canadiens du génie-conseil célèbrent l'excellence

Dans ce numéro de *Canadian Consulting Engineer*, nous soulignons le caractère exceptionnel de 20 projets qui se distinguent par leur sens de l'innovation, leur complexité, ainsi que par leurs avantages sociaux, économiques et environnementaux. Nous leur avons rendu hommage dans le cadre du gala des Prix canadiens du génie-conseil, organisé par l'AFIC-Canada et *Canadian Consulting Engineer*. Cette soirée, qui a lieu en octobre, est le point culminant du Congrès national du leadership de l'AFIC.

Les projets primés, mais aussi les cinquante projets sur lesquels s'est penché le jury, sont des exemples de l'apport considérable des firmes de génie-conseil à la société canadienne, dans différents domaines. Chaque année, les projets qui nous sont soumis semblent gagner en ingéniosité, en créativité et en innovation, les ingénieurs-conseils devant relever des défis toujours plus grands et trouver des solutions pour leurs clients du secteur public et privé.

Les projets primés cette année seront également mis en valeur pendant la campagne #20DaysofExellence, qui aura lieu en novembre. Je vous invite à suivre cette campagne sur Twitter et Facebook, et à partager nos publications avec votre réseau social. Vous contribuerez ainsi à célébrer l'excellence dont a fait preuve le génie-conseil au cours de la dernière année.

L'AFIC salue également Wayne Clifton, l'un des chefs de file les plus estimés de la communauté canadienne du génie-conseil, qui a reçu le très convoité *Prix Beaubien*. Il s'agit de la plus grande distinction décernée à une personne pour sa contribution de toute une vie à l'industrie canadienne du génie-conseil. *La Bourse Allen D. Williams 2018* a été octroyée à Michael Walker, une étoile montante de l'industrie. *Le Prix du président*, décerné annuellement par le président de l'AFIC, a été accordé à Enrico Vink, directeur général de la FIDIC, et à David Raymond, président et chef de la direction de l'ACEC-US, pour leur apport exceptionnel à l'industrie du génie-conseil tout au long de leur carrière.

Je profite de l'occasion qui m'est donnée ici pour remercier les membres du jury, qui ont consacré un nombre incalculable d'heures à l'étude des projets soumis. Je tiens également à adresser des remerciements spéciaux à notre partenaire, le magazine *Canadian Consulting Engineer*, avec qui nous espérons collaborer encore longtemps pour étendre cet important programme national. Mais surtout, j'aimerais remercier toutes les firmes qui ont présenté un projet dans le cadre des Prix de 2017.

TODD G. SMITH, P.ENG.
PRÉSIDENT, CONSEIL D'ADMINISTRATION, AFIC-CANADA

2017 ACEC Beaubien Award goes to Wayne Clifton

On October 24, outstanding achievements in consulting engineering were showcased at the Canadian Consulting Engineering Awards gala, an annual event organized by ACEC-Canada and Canadian Consulting Engineer magazine. Twenty projects were recognized with an Award of Excellence, and of these, five were presented with a Special Achievement Award.

Wayne Clifton, P.Eng., M.Sc., D.SC., was honoured that evening as recipient of ACEC's prestigious Beaubien Award. Presented annually, the Beaubien Award recognizes individuals for exceptional service to ACEC and for contributions to the advancement of consulting engineering through professional accomplishments.

In Saskatchewan, the name Wayne Clifton is synonymous with engineering. A professional engineer since 1966, Wayne has consulted on more than 3,000 projects related to geotechnical and environmental issues throughout his career. One of his greatest professional achievements is establishing and growing Clifton Associates, the largest independent, specialist consulting engineering firm headquartered in Saskatchewan. Founded in 1978, it now boasts six offices and 250 staff across Saskatchewan and Alberta. Under Wayne's leadership as President and CEO, Clifton Associates provides engineering, science and technology solutions to clients across Canada and internationally. He continues to be the first choice for many clients seeking sound knowledge to address difficult variations on geotechnical and environmental engineering projects.

Despite the firm's global project list, the one that stands out for Wayne is of great local significance. The "Big Dig", a design and construction management project, was a complex $18 million project to deepen Wascana Lake in the heart of Regina. The community turned to Wayne for his expertise and leadership to ensure the project's success. His ability to build consensus was critical in bringing together all levels of government, community leaders, environmental activists, and the citizens of Regina and Saskatchewan. His inimitable style was without doubt one of the key factors in the project's success.

Wayne has an enduring commitment and personal interest in developing the next generation of engineers. He has generously shared his knowledge and expertise as an adjunct professor at the University of Saskatchewan and the University of Regina, and by authoring several hundred technical reports that have been published in journals and conference proceedings. By way of the firm, Wayne has provided financial support to more than 45 employees pursuing graduate degrees.

An active member of many industry associations, he is a Past Chair of ACEC-Saskatchewan and Past President of the Association of Professional Engineers and Geoscientists of Saskatchewan (APEGS) and was a Director on the ACEC-Canada Board and the Canadian Council of Professional Engineers (now Engineers Canada). These are but a few of the many leadership roles Wayne has held in support of the profession. In 2003, ACEC-SK recognized his contribution to the profession by presenting him the Lieutenant Governor of Saskatchewan, Meritorious Achievement Award.

An active leader in his community, Wayne is a member of the Saskatchewan Baseball Association and a national leader of Scouts Canada as well as other youth sports groups. In recent years, he has provided leadership in the implementation of an Environmental Code as the basis for environmental regulation in Saskatchewan. He has served on the Prime Minister's Scientific Advisory Committee, as a member of the National Research Council, and the Standards Council of Canada Advisory Committee on Trade.

Wayne follows a code of ethics in his professional and his personal life. He is a trusted and respected member of his profession and a dedicated family man. If Wayne commits to doing something, you can depend on it being done.

As the recipient of ACEC's 2017 Beaubien Award, Wayne Clifton is recognized by his peers for his exemplary service to the consulting engineering industry and the engineering profession.

Michael Walker wins the 2018 Allen D. Williams Scholarship

The Association of Consulting Engineering Companies-Canada (ACEC) is pleased to announce that the 2018 Allen D. Williams Scholarship has been awarded to Michael Walker, P.Eng., PE, PMP, of McElhanney Consulting Engineering Services Ltd. Mr. Walker was presented with his award at the Canadian Consulting Engineering Awards gala, the culminating event of the ACEC national leadership conference.

Michael Walker is a young professional who is already recognized for his extraordinary leadership skills. An employee of McElhanney since 2015, he has managed a number of high profile projects within Canada's National Parks. He is also playing a significant role in McElhanney's two largest design-build projects in Saskatchewan, each requiring dedicated effort to meet tight deadlines. His passion, problem solving ability, and client understanding have made him a successful project leader on these highly technical assignments.

Recognizing his consulting skills, leadership ability and passion, McElhanney tasked Michael with launching an office in Regina. In a year, he has increased the staff to four people, established a growing client list and achieved various certifications for the new branch office, including ISO and OQM. His exceptional interpersonal skills are a key to his raising the profile of the firm in this new market.

While completing the FIDIC YP Management Training Program, Michael recognized the role and influence of Canadian consulting engineers in the international marketplace. He believes that with this influence comes the responsibility to advance the industry and learning. This philosophy is what drives his passion to share experience and knowledge as a mentor. He has selflessly dedicated himself to the provincial, national and international Young Professional networks. Michael also believes sharing his experience with children is a meaningful way to give back to the industry. In partnership with a local elementary school, he volunteers his time to provide presentations to the students and teachers on STEM careers.

Michael's high energy, strategic approach and vision are a credit to the industry. He is an inspiration and role model to current and future generations of consulting engineers.

The Board of the Allen D. Williams Scholarship Foundation selected Michael as the recipient of this year's scholarship for his clear understanding of the role of consultants in the engineering industry. They were impressed with his leadership role in large complex projects and his involvement with industry associations including ACEC-Canada, CEA and ACEC-SK which they felt is a testament to his role as a mentor to other Young Professionals in the industry. His dedication to the profession, through his volunteer work with his employer and his community, was applauded by the Foundation Board.

The scholarship commemorates Allen Williams, past ACEC Chair and Founder of Williams Engineering Inc. It provides the winner with funding to cover registration, airfare and accommodations to attend the annual conference of the International Federation of Consulting Engineers (FIDIC).

Association of Consulting Engineering Companies – Canada (ACEC-Canada), Tel: (613) 236-0569, 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 des firmes de génie-conseil – Québec, Association of Consulting Engineering Companies – New Brunswick, Consulting Engineers of Nova Scotia, Association of Consulting Engineering Companies – Prince Edward Island, Association of Consulting Engineering Companies – Newfoundland & Labrador

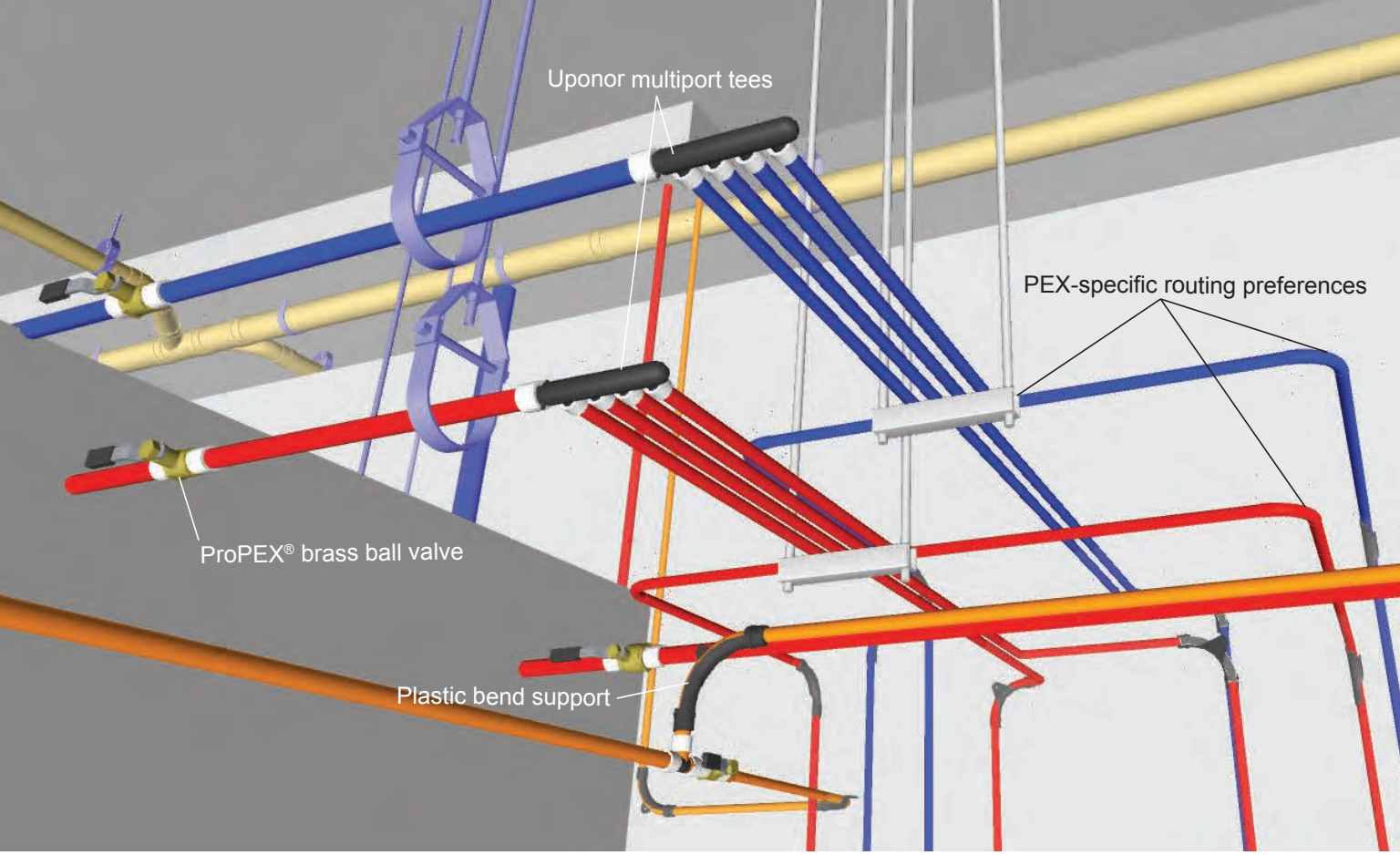
AUTODESK.

BIM in the Era of Connection

By Terry Bennett, Senior Industry Strategist, Civil Infrastructure

Not only is our infrastructure aging, but the approach to planning, designing, and constructing it is rapidly becoming out of date. New trends in technology are poised to deliver a more profitable, resilient, and agile industry, as well as a better built environment. While population growth, urbanization, and economic expansion are set to push demand for infrastructure to unprecedented levels, technology is changing the way industry professionals, across all civil infrastructure sectors, plan, design, build, and maintain the world's infrastructure. Innovation is now no longer optional.

In this cloud-connected era, Building Information Modeling (BIM) will play an even more important role in the efficient and innovative approach for a resilient and sustainable built environment that enables people to thrive and creates economic value. Infrastructure owners and design firms must change the way they work. Going forward, challenges must be addressed by considering the interdependency of all adjacent infrastructure systems and their costs over the lifecycle of each system. Focusing on the right way to increase infrastructure will help future-proof systems for growth, adaption, and resiliency.



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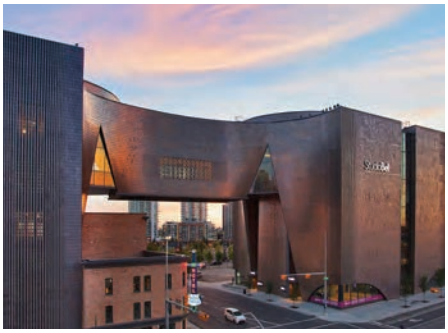
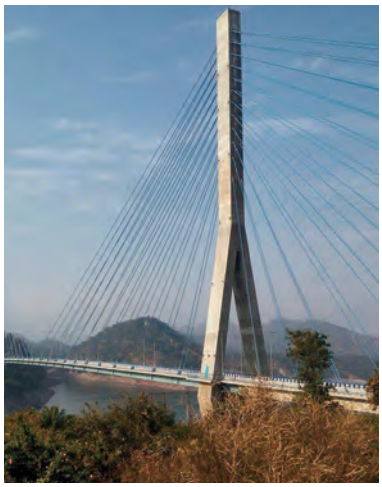
CANADIAN CONSULTING ENGINEERING AWARDS

AWARDS

PRIX CANADIENS DU GÉNIE-CONSEIL





Projects representing the Top 20 Awards of Excellence from the 2017 Canadian Consulting Engineering Awards are presented on the following pages.

This is the 49th annual edition of the Awards, held jointly by *Canadian Consulting Engineer* magazine and the Association of Consulting Engineering Companies – Canada (ACEC/AFIC).

These are the longest-running and most important national mark of recognition for consulting engineers in Canada. This year's winners were selected from 50 qualifying entries from across the country.

From the top 20 projects selected by this year's esteemed jury, five were singled out for Special Awards.

The **Schreyer Award**, the top prize presented to the project that best demonstrates technical excellence and innovation, went to Ausenco Engineering for the firm's work on the Port Mann Water Supply Tunnel in Vancouver.

Knight Piésold claimed the **Tree for Life Award**, presented to the project that best demonstrates outstanding environmental stewardship, for the Box Canyon Hydroelectric Project in B.C.

The **Engineering a Better Canada Award**, for the project that best showcases how engineering enhances the social, economic or cultural quality of life of Canadians, was presented to RJC Engineers & Stantec for Studio Bell, home of the National Music Centre in Calgary.

And this year there were two **Ambassador Awards** handed out for projects constructed or executed outside of Canada that best showcase Canadian engineering expertise. COWI North America (formerly Buckland & Taylor) won for the work done on the World Trade Center Transportation Hub (Oculus) in New York City, and McElhanney Consulting also won for the Atal Setu (Basohli Bridge) built in Jammu & Kashmir, India.

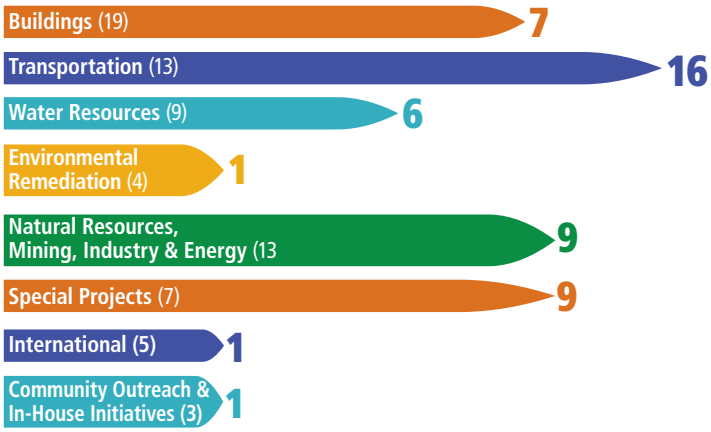
The awards were presented at a gala dinner held October 24 in Ottawa. Congratulations to all of our winners.

TOTAL NUMBER OF ENTRIES 50

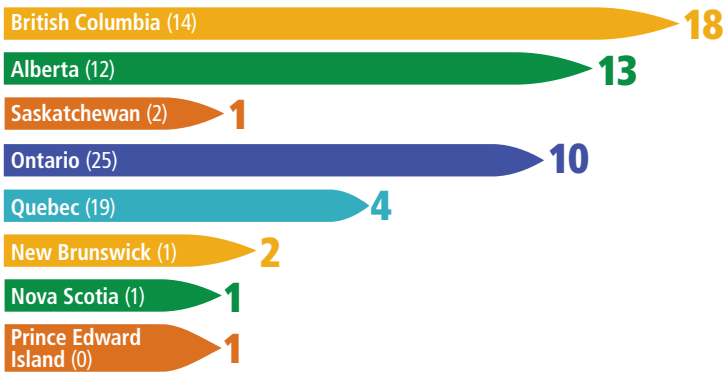
77 NUMBER OF ENTRIES LAST YEAR

ENTRIES BY CATEGORY

(last year's total in brackets)



ENTRIES BY PROVINCE



Note: Awards are not chosen as one project per category (which would not be fair since the number of entries in each category varies widely). Rather awards are given by their merit.

CHAIR'S COMMENTS

Recognizing Excellence

In all my years of leading engineering associations, as a profession we struggle to promote the essential and innovative work that our Canadian engineers and their firms contribute to our country.

Canada is beautiful and yet daunting in the changing geographic challenges it continues to present to our engineering companies. It's astonishing to see that beauty reflected back in the designs of this year's projects.

These annual awards play a part in highlighting the best of the best across our country, and they remind the public that not only are engineers necessary to our infrastructure but they are key stewards of our environment and social needs.

Thank you to all of the firms that submitted their projects with pride, and thank you to the jury volunteers who very much enjoyed reading the submissions and spent hours agonizing and vigorously debating the selection of awardees from such excellent and unique projects.

Congratulations to all of the final award winners—we continue to be amazed and impressed with your work.

To those reading this magazine, please share it widely. You'll be doing your part to promote the fine work within our profession and celebrating our engineering firms!

— *Annette Bergeron, P.Eng., Jury Chair*

Portfolios of all this year's and previous years' entries are showcased at http://www.canadianconsultingengineer.com/awards/showcase-entries/

Also, for more details about the awards' history and purpose, visit http://www.canadianconsultingengineer.com/awards/about/

CANADIAN CONSULTING ENGINEERING AWARDS JURY

The jury for this year's awards met in Toronto in early June for the final round of judging. Front row (l-r): Bronwen Parsons, Oya Mercan, Cheryl Atkinson, Annette Bergeron, Louise Millette. Back row (l-r): Rob Jamieson, Jocelyn Hayley, Stephen Panciuk, Peter Judd, Jim Burpee and Guy Mailhot. (Missing: Clive Thurston.)

CHAIR

Annette Bergeron, P.Eng., MBA, FEC, is president-elect, Engineers Canada. She was president of Professional Engineers Ontario in 2013, and president and chair of the Ontario Society of Professional Engineers in 2005 and 2010. She also has been appointed to the Boards of the Electrical Safety Authority (of Ontario), and the South East Local Health Integration Network. And she's currently consulting for the federal government under the Ministry for the Status of Women. Twice she has been named one of the Top 25 Women of Influence in Canada. She has also served on the *Canadian Consulting Engineering* Awards jury in 2015 and 2016.

Cheryl Atkinson, OAA FRAIC is a principal in Atkinson Architect in Toronto and an associate professor at Ryerson University in Architecture. Prior to Ryerson she was a senior associate at Teeple Architects Inc., where her projects have been recognized both nationally and internationally for design excellence and their contribution to the public realm. She serves on the Metrolinx Design Review Panel and is an executive Board Member of Subtle Technologies.

Jim Burpee, P.Eng. retired in 2015 as president and chief executive officer of the Canadian Electricity Association. Involved in the North American electricity industry for 38 years, he held senior executive roles in Ontario Power Generation and its predecessor Ontario Hydro. During that time he oversaw 17,000 MW of fossil and hydroelectric generation, two different nuclear sites, energy trading and corporate development.

Jocelyn Hayley, P.Eng., Ph.D. is a professor (geotechnical) in the department of civil engineering and is the senior associate dean (research) for the Schulich School of Engineering at the University of Calgary. She is a Fellow of the Engineering Institute of Canada and was recognized by APEGA as the 2017 Champion of Women in Engineering and Geoscience.

Rob Jamieson, PhD, P.Eng. is a professor in the department of civil and resources engineering at Dalhousie University and is the associate director of the Centre for Water Resources Studies. He holds the Canada Research Chair in Cold Regions Ecological Engineering.

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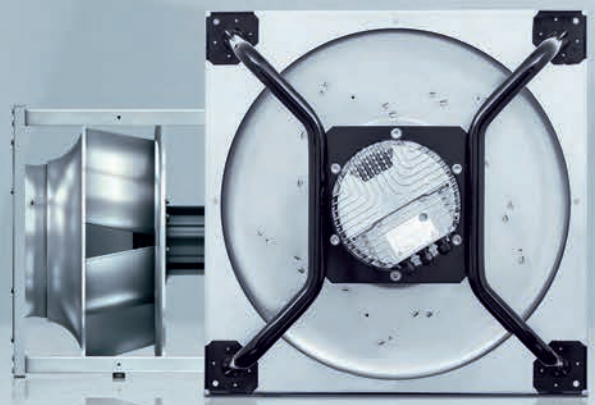

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Peter Judd, P.Eng., was general manager of engineering for the City of Vancouver until his retirement in 2015. In that role he oversaw 1,800 employees and a department that provided everything from public works planning and design, to construction and maintenance. He led many of the city's green initiatives, and also spearheaded Vancouver's Olympic and Paralympic Operations during the 2010 Winter Games.

Guy Mailhot, Eng., M.Eng. is a McGill graduate (M.Eng. 84). After working 15 years for consulting firms in Vancouver and Montreal in bridge engineering, he joined The Jacques Cartier and Champlain Bridges Incorporated in 1999 where he was principal director – engineering. Under a Government of Canada exchange program he has been on loan to Infrastructure Canada since 2012, acting for the Authority as chief engineer – new bridge for the Saint Lawrence.

Oya Mercan, Ph.D. received her undergraduate degree in civil engineering from Bogazici University in Turkey as the first ranking student. She then received M.Sc., and Ph.D. degrees from Lehigh University, U.S. After serving as an assistant professor at the University of Alberta for two years, Dr. Mercan joined the faculty at the University of Toronto in 2010.

Clive Thurston has been president of the Ontario General Contractors Association since 2002. He has worked as a superintendent, estimator, project manager and former owner/operator of a Toronto-based construction company for 12 years. He held the position of by-law/building official with the City of Brampton and was the chief building official for Prince Edward County.

Stephen Panciuk, P.Eng., is senior vice president and national engineering professional lead at Marsh Canada. Based in Ottawa, he specializes in developing and implementing a national strategy for large design firms, and project errors and omissions liability insurance. After earning a civil engineering degree he had five years' experience in the heavy civil construction industry before entering the insurance business. He is a frequent speaker at conferences and a member of the Association of Consulting Engineering Companies' contracts committee.

Bronwen Parsons, M.A. has been involved in the Canadian construction business press for almost 30 years. She was the editor of *Canadian Consulting Engineer* magazine for 19 years (1997-2016) and previously was an editor with *Canadian Architect* magazine for 10 years. She has written feature articles about the Canadian construction industry on a wide variety of subjects related to building design, infrastructure and the environment, and has won several awards from the Canadian Business Press.

Louise Millette, Eng., Ph.D. is director of the department of civil, geological and mining engineering at Polytechnique Montréal, and the first woman to hold the position. She is also head of the Sustainable Development Office at the university. Outside academia her roles have included helping to draft the "First Strategic Plan for Sustainable Development of the Montreal Community." She has served on several boards and was recently appointed to the board of the Canadian International Resources and Development Institute.

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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MADE IN CANADA

Made in Canada

Bibby-Ste-Croix is a Canadian manufacturer of cast iron soil pipe and fittings for drain, waste and vent plumbing system.

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SCHREYER AWARD &
AWARD OF EXCELLENCE

Port Mann Water Supply Tunnel

Pipe elbow at bottom of shaft. The pipe is supported only at the bottom of the shaft and at the valve chamber end wall—a 60-metre span.

Above & below right: Work crews and the tunnel boring machine cutterhead entering the south shaft.

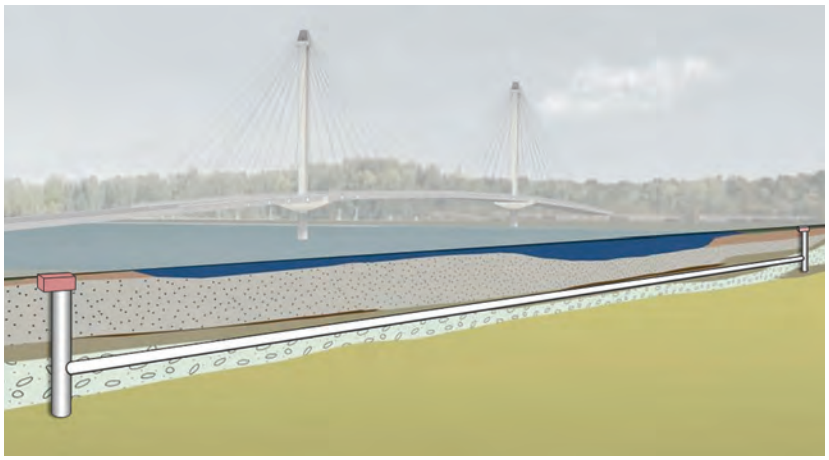
Ausenco Engineering

"We were impressed with the project's innovative and complex engineering. In particular, the technical elements such as the production, testing and selection of the steel for the pipe and the tunnel's depth of 55 meters below grade."
–Jury

Metro Vancouver (MV) replaced a critical water supply pipe crossing beneath BC's Fraser River, to increase seismic and scour resilience and meet future demand. The existing crossing, installed in the 1970's, was damaged by riverbed scour in 1997, had insufficient capacity for population growth, and had a high risk of failure during a low level (1 in 475 year) earthquake.

Ausenco's team designed a deep tunnel, access shafts, valve chambers, and pipe mains to replace the crossing. The project introduced many industry firsts, including: highest water pressure encountered in Canada; unreinforced ground support walls; and a concrete shaft and pipe main that can yield and significantly deform during an earthquake yet maintain water delivery, allowing downstream communities and economy to recover quickly post-earthquake.

MV's criteria included water supply following a 1 in 10,000 year earthquake. Ausenco's team determined the soil behaviour by applying earthquake data from six similar locations around the Pacific Rim to the local soil properties. The analytical models indicated soil movement of some 6m near the surface during the 1 in



The variable conditions of the saturated soils beneath the Fraser River raised challenges in the design and during construction.

10,000 earthquake, imparting enormous forces particularly on the north shaft. Conventional concrete shaft design could not withstand these forces—neither adding the maximum amount of reinforcing steel nor increasing the shaft diameter increased the strength sufficiently.

Ausenco designed the 65m deep, 5m ID, 1.5m thick north shaft as a yielding shaft, and the pipe within it to yield also. The 1.6/2.1m diameter, 25mm wall thickness steel pipe is self-supporting from the shaft base to the valve chamber end wall pipe, and is designed to yield to over ten times its initial yield strain. Standard steel grades did not provide the ductility needed at the yielding zones; the team worked closely with suppliers to produce, test, and select specific steel, to ensure it deformed appropriately without buckling. This is the first use of such a shaft and pipe combined as a yielding system.

Ausenco's design included a unique low friction slip liner to separate the shaft concrete from the ground support walls. This will minimize the potential for composite shaft/wall behaviour that could inhibit flexural yielding. Specialized testing selected a liner with the lowest friction. The team also broke with convention by designing the 80m deep ground support concrete walls with no reinforcing steel, to limit their strength should some composite behaviour occur.

The 55m deep tunnel exposed it to high groundwater pressures and required an earth pressure balance (EPB) tunnel boring machine (TBM) with provision for hyperbaric (high air pressure) entry into the cutterhead. Tunnelling withstood 600 kPa hydrostatic pressure, the highest for an EPB machine in Canada.

The 3.5m diameter bored tunnel, 1km long, comprised 250mm thick precast concrete segment liner, with internal steel pipe, 2.1m diameter, 25mm thick wall, grout encased. The tunnel crossed beneath an active rail yard and exited in a public park. The rail yard operation was not disrupted, and access around the park and to the public boat launch was maintained throughout construction. The park was returned to its original condition, and the other shaft site was reforested and replanted.

Innovation was required during construction, when ground freezing was implemented from a platform on the river, to allow repairs to a damaged TBM. Ausenco's team reviewed the contractor's plans and monitored the work to ensure safe, environmentally acceptable methods were implemented.

Ausenco's team of environmental specialists prepared an environmental management plan and monitored construction activities; there were no detrimental effects to fish bearing streams nearby, to the Fraser River, nor to the general environment. The work included a fish capture and release program and creek restoration with Coho spawning beds.

The project was completed within the $240M budget.

The tunnel increases both the reliability and capacity of MV's drinking water transmission to communities south of the Fraser River. Its capacity doubles that of the original crossing, allowing for population growth beyond 2050. Its seismic resilience will provide a stable water supply to allow the community and local economy a return to normal more quickly following a major earthquake.

The Tunnelling Association of Canada awarded the project "Innovative Tunnelling Project of the Year" in 2016, and ACEC-BC granted it an Award of Excellence in 2017. The structural aspects of the design were presented at the International Association for Bridge and Structural Engineering (IABSE) Symposium held in Vancouver, September 2017. CCE

Port Mann Water Supply Tunnel, Vancouver

Award-winning firm (prime consultant):	Ausenco Engineering Canada (John Sherstobitoff, P.Eng., Peter Galbraith, P.Eng., Derek Zimmerman, P.Eng., John Karlsson, P.Eng., Rob Gardner, P.Eng., David Bean, P.Eng.)
Owner:	Metro Vancouver
Other key players:	Golder Associates (geotechnical and environmental) Bruce Downing, P.Eng., Kyle Paddon, C.Tech, Upul Atukorala, P.Eng.; McMillen Jacobs Associates (tunnel and shaft ground support walls) Andrew McGlenn, P.Eng.; Hatch (construction management); McNally Aecon JV (prime contractor)

TREE FOR LIFE AWARD
& AWARD OF EXCELLENCE

Box Canyon Hydroelectric Project

Knight Piésold

Below: Installation of buried penstock on a steep leg of the Box Canyon penstock.

"We appreciate how the unique engineering utilized three main and six tributary intakes to address the unique geography along the creeks and tributaries with minimal environmental impact."
–Jury

The 16 MW Box Canyon Hydroelectric project may have the most hydraulically complex design of any run-of-river hydroelectric project in North America, if not the world. It has nine intake structures on different creeks and tributaries, all feeding into a single, high-pressure penstock that directs water to the powerhouse containing a six-jet vertical axis Pelton turbine generating unit.

The project has three main intakes and six tributary intakes that address the unique hydrology, river morphology, and fish species distribution along McNab Creek and its tributaries. It has an 8.6-km-long water conveyance system of interconnecting pipelines and high-pressure penstocks that handles varying intake elevations and flow contributions, requiring the addition and design of surge facilities and check valves.

The project design also takes into account the complex hydraulic transient pressures (water hammer), and provides unique ecological flow releases at each of the diversion weirs.

Knight Piésold Ltd. assisted Box Canyon Hydro Corp. in project development, from concept development through to operational monitoring

The original project concept was a 7 MW facility with a single intake on Box Canyon Creek. Knight Piésold optimized the design to the current 16 MW facility with multiple intakes, addressing complexities not typical in a single intake, run-of-river hydroelectric project.

The water conveyance system includes open channel sections, which

Right: Marty Creek main intake, showing Coanda screen and maximum diversion control weirs.

divert water from the tributary intake to the main intakes. Given the steep terrain, all penstock branches were installed below surface to overcome challenging construction and design conditions that were encountered at several sections of its length.

Instream flow requirements

The project design accounted for complex hydraulic transient pressures and provided unique ecological flow releases at each diversion weir. The project, under its Water License, must maintain minimum instream flow requirements (IFR), maximum allowable diversion rates, and maximum flow ramping rates that vary for each intake, due to differences in hydrology, river morphology, and fish species distribution.

The IFR at each intake is controlled by the intake design to ensure that IFR is released as priority before water can be diverted for power generation.

In single intake projects, the maximum diversion rate is often plant controlled (i.e., throttled by turbine nozzles). Due to the multiple intake design, the maximum amount of water that can enter the penstock must be limited at each intake. The Marty Creek and Cascara Creek intakes have a weir system to passively limit the maximum diversion rate.

When the project starts-up, creek flows downstream of the intakes are reduced and flows downstream of the tailrace are increased. The opposite response occurs during a shutdown. Because the intakes are connected to a single, high-pressure penstock and are at different elevations, the start-up procedure is governed by the ramping rates at each intake depending on the conditions in the penstock.

The project is operated from level control at the "master" Box Canyon Creek intake. This intake can be locked-out, if required, making the project operable from level control at the Marty Creek intake, with water being diverted from any combination of Marty Creek and Cascara Creek.

The facility monitors water level at Box Canyon Creek and Marty Creek intakes to manage ramping rates in each creek. The three main intakes were designed to divert a portion of the natural stream flow to the water conveyance system. Each of the two passive intakes at Marty Creek and Cascara Creek has a weir system to passively limit the maximum diversion rate. They also have Coanda screen solutions to prevent debris and course sediment entrainment into the turbine flow.

Overflow weir

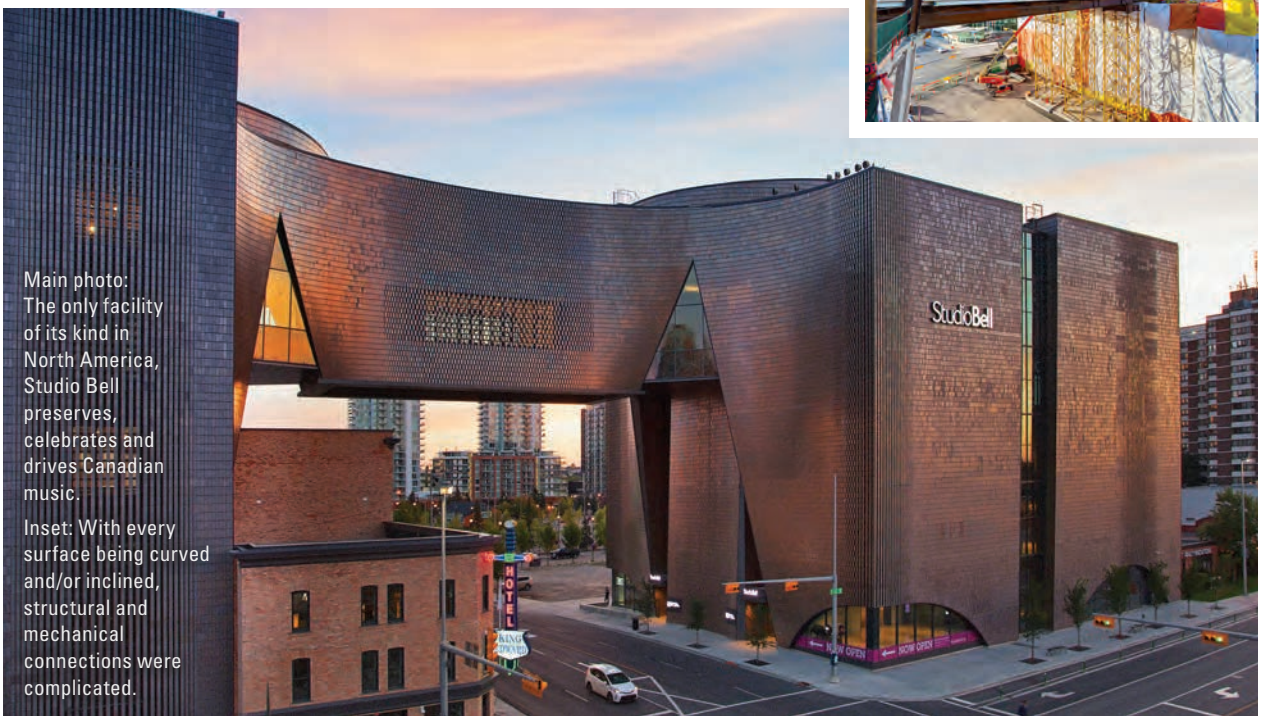
The overflow weir wall is designed to accommodate the 1:200-year peak instantaneous return period flood without structural damage to the intake structure and/or the penstock. The penstock optimization design required a balance between head loss and the pipe installation costs associated with different sizes of pipe, the resultant net head available for power generation, and the value of that energy. The steel sections of the alignment comprised of seven different pipe sizes in total, while the HDPE sections of the alignment comprised of four different pipe sizes, utilizing six different HDPE DR ratings.

The project will provide renewable energy for the BC electrical grid for the next 60 to 75 years, generating approximately 46 GWh/year. **CCE**

Box Canyon Hydroelectric Project, Howe Sound, BC	
Award-winning firm (prime consultant):	Knight Piésold (Sam Mottram, P.Eng.; Toby Perkins, P.Eng.; Benoit Otis, P.Eng.; Egbert Scherman, P.Eng.; Rob Adams, P.Eng.; David Levi, P.Eng.)
Owner:	Box Canyon Hydro Corp. (Elemental Energy Inc.)
Project management:	Chant Construction Company
Prime Contractor:	Jacob Brothers Construction

ENGINEERING A BETTER CANADA AWARD & AWARD OF EXCELLENCE

Studio Bell



Main photo: The only facility of its kind in North America, Studio Bell preserves, celebrates and drives Canadian music.

Inset: With every surface being curved and/or inclined, structural and mechanical connections were complicated.

RJC Engineers & Stantec

"The project represents a holistic design and a sophisticated integration of mechanical, acoustic and structural engineering. The building is also significant for its transformation of a condemned historical building and creating an iconic site that has become a catalyst for the re-development of one of the oldest areas in Calgary."
–Jury

The design of Studio Bell, home of the National Music Centre, was unconventional and required inventive structural and mechanical solutions to achieve the client's goals. Each discipline's collaboration and creativity helped to bring Studio Bell to life.

The only facility of its kind in North America, Studio Bell preserves, celebrates and drives Canadian music. It is a museum, performance venue, interactive music education centre, recording studio and broadcast centre.

The building is also a catalyst in re-developing one of the oldest areas in Calgary. Studio Bell's bridge connecting its east and west towers has created a new and dramatic gateway into the city's East Village.

Studio Bell also revitalized the historic King Edward Hotel, making the condemned structure safe and able to continue its legacy as a musical landmark.

Challenging design

Studio Bell's complex design posed many challenges. With every surface being curved and/or inclined, structural and mechanical connections were complicated and required significant coordination to deliver the architectural vision.

Building information modeling processes were critical during design and construction. Full building models of the structure provided a picture of how the overall building behaved. A model was also created for all major mechanical rooms, facilitating the coordination of the mechanical systems in the available spaces and the crossing between mechanical and structural components in the narrow spaces connecting the different mechanical rooms. All the mechanical systems were designed to be visually minimalistic, unobtrusive, quiet and coherent with the design of the building.

The east-west bridge presented a complex structural problem. Trying to do what was 'always' done, detailing an expansion joint, created more problems than it solved, so an unconventional solution was proposed—no

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expansion joint. This structural solution allowed for the removal of torsional cross braces in the west building. Not having an expansion joint ties the buildings together, allowing the lateral load to be shared.

The stairs in the east building—a key architectural feature—open and curve like much of the building. They are supported at each floor level by mini bridges. Each stair run features an intermediate landing extending into the interstitial space, but without support, creating the impression of a floating landing.

The design included six towers as separate gallery spaces linked together by interior bridges at each floor, so patrons can look from the main floor and see the roof and skylights of the six-storey building.

Other complexities included framing a column-free theatre with sloping walls and the "Enormadome"—a quasi-elliptical ring of skylights measuring 31m x 18m.

Structural support for the Enormadome, along with the roof area in its interior, was provided by a curved structural steel truss sitting on top of the roof. The truss is supported on the inclined columns of the main building.

Climate control

The building's galleries have precise requirements for maintaining indoor humidity and temperature within museum class AA & A levels—fluctuations need to be within +/- 1-degree C and 5% relative humidity. Stantec designed mechanical systems that consider changes in occupancy and outdoor conditions, ensuring the stringent requirements are met.

Acoustics are key for the recording studios, galleries, and performance spaces. Various strategies used include: low velocity ductwork, silencers, acoustic lining, exterior acoustic lagging, etc. Due to the effective acoustic design, the Noise Criterion (NC) rating achieved by the acoustic design in key areas was as low as NC 15.

Stantec selected high efficiency sustainability-conscious equipment and mechanical systems. Compared to conventional, Studio Bell's have achieved a 34% energy savings.

Using a free cooling process has allowed for chiller use to be greatly reduced during times with cool outdoor temperatures. Heat recovery and reuse is prevalent across the heating and cooling systems. The precision units used in the galleries are interconnected with the ability to transfer heat from an area of excess to an area of need.

The entire building envelope was modeled to analyze and account for the effects of thermal bridging on the building environmental conditions, especially in the areas requiring precise control. The analysis allowed for optimal sizing and costing of the systems.

Together with the entire team, RJC and Stantec helped to make Studio Bell's bold vision a reality. CCE

Studio Bell, Calgary	
Award-winning firms:	RJC Engineers (structural) (Simon Brown, P.Eng.; Kyle Schonknecht, P.Eng.; Cory Getz; Jeff Rent, P.Eng.; Kevin Zwaagstra, P.Eng.; Kali Olson, EIT;) Stantec (mechanical) (Jeff Rent, P.Eng.; Jason Hancock, C.Tech; Miguel Burgos, P. Eng.; Thomas Pilmoor, C.Tech)
Owner:	National Music Centre
Architects:	Allied Works Architecture & Kasian Architecture
Electrical:	SMP Electrical Engineers
Wind:	RWDI
Project Manager:	Duke Evans
Construction Manager:	CANA Construction
Other key players:	Walters Group (steel fabricator/ structural design assist), PICCO Engineering (light gauge framing engineer)

AMBASSADOR AWARD &
AWARD OF EXCELLENCE

The World Trade Center Transportation Hub (Oculus)

Main: The unique design of the Oculus required innovative engineering solutions.
Inset: The rafters were erected, from shortest to longest, starting on opposite sides of the structure.

COWI North America (formerly Buckland & Taylor)

"This project showcased extremely innovative Canadian engineering, from the finite element analysis, to the erection tolerance, to the use of bridge building techniques to create what they described as a sculpture."
–Jury

The World Trade Center Transportation Hub (Oculus) in New York City is striking in its architecture, and it was extremely complicated to build. The project pushed the boundaries of structural engineering and required innovative construction solutions.

Skanska (the contractor) approached COWI North America (formerly Buckland and Taylor) and collectively they concluded that applying bridge engineering concepts and first principles was the ideal approach to erecting Oculus.

Erection Engineering

As erection engineers, COWI NA worked closely with the contractor, owner and design team to introduce innovative applications to improve the erection schedule, including:

Segmental Construction: A free cantilever segmental erection scheme allowed the contractor to reduce the amount of falsework, and provided for geometry adjustments as needed. Starting at both ends (abutments) of the building, long steel columns were lifted into place by crane; arch segments were then installed and attached on top—one in front of the other—until the arches finally met at its peak in the centre. After installation of each arch segment, COWI NA and Skanska surveyed and assessed the as-built geometry. This procedure ultimately saved both time and money, and reduced risks associated with the intricate design and glazing tolerances required.

Computer Analysis Model: The finite element (FE) analysis model created for the project was essential to the segmental erection scheme. To allow the glazing to fit properly, the final position of the steel in the arch and

the columns had to be within ± ½-inch of the theoretical design location, including both fabrication and erection tolerances.

COWI NA used the FE analysis model to determine the cambered shape of each individual steel segment, and to compute the stresses in the structure and the position of the geometry control points during each stage of the erection. From the FE analysis model, COWI NA prepared a geometry control spreadsheet that provided target coordinates to the surveyors as each steel segment was maneuvered into place. The FE analysis model helped define the erection sequence, maintain tolerances, achieve schedule, and reduce costs.

Tight workspace

Located at the heart of the World Trade Center, the construction site for Oculus was very constrained. COWI NA looked at solutions on how to reduce the number of steel components stored onsite. An erection schedule was developed for faster installation of the long steel columns and improved installation from two to four free-standing columns without the connecting arch segments. These innovations reduced the storage requirements, optimized the erection sequence, and accelerated the schedule.

The extensive use of glass and the tight tolerances of the steel structure enhanced the complexity. The project team identified that significant risks were associated with field welding (cost, time, and weld shrinkage distortions). COWI NA helped mitigate these risks by replacing welded splices in the arches with bolted connections. This solution drastically reduced the erection schedule , made it easier for the contractor, and helped achieve the desired geometry.

This challenging and complex structure required innovation, and the Oculus is an example of the successful application of a traditional bridge erection engineering technique in building construction. **CCE**

World Trade Center Transportation Hub (Oculus), New York

Award winning firm:	COWI North America (Darryl Matson, P.Eng.; Nedim Alca, P.Eng.; Tobias Petschke, P.Eng.; Joe Viola, P.E.; Genaro Velez P.E.; Alex Yee, P.E.; Tom Surtees, P.Eng.; Charles King, P.Eng.)
Owner:	Port Authority of New York and New Jersey (PANYNJ)
Client/contractor:	Skanska USA
Other key player:	RWDI (wind load assessment)

PROVIDING INNOVATIVE SOLUTIONS TO COMPLEX ENGINEERING CHALLENGES

COWI is honoured by ACEC-Canada's selection of The World Trade Center Transportation Hub (Oculus) and Abraham Lincoln Bridge as two of 2017's award winning projects. As thought leaders in our field we continue to use our expertise and passion to design innovative and sustainable solutions that connect communities around the world.


Abraham Lincoln Bridge


The World Trade Center Transportation Hub (Oculus)

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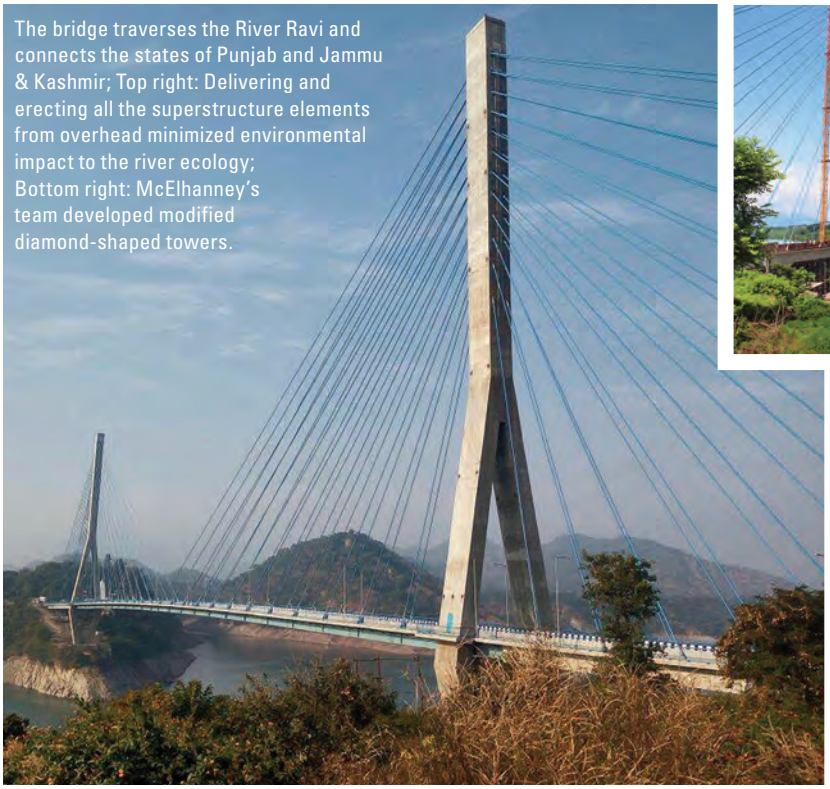
The Atal Setu (Basohli Bridge)



The bridge traverses the River Ravi and connects the states of Punjab and Jammu & Kashmir; Top right: Delivering and erecting all the superstructure elements from overhead minimized environmental impact to the river ecology; Bottom right: McElhanney's team developed modified diamond-shaped towers.

McElhanney Consulting Services Ltd.

"The project was a great example of the transfer of knowledge to the local community, and the positive socio-economic impact on the region, thanks to the reduction of travel time from Jammu & Kashmir to Punjab by over four hours was impressive."
–Jury

The Atal Setu Bridge project is the first cable-stayed bridge procured under a design-build contract in India by the Border Roads Organization of the Ministry of Defence. The bridge traverses the River Ravi and connects the states of Punjab and Jammu & Kashmir, creating a critical link for the communities on either side of the river and emergency response access to the Kashmir Valley.

McElhanney was responsible for the detailed design, construction engineering, and site support. Developing a cost-effective design suited to the difficult site conditions that could be built smartly were the main goals.

As the bridge is in a high seismic zone with strong winds of 140 km/h, McElhanney's team developed design features to minimize construction materials, improve constructability, enhance aerodynamic stability, and reduce seismic response.

For high seismic regions, diamond-shaped towers are favorable but difficult to build due to the inclined legs. McElhanney's team developed modified diamond-shaped towers, which meant bringing the tower legs above deck together to a common point just above the traffic clearance envelope to merge into a single vertical cantilever leg. This vertical leg is simpler and faster to build than two inclined legs and it permitted superstructure cantilevering concurrently with tower construction.

By connecting the cables to the central vertical leg, a rigid cables-deck triangle resulted that provided aerodynamic stability against twisting effects. With the tower and cable configuration aiding in the wind stability, the main span could then be engineered as a lightweight edge girder system, easier to fabricate and erect than stiffer box shapes typically used on such bridges.

Most modern cable-stayed bridges

have superstructures made entirely of either composite steel or concrete. Taking advantage of the shallow natural terrain on either side of the river, the team could use a combination of cast-in-place concrete for the side spans and lightweight composite steel in the main span, which provided erection advantages and assisted in eliminating uplift at the abutments.

Three sets of intermediate pier props in the side spans helped stiffen the system and reduce demands from wind and live load by over 50%.

Overcoming challenges

The site has steep rocky banks with large river water level fluctuations that made the transport of materials and erection from the water very difficult. A customized gantry was developed to lift the superstructure steel segments from overhead and hoist them into position from the previously constructed superstructure in a progressive cantilever manner. The material was transported along the side spans, which were completed on falsework prior to the main span cantilevering operations.

Aside from technical challenges, the team faced an aggressive six-month design schedule.

Other factors that increased complexity included a foreign contractor with no previous experience in cable-stayed construction that needed exceptional support, a 12-hour time difference between India and Canada and significant cultural differences.

To mitigate the potential coordination problems, upon award of the project, McElhanney established a project office in Gurgaon, India, staffed with personnel from Canada. The office facilitated better communication among team members, aided in understanding and interpreting the IRC code, and added further support for the client's proof-checking process performed by IIT Delhi.

Positive contribution

The bridge has reduced travel time from Basohli in Jammu & Kashmir to Dunera in Punjab by over four hours and has led to expanded opportunities for previously isolated communities.

Reports already indicate an economic boost from increased tourism activity to the scenic region and the commercial mining of gypsum and limestone.

Attention was paid to the durability of permanent components to ensure longevity of the bridge. Concrete components were detailed to limit cracks and distribute them over wider areas. The team designed the steel components to provide easy access for inspections and maintenance. The team also developed a maintenance manual documenting inspections and upkeep procedures.

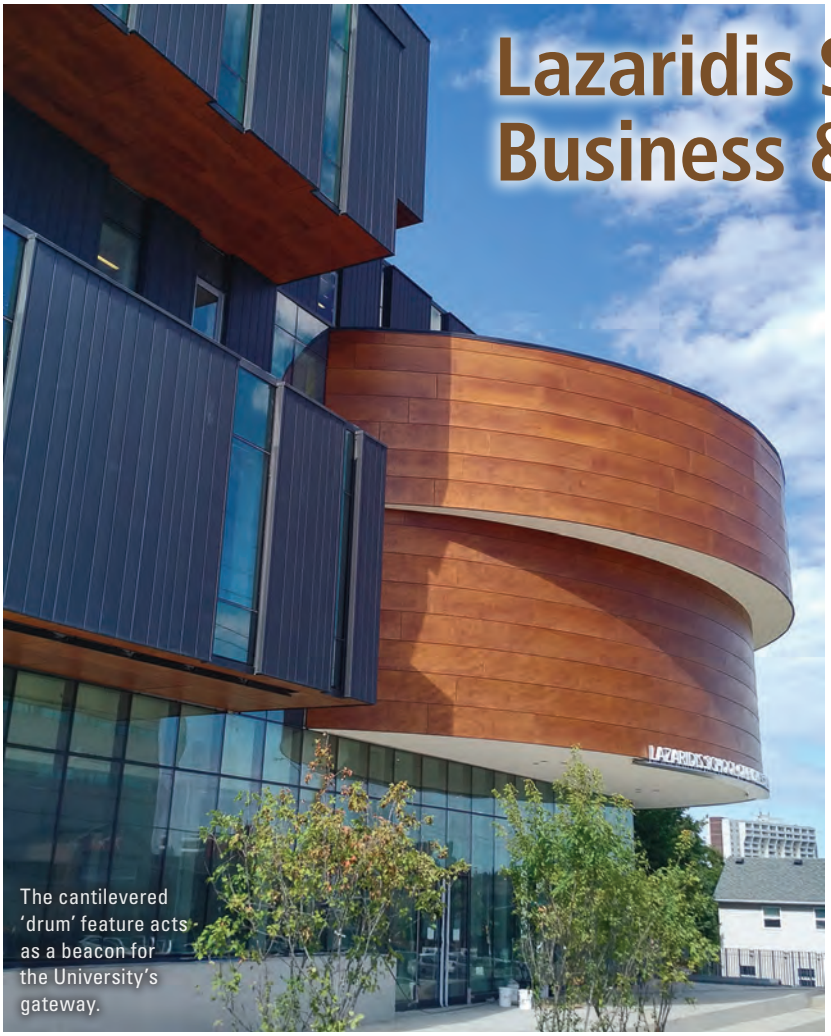
McElhanney's team will be involved in the annual inspections program to detect potential problems and take appropriate mitigating measures, ensuring structural longevity. **CCE**

Atal Setu (Basohli Bridge), Jammu & Kashmir, India

Award winning firm (prime consultant):	McElhanney Consulting Services Ltd. (Raj Singh, P.Eng.; Chad Amiel, P.Eng.; Morgan Trowland, P.Eng.; David Jeakle, P.Eng.)
Owner:	Border Roads Organization of the Indian Ministry of Defence
Client:	IRCON/SP Singla Constructions Pvt. Ltd.
Other key players:	ASC Infratech (detailed design of towers, abutments and foundations); VSL India (detailed design of stay cable anchorages)

AWARD OF EXCELLENCE

Lazaridis School of Business & Economics



The cantilevered 'drum' feature acts as a beacon for the University's gateway.

VanBoxmeer & Stranges Engineering

"We're impressed with this ambitious structural design. The methods used to create the cantilevered girder trusses, which provides the roof of the drum-shaped lecture hall a floating quality, is impressive."
–Jury

Lazaridis Hall in Waterloo, Ontario is designed to meet increasing enrolment demands, provide excellent space for learning, and enhance Wilfrid Laurier University's (WLU) competitive edge. The stand-alone facility serves as a landmark building and gateway for the expansion of the campus.

The building's large atrium creates the central hub that interconnects the 220,000 sq. ft., four-storey, academic facility. Common student areas are distributed around and within the atrium through all floors. A large 42 x 21m freeform structural glass and steel skylight creates a light-infused space for the central gathering area. The skylight may be the largest single layer trussless skylight in Ontario.

Other major elements include a multipurpose 1,000-seat auditorium, a 350-seat lecture theatre housed in a drum-shaped feature, along with 150- and 75-seat horseshoe-shaped interactive classrooms. Over 240 offices and administrative suites are interspersed on floors two through four, and alongside common student areas are private study areas for graduate, masters and PHD students on the upper floors.

It's a hybrid concrete and steel building with steel reserved for complex structure, long spans and cantilevers. For instance, the lecture theatre is supported within the café on remarkably few HSS Steel columns, a custom design collaboration between architect and structural engineer.

Other columns are carefully embedded within walls keeping the spatial experience clear and uncluttered. The cantilevered 'drum' feature acts as a beacon for the University's gateway. A series of cantilevered trusses and wide flange beams were used in the roof and floor to support the front end of this complex structure on two columns located behind the curtainwall. This gives the drum the appearance of floating above the main foyer and cafeteria.

The drum's entire roof and sloped seating area is supported by a series of cantilevered welded wide flange roof beams and cantilevered WWF floor beams. The café fits into the interstitial space below and looks out over University Avenue with terracing steps creating seating areas that link to the sidewalk.

The primary entry from University Avenue to the west is sheltered by an enormous cantilever on the southwest corner at the third and fourth floors. Spanning the length of the 1,000-seat

AWARD OF EXCELLENCE

auditorium, the cantilever is achieved with three large span girder trusses, some two stories deep and cantilevering nearly 24 m.

An additional challenge was the large spans required over the three 150-seat classrooms located at the main floor, north of the atrium. A hybrid design of cast-in-place concrete on a structural steel girder support structure was designed. A series of the second floor steel transfer girders and beams were erected with a conventional two-way span cast-in-place concrete structure bearing on the steel girders. This construction approach was used to take advantage of the higher floor-to-floor heights allowing the use of main floor steel transfer girders.

In order to navigate the complex relationship between the hybrid steel and concrete structure, Revit modeling was used as a key tool throughout all phases of design and construction. BIM allowed the project team to refine the design and also allowed all disciplines to interact through design in a way that ensured that the various needs of the project team and any discrepancies were addressed.

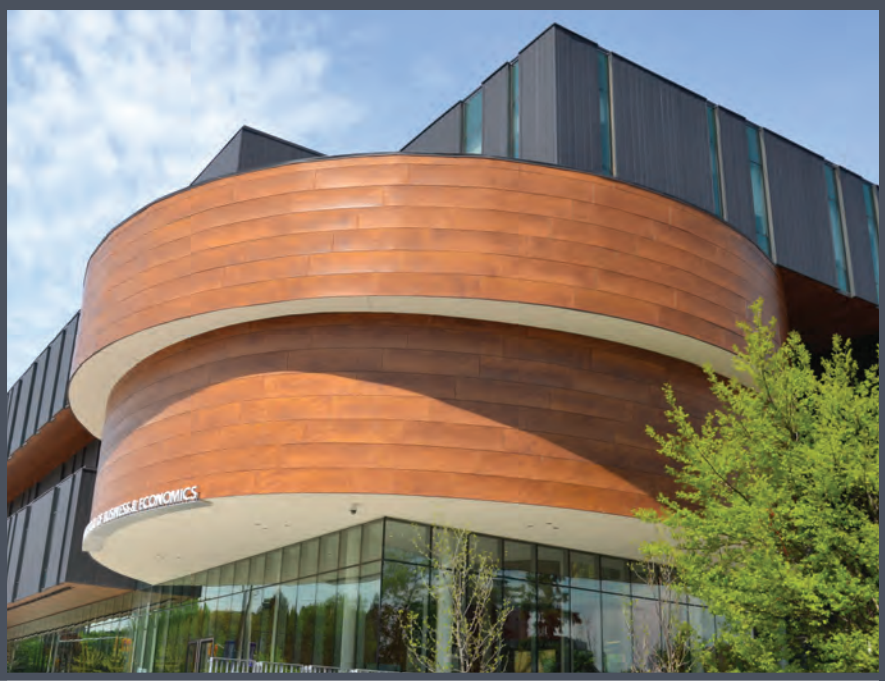
The building was challenged with an overall height limitation; a minor variance would have delayed the crucial opening date. A cast-in-place concrete structure was used to minimize the floor thickness. This innovative technique took advantage of the strength of steel to support the upper concrete structure, and was the perfect solution for achieving span and building height requirements.

Lazaridis Hall strives to signal change: it shifts focus from an internalized campus approach to engage with the community, it establishes an appropriate scale for future development of the WLU campus and it urbanizes and animates University Avenue and its surroundings. **CCE**

Lazaridis School of Business & Economics

Award winning firm (structural):	VanBoxmeer & Stranges Engineering (Rick Stranges, P.Eng., Gary VanBoxmeer, P.Eng., Lijun Guo, P.Eng., Brad Stott, P.Eng.)
Owner:	Wilfrid Laurier University
Architect:	Diamond Schmitt Architects
Other key players:	Smith + Andersen (mechanical and electrical), Enermodal (LEED), Bondfield Construction (general contractor)

VanBoxmeer & Stranges Engineering Ltd is pleased to be recognized for a Canadian Consulting Engineering award of excellence for the Lazaridis School of Business and Economics project.



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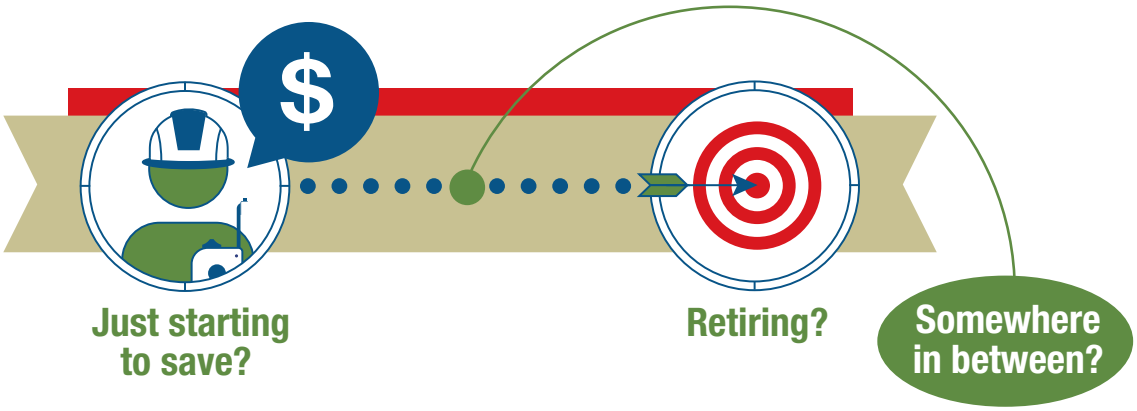

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Abraham Lincoln Bridge

Abraham Lincoln Bridge crossing the Ohio River. Inset: The concrete components designed for 100 years.

COWI North America

"The bridge's innovative foundation, constructed under unique geotechnical conditions, compelling the design team to continuously find and adopt solutions to address these technical challenges was very impressive."
–Jury

The Abraham Lincoln Bridge crosses the Ohio River and connects downtown Louisville, Kentucky with Jefferson, Indiana. The purpose of this project was to improve connectivity between the two states and alleviate traffic on the existing JFK Bridge.

The project owner's vision of the bridge type and arrangement included:

- 3 towers and 4 cable stay spans
- Bridge spans and tower height above deck symmetric about center tower
- Center tower taller than two side towers
- Towers unbraced (no crossbeams) above deck level
- Five-sided tower leg section (similar to baseball home plate)
- 100-year service life

Jacobs Engineering Group (prime consultant) hired COWI North America (formerly Buckland & Taylor) as engineer of record for the cable-stayed bridge, including the foundations. Additionally, COWI provided Walsh Construction (design-build contractor) with detailed erection engineering and temporary works designs.

Designed under unique geotechnical conditions, the bridge uses an innovative foundation system with an inherently flexible three tower cable-stayed system. The three-tower cable stayed main bridge is 640m (2,100 ft) long. The two middle spans are 228m (750 ft) and the two side spans are 92m (303 ft).

The center tower extends 59m (195 ft) and the side towers extend 44m (145 ft) above the deck. All three towers have twin reinforced concrete vertical legs in a pentagon shape with no cross beams above the foundation.

Two planes of stay cables fan out from the tower tops and are anchored to the exterior of the steel superstructure.

The substructure consists of three towers founded on drilled shafts placed in the river, and two anchor piers with drilled shafts, one at each end of the bridge.

Challenging subsurface conditions at the site included highly-vari-

AWARD OF EXCELLENCE

able depths to bedrock along the bridge alignment. This resulted in a stiffness contrast for the structure that required careful consideration of foundation axial capacity and lateral stiffness in order for the bridge to remain technically and economically feasible.

Drilled shafts support the three main towers and the two anchor piers. Each tower foundation is supported by a single row of four 3.7m (12 ft) diameter drilled shafts socketed into limestone. The selected foundation system reduced the foundation installation time and accelerated the overall bridge construction schedule, which was a vital component for this design-build project.

This is the first major cable-supported bridge where a single line of large diameter drilled shafts was used for each tower foundation. The combination of three-tower arrangement and single line of drilled shafts for each tower foundation created a very flexible system.

Using a single row of drilled shafts for each tower foundation resulted in high geotechnical and structural demands on the drilled shaft foundations, both under critical unbalanced erection loads during the erection of superstructure and under governing live and wind loads. Variable limestone depths on both the Kentucky and Indiana sides created the severe foundation stiffness contrasts that affected the load transfer from the superstructure to the substructure and the location of the bearing fixity.

Throughout the project, the design team continuously pushed the boundaries to address these technical challenges.

In order to verify the ambitious foundation concept, a record setting Osterberg-Cell load test with an applied load of 323 MN (36,333 tons) to the test shaft was conducted and Statnamic lateral load testing was performed to verify the lateral stiffness of the drilled shaft socketed in limestone.

The Abraham Lincoln Bridge has been designed to have significant redundancy and robustness, and the bridge is capable of withstanding a significant blast from terrorist threat and significant ship collision. The bridge has been designed for a 100-year service life, and COWI engineers applied a rational durability design approach to make every aspect of the project durable. It's one of the first major bridges in North America where a rational durability study was explicitly performed and incorporated into the design process.

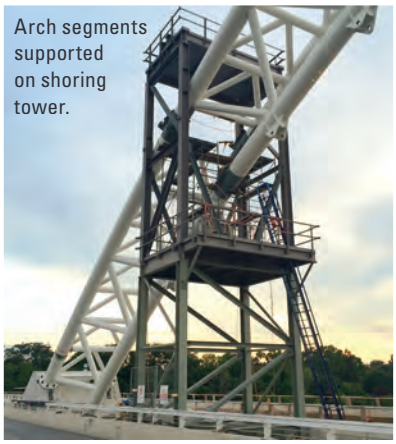
The Abraham Lincoln Bridge opened to traffic in December 2015, four months ahead of schedule, and the project reached final completion in December 2016. **CCE**

Abraham Lincoln Bridge, Louiseville, Kentucky

Award winning firm (engineer of record for cable-stayed bridge):	COWI North America (John Brestin, PE; Steve Zhu, PE; Brian Morge nstern, PE; Dan Yang, PE; Matt Baughman, PE; Mark Stuenenberg, P.Eng.; Claudio Osses, PE; Dusan Radojevic, PE; Frank Fan, PE; George Klonaris, PE)
Owner:	Kentucky Transportation Cabinet
Client:	Jacobs Engineering Group (prime engineer, geotechnical)
Contractor:	Walsh Construction
Other key players:	Stantec (geotechnical consultant to Jacobs), RWDI (wind studies), IBT (bridge design review), Michael Baker Consultants (owner's engineer)

AWARD OF EXCELLENCE

Burgoyne Bridge Replacement



Arch segments supported on shoring tower.

Harbourside Engineering / Parsons

The Burgoyne Bridge replacement project consisted of replacing a 100-year-old high level truss bridge at the end of its useful life with a signature landmark arch bridge in order to enhance the environment and maintain a key link in the transportation system in the City of St. Catharines.

Parsons' arch bridge solution delivered the environmental enhancement required from the appearance of the bridge and improved functional and public safety characteristics. The bridge erection and temporary supports were designed by Harbourside Engineering Consultants who used innovative and unique construction techniques to allow this complex bridge project to be successfully executed.

The new structure incorporates twin 333m-long steel box girder bridges with a single central structural steel arch supporting a main span of 125m.

The innovative arch design—incorporating post-tensioning stay systems in all three axes (the horizontal tie, the vertical hangers, and a hidden post-tensioned system between the two box girder structures located within each of the transverse floor beams) was developed to facilitate the staging of the project.

"The bridge's design and staging process was remarkable. The modeling and testing that was conducted, which is reflected in the final design, was also noteworthy."
–Jury

The erection included an incremental launching procedure. Box girder segments were analyzed by the erection engineer for all construction loads and a frame system was designed which allowed segments to be assembled and simultaneously launched across permanent and temporary piers. This approach allowed the contractor to quickly erect the girder without the need for large cranes.

Temporary support towers were designed to allow the precise three-dimensional alignment and support of the girders and arch segments during erection. These temporary towers facilitated the girder launch, support of the decks prior to arch erection, erection of the arch segments, field welding of the arch chords, and load transfer to the arch system after the hangers were installed.

A comprehensive erection phasing included a full analytical model of the designed bridge, incorporating field conditions and design changes found during erection. The load transfer procedure was a complex operation which consisted of simultaneously post tensioning the horizontal ties and lowering the temporary supports until the vertical hangers were fully engaged and the bridge deck was supported by the arch. Target hanger loads and bridge profile were achieved during this process without any additional adjustments.

Sophisticated structural analysis methods were utilized to model the structure and understand the soil-structure interaction between the arch, piers and foundations due to the integral connection of the arch and its tie with the piers as well as non-linear characteristics of the proposed construction staging.

Wind tunnel tests were also conducted to gain a comprehensive understanding of the wind effects

AWARD OF EXCELLENCE

under the bridge's complex geometry and the irregular surrounding terrain.

As a result of the staging and the twin structures being complete and in service prior to the arch completion, it was necessary to determine a suitable means by which to transfer load from the temporary supports to the arch structure. The bridge is an interdependent system, as the girders rely on the arch for support, and the arch relies on the weight of the deck to provide lateral stability. As such, the entire system had to be erected independently and then engaged simultaneously in a comprehensive, precisely determined, load transfer procedure.

A series of interacting construction stages was planned to install the arch horizontal ties and the stay cables and to introduce the associated prestressing forces while lowering the temporary supports of the girders. These stages were performed in a specific sequence and magnitude until the structure was fully self-supporting and the temporary supports could be removed.

Due to the project's close proximity to downtown St. Catharines and urban surroundings, it was a project requirement that noise and vibration be minimized. Using the incremental launch procedure for the bridge girders, crane work adjacent to the waterway was significantly reduced. Erection of the arch segments was performed by crane from the deck of the existing structure, and much of the temporary support works relied on the permanent structure itself for support.

All these measures aided in reducing the impact on the surrounding environment. The bridge replacement met the owners' objective to maintain the existing alignment of the crossing through the construction staging which was predicated on superimposing the new structure on the footprint of the existing bridge. CCE

Burgoyne Bridge Replacement, St. Catharines, Ontario

Award winning firms: Parsons (design) (Vic Anderson, P.Eng.; Brent Archibald, P.Eng.; Sameh Salib, P.Eng.; William Moore, P.Eng.; Nelson Guiot, P.Eng.) Harbourside Engineering (construction, erection & demolition) (Greg MacDonald, P.Eng.; Robbie Fraser, P.Eng.; Kyle Boudreau, P.Eng.; Nicholas MacEachern, P.Eng.; Chris Mantha, P.Eng.)

Owner: Niagara Region

Contractor: Pomerleau

Other key players: Golder Associates (geotechnical), Walters (steel erector), VSL International (cable suppliers), Groupe HBT (bridge demolition)

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Halifax Shipyard Modernization Project

The shipyard modernization project was a complete redevelopment of Irving Shipbuilding Inc.'s facility in Halifax. Inset: The Assembly Hall is a 265m-long structural steel production hall.

Hatch

"The project's aggressive 36-month schedule and multi-disciplinary engineering approach was remarkable. And the project complexity caused by the presence of hazardous materials, contaminated soil and unexploded ordnance on the site added to the challenges."
–Jury

Partnering with Hatch as their lead design engineer and construction consultant, Irving Shipbuilding Inc. (ISI) invested more than $350 million to build North America's most modern shipyard, located centrally on the Halifax harbour front.

The new massive assembly building with an integrated blast/paint shop, final assembly and launch pier will continue to provide economic benefit to Nova Scotia for decades to come, as workers construct the next fleet of Canada's navy vessels.

Innovations in design

Hatch was able to efficiently combine commercial and industrial design elements into a single building to maximize usage of the site.

The Assembly and Ultra Halls house 15 overhead cranes (up to 200t capacity), 4 semi-gantry cranes; and 10 jib cranes. By industry standards, the overhead cranes are very long spans. The number of cranes in simultaneous operation required careful attention to detail to avoid conflicts with other cranes, installed equipment, and the structure itself.

Existing soils had low bearing capacities incapable of supporting extremely large loading from the superstructure and shipbuilding activities. An innovative approach to ground improvement was taken in the form of dynamic compaction—the transmission of high energy impacts to loose and soft granular soils in order to significantly improve the soil's characteristics at depth.

Compressed schedule

One of the primary complexities was the aggressive schedule, set by contractual mandates with the Federal Government, which required the project to move from preliminary design to the commencement of shipbuilding in 36 months.

Another major challenge was maintaining operations during construction. The previous fabrication facilities were removed in stages to allow for successful completion of a final coastguard vessel.

The demanding schedule required a vast multi-disciplinary design team to be established, compiled from multiple offices across the country. Using the latest communications technology, Hatch completed the design seamlessly on time without sacrificing quality.

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Benefits of BIM

The facility was collaboratively designed, reviewed, analyzed and shared with contractors, engineers, subconsultants and the client using BIM technology.

Combining designs for structural steel, concrete, marine, HVAC, piping, electrical, plumbing, architectural, water, sewer, industrial gasses, and overhead cranes into a single design and construction phasing plan presented real challenges. These challenges were exacerbated by the physical constraints imposed by the site. The employment of BIM was critical in preventing service clashes.

Environmental efficiency

The lighting, air exchange, fuel and building management systems in the new Assembly and Ultra Halls were switched to natural gas (cleaner burning fuel with a lower carbon footprint) and were designed to be more energy efficient than the existing facility.

A comprehensive Fume Exhaust System was installed to purify the air in the facility through the installation of push/pull air exchange units throughout the building. By purifying the existing air, it limits the need to introduce outside air, saving energy and heating costs.

The facility features 100% LED lighting. The lighting control system is automated to turn lights on and off depending on the time of day.

When installing these upgraded systems, Hatch introduced a complex Building Management System that allows Irving Shipbuilding to centralize, monitor and regulate the building temperature and lighting while also allowing them to monitor all of the operational equipment in use.

The project was completed within scope and budget and the team was able to accommodate late design changes during construction. **CCE**

Irving Shipbuilding, Halifax

Award winning firm (prime):	Hatch (Chris Tatterall, P.Eng.; Lorne Flowers, P.Eng.; David Johnson, P.Eng.; Brendan Connors, P.Eng.; Serge Doucet, P.Eng.; Bob MacCrimmon, P.Eng.; Jason Molenaar, CET; Amita Marjara) J.D. Irving (Doug Dean, P.Eng.; Rob Stewart, P.Eng.)
Owner:	Irving Shipbuilding Inc.
Other key players:	RJ Bartlet Engineering (fire code); Conquest Engineering (geotechnical)

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Mayerthorpe Rail Bridge Replacement

Top: More than 190,000 metric tonnes of material was used to build the new bridge, constructed of steel, concrete and fill. The completed structure stands about 14m tall and 335m long. Inset: The final instrumentation is being installed, new piers were welded together and backfill of the bridge approaches is completed.

Klohn Crippen Berger

"We were very impressed with the team's agility and ability to make design adjustments that adapted to very difficult ground conditions with limited time and data available."
–Jury

Klohn Crippen Berger (KCB) was retained by CN to complete a site investigation, design and supervise construction for a rail bridge replacement near Mayerthorpe, Alberta. The original 335m-long timber bridge was destroyed by fire on April 26, 2016. The goal was to restore service within three weeks.

KCB worked in collaboration with CN and other contractors to facilitate the fast-tracked construction. Contractors were mobilized the day of the fire. A drone was used to capture photogrammetry and generate ground surface topography to provide a basis for design.

Given the compressed timeline for the design and construction, it was key to observe the performance of the foundation in response to construction and modify the design as the construction progressed.

An observational design approach was implemented through installation and monitoring of both construction induced pore pressures through vibrating wire piezometers and foundation movements through inclinometers.

Monitoring was implemented round-the-clock to help manage the risk of slope instability during and after construction, and to add confidence in the design assumptions and design criteria. Along the toe of the western approach fill, a shear key and a toe berm was constructed due to ground conditions.

The stability assessment conducted was based on assumed pore pressure response in foundation soils and it was key to monitor those pressures to be in line with design assumptions. The vibrating wire piezometers were installed in the surficial clays and deeper till layer along key stability sections, and were read three times per day to record changes in pore pressure in response to increased fill. Slope inclinometers were installed to monitor for movements in the approach fills.

Inclinometers were read twice daily during construction and periodically after construction to confirm that observed movements during construction had slowed. Movements were also monitored with survey pins installed on the toe berm.

To initiate the early start of the embankment fills prior to the results of test drilling, a general slope configuration utilizing 2H:1V slopes was adopted. A granular shear key was designed under the north slope toe of the east embankment and a 5m berm was constructed to half the embankment height to mitigate against inferred weak soils.

Construction continued 24 hours a day and the engineering had to be

AWARD OF EXCELLENCE

completed at a similar pace. KCB and Journeaux Associates worked simultaneously to complete the pile design for the new bridge and stability analysis of the embankments.

The headslope of the approach fills had to maintain a minimum setback from the river due to environmental constraints. Shear keys were the only stabilization measures implemented as they would stay within the footprint of the approach slope.

The headslopes were founded on deep deposits of alluvial materials. Under the centre of the headslope there are rows of piles that were constructed to support the original bridge and new piles installed for the replacement span. These piles provide additional shear resistance through the centre of the headslope.

CN elected to use a steel bridge span salvaged from a bridge abandonment project in BC reducing the requirement for new raw materials for the project.

The final fill placement in the approach was completed May 11 and the first train crossed the bridge on May 15, only 20 days after the original bridge was destroyed by fire.

The continuous monitoring of construction, design revisions in response to field observations, and close coordination between all the contractors, CN and the various other team members led to a safe and timely completion of the project and resumption of rail service.

Follow up monitoring of the instrumentation has shown that pore pressures are dissipating and movements have stopped. **CCE**

Mayerthorpe Rail Bridge Replacement, Mayerthorpe, Alberta

Award-winning firm (prime consultant):	Klohn Crippen Berger (Tim Keegan, P.Eng.; Pamela Fines, P.Eng.; Chris Grapel, P.Eng.; Kurt Tomblin, P.Eng.; Kayla Chmilar, EIT; Raj Mahant)
Owner:	Canadian National Railway
Other key players:	AECOM (structural bridge design), Barsi Enterprises (earthworks contractor), Challenger Geomatics (photogrammetry and survey), ConeTec (geotechnical investigation), Formula Contractors (pile installation, bridge erection), Journeaux and Associates (review of geotechnical and pile design), Mobile Augers and Research (geotechnical investigation, instrumentation installation), Universal Civil Management (earthworks contractor)

AWARD OF EXCELLENCE

Sir Ambrose Shea Lift Bridge Replacement

Photo: Floyd Edison

An overview of the bridge showing the innovative tower design and the transparent machine rooms.

Parsons

"The project involved complex installation, addressed the client's needs for durability, reliability, and improved the architecture design. It is designed to withstand a harsh and corrosive environment and will reduce maintenance costs and impacts to the environment. –Jury

The Newfoundland and Labrador Department of Transportation and Works retained Parsons to replace a 50-year-old movable bridge that connects two adjacent communities in the town of Placentia.

The project's objective was to create a bridge that satisfied the functional requirements of the existing bridge, including accommodating both vehicular and boat traffic, and minimizing navigation restrictions, which can negatively affect local commercial fishing activities.

Complexity arose from the requirements to design an aesthetically pleasing structure while also providing reliable access to a safe harbour and a robust structure in a relatively harsh environment.

Smart design

The replacement bridge is a three-span structure with a center movable span (vertical lift span) flanked by two simple fixed girder spans. Towers consist of a 3-D truss shape representative of boat masts. Each tower component is connected by a 3-D exoskeleton truss which shelters the lift span machinery.

The bridge was designed and constructed with these key innovative design features:

Durability: Because of the harsh environmental conditions, special care was taken to select robust members, details, and systems that would also enhance the structure. Details included: sealed tubular structural sections; enclosures for mechanical machinery and components; positioning of mechanical and electrical components in machine rooms 25m above the water level, minimizing salt spray exposure; the use of galvanized rebar within the concrete elements; and elimination of expansion joints at the approach spans' abutments.

Reliability: Simple and conventional mechanical and electrical operating systems bring a high degree of reliability while minimizing maintenance. Standby generators ensure continued service. Control system technology utilizing a Programmable Logic Controller for system control and monitoring included the capability for remote monitoring and diagnostics. This proved useful during bridge commissioning.

Architecture: As a highly visible structure in the community, the new bridge design enhances the crossing while providing practical, functional, and durable structural elements. It integrated the mechanical, electrical and HVAC systems into the structure with minimal visual impact while minimizing maintenance requirements and improving overall system efficiency.

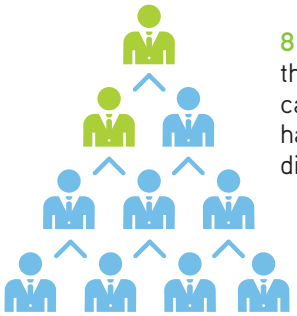
what's ailing the self-employed?

How health and disability insurance can help

The Self-Employment Challenge

Being your own boss has its perks. But without an employer's group benefits, self-employment also means fending for yourself in case of illness or disability.

Over two-thirds of surveyed self-employed individuals are concerned about their lack of access to medical coverage and insurance.[1]



8 in 10 Canadians are concerned about the government's ability to fund health care, the cost of longterm care, and having enough money if they become disabled or seriously ill.[2]

The Role of Insurance

Supplementary health and disability income insurance plans help protect against financial loss due to illnesses or accidents.

Why health insurance?

Canadian families are spending an **increasing share of their household income** on health care.[3]

Households in the 3 top income quintiles had an average:[4]

- **39% increase** in dental spending
- **24% increase** in prescription drug spending

Why disability insurance?

- **1 in 3** people will be disabled for 90 days or more at least once before they reach age 65.[5]
- **49%** of bankruptcies and mortgage foreclosures are due to disability.[6]
- **A disability of over 90 days** is likely to last three years or more for a 35-year-old man or woman, and four years or more for a 45-year-old man or woman.[7]

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Challenging environment

Key challenges of the project included the high winds, changing tides and fast current. Although this was accounted for in the design to ensure structural stability during all stages of construction, it added complexity and limited crane operations.

Because of silty and poorly graded sand and no bedrock, the pier foundation design relied on friction piles or shallow foundations where limited bearing capacity was located. Parsons managed to design two foundation options allowing contractors to bid on an option based on their experience level, available equipment and cost.

Unique towers

Design of the tower's steel tubular connections is absent in traditional literature or codes, and required extensive finite element models to confirm connection capacities.

Tower members were designed of sealed and welded tubular pipe members. Connection design allowed the contractor to fabricate towers into manageable segments for transportation and handling without requiring field welding.

The lift span design had optional splices, allowing the contractor to assemble the 100-ton lift span on a barge from shore and lift it into position using jacks.

Long-term future

The bridge design incorporated long term durability and sustainability features to achieve an extended bridge service life while minimizing future maintenance costs and associated impacts to the environment.

The bridge opened to traffic on September 23, 2016, and the community welcomed the opening of the new bridge with great enthusiasm. **CCE**

Sir Ambrose Shea Lift Bridge Replacement, Placentia, Nfld. & Labrador

Award-winning firm (prime consultant):	Parsons (Joanne McCall, P.Eng.; Jack Ajrab, P.Eng.; Lying Zho, P.Eng.; Ryan O'Connell, P.Eng.; Ken Smith, CET; Richard Dynka, CET)
Owner:	Newfoundland and Labrador—Dept. of Transportation and Works
Architect:	Barry Padolsky Associates
Other key players:	Stafford Bandlow Engineering (electrical/mechanical), Golder Associates (geotechnical), GPY + Associates Engineering (HVAC), H.J. O'Connell (BIRD) and Vancouver Pile Driving (contractors)

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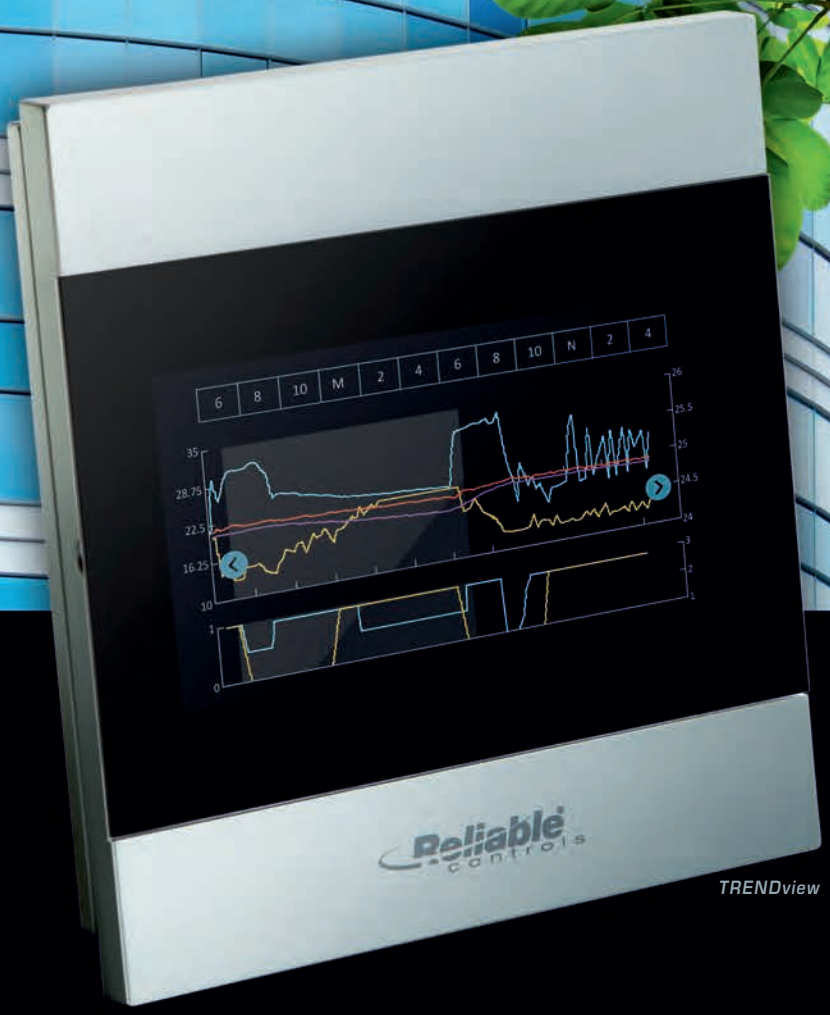

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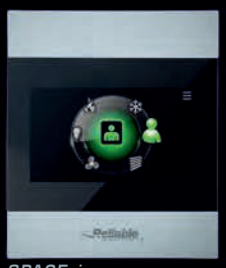

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Evergreen Line Rapid Transit Project

Top: The launching truss used to build the elevated guideway; Inset: The completed bored tunnel.

SNC Lavalin

"The line's ability to handle a large volume of commuter traffic with little disruption to the environment and the resultant reduction in pollution from vehicle usage is very admirable."
–Jury

SNC-Lavalin was responsible for the design, construction, and partial financing of the 11km Evergreen Line Rapid Transit (ELRT) project. The firm used a variety of innovative techniques to build 5km of elevated guideway, 4km of at-grade guideway and a 2km bored tunnel to deliver a complex transit infrastructure project in an urban area.

The advanced light rail transit connects with and extends Vancouver's existing SkyTrain system from Burnaby through Port Moody to Coquitlam, making it the longest driverless system in the world.

The project included some challenging design and construction issues including accommodating higher seismic requirements in areas of poor soil conditions, difficult tunnel boring conditions, 4km of construction adjacent to a Canadian Pacific Railway (CPR) mainline, integrating new train control systems into the existing operation and significant traffic management issues. Key innovations included:

• Hydraulic jacking of a 5,200 tonne precast concrete station box under a local highway. Traffic disruption was minimized and engineering prevailed by constructing the concrete station box beside a major roadway, then jacking it under the road over a single long weekend.

• Tight radius steel structures in combination with pre-cast segmental concrete spans. Special connection details and cross-sections were utilized to design and install tight radius curves on the new elevated guideway before transitioning to concrete segmental guideway.

• Timber piles for ground improvement and seismic stability. SNC-Lavalin, in partnership with Tetra Tech EBA, utilized driven timber piles to provide resistance against seismic induced liquefaction and provide resistance for slope stability adjacent to CPR tracks.

• Cement Deep Soil Mixing (CDSM) for ground improvement. CDSM was used to reduce the seismic lateral spreading displacements. Advanced dynamic analyses (using FLAC) were the basis of demonstrating that both seismic and non-seismic performance of CDSM would be equal to or exceed that of driven piles.

• Large diameter tunnel bore, unique invert fill and centre wall. A 10m diameter tunnel eliminated risk associated with cross-passages excavation, a granular fill option for the invert provided a softer interface with the tunnel lining when subjected to seismic racking loads and a trowelled shotcrete centre fire wall provided schedule gains in construction.

• The use of steel fibres in single pass concrete segmental liner. This was the first time steel fibres have been used on a one-pass, segmentally-lined tunnel in an area of moderate to high seismicity.

Tunneling solution

Throughout tunnel construction, the team encountered challenging ground conditions. It was difficult to

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prevent water and sandy soils from entering the tunnel boring machine (TBM) cutter head during planned maintenance stops. To deal with these issues the team implemented a ground improvement program which involved dewatering and jet-grouting to strengthen the soil in front of the TBM to stabilize the ground and allow the team to safely change the cutterhead tools.

The tunnel boring program took almost 12 months longer to complete than planned, however with re-sequencing and acceleration of the follow-on works, the total delay to the project was mitigated to only three months. This was possible through innovation, close coordination of the various design and construction teams as well as a very good working relationship with the owner and operator.

Local benefits

The vast majority of the design, fabrication, construction and management work was performed by local Vancouver and BC residents.

Since opening in December 2016, the Evergreen Line has influenced the travel patterns of existing transit users while attracting new riders to the transit system. The project has met its primary goal of providing fast, frequent and convenient SkyTrain service, connecting Coquitlam City Centre through Port Moody to Burnaby in approximately 15 minutes. It has already met its initial ridership projections and ridership is increasing steadily with 30,000 trips taken on an average weekday in 2017.

In addition to the transportation benefits, the Evergreen Line project constructed over 13,000 m2 of more productive riparian and aquatic habitat, a 40% increase over the less productive habitat that existed in the project corridor, resulting in an increase of more productive fisheries habitat. CCE

Evergreen Line Rapid Transit

Award-winning firm (design-build contractor): SNC-Lavalin (Dave Weatherby, P.Eng.; Jeff Spruston, P.Eng.; Meiric Preece, P.Eng.; Will Gowen; Brigitte Bilodeau, M.Arch.; Yuming Ding, P.Eng.; Satwant Deepak, P.Eng.)

Owner: BC Ministry of Transportation and Infrastructure

Other key players: WSP Group Canada (structural) Monty Knaus, P.Eng.; McMillen Jacobs Associates (tunnel design) Andrew McGlenn, P.Eng.; Tetra Tech EBA (geotechnical) Ali Azizian, P.Eng., Brian Hall, P.Eng.; IBT Canada (elevated guideway design); Dialog/Francl Architecture/Perkins+Will (station design)

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FORT MCMURRAY WILDFIRE:
Wastewater & Stormwater Recovery

Clockwise from top left: Silt socks and erosion barriers were installed on catch basins in the devastated neighborhoods; Sewage service connection "Cut and Cap" initiative for monitoring and cleaning the siphon headworks vaults; Each catch basin was then photographed and tagged in the GIS system.

Stantec

"The complexity of the risk management and operations required for this project were impressive, especially considering this was conducted under a state of emergency."
–Jury

In response to the 2016 Fort McMurray Wildfire, the Regional Municipality of Wood Buffalo (RMWB) engaged Stantec to assist in the recovery of the storm water drainage and wastewater collection and treatment systems in Fort McMurray.

Stantec worked with the RMWB to triage the situation and develop a plan to include specific actions necessary to mitigate further damage, and complete the recovery and return of the systems to a state of normalcy.

Biomass transplant

Fort McMurray's Wastewater Treatment Plant (WWTP) was inundated with water coming into the sewer system, devastating the plant's biological process. To mitigate the speed of biomass loss, all but one plant bioreactor were taken offline so that the little bit of organic material entering the plant could sustain some of the biomass for longer. Then, as repopulation of Fort McMurray neared, an innovative biomass transplant using Thickened Waste Activated Sludge from the City of Red Deer WWTP — a distance of 700km away — was carried out in two events.

The biologically active material was trucked in and deposited into the Fort McMurray WWTP just upstream of the bioreactor. Five days after the second transplant, there was a noticeable improvement in the plant biology. This ensured a return to normal of the WWTP operations without exceeding the regulated toxicity limits in the plant discharges.

Tracking stormwater

GIS technology was employed as part of the water system flushing program. As the RMWB flushed its water distribution mains, the entry point of the water into the storm sewer system was tracked. The resulting discharge for downstream storm sewer outfalls was also tracked and sampled to confirm if toxic substances had entered the storm sewer or receiving watercourses.

The fire led to ash, debris, and burnt cars littering the streets of the destroyed neighborhoods, which presented a risk of toxic materials entering the drainage system. To mitigate this risk, silt socks and erosion barriers were installed on all the catch basins in and adjacent to the devastated neighborhoods.

Each catch basin was then photo-

AWARD OF EXCELLENCE

graphed and tagged in the GIS system to ensure they were addressed and checked regularly to ensure collected debris was cleared before any flooding could result.

Wisdom gained from Stantec's involvement with the Town of Slave Lake fire in 2011, taught them that it was critical to protect the sewage collection system against the entry of silt, toxins, and debris. This led to the sewage service connection "Cut and Cap" initiative — the program for monitoring and cleaning the siphon headworks vaults — and the sewer main plug initiative, among other infrastructure protection plans.

Cautious cleanup

Personnel had to overcome numerous extraordinary conditions. The biggest obstacle was the wildfire and the state of emergency in effect which constrained the logistical support for the recovery efforts.

And uncertainty about the types of waste entering the storm and sanitary sewers meant that this material couldn't be taken to landfill, and that the potentially toxic wastes had to be segregated and stockpiled while materials were tested in labs halfway across the country.

One of the key objectives of this program was to monitor and to prevent sewer backups from damaging homes that had not already sustained damage due to the fires. Ensuring the lift stations remained in operation, monitoring the storm and sanitary sewer flows, and having critical infrastructure support in place during the reentry were crucial to achieving this objective.

Fort McMurray will be recovering from the social and environmental impacts of the 2016 wildfire for years to come. However, thanks to the timely response of the early responders in preventing further damage to the critical infrastructure, the residents of Fort McMurray were able to return home to functioning wastewater and stormwater systems. **CCE**

Fort McMurray Wildfire: Wastewater and Stormwater Recovery, Fort McMurray, Alberta

Award-winning firm (prime consultant):	Stantec (Todd Simenson, P.Eng.; Stephan Weninger, P.Eng.; Darcy Elder, P.Eng.; Sean Larson, P.Eng.; Mike Mushins, P.Eng.; Amber Mitchell, P.Eng.; Scott Sanderson, CTech; Mike Magas, CET; Don Munro, CET; Praveen Mahendra, EIT)
Owner:	Regional Municipality of Wood Buffalo

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Application: *Surface Water*
Commissioned: *2011*
Flow Rate: *115 m^3/hr*

Parameter	Raw Water	Produced Water
TOC (mg/l)	26.7	<1
DOC (mg/l)	24.0	<1
Turbidity (NTU)	4.79	<0.1

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Whitecap Dakota First Nation, SK

Application: *Ground Water*
Commissioned: *2010*
Flow Rate: *14.4 m^3/hr*

Parameter	Raw Water	Produced Water
Iron (mg/l)	5.1	<0.014
Manganese (mg/l)	0.15	<0.001
Arsenic (mg/l)	23.0	<0.1

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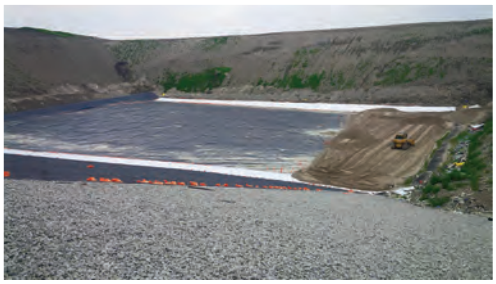
Barrie Landfill Reclamation and Re-Engineering



Top: Waste screening operations. Inset: Construction of the final phase of geosynthetic liner.

Golder Associates

"Use of the new liner was impressive. This project is also an excellent example of how good engineering can overcome multiple challenges while utilizing the resources at hand, including limited working quarters that were in operation throughout the project."
–Jury

The City of Barrie landfill was impacting water resources and required remediation. Golder was retained as the design engineer and construction management firm. The seven-year project involved innovative liner design, waste slope stability assessment and large-scale material management in a limited space.

Whereas landfill reclamation and installation of engineered controls is not unique, this project involved challenges relating to the limited space, remaining fill volume, odour control, waste density and stability, which required unique engineering design and project sequencing.

Liner innovation

The use of a composite geosynthetic liner, consisting of high-density polyethylene and geosynthetic clay layers was the first approved use of this system for a landfill in Ontario. Modelling was used to show that this liner, along with diffusion characteristics of the thick unsaturated zone, could provide the necessary barrier to leachate migration.

The benefit of the new liner and leachate collection systems is that leachate will be captured within the lined cells and no longer mix with the underlying groundwater.

The use of geogrid reinforcement on the cell side slopes to hold the drainage stone, in place of buttressing, was also new. Both of these design aspects have resulted in research level data and analysis useful for subsequent landfill design.

The use of geosynthetic liner allowed for redesign of the landfill configuration to a lower grade, reducing runoff, and allowed for cell sizing and rapid construction that could keep up with the rate of landfill reclamation and waste placement within the required schedule.

The project began when the landfill was substantially filled, resulting in a challenge of tight working quarters. Because of this, it was necessary to cut the excavated slopes in the waste to 2H:1V. A test section of the excavated waste slope was progressively cut to a slope slightly steeper than 1H:1H over a height of 20 m, while monitoring the slope face and inclinometers installed at the crest of the slope prior to steepening.

This data, along with lab testing of waste cores and modelling, was used to obtain regulatory approval for steep slopes during construction.

Space reclamation

In 2004, the landfill was predicted to be at capacity by 2017; the reclamation project resulted in extension of the landfill lifespan to 2035, an

continued on page 60

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Central at Garden City District Energy System Mini-Plant

Top: Mini-plant installed on parkade roof behind sound wall structure. Inset: District energy mini-plant interior layout.

Kerr Wood Leidal Associates

"This is a very innovative implementation of district energy to reduce CO_2 emissions and address climate change. This type of energy storage could be the way of the future."
–Jury

The City of Richmond retained Kerr Wood Leidal Associates Ltd. (KWL) to design and administer the construction of the Central at Garden City District Energy System Mini-plant. The project includes a central heating and cooling plant that utilizes low-carbon air-source heat pumps (ASHPs) to provide heating and cooling to 284,000 sq. ft. of new retail space.

This project reduces greenhouse gas (GHG) emissions by reducing natural gas use by up to 70% compared to conventional alternatives.

Central at Garden City District Energy System Mini-plant is Phase 4 expansion of the Alexandra District Energy Utility (ADEU), the largest ambient heating and cooling district energy system in North America. Phase 4 was developed to meet the unique needs of Central at Garden City shopping mall, while also integrating with the main ADEU system, which is based on geoexchange technology.

Since retail buildings require significantly larger cooling and less heating capacity than surrounding residential buildings, KWL's team designed a 'mini-plant' to satisfy these load conditions while remaining within cost-of-service targets.

The plant ASHPs were selected as the energy source due to their highly efficient operation, since they run on BC's low-carbon electricity supply and offer heating and cooling capabilities, including heat recovery.

This project is the first district energy system in Canada to provide heating and cooling to large-format retail buildings using ASHP technology and has several unique features.

Buildings at Central at Garden City share energy through the central heating and cooling mini-plant. Additionally, an energy transfer station links the miniplant to the main ADEU system, which allows the ASHPs to back-feed the entire Alexandra neighbourhood, hence sharing excess cooling energy or heat captured from the outside air with the larger neighbourhood or recharging the geoexchange loop.

From a process perspective, the on-site distribution system can be configured in multiple operating modes depending on the outside air temperature. During the coldest weather season, when the outside air temperature is less than -1°C (less than 5% of hours/year for an average year), ASHPs cannot operate, hence high-efficiency boilers provide the development's heating requirements. When the outside air temperature is above 5°C, the ASHPs can provide all the development's heating requirements. From Spring to Fall, the heat pumps can provide simultaneous heating and cooling to the develop-

continued on page 60

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Barrie Landfill, continued from page 56

increase of 18 years. This gain resulted from re-use of the fines component as cover, greater density of compaction of the in-place materials and reductions in waste disposal rates achieved since the project began.

At the beginning of the project, there was less than 130,000 m^3 of airspace available for immediate use. A critical aspect of the project involved planning of waste reclamation and new cell construction, such that the available space in new lined cells could hold the reclaimed and incoming new waste until the next cell could be constructed.

Equally important was ultimate material management, as the fines screened from the waste had to be stored within the landfill footprint in an accessible location for future use. Double handling of material was avoided and the final landfill design resulted in fines stored centrally in an area which would be filled last.

Detailed CAD design of future waste cells and fines storage were developed, along with scheduling of reclamation and liner construction. Added to this was the need to develop concurrent landfill gas collection and stormwater controls. The collection and flaring system installed in the reclaimed portions of the waste will capture landfill gas, reducing the effects of greenhouse gas emissions

Air quality and greenhouse gas

Public concerns with respect to air quality and odours were a significant part of the project planning process. These concerns were addressed through sampling of landfill gas and air quality, development of risk-based air quality standards and a pro-active off-site odour monitoring and contractor response. A gas collection and flaring system was installed in the reclaimed portions of the waste, which capture landfill gas, reducing both odours and the effects of greenhouse gas emissions.

Team work

The City of Barrie's objectives were to ensure their landfill site was designed and operated to minimize impact on the environment while also achieving the City's overall sustainability and budgetary requirements. The project was on time and completed on-budget through a managed process involving a team of City, Golder and contractor leads. **CCE**

Landfill Reclamation and Re-Engineering, Barrie, Ontario

Award-winning firm (design and construction oversight):	Golder Associates (Paul Dewaele, P.Eng.; Frank Barone, P.Eng.; Doug Kerr, P.Eng.; Colin Wong, P.Eng.; Chris Visser, P.Eng.; Frank Ciuffreda; Martin Castillo, P.Eng.; Toivo Pallop, P.Geo.)
Owner:	City of Barrie
Other key players:	Golder Construction (contractor), Tervita (contractor), Terrafix (liner installation)

Garden City, continued from page 58

ment. The cooling pipes can also be switched to a low-temperature heating mode to feed the ADEU system with the ASHPs while the boilers provide on-site heating. These four different operating conditions extend the range of the ASHPs operation and reduces gas use in the surrounding neighbourhood.

The project delivery schedule was challenging since the project had to be fully commissioned in time for the mall's occupancy. Since the mini-plant site was located on top of the 5-level parkade (base building) to limit noise generation at the ground level, this further compressed the construction schedule. A sound barrier was required to be installed to abate AHSPs noise since the retail mall is surrounded by residential buildings.

There were also hydraulic design limitations due to the difference between the pressure rating of the mini-plant and the main ADEU system, which necessitated the installation of the energy transfer station at the ground floor level of the parkade. Accordingly, additional piping and controls were required to facilitate the energy transfer from the mini-plant to the ADEU system.

The interconnection between the mini-plant and the ADEU system allows the ASHPs to run for longer periods when compared to a scenario where they would only serve the Central at Garden City retail development. This results in a more effective capital investment and helps maintain lower energy rates for both neighbourhood residents and the retail development.

The system will gradually increase its energy output as the surrounding neighbourhood grows and additional demand is required from the ADEU system.

In the early years of operation, the plant is expected to eliminate the production of 350 tonnes of CO_2 equivalent (t CO_2e) per year that would have resulted from using natural gas boilers or furnaces. Once the ADEU reaches its full capacity, which is anticipated around 2025, the system will eliminate 800 t CO_2e per year. **CCE**

Central at Garden City District Energy System Mini-Plant, Richmond, BC

Award-winning firm (prime consultant):	Kerr Wood Leidal Associates (Mike Homenuke, P.Eng.; Karen Sutherland, P.Eng.; Alan van der Holt, P.Eng.; Padraig Harrington, P.Eng.; Robin Parker, P.Eng.; Thomas Mah, EIT; Ayman Fahmy, P.Eng.; Thomas Mah, EIT; Mohammed Sheha, EIT)
Owner:	City of Richmond
Other key players:	BKL Consultants (acoustic modelling), Geopacific Consultants (geotechnical), RJC Engineers (structural), Smith + Andersen (mechanical), Chandler Associates Architecture (archictect), Smart REIT (developer), Graham Construction & Engineering (general contractor)
Supplier:	Trane Canada (air source heat pumps)

AWARD OF EXCELLENCE

Online Control System Migration of an Industrial Centrifuge

Above: The TEMPUS solution changes the way control system migrations can be completed, making them safer, quicker, and at lower cost. Left: TEMPUS was used to complete the online migration of 56 signals for a Suncor 500HP ODB centrifuge.

CIMA Canada

"The system's ability to start implementing new control systems without ceasing operations, permitting substantial cost savings for the client are worth noting. It's also impressive how many industries could benefit from this approach."
–Jury

During a critical stage of the oil sands recovery process, centrifuges are used to separate impurities from the bitumen stream. This separation stage is one of the final steps prior to "forwarding" bitumen for upgrading.

Suncor Energy Inc.'s secondary extraction plant 4, in Fort McMurray, consists of multiple centrifuges in a variety of manufacturers and sizes. Due to the criticality of the final separation process, individual centrifuges had been migrated to a new, common Distributed Control System platform over several plant outage opportunities.

Prior system conversions were completed using traditional "cold cutover" migration techniques that require the process to be offline. To support the complicated and delicate migration process, CIMA+ utilized the TEMPUS hot cutover tool to facilitate the replacement of any industrial control system to a new platform, without the need to shut down the plant's production.

TEMPUS was used to complete the online migration of 56 signals for a Suncor 500HP ODB centrifuge to the new control system. As part of the migration, an average of 10 loops per hour were migrated without any disruption, while allowing for complete visibility and control of all I/O on both the old and new control systems during the migration.

The project was completed over a five month period from conceptual design through to construction packages, testing, and programming. The project execution including construction, commissioning, and turnover occurred within a three week period, while the swingover to the new control system was carried out in less than four hours, from start to finish.

Overall, the main advantages derived from online migration tools include migration without loss in productivity, a decrease in risk of losing control over the system, and full online commissioning.

Control system migrations are typically a challenging project requiring balancing many conflicting demands between safety, productivity, reliability, and cost. Migration projects also often have very unique aspects starting with the requirement of needing

AWARD OF EXCELLENCE

to clean up decades of undocumented changes to the systems—a requirement to establish the project baseline. Before TEMPUS, full online commissioning was not possible.

The ability to maintain any process within its operating envelope provides both societal, environmental and economic benefits. By eliminating the need for plant outages—and as a result providing continuous monitoring and control of the facility—not only will the facility workers be safer by preventing an unplanned shutdown, but residents in the surrounding area of the facility will also be sheltered from any corresponding impact to their environment, including reduction of emissions or accidental releases.

Online conversions also contribute to the 'bottom line' of any company during a migration project through minimizing the required plant outage, managing cash flow, and making the most effective use of the team tasked with executing the project.

Not only was the original pilot project successful, proving all elements of the migration tool on a range of different signal types without affecting operations, the client subsequently executed a second, larger and more process critical project using the TEMPUS technology.

The second project scope included the migration from three different control systems to a new platform for six critical heat exchangers, 12 pumps and associated equipment that could not be removed from service, as it would affect the entire facility.

Because the utilities provided by the heat exchanger systems are in constant demand to support parts of the plant operation including during normal plant outages, by the time this migration was executed, the systems had been operating continuously for over 25 years. This second project was also completed without any process disruption.

TEMPUS has been designed to be used on any type of migration project regardless of whether that project is for a replacement system, phased migration, or mixed system implementation.

When considered in its entirety, the TEMPUS solution radically changes the way control system migrations can be completed, making them safer, quicker, and at lower cost than has been previously possible using existing techniques and tools. **CCE**

Online Control System Migration of an Industrial Centrifuge, Fort McMurray, Alberta	
Award-winning firm (prime consultant):	CIMA Canada (David Findlay, CET; Gerald Desrochers; Craig Salahub, PMP; Bruno Plante, P.Eng.)
Owner:	Suncor Energy
Other key players:	CIMA Canada (André Couturier, P.Eng.; Esteban Castro; Brian Brunning; Julie Garand, Eng.), Suncor Energy (Rajeev Varma, P.Eng.; Vineet Saxena, P.Eng.)

AWARD OF EXCELLENCE

Jimmie Creek Hydroelectric Project

Top: Diversion weir with 20m-long inflatable rubber dam that deflates in a flood event. Inset: Built on an elevated rock platform, the power station houses two vertical axis pelton turbines.

SNC Lavalin

"The innovative use of an inflatable rubber dam was impressive along with the lack of disruption to the fish habitat downstream. The work is noteworthy because of the challenges created by the remote site and difficult working conditions."
–Jury

The Jimmie Creek 62 MW Hydropower Project is a run-of-river development located in the Toba Valley within the traditional territory of Klahoose First Nation. Jimmie Creek is an engineering, procurement, construction and management (*EPCM*) project that was commissioned ahead of schedule and under budget.

The project's unique features include a sluiceway channel that reduces sediment entering the intake, as the invert is lowered in front of the intake openings. The intake structure was designed to minimize velocity and turbulence for smooth transition of flow into the penstock.

In addition, a sediment trough was installed inside the intake structure to remove suspended sediment that enters the intake structure before entering the penstock. The design process for the intake involved the construction of a 1:16 scale physical model at the Northwest Hydraulic laboratory in North Vancouver. This enabled the team to test and adjust sediment excluding features throughout the headworks.

Challenging terrain

The penstock constructability was challenging and complex as the alignment passes through very rough and steep terrain. A long section of the buried penstock is constructed on a 42% gradient, which made it challenging to transport heavy pieces of penstock to install in such an inclined trench. An exposed section of the penstock is installed above the creek to cross over to the right bank. Its installation required multiple cranes and careful planning to launch safely.

The powerhouse is built on an elevated rock platform at the junction of Jimmie Creek and Toba River. The powerhouse is compact to accommodate the shortage of space and allow discharge above the natural fish barrier.

The unique tailrace was built within a waterfall and with two outlets to help modulate flow distribution and make sure that fish downstream of the powerhouse are not affected by the project.

The spillway for the diversion of flow features a free overflow spillway and a 20m-long inflatable rubber dam that deflates in a flood event. This feature reduces the height of the structure and ensures minimal sedimentation above the natural river bed.

The tailrace design features a rock excavated trench and an embedded corrugated steel pipe that respects natural flow distribution into two arms of the creek. Flow is distributed without mechanical means to each of the two branches of the fish barrier creek.

Overcoming obstacles

There were several areas of complexity were overcome with positive outcomes. These areas included: the risk of avalanches posed health and safety concerns on the project team; materials had to be transported to site by sea or air freight, with the majority of large or bulk materials transported via barges managed by Klahoose First

AWARD OF EXCELLENCE

Nation, which were then transferred 34km further by road to the work site; managing construction, material shipment, and staff rotations in such a remote site required planning and coordination; site planning over 3km in length and over 450m of elevation in a steep and remote valley required extensive slope stabilization measures and constant monitoring—building a penstock over slopes of over 40% required experienced operators and careful oversight.

Social and environmental benefits

The project, located within Klahoose First Nation traditional territory, provided a unique opportunity to work closely with the local community and create jobs and business opportunities.

The sustainable run-of-river project now provides clean energy to local communities—159,000 MWh of renewable energy to the grid annually. Due to the environmental sensitivity of the project, SNC-Lavalin took care to locate components upstream of natural fish barriers to minimize impact.

The unique tailrace design allowed for restitution of the water within a waterfall. The two tailrace outlets allow for the water to be modulated which ensures the fish downstream of the plant are not impacted by the project.

The client's objective and main project goal was to build a third clean hydro energy plant in Toba Valley. Minimizing environmental impacts and meeting and exceeding the commitments made to the Province of BC and the Ministry of Environment were also critical.

Despite the remote conditions, delivering the project on time, on budget, and with minimal risk to health and safety was vital. The project was scheduled to begin commercial operations on August 2, 2016 and was commissioned on July 1, 2016. **CCE**

Jimmie Creek Hydroelectric Project, Powell River, BC

Award-winning firm (prime consultant):	SNC-Lavalin (Travis Smith; David Morch, P.Eng.; Paul Morcombe, MRiCS; Yasas Ponweera, P.Eng.; Amarjit Pnaiser, MRiCS; Francois Vitez, P.Eng.; Danny Alarie, P.Eng.; Mahar Suleyman, P.Eng.; Francois Bousquet, P.Eng.)
Owner:	Alterra Power Corp.
Other key players:	CM Rock Engineering (geotechnical), BBA KAWA Engineering (penstock design), Northwest Hydraulic Consultants (model studies)

AWARD OF EXCELLENCE

Wildlife Detection System

The system's main function is to detect the presence of large animals, namely deer, elk, moose, and sheep. Inset: Thermal camera recording.

PBX Engineering

"The system's 97% accuracy and use of artificial intelligence is a move toward the future. It's important to recognize how the system protects the environment as well as animal and human life."
–Jury

Each year, thousands of collisions with wildlife are reported on BC Highways. The BC Ministry of Transportation and Infrastructure (MoTI) identified two corridors along Highway 3 in Southeastern BC as having the highest densities of large wildlife-vehicle collisions (WVCs) in the province. The Wildlife Detection System (WDS) was implemented on these roadways to protect wildlife and increase safety using sophisticated detection technologies integrated with dynamic message signs. PBX Engineering planned, designed, and commissioned the system, providing the wildlife with greater protection, and motorists within the corridors a safer commute than ever before.

Multi-disciplined approach

A multi-disciplinary team comprised of systems and electrical engineers, as well as biologists familiar with the area's fauna, was formed to account for all aspects of the system design.

PBX was able to draw on its experience in both Intelligent Transportation Systems (ITS) and security systems to address the challenge. The engineered solution was a fusion of driver-information technology from the transportation field, combined with detection and analytics technologies from the security field.

Typical devices required for the core functionality of the system include Dynamic Message Signs (DMS), radar sensors, thermal and colour cameras, and various communication devices. The system's main function is to detect the presence of large animals (deer, elk, moose, and sheep) using technologies developed primarily for the security industry.

When a large animal is detected, the control system activates a series of electronic warning signs advising motorists of the presence of animals. Additionally, thermal and high-definition video of detected wildlife is recorded and stored for analysis.

Rigorous testing

PBX developed a rigorous and systematic testing methodology and applied it effectively to verify the system's accuracy and sustainability. All technology was carefully selected, with considerations of the challenging topography, climate and remote rural setting of the project area. All devices

AWARD OF EXCELLENCE

needed to be "hardened" to deal with sub-zero temperatures.

Intermittent cellular coverage was overcome with point-to-point wireless Ethernet radio links, allowing remote access to all devices through a single cellular modem on each corridor. Optimal placement was crucial for all detection and communication equipment to overcome line-of-sight and blind spot issues.

It is the technology selection and design that sets this system apart from past WDSs; sophistication was chosen over simplicity to achieve high-level integration of multiple ITS and security industry devices.

Safety first

The Insurance Corporation of BC's (ICBC) statistics show that between 2011 and 2015 there was a yearly average of 10,000 animal-vehicle incidents in BC. These incidents resulted, on average, in 570 personal injuries, and three fatalities per year.

The WDS has a demonstrated impact on driver behavior, with vehicles traveling measurably slower through the corridor when warning signs are activated, resulting in a lower wildlife collision rate and increased roadway safety.

The WDS does not compromise the local habitat, nor does it encumber wildlife unlike fencing techniques which often run for kilometers.

Effective and repeatable

As the long-term goal is to expand the WDS to other areas of the province, it was critical that the system performed correctly and effectively so that MoTI could justify additional capital investment for subsequent systems.

Through the application of rigorous and systematic testing, the performance of the implemented WDS has been confirmed to meet the client's requirements and the accuracy and effectiveness of the system was found to be exceptional. **CCE**

Wildlife Detection System, BC	
Award-winning firm (prime consultant):	PBX Engineering (Ian Steele, P.Eng.; Julian Vasquez, P.Eng.; Gary Brykov, P.Eng.; Fred Vey; Rupert Vey)
Owner:	BC Ministry of Transportation and Infrastructure
Suppliers:	Flir 360 Surveillance (systems integration consultant); Valid Manufacturing (control cabinets/digital message signs)

Congratulations!

Valid Manufacturing Ltd. would like to congratulate PBX Engineering Ltd. on winning an Award of Excellence for their Wildlife Detection System, installed on Highway 3 in the East Kootenays, BC.

Valid Manufacturing was pleased to provide the electrical control enclosures and the dynamic message system wildlife signs.

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AWARD OF EXCELLENCE

Northern Region Small Towns Water and Sanitation Project (NORST)

A drilling rig, part of the NORST project in northern Ghana. Inset: A borehole waiting for mechanization.

Cowater International and Norda Stelo

Global Affairs Canada funded this $30M project with the goal of improving the health of residents in 20 towns in Ghana's Northern Region through improved access to water supply and sanitation services. Cowater International with Norda Stelo provided engineering design, technical assistance, capacity building and management support to the Government of Ghana in the implementation of project activities, resulting in new community-managed water supplies and improved health and quality of life for over 165,000 residents.

The Northern Region Small Towns Water & Sanitation (NORST) Project was implemented between 2008 and 2016. At the outset less than 25% of northern Ghana's rural population was estimated to have access to clean water supplies. The project was co-implemented with Ghana's Community Water & Sanitation Agency (CWSA) and District towns, who were responsible for procurement of construction services.

"The project's positive societal impacts, including the resultant knowledge transfer and the number of people served by the new community-managed water supplies is noteworthy. How the team was able to exceed the goals of this very lengthy project while operating on a small budget was also impressive."
–Jury

Multiple benefits

The NORST project provided multiple benefits including:

- New water systems operating in 20 towns, benefiting a population of 165,774. Given the region's topography and hydrogeology, systems typically include borehole sources with submersible pumps, elevated storage tanks, basic treatment, and distribution to both public and domestic taps.
- Effective operation and maintenance structures were established in all towns. All benefited from training on operation, maintenance, administration and financial management.
- All towns now regularly prepare and update District development plans which address water, sanitation and environmental concerns and objectives.
- Approximately 2,400 latrines constructed; a 13% increase in sanitation coverage.
- 400 latrine units constructed at elementary and secondary schools, providing service to 19,500 children where facilities were previously inadequate or absent altogether.
- 10,000 schoolchildren received basic information on health, hygiene and household sanitation through a Healthy Play methodology in which students learn through games and sport. Schools received technical assistance in the methodology, and game/sports equipment to encourage

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AWARD OF EXCELLENCE

amiskwaciy Academy Sweat Lodge Shelter

The collaborative community project marked the first traditional sweat lodge on school property within the Edmonton Public School Board District. Above: Consultation sessions were held with amiskwaciy Elders, staff, and students.

Stantec Consulting

Elders and staff at amiskwaciy Academy—an Edmonton Public School that provides academic programming within an Aboriginal context—had a vision: they wanted to have a traditional sweat lodge built on school property where traditional ceremonies, teachings, and rituals could be performed. But they knew they couldn't build a sweat lodge without a protective structure to provide shelter against the elements and for privacy.

Recognizing the uniqueness of the opportunity Stantec seized the chance to get involved. Ledcor Construction also agreed to join the initiative as the constructor, helping make the vision a reality.

"The challenges faced by the project team of bringing the various stakeholders together to achieve consensus was impressive, and how engagement and knowledge transfer enhanced the value of the project to the community is commendable."
–Jury

Inspired design

Stantec began working on the design in early 2016, and sought input through consultation sessions with amiskwaciy Elders, staff, and students. The goal was to design an enclosure that captured the essence of the sweat lodge itself: a traditional space for mental, spiritual, and physical refuge.

A circular, wooden shelter was identified as the right approach, as both elements are central to Indigenous culture. In the end, a customized shelter design was presented that used wood for the structure and steel for anchorage.

When the design was complete, Stantec presented the drawings to students, explaining the steps and considerations involved in arriving at their design decisions.

During initial planning, Stantec also used building information modelling (BIM) for viewing with 3D glasses, which enabled the students and staff to visualize the inside of the shelter. Project leaders consistently met with school staff and together they developed the basis of design.

Collaborative effort

The Stantec team shepherded the design through the necessary approvals with the City of Edmonton, and the Edmonton Public School Board.

Given the limited financial resources available to bring this project to fruition, Stantec donated countless hours.

Stantec's design team produced a set of construction documents that were handed over to Ledcor who volunteered their time and resources to build the structure. All of the work was done as an in-kind donation.

Throughout construction, Ledcor worked with students onsite, providing them with both hands-on construction experience while deepening their personal connection to the project.

The sweat lodge itself was built by the Elders using centuries-old tradi-

continued on page 69

AWARD OF EXCELLENCE

NORST, continued from page 67

healthy behaviour change.

Knowledge transfer

The transfer of knowledge and know-how was the cornerstone of the NORST Project and the foundation for long-term sustainability of project results. Over the eight-year duration, the project strengthened counterparts at the local, regional and national levels. Twelve Canadian experts—in areas including water system engineering design and construction, GIS, hydrogeology, sanitation, environmental management, procurement, gender equality and social inclusion, AIDS/HIV, human resources, and communications—provided expert technical assistance to Ghanaian stakeholders.

Logistics challenge

The Project was based in Tamale, over 600km north of the capital city of Accra. Most towns were accessed over unpaved dirt roads which sometimes became impassable during the wet season. Construction supplies and equipment were procured from Accra, and timely distribution to the various work sites was a challenge.

Wherever possible, procurement was done in bulk well in advance of schedule and transportation to sites was done during dry months.

Exceeding goals

Under the overall goal of improving the health of residents, the client defined results to gauge performance, including:

- Improved access to sustainable potable water supply, and sanitation facilities in selected towns, benefiting a minimum of 125,000 residents;
- Strengthened capacity of District Water & Sanitation Management Teams to fulfill their mandates in water service delivery, management, operation and maintenance; and
- Strengthened capacity of government stakeholders to support the planning, construction and operation of small town services.

A Performance Measurement Framework was established with measurable indicators to gauge performance against baseline values. All NORST water systems are operating within CWSA performance guidelines, and recurrent system costs are being recovered through tariffs.

By December 2016, NORST had substantially achieved all Project goals, exceeding by 29% the target of providing new service to 125,000 residents across all towns, among other goals. District towns are now better able to manage, operate and maintain these services, and are more satisfied themselves with the level of support received from government counterparts. CCE

Northern Region Small Towns Water and Sanitation Project (NORST), Ghana

Award-winning firms:	Cowater International and Norda Stelo (Andrew Livingstone, PhD; Stein Mathisen, P.Eng.; Norman Looker, P.Eng.; Mark Redwood)
Owner:	Global Affairs Canada

amiskwaciy, continued from page 68

tional construction techniques with bent willow trunks to create arches supporting a canvas covering. To allow the willow arches to be planted and remain in place in 18-inches of soil that sits on a concrete tarmac formerly used for an airport, Stantec designed custom steel anchors to secure the willows in place.

Community building

Construction of the sweat lodge and shelter began on Stantec's volunteer day, Stantec in the Community Day, on September 21, 2016 that saw 20-plus Stantec staff roll up their sleeves alongside amiskwaciy staff and students.

Its official grand opening took place on Friday, November 18, 2016. The collaborative community project—the first traditional sweat lodge on school property within the Edmonton Public School Board District—was an exchange of technical knowledge and culture across groups, combining the traditional insight and guidance of school Elders and students, the design expertise of Stantec consultants, Ledcor's carpentry and construction services, and the generous contributions of several suppliers.

Since its opening, both students and community members have had the chance to experience a traditional sweat, including members of the Catholic School Board, the RCMP, and Stantec staff. In the spirit of Truth and Reconciliation, this collaborative project has bridged a gap, bringing together diverse organizations and members of the community in the spirit of learning, cultural exchange and respect, and acceptance.

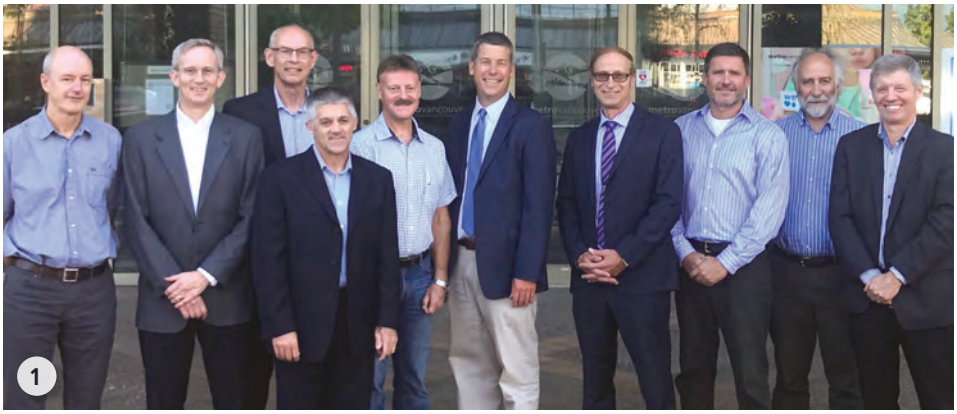
The ceremony allows participants to come together in a tranquil space that allows for personal reflection; it cultivates a sense of community for participants about to go through an emotional journey while being surrounded by others for reassurance. It also brings together members of the Indigenous community to connect with an important part of their spiritual tradition. The building is small in footprint, but is a grand and invaluable teaching tool for the students and the community at large. CCE

amiskwaciy Academy Sweat Lodge Shelter, Edmonton

Award-winning firm (prime consultant, architect, structural):	Stantec Consulting (Robert Bourdages, P.Eng.; Frédéric Brisson, M.Arch.)
Owner:	amiskwaciy Academy
Contractor:	Ledcor Construction

MEET THE WINNERS

The following photo gallery helps us put a face to some of the names behind this year's award-winning projects.



SCHREYER AWARD

1. Port Mann Water Supply Tunnel, Vancouver. Ausenco Engineering Canada. *Left to right:* Bruce Downing (Golder), Derek Zimmerman (Ausenco), John Sherstobitoff (Ausenco), Murray Gant (Metro Vancouver), Allen Mitchell (Metro Vancouver), Dan Adams (McMillen Jacobs), Frank Huber (Metro Vancouver), Andrew McGlenn (McMillen Jacobs), Trevor Fitzell (Golder), and Peter Galbraith (Ausenco).

TREE FOR LIFE AWARD

2. Box Canyon Hydroelectric Project, Howe Sound, BC. Knight Piésold. *Left to right:* Ryan Hanson (Elemental Energy), Toby Perkins, Benoit Otis, Sam Mottram. (photo courtesy ACEC-BC)

ENGINEERING A BETTER CANADA AWARD

3. Studio Bell, Calgary. RJC Engineers & Stantec. *Left to right:* Jeff R. Rent (Stantec), Simon Brown and Kevin Zwaagstra (RJC Engineers).

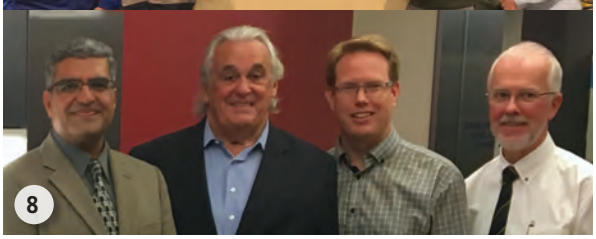
AMBASSADOR AWARD

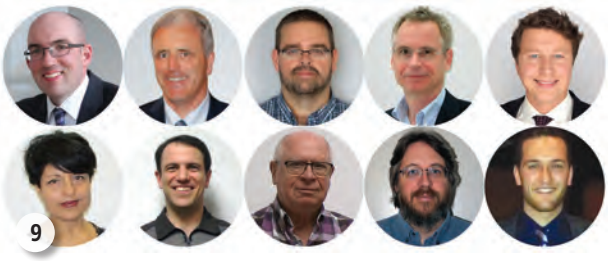
4. World Trade Center Transportation Hub (Oculus), New York City. COWI North America (formerly Buckland and Taylor). *Left to right:* Dan Payea (Skanska), Steven Plate (PANYNJ), AJ Powell (Skanksa), Mark Pagliettini (PANYNJ), Darryl Matson (COWI), Joe Viola (COWI), Genaro Velez (COWI), Ralph D'Apuzzo (PANYNJ), and Ming Jin (COWI).

AMBASSADOR AWARD

5. The Atal Setu (Basohli Bridge), Jammu & Kashmir, India. McElhanney Consulting. Morgan Trowland (centre) among local workers on the site.

The above special award-winners also won Awards of Excellence. For others involved, see the list of members of the award-winning firms at the end of the articles describing the projects.





AWARDS OF EXCELLENCE

6. Lazaridis School of Business & Economics, Waterloo, Ontario. VanBoxmeer & Stranges Engineering. *Left to right:* Lijun Guo, Gary VanBoxmeer, Rick Stranges, Phil Rizzo, and Brad Stott.

7. Abraham Lincoln Bridge, Louisville, Kentucky. COWI North America. John Brestin, COWI NA (far right), with construction foreman (Walsh) and project engineer (Jacobs).

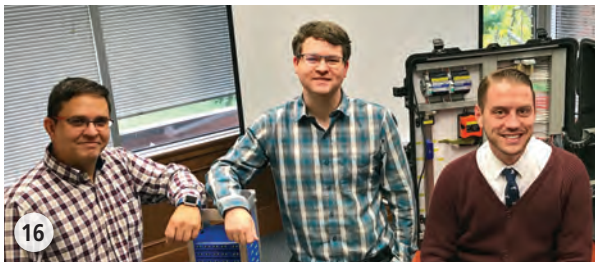
8. Burgoyne Bridge, St. Catharines, Ontario. Habourside Engineering and Parsons. *Top, left to right:* Harbourside Engineering – Robbie Fraser, Chris Mantha, Paul Burke, and Sarah Hardy. *Bottom, left to right:* Parsons - Sameh Salib, Vic Anderson, Brent Archibald, and William Moore.

9. Halifax Shipyard Modernization Project. Hatch. *Top, left to right:* Robert Stewart (Irving), Doug Dean (Irving), Lorne Flowers, Chris Tattersall, David Johnson. *Bottom, left to right:* Amita Marjara, Serge Doucet, Robert MacCrimmon, Jason Molenaar, Brendan Conners.

10. Mayerthorpe Rail Bridge Replacement, Mayerthorpe, Alberta. Klohn Crippen Berger. *Left to right:* Tim Keegan, Jim Lowe (CN), Chris Grapel, Jim McLeod (CN), Tom Edwards (CN), and Pam Fines.

11. Sir Ambrose Shea Lift Bridge Replacement, Placentia, Nfld. & Labrador. Parsons. *Left to right:* Ryan O'Connell, Jack Ajrab, and Joanne McCall.

12. Evergreen Line Rapid Transit Project, Vancouver. SNC-Lavalin. Left to right: Meiric Preece, Dave Weatherby, Will Gowen, and Jeff Spruston.



13. Wastewater and Stormwater Recovery, Fort McMurray Alberta. Stantec. *Left to right:* Mike Magas, Stephan Weninger, Alan Peturson, and Todd Simenson.

14. Landfill Reclamation and Re-Engineering, Barrie, Ontario. Golder Associates. Left to right: Frank Barone, Paul Dewaele, and Frank Ciuffreda.

15. Central at Garden City District Energy System Mini-Plant, Richmond, BC. Kerr Wood Leidal. *Left to right:* Mike Homeuke, Ayman Fahmy, Karen Sutherland, Mohammed Sheha, and Thomas Mah.

16. Online Control System Migration of an Industrial Centrifuge, Fort McMurray, Alberta. CIMA Canada. *Left to right:* Esteban Castro, David Findlay, and Brian Brunning.

17. Jimmie Creek Hydroelectric Project, Powell River, BC. SNC-Lavalin. *Left to right:* Danny Alarie, David Morch, Travis Smith, Francois Vitez, and Paul Morcombe.

18. Wildlife Detection System, BC. PBX Engineering. *Left to right*: Carlos Matias, Gary Brykov, Bill Chou, Ian Steele, Michael Taladiar, Rupert Vey, and Julian Vasquez.

19. Northern Region Small Towns Water and Sanitation Project (NORST), Ghana. Cowater International. Andrew Livingstone (second from right), Alex Opare-Akonor (far right).

20. amiskwaciy Academy Sweat Lodge Shelter, Edmonton. Stantec. Robert Bourdages (left), and Frederic Brisson.

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Turning Up the Heat on Energy Recovery

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By Greg Daum, P.Eng.

Tree Management

The future of your firm relies on being responsive to the insights you can glean from every employee.

The familiar saying goes: "You can't see the forest for the trees." As we all know, this refers to being so overly concerned with detail that we miss comprehending the whole situation. This traditional maxim is often used by senior company managers and executives to avoid dealing with employee concerns, inferring that the employees aren't seeing "The Big Picture."

I don't profess that company leaders should micromanage, but management must at least have an appreciation, or trust, for some aspects of the finer details of their operations. After working with and for a number of engineering firms around North America for over 40 years, I have taken part in introducing senior executives to the Trees, and I've witnessed a positive metamorphosis in the way companies moved forward because of a better understanding of the impact of the Trees on their company's ultimate progress and success.

I would like to propose a reversal of the old saying to read: "One can't see the Trees for the Forest." Let me explain. First of all, I am not suggesting company executives get bogged down in minute details that will slow down the wheels of progress, but it's important that they deal with the details that are already probably bogging down the corporation. I suggest that if the top echelons of management fail to pay attention to the Trees, their Forest WILL die.

There have been thousands of books written on management styles, and there are seminars based around the principles of being responsive, respectful, progressive and accountable. In my proposal of paying attention to the Trees, I would suggest that to create a positive change in your business direction, senior executives need to prioritize just one principle, that is Responsive. By accepting this role, all the other management and business cliché's will follow naturally, or with a little bit of coaching.

With today's well-educated engineers and their high levels of technical awareness, the time for listening to your staff has come of age. Not that long ago, before the Google information age, the knowledge base of employees was not as wide spread, and advancement within companies was limited to a small percentage of the most talented employees.

And a corporate environment of "right-sizing" organizations, with consistent budget constraints, and lowest-bid-wins proposals, the need to drive an engineering workplace focused on expedient design and functionality can be a disaster.

Professional licensed engineers are obligated, even legally bound, to practice their trade correctly and truthfully. Therefore, it's in management's interest to be positively responsive to ideas or concerns brought forward by an engineer.

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As a former member of an engineering society discipline investigation committee, I've seen how engineers get subjected to the trap of contravening their legal ethics through their employer's less than ethical short cuts.

In my years of engineering I have a lot of stories, but following are two examples of my "Trees for the Forest" dissertation:

As an independent consulting engineer I was working for a pipeline company upgrading its pumping stations, and I had ordered some sensitive electronic vibration monitoring modules for the company's large pumps.

When the delivery of these units was late I called the international supplier, and they tracked their shipment to the back door of the company where I was working.

Basically, the delivery truck came to the back receiving area where someone let them in. This door didn't seal very well, and as we were going through a winter blizzard condition a snowdrift developed through this door leaving my vibration equipment in the snow for about four days.

This became an opportunity for improvement, so I approached the general manager with the situation and a suggested solution—hire a student or a local youth with some computer expertise to check the warehouse stock, set up a database and record existing and new receivables.

To my surprise he acknowledged the short coming, but he stated, "Once this has been set up, in a few months I'll have to fire this person." I left his office aghast. Here was a pure win-win situation. The company would get their inventory up to date, and the worker would get some experience. As I saw it, if he was uneasy about firing this person then set up on a short-term contract where the termination arrangements are up front.

Nevertheless, this reminded me of a story where an insensitive reporter inquired of Helen Keller (a blind and deaf 20th century American author, political activist, and lecturer), how unfortunate it was that she was blind. To this Ms. Keller replied, "I would rather be blind then have no vision."

Secondly, many years ago I was a project engineer in a factory in the southern U.S. I made it a common practice to talk with the assembly line workers about what they were building. One young lady in particular was very interested in any new item that came in the receiving door and made it to her assembly area. One day, when I was out on the shop floor, she came running over very excited because after all the information she had gleaned from her many questions to me she had been promoted to a quality control agent on material coming into the company.

The company wins, and the employee wins. Being responsive to an employee's curiosity produces the employer's goal of a better company through improved employee skills and, in this case, a better check on products.

Is this a new idea? No! To quote from the leadership book that is most read in countless languages, "Be quick to listen, slow to speak …." James 1:19. This guideline that is thousands of years old is still the best method to effective management. Remember, listening is not an activity but an invitation to your understanding and progress.

How does your company fair when measured against my twist to "Can't see the Trees for the Forest"? Remember, a forest only exists because it has trees.

Knowledge does not automatically bring or equate to smarter behaviour. Like trees, knowledge has to be nurtured to reach its potential. Your employees are like a diversely beautiful garden (sorry for the mixed metaphor). If left unattended it will be overrun with weeds and be of no use to anyone. The more the gardener knows and attends to the requirements of his individual plants, the more the garden, as a whole, will flourish.

For a company to survive today it needs skilled people at every level, whether it be the intellect of the engineer or the conscientiousness of the janitor. Nevertheless, if company executives don't have the skill of listening then no matter how great the trees, the forest will die.

If I have caught your attention, then I'd like to take this next step.

We have all heard the evolutionary phase "survival of the fittest." Well I would like to present a supplementary concept to this as "survival of the skilled."

For a company to survive today it needs skilled people at every level, whether it be the intellect of the engineer or the conscientiousness of the janitor. Nevertheless, if company executives don't have the skill of listening then no matter how great the trees, the forest will die.

As a company leader, are you a skilled listener? Are the managers in your company skilled listeners? Do you want a vibrant forest? Do you have a skilled guide to help you on this road to listening?

To quote John Ruskin (a leading English art critic of the Victorian era): "Every great person is always being helped by everybody; for their gift is to get good out of all things and all persons." **CCE**

Greg Daum, P.Eng. is the owner of GDC Ltd. in Regina, Saskatchewan. He has over 40 years experience in electrical engineering and currently sits on the Board of the ACEC-SK.

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Building Automation

Two new IP/Ethernet-based controllers have been added to Johnson Control's building automation system Metasys product line along with user interface features that make finding critical information and resolving issues easier. Because the two new BACnet IP field equipment controllers communicate on Ethernet IP networks, they support increased network performance and bandwidth and enable easy integration with Metasys 9.0.
www.johnsoncontrols.com

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The new Free Flex Ultra-High Efficiency Commercial Condensing Boiler from Bryan Steam offers a thermal efficiency of 95% and features Bryan's weld-free design. Free Flex permits field access to the heat exchanger for cleaning and tube replacement, making it the only repairable condensing boiler available.
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SPX Cooling Technologies announced the availability of the Marley Cube BTC forced draft evaporative condenser and Cube DTC induced draft evaporative condenser for industrial cooling applications. Both Cube models are geared toward cooling applications in chemical processing, industrial gases production and pharmaceutical production, where they offer robust construction materials, ease of installation and maintenance, and reliable performance.
www.spxcooling.com

Trane is expanding its Series S CenTraVac chiller line with the new CVHM model. The Series S CVHM is available in 170-370 ton range and can be applied to any commercial building including retrofits and system replacements. The chillers are designed to fit in varied spaces, which addresses needs for a simpler replacement in existing, tight structures.
www.trane.com

Johnson Controls has introduced a new, patented 270-degree six-way valve and actuator line that provides improved control in chilled beam and fan-coil installations. The device minimizes the number of valves and actuators in an installation—replacing up to four valves and four actuators—while reducing operating costs.
http://www.johnsoncontrols.com/valves

Viessmann Open House

Demonstration of the commercial biomass wood-fired boiler, led by Andreas Wintzer of Viessmann.

Celebrating its parent company's 100th anniversary, Viessmann Canada opened the doors to its headquarters in Waterloo, Ontario on September 21 to welcome customers and friends to the Viessmann Tech Social 2017.

All year the company is recognizing its birthday with the theme "100+ Into a new century."

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GRUNDFOS

Leading Canadian Real Estate Co. Partners with Grundfos on Commercial High-Rise Energy Audit and Booster Retrofits Saving Over 95% Energy

Colliers International headquartered in Toronto, Ontario is a commercial real estate services organization that currently manages 47.8 million square feet of property space worldwide. Two office towers particularly located at 2 and 4 Robert Speck Parkway in Mississauga, Ontario each had existing booster pump systems consisting of two pumps that were oversized by design. Both systems were operating at constant speed, were over 15 years old, and running at low efficiency. Due to end of life expectancy the systems were causing operational and maintenance issues.

Colliers Project Manager; Joel Victoria was seeking assessment of the existing system's efficiency and partnered with Grundfos in order to determine an energy efficient "right-sized" solution that would be suitable for a domestic cold water variable flow application. Grundfos Sales Manager; Janusz Kic contacted MAC Energy Solutions & Building Services to perform a pump audit that would log the existing system's flow, pressure and power consumption. Data collected revealed that pump one in "2 Robert Speck" was running on manual, and pump 2 was running on auto totalling 30HP. Pump one in "4 Robert Speck" was completely shut off, while pump 2 was on auto totalling 27.5HP. Pressure reducing valves were also being used to regulate fluctuation in pressure causing a significant waste of energy.

Following analysis of the system's profiles Grundfos recommended installation of a Hydro MPC-E 3CRE10-6 5HP (3x460V for "2 Robert Speck", and 3x575V for "4 Robert Speck") BoosterpaQ system in each of the office towers. "2 Robert Speck's" projected annual energy consumption is 3,826 kWh, a savings of 95% and $9,141 annually, with an estimated ROI of over 5.8 years. "4 Robert Speck's" projected annual energy consumption is 5,224 kWh, a savings of 96% and $13,994 annually, with an estimated ROI of over 4.2 years.

The Hydro MPC (Multi Pump Controller) BoosterpaQ was chosen for the following reasons:

- CR pumps are the best foundation for the system. They have the highest efficiency in the market and are extremely reliable. Just two pumps will meet 100% of demand, while the third pump remains on standby.
- The MPC alternates between lead and lag pumps ensuring equal run hours on all of the pumps. It's built in pump curves identify if it's more efficient to operate two pumps at a slower speed, rather than one pump at full speed.
- The VFD (Variable Frequency Drive) located in the MPC reduces speed to match flow demand. It allows the CR's to continuously regulate speed while maintaining pre-set constant pressure. It also allows the pumps to run only when demand is detected, extending the pump's lifespan, decreasing energy consumption, and reducing maintenance costs.
- The system includes a pressure tank that will aid in absorbing water hammers, and will be used to enable the no-flow shutdown function.
- The control panel allows for communication with the building's automation system.
- The system comes preassembled, is tested prior to delivery, and requires minimal maintenance.

Ainsworth completed "2 Robert Speck's" tower system install in January 2016. Just five months earlier in August 2015 they had installed "4 Robert Speck's" tower system. Both systems qualified Colliers for a total projected incentive rebate of $19,988 from Toronto Hydro.

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

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Simplifying the Installation of a Modern Building Management System in a Historic Site

When NSW Contrôle were faced with the challenge of updating the Building Management system and controls for an historic government building in Québec, they turned to the #1 rated Building Management System (BMS). NSW Contrôle partnered with Schneider Electric and are certified at the highest partner level of Master EcoXpert to offer the "EcoStruxure for Buildings" BMS solution for this project.

Overcoming challenges

There is always a challenge retrofitting an historical building. "Certainly, the building was considerably reconstructed, but we always kept in mind that we had to respect the old construction. This project uses geothermal heating and cooling and integrating that into the existing system was also part of the challenge" noted Francis Habel from NSW Contrôle, Quebec branch.

Practical solution

As part of a complete multi-million-dollar restoration, it was critical to pick a solution that met the demands of the customer but also preserved the historical aspect of the heritage building. Utilizing the Schneider Electric "EcoStruxure for Buildings" offer, NSW Contrôle found that they could seamlessly integrate the older sections of the building with the latest in wireless field devices, smart controllers, automation servers and a new software user interface in the new building office section.

Easy integration

The advantage of the "EcoStruxure for Buildings" approach is that it is designed from the ground up as an open system allowing easy integration, adding new controllers, servers and new smart wireless field devices into the existing infrastructure. The Schneider Electric MPM device pulls everything together which is then routed to the user interface and the SmartStruxure Automation Server. It congregates the existing field devices along with the new devices into a single homogenized system. By doing so, there is no need to rip and replace or start drilling holes and running conduit to accommodate the new intelligent field devices.

The MPM controller uses multiple wireless technologies to allow individual office and room control. It is easy to install and utilizes existing wiring and the integrated intelligence enables significant energy savings with accurate temperature control in any building design.

Retrofitting an older building has its challenges but with the "EcoStruxure for Buildings" offer from Schneider Electric, you can not only reduce installation time by up to 30%, you also reduce energy consumption and enhance customer quality and security. By not having to "rip and replace", drill holes or run conduit in heritage buildings, it simplifies installation saving time and costs.

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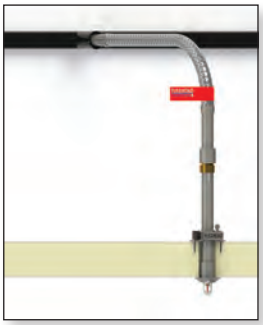

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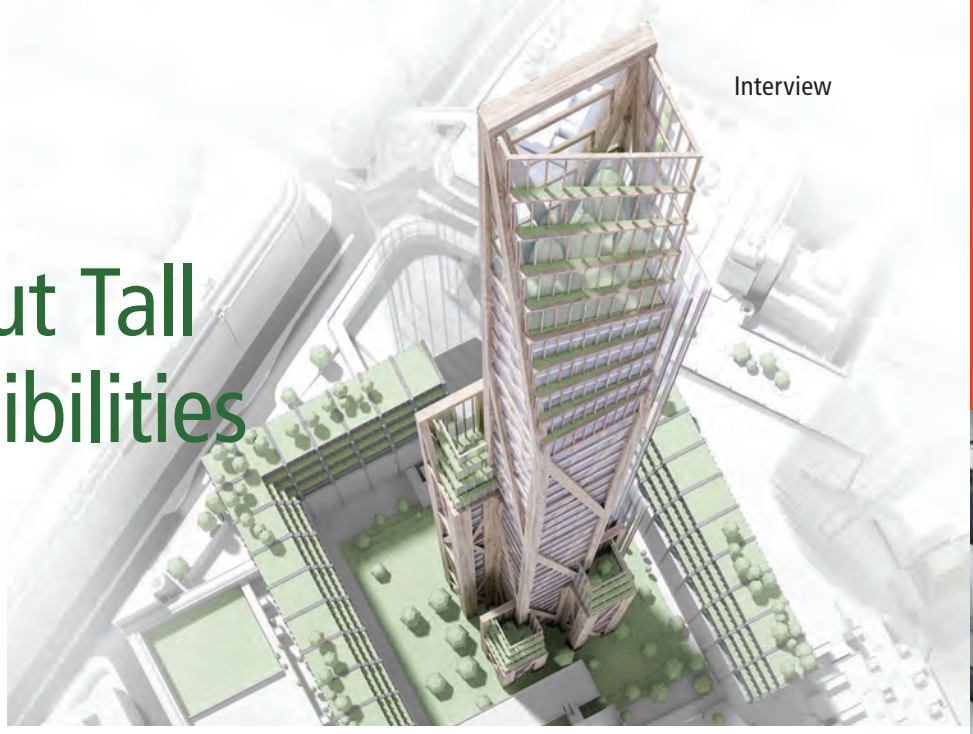
Talking about Tall Timber Possibilities



Kevin Flanagan, partner with PLP Architecture (London, UK) presented the opening keynote presentation at the 2017 Green Building Festival (hosted by Sustainable Buildings Canada) held Oct. 5 in Toronto.

Flanagan focused on two projects: The Edge, a "smart" green building located in The Netherlands; and Oakwood Tower (pictured) a feasibility study demonstrating the viability of building an 80-storey timber tower constructed with cross-laminated timber (CLT) in downtown London.

Ahead of the conference, *Canadian Consulting Engineer* spoke with Flanagan to learn more about the Oakwood Tower project and the future of timber towers.

How did the Oakwood Tower project cross your desk?

We were invited by Cambridge University to look into the use of cross-laminated timber for high-rise construction. This was about 1½ years ago, and there was very little discussion of high-rise timber—something for residential particularly—so we were just at the crest of the wave of the media interest in this particular subject.

What did you learn about CLT?

It's strength and fire resistance is considerably different than wood alone.

Solid wood can have a weakness, and forces will go to weakness. With CLT, if there are anomalies in the material they're taken away from the calculation because you're able to cross laminate the material.

It's very light and apparently can be cut with very great precision. Because it's light, you may not need the same types of foundations you would need otherwise because the building itself is not as heavy.

And it takes about 20% of the time it would take to build something out of concrete or steel. And the number of people on-site is about one-half or one-third. That's important in cities like London where it's very congested and the planning authorities restrict the time it takes to build things.

How is designing with timber different from other materials?

When you design with timber you have to think of a different kind of architecture, because the material itself doesn't take loading in the same way (as steel or concrete).

It's weak in tension and fairly strong in compression. So you have to deal with distributing the loads in a different way. What we've been doing is putting all of the loading on the outside. So you get an external frame to the building instead of an internal core. And it doesn't span quite as far, so it's very good for residential which tend to be smaller scale dimensions internally, about 3m or 4m centres, more modular structural systems.

So the architecture is responding to the material. And that's what's really interesting because this is a new material you're starting to get a new language of design.

What's unique in Oakwood Tower?

On the very base of the tower, the timbers are 2.5m x 2.5m, they're made out of sections of 1.25m x 1.25m, so the biggest columns are actually made of four parts that are brought together.

The four corners are critical to getting the building to stand up, in fact the building is its own scaffolding.

Why aren't people building with timber?

There are engineers who specialize in steel or concrete, but very few have an expertise in this type of material. And contractors are more concrete and steel oriented. So for a variety of reasons, new products are difficult to get into the market.

Can timber towers catch on?

A hundred years ago in Chicago they were constructing buildings of 12 storeys out of steel, and that's sort of where we're at now with timber.

In Europe timber is a luxury material, and Canada is one country that has a GDP that's dependent on timber, and it needs retooling (because the pulp & paper industry hasn't moved forward much). So there is a movement to use this kind of material in high-rise buildings.

The 18-storey Brock Commons Tallwood House, built at the University of British Columbia, is a tall wood hybrid building, with concrete cores for lateral resistance to wind load.

There are a number of hybrids that have come up, and mostly they're concrete masquerading as timber—that's my thought. We're at the stage where we need purity of a commitment towards the technology. **CCE**

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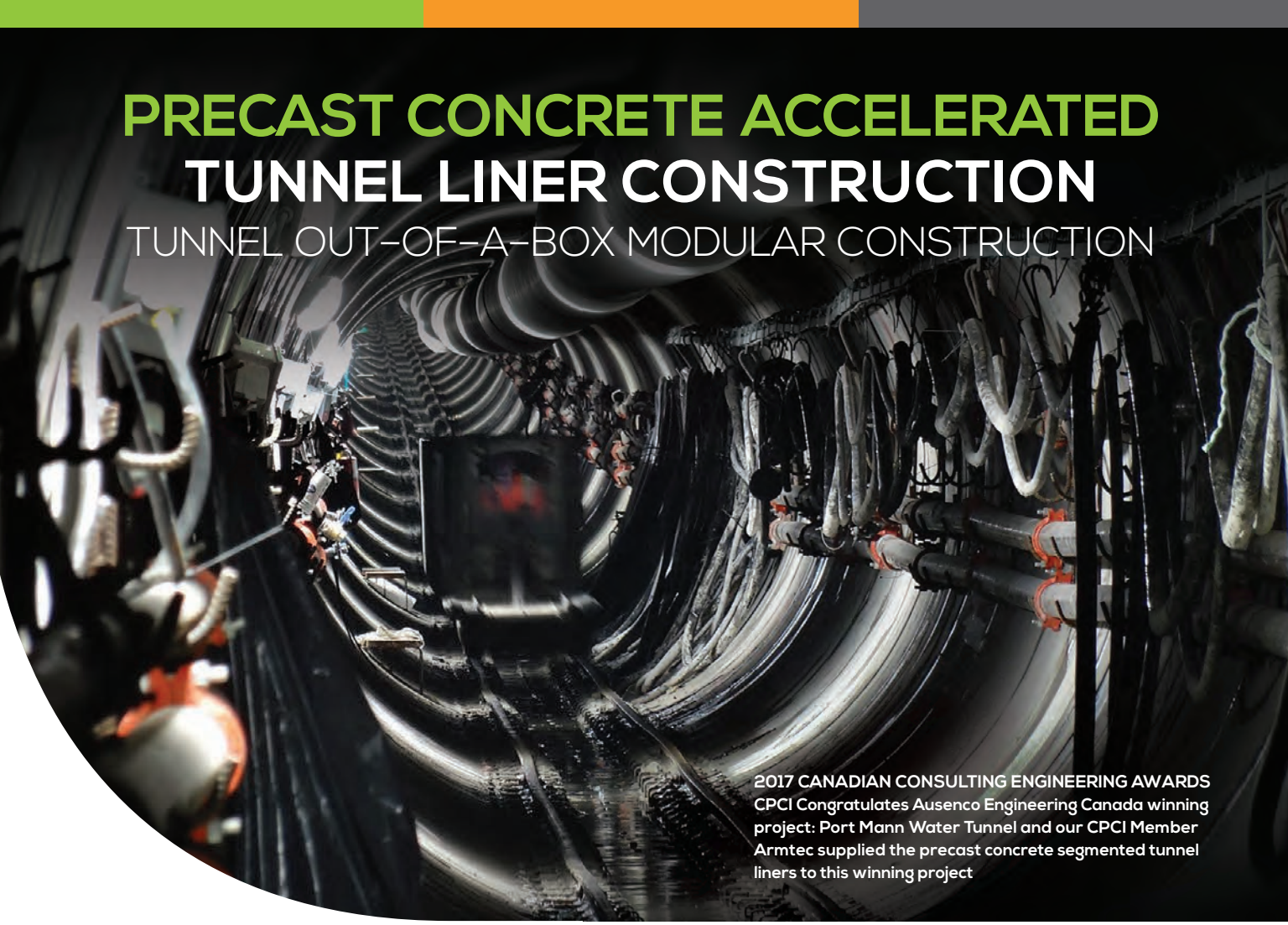

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