

CANADIAN | CONSULTING
engineer



**DEMONSTRATING
THE BENEFITS OF
BIOENGINEERING**

Tax Incentives for R&D
Energy-efficient Recladding
Public Engagement for
Infrastructure Projects

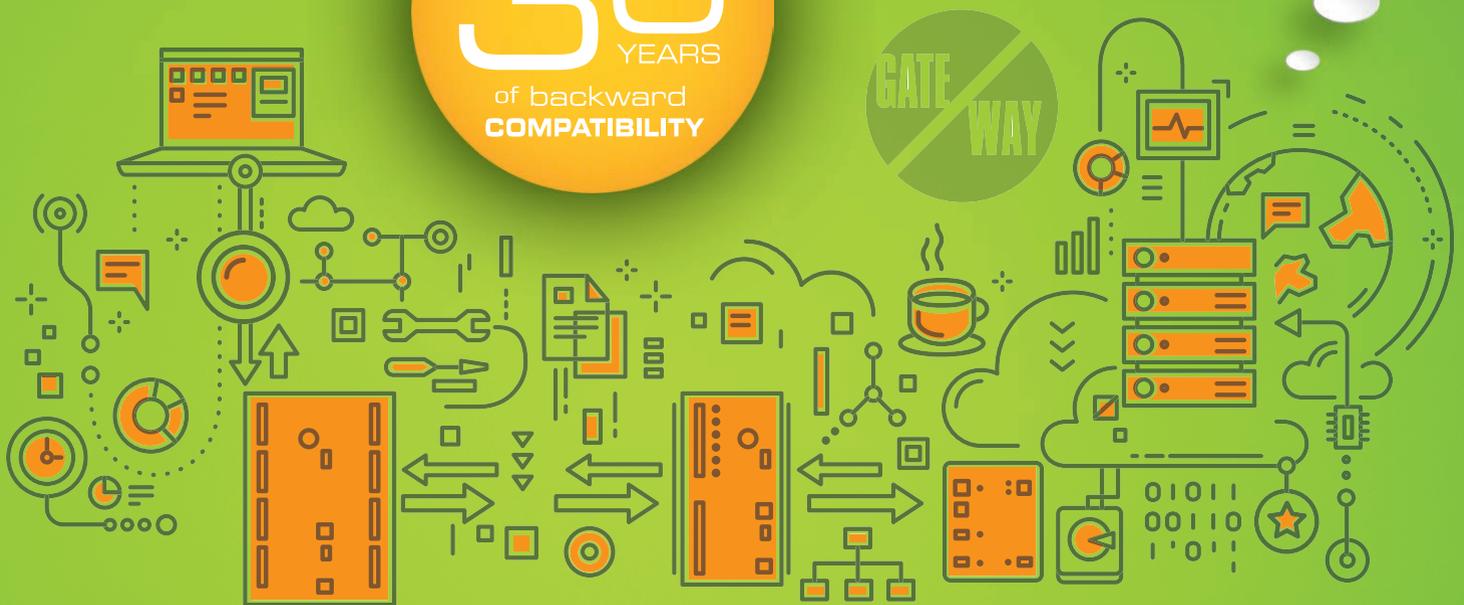
the ART of Building Sustainability



TECHNOLOGY THAT SUPPORTS
BACKWARDS COMPATIBILITY.



Will your IoT vendor abandon their legacy technology, or will they provide a way forward that maintains backward compatibility?



Better by design™

In addition to a high level of integration between HVAC, lighting, and security systems, sustainability demands other technological and supporting elements that will endure over the long term. At Reliable Controls, we provide nine important elements to help you create true building sustainability—now and into the future. One of these elements demands the use of technology that supports backward compatibility. The way manufacturers respond to new technologies highlights a fundamental challenge in the building controls industry: planned obsolescence. For decades, Reliable Controls has countered this challenge with an ongoing commitment to backward compatibility. When we develop new products and improve existing ones, our customers can be confident in a smooth transition to new technologies—without the need for third-party gateways or expensive hardware replacement. To learn more about the art of building sustainability please visit reliablecontrols.com/TABS



March/April 2021
Volume 62, No. 2



Cover photo courtesy Kerr Wood Leidal Associates
See page 16

features

Twinning Alberta's Highway 15

Planning and design were fast-tracked for a new highway bridge and architectural underslung pedestrian bridge over the North Saskatchewan River. Construction is expected to finish next year.

By Dan Morin **12**

A Net-Zero Fire Hall

A fire hall that opened in 2018 in Richmond, B.C., targeted both LEED Gold certification and net-zero emission performance, in part by using structural thermal breaks to support and insulate its cantilevered roof.

By Tracy Dacko **14**

Demonstrating the Benefits of Bioengineering

Along Alberta's Bow River, a new initiative has showcased next-generation techniques for protecting riverbanks from flooding, as an alternative to such conventional methods as rock riprap.

By Mike Gallant, P.Eng. **16**

Making the Most of R&D Incentives

Many of Canada's consulting engineers are not aware of valuable research and development (R&D) tax incentives that can be reinvested in their work, let alone how to go about claiming them.

By Richard Hoy **18**

Calculating Arc Flash Incident Energy and Boundary

It is important for electrical engineers to be familiar with IEEE 1584.1, a guide that explains steps to complete a power system study, calculate arc flash incident energy and boundary and generate a quality engineering report.

By Terry Becker, P.Eng. **22**



See page 14

departments

Comment	4
Up Front	5
ACEC Review	7
Products	28



Next issue:
Future-ready mechanical systems.

on topic

LEGAL

For consulting engineers retained to provide services in relation to public engagement for large infrastructure projects, there are many important factors to consider, including legal risks.

By Karen L. Weslowski **24**

CONVERSATION

A Natural Resources Canada (NRCan) pilot project is bringing aging community housing units in one Ottawa neighbourhood to net-zero energy performance through the addition of custom prefabricated exterior panels. **30**

Addressing COVID-19 from an HVAC perspective

While there was no co-located AHR Expo this time, ASHRAE's winter conference made the successful transition to virtual event earlier this year, reportedly drawing more than 1,800 attendees over four days and showcasing educational presentations from HVAC professionals around the world.

Running from Feb. 9 to 12, the event featured nearly 60 live sessions, 27 conference paper Q&As and more than 80 on-demand sessions. There was a heavy focus on the global pandemic, with top sessions including 'Building Operation and COVID-19: What is the Standard of Care and Who's Responsible' and 'Lessons from Managing Infrastructure through the COVID Shutdown,' for which one of the speakers was Orvil Dillenbeck, manager of site technical services at Ontario's Chalk River Laboratories (CRL) nuclear research facility, who weighed the fortunate opportunities for HVAC repairs and maintenance against the unfortunate risks of infection control.

Donald LeBlanc, manager of the National Research Council of Canada's (NRC's) climatic engineering facility, tackled the issue of whether or not mass transit can be made safe during the pandemic. This is a challenging question, he explained, given most of these vehicles' HVAC systems were not designed for the addition of high-efficiency particulate air (HEPA) filters, but such a system's minimum efficiency reporting value (MERV) rating can be increased, as long as its performance is not unduly hindered. And as a filter can only treat the air passing through it, passengers can still spread infections as viral particles travel through the untreated air between them.

"All we can ask of filtration is that it reduces the risks," he said. "It never eliminates them."

ASHRAE also used the occasion of the conference to recognize the outstanding achievements and contributions of its members, including the following Canadians, through special honours and awards:

- Elevated to the Fellow ASHRAE membership grade: John M. House, principal, John House Consulting Services, Montreal.
- Dan Mills Chapter Programs Award: Beatriz Salazar, electrical director, Smith and Andersen, Toronto.
- Exceptional Service Awards: Nicolas Lemire, P.Eng., president and CEO, Pageau Morel & Associates, Montreal (who also earned a Distinguished Service Award); Tim McGinn, P.Eng., retired, Calgary.
- Distinguished 50-Year Member Awards: John B. Bisset, P.Eng., Fellow Life Member ASHRAE, founder, Chorley + Bisset, London, Ont.; Frantisek Vaculik, Life Member ASHRAE, Nepean, Ont.
- First place in ASHRAE Technology Awards: Aaron Smith, P.Eng., Denis A. Morris and Andrew Bartlett, new educational facilities, Dalhousie University IDEA and Design Buildings project, Halifax.

Finally, the organization announced this summer's annual conference, originally scheduled to be held in Phoenix, Ariz., would instead also become a virtual event—a reminder that things are not back to normal just yet.



Peter Saunders
psaunders@ccemag.com

Reader Service

Print and digital subscription inquiries or changes, please contact
Barb Adelt, Audience Development Manager
Tel: (416) 510-5184
Fax: (416) 510-6875
email: badelt@annexbusinessmedia.com
Mail: 111 Gordon Baker Rd., Suite 400
Toronto, ON M2H 3R1

Editor

Peter Saunders (416) 510-5119
psaunders@ccemag.com

Senior Publisher

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

Media Designer

Lisa Zambri

Editorial Advisors

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

Account Co-ordinator

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

Group Publisher

Paul Grossinger (416) 510-5240
pgrossinger@annexbusinessmedia.com

COO

Scott Jamieson
sjamieson@annexbusinessmedia.com

CANADIAN CONSULTING ENGINEER

is published 6 times per year
by Annex Business Media
111 Gordon Baker Road, Suite 400,
Toronto, ON M2H 3R1
Tel: (416) 442-5600
Fax: (416) 510-6875 or (416) 442-2191

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

SUBSCRIPTIONS: Canada, 1 year \$66.00, 2 years \$106.00. Single copy \$8.50 Cdn + taxes. (HST 86717 2652 RT0001). United States \$150.00 (CAD). Foreign \$172.00 (CAD).

PRINTED IN CANADA. Title registered at Trademarks Office, Ottawa. Copyright 1964. All rights reserved. The contents of this publication may not be reproduced either in part or in full without the consent of the copyright owner(s). Annex Privacy Officer: Privacy@annexbusinessmedia.com Tel: 800-668-2374.

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

POSTAL INFORMATION: Publications Mail Agreement No. 40065710. Return undeliverable Canadian addresses to Circulation Dept., Canadian Consulting Engineer, 111 Gordon Baker Road, Suite 400, Toronto, ON M2H 3R1.

PRIVACY: From time to time we make our subscription list available to select companies and organizations whose product or service may interest you. If you do not wish your contact information to be made available, please contact us. Tel: 1-800-668-2374, fax: 416-510-6875 or 416-442-2191, e-mail: vmoore@annexbusinessmedia.com, mail to: Privacy Officer, 111 Gordon Baker Road, Suite 400, Toronto, ON M2H 3R1.

Member of the Audit Bureau of Circulations.
Member of Magazines Canada



Rendering courtesy LAC



Ottawa super-library aims for net-zero carbon

The Ottawa Public Library (OPL) and Library and Archives Canada (LAC) are making significant enhancements to their new joint facility to achieve net-zero carbon performance.

Prior to these changes, the design for the building in downtown Ottawa's LeBreton Flats district already complied with the Leadership in Energy and Environmental Design (LEED) Gold standard, which addresses ecological land and water use, energy efficiency and sustainable materials. Now, \$34.5 million in additional federal funding will also allow for:

- building envelope and insulation upgrades.
- triple-glazed windows.
- rooftop and façade solar panels.
- an indoor 'green wall.'
- additional sustainable materials.

The major infrastructure project is scheduled to begin construction this year, be completed in 2024 and officially open to the public in 2025.

This is the second major sustainable infrastructure project for LAC; it is building a new net-zero carbon preservation facility in Gatineau, Que., which is set to open next year.

Golder to lead closure of Ontario's only diamond mine

De Beers Group has appointed Golder as prime contractor for the closure of the Victor Mine, Ontario's first and only diamond mine, which operated from 2008 to 2019 in the James Bay Lowlands, some 90 km west of Attawapiskat First Nation.

The work will include demolish-

ing the open-pit mine's remaining infrastructure and rehabilitating the remote (fly-in/fly-out) site. Golder will offer employment opportunities for nearby Indigenous community members in the day-to-day management of the site, including direct hiring of labourers and operators and company contracts for security, cleaning and catering, among other services. Both Golder and De Beers will provide skills training and business development to serve the community after the mine's closure.

Photo courtesy De Beers Group



"Golder has a strong track record of successful closure and rehabilitation of industrial sites around the world, including working with local communities where they operate," says Maxwell Morapeli, De Beers' head of asset retirement. "We look forward to benefiting from their experience as we continue the responsible closure of Victor mine."

The closure project mobilized Golder's team—including construction, environmental and mining specialists—to the site earlier this year and the work is expected to continue to 2023.

Saskatchewan names team for Westside irrigation canal

The government of Saskatchewan has named the engineering team for

its Westside irrigation canal project, which comprises Clifton Associates, Associated Engineering (AE) and Stantec.

The team will be led by Regina-based Clifton. The work will encompass the first stage of the Lake Diefenbaker irrigation expansion, the largest infrastructure project in the Saskatchewan's history, which is intended to double the province's amount of irrigable land.



Photo courtesy Associated Engineering

Over the next 12 to 18 months, the team will complete an overall preliminary engineering design for the first and second phases, which will inform geotechnical, soil suitability and geographical mapping, environmental services and extensive consultations with First Nations and other stakeholders.

"This legacy project will reinforce Saskatchewan's position as a leader in global food security, while building on the vision made possible by the creation of Lake Diefenbaker half a century ago," says Wayne Clifton, CEO of the firm that carries his name.

The first phase will rehabilitate and expand the canal system to increase irrigable land by 80,000 acres. The second phase will further build out the project, adding 260,000 acres. Finally, the third phase will build out the Qu'Appelle south water conveyance project, adding an estimated 120,000 acres.

NRCan helps fund Fast + Epp's mass-timber HQ

Natural Resources Canada (NRCan) announced funding support for construction of consulting engineering firm Fast + Epp's new head office, through the Green Construction through Wood (GCWood) Program.



Photo courtesy Fast + Epp

The four-storey mass-timber hybrid office is being built in Vancouver.

Federal minister of digital government Joyce Murray visited the site in early March to announce \$648,250 in support.

“The building will serve as a living lab, with ongoing thermal, moisture and vibration monitoring,” says Fast + Epp partner Paul Fast. “It will also house a concept lab, where physical testing of mass timber components will take place.”

The GCWood Program, first announced with the federal government’s 2017 budget, encourages the use of wood in non-traditional construction projects, including tall and low-rise non-residential buildings and bridges. It has made \$39.8 million available over a four-year period, starting in 2018-2019, with non-repayable contributions to projects’ eligible incremental costs for demonstrating innovative wood products and systems.

Engineering firms represented in nominations for 2021 WIN Awards

The Women’s Infrastructure Network (WIN) announced the nominees for its 2021 awards program, including many professionals at Canadian consulting engineering firms. Nominees for Emerging Leader include:

- Christina Addorisio, associate director, Turner & Townsend.
- Bailey Arnott, structural engineer, WSP Canada.
- Annie Batsaikhan, senior cost consultant, Turner & Townsend.
- Marie-Eve Belzile, infrastructure maintenance manager, SNC-Lavalin.
- Marie-Pier Charbonneau, senior legal counsel, SNC-Lavalin.

- Ann Clancy, manager (infrastructure and environmental management), Hatfield Consultants.
- Louise Curran, senior cost consultant, Turner & Townsend.
- Christina Fletcher, advisor, Collings Johnston.
- Harminder Kaur, associate director, Turner & Townsend.
- Anita Le, project manager and group leader, Jacobs.
- Dayna Peloquin, structural engineer, WSP Canada.
- Michelle Saumure, structural engineer and project manager, WSP Canada.
- Christine Tschetter, director of project services, RAM Engineering.
- Jessica Wheatley, project engineer (infrastructure), WSP Canada.
- Adrienne Willoughby, process engineer, Jacobs.

Meanwhile, nominees for Outstanding Leader include:

- Amrita Banerjee, senior project manager (highway design), Binnie.
- Jo Balmer, associate (program and project manager), Arup Canada.
- Luba Ebert, director of project delivery, RAM Engineering.
- Karen Freund, vice-president (VP) and geographic sales manager for Canada, Jacobs.
- Sarah Howard, manager (buildings/structures), WSP Canada.
- Arielle Kadoch, sector leader (transmission and distribution power delivery in Canada and for North American export), Stantec.
- Karen McMillan, senior manager (infrastructure management), Hatfield Consultants.
- Kerra Mruss, manager (transportation planning), WSP Canada.
- Tamar Nalbandian, manager (mechanical and electrical engineering), WSP Canada.
- Tamsin Silvester, director (transportation systems), WSP Canada.
- Jennifer Stephenson, senior engineer and project manager (buildings/structures), WSP Canada.

WIN will present both awards at a virtual event on Apr. 29.

COMPANIES

CIMA+ acquires Groupe-conseil TDA

CIMA+ has acquired Groupe-conseil TDA (TDA Consulting Group), headquartered in Baie-Comeau, Que., which has more than 70 employees, including engineers, technicians and senior managers. The acquisition brings the total number of CIMA+ employees to more than 2,400 and expands its presence in Quebec’s North Shore region.

Hatch celebrates 65 years

Hatch, headquartered in Mississauga, Ont., is continuing to mark its 65th anniversary in 2021. The firm was founded in Toronto in 1955 as W.S. Atkins & Associates. Early projects included Toronto Transit Commission (TTC) subway tunnels and the Quebec Iron & Titanium (now Rio Tinto) metallurgical complex in Sorel-Tracy, Que. Gerry Hatch joined in 1958 and the company was renamed Hatch in 1962. Today, the company has grown to encompass more than 9,000 employees in more than 70 offices around the world.

Englobe acquires Terraprobe

Englobe, which specializes in soil, material and environmental engineering and has offices across Canada and Europe, has acquired consulting engineering firm Terraprobe, headquartered in Brampton, Ont. The companies have partnered on projects in the past. The acquisition increases Englobe’s presence in the province’s Hamilton-Niagara Peninsula region, provides additional support to its own office in nearby Brantford and adds approximately 200 employees.



CHAIR'S MESSAGE

COVID One Year Later: Optimism Grows But Uncertainty Remains



It has now been a year since the start of the COVID-19 crisis. While the consulting engineering industry has been able to sustain itself over the last 12 months, compared to other sectors, there is continued uncertainty and concern regarding the coming construction season and beyond. Recovery of the current economic crisis will require a major stimulus - and no form of stimulus is more effective than infrastructure. However, this will require significant and timely investment by the private and public sectors.

In support of its members, ACEC-Canada has long advocated for predictable, sustained infrastructure investment to ensure the consulting engineering industry and its partners in construction can maintain capacity. It is a message that is critical now more than ever for the government to hear and understand as it develops its plan for post-COVID economic recovery.

In the past months, various announcements that touch on and include infrastructure investments have been delivered by the government. The programs announced to date have reflected an emphasis on achieving climate change goals and developing a green economy. While ACEC-Canada agrees with the government that there is a unique opportunity to invest in “transformative” projects, it is also an opportunity to strengthen the economy by closing the infrastructure deficit. In fact, investing in core infrastructure is necessary to provide the economic capacity for the success of these transformative projects. Core infrastructure can be developed sustainably while also creating jobs, stimulating the economy, closing the infrastructure deficit and making investments in transformative projects economically viable in the long-term. Also, core infrastructure can address immediate needs in smaller, remote and/or Indigenous communities.

It is also important that these investments be made in a timely manner. While there is no doubt that the federal government has made significant commitments to infrastructure, many programs were significantly back-end loaded, with large amounts of investment planned for the later years of the programs. These are already committed funds that could make an important difference now, rather than in three or four years.

Along with ACEC-Canada President and CEO John Gamble and Vice-President Martine Proulx, I recently had the opportunity to meet with Infrastructure and Communities Minister Catherine McKenna and her

team. This provided us with an opportunity to directly make our case to balance core and transformational investments and to accelerate current commitments in order to inject much needed money into the economy sooner, providing much-needed stimulus to strengthen the post-COVID recovery while closing the infrastructure deficit more quickly to strengthen the economy in the longer term. Furthermore, this could more evenly distribute the investments year-over-year, which would help our industry and our municipal partners to manage resources and capacity.

Minister McKenna, acknowledging the knowledge, expertise and practicality of our members, recognizes that our industry is willing and well-positioned to help government achieve its infrastructure goals. Some areas in which ACEC-Canada and its members' expertise can be of particular assistance include supporting government plans for a national infrastructure assessment and identifying effective, industry-recognized best practices for sustainable engineering (such as Envision or re-instituting the National Guide to Sustainable Municipal Infrastructure). ACEC-Canada has also offered to facilitate a Canada-wide roundtable of experts in delivering infrastructure to help the Minister achieve the government's infrastructure goals.

The ACEC-Canada team based in Ottawa continues to follow up with Minister McKenna and officials at Infrastructure Canada to identify ways of collaborating toward effective and efficient infrastructure programs that not only support our industry but, more importantly, also improve the economic, social and environmental quality of life for all Canadians.

It is worth noting that we are not alone in our advocacy. We joined with our stakeholder partners as the *Building for Recovery* coalition in order to educate policy and decision makers on the importance of the design and construction sector and the important role it can play in rebuilding our economy. For this edition of *ACEC Review*, we talked to our partners at the Canadian Construction Association, the Nation Trade Contractors Council of Canada and the Allied Equipment Distributors about the coalition and how we can help lead Canada out of the pandemic toward a better future for Canadians. I encourage you to visit the *Building for Recovery* website (www.buildforrecovery.ca) and add your voice to this campaign.

ANTHONY KARAKATSANIS, P.ENG.
CHAIR, BOARD OF DIRECTORS, ACEC-CANADA

IN DISCUSSION

with

ACEC

In *Discussion with ACEC* is a series of informal conversations between ACEC-Canada, government decision makers and business leaders. In this edition, ACEC-Canada speaks to the Building for Recovery coalition, formed to put pressure on elected officials to get committed infrastructure funding flowing and help rebuild the Canadian economy in the wake of COVID-19.

The coalition includes ACEC-Canada, the Associated Equipment Distributors (AED), the Canadian Construction Association (CCA) and the National Trade Contractors Council of Canada (NTCCC).

About the Canadian Construction Association (CCA)

CCA is the only national association representing contractors (general, trade, civil) and manufacturers, service providers and suppliers in Canada. Backed by 20,000 member firms drawn from 63 local and provincial integrated partner associations, CCA gives voice to the public policy, legal and standards development goals of contractors, suppliers and allied business professionals working in or with Canada's institutional, commercial and industrial (ICI) construction industry.

About Associated Equipment Distributors (AED)

AED is the international trade association representing companies that sell, rent, service and manufacture construction, farm, energy, mining, forestry and industrial equipment and related supplies. The Canadian equipment distribution industry, which is dominated by small-medium-sized, family-owned businesses, has more than 420 locations across Canada that employ over 27,000 workers and accounts for at least \$8 billion in annual economic activity.

About the National Trade Contractors Council of Canada (NTCCC)

NTCCC represents the best interests of the trade contracting sector in Canada in the context of the industry as a whole. NTCCC's member associations represent over 12,000 firms across Canada. The Council has identified several key projects of focus: prompt payment legislation, both federally and provincially; supporting the use of unaltered forms of industry-accepted standard forms of contracts; improvement of drawings and the impact on construction efficiency; and support for industry-wide acceptance of a national change order standard, combined with a national education/awareness program.

To learn more about Building for Recovery and its stakeholder organizations, visit www.buildforrecovery.ca.

What is the most important thing the federal government can do to leverage infrastructure investments?

CCA - The federal government must ensure committed infrastructure funding is fully allocated. In addition, by ensuring timely approvals are delivered to projects, the government can stimulate the economy as we head into pandemic recovery. The evidence – like that of the Public Policy Forum in their report, *Building the Future: Strategic Infrastructure for Long-Term Growth* – shows that for every dollar invested in public infrastructure, governments can expect to see a return in investment of two to four dollars. It creates immediate employment and, more importantly, it also creates new resources and opportunities for communities. From roads to housing to broadband to hospitals, infrastructure benefits everyone. These investments improve social, economic and environmental quality of life for all Canadians and fuel economic growth for decades to come. With federal and provincial governments working in collaboration with Canada's construction sector, we can ensure that we build back a stronger, more resilient country from the pandemic. The time is now to deliver on billions of dollars of investments, so that we can start to rebuild our economy.

AED - Despite the need for stimulus and the billions of dollars of existing infrastructure commitments, many of



BUILDING FOR RECOVERY

these commitments are aren't planned for several years. And many of the current commitments have been slow to roll out. Delays in getting projects started is a missed opportunity to inject much needed stimulus into the economy while closing the infrastructure deficit and improving the quality of life for Canadians. The Parliamentary Budget Officer recently expressed concern that the federal government is behind in its investments through the *Investing in Canada* plan by over \$2 billion. Now is the time to deliver on these commitments. We need to catch up to spur economic growth, create jobs and provide confidence to the industry and the private sector. When the construction sector is working, all other parts of the Canadian economy are also growing.

NTCCC - The federal government's *Investing in Canada Plan* appropriately seeks to leverage infrastructure investments to improve communities and create opportunities for more Canadians over the long term. Considering the impact of COVID-19 on the economy, the plan should allow additional flexibility for project selection and give immediate priority to infrastructure that grows the economy, creates jobs and re-energizes local communities. Supporting a broad base of infrastructure will also provide the economic capacity to invest in long-term, transformative projects, while providing support to small communities that often most need it. Investing in infrastructure to help Canada build

back better also presents an opportunity to eliminate the infrastructure deficit, noted as recently as 2019 in the *Canadian Infrastructure Report Card*. Growing the economy will be essential to making further investments in community and social infrastructure more viable in the long term and ensuring the design and construction sector remains stable should future outbreaks occur in the shorter term. The construction sector is ready to rebuild Canada's economy, but all levels of government must deliver on infrastructure investments now to get projects started.

What are some of the risks associated with delayed construction projects? Likewise, what are some of the benefits in better supporting the industry with timely approvals?

CCA - Canada's construction industry continued to operate throughout COVID-19 with relatively little disruption. As such, it is well-positioned to be on the frontline of Canada's economic recovery, but delays to existing and future projects can have immense drawbacks. Without predictability on project timelines, it is difficult for firms to bid accordingly, which can cause severe issues of sector capacity if projects are being awarded in boom/bust cycles. This has a further impact on workforce retention – workers cannot be expected to remain idle for lengthy periods of time, especially when there is such a high demand for

skilled labour in many different industries. It also stanches the industry's continued capacity for innovating and improving upon existing methods. A clear, balanced and flexible pipeline of projects will create jobs, enhance communities and ensure stability in the Canadian economy going forward. Beyond new builds, the *2019 Canadian Infrastructure Report Card* warned that Canada is facing a serious infrastructure deficit, with seven different asset categories defined as needing urgent upgrade or repair. The timely approval of projects and swift rollout of existing funding is critical in addressing these issues and will have long-term benefits on communities. Studies also show that every dollar invested at key points in an asset's life cycle results in six to 10 dollars in savings later. An ample supply of projects in uninterrupted cycles also helps our firms to continue our workforce training and recruitment efforts.

How has the pandemic affected supply chains in the United States and Canada and what can be done to better address gaps in the system?

AED - While the pandemic has impacted the equipment supply chain in several ways, it is important to note that prior to COVID-19, it was already strained. Increased machinery demand resulted in longer lead times than those to which the industry was accustomed. The situation was exacerbated by trade and tariff issues,



including the uncertainty surrounding the Canada-United States-Mexico Trade Agreement, which was only finalized in 2020. During the pandemic, manufacturers were forced to significantly reduce operations due to public health requirements, resulting in even longer lead times on equipment orders. Shipping capacity in many areas is overwhelmed, delaying product delivery, and ports have had significant backlogs. Meanwhile, in both Canada and the United States, construction work continued.

To alleviate the strain on the heavy equipment supply chain, first, the COVID-19 pandemic must be resolved. Defeating the virus will allow manufacturers to increase workforce and production. Additionally, governments at all levels must resolve the uncertainty surrounding infrastructure funding and spending. Otherwise, contractors postpone equipment purchases, which impacts how distributors stock and maintain inventory. Long-term predictability in infrastructure investments will allow manufactur-

ers to adequately meet market demand and distributors to maintain proper inventory levels to fulfill the needs of its customers—the companies building and maintaining vital infrastructure.

What are the benefits of having a predictable pipeline of skilled jobs on communities, families and economic recovery at large?

NTCCC - Trade contractors are, for the most part, small to medium size businesses that depend on a steady cash flow to operate. A stable stream of jobs and projects allows them to grow their workforces by bringing on apprentices because they will have confidence in having a sustainable workflow. This is an economic win-win-win for the industry, for our communities and for Canadians at large.

When there is uncertainty regarding projects, whether it be delays or cancellations, trade contractors will immediately reduce their workforce, as they are unable to maintain employees on the payroll who are not actively working. With continued uncertainty, it is likely that contractors will continue to operate with a reduced workforce, leading to less economic opportunities overall. Additionally, they will reduce investment back into their business to maintain liquidity to deal with a volatile or uncertain flow of projects. This reduces employment and puts pressure on the ability to train new apprentices. And it is trade contractors that employ 80% to 90% of workers on any given job site. Their ability to take on and train new apprentices is critical to ensuring workforce availability in construction. It also creates uncertainty in the workforce, as there is less assurance of long-term work and fewer available jobs, reducing total wages flowing into households and, consequently, household spending. The reduced employment opportunities impact communities at large, as construction is a large employer across Canada.

When private and public sector investment does start flowing following a contraction, contractors are faced with and must respond to a rapid increase in demand. This often generates economic overextension and solvency issues, since trade contractors generally finance the first 60 days on the job and require cash flow to take on new work. Often, they become stretched too thin and solvency issues occur. If the flow of work and project were steady, it would create better financial health for trade contractors, construction workers and their families, as well as the communities where they live.

I N N O V I A

Succession planning: Building resiliency for the future

By Rowley Mossop, Principal, Innovia

innoviapartners.com

Over the past year, we have been advising clients to use the pandemic as an opportunity to double-down on organizational design and building resiliency. More recently, however, we have witnessed an appetite for one service in particular: succession planning.

While Covid upended business as usual, it didn't alter the fact that every firm will eventually change hands. Some principals have found that their assumptions about succession didn't hold up under the pressures of the downturn. Business owners are not only concerned with ensuring their financial security, but also a horizon of leadership that will safeguard the future of the companies they've worked so hard to build.

The earlier that owners begin planning, the greater the probability of success; this is even more true in the face of increased risks. Developing an effective succession plan entails taking an integrated look at business strategy, people, and finances. Leaders who understand succession planning as a value-building process for the long game will see near-term advantages: by proactively raising the expertise of their staff, they are creating meaningful career pathways, increasing their firm's ability to grow and pursue strategic opportunities, and ensuring long-term sustainability.

WOMEN IN CONSTRUCTION

To celebrate International Women's Day, eight of Canada's leading construction media brands teamed up to deliver an exclusive virtual event. You can view the content on-demand, and stay on top of news throughout the year, at women-in-construction.ca.

THANK YOU TO OUR SPONSORS



PLATINUM SPONSOR

JOHN DEERE

GOLD SPONSORS

LIEBHERR PROCORE®

SILVER SPONSORS

BKT

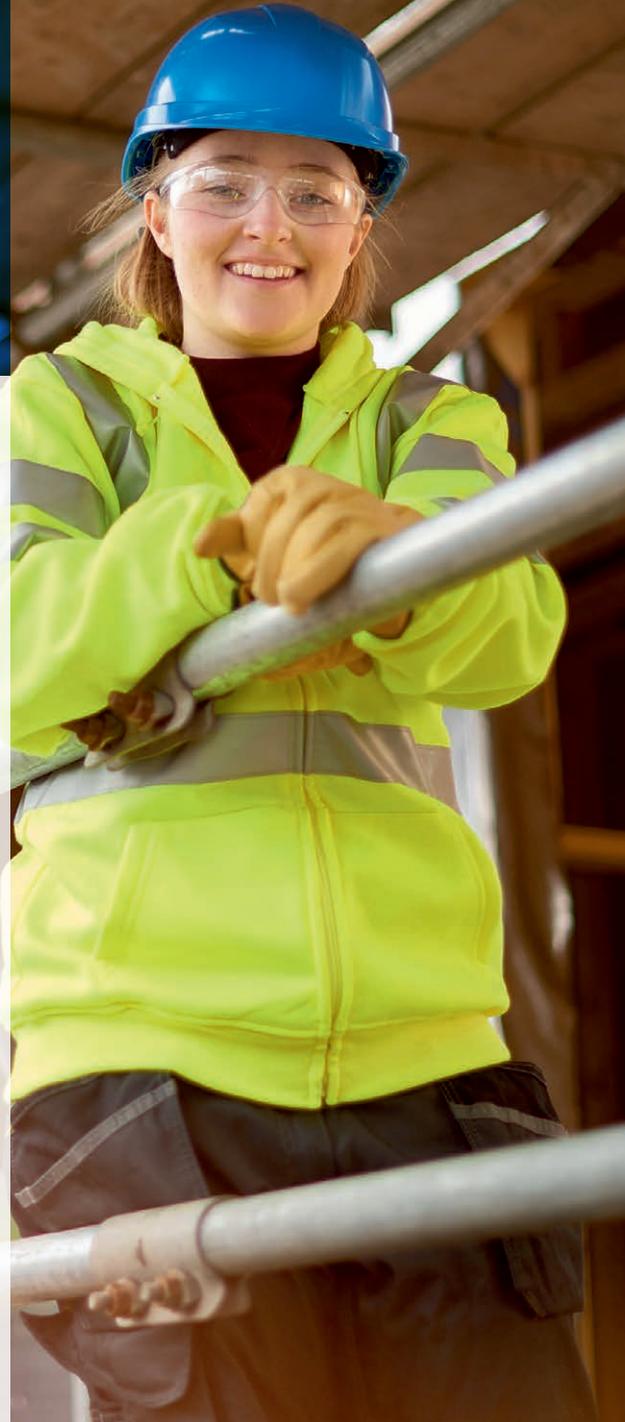
GROWING TOGETHER

GRAHAM

BRONZE SPONSOR

SKYJACK

simply reliable



PRESENTED BY

CONTRACTOR

CANADIAN CONSULTING
engineer

Crane & Hoist
INTERNATIONAL CANADA

RENTAL
POWER

FENESTRATION
CANADA'S WINDOW AND DOOR MAGAZINE

GC
GLASS CANADA

On-Site
CANADA'S CONSTRUCTION MAGAZINE

ROCK-ROAD

Twinning Alberta's Highway 15

Planning and design were fast-tracked.

By Dan Morin

The twinning of Highway 15 near Fort Saskatchewan, Alta., is adding a new 330-m long highway bridge and architectural underslung pedestrian bridge over the North Saskatchewan River, along with roadway, retaining wall and other bridge work on both sides of the river.

Planning and detailed design, completed in 2019, were fast-tracked to address congestion and safety issues for this important corridor between Edmonton and Alberta's Industrial Heartland. AECOM's Edmonton team served as prime consultant and delivered the design within 14 months by working collaboratively with stakeholders. Projects of this magnitude typically take upward of three to four years to plan and design.

Alberta's ministry of transportation challenged AECOM with the aggressive schedule, which called for an innovative approach to project management and risk management. Both parties realized the traditional planning and design process needed to be modified to reduce timelines without compromising on technical attention to detail and reporting requirements. The project relied upon regular discussions with the City of Fort Saskatchewan, Sturgeon County, the River Valley Alliance, utility companies, regulatory agencies, CN Rail and private landowners.

Construction began in 2019 and should finish in 2022.

The need for improvement

The twinning of Highway 15 will provide wide-reaching and long-lasting benefits for Albertans. Improved access will help support the economic growth of the region, where planned development includes two multi-billion-dollar petrochemical facilities. Reduced travel times will benefit not only commuters to the Industrial Heartland, but also agricultural producers and businesses across Fort Saskatchewan, Sturgeon County and Strathcona County.

Indeed, the project is important for the efficient movement of goods and people throughout the entire Alberta Capital Region and beyond, which is why the provincial

government fast-tracked its delivery.

The existing river bridge carried just one lane of undivided traffic in each direction, resulting in a significantly substandard level of service, given the volume of 23,000-plus vehicles per day—more than 50% higher than in 2009 and continuing to grow.

In the past, collisions often resulted in the entire bridge being closed to vehicles, which made for long lines of traffic, with no nearby alternative for crossing the river and restricting access for emergency services. The twinning will improve safety and reduce disruption caused by accidents.

The underslung pedestrian bridge, meanwhile, will provide an important link for pedestrians and cyclists between an existing trail network within Fort Saskatchewan and a recently constructed trail that runs along the west side of the river in Sturgeon County.

Design challenges

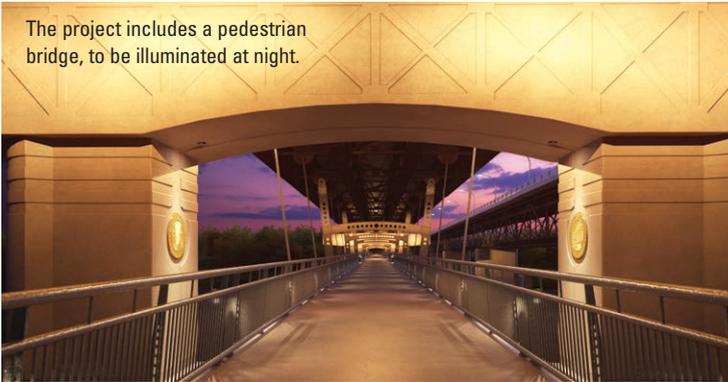
The roadway's vertical alignment design was very challenging to meet the clearance requirements of the existing overpasses on both sides of the river and the freeboard to the underslung pedestrian bridge. This challenge was addressed with an innovative superstructure arrangement, with tapered girders along three of the five spans.

With the pier locations selected to optimize the structural efficiency of the tapered superstructure, the piers were positioned away from the deepest portion of the river. This would reduce the project's in-stream work, construction risk, scheduling, costs and environmental footprint.

Technical innovation also extended to a number of the bridge details, including casting the deck expansion joints into position after all joint rotations to better support superimposed dead loads and significantly reduce structural fatigue for the joint fingers. The slender structure of the underslung portion, meanwhile, was designed to mitigate vibrations and resonance.

Highway twinning beneath an existing CN Rail bridge

The project includes a pedestrian bridge, to be illuminated at night.



required AECOM to design two additional bridge lengthening spans while allowing the railway to maintain operations throughout construction. This required careful co-ordination planning.

On the east side of the river, the highway's design was widened from two to four lanes within a constrained urban corridor. Soil nail retaining walls were specified from the top down to retain the fills at the abutments of two city bridges. This design concept meant these bridges could be kept, rather than replaced, thus reducing the project's cost and impact.

Environmental impacts

The project team's environmental goals included minimizing impacts, securing all approvals and leaving a long-lasting benefit.

The most significant environmental impact identified was constructing the new river bridge piers, which use earthen berms for access. The design team was conscious to minimize the number of permanent piers in the river compared to the existing bridge, to reduce permanent habitat loss for fish. The team also specified minimal construction and materials to limit turbidity during berm installation.

Further, the underslung pedestrian bridge will offer a sustainable transportation option over the river for cyclists and pedestrians and provide a key connection for the River Valley Alliance's 'Ribbon of Green' vision, which calls for a continuous network of river valley trails from Devon to Fort Saskatchewan.

Reducing risks

Reducing construction risk was another key goal. This was achieved by

prequalifying general contractors, based on the specific attributes required for the project.

In addition, AECOM ensured all utility crossing agreements and environmental permits were secured prior to the awarding of the construction contract and mitigations were in place for risks during construction, such as scour of the existing bridge piers. **CCE**

Dan Morin is a project manager for AECOM.

Tt TETRA TECH

Leading with Science®

Tetra Tech's scientists and engineers are developing sustainable solutions for the world's most complex projects. With more than 3,500 employees in Canada and 20,000 associates worldwide, we have grown to become one of North America's largest engineering firms.

tetrattech.com |



A Net-Zero Fire Hall

Structural thermal breaks help reduce energy consumption.

By Tracy Dacko

In 2018, a new fire hall opened in Richmond, B.C., replacing an older building. Its design targeted LEED Gold certification and net-zero emission performance, in part by using structural thermal breaks to support and insulate its cantilevered roof.

Flagship facility

Located on the western edge of Richmond's civic precinct, the three-storey, 24,240-sf Brighthouse Fire Hall No. 1 is the flagship facility for the city's fire-rescue department, serving a region that includes Vancouver International Airport. The building includes four fire truck apparatus bays and training areas on the ground floor, living quarters on the second floor and administrative offices on the third floor.

The building's functions require fire-rated masonry construction. The design team, including consulting

engineering firm Fast + Epp, wrapped a stout reinforced concrete shell in a brick veneer for the first two levels. The third storey, resting on top of this plinth, has a steel frame structure, accommodating an open window-wall system. The administrative offices are recessed by balconies on three sides.

To support the roof, six wide-flange steel beams span the length of the structure and cantilever 6 ft beyond the north side. On the south side, the roof slopes upward and cantilevers 18 ft to shade one of the balconies.

A cross-laminated timber (CLT) roof deck serves as a structural plate that spans the beams and provides a warmer wood-finish material for the underside. CLT, composed of dimensional lumber glued in perpendicular layers, is growing in popularity for floor plates, roof decks and shear walls because of its esthetic appeal and low

carbon footprint.

"We saw the fire hall building as a gateway to the public sphere," says Steve DiPasquale, project lead for Vancouver-based HCMA Architecture + Design, another member of the team. "We wanted a dramatic gesture, so we designed the cantilevered roof to serve as a marker for the pedestrian route that winds through a civic complex and terminates at City Hall."

Preventing heat dissipation

One of the project's goals was to reduce energy consumption by more than 50% compared to a baseline building, as specified by Canada's Model National Energy Code. Although the fire hall predates British Columbia's newer Energy Step Code, it nevertheless adheres to that code's mission of achieving net-zero performance by 2032.

Photos courtesy HCMA Architecture + Design

To achieve this goal, the design team specified efficient insulation, heat recovery ventilator (HRV) systems and an air-to-air heat pump. Unfortunately, energy modelling also revealed significant heat loss through steel beams penetrating the building envelope.

“We looked at several systems to create a thermal break in the beams, including a custom design, but we weren’t getting a big reduction,” says Ian Boyle, a principal structural engineer at Fast + Epp.

The firm had successfully used structural thermal breaks on projects in much colder climates. Boyle proposed using the same approach for the fire hall.

The resulting roof design incorporates 60 steel-to-steel structural breaks to thermally separate the six wide-flange beams on either end, penetrating the building envelope from the interior to the exterior. In addition to reducing heat loss through the steel beams, this approach provides structural support for both the long and short cantilevers. Specifically, six structural thermal break modules were used on each 18-ft cantilever and four on each of the 6-ft cantilevers.

In the steel-to-steel thermal breaks, stainless steel components penetrate R-15 insulation blocks, enabling the necessary structural integrity, while reducing heat transfer by up to 75%.

“This approach uses stainless steel instead of mild steel threaded rods and bolts,” Boyle explains. “Stainless steel is about 70% less thermally conductive than mild steel.”

An added benefit of the material is corrosion resistance.

Providing resilience

Another special requirement for a fire hall is the capability to serve as a post-disaster facility. Regulations mandate specific structural, mechanical and electrical guidelines to ensure the facility remains functional after earthquakes and other calamities.

This need, too, informed the specification of the thermal breaks, since cantilevered steel structures—such as



The beams are reinforced at the connection point of the steel-to-steel structural thermal breaks, which are positioned in line with the wall assembly.

balconies, canopies or roofs—present the danger of introducing moisture into the wall assembly, when warmer, moist air condenses on the cooler surface of the steel.

“As a steel beam passes from the interior to the exterior, a thermal break reduces the risk of condensation forming in the middle of the wall assembly,” DiPasquale explains. “Otherwise, once the assembly starts to fail, water ingress and other moisture related problems can develop.”

The combined goals of energy efficiency and resilience called for careful focus by the design team.

“The large cantilever isn’t your everyday thermal break,” says DiPasquale. “We worked closely with consultants in the planning and design phases and then made sure the details were executed well in the field. Even if you have a building that’s well-insulated, if those details don’t perform, you can really lose efficiency.” **CCE**

Tracy Dacko is marketing manager for Schöck North America, which engineers structural thermal breaks.

DO IT ONCE • DO IT RIGHT • DO IT DENSO

COLD AND HOT APPLIED BITUMEN JOINT SEALING TAPE

Re-Instatement Tape and Densoband are polymer modified bitumen tapes for long-term sealing between existing materials and new asphalt installations



Denso North America Inc.

LEADERS IN CORROSION PREVENTION & SEALING TECHNOLOGY

(416) 291-3435 | sales@densona-ca.com

www.densona.com



Demonstrating the Benefits of BIOENGINEERING

Calgary's 'living laboratory' openly shares new findings.

By Mike Gallant, P.Eng.

For Alberta, the Bioengineering Demonstration and Education Project (BDEP) is a significant initiative that showcases next-generation techniques for protecting riverbanks from flooding, as an alternative to such conventional methods as rock riprap. About 100 trees, 2,300 shrubs and 30,000 live cuttings were planted to improve riparian (*i.e.* aquatic-terrestrial) health.

Alberta Environment and Parks partnered with the City of Calgary to undertake the BDEP to mitigate impact to fish habitats and improve riparian health along a 680-m stretch of the Bow River in the community of Inglewood, in the wake of a 2013 flood recovery program.

As design lead and engineer of record, Kerr Wood Leidal Associates (KWL) of Calgary completed the project's design in collaboration with Hemmera Envirochem (prime consultant), Terra Erosion Control (bioengineering specialist), Polster Environmental Services (bioengineering specialist), O2 Planning & Design (landscape architect), and Thurber Engineering (geotechnical engineer) between July 2016 and September 2017, followed by construction by DFH Enterprises from February 2018 to June 2019.

The project successfully showcased

both common and new techniques and openly shared its documentation, research findings and performance monitoring results through a municipal website, www.calgary.ca/BDEP, which was launched in 2020.

Novel techniques

Bioengineering is still an emerging field in Canada. In Alberta, specifically, with a low rate of vegetation survival (typically only around 50%), projects have not always been successful.

The BDEP, however, demonstrated how higher vegetation survival rates could be achieved using best practices. Indeed, through focused attention to vegetation design, installation and maintenance, performance monitoring shows the BDEP's rate of vegetation survival is 80%.

This was accomplished by implementing 14 different techniques at 10 treatment areas with a variety of hydraulic, geotechnical and environmental conditions. Of these techniques, half were novel to Calgary, including:

- three new techniques for vegetating existing riprap bank protection works to enhance aquatic habitat, wildlife passage, riparian health and esthetics.
- a new vegetation preparation technique

to allow for summer construction, when live cuttings should not be used, to provide construction schedule flexibility.

- a new scour protection technique equivalent to riprap that uses only vegetation and locally available materials.
- a new technique that combines live cuttings with rooted plants to increase biodiversity, wildlife habitat and nitrogen fixing.
- a new technique that incorporates submerged refuge shelters under a timber crib wall to provide fish habitat along the bank.

Challenges and resolutions

During the 2013 flood, the Bow River's velocity reached 4 to 5 m/s and the riverbed dropped by about 4.5 m at the site, forming the river's deepest scour hole in Calgary. After conducting a detailed analysis, KWL designed a self-launching riprap scour apron that included rock structures for fish habitat.

When the BDEP's design was nearly complete, a new transit bridge within the site was announced. KWL collaborated with the bridge design team to minimize the need to redesign the BDEP. They worked to increase the bridge's dimensions to accommodate

Photo courtesy KWL

a wildlife corridor and two BDEP viewpoints. These measures had minimal impact on the bridge's cost and construction schedule.

The original contract included removal and disposal of historic construction debris from the riverbank. The extent of debris, however, was larger than expected. Several change orders had to be issued to facilitate the removal and disposal of approximately 2,000 tonnes of concrete rubble, wood debris and rusting steel.

To secure an experienced contractor and reduce construction risk, the design team developed a custom tender evaluation based on price, experience and project understanding. Even with this effort, 27 site instructions and 54 requests for information had to be administered over nine months during construction.

Socioeconomic benefits

The BDEP provides many social benefits. It increases biodiversity and improves riparian health and water quality by replacing riverbank debris with native vegetation; serves to protect the historic neighbourhood of Inglewood from the next big flood; provides access to green space and an educational amphitheatre, gathering space and lookout points; helps educate the public about bioengineering and riparian health through interpretive signage; and links the Inglewood Bird Sanctuary and Pearce Estate Park with a wildlife corridor, nature trail and pathway; provides safe passage for wildlife under Cushing Bridge and the new transit bridge.

As mentioned, it also shares key information with other professionals, so they can incorporate bioengineering techniques into their own designs and improve other projects' outcomes.

The BDEP also provided cost savings. Its final construction cost was \$4.15 million; a riprap design covering the same project footprint would have cost about \$5.15 million, mostly due to the import of rock riprap.

Other, unquantified economic benefits come from enhanced fish and wildlife habitats, improved water quality and new recreation opportunities.

Environmental benefits

Beyond those already mentioned, the BDEP achieved further environmental enhancements.

For one, its fish habitat enhancements—including shelters, overhanging vegetation, boulder clusters and rock spurs—were so extensive, they earned offset credits for application on another municipal project.

The design team incorporated an existing nesting area for federally protected bank swallows. During construction, it was screened off to limit disturbance. After construction, the swallows were observed returning to it.

Similarly, ongoing performance monitoring has confirmed local wildlife is using the corridors constructed for it



About 100 trees, 2,300 shrubs and 30,000 live cuttings were planted.

There were significant cost savings compared to a conventional approach.

under the aforementioned bridges.

Three techniques for retrofitting existing rock riprap erosion protection with vegetation were piloted in the BDEP. Monitoring found the resulting vegetation survival rates ranged from 60% to 97%.

Spreading the word

Technical presentations about the BDEP have been delivered at the site and at local and international conferences. In addition to KWL-initiated research with the University of Calgary, the project's contract documents have been used as a template for 10 other projects within the same overall flood recovery program.

The performance monitoring program is still underway, with a 10-year duration, evaluating and reporting on the project's impact on fish habitat, wildlife, riparian health and bioengineering structural integrity. The first

year's results have already shown the BDEP's effectiveness exceeds expectations. **CCE**

Mike Gallant, P.Eng., is a senior water resources engineer with KWL.



KERR WOOD LEIDAL
consulting engineers

» Stormwater

» Facilities Design

» Water Resources

» Wastewater

» Environment

» Water Supply & Treatment

» Civil Infrastructure

» Community Infrastructure & Development

» Energy

» Utility Management

» Electrical

Greater Vancouver | Vancouver Island
Calgary | Okanagan | Kootenays

For more information visit, kwl.ca



File photo courtesy Catax Canada

MAKING THE MOST OF R&D INCENTIVES

Pioneering engineers should benefit from innovation.

By Richard Hoy

Canada's engineering industry represents one of the most innovative sectors in the country and is responsible for construction and infrastructure projects of crucial importance to the economy. Yet, many consulting engineers are not aware of available tax incentives that can be reinvested in this kind of work and of the assistance to which they may be eligible.

It is worthwhile to understand the relevant scheme, what kind of activity qualifies for it and how to go about claiming it.

The SR&ED program

Tax credits for innovation are available in Canada through the Scientific Research & Experimental Development (SR&ED) program. Taking advantage of these credits can go a long way towards easing the costs of an engineering project.

Many professional engineers wrongly assume such tax incentives

awarded for research and development (R&D) are the preserve of the scientific community, but the federal government has been very careful not to exclude any sector. The rules are actually very generic and can apply to many industries.

Further, contractor costs also qualify for incentives. So, firms using third-party engineering expertise for R&D-related activity can benefit.

Indeed, the cost of hiring consulting engineers can form part of an overall SR&ED claim. With this in mind, clients should be asking engineers to provide evidence of their R&D work to support their own claims.

If you are not being asked about this, but you know you are performing work that is likely to qualify, then there is an opportunity to add more value by alerting that client to the opportunity to claim. To this end, it's

worthwhile for all consulting engineers to get a grip on how the program works.

For one thing, it is not to be confused with the Industrial Research Assistance Program (IRAP), which makes government-funded grants available to small and medium enterprises (SMEs), rather than tax incentives for R&D.

That said, the SR&ED regime for SMEs has improved recently. There has never been a better time to claim.

Work that qualifies

The SR&ED program's rewarding tax incentive for innovation allows busi-

nesses to claim back up to 41.5% of expenses incurred through R&D-related activity. It represents a combination of federal and provincial incentives, so it varies by province.

Not every cost associ-

Tax credits can go a long way in easing the costs of an engineering project.

ated with R&D can be included in a claim. The main qualifying expenses include staff costs, salaries, materials and payments to contractors and third parties.

Consulting engineering firms and individual professionals are likely to perform qualifying SR&ED activity. By way of example, consider the ongoing development of renewable energy sources. While Canada has a long history of fossil fuels, it is also becoming one of the world's strongest champions of renewable energy, with much innovation in this sector that would qualify for SR&ED incentives.

From the point of generation to load centres, each facility needed to deliver clean energy to homes and businesses requires new technology and processes. The high-voltage direct current (HVDC) transmission market, for instance, is one area of the energy industry that is set to expand in the coming years, as innovation steadily

increases.

The incentive for a private business is received as a cash payment. For publicly traded companies, it is a credit to be offset against outstanding taxes.

The best way to check what qualifies is to work with seasoned tax advisers who are experienced in SR&ED claims. By doing so, consulting engineers have a strong opportunity to improve the value they offer to their clients, guiding them as to where they should be using and benefitting from the program.

Broadly speaking, there are three simple tests to identify what innovations might qualify for these tax incentives. The work must:

- further technical knowledge or create advancement in the industry.
- overcome scientific or technological uncertainties.
- do something, by design, that other professionals would find difficult or not obvious.

Businesses can claim up to 18 months after the tax year in which the innovation took place. So, if you didn't know about the scheme before, there still is a good chance you or your clients could claim substantial amounts retroactively.

And at a time when some businesses are struggling financially due to the COVID-19 pandemic and many projects have been put on hold, now is the perfect moment to make sure you are taking full advantage. **CCE**

The cost of hiring consulting engineers can form part of an overall SR&ED claim.

Richard Hoy is president of specialist tax consultancy Catax Canada. He can be reached at richard.hoy@catax.com.



THURBER ENGINEERING LTD.

**Thurber Engineering Board of Directors
is pleased to announce the appointment of two new Principals.**



J. Suzanne Powell - Thurber Principal and Director for the Victoria office

Suzanne joined Thurber in 2009 and has focused primarily on land development and transportation infrastructure projects. In 2017, she was promoted to Branch Manager of the Victoria office and was named an Associate later that same year. In 2019, she was appointed as a Review Engineer. Suzanne completed both her B.Sc. (2002) and Ph.D. (2010) in Geological Engineering at Queen's University in Kingston, ON. Suzanne served as the Vice President Technical for the Canadian Geotechnical Society (CGS) in 2017/2018 and was the inaugural recipient of the CGS Early Achievement Award in 2019. Suzanne is a current board member for several professional organizations, including the Association of Consulting Engineering Companies British Columbia (ACEC-BC), the Victoria Civic Heritage Trust and the Canadian Foundation for Geotechnique.

Mark Popik - Thurber Principal and Director for the Toronto office

Mark joined Thurber in 2012 as a Senior Pavement Engineer and was promoted to Associate in 2016. Over this time, he has been expanding Thurber's pavement capabilities across the company, while growing a pavement group in the Oakville office. Mark completed his undergraduate in Civil Engineering at the University of Waterloo (1999) with a Master of Engineering degree from the University of Florida in 2000. After graduation, he returned to Canada to work on a variety of pavement related projects. His experience includes pavement investigations & evaluations; pavement rehabilitation strategies; new pavement designs; life cycle cost analysis; as well as constructability review of design packages. Mark is registered as an Associate Value Specialist (AVS) and is a licensed Professional Engineer in Alberta and Ontario.



Geotechnical • Environmental • Hydrogeology • Materials Engineering and Testing
thurber.ca



Place your job ad today on [ConstructionJobsite.ca](https://www.constructionjobsite.ca)

Q Keywords

📍 Location

📏 Distance ▾

Search



CONSTRUCTION
JOBSITE

RIGHT PEOPLE RIGHT TIME RIGHT PLACE

ConstructionJobsite.ca is Canada's premier online job portal for the growing construction sector. A laser focus on the right people across the country's largest construction media audience means you get the right applicants the first time. No more massive piles of unqualified applicants, just professional employers reaching qualified professionals.

Powered by the top construction media brands in Canada,
the reach to over 468,000 industry professionals on

ConstructionJobsite.ca is amplified by:

- 🕒 Website advertising to 150,000 qualified unique monthly site visitors
- 📧 Email promotion and Job Alerts to 76,000 industry emails using Canada's largest CASL-compliant direct access to construction professionals
- 📱 Social media promotion to all brand networks on Facebook, Instagram, Twitter and LinkedIn
- 🎯 Audience extension as required to targeted audiences



POWERED BY CANADA'S TOP CONSTRUCTION MEDIA BRANDS



ELECTRICAL
BUSINESS

CANADIAN
CONTRACTOR

ROCK ROAD

CANADIAN CONSULTING
engineer

Crane & Hoist
CANADA

On-Site

HPAC
HEATING
PLUMBING
AIR CONDITIONING



Calculating Arc Flash Incident ENERGY AND BOUNDARY

By Terry Becker, P.Eng.

Not many electrical engineers across Canada seem to be aware of IEEE 1584.1, *Guide for the Specification of Scope and Deliverable Requirements for An Arc-Flash Hazard Calculation Study in Accordance with IEEE Std 1584*. It was first published in 2013—as a companion to IEEE 1584, *Guide for Performing Arc-Flash Hazard Calculations*—to ensure such studies were completed correctly, with a detailed report aligned with good engineering practices. With both documents, an electrical engineer can substantiate any assumptions/parameter selections and/or disclaimers they may include in reports to their clients.

Step 1: Collect system and installation data.

Start with an available single line diagram, use specific electrical equipment data sheets and request utility fault data for each service. Create a digital single line diagram model in power engineering software.

Step 2: Determine system modes of operation.

You need to consider single mode or multiple modes when determining both low (minimum) and high (maximum) bolted fault currents. For motor contributions less than or equal to 50 hp—and in some cases with client requirements for motors less than 200 hp—lump the motors.

Step 3: Address three-phase electrical equipment.

The guide says “sustainable arcs are possible, but less likely, in three-phase systems operating at 240 V AC nominal or less with an available short-circuit current less than 2,000 A.” For 208-V AC three-phase electrical equipment at 2,000 A, the available fault current is typically a 45-kVA or



higher transformer size and all related panelboards will require calculations. Alternatively, the arc flash personal protective equipment (PPE) category method in CSA Z462, *Workplace Electrical Safety*, Table 6A, could be applied where the transformer is up to 300 kVA, depending on impedance. The minimum recommendation is 8.0-cal/cm² arc thermal performance value (ATPV) arc flash PPE.

Step 4: Determine gaps for electrical equipment.

Determine typical gaps and enclosure sizes based on system voltages and classes. If you increase the gap from the default values, calculated incident energy will increase. Use typical data; no field measurements are required unless atypical electrical equipment is identified. Verify with the manufacturer’s shop drawings, if available. The gap does affect incident energy calculations, but is not as significant as other parameters.

Step 5: Determine the box correction factor (shallow vs. typical).

Field measurements are not required. Use typical data. Assume the worst-case scenario for motor control centre (MCC) starter buckets or other power distribution equipment where box sizes may vary. The box correction factor does not affect incident

energy results as significantly as other parameters do.

Step 6: Determine the electrical equipment box/electrode configuration.

The available configurations are VCB, VCBB, HCB, VOA and HOA. HCB yields the highest calculated incident energy, followed by VCBB, while VCB yields the lowest. Two separate box/electrode configurations—and two separate arc flash and shock equipment labels—may be required for a single piece of electrical equipment.

Step 7: Determine working distance.

This is the anticipated distance from the abnormal arcing fault location in the electrical equipment to the qualified electrical worker’s (QEW’s) face and torso. Use typical distances unless the electrical equipment is unique. Increasing the distance reduces incident energy. For an application where the distance can be increased in the field by the QEW, use that working distance in calculations and the report.

Step 8: Calculate arcing current.

The system grounding does not affect the incident energy calculation, as per the formulas in IEEE 1584.

Step 9: Determine the arc duration.

Use the two-second guideline if required. Adequate egress from the

Photo courtesy Oberon Compan

work task area is required.

Step 10: Calculate incident energy for each location.

Calculate incident energy at the assumed working distance for each specific location of the electrical equipment where an energized work task may be completed. You may need two calculations for a specific piece of electrical equipment if you decide to use two box/electrode configurations relating to specific energized work tasks.

Step 11: Determine the arc flash boundary.

Determine the distance for the arc flash boundary for the electrical equipment where energized work tasks will be completed. This is the distance from the abnormal arcing fault where the incident energy is 1.2 cal/cm^2 , i.e. the threshold value that can ignite flammable clothing.

Step 12: Draft and issue the report.

IEEE 1584.1 recommends the report include a P.Eng.-stamped cover page, executive summary, scope of study and results summary, background information, disclaimers, review of system data, short circuit analysis results, protective device co-ordination study, arc flash hazard incident energy analysis, recommendations for incident energy reduction, conclusion and appendices for definitions, IEEE device numbers, single-line diagrams, utility fault data, field data sheets, short circuit data and analysis report, time current curves (TCCs), electrical protective device settings, arc flash results, examples of arc flash and shock equipment labels, etc.

Too many reports include misinformation, errors and omissions. With the most recent edition of IEEE 1584, it has become more important for electrical engineers to document in detail any assumptions, disclaimers and field data validation. Conservative assumptions and unnecessary field measurements can add an unreasonable cost burden for the client.

It is also extremely important for

the arc flash and shock label recommendations to meet the minimum requirements in CSA Z462. The 'danger' signal pane should only be used where calculated incident energy is greater than 140 cal/cm^2 . The footer of the label should identify the protective device and indicate the location of the incident energy. **CCE**

Terry Becker, P.Eng., is past vice-chair of the CSA Z462 standard technical committee, voting member for the CSA Z463 (Maintenance of Electrical Systems) standard technical committee and voting member for the IEEE 1584 technical committee. He runs TW Becker Electrical Safety Consulting and can be contacted at terry.becker@twbesc.ca.

YOUR HIGH RISE CONSTRUCTION PARTNER

Reduce risk and increase efficiency using Victaulic as your complete project partner.



JOINING AND FLOW CONTROL SOLUTIONS FOR DOMESTIC WATER



EQUIPMENT MODULES



ENGINEERED SOLUTIONS FOR RISER DESIGN AND PIPING MOVEMENT



MODULAR CONSTRUCTION



victaulic.com/high-rise-construction



© 2021 VICTAULIC COMPANY. All rights reserved.

Public Engagement for Infrastructure Projects

By Karen L. Weslowski

Public engagement can serve a fundamental role in the democratic process. It usually involves a level of government deliberately involving the public in a decision-making process. The level of engagement can range from requesting input to granting decision-making authority. In some instances, public engagement is mandatory, particularly in relation to changes in land use.

Large infrastructure projects are often subject to at least some level of public engagement, which helps demonstrate accountability and legitimacy in their development and design. A transparent engagement process also helps manage people's expectations.

Consultants may be retained to provide services in relation to public

engagement for infrastructure projects. There are potential risks and considerations.

The consultant's role

A consultant's involvement in the public engagement process may include:

- preparing design and engineering work, including assurances to the environmental, health and safety impacts of the proposed project.
- identifying the quantitative (*i.e.* economic) and qualitative (*i.e.* community-oriented) benefits of the project.
- identifying and/or preparing applications for permits, licences and other statutory or regulatory approvals required for the project.
- preparing procurement and con-

struction documents and contracts.

Failure by the consultant to properly fulfil any of these duties could result in a lack of meaningful consideration, extensive opposition to the project, delays in approvals and/or errors in design causing loss or damage.

The question arises as to what extent a consultant may be legally liable for such errors.

Grounds of legal liability

Most claims against consultants will be based upon either breach of contract or tort (*i.e.* negligence or negligent misrepresentation).

Whether the consultant is in breach of contract is fact-specific, depending upon the particular terms of the



contract. Consultants should know if the contract or request for proposals (RFP) contains an indemnity provision. The following example is from an RFP for consulting services issued by a town for an urban waterfront renewal project:

“The successful respondent, its officers, agents or employees and if applicable all subcontractors shall at all times indemnify and save harmless the town from and against any and all manner of claims, demands, losses, costs, charges, actions and other proceedings whatsoever made or brought against, suffered by, or imposed on the town in respect of any loss, damage or injury to any person or property directly or indirectly arising out of, resulting from, or sustained, as a result of this agreement, provision of services or any operations connected therewith caused by or resulting from the negligent or wilful acts or omissions of the Successful Respondent, its officers, agents or employees or if applicable its sub-contractors.”

This particular provision is triggered by allegations of negligence or breach of contract relating to wilful

acts or omissions. If possible, consultants should generally avoid agreeing to such broad indemnity provisions.

Another question arises as to whether the consultant owes a duty of care in tort to the public at large in the course of providing professional services relating to public engagement for an infrastructure project. Consider a situation where the consultant provided inaccurate information about environmental safety, which resulted in public approval of a project; subsequently, an incident causes significant damage to natural resources (e.g. contaminating a water source). Could a member of the public sue the consultant for negligence and resultant damages? Does

If possible, consulting engineers should generally avoid agreeing to broad indemnity provisions.

the engineer owe a duty of care to the public at large? So far, Canadian courts have not squarely addressed these issues.

The code of ethics governing engineers in most Canadian jurisdictions contains a provision requiring registrants to “hold paramount the safety, health and welfare of the public and the protection of the environment.” The law, meanwhile, has long recog-



**Denso Anti-Corrosion & Sealing Systems
Unmatched Quality and Performance**

If it doesn't say

Denso®

on the outside, then it's not

Denso®

on the inside.



CSA Z245.30 compliant

Denso North America Inc.
90 Ironside Crescent, Unit 12
Toronto, Ontario M1X 1M3
Tel: 416-291-3435
Fax: 416-291-0898
sales@denso-na.ca.com
www.denso-na.com

nized a duty on a person engaging in an activity to take reasonable steps to prevent physical harm to others from that activity. In 2009, in *Lovely v. Kamloops (City)*, the British Columbia Supreme Court (BCSC) held that an engineer has a “paramount professional duty to ensure public safety in all designs signed and sealed by a professional engineer.”

A consultant involved in the public engagement process for infrastructure projects will owe a duty of care to their client and, potentially, end users of the project who are foreseeable and in a reasonably proximate relationship with the consultant. However, whether a duty of care exists—and the scope and extent of such duty—ultimately comes down to the particular facts of the case.

The engineer’s duty of care must still remain tethered to his/her contractual retainer and professional obligations. In the example given above, assuming the engineer’s negligence caused loss and damage to a natural resource, giving rise to a claim by a concerned citizen not directly affected by the loss, an argument could be made that the requisite proximate relationship does not exist to give rise to a duty of care or that liability should be refused on the grounds of residual policy considerations. Courts guard against the spectre of “liability in an indeterminate amount for an indeterminate time to an indeterminate class,” as Justice Cardozo put it in the U.S. tort law case *Ultramares Corporation v. Touche* in 1931.



CCE Online Reader Poll

Q: How has your experience been with public engagement for infrastructure projects?

- Highly positive: **29%**
- Slightly positive: **36%**
- Neither positive nor negative: **7%**
- Slightly negative: **29%**
- Highly negative: **0%**



Consultants involved in public engagement for infrastructure projects should ensure they enter a written contract with their clients that clearly outlines the scope of the consultant’s retainer, which will, in turn, inform the scope of the consultant’s duty of care.

Risk management

At the most basic level, to guard against potential claims, consultants involved in public engagement for infrastructure projects should ensure they enter a written contract with their clients that clearly outlines the scope of the consultant’s retainer, which will, in turn, inform the scope of the consultant’s duty of care.

Given the size of many infrastructure projects, common problems include delays and cost overruns. Proper risk management in this regard includes carefully prepared,

contemporaneously maintained documentation. Consultants should provide adequate contingencies to account for design changes in projects’ early stages. Timely responses to stakeholders can also assist in mitigating potential issues.

Due to the prolonged nature of these projects, consultants should ensure their professional liability insurance remains in force throughout completion and, potentially, for a

reasonable period afterwards, during which deficiencies may be identified, as most professional liability insurance policies are written on a ‘claims-made’ basis and the policy that responds is the one in force at the time of the claim. Given the size of these projects, consultants may also require increased limits on their professional liability coverage.

Conclusion

In some ways, a consultant’s retainer for the public engagement process relating to infrastructure projects is no different from any typical project.

The consultant is still required to apply the correct engineering principles, provide sound professional advice and design to meet all relevant industry standards, bylaws and statutory and legislative requirements. Failure to do so may result in liability for the consultant in breach of contract and/or tort.

Whether an aggrieved member of the public can claim against the consultant for negligence in the public engagement process or damages resulting from the project is an issue that has not yet been addressed in Canadian law. The prospects of such a claim succeeding appear remote, but that does not mean such a claim will never be made and, of course, the ultimate success of any such claim will turn on its own particular facts. **CCE**

Karen L. Weslowski is a partner with Miller Thomson LLP in Vancouver.

Brandt Supports Canadian OEMs with State-of-the-Art Smart Factory.

With the recent launch of its all-new SmartSteel Centre in Regina, SK, the Brandt Group of Companies has sent a clear message about their commitment to support the Canadian manufacturing industry with advanced manufacturing technologies on a scale never previously seen.

The longstanding Saskatchewan industrial manufacturer now boasts one of the largest fully automated smart factories in the country, equipped with an array of state-of-the-art machinery never before available in Western Canada.

Like other Canadian OEMs, the company's growth has made it challenging for suppliers to keep pace in recent years, given the competitive pressures from automation and globalization.

"Canadian manufacturing companies grow more competitive every day, especially with offshore manufacturers," says Brandt President – Manufactured Products, Chris Semple. **"With challenges related to reducing costs, increasing quality, and shortening lead times, it is more critical than ever that component and service suppliers keep pace and invest in their operations to deliver value."**

Deployed via Brandt's OEM Services division, the SmartSteel Centre fills an important gap in Canada's manufacturing sector. The company's goal is to be the one-stop manufacturing partner for high-quality parts and components; able to take care of all aspects of production from start to finish.

To accomplish this, Brandt has added 75,000ft² of integrated manufacturing capacity and partnered with TRUMPF GmbH + Co. KG to provide machine tools, laser technology, and electronics for the new facility. Existing buildings have been upgraded and expanded to accommodate three TRUMPF TL5040 10kW Fibre lasers and an 18-tower STOPA storage system, featuring 375 storage locations. Two of the lasers are connected to PartMaster manual sorting stations, while the third employs a fully automated SortMaster for picking and stacking. The system has a capacity of 4,000,000+ lb of plate inventory. The new facility is also home to three new Trumpf TruBend press brakes, including an 880 ton x 26 foot unit.

The result is a complete service including engineering, parts and assembly, design, and machine, cut, weld, and paint capacity. Extensive packaging options include just-in-time delivery, parts kitting and customer-specific packaging.

The company also offers fast-response 24/7/365 customer support, 24–48 hour estimate turnarounds for standard RFQs, and close monitoring of market fluctuations and material requirements to maximize customer ROI.

With these new operations, the Canadian manufacturing industry receives an important boost to its component manufacturing capacity. It gives manufacturers access to comprehensive control over every phase of their process, resulting in quicker-than-ever turnaround times and an unprecedented level of quality control at every stage of the process. The facility also fits seamlessly into Brandt's own well-established supply chain, delivering better access to suppliers and raw materials due to their ability to make large-volume purchases.

"We're very excited about the value this will add for Canadian manufacturers," concludes Semple. **"Bringing this expanded domestic capacity online is already injecting a new level of competitiveness into our industry."**

For more information about the Brandt SmartSteel Centre, contact info@brandt.ca.



SECURITY



The IP-A1SC15 horn speaker from TOA Canada is intended to help add intelligible audio to buildings' video security management systems, to better enable live announcements in emergency situations.

Constructed from aluminum, the device joins

TOA's existing SC series of horns and can broadcast in four different modes: Session Initiation Protocol (SIP) live voice announcement; group broadcasting (for up to 10 different groups); video management system (VMS) live broadcast, with connected camera or audio device; and remote application programming interface (API) audio playback, with up to 20 sound sources. The horn's ability to prioritize network announcement with prerecorded messages can support swift action in emergencies, while an offset volume adjustment function allows sound levels to be increased or decreased based on the time of day.

toacanada.com

ROBOTICS



Festo's Bionic Mobile Assistant robotic helper mimics the human hand as a gripping tool. A Bionic SoftHand 2.0 pneumatic gripper is mounted to a DynaArm electric robot arm and then to a 'ballbot' for 360-degree mobility. Applications include carrying items in areas of hospitals where staff cannot

enter, due to increased risk of infection. The SoftHand integrates compact valve technology, tactile force sensors, a depth camera, electronics and mechanical components. The fingers and opposable thumb are made of flexible bellows structures with air chambers, surrounded by knitted fabric. Compared to Bionic SoftHand 1.0, the thumb and index finger are now longer, to increase lateral swivel range. All energy supplies are on board, including a battery for powering the arm and robot and a compressed air cartridge for the pneumatic hand. The robot can work autonomously, orienting itself independently in three dimensions using two cameras.

festo.com

IT NETWORKS

Rittal Systems, based in Mississauga, Ont., launched its new TS IT Pro enclosures for data centres' network and server racks. Designed for a range of information technology (IT) infrastructure applications, from large-scale deployments to high-density cooling and cabling, the cabinets are shipped complete with a perforated single front door and split rear doors keyed alike, leveling feet, casters, roof with



brush baffle cable access channels and vertical cable walls with dual power distribution unit (PDU) mountings. The enclosures also feature full-height rear accessory channels for power distribution and cable management, additional mounting locations for tool-less accessories, quick-release door handles and increased openings to accommodate growing cable densities and larger PDUs.

rittal.ca

ACOUSTICS



Focal Point's AirCore Bridge integrated acoustic ceiling system is designed to help specifiers configure architectural spaces for optimal sound management and lighting, with linear baffle and luminaire arrays. The system is offered in truss, cantilever and cantilever wave versions, each of which uses suspended direct luminaires as primary structural support for acoustic baffles. In the symmetric truss assembly, for example, two parallel luminaires serve as rails for perpendicular baffles. In the cantilever configuration, the baffles project from one luminaire with a suspension point at the other extremity, so they appear to float. Arrays can be specified with luminaire lengths from 6 to 208 ft, baffle lengths from 5 to 8 ft (in 1-ft increments) and baffle heights of 8, 12 or 16 in., with a variety of on-centre spacing options. Lighting ranges from 125 to 625 lumens/ft and colour temperatures of 3,000, 3,500 or 4,000 K, with dimming options and compatibility with a variety of control systems.

focalpointlights.com

professional directory

Experts in Measurement, Analysis & Control



ACOUSTICS



NOISE



VIBRATION



905-826-4546
answers@hgcengineering.com
www.hgcengineering.com

For information on placing an advertisement in the *Canadian Consulting Engineer Professional Directory*, contact Maureen Levy, Senior Publisher, 416-510-5111, email: mlevy@ccemag.com

Specifier's Literature Review



Bradford White eF Series Proven Performance You Can Trust

The eF Series® of Ultra High Efficiency Gas Water Heaters deliver proven commercial performance, flexibility (60 to 119 gallon capacity), innovation (BMS integration with remote monitoring) and efficiency (ENERGY STAR® certified models available). They include exclusive quality features like the ICON HD® intelligent Gas Control, Hydrojet® Sediment Reduction System and Vitraglas® tank lining. Learn more about the eF Series at bradfordwhite.com

SUPPLIER: BRADFORD WHITE



SAVE MORE FOR YOUR FUTURE

Group savings products, like the ones offered through the Engineers Canada financial security program, give you a real advantage: you'll pay typically lower fees compared to retail investment options, and this can add up to more future savings.

Plus, you get free investment guidance when you join.

Visit www.engineerscanadafsp.grsaccess.com for more information on the financial security program sponsored by Engineers Canada.

SUPPLIER: CANADA LIFE



No PVC? No Problem!

As the PVC shortage continues, Champion Fiberglass® has short lead times and competitive pricing to keep projects on track.

www.championfiberglass.com
SUPPLIER: CHAMPION FIBERGLASS



STOP WATER INFILTRATION IN ONE SIMPLE STEP WITH DENSO

Road erosion, premature concrete failure or water ingress into wastewater systems? Denso's 12" LT tape has been proven for nearly a century to block water from accessing assets. It won't harden or crack and is the perfect solution for degrading concrete and persistent water infiltration. Applied in minutes, requiring minimal surface preparation, no product mixing and no curing, it can be buried immediately. Contact Denso for more information or demonstration.

T: 416-291-3435 F: 416-291-0898

Email: sales@denso-na.ca

Website: www.denso-na.com

SUPPLIER: DENSO NORTH AMERICA INC.



MACH-PROVIEW LCD EQUIPMENTVIEW

The Reliable Controls® MACH-ProView™ LCD is a powerful BACnet Building Controller (B-BC) and BACnet Operator Display (B-OD) which provides a fully customizable, high-resolution graphical user interface called EQUIPMENTview. This freely programmable, touch-screen controller also features six universal inputs and outputs and communicates on industry standard topologies such as Ethernet, Power over Ethernet, Wi-Fi and EIA-485, using BACnet and Modbus protocols. In addition to temperature, the MACH-ProView LCD supports occupancy, humidity, CO₂ and VOC sensing.

reliablecontrols.com/MPV-L

SUPPLIER: RELIABLE CONTROLS CORPORATION



VICTAULIC® SYSTEM SOLUTION FOR HDPE PIPE

Up to 10 times faster to install, the Victaulic mechanical joining system for HDPE provides fully self-restrained joints that meet or exceed the pressure ratings of HDPE pipe. Designed for buried, submerged, and above ground applications, Victaulic's HDPE solution can be installed in any weather and proper joint assembly is visually verifiable.

Visit victaulic.com/hdpesolutions

Call 905-884-7444 x5469

SUPPLIER: VICTAULIC



CANADIAN CONSULTING ENGINEER 2021 MEDIA KIT

Canadian Consulting Engineer magazine provides high quality editorial coverage of the most pertinent and timely issues that affect engineers across Canada. The magazine reaches the consulting engineers who make the critical decisions on building and construction projects. This is exactly the audience you need to reach. Advertise your product or service with us. Be seen and be specified!

To order your 2021 media kit, please send along your request to Maureen Levy at (416) 510-5111, email: mlevy@ccemag.com or visit www.canadianconsultingengineer.com

PEER Support

Prefabricated panels can add an energy-efficient building envelope over an older, leaky one.



In the Ottawa neighbourhood of Overbrook, a Natural Resources Canada (NRCan) CanmetEnergy research centre has been working with Ottawa Community Housing (OCH) on the Prefabricated Exterior Energy Retrofit (PEER) net-zero pilot project to make existing buildings more energy-efficient by adding panels to their façades. We spoke to Mark Carver, the CanmetEnergy housing team project leader, and Dan Dicaire, P.Eng., OCH's manager of conservation and sustainability, about this effort.

Mark:

We identified disruption as a major barrier to traditional deep-energy retrofits, which are noisy and dusty. That sparked this idea of a 'kit of parts' that could be applied largely from the outside.

The process involves four major steps. The first is 'building capture,' using 3-D laser scanning or photogrammetry to rapidly, accurately measure dimensional data for a digital model of the building. From that, we can design a new enclosure for the building. We custom-fabricate the panels with control layers for water, air, vapour and thermal control. After they are preassembled in a factory or off-site shop, they are lifted or craned into place to complete the retrofit. This can really reduce the amount of time needed on-site.

By addressing space heating demand, we can dramatically reduce overall energy use. Then we can right-size the mechanical systems, add ventilation and offset remaining loads with a reasonably sized photovoltaic (PV) array that will fit on the building, to get all the way to net-zero.

Dan:

With the building envelope retrofit, we have reduced the heating and cooling loads so much inside, we can go with a much smaller, more efficient, electrified solution. We're taking out the hot water tank and natural gas furnace and putting in a heat pump and retrofitting the forced air system with a heat

recovery ventilator (HRV).

Once we've got that new building envelope and mechanical system, we need this small amount of energy we can cover with renewables. Our southern-facing roof exposure will feature 34 kW of solar panels. Each home is getting its own piece of that array, generating as much energy as the tenants use for plug loads and all the mechanicals, effectively making the homes net-zero.

This is a really good model for social housing retrofits. These units were built in the 1950s and '60s and are at their life-cycle tipping point. If we do not do some work, we might lose them. This is not just an energy question; the city is in the middle of a housing crisis. We want to ensure we are maintaining our existing stock.

Our cost is around \$200,000 per unit, which includes a lot of upfront consulting we will not need to repeat. With economies of scale for multiple projects, we are hoping to drive that cost all the way down to \$100,000, probably even lower.

Investment today makes sense, to offset consumption for the future. And this approach is extremely applicable to pretty much any other templated buildings out there. There is a lot of reproducibility.

Mark:

We see the affordable housing sector as a real catalyst market for scaling up this type of concept. If we are serious about addressing emissions, this is probably one of the only ways to industrialize the effort to get to where we need to be by 2050.

There is a role for consulting engineers going forward. The Pembina Institute and BC Housing have the Reframed initiative. There's also Recover in Nova Scotia. I would encourage anyone who is interested to check those out. **CCE**



Mark Carver



Dan Dicaire

Photo courtesy CanmetEnergy

This article is based on a recent episode of The Better Buildings Podcast. To hear the full conversation, visit www.canadianconsultingengineer.com/podcasts.



NO PVC? NO PROBLEM!

As the PVC shortage continues, Champion Fiberglass® has short lead times and competitive pricing to keep projects on track.

Across many applications, projects using fiberglass conduit benefit from:

- Lower installation costs
- Light weight
- Superior compression and impact strength

BIM/Revit Models Available Now
Visit championfiberglass.com

MADE IN THE
★ USA ★

MasterSpec®
a product of The American Institute of Architects

020421

Choose Champion Fiberglass electrical conduit instead of PVC conduit today.



©2016 Champion Fiberglass, Inc.

Bradford White's eF Series®

PERFORMANCE THAT'S PROVEN.



BRADFORD WHITE®

WATER HEATERS

Built to be the Best®



When you're specifying a water heater for a commercial application, you don't want to take chances.

The eF Series® Ultra High Efficiency Gas Water Heaters deliver proven performance and efficiency to meet virtually every commercial need.

- **Flexibility.** The eF Series® offers a variety of capacities from 60 to 119 gallons.
- **Innovation.** The eF Series® features BMS integration with remote monitoring for quicker, easier troubleshooting.
- **Efficiency.** ENERGY STAR® models available up to 94% efficiency.
- **Ultra-Low NOx models available** that comply with the latest ultra-low NOx requirement (14 ng/J NOx Limit).
- **Quality.** Includes exclusive features like the ICON HD® intelligent Gas Control for better performance, Hydrojet® Sediment Reduction System for reduced maintenance and Vitraglas® tank lining for longer life.

Learn more about the eF Series at
bradfordwhite.com