

ReNew

March/April 2019

CANADA

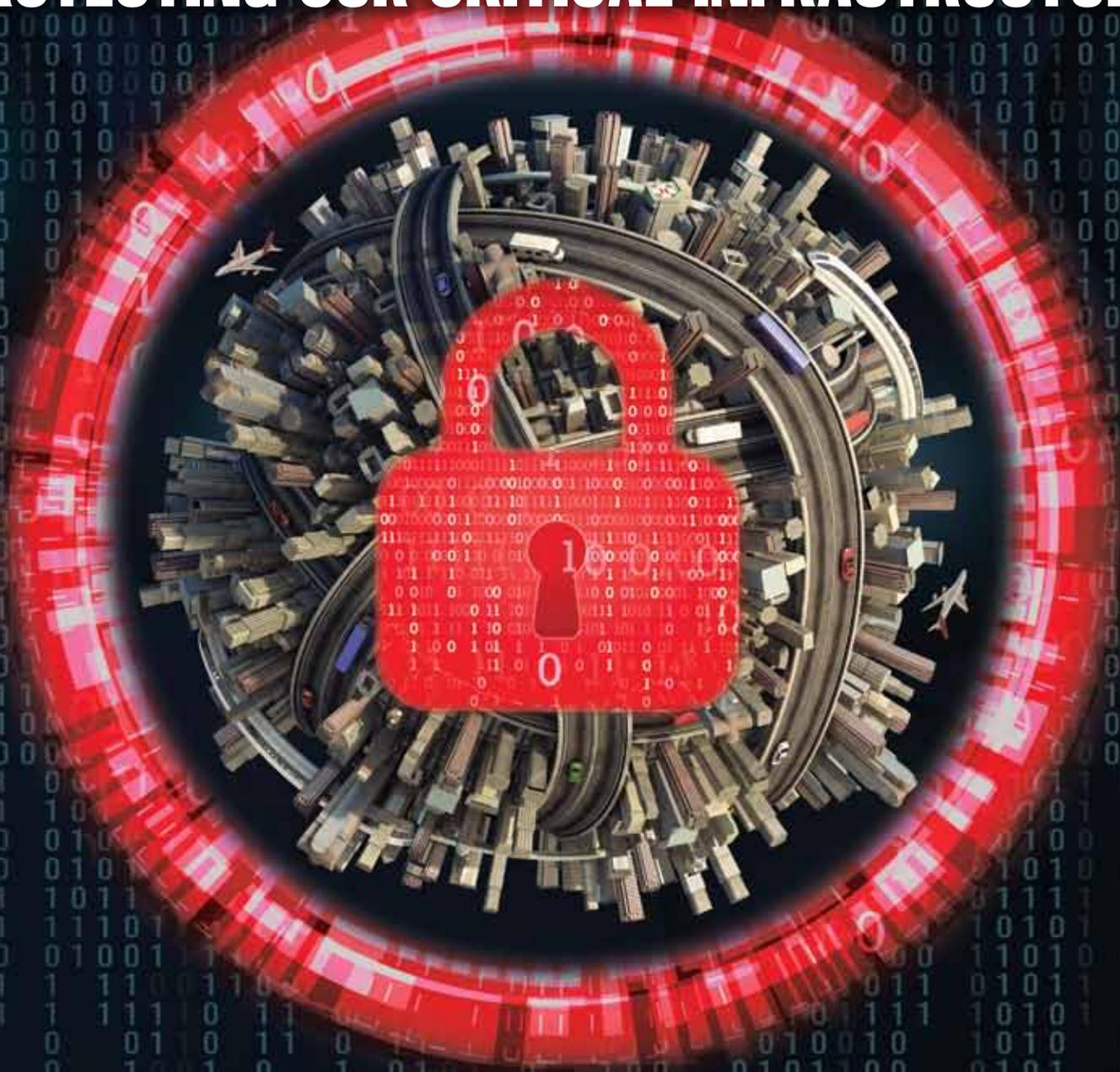
The Infrastructure Magazine

+ Making 'Grey'
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BROWNFIELDS BEFORE URBAN SPRAWL

By Andrew Macklin

Southern Ontario has a real conundrum on its hands.

In the wake of proposed changes to the Greenbelt legislation, ones that would have seen development occur on previously environmentally protected lands, cities in the region were up-in-arms protesting the notion and are telling property developers that they will not allow this to happen in their communities.

For the health of the communities in the region, as well as the province and country as a whole, this was a very welcome sight. Say what you will for the previous Liberal government, but the Greenbelt legislation was, about the most part, a very studious undertaking.

But there is a growing problem, and it isn't being addressed: if not on the lands surrounding our cities, where do we build for the housing demands of the short-term future? The easy answer would be to start forcing 'missing middle' and high-rise developments in traditional neighbourhoods throughout these communities. But the rise of the Not In My Backyard or NIMBY movement has politicians in many cities running scared, afraid the current four-year term in office could be their last. And for good reason: there are numerous cases across the country where successfully-mobilized NIMBY movements have caused elected officials to fall in the following campaign.

So, if we are not going to force development on traditional communities, what is the plan to ensure housing demands are being met, developers are staying in business, and the environment isn't being sacrificed for the sake of expansion?

There is a simple starting point: brownfields.

The largest cities in the country have derelict properties that are no longer in use, and are an environmental hazard for the rest of the community. These brownfields represent significant-sized properties currently not utilized by anyone in the community.

Imagine what happens if, with a little bit of financial support to spark development, we use these properties to help create new residential spaces, and commercial spaces for that matter, with the current urban footprint of our cities?

But what's that you say? It's already happening in many communities? Yes, that is true. But to what extent? How many more hectares of these lands still exist within the city limits? And, more to the point, if you take all of the brownfield properties in and connected to residential areas, and filled those spaces with mid rise or high rise residential structures, how many years of residential growth does it represent?

These questions have to be answered on a city-by-city basis, but I would argue there is significant opportunity to solve, in the short term, issues surrounding the need for residential growth. And I haven't even added the argument about the environmental benefits.

So before we start tearing up valuable farmland that feed our growing cities, let's face the lens inward to see what solutions lie within. ♻️

Andrew Macklin is the managing editor of ReNew Canada.

andrew@actualmedia.ca

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- MANAGING EDITOR** Andrew Macklin
- GROUP PUBLISHER** Todd Latham
- PUBLISHER** Nick Krukowski
- DIRECTOR OF BUSINESS DEVELOPMENT** Elena Langlois
- ART DIRECTOR AND SENIOR DESIGNER** Donna Endacott
- ASSOCIATE EDITOR** Simran Chattha
- CONTENT AND MARKETING MANAGER** Todd Westcott
- CONTRIBUTORS** Geordie Anderson, Stephen Bauld, Iain Cranston, Candice Laws, Kevin Li, Carroll McCormack, Glenn Miller, Alexander Mirescu, Lindsay Wigington
- ADVERTISING** Elena Langlois elena@actualmedia.ca
- ADVISORS** Nick Reid, James Sbrolla

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Municipalities are faced with the daunting challenge of securing their critical infrastructure.

Learn more about how to protect and manage data on pages 10 and 12.

GoC SUPPORTS GEOTHERMAL ENERGY



The Government of Canada has announced support for a new geothermal power facility near Estevan in Southeastern Saskatchewan. The energy project, led by DEEP Earth Energy Production Corporation, is the first of its kind in Canada and taps into a new renewable energy resource.

“DEEP’s project has the potential to transform how the province and the country produces energy,” said Prime Minister Justin Trudeau.

The Government of Canada will provide \$25.6 million in funding for the five megawatt facility, which will produce enough energy to power approximately 5,000 homes all while taking the equivalent of the yearly emissions of 7,400 cars out of the atmosphere.

Funding for this project is being provided through Natural Resources Canada’s Emerging Renewable Power Program. In 2014, Natural Resources Canada contributed \$1 million through its ecoENERGY Innovation Initiative for a pre-feasibility study for this project. Natural Resource Canada’s Clean Energy Innovation Program and Innovation Saskatchewan also contributed \$350,000 and \$175,000, respectively, towards test drilling. The total cost of the project is \$51.3 million.

The local community will channel excess heat from the facility to a 45-acre greenhouse for commercial use.

EDMONTON PREPARING VALLEY LINE WEST LRT RFQ

The City of Edmonton is preparing to launch the procurement process for the design and construction of the Valley Line West LRT Project (The Project), with the release of an RFQ in early March of 2019.

The Project will include civil and structure works, systems, and light rail vehicle supply and will be procured using as a Design-Build-Finance delivery model. Light rail vehicle supplier companies will be designated as non-exclusive suppliers for the purposes of the project procurement process, meaning no one supplier can be exclusive to a proponent team. As such, light rail vehicle suppliers will not be evaluated as part of the RFQ.

It is of critical importance that the Valley Line West integrate successfully with the Valley Line Southeast currently under construction. The Valley Line will operate as one line with continuous service between Mill Woods and Lewis Farms. Operations and Maintenance of the Valley Line West are not part of the Design-Build-Finance procurement, and will be procured at a later date.

Project Funding Status

The total budget (including engineering, land etc.) is \$2.6 billion. On November 1, 2018, the Government of Alberta committed \$1.04 billion to the Project. The Federal Government is evaluating the Project Business Case under the “Investing in Canada Infrastructure Program” funding program, with confirmation of funding approval anticipated by Spring 2019.

The Valley Line

The Valley Line is the largest single infrastructure project in the history of Edmonton. It consists of a 27 km urban-style, low-floor LRT line that will operate between Mill Woods in southeast Edmonton and Lewis Farms in west Edmonton. It will be separate from the City’s existing high floor LRT system. This line will feature modern, low-floor, light-rail vehicles running segregated along existing streets and integrating with Edmonton’s surrounding neighbourhoods.

The Valley Line was separated into two stages for project delivery: Valley Line Southeast (between 102 Street downtown and Mill Woods Town Centre) and Valley Line West (between 102 Street downtown and Lewis Farms Transit Centre).

Valley Line West LRT Project Overview

- 14 km of double track
- 14 street-level stops and two elevated stations (Misericordia Hospital and West Edmonton Mall)
- Two new bridges on 102 Avenue over Groat Road and 87 Avenue over Anthony Henday Drive
- 1.6 km of elevated guideway
- Transit centre at West Edmonton Mall
- Park & ride facility at Lewis Farms
- Vehicle storage facility at Lewis Farms
- Expansion of the Gerry Wright operations and maintenance facility
- Low-floor urban vehicles, including step-free boarding
- Guideway/track
- Roads/drainage/landscaping
- LRT signals
- Traffic signals
- Communications/security systems
- Train control system
- Traction power
- Overhead catenary systems

NEXT ISSUE: MAY/JUNE

THE GOVERNANCE ISSUE

Nuclear Perspectives

How Canada stands up in the global energy market.

Missing Middle

Housing’s potential impact on existing infrastructure.

Growing Tall Wood

How policy is changing acceptance of tall wood.

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Will the end of May usher in a new key tenant at the Alberta legislature? Polls leading up to the spring election suggest it's possible.



SPRING 2019 AND BEYOND

The what and how of infrastructure in Alberta. *By Candice Laws*

In spring 2015, Alberta underwent a momentous change as the New Democrat Party (NDP) unseated the decades-old Progress Conservative (PC) government. The province is on the verge of its next election, which must occur between March 1 and May 31, 2019. Change might again be on the horizon as Jason Kenney's United Conservative Party continues to build momentum. At the close of 2018, a poll conducted by ThinkHQ found the UCP leading with 50 per cent support among decided voters; the NDP trailing with 35 per cent.

Battle lines are being drawn ahead of what is likely to be a fierce few months of campaigning, and commitment to infrastructure will feature as high priorities for both major parties. The NDP have been quick to tout their commitment to infrastructure development including their building of schools, roads, and healthcare facilities—especially the Calgary Cancer Centre. Yet, these were also priorities of the previous Conservative government and are likely to continue to be priorities if there is a change in government. This raises the question of what has changed in the realm

infrastructure development in the province. Upon closer look, it becomes clear that the conversation is not around the question of “what” but “how”.

What: big talk, little change

One of the first acts of the NDP government was to enlist former Bank of Canada Governor David Dodge to develop a report to inform their capital investment plan. The

not heeded being the suggestion to introduce tolls to pay for infrastructure.

The resulting level of investment did not appear much different. Prior to the election of the NDP, the provincial government spent over \$5 billion on its capital plan in each year since 2007-08, focusing on a series of health projects, highways, schools and other public infrastructure. In the final Progressive Conservative budget that was introduced—

Should the next election follow polling trends, key UCP commitments have implications for infrastructure investment.

report was based on Keynesian economic logic of investing in infrastructure in weaker economic times when the costs of borrowing and labour are lower. The NDP used this report as their “playbook” and made infrastructure spending a key part of its plan to stimulate a provincial economy hammered by low oil prices. The only recommendation

but not passed—in March of 2015, the Prentice government proposed \$29.5 billion for new schools, health facilities, and roads over five years. At the time Finance Minister Fred Horne noted that “borrowing money for necessary capital projects makes sense because interest rates are the lowest they have been in 50 years.”



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How: the devil's in the details

Having been critical about the use of public-private partnerships in the run up to the election, the NDP were quick to change the conversations around how projects were to be delivered. While not banning public-private partnerships outright, they reduced their use dramatically. This included switching to traditional procurement for the high-profile Calgary Cancer Centre. They also began a shift to public ownership and operation of some facilities and services, notably continuing care facilities and medical lab services, as well as driving tests.

The NDP government also put in place new measures touted as increasing the transparency in how large capital projects are chosen. Alongside their capital plan, they published parameters by which projects were assessed as well as an “Unfunded Capital Projects” list, which outlines the projects in the pipeline in the longer term.

Perhaps the most monumental change was the funding deal struck between the province and Alberta’s two largest cities. Bill 32, the City Charters Fiscal Framework Act enshrines a commitment to Calgary and Edmonton that will see them split base funding of \$500 million in the first year of the agreement (2022). This will then rise or fall incrementally based on provincial revenues. The bill also enshrines into law current rapid transit funding of \$3 billion through to 2027. After that, \$400 million would be made available annually from carbon tax revenue split evenly between Edmonton and Calgary for transit.

This will allow cities greater certainty on funding and support longer term capital planning. Politically, this suggests an increase in the importance of the decision-making process at the municipal level—at least in the province’s two major municipalities—around capital project prioritization.

which may include a return of public-private partnerships.

While Kenney has drawn clear lines regarding the carbon tax, he has been equally clear that his government will be slow, tempered and thoughtful in approaching the province’s electricity system, recognizing the delicate dynamics involved with long-standing issues such as the coal generation phase-out transition.

Recognizing the UCP’s largely rural support base may also increase the pressure on the UCP to secure infrastructure-funding deals for the province’s smaller municipalities, akin to the deals in place for Calgary and Edmonton. The two associations representing small to medium sized cities, towns, and villages and counties—the Alberta Urban Municipalities Association and the Rural Municipalities Association—are currently negotiating with the NDP. However,

PRIORITY PROJECTS TO WATCH

Here are the priority infrastructure projects that could become hot-button issues during the election campaign:

Edmonton’s West LRT expansion

Calgary’s Green Line CTrain expansion

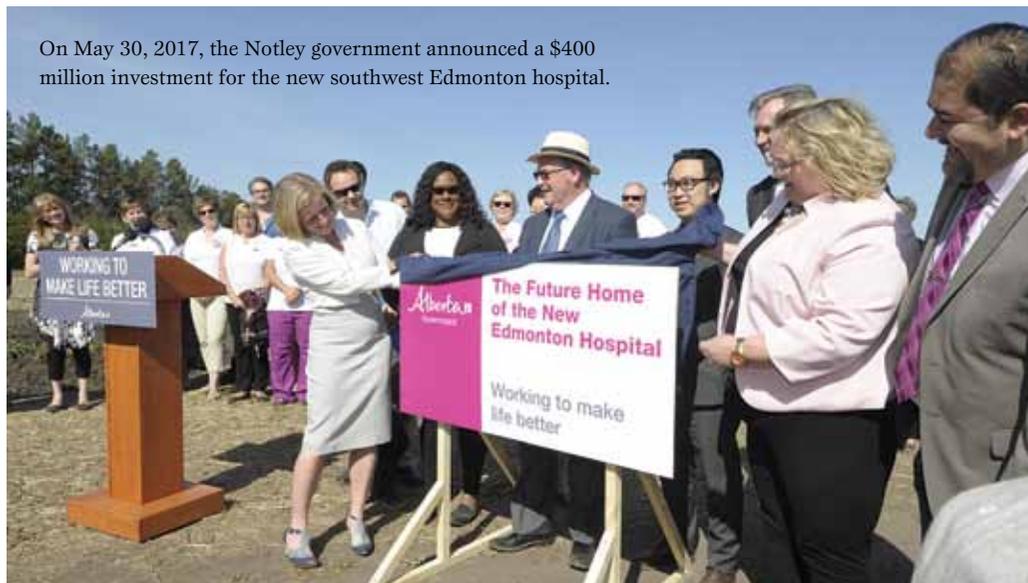
Calgary’s BMO Convention Centre

Calgary’s Arts Centre Transformation (ACT) Project – Phase 1

Red Deer’s regional hospital expansion

Southwest Edmonton hospital

On May 30, 2017, the Notley government announced a \$400 million investment for the new southwest Edmonton hospital.



Credit: Government of Alberta

What this means

Should the next election follow polling trends, key UCP commitments have implications for infrastructure investment. For one, Jason Kenney has been very clear about his intention to scrap the provincial carbon tax. He may choose to replace it with a levy on large emitters, perhaps returning to a model similar to the Specified Gas Emitters Regulation put in place by the PCs in 2007. Whether the levy is scrapped entirely or replaced, there will be reduced revenue available to finance infrastructure projects and will likely see the province return to the use of alternative project financing structures to ensure priority projects can be built,

time is quickly running out, and given the NDP’s support is largely derived from urban centers there is not the same political impetus to ensure a deal.

Elections always lead to a change in priority, but Alberta follows the pattern across the country that infrastructure is a priority across political lines. A change in government could see a change in the route travelled, but the destination should remain largely the same. ♣

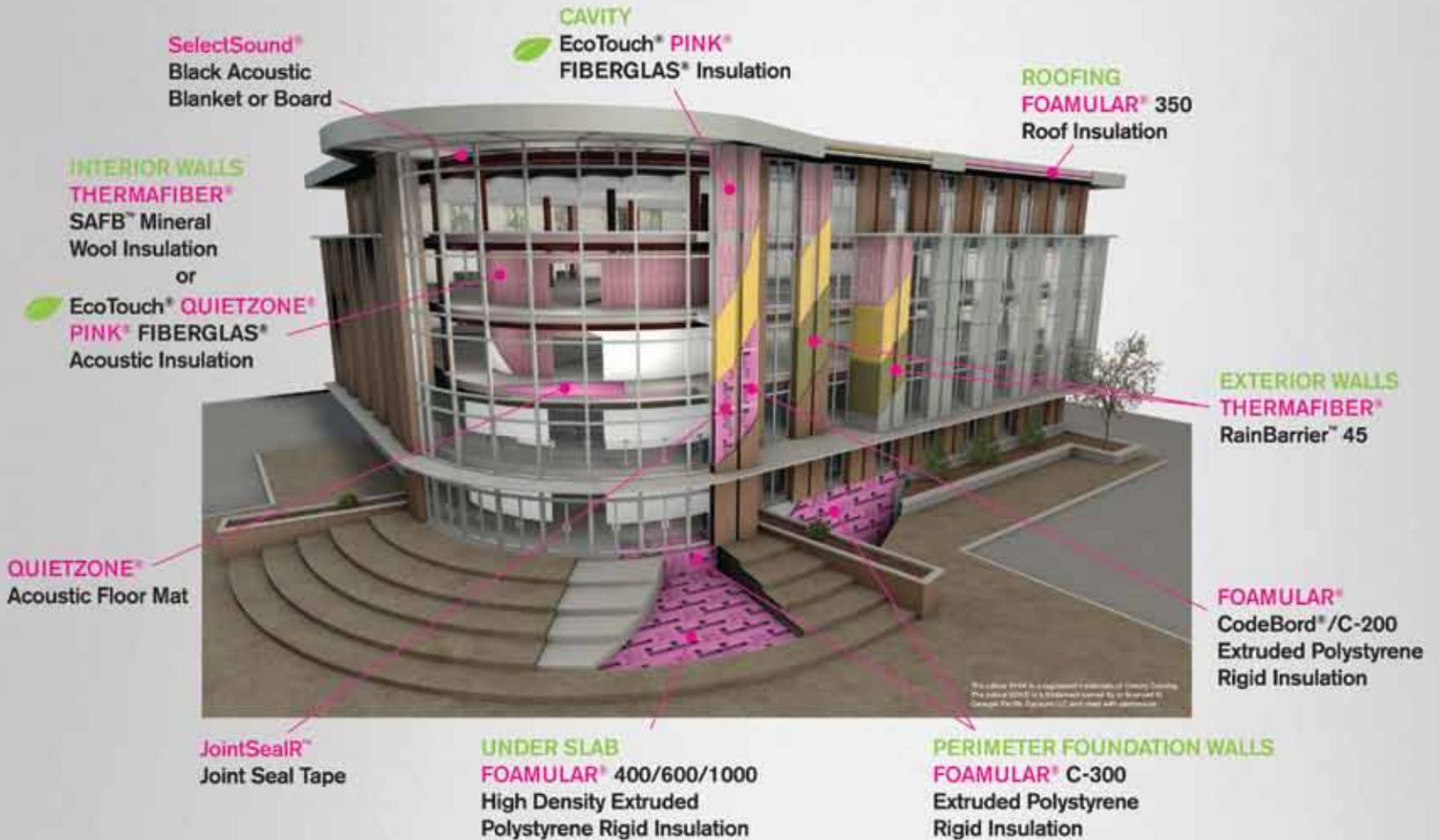


Candice Laws is a director with Global Public Affairs.

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WESTERN CANADA
Luis Faria, B.Eng., PMP, CMgr MCM1
Technical Sales Manager,
Western Canada
1.833.258.5299
luis.faria@owenscorning.com

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The City of Calgary itself is a service provider, and receives around 2,500 attempted cyber attacks per week.



CYBER THREATS

Do municipalities have the tools to protect their critical infrastructure? *By Glenn Miller*

This November will mark the 30th anniversary of the Mississauga train derailment, which triggered, what was at that time, the largest-ever peacetime evacuation in North America. Remarkably, no one was killed when more than 200 rail cars containing chemicals and explosives derailed in the middle of the city, setting fire to buildings and sending poisonous clouds of sulphur and chlorine into the sky.

In today's hyper-connected world, the fact that municipal officials and police were able to successfully coordinate the rapid relocation of more than 200,000 residents fully two years before the emergence of the Internet is impressive to say the least. The event is acknowledged to have had lasting impact on the way cities view emergency preparedness, particularly with respect to the handling of critical infrastructure, a term that encompasses everything from electrical grids and water systems to telecommunications and rail infrastructure.

The new frontier

Since 1989, the field of emergency planning and response has evolved to become an essential, highly professionalized component of how cities manage risk, but the recent release of two major reports from Public Safety Canada and the Senate Standing Committee on Banking, Trade and Commerce suggests that dealing with cyber threats could become the new frontier for emergency preparedness planning for municipalities.

National Cyber Security Strategy—Canada's Vision for Security and Prosperity in the Digital Age, issued in June 2018, affirms the government's commitment to "protect the safety and security of Canadians

and our critical infrastructure," in part through "funding for the Canadian Centre for Cyber Security to support leadership and collaboration between different levels of government and international partners." The key message from Minister Ralph Goodale is, "We are heavily inter-connected and networked, a fact that enhances our quality of life, but also creates vulnerabilities. From commercial supply chains to the critical infrastructure that underpins our economy and our society, the risks in the cyber world have multiplied, accelerated, and grown increasingly malicious."

Cyber Assault—It should keep you up at night, published by the Senate in October, identifies ten critical infrastructure sectors that need special attention, including energy and utilities, water, and transportation. Among other recommendations, the Senate report calls on the federal government "to enable and fund cyber security skills training programs, in collaboration with the provinces, territories and municipalities, to assist businesses with their cyber security needs."

Although both reports benefited from extensive consultation across multiple sectors, municipalities did not directly participate in the hearings. According to Matt Gemmel, manager of policy and research with the Federation of Canadian Municipalities (FCM), "Municipalities, not unreasonably, are still focused on the broader topic of smart cities are dealing with long-term challenges like aging infrastructure and the overall infrastructure deficit. The priority for emergency planners tends to be focused on responses to climate change." This sentiment is echoed by Craig Read, a senior advisor with the Association

of Municipalities of Ontario (AMO), who suggests that: "Cyber security issues at this point are still being dealt with on an individual basis in terms of risk analysis, in part because municipalities lack the capacity to deal with additional issues."

Brent Arnold, a partner with Gowlings WLG, whose practice focuses on cyber security, agrees. In his experience, most municipalities are still in "reactive mode when it comes to cyber security. But cities ready to embrace cyber security are opting to integrate the practice into their emergency response planning processes."

Although this approach makes practical sense, there are stark differences between vulnerability assessments that avoid locating sensitive land uses in flood plains versus less tangible challenges associated with coping with malware and hacks by perpetrators whose location may be undetectable. In an age where the Internet of Things (IoT) is already defining our world, everything from cars, to refrigerators to domestic thermostats—as well as a community's many critical infrastructure assets—are connected to the Internet, and therefore vulnerable to cyberattack.

As Minister Ralph Goodale notes, networked interconnectivity has many benefits but also introduces vulnerability. In the decades since the Mississauga derailment, for example, improvements in communications technology have had a significant impact on reducing the number of rail-related accidents. Railway dispatchers can now monitor the condition of freight train wheels remotely, which reduces the risk of derailment by detecting faulty wheels before they break, permitting a supervisor to bring the train to a halt to allow a

physical inspection. But this enhanced communication capability also creates problems for emergency preparedness planners because hackers can potentially override a railway's intranet, causing a freight train to accelerate into a curve, with disastrous consequences.

According to Bruce Schneier, author of *Click Here to Kill Everybody—Security and Survival in a Hyper-connected World*, researchers have already demonstrated that it is possible to hack into an automobile's supposedly secure entertainment system to manipulate a car's steering wheel or cause the car to accelerate without warning. In the municipal context, engineers now routinely monitor water flow from their desktops and rely on embedded sensors to identify cracks in distribution pipes before leaks occur. But this means that hackers can also take control of any interconnected system, opening sluice gates or switching off alarms.

Cyber attacks on the rise

Although cyber-attacks against critical infrastructure such as electrical grids and water utilities appear to be on the increase globally, media reports tend to focus on security breaches in the private sector, particularly those affecting customer data. Nevertheless, industry representatives remain philosophical about the challenge of beefing up security systems.

Introducing firewalls and encryption, the most commonly used industrial cyber security programs, is one such challenge. These are complex systems that require a level of training and technical expertise that is expensive to acquire, they say. Such systems also require a high level of acceptance and compliance on the part of utility staffers, whose default priority still tends to be avoiding downtime.

Michael Deane, executive director of the National Association of Water Companies in the U.S., writing in the Huffington Post, points out that in an increasingly interconnected environment, managers are faced with a dilemma. "While the evolution of computer-based management systems has improved the reliability and quality of water services, (this also) increases the possibility of targeted or accidental cyber events that could lead to disruption in the water supply." He adds, "In the drinking water and wastewater sectors, a cyberattack could hone in on four different threat vectors: chemical contamination, biological contamination, physical disruption, and interference with the highly specialized computer systems controlling essential infrastructure."

Damiano Bolzoni, founder and CEO of SecurityMatters.com, a U.S.-based cyber

security firm, points out that industrial control systems (ICS) play a key role in the smooth operation of energy, water and telecommunications utilities, and merit special attention. "Internal malfunctions are far more frequent than targeted cyber-attacks. From disgruntled employees to careless or malicious third-party contractors and vendors, insiders are a major source of threats to ICS networks. Insiders have deep knowledge of the network and often unrestricted access to its resources, and therefore, a very easy way to cause damage through intentional or unintentional misuse." A frequently cited example is the case of a community in Australia where a former contractor caused 800,000 liters of raw sewage to spill out into local parks and rivers.

Another challenge is that because risk analysis begins with a review of historical data, in sectors like water distribution, energy and transportation where the uptick in cyberattacks on critical infrastructure globally is a relatively new phenomenon, facility managers tend to underplay the significance of such attacks.

Collaboration is key

An important lesson for city managers and municipal policy makers, notes Arnold, is that cities must plan for—and be prepared to deal with—threats to all critical infrastructure located in their jurisdiction, not just infrastructure under their direct control. This includes pipelines, telecommunications, and hydro infrastructure as well as railways. The need for an inclusive approach that embraces the needs of all stakeholders and their respective critical assets is clearly outlined in a 2016 report prepared by CEMA (Calgary Emergency Management Agency), which identifies "cyberattacks and hyper-connectivity, plus aging, vulnerable infrastructure as two trends expected to impact Calgary's emergency management preparation and planning" in the coming years.

This is no surprise to Arnold, who identifies Calgary as a leader in the area of municipal cybersecurity. The City's chief information security officer, Owen Key, who previously worked in the private sector, has revolutionized Calgary's approach and staff capacity to address the City's security needs since arriving at the City in 2004. "Calgary faces unique cyber security issues," he explained recently to a national conference audience. "Unlike Toronto and Ottawa which use third-party providers, the City of Calgary itself is a service provider, and receives around 2,500 attempted cyber-attacks per week."

The push to upgrade Calgary's capacity to deal with all kinds of threats to critical infrastructure, including cyber-related issues,

began with a desire to better coordinate across municipal departments but has since expanded to include an extensive range of public, private and institutional stakeholders, as well as direct linkages to provincial and federal response teams. The latter initiative is seen as a high priority and is featured prominently in CEMA's action plan.

The holy grail of collaboration however, may well be embedded in comments made by an NGO based at the University of Waterloo. Responding to the government's *National Cyber Security Strategy*, Quantum Safe Canada (QSC) highlights the National Strategy's focus on "the need to prepare for increasingly sophisticated threats to the cyber systems relied on by our critical infrastructure and democratic institutions." QSC agrees that "cyber security is not only a means of protection, but also an important source of innovation that will help ensure Canada's competitiveness."

Bill Munson, a senior staffer with QSC whose roots are in municipal public works, adds that the National Strategy commits the government to "focus on emerging areas of Canadian excellence, such as quantum computing." He points out that although it will likely be a decade or more before quantum computing becomes a reality, the push for intense collaboration between all levels of government, academia and the private sector should begin immediately.

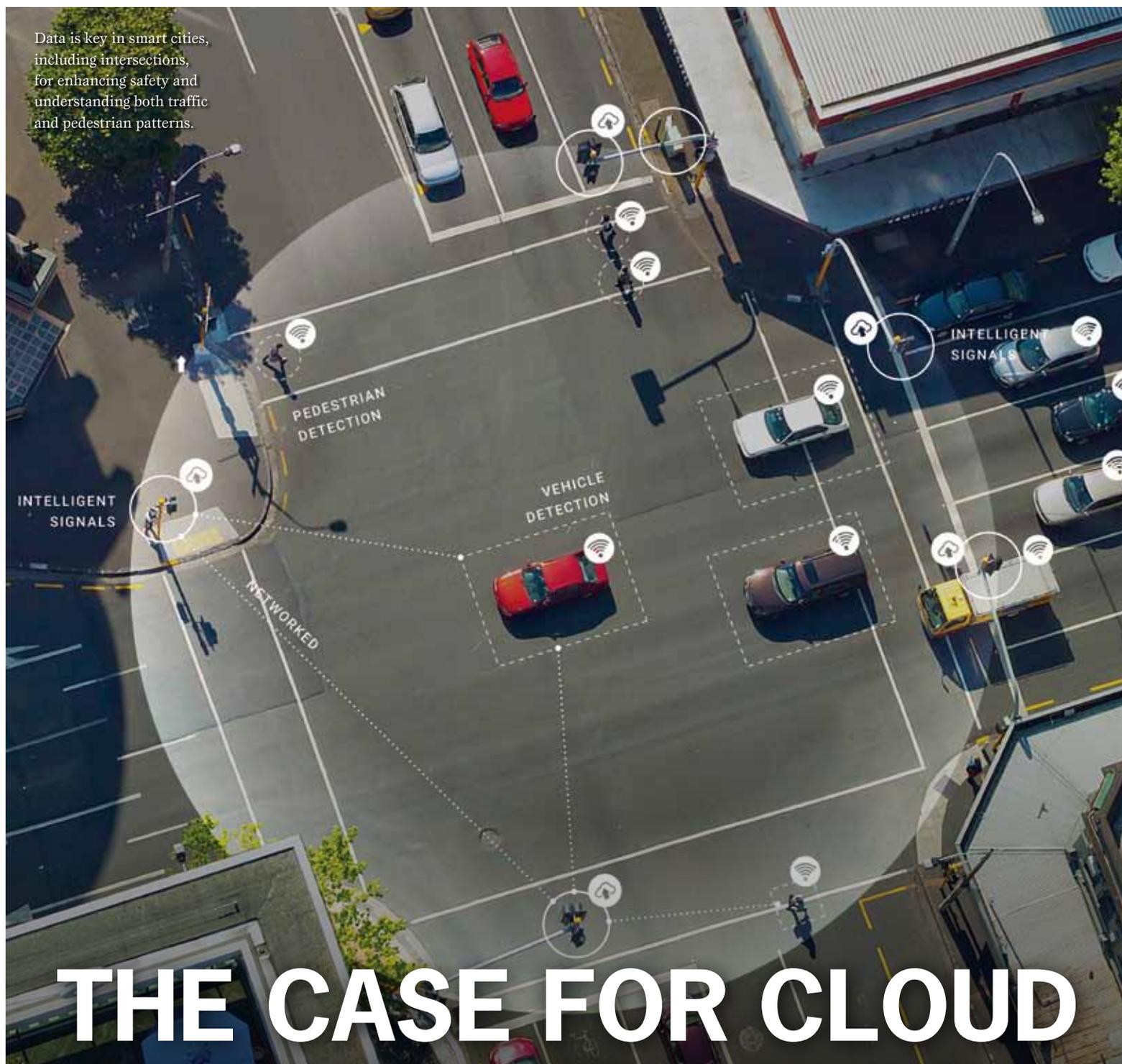
As noted in QSC's brief to Pre-Budget Consultations in advance of the 2019 Budget, "Quantum computing will bring an almost unimaginable speed-up in the ability of computers to perform calculations. Unfortunately, along with enabling wonderful advances in, for example, mapping the human genome and testing new life-saving drugs, powerful quantum computers will also allow today's 'unbreakable' encryption to be hacked in minutes." What this means for critical infrastructure remains to be seen.

If cyber security is indeed the next frontier for municipal emergency preparedness planners, concerns like those raised by QSC could well put issues raised in this article closer to the top of municipal agendas. At a minimum, municipalities need to be included in on-going discussions led by the Canadian Centre for Cyber Security and capacity-building initiatives recommended by the Senate Standing Committee on Banking, Trade and Commerce. ♣



Glenn Miller is a senior associate with the Canadian Urban Institute and a frequent contributor to ReNew Canada.

Data is key in smart cities, including intersections, for enhancing safety and understanding both traffic and pedestrian patterns.



Credit: MoxVision

THE CASE FOR CLOUD

Why security and privacy aren't blockers for smart cities. *By Geordie Anderson*

Each day, more and more cities leverage cloud for their applications in order to enhance citizen engagement. Whether it's smart signals for traffic like the Town of Milton implemented to address congestion concerns on two busy intersections or getting public transit users real-time data on buses for the Grand River Transit system in the Region of Waterloo, municipalities are looking at a myriad of solutions. While transportation and mobility are often top of mind when we think of smart cities, the use cases for public safety, public health, and the environment can't be overlooked.

Implementing some of these solutions can seem daunting when you have to consider

using legacy systems and navigating security and privacy concerns. But the cloud offers answers to those pain points.

Local data privacy laws

Municipalities need to classify their data and should understand how their Cloud Service Provider (CSP) handles and stores data, including the geographical locations where data will be stored. As an example, Amazon Web Services (AWS) operates a region in Canada, located in Montreal. Municipalities have the flexibility to choose the AWS Region in which to place their data. Customer data is not replicated to other AWS regions, and does not move, unless the customer moves it. This allows municipalities to comply with

local data privacy laws, by controlling where data is stored, who can access content, and who can control its lifecycle and deletion.

A common security best practice is to encrypt both data in transit and data at rest. When encrypting data, an important consideration is key management, especially in the cloud where resources are elastic and can easily scale up and down. Municipalities can leverage many different options for key management in the cloud. CSPs will typically provide some form of a native key management service, which is usually the simplest method to use, as it is integrated with many other resources and services. This makes it simple to create and control the keys used to encrypt your data, without

the hassle of actually having to manage the keys. A second method is to leverage a third-party key management solution. There are many third-party software vendors that provide key management solutions which can integrate with both on-premises and cloud environments. A third method for municipalities that need to align to more stringent compliance requirements, is to use a cloud-based hardware security module (HSM) service. Several CSPs provide cloud-based HSM services, available on a monthly pay-as-you-go basis, which can align to FIPS 140-2 Level 3 compliance.

Enable central identity management

Most municipalities will already have some form of on-premises corporate directory service, such as Microsoft Active Directory. Rather than duplicating a second set of identities in the cloud, municipalities can leverage their existing corporate directory for authentication, in order to access resources in the cloud using single sign-on (SSO). This can be achieved using identity federation protocols such as Security Assertion Markup Language (SAML) 2.0. This enables municipality staff to leverage their existing corporate credentials in order to access resources in the cloud, providing a single source of truth for user authentication.

As municipalities continue to evolve and provide more online services to residents, it becomes very important to provide a deeper level of security protection to those public-facing web resources. A web application firewall (WAF) can go beyond a traditional firewall with the ability to filter content specific to web applications. WAFs typically

Infrastructure as code

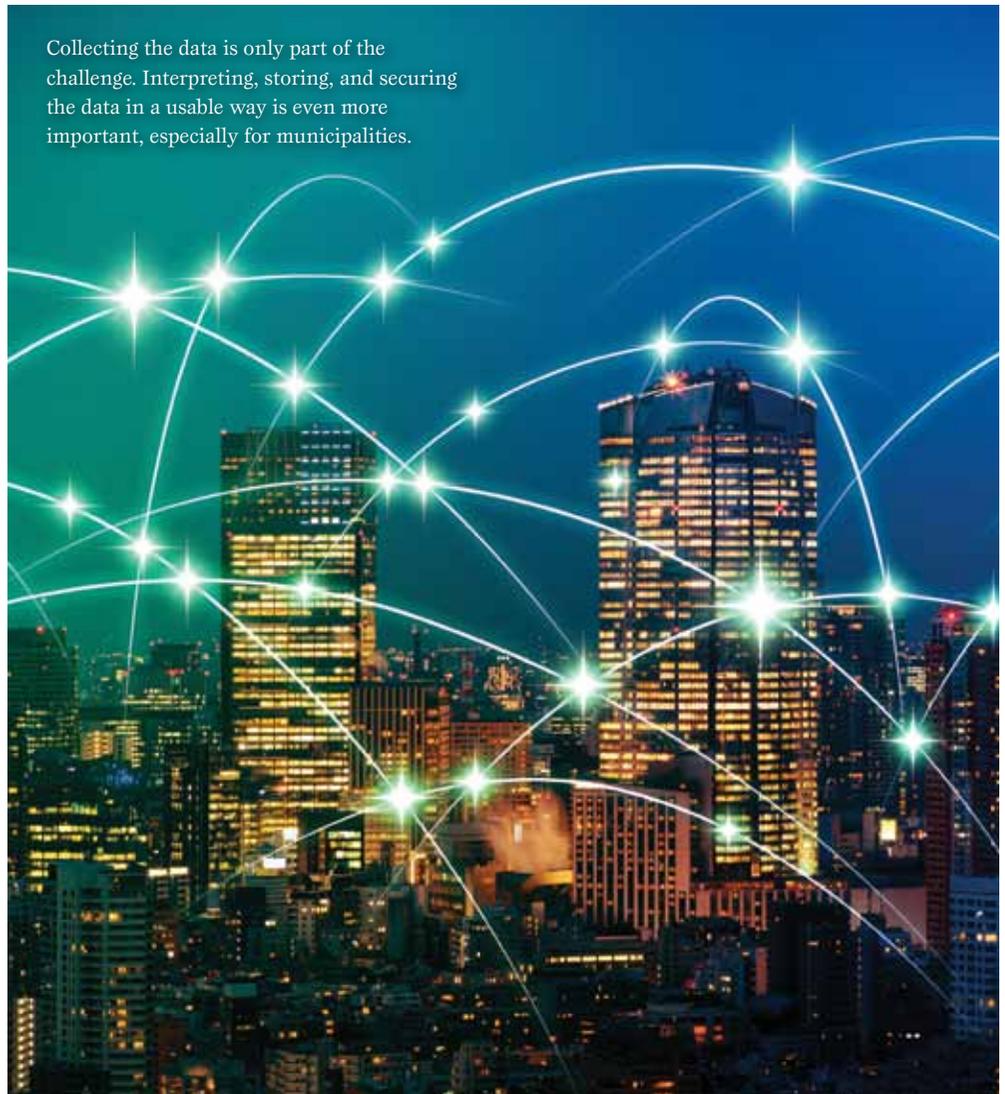
CSP offerings are typically Application Programming Interface (API) based services, meaning that infrastructure can be template-driven and dynamically provisioned in a programmatic way. Architecture artifacts can now be committed to common repositories

a multi-account strategy should be considered for scalability and security. As an example, AWS has released a new solution called AWS Landing Zone, which is an automated template-driven deployment based on best practices for a multi-account strategy. It provides a baseline environment that large organizations like municipalities can leverage for central account management, identity management, access management, governance, data security, network design, and central logging.

It is an exciting time for municipalities as they migrate to cloud, taking advantage of the many benefits such as agility, elasticity, and cost optimization. Addressing security, risk, and compliance requirements aren't insurmountable obstacles as once thought. Whether you work directly with a Cloud Service Provider, or use a partner to run your projects, moving applications to the cloud to better serve your citizens is a smart move. 🌟

and revision control systems, and then deployed using Continuous Integration/Continuous Delivery (CI/CD) tools. This is a key benefit in high-risk environments, where configurations can now be defined and managed entirely in code. Governance can be achieved by deploying environments in an automated and consistent fashion, based on approved IT architectures, limiting error-prone human interaction.

For large organizations like municipalities,



Collecting the data is only part of the challenge. Interpreting, storing, and securing the data in a usable way is even more important, especially for municipalities.

Municipalities need to classify their data and should understand how their Cloud Service Provider (CSP) handles and stores data.

help protect against common web exploits such as cross-site scripting, SQL injection, bad bots, and content scrapers. Several CSPs offer cloud-based web application firewalls as a service, with monthly pay-as-you-go pricing. Other options for WAF deployments in the cloud include running third-party software-based WAF images on cloud-based virtual machines, or even third-party WAF offerings that are Software-as-a-Service (SaaS) based.



Geordie Anderson is a solutions architect that focuses on security for Amazon Web Services in Canada.

Cities fear the damage done when the rain starts to pour. With a new approach to grey assets, that fear will wash away.



CHANGING OUR PERCEPTION

Converting impervious space into resilient assets.

By Dr. Alexander Mirescu

What is the one thing that nearly every municipality, regardless of size, has in abundance? It is impervious spaces and urbanized surfaces. Indeed, the very creation of concentrated urban centers is predicated on converting the earth's surface into concretized, buildable foundations for every aspect of life, from schools to public transportation, from hospitals and commercial centers to sidewalks and streets. No matter where you look, human dwellings in Canada, large or small, have a high percentage of concrete and asphalted space. And the trend is growing, rapidly.

Ask any urban planner and they will tell you following: the planet is urbanizing at the fastest rates in human history. According to the United Nations, by mid-century seven in every ten humans will live in an urban area with the most pronounced urban growth to take place in medium-sized urban areas, rather than megacities. Try to imagine medium-sized municipalities, like Markham, Saskatoon, Regina, Burnaby, Gatineau, or Windsor, with 500,000 to one

million inhabitants by 2050. Unless properly managed and innovatively designed, this type of growth will bring more risks than advantages, more social pressures than economic growth and more stress on critical infrastructure. If we combine rapid and unplanned urbanization with the negative effects of climate change (longer and more intense rain events, flash floods, and sea-level rise), then the future success or failure of Canadian cities becomes dependent on their ability to design and build in ways that make them more adaptive, less vulnerable to disruption and, ultimately, more resilient.

Urban resilience is no longer the buzzword it once was, but rather is a proven urban design and policy solution to an increasingly complex set of risks and 'stressors,' as it combines essential aspects of urban growth: sustainability and climate adaptation, planning, construction and development, community inclusion, and infrastructure. While there is minor squabbling about a still elusive standardized definition, academics and practitioners largely agree that resilience

is the capacity of an urban system to resist, absorb, recover and evolve. Resiliently designing, adapting, and retrofitting the built environment of municipalities that are exposed and vulnerable to hazards can begin to reverse existing risk drivers—attributes that increase the likelihood of smaller, but more regular and costly disruptions, as well as larger atypical events. Parallel to climate change and urbanization, other man-made risk-drivers include governmental knowledge gaps, ageing infrastructure, ecological degradation, poverty, exclusion of key stakeholders, and poor land use management.

However, experts have recently started to focus on a new risk driver: traditional engineering. Faced with such a complex risk profile, municipalities and the private sector can no longer rely on decades-old design practices and a lack of information on new engineering technologies. Traditional engineering approaches are effectively being outpaced by climate risk. Recognizing this weakness, small and larger design firms have



Waterloo's ION Light Rail System is lined with flood mitigating green infrastructure and tree pits; an innovative use of pedestrian spaces to increase the resilience of critical transport infrastructure.



Markham's Free Methodist Church, whose spaces were designed for subterranean storm water capture, green infrastructure, and water re-harvesting. This reduces stress on municipal water infrastructure, which saves Markham money on costly pipe and catch basin repairs.

begun to more actively promote and integrate new resilient innovations, especially in the area of subterranean storm water capture and green infrastructure. The concept of “building back better” after a flood event rather than using antiquated approaches, which likely contributed to the disruption, has been gaining traction as flood mitigation technologies have become more accessible.

Because of new design approaches and the pressures of increased disaster risk, municipalities and the real estate development and construction sectors have a unique opportunity to convert the built environment into resilient assets. From the private sector perspective, real estate developers, recognizing that risk affects their long-term value chains and business continuity, are turning to resilient

capture. What mayor, councilor or planning board would not approve flood resilience at virtually no cost to the municipality?

From the municipal perspective, converting risk-driving impervious spaces into resilient assets makes for a good business model. According to the World Bank and the United Nations Office for Disaster Risk Reduction, one dollar invested in resilience equals approximately seven dollars for response, recovery and reconstruction. Since most municipalities have annual budgets for repairing existing impervious surfaces or building new ones, resilience becomes a smart investment with proven return on investment. Moreover, benefitting from the knowledge transfer and technology exchange from successful project implementation in the private

occur and reduce the risk of costly asset loss (carriages, track, switching technology, and stations).

In Tavistock, a real estate developer integrated large-scale storm water capture into its design plans. In an effort to protect local waterways and enhance municipal flood management, Apple Homebuilders designed their Ponds residential community with subterranean capture technologies. Similarly, designers and construction engineers at Cameron Welch Management opted for a multi-role storm water management system for the Markham Free Methodist Church. By capturing pluvial, flood and rain waters in the design of the structure, the church's foundation generates additional municipal benefits of reducing combine sewage outfalls and protecting water quality, as well as the ability to re-harvest captured water for the site's green infrastructure.

These cases highlight the capacity of municipalities to adapt to a more complex set of risks, both man-made and natural, by pivoting to innovative design approaches and creative technologies. Cities do not have to completely re-design their spatial footprint, but they are beginning to show that re-thinking their relationship with impervious space does not have to one of risk generation. Instead, more and more real estate developers, urban planners and design and engineering firms, as well as mayors and councilors, are turning to cost-effective options to convert risk driving impervious and grey field spaces into something of municipal benefit. Ultimately, citizens, the private sector and municipalities reap the rewards of a more resilient urban environment. ♣

From the municipal perspective, converting risk-driving impervious spaces into resilient assets makes for a good business model.

design approaches as a municipal benefit. Next to the standard palette of givebacks that planning boards expect from new developments or redevelopment projects, innovative real estate developers are partnering with forward-thinking design firms to integrate greater storm water capture and enhanced green infrastructure into parking areas, right-of-way and sidewalk spaces and plazas as a competitive advantage over other bidders and gain the favour of planning boards for quicker approvals. The municipality becomes the beneficiary of resilient stormwater management that can detain, delay and reduce the hydrological load on an ageing and easily overwhelmed infrastructure, thereby saving the city millions on costly infrastructure by decentralizing flood and storm water

sector, municipal decision-makers can craft policies for the repair and maintenance of right of way, streetscape, public realms, bike lanes, and parks to mandate subterranean storm water capture. Over time, the private and municipal sectors can turn impervious spaces into resilient assets.

In Canada, municipalities and their private sector partners have demonstrated the viability of this approach. As a type of retrofitting of the right of way, the region of Waterloo strategically installed flood mitigating green infrastructure and tree pit technology alongside segments its 19-kilometer long light rail system (see image below). Designing sidewalk spaces with the additional performance of flood capture and enhanced tree canopy will extend the LRT's lifecycle, ensure that less service disruptions



Dr. Alexander Mirescu is the business unit head of urban engineering at Pontarolo Engineering.

BUILDING CORE COMPETENCY



Education and understanding is helping to change the culture on managing assets in communities like Oakville.

Ensuring communities understand, and implement, the basics of asset management. *By Iain Cranston*

As if the magnitude of Canada's aging infrastructure base across the country, and size of the associated financial deficit—last estimated to be \$125 billion dollars and growing by \$2 billion per year back in 2016 according to the Federation of Canadian Municipalities (FCM)—wasn't a big enough issue to deal with. We also have the added factors of climate change, population change, and a limited public funding model, not to mention living in an era where customers are demanding higher levels of service at a lower cost. But it's even more than that. We know that infrastructure asset management (AM) can help us fully understand the scope of the deficit, help us articulate the optimum balance of service, risk and cost for asset owners, and help us plan a sustainable way forward; but organizations need help in implementing more complete asset management practices. Industry and public sector infrastructure owners across Canada tell us their organizations face a serious hurdle to dealing with the above challenges—increasing capacity and building capabilities to develop and implement formal, organization-wide asset management programs.

In recent years, there has been a major surge in training courses and materials available on asset management to the industry, due to a combination of demand from the sector, as well as funding from various levels of the Canadian government to stimulate this very issue of capacity

standard has done amazing things for the industry—in aligning people on the debate between 'big picture' infrastructure asset management versus maintenance management, and the scope of an organization's management system and controls framework for asset management

For asset management to be truly successful in your community, you must work across your organization [...] to connect the valuable components and information.

building. But we need more, and we need a better framework for communities, training providers, and public regulatory bodies to align with.

"Changing the culture of an organization takes time, but the best way is through education and understanding. Ultimately, our goal is for everyone to have a core competency within asset management." said Shawn Boast, manager of asset management for the Town of Oakville.

While the ISO 55000 international

activities—it does not provide communities with the detail of activities or processes needed to build for asset management in the context of public sector infrastructure or services, nor was that the standard's intent.

Developing a competency framework

People do asset management. The staff in your organization is critical to progressing asset management. The staff needs to work together in cross-functional groups, and

organizations need to develop any of the necessary skills, behaviours and knowledge they might be missing. For some, this can be a big change and a different way of working. For some organizations, this can require staff training and/or new hires. To support this, we are developing an Asset Management Competency Framework for Communities. The framework will help formally capture the AM skills, behaviours, and knowledge you need across your organization, and enable you to put training plans in place to help staff fill the gaps.

“Asset management isn’t a capital project like building a bridge. It’s a change in perception and way of working,” said Gordon Duff, treasurer and deputy CAO for the Town of Minto, Ont.

For asset management to be truly successful in your community, you must work across your organization—breaking down department silos—to connect the valuable components and information that can often be tucked away. You need to bring together people and skills across the organization to solve your service and infrastructure problems: engineers, planners, accountants, and elected officials. So, we are walking

our own talk. The Canadian Network of Asset Managers (CNAM) is bringing together several national associations that are involved in supporting the various aspects of community management and industry professions to leverage their collective expertise in developing this Asset Management Competency Framework for Communities. One of the partners CNAM is working with on this initiative is the Government Finance Officers Association (GFOA).

“This is a great opportunity to help local governments solidify their approach to asset management. We are excited to be a part of it,” said Shayne Kavanagh, senior manager of research at the Government Finance Officers Association (GFOA)

This initiative is delivered through the Municipal Asset Management Program, which is delivered by the Federation of Canadian Municipalities, and funded by the Government of Canada—without whom this would be not be a possible, so a big thanks for their continued support.

The competency framework will provide alignment across the industry on the scope of the discipline, highlight the

connections with the various professions in the organization, and identify skills, behaviours, and knowledge communities should have in place to support delivery of their asset management programs. The framework will be developed over the course of 2019 and will be widely reviewed by various professional groups and tested with many communities across Canada before being finalized later in the year. ✦



Iain Cranston is director of icInfrastructure and a program manager with the Canadian Network of Asset Managers.



Join CNAM, FCM, and the other national partners May 6-9, 2019 in Kelowna, B.C.—Canada’s sixth fastest growing city—for the 13th CNAM Annual Conference. For more information on this initiative, visit cnam.ca/AMCompetencyFramework.

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Bio-En Power Inc.'s 70,000-tonne/year R&D biogas plant in Elmira, Ontario facility.

Solar panels on the Windsor International Aquatic & Training Centre.



Bright, energy saving LED lighting at the Vancouver airport.

A CALIFORNIA ALTERNATIVE

How Canada can build its own strategy for household energy production.

By Carroll McCormick

Starting in 2020, new homes in California will have to include solar rooftop panels. In Canada (thankfully, many would say) the Canada Building Code has no such plan. Instead, an enthusiastic marketplace is choosing from a buffet of alternative energy technologies that are evolving to exploit a variety of niches.

Each offers a special place in the post-fossil fuel and post-mega-project energy mix, tapping sources like wind, sun, waste heat, and decomposing organic waste.

For towns and cities, which lie between the bookends of homeowners, with relatively modest budgets, and provinces, quite capable of unrestrained spending, this variety—like sizing shoes to feet—lets them tap available resources and work within their larger, but finite means.

Here are some examples of what they are doing:

Solar

Often referred to as PV (photo-voltaic) systems, solar panels have some advantages over all other technologies. They are easily scalable, from home set-ups, to the 10-kilowatt (kW) array on the roof of the Kington Airport terminal, to the 50-Megawatt (MW) Windsor Solar project in Windsor, Ontario. They are pretty much maintenance free and they last a long time.

Environmental, energy and waste management policies at the provincial and federal levels are starting to coalesce and offer a supportive platform.

According to the National Energy Board (NEB), by 2015 there was 2,135 megawatts of installed capacity in Canada, representing 0.5 per cent of the country's electrical generation. That sounds miniscule, but, the NEB notes, that that amount grew by 2,344 per cent between 2005 and 2015, and the installed per-watt cost is plummeting from \$6.18/watt in 2004 to \$0.85/watt in 2014.

The City of Windsor, in Ontario, is big on solar, part of what Sergio Grando, its manager of energy initiatives refers to as the city's low-hanging fruit strategy. Solar is the best of the alternative energy technologies the city has adopted, he says, "[...] because of the simplicity of it, and that, by and large, you will always have sunshine. Because there are, generally speaking, no moving parts, it is an efficient energy source to use. Solar panels still produce 80 per cent of initial output after 20 years and can last 30 years."

The city's biggest PV systems are feed-in tariff: the electricity they generate go into the provincial grid and Hydro One pays the city for what it produces. They include systems on the Windsor International Aquatic & Training Centre (350kW), WFCU Centre Community Pool (500kW) and the Transit Windsor Garage (500kW).

"We get a monthly cheque," Grando says—around \$750,000/year for these three systems alone. "These panels don't require a lot of maintenance. Since they were commissioned, we've done nothing."

The city has begun installing solar panels using what is called net metering. "With net metering you can't sell any

excess to the grid. The electricity produced will go into the buildings. It is the wave of the future," Grando says.

Research being done by the Berwick Electrical Commission, in Berwick, Nova Scotia, illustrates the possibilities for PV in small towns. The power needs of Berwick, with a population around 2,500, are served by its own hydroelectric dam,

wind turbines co-owned with two other towns, and power purchased from the provincial grid.

Once the hardware drops enough in price, the town envisions a solar garden in which ratepayers own shares, rather than having their own systems. "We hope to divert the cost from rooftops to a scale that fits our own utility. [The power] will be sold to the utility," says Don Regan, superintendent at Berwick Electrical Commission.

Regan mentions another PV project. "We have four experimental panels floating in one of our sewage treatment lagoons. The plant operator tells me the panels shed snow well, one of the elements we wished to examine."

Wind

According to the Canadian Wind Energy Association (CanWEA), there are 295 wind farms in Canada. In 2017 the installed capacity was 12,239MW, up from 137MW in 2000, and met about six percent of Canada's energy demand.

Here's how three little Nova Scotia towns got together to build a wind farm:

The Berwick Electrical Commission, the Antigonish Electrical Utility and the Mahone Bay Electrical Utility were seeking a company to build a wind farm, but they were not having any luck. "We went to the market three times asking for proposals for wind energy. The third time we did that, it was suggested we build our own. The proposal that came back was to build it for us and have Enercon service it," Regan says.

Construction of the wind farm, in Ellershouse, about a 40-minute drive east of Berwick, started in 2015. Ten Enercon E92 machines, at 2.35MW/each, were erected in three phases, with the last three coming on line around the end of 2017. The project cost \$51 million - shared among the three utilities to reflect each one's electrical consumption.

"Electricity from Ellershouse is delivered to the four utilities (Riverport is a customer but not an owner) using the Nova Scotia Power transmission system under the Open Access Transmission Tariff. We pay to use the system. The wind farm provides 40 percent of the electricity we sell to our customers," Regan says.

A KILOWATT SAVED...

Surely the easiest way to earn a kilowatt is to not burn it in the first place. While methods abound, including better insulation and windows, caulking, and passive solar heating, retrofitting with equipment that uses less electricity is a potent strategy.

Likely the best-known switch currently is to LED lighting. Big-ticket LED fans are North American airports. They have been replacing their powerful airfield lighting (and terminal lighting too) with millions of LED lights. They are two-to-four times more efficient than incandescent fixtures, according to ADB Airfield Solutions.

The Vancouver airport tested taxiway lighting back in 2003. The technology has since advanced to where all airfield lighting, including approach lights, can be LED. Adopter Canadian airports, to varying degrees, include St. John's, Halifax Stanfield, Iqaluit, Quebec City, Billy Bishop, Pearson, Winnipeg, Calgary, Vancouver, and Victoria. ✿

Geothermal and waste heat

The prototypical understanding of a geothermal installation is of wells that tap hot water deep in the ground, which is pumped up to warm buildings. (Residential systems, in which the ground warms liquid pumped through tubing buried in yards, which in turn heats houses, are called geo-exchange, according to the Canadian Geothermal Energy Association.)

Hinton, Alberta is working on a plan to use heat from the bottom of an abandoned gas well to heat municipal buildings. The skinny on the economics of the plan, according to Epoch Energy Development, which Hinton commissioned to conduct a pre-Front-End Engineering Design study, is that the project would heat 12 municipal buildings, and have a 16-year payback. One article notes that the project cost will be \$10.2 million.

(Of geothermal and Windsor, Grando notes, “We have done some analyses. The cost of some of the sites we were looking at were significant. Five, six, seven-year payback you can sell to senior administrators, 10-14-year

paybacks become more difficult to sell.”)

While geothermal energy extraction of the deep-well variety seems to be in its infancy in Canada—one article touts Hinton as the first to attempt it for heating—there is a variation on the geothermal theme that nicely illustrates the site-specific nature of some power and heating opportunities; in this case, flooded coal mines.

has a number of facilities that are using heat from the coal mines. Compared to drilling deep for hot water, Brushett says, “The drilling costs are much lower.”

Speaking of free heat, what about the waste heat we dump in the process of doing something else? Brushett gives a tantalizing example with a story about waste heat recovery in the Centre 200 cultural and

An enthusiastic marketplace is choosing from a buffet of alternative energy technologies that are evolving to exploit a variety of niches.

Nova Scotia has a long history of mining coal. Abandoned mines were left to flood, and the ground heated that water. According to David Brushett, energy manager at Halifax Regional Municipality, Efficiency Nova Scotia, arenas in Glace Bay and Springhill are extracting heat from this warm water. B-Way, a plastics company in Springhill, uses mine water to heat its building. The Cumberland County Municipal Authority is trying to market the flooded coal mines and

entertainment facility in Sydney. “That facility was using \$200,000 worth of oil a year to heat. They did a major upgrade about five years ago with a two-stage ammonia system, to recover waste heat from ice making and eliminate the oil bills.”

While he notes that many arenas are using waste heat recovery, there remains a huge amount of potential. For example, he says, “A lot of older arenas use refrigerant (Freon) that needs to be changed out. If you do a

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capex [waste recovery equipment] becomes more of an add-on.”

“There are a lot of opportunities to use waste heat,” he says. “Waste heat is generated from many different sources.”

Biogas

Two hundred participants attended Value of Biogas West in Vancouver this January. Billed as Canada’s premier biogas and RNG (renewable natural gas) conference, attendees heard presentations on challenges and opportunities for biogas/RNG production, case studies, met with exhibitors and even got to tour the Surrey Biofuel Facility and Fraser Valley Biogas.

“[There was] a broad representation from developers, technology providers, government and utilities across Canada, the United States and internationally. The tours were sold out and offered an excellent hands-on experience to complement the information sharing and networking at the conference,” says Jennifer Green, executive director of the Canadian Biogas Association.

The potential for biogas facilities in Canada is large. “There are 225 projects [facilities]

in total, 25 initiated and 200 operational: 84 digester projects (operating or initiated), 88 waste water treatment plant digesters, [and] 53 landfill gas projects producing electricity, heat, or RNG,” Green says.

The greatest concentrations of biogas facilities are in Southern Ontario, the Vancouver area and Montreal.

They come in a range of sizes: On the large end are installations like Toronto’s Dufferin Organics Processing Facility, which, by the end of 2018, was due to double its processing capacity of organic materials from the city’s Green Bin program to 50,000 tonnes/year. “It is estimated the RNG facility will produce approx. 5.3 million cubic metres of RNG annually, enough to fuel 90 percent of the city’s solid waste collection fleet,” Green says.

A medium-size system, Green says, “[...] [is] any farm-scale system producing 250-500kW of renewable electricity.” An example of a micro-scale system is the 20-kW digesters, from Belgium-based Bioelectric, at Harcolm Farms in Beachville, Ontario. Anaerobic fermentation of cow manure produces gas, which fuels an engine, and produces electricity to offset

on-site energy demands.

There are currently five commercial systems in Canada; e.g., StormFisher Environmental, which owns and operates a 2.85MW biogas facility in London, Ontario.

There are 1,800 potential biogas projects in Canada, according to the Canadian Biogas Association. “Capital intensiveness is a barrier to an explosion of this technology, [but] the basic building principles and building blocks are there,” Green says. “Environmental, energy and waste management policies at the provincial and federal levels are starting to coalesce and offer a supportive platform for biogas to grow in Canada. Where municipalities are recognizing more in their energy plans to capture energy, that is where we are seeing more progressive plants and investments in plants and recirculation of materials.” ♣



Carroll McCormick is a freelance writer based in Montreal, Quebec.



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Panorama

Reaching New Heights

An aerial view of two buildings, part of the \$765-million CAMH Phase 1C Redevelopment, that were topped off in late January of 2019. —Staff



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As climate change heats up the north, ice roads become less dependent, and the need for new all-season roads increases significantly.



BUILDING THE NORTH

Understanding infrastructure priorities, challenges in the Northwest Territories.

By Andrew Macklin

It's difficult enough to meet the challenges of maintaining existing infrastructure while building new assets to keep up with population growth. But adding the impacts of climate change to that mix, prompting the need for more frequent rehabilitation and more resilience in construction, and the daunting task of managing infrastructure becomes that much more difficult.

Nowhere is the story told clearer than in Canada's north, where the infrastructure deficit has been amplified by climate impacts. Covering a land mass of close to 1.35 million square kilometres, the Northwest Territories (NWT) is comprised of 33 communities and under 45,000 people.

Premier Bob McLeod, now in his eighth year in the position, freely admits the Territory has a large deficit, one that it is working to overcome. NWT has, in the case of many communities, relied on assets like ice roads for people movement and diesel-fuelled power generators. But the impacts of climate change have made

those roads less reliable, and the pollution from burning diesel fuel only exacerbates the issue.

Transitioning transportation

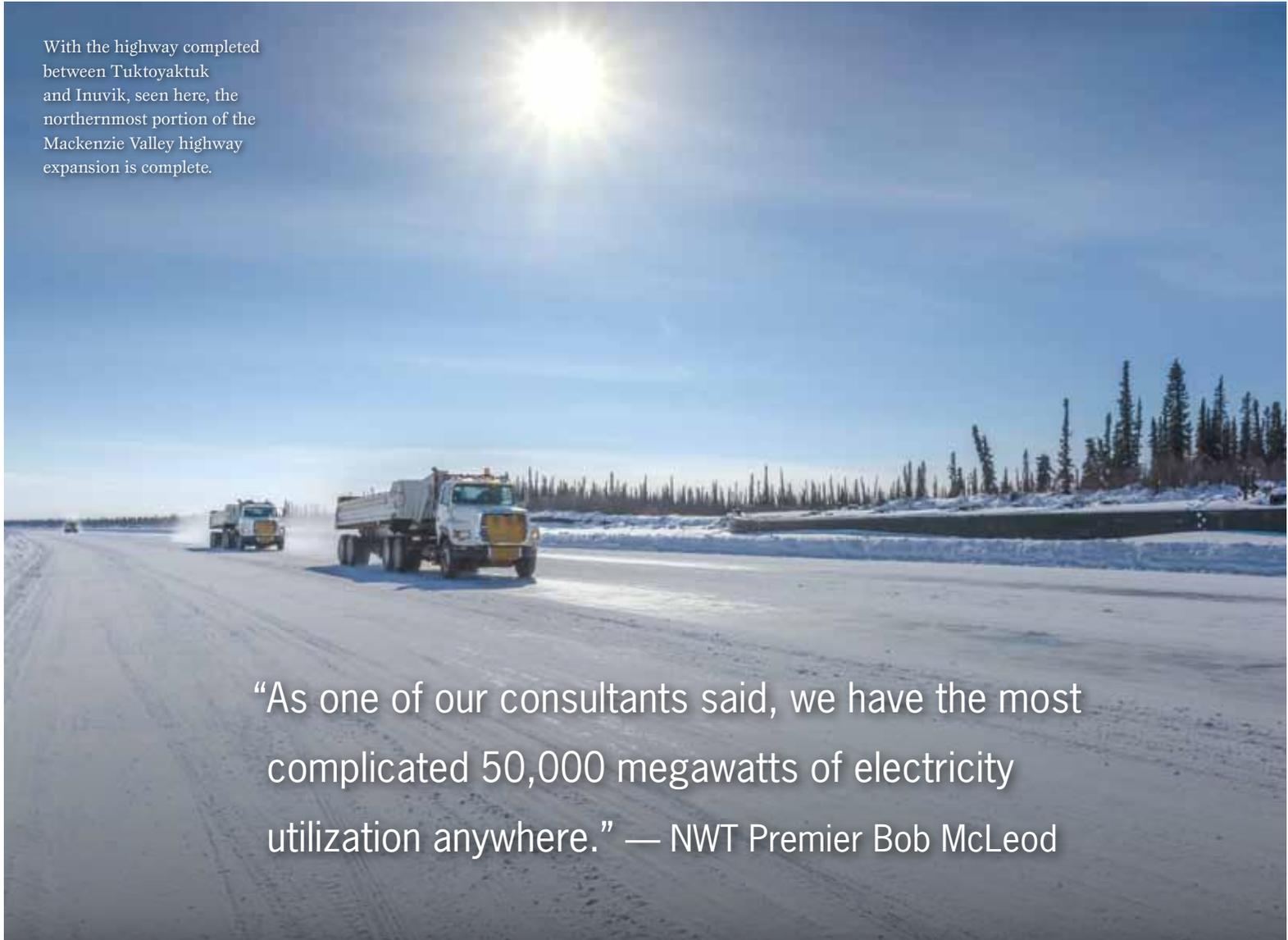
The number one priority had been, for several years, the development of the Mackenzie Valley Highway, connecting several NWT in the western part of the territory to the Arctic Coast. The highway would allow residents in Wrigley, Tulita, Norman Wells, Fort Good Hope, and Inuvik to have direct all-season roadway access at its northernmost point in Tuktoyaktuk.

To provide some perspective, Tuktoyaktuk is approximately 800 kilometres due north of Wrigley. However, according to Google Maps, the most efficient current driving route between the two communities is 2,964 kilometres, a route that would take you south into British Columbia, northwest along the Rockies, cut back up through the middle of the Yukon Territory, and then move northeast back over to Tuktoyaktuk.

McLeod's government has been steadily working on bits and pieces of the Mackenzie Valley Highway north, completing the Inuvik to Tuktoyaktuk portion of the highway in 2017, and completing 40 of the 42 bridges needed. The next phase, a combined federal-territorial investment of \$140 million, will be completed in six phases moving north from Wrigley to Norman Wells, representing 321 kilometres of two-lane gravel highway.

However, the government has also recognized two other roadway projects that have become priorities: the Tłı̄chǫ All Season Road (TASR) and the Slave Geological Province Corridor Project. The TASR is a 97-kilometre all-season road from kilometer 196 of Highway 3 to the community of Whati, northwest of Yellowknife. The Slave Geological Province Corridor Project is a 413-kilometre two-lane gravel infrastructure corridor, one that would help facilitate expanded energy resources, access to mines and mineral deposits, and a connection to the border of NWT and Nunavut.

With the highway completed between Tuktoyaktuk and Inuvik, seen here, the northernmost portion of the Mackenzie Valley highway expansion is complete.



“As one of our consultants said, we have the most complicated 50,000 megawatts of electricity utilization anywhere.” — NWT Premier Bob McLeod

The TASR has made steady progression in the past few years, with North Star Infrastructure (Kiewit, Hatch, and Thurber Engineering) named as the successful proponent for the project on November 13th of last year. Development of the Slave Geological Province Corridor Project has not progressed into the procurement phase as of yet, as a funding submission to Transport Canada’s National Trade Corridors Fund was turned down. However, McLeod is hopeful that funding could be made available through a Northern-specific call for proposals under the program.

NWT’s power play

The development of the Slave Geological Province Corridor Project could open up the opportunity for a significant power play for NWT, paving the way for the expansion of the Taltson Dam. But even that may not solve the Territory’s energy issues.

“As one of our consultants said, we have the most complicated 50,000 megawatts of electricity utilization anywhere,” said McLeod. “It’s because things keep changing. Seventy per cent of our population is on hydroelectricity. Yet three years ago, we had a drought and two snare hydro facilities; their reservoirs couldn’t replenish themselves at all.”

The unfortunate solution was to fire up diesel generators to provide power to Yellowknife. The cost: \$50 million.

That’s just one of the key power struggles that have faced a province.

EXPANDING HYDROELECTRIC

As the Northwest Territories has explored options for reducing diesel dependence, one of the options has been to expand its use of hydroelectricity either within the territory or by importing from a neighbouring province.

“We were looking at that as part of the expansion of Taltson,” said McLeod. “The last time we looked at it, it was going to cost more to build transmission lines than it was to expand Taltson.”

Technological advancements have the territory now looking at opportunities for the use of subsea cable, allowing NWT to run single or bi-directional power from a facility in an adjoining province. However, the preference is to instead invest in transmission capacity to connect the Taltson station to the Snare hydro system.

The territory would also like to proceed with plans for a two-phase expansion of the Taltson Generating Station. The expansion would add another 140,000 kilowatts of production, which could be sold to Saskatchewan for use in Uranium City (120 kilometres away) or to Alberta for use in High Level (320 kilometres away). ❁

“Inuvik, which we had converted to natural gas on the understanding that when the Mackenzie Valley natural gas pipeline was built, we thought we would take natural gas from there and use it in the town. The Mackenzie Valley natural gas project got approved, but it never got built.”

The wells that the town was instead using are now watering out, which caused a significant reduction in the amount of natural gas used. The solution? The town had to be converted to synthetic propane. Now liquid natural gas (LNG) is being hauled all the way from Delta, B.C. to the far north community. However that solution will soon be removed, as federal-territorial funding of \$40 million was committed to the Inuvik Wind Generation Project in November of 2018, the first project to receive funding through the federal government’s Arctic Energy Fund.

The use of diesel for power generation also continues to be an issue plagues some NWT communities, and servicing that demand in recent years has become even more difficult. The barging company run by the Inuvialuit went bankrupt during its seven-year contract with the government to supply diesel fuel to communities

throughout the territory. According to McLeod, after going out to tender for a new supplier, the prices quoted would have caused the fuel to cost communities an additional 50-to-70 per cent. With the company still up for sale, the territorial government purchased the barging company, and now supplies fuel to its communities using a Crown corporation.

Yet even with the fuel-shipping crisis solved, more issues arose in 2018. Quality, shipping, and water level issues caused delays, and by the time the fuel could be shipped, the government was unable to access three communities due to poor ice conditions. Instead, they had to fly the fuel to the remote communities using planes with 5,000-litre fuel bladders, adding a significant cost.

Positive outcomes

But with all of the energy issue encountered, there have been some success stories that the government continues to build on.

“We’ve spent a lot of time converting to alternative and renewable fuels,” McLeod explained. “Within government, I think we’ve met our target of reducing our greenhouse gas emissions by 30 per cent

over 2005 limits. On a per capita basis, we’re the largest users of biomass. We’re first or second per capita in the use of solar panels. And we’re starting to use wind energy.”

On the transportation front, the completion of the \$299-million Inuvik to Tuktoyaktuk highway linked Canada’s all-season road network to the Arctic Ocean for the first time, as was a significant step in the development of the Mackenzie Highway.

On the healthcare front, the development of the \$751-million Stanton Territorial Hospital Renewal Project has gone very well, and work is beginning on converting the old facility to apartments and additional residential and commercial uses.

Like other Canadian provinces and territories, the Northwest Territories has a unique set of infrastructure challenges. But as the impacts of climate change wreak further havoc on Canada’s north, the need to find new ways to build energy and all-season transportation assets is an immediate priority. 🍁

Andrew Macklin is the managing editor of ReNew Canada.



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When Pandora finally opened the box, according to Greek mythology, horrible things like greed and envy flew out. In the case of Bill 66, that could translate to the emergence of dubious suppliers in procurement.



OPENING PANDORA'S BOX

Ensuring that changes to Ontario's Bill 66 create a better way to procure construction. *By Stephen Bauld*

Bill 66 continues to get headlines in the news as well as being a hot topic to discuss during most meetings that I have attended since the Bill was introduced. Therefore, I wanted to further investigate the pros and cons of this new government proposal from a purchasing perspective. My immediate concern is related to the policy and procedure changes that need to be put in place to ensure that the contractors understand what is required from them with respect to the bidding process.

Making Ontario open for business is a reasonable request providing the process is conducted in a fair, open, and transparent manner, and does not create a race to the bottom. I am still not sure of the genesis for this change, as I have not seen any fact-based research showing this tremendous savings that has been reported related to implementing Bill 66, Schedule 9. In my opinion, it is critical to have as much industry consultation from contractors and stakeholders, union and non-union, before this bill is passed.

One fact that is never mentioned in this discussion is that approximately 75 per cent of construction projects relate to costs such as goods and services, equipment etc. leaving somewhere in the general vicinity of 25 per cent for labour costs. You can't just take the

overall cost of a construction project and add an unsubstantiated percentage as a premium for using union contractors to create urgency to enact Schedule 9.

As I continue to read about all the concerns presented in several published articles from other segments of business, I would again ask for greater consultation on many fronts. Areas that address changes to the Greenbelt, that threatens drinking water, eliminating environmental regulations, which currently safeguard environmental quality and public health and safety throughout Ontario, amendments to the Planning Act. A dozen significant and sweeping changes will be altered if Bill 66 is passed. I think it would be safe to say, a wide range of factors need to be considered in every schedule of this Bill before it moves forward.

My personal issue with these changes is solely related to government policy and procedure. I have always stated that government procurement is about rules and regulations, and private sector procurement is about profits and shareholders. Without the proper policies, procedures, and by-laws in place for the change's related to Schedule 9 of this Bill, the integrity of the government procurement process could be launched into the abyss. I don't want to sound too dramatic however, I have seen smaller

changes to government procurement over the last 40 years that are far less intrusive than this scheme, yet created uncertainty and upheaval to the bidding process.

Should the government prove in a fact-based argument through consultation with the industry that Schedule 9 is a better way to procure construction at a cheaper cost, I am on board. Having said that, it can't be done by sacrificing any of the current safeguards presently in place to protect the integrity of the construction process. Some of these issues I have previously mentioned include: health and safety, mandatory training, certifications, qualified bidders, and all the rules and regulations already baked in to the present bidding process. We need to continue to attract the high standard of qualified contractors we presently have, both union and non-union. As stated in the government's press release of December 6, 2018: "if the proposed amendments are passed, this is expected to increase competitiveness for broader public-sector construction projects." What does competitiveness actually mean in broader terms? Are we talking about value for money and qualified contractors, or are we just opening Pandora's Box to dubious suppliers?

I have been around long enough to live through the low bid mentality, and it is not a pretty sight, and ultimately costs more time

and money in the long run.

A small non-union contractor bidding above the limit of their comfort level is potentially how the problems begin. Having the lowest bid is one thing, having the work force to do the job is another. The scramble to keep the work on time and on budget creates the perfect storm for projects to go sideways. Currently many of the skilled trades are facing a work force shortage. This often results in cutting corners to stay afloat for construction companies lacking experience and resources for larger projects.

Take the same situation for a small union contractor. Their advantage is that they have a built-in HR department, by calling the union hall and having them send over qualified workers with the proper training and certifications to work on the site.

Let's assume for the sake of argument, that large contractors, union and non-union, both have the training to do the work properly. Larger construction companies also have greater overhead and may have trouble competing in a completely open tendering system.

Should the larger construction companies lose bids to the smaller less experienced firms that are not capable of performing the work, that's when the trouble starts. A project being delivered on time and on budget goes out the window.

Presently, things like pre-qualification and several other factors mentioned earlier, create the checks and balances in the system that we all currently enjoy. If the intention of Schedule 9 is to increase competitiveness for broader public sector, we need to investigate the possibility of a significantly better pathway to create value for money in government procurement. For the municipalities, school boards, hospitals, colleges, universities, and public bodies that are directly affected by these changes, I would suggest that this may be the perfect opportunity to conduct a wholesale revamp of government procurement documents.

I have the confidence in the government powers to be, that they have the full intention to do the proper due diligences as we lead up to the final reading of this Bill. Now is the time for the entire construction industry to come together as one voice, to develop a new system of procurement that benefits everyone. ✪



Stephen Bauld is the president and CEO of Purchasing Consultants International Inc.

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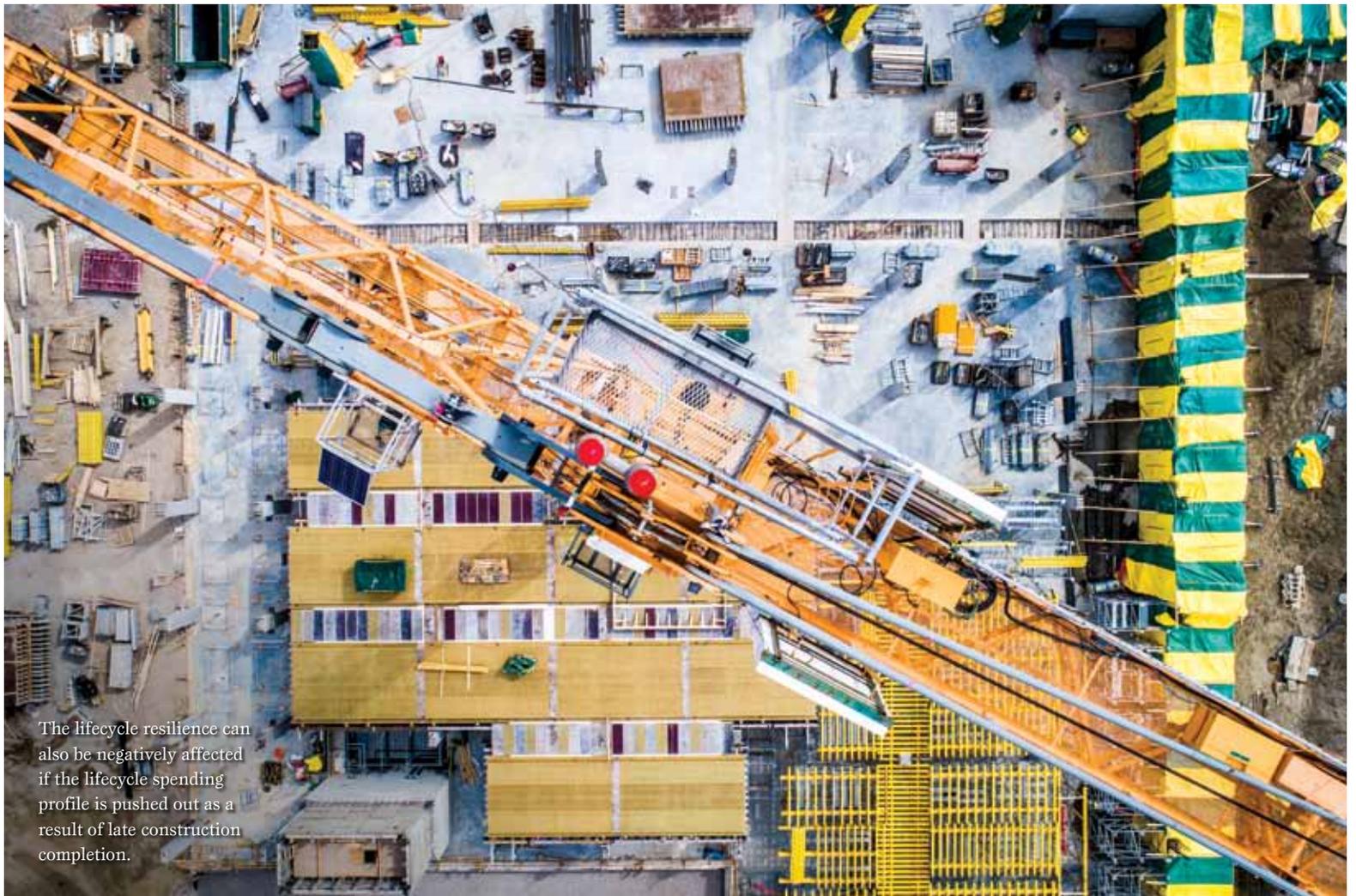
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The lifecycle resilience can also be negatively affected if the lifecycle spending profile is pushed out as a result of late construction completion.

P3 RESILIENCE

Understanding the key indicators that determine a project's resilience during construction. *By Kevin Li*

Public-Private Partnerships (PPPs) have long been an attractive means of infrastructure procurement given their fixed-price nature. A cornerstone of the PPP structure, the Project Company (ProjectCo) contains management and coordination expertise, although it typically self-performs few tasks and often passes down virtually all of its contractual obligations. In addition, the ProjectCo generally carries limited extra liquidity, and where replacement of a major contractor is necessitated, it is important to understand what resources ProjectCo can rely on in order to turn the project around. During the project term, some difficulties are bound to surface, and the ability to respond to adversity is a key indicator of a project's resilience.

The construction phase of a PPP is generally viewed as riskier than the service phase. Not only does the private consortium have to deal with various physical unknowns,

it may also face uncertainties interacting with unfamiliar government sponsors, including differences in how government counterparties interpret and apply the Project Agreement (PA). Sometimes, rights and responsibilities are not clearly delineated, and as a result time-consuming and potentially hostile disputes may occur. Resilient projects have comprehensive yet somewhat flexible dispute resolution mechanisms that engender communication and cooperation between all parties. Resilient projects would also feature a PA created as a tool to drive desired behaviors instead of mechanisms that are punitive to the party at fault.

Triggered by severe construction delays, the replacement of the construction contractor may be initiated by the public-sector counterparty. In such a case, ProjectCo is required to replace a non-performing contractor within a certain timeframe to avoid termination of the PA.

Such a replacement scenario would likely lead to a re-pricing of the contract, which could cause further delays and potentially squeeze financial metrics materially should further *pari passu* debt be necessitated. As such, contractor replacement is viewed by DBRS as a drastic option, only to be undertaken after other remedial efforts have been exhausted and it has become apparent that the existing contractor will not be able to complete the project.

Higher replacement costs can be exacerbated by a number of issues, including:

- 1 Aggressive budgeting and/or inadequate contingencies;
- 2 Schedule optimism;
- 3 Significant complexity of remaining works;
- 4 Construction elements completed out of sequence, necessitating a "rip and tear" approach;
- 5 Limited timeframe for replacement; and

- 6 Where construction has progressed to a point where technical compatibility issues or institutional memory make for a difficult replacement.

To mitigate the higher costs, the contractor's security package can be valuable to the extent that it remains available.

The need to replace a construction contractor can also be triggered by non-project-related financial difficulties experienced by the contractor or its parent company guarantor. In such cases, the parent's guarantee becomes less reliable, although the replacement premium may be modest, provided that the original budget and schedule have been well-thought out and there have been no material delays or major quality issues. As well, where the contract is standard and well understood by the construction market and key subcontracts are assignable (allowing work to continue unabated), it may be easier to entice a replacement contractor to complete the construction. Guarantor replacement can potentially be mitigated by an effective last man standing clause, enabling the remaining solvent partner to take over as guarantor, provided that it has the financial means to do so.

Triggered by severe construction delays, the replacement of the construction contractor may be initiated by the public sector counterparty.

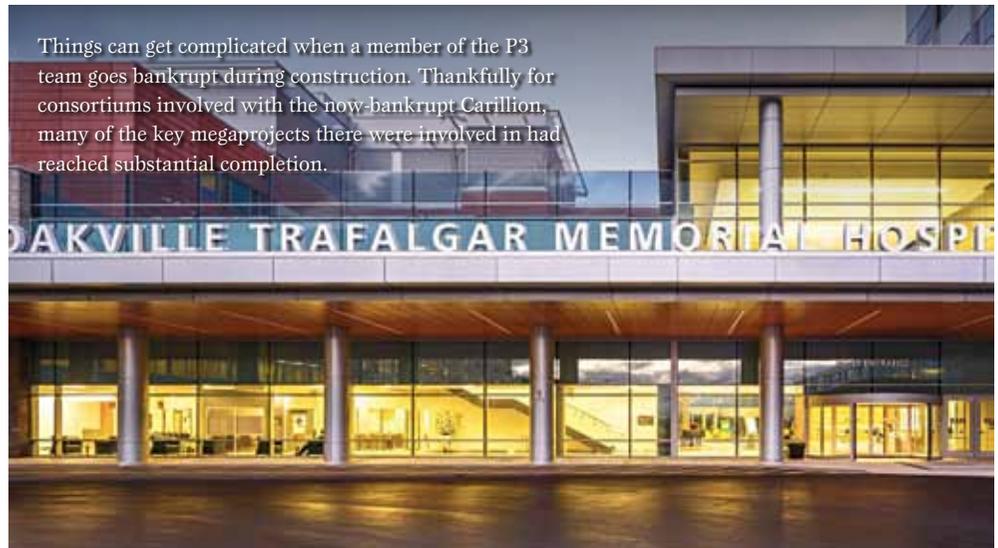
The perfect storm occurs when the contractor or its parent company guarantor is bankrupt and the project has also encountered material delays and quality issues. This can lead to a substantial replacement premium, with potentially little reliable security to foot the bills. Once such a perfect storm has formed, ProjectCo would have to rely on contingencies in the structure to mitigate negative impacts. For example, ample time to replace a contractor or longer longstop date under the PA will engender more resilience. A thorough payment certification and withholding mechanism can also be helpful to enable early identification of problems and provide increased protection against re-tendering risks.

The service phase can be subject to challenges as well. Given the fixed nature of the revenue stream and highly leveraged capital structure observed in most availability-based PPPs, ProjectCo typically has little room to weather significant cost

overruns. This is reflected in the high debt-to-cash flow available for debt-service ratio of typically around 10 times post-substantial completion and the minimum senior debt-service coverage ratio often being as low as 1.15 times over the life of the project. Moreover, many PPPs tend to start with operations and maintenance (O&M) and lifecycle resiliencies that are relatively low, because of the competitive bidding process, the heavy reliance on net present value in bid evaluation, and the increased government funding during construction.

For LRT projects and for some social projects that involve performance of non-typical tasks (such as running and servicing trains) and/or frequent technology refreshing requirements, respectively, the O&M breakeven ratio is often lower than the lifecycle breakeven ratio. The O&M resilience can be further challenged by unexpected cost overruns, such as energy overconsumption, although some pain share or benchmarking mechanisms can offer a modicum of relief.

For civil projects, the lifecycle resilience tends to be lower than O&M resilience and can be eroded by change orders, although this can be mitigated if ProjectCo can prove such changes would materially alter a project's risk profile. The lifecycle resilience can also be negatively affected if the lifecycle spending profile is pushed out as a result of late construction completion. Under such circumstances, to the extent that lifecycle funds are still being received according to the original schedule, stronger projects feature



Things can get complicated when a member of the P3 team goes bankrupt during construction. Thankfully for consortiums involved with the now-bankrupt Carillion, many of the key megaprojects there were involved in had reached substantial completion.

Credit: Elia Don

mechanisms whereby any unused funds are set aside in reserves, rather than being counted as excess cash flow immediately available for equity distribution (unless an independent engineer has confirmed that such relevant works are no longer required to meet handback requirements). For highway projects, materially higher traffic volumes (particularly for larger multi-axle vehicles) also have the potential to add or accelerate lifecycle requirements and, therefore, erode a project's resilience, although sometimes compensation is offered under the PA to maintain a project's resilience level.

O&M and lifecycle reserves can help to manage cash flows but generally are not relied upon in resilience calculations. The standard look-back and dynamic look-forward tests and reserving through extensive third-party inspections will be helpful to timely identify any re-tendering needs and provide better protections. While service phase security packages are typically much smaller than seen in construction, these can also offer a measure of safety.

In summary, availability-based PPP projects can be resilient to several unexpected challenges. Such resilience can be realized either through external supports, such as the contractor's security package, or with internal buffers, such as last man standing clauses, conservative budgeting, suitable breakeven ratios, flexible and protective clauses under the PA, standard construction contracts, and proactive inspecting and reserving mechanisms. These positive attributes could all potentially keep relevant risks at bay and help the project survive a perfect storm. ❁



Kevin Li is a senior vice president of infrastructure finance at DBRS.

If tolls are placed on the two busiest thoroughfares to and from downtown Toronto, more drivers could experience traffic similar to what is seen in this image, rather than the typical bumper-to-bumper commute.



How tolling Toronto's key thoroughfares could provide a real solution for Toronto's traffic nightmares. *By Lindsay Wigington*

Like other global metropolises, the Greater Toronto and Hamilton Area (GTHA) is experiencing rapid population and economic growth, which is putting increased demands on roads and public transit systems. Indeed, residents of Toronto have the longest commute times in Canada, with about one in six people spending more than an hour to get to work. When asked to name the top issues facing the Greater Toronto Area (GTA), 52 per cent of respondents to a 2018 poll listed transportation, traffic, and transit issues among their top concerns.

Road pricing is a way of pricing mobility more fairly. It reduces congestion by providing incentives that spread out the use of the roads and encourage the use of alternative modes like transit. This shift helps to reduce air pollution and greenhouse gas (GHG) emissions and raise revenue for public investments in infrastructure, such as transit. Discussions have emerged in Canadian cities and regions—including the City of Toronto and Metro Vancouver—about how well designed road pricing can improve the transportation system for citizens, following successful programs in other jurisdictions.

Equitable access to transportation is a

backbone of strong, sustainable communities. One important concern about road pricing that has been raised by stakeholders is its potential to add to the financial burden of low-income residents. Research on the potential impact of road pricing on low-income communities is scarce, leaving policymakers without essential insights needed to design good policy.

This study examined which income groups would be impacted by the City of Toronto's 2016 proposal to apply a flat highway toll of \$2 on the Don Valley Parkway (DVP) and Gardiner Expressway (Gardiner). We find that a majority of GTHA commuters who would be impacted have household incomes above Toronto's median. However, we also find that without mitigation measures, the toll would represent a higher financial burden on those lower-income households that would be impacted.

Income characteristics of impacted population

We estimate that approximately 172,000 workers in the GTHA (approximately 5.9 per cent of all workers) are likely to be impacted by a toll on the DVP and Gardiner based on their current commute behaviour.

We find that a much greater proportion

of the impacted workers are from higher-income groups in the GTHA. Approximately 69 per cent of all impacted workers have household incomes above \$60,000 (i.e. roughly above Toronto's median household income) and more than half of these (34 per cent of total) have household incomes above \$125,000 (roughly double Toronto's median). Approximately 6.8 per cent of all impacted workers have household incomes below \$40,000 and 10.2 per cent have household incomes between \$40,000 and \$60,000.

The likelihood of being impacted by the proposed highway tolls increases as one's household income increases. While workers with household incomes below \$40,000 represent 8.8 per cent of the working population as a whole, they represent only 6.8 per cent of impacted workers. Conversely, while 34.0 per cent of impacted workers have household incomes above \$125,000, this group makes up only 26.2 per cent of the population of workers. These findings align with experiences and studies in other jurisdictions.

Despite the prediction that a greater share of the higher income population would be impacted by the proposed toll on the DVP and Gardiner, lower-income households spend a significantly higher share of their

The traffic getting in and out of the downtown core of Toronto would also benefit through tolling the Gardiner and DVP, as less people are inclined to drive into the heart of the city's employment district.



income on basic necessities like housing and transportation. We found that for households in the lowest before-tax household income quartile, the annual cost of the toll would amount to approximately 23.2 per cent of annual transportation expenditure, whereas the cost would amount to only 4.6 per cent of annual transportation expenditure for households in the highest income quartile (based on Ontario average expenditures). This means that the toll would represent more of a financial burden for lower-income households than for higher-income ones under the scenario where no cost mitigation measures are included.

Spatial distribution

Based on our modelling, the City of Toronto is home to the greatest share (116,000 people or approximately 67.8 per cent) of impacted workers across the region. About 12 per cent of impacted workers are from Peel Region, 8.3 per cent are from York Region, and 6.7 per cent are from Durham Region. The City of Toronto is home to the vast majority of impacted low-income workers: about 81.7 per cent.

Within the City of Toronto itself, the greatest absolute number of impacted workers, approximately 40,160, is from downtown. East York and North York are home to the greatest numbers of impacted low-income workers, with approximately 28.2 per cent and 25 per cent of Toronto's

impacted low-income workers respectively. These results give direction for where cost mitigation efforts, including transit investment, should be focused.

Cost mitigation options

We review direct and indirect approaches to mitigating the financial impact of road pricing on lower-income populations. We find that while there is precedent in other jurisdictions for providing direct discounts and exemptions to certain target groups that include vulnerable populations such as people with disabilities, we did not find precedents of providing such discounts and exemptions to low-income users specifically.

We recommend that it would be appropriate to provide a discount based on a combination of household income, household size, and use of the priced roadway. This could be done in place of capping the annual amount that any user would pay per year (one option that City of Toronto staff were asked to study). Different approaches would require varying levels of administrative burden, which should be studied further.

We also recommend that the net revenue generation from a road-pricing plan be legally tied to investments in public transit. Based on the spatial distribution of commuters that are likely to be impacted, we highlight planned or proposed transit projects that can be accelerated to provide viable alternatives to travelling by car

on the DVP and Gardiner. Finally, based on our results, we also recommend that time-of-day, dynamic, and distance-based pricing designs be further studied especially because of their potential to make a road-pricing plan more equitable.

The Pembina Institute believes that mobility pricing, and road pricing specifically, must be part of a multi-pronged approach to addressing the GTHA's current transportation challenges and preparing for future trends. This study contributes new knowledge about the income impacts of a specific City of Toronto road-pricing proposal, with the intention to contribute to the ongoing region-wide conversation now and in the future. ♣



Lindsay Wiginton is a managing director of transportation and urban solutions at the Pembina Institute.



This article is an excerpt from the Pembina Institute report *Fare Pricing: Exploring how road pricing on the DVP and Gardiner would impact income groups in the GTHA*. To download a copy of the full report, visit pembina.org.

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Calgary Cancer Centre
2019 Top100 Projects Rank: 42
Value: \$1.4 billion

Calgary Cancer Centre making steady progress

Construction of the \$1.4-billion cancer research and treatment centre—the largest government infrastructure project in Alberta—remains on time and on budget.

Thirty per cent of the project's total concrete, or 37,000 cubic metres, has been poured as work progresses on the 12-room radiation therapy department.

With a total concrete volume of 125,000 cubic metres, it will be the largest stand-alone cancer centre in Canada when it begins offering improved care for patients in 2023.

The Tom Baker Centre reached full capacity in 2003. Since then, cancer rates

have continued to rise at a rate of three to five per cent a year. The project is expected to add 1,500 jobs for Calgarians over the next six years.

Development of the radiation therapy department will continue later this year with the pouring of more than 10,000 cubic metres of concrete and the construction of 12 steel and concrete vaults. Each vault will have 1.8-metre-thick walls to protect patients and families from radiation exposure. This will nearly double the current Tom Baker Cancer Centre's capacity to treat patients with radiation therapy—currently more

than 3,300 a year—to meet an anticipated 60 per cent increase in demand by 2030.

The Calgary Cancer Centre will be integrated with the Foothills Medical Centre and will replace the aging Tom Baker Cancer Centre. Four cranes and about 300 workers are currently on site with construction well underway on the lower levels, all five parkade levels and the first clinical areas of the centre.

PCL Construction has removed about 450,000 square metres of material since the project's groundbreaking in 2017 and will continue with below-grade activities through 2019. Construction will continue until 2022. ♣



Wataynikaneyap Transmission Project
2019 Top100 Projects Rank: 36
Value: \$1.6 billion

Additional communities join Wataynikaneyap project

Wataynikaneyap Power has announced that Mishkeegogamang and Ojibway Nation of Saugeen legally joined the First Nations-led power project, bringing the number of First Nations communities who are equal owners in the project to 24.

"I am very pleased to say that Wataynikaneyap's engagement and discussions have resulted in an even stronger partnership of 24 First Nations who have agreed to work together to connect the 17 remote First Nations to the grid," said Margaret Kenequanash, chief executive officer at Wataynikaneyap Power. "This is a significant project milestone that will have a powerful positive impact to the Indigenous People of the homeland in harnessing

opportunities, improving community infrastructure and growth."

"We're pleased to see all 24 First Nations join the partnership," said Barry Perry, president and chief executive officer of project partner Fortis Inc. "With the recent connection of Pikangikum, work is well underway to advance the project."

Simultaneous with the two First Nations joining the partnership, partner Fortis Inc. has entered into an arrangement with Mishkeegogamang First Nation and Ojibway Nation of Saugeen's utility partner, Algonquin Power & Utilities Corp. (Algonquin), for a minority share of its ownership.

"Algonquin and our First Nation

partners are pleased to join forces with the Wataynikaneyap Power team for this important project," said Ian Robertson, chief executive officer at Algonquin. "Our continuing focus on Northern Ontario transmission is based on a recognition that access to clean and reliable energy sources plays a critical role in the health, well-being and economic opportunities for the communities served by this project and we are pleased to partner on this important project."

The transmission project is making significant progress toward the completion of regulatory permitting. Construction is planned to begin later this year with a competitively selected EPC contractor. ♣



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THE "MISSING MIDDLE" IN NEW HOMES

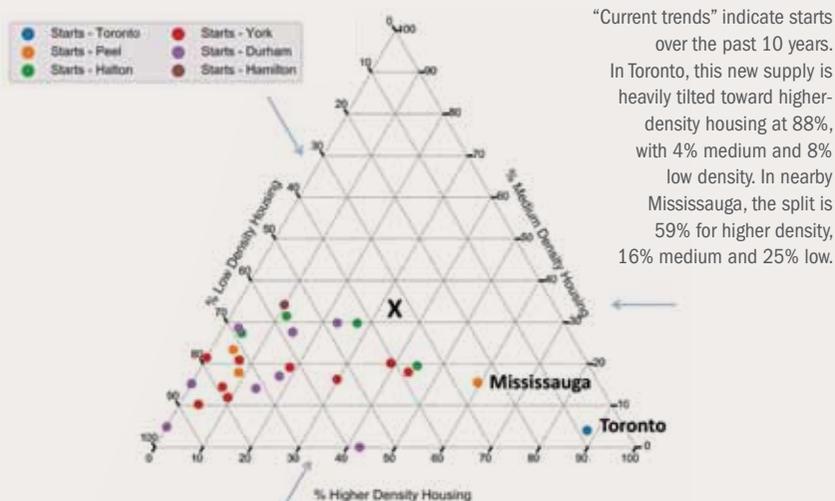


Sourced from a graphic by the Ministry of Municipal Affairs and Housing. The right bracket was moved to reflect this report's definition of low-density housing (comprised of single-detached, semi-detached and duplex homes).



Missing middle experts Matthew Cory, Michelle German and Paul Smetanin exchange ideas at Ryerson University in Toronto.

CURRENT HOUSING TRENDS IN THE GTHA



Graphics source: Canadian Centre for Economic Analysis Inc.

PLACES TO GROW TARGETS



'STICK A CROWBAR IN THE YELLOWBELT' IN GTHA, SAYS PLANNER

Professional planner **Matthew Cory** did not hold back when asked what policy direction would help the future prosperity of the Greater Toronto and Hamilton Area's housing industry.

"I would stick a crowbar in the yellowbelt," he told a crowd of academics, industry professionals and students gathered at Ryerson University in Toronto. About 70% of the GTHA is covered in yellowbelt, also known as low-density residential zoning.

Cory, principal of Malone Given Parsons, was one of three report authors speaking about the importance of missing middle housing in a seminar presented by Ryerson's Centre for Urban Research and Land Development. The seminar was entitled "Let's Talk Housing Research: A Review of the Latest Reports Focused on the GTHA."

Cory was joined by Michelle German of Evergreen Foundation, and Paul Smetanin of the Canadian Centre for Economic Analysis and author of RCCAO-commissioned report "The GTHA's Unbalanced Housing Stock: Benchmarking Ontario's New LPAT System."

German defined the missing middle as attached housing that "fits into the fabric and the feel and the culture" of many neighbourhoods. This includes row houses, apartments in buildings under five storeys and

stacked townhouses. But it isn't always easy to build. German says zoning in two-thirds of Toronto's residential land, for example, is zoned for detached housing, making it difficult to add gentle density.

"An anecdote we've heard over and over again is that it's absolutely the easiest thing in the world to rip down a house that has been turned into three or four apartments and turn it into a McMansion but why can't you sever the lot and make four tiny homes for four families? It's just not possible based on the current zoning."

If current construction trends continue, Smetanin said the region will be short 7,200 dwellings per year of Growth Plan targets with an average loss of \$1.95 billion in GDP accruing directly from residential construction activity.

Only about 15% of GTHA households live in medium-density (missing middle) housing. Smetanin said the region needs a range of housing sizes and budgets to help, among other things, residential mobility. "You'll find there's a lot of statistical analysis in the report that will help you begin to understand the demand, supply and key challenges before us," Smetanin said.

See a videocast at ryecast.ryerson.ca/86/Watch/15158.aspx

Actual Media editorial director Andrew Macklin (right) conducts a keynote panel discussion on infrastructure needs from the next federal government.



Top100

Canada's Biggest Infrastructure Projects

KEY PLAYERS AND OWNERS DINNER

CELEBRATING THE BIGGEST INFRASTRUCTURE PROJECTS IN CANADA

Close to 300 senior infrastructure industry professionals and stakeholders from across Canada and around the world joined ReNew Canada at the 2019 Top100 Projects Key Players and Owners Dinner at The Carlu in Toronto.

Among the attendees were Ontario's Minister of Infrastructure **Monte McNaughton**, who provided an update on the Ford government's priorities for infrastructure spending in the province. He was joined by **Marco Mendicino**, Parliamentary Secretary to the Minister

of Infrastructure and Communities, who discussed the continuing investments being made by the federal government to address infrastructure needs across Canada.

This year's keynote panel debated the country's needs for infrastructure investment under the next federal mandate, following the election this fall. ReNew Canada's managing editor **Andrew Macklin** was joined by Toronto Region Board of Trade president and CEO **Jan de Silva**, Canadian Construction Association president **Mary Van Buren**, and Enterprise vice

president of marketing and communications **Dennis Matthews**, a former senior advisor to Prime Minister Stephen Harper.

The 2019 Top100 Projects report topped \$212.5 billion, up \$13.5 billion from 2018. A list of the top100 Projects can be found at top100projects.ca.

Work is already underway in preparing for the 2020 Top100 Projects report. To submit your projects, or to ask any questions you may have about the report, please contact Andrew Macklin at andrew@actualmedia.ca.

TOP100PROJECTS.CA/CELEBRATE

RENEW CANADA WOULD LIKE TO THANK OUR PARTNERS AND ALL THE ATTENDEES WHO MADE THE EVENING A SUCCESS!

PREMIER PARTNER



SELECT PARTNERS



ELITE PARTNERS



All Photos: Josh Fera



Enterprise VP marketing and communications Dennis Matthews.



Canadian Construction Association president Mary Van Buren.



Toronto Region Board of Trade president and CEO Jan de Silva.



Attendees enter the theatre to begin the evening's official program.



Eric Peissel, national business line executive for transportation for WSP, introduces Ontario Minister of Infrastructure Monte McNaughton.



Ontario Minister of Infrastructure Monte McNaughton.



Arcadis VP Rene DeVries with SNC-Lavalin senior VP of infrastructure engineering for Central Canada Kristin Hanson.



EXP Principal buildings for Central Canada, Li Ming, VP buildings for Central Canada Rebecca Huang, director of regional marketing Christina Cruz, and president and COO Mark Dvorak.



Marco Mendicino, Parliamentary Secretary to the Minister of Infrastructure and Communities.



The team from DECAST.



Parliamentary Secretary to the Minister of Infrastructure and Communities Marco Mendicino with Canadian Council for Public-Private Partnerships CEO Mark Romoff.



Michael Chiu, VP of business development for transportation for WSP alongside Tom Middlebrook, senior VP of business development for Dragados Canada.



Ana Rincon-Gomex, environmental assessment specialist and project manager at Golder.



Greater Toronto Airport Authority director of public affairs and stakeholder relations Lorrie McKee with Crosslinx Transit Solutions third party technical advisor Joanna Kervin.



AECOM's practice lead for communications and community engagement Avril Fiskien and senior process engineer/project manager Brian Sahely.



Morrison Hershfield VP of business development Loui Pappas.



Hatch's senior VP of infrastructure Carl Bodimeade, global director of infrastructure advisory Julia Stefanishina, and global director of climate change and sustainability services Susan McGeachie.



Muhammad Ardalani-Farsa, control manager at Comtech.



RBC Capital Market's managing director and co-head of infrastructure finance Vickie Turnbull and Torys LLP partner and head of public-private partnerships practice group Mark Bain.

AI Photos: Josh Fera



Ontario Society of Professional Engineers CEO Sandro Perruzza shares a laugh with a colleague.



Englobe's VP operations Tewfik Atia and VP corporate development Marc Trudell.



WSP Canada CEO Ryan Brain and Infrastructure Ontario president of major projects Chris Gauer.



DBRS vice chairman Doug Turnbull with Polar Star Advisory Services president Cliff Inskip.



Entuitive senior associate David Fox, Carpenters District Council of Ontario president Mike Yorke, and Entuitive Principal Michael Meschino admire one of the corporate Top100 projects plaques.



Plan Group director of business development Deborah Barnes, Canadian Council for Aboriginal Business CEO JP Gladu, and Enterprise chair of the advisory board David de Launay.



Crosslinx Transit Solutions CEO, Metrolinx CEO Paul Verster, and Aecon founder and executive chairman John Beck.



Actual Media CEO Todd Latham with Morrison Hershfield COO Catherine Karakatsanis and Ontario Minister of Infrastructure Monte McNaughton.



Gannett Fleming vice president Yousef Kimiagar introduces DST director of infrastructure client group George Thomas to Comtech deputy program manager Crystal Cole.

Top100

Canada's Biggest Infrastructure Projects

KEY PLAYERS AND OWNERS DINNER

CELEBRATING THE BIGGEST INFRASTRUCTURE PROJECTS IN CANADA

SEE YOU NEXT YEAR!

FEB. 18, 2020

Plan your presence at the 2020 Top100 Projects Dinner by contacting Elena Langlois 416-444-5842 ext. 151 elena@actualmedia.ca

TOP100PROJECTS.CA/CELEBRATE

APPOINTED



David Morley

Pierre Lavallée, president and Chief Executive Officer of Canada Infrastructure Bank, has announced that **David Morley** is joining the organization as Head of Public Affairs and Communications.

Morley has significant experience working in the public sector related to infrastructure and government-business partnerships. Most recently he was Senior Vice President, Strategy and Communications at Infrastructure Ontario, where he led a team responsible for corporate affairs, communications, and external stakeholder and community engagement.

“With deep public sector and infrastructure expertise, David will be a strong addition to our executive team,” Lavallée said. “He will provide public affairs and communications leadership as we continue to develop partnerships to build infrastructure that is in the public interest.”

Prior to working at Infrastructure Ontario, Morley advised the governments of Ontario, Manitoba and Canada, and was a participant in the 2017 Governor General’s Canadian Leadership Conference.



Jacynthe Côté

The Government of Québec announced the appointment of **Jacynthe Côté** as chair of Hydro-Québec’s Board of Directors

Her track record includes her work as an independent director on many corporate boards in a variety of industries, including aluminum, finance and energy. From 2009 to 2014, she served as president and CEO of Rio Tinto Alcan.

A native of Normandin in the Lac-Saint-Jean region, Côté holds a Bachelor’s of science degree in chemistry.

Hydro-Québec is proud of this appointment of the first woman to chair Hydro-Québec’s board of directors.

Hydro-Québec would also like to thank **Michael Penner** and **Michelle Cormier** for their contribution to the company’s governance and their commitment to a number of important files.

B.C. Minister of Transportation and Infrastructure **Claire Trevena** announced the board of directors of B.C. Infrastructure Benefits Inc. (BCIB), the Crown corporation responsible for executing the Province’s Community Benefit Agreement (CBA).

The chair and six members have been appointed for a three-year term: **Allan**

Donald Bruce (chair), **Roberta Ellis**, **Kirsten Ragnhild Wilson**, **Michael Alan Bonshor**, **Gary Wayne Kroeker**, **Anita Kaur Atwal**, and **Clyde Hill Scollan**.

BCIB was established in July 2018, with its first priority being to support the delivery of the new Pattullo Bridge and projects within the Trans-Canada Four-Laning program under the CBA. BCIB will lead the recruitment, hiring and co-ordination of skilled labour for these projects, in addition to human resources, employee relations, identifying training needs, and reporting and performance measurement.



Juanita Spencer

The Nova Scotia Federation of Municipalities (NSFM) has announced the appointment of **Juanita Spencer** as chief executive officer. Spencer was

previously the executive director of the Spring Garden Area Business Association. She is replacing **Betty MacDonald** at NSFM, who retired in December. NSFM’s Board of Directors voted unanimously in favour of Spencer’s appointment.

“Juanita is an accomplished organizer and spokesperson who has a deep understanding of what it takes to lead a successful member association. I am excited to see how she will help NSFM and our member municipalities with our work of delivering better government and building stronger communities,” said NSFM President **Wayne Mason**.



Ryan Brain

WSP Global Inc. has announced **Ryan Brain** as the new president and chief executive officer of WSP in Canada.

Brain has over 20 years of experience in the professional service industry, mainly at Deloitte, one of the largest global professional services firms. Known for his leadership, he has in depth experience and understanding of professional services business models. He is also well acquainted in areas such as market and corporate strategy, M&A due diligence, and integration. He has worked with various stakeholders and clients across the private and public sectors and led several complex and high-profile projects across various industries, with a focus on consumer business industries.

Brain is a certified management consultant and has a Master of Management Sciences from the University of Waterloo.



Paul Hammond

Mott MacDonald has appointed **Paul Hammond** as global leader for its new infrastructure development and economics practice. Hammond will be responsible for leading the consultancy’s practice community and enhancing its global visibility.

The new practice merges the expertise of Mott MacDonald’s economics and infrastructure finance global practices. It focuses on providing support services at the early stages of infrastructure planning—from funding through to economic, social and environmental impact assessment. Services provided include: infrastructure pipeline development and prioritisation; pre-feasibility and feasibility studies; local and regional economic development; economic appraisal and cost-benefit analysis; business case development; regulatory and policy advice; risk management and mitigation; and infrastructure finance and PPP advisory.

Hammond has considerable experience in the infrastructure and economics arena. His 25 years’ experience include the delivery of consultancy and research assignments for clients including the International Finance Corporation, World Bank, European Investment Bank, European Commission, and national roles as economic adviser to the Local Government Association in England.

DECEASED



Terence Hardy

Terence (Terry) Hardy, passed away peacefully in his home in Niagara-on-the-Lake, Ontario on December 13, 2018 after a brave battle with Idiopathic Pulmonary Fibrosis.

A lifelong civil engineer, Hardy was a past president of Ainley Group, an engineering and planning company based in southern Ontario. In addition to his contributions as an engineer, Hardy was very active as an industry volunteer, serving terms as chair of the Consulting Engineers of Ontario (CEO) and as president of Ontario Public Works Association (OPWA).

In honour of his contributions, OPWA renamed its Exemplary Service Award to the Terry Hardy Exemplary Service Award, which recognizes significant service to the association for a minimum of 25 years.

Hardy is survived by his loving wife Sandra, his two sons Russell and Matthew, and three grandchildren.

All Photos: ReNew Canada



Nik Nanos discusses the changing narrative with the rise of populist governments.



CCPPP president and CEO Mark Romoff.

VOTER RAGE & POPULISM: THE THREAT TO BUILDING INFRASTRUCTURE TORONTO, ONT.

The rise of populist governments and politics is changing the way we need to approach the narrative on building infrastructure in Ontario, North America, and around the world.

Voter Range & Populism: The Threat to Building Infrastructure, hosted by the Canadian Council of Public-Private Partnerships (CCPPP), educated infrastructure developers and project owners on the impacts of this growing political movement thanks to a keynote presentation from **Nik Nanos** of Nanos Research.

“We’re sensitive to today’s reality, and astute enough to recognize that we can’t avoid the impact in our space, because it is so

politically visible, and an industry that is of such high priority to politicians,” said **Mark Romoff**, president and CEO of CCPPP.

CCPPP commissioned Nanos Research to conduct a survey to better understand whether infrastructure delivery in Canada could be susceptible to populist movements.

“Overall, the survey suggests Canadians continue to support public-private partnerships, but the infrastructure sector is not immune to voter rage,” said Nanos, the executive chairman of Nanos Research. “It’s reassuring to see that despite a tumultuous last few years in global politics, Canadians are largely moderate in their

views on these issues although there are some significant differences among men and women, the regions and even age groups that bear watching.”

The observations are based on a random telephone survey of 1,000 Canadians, 18 years or older, between September 29 and October 4, 2018. The margin of error is +/- 3.1 percentage points, 19 times out of 20.



To access the full survey, visit pppcouncil.ca/web/pdf/nanos_infrastructure_survey_102018.pdf

All Photos: ReNew Canada



Outgoing OPWA president Ed Dujlovic introduces incoming president Angela Story.



Esri’s Barry Kelly, also a member of the OPWA board of directors, discusses innovations that are changing the way the public works industry does business.



Eric Peissel from WSP discusses continued changes being made to project delivery.

OPWA 2019 CONFERENCE TORONTO, ONT.

More than 250 people joined the Ontario Public Works Association in Mississauga for the 2019 annual conference and awards luncheon.

This year’s conference, Navigating the New Normal: A Nation Managing Change, focused on how policy, innovation, governance, technology, and politics are changing the way the public works industry goes about its business in building, operating, and maintaining infrastructure across the province.

Andrew Pariser, vice president of the Residential Construction Council of Ontario, explored the impact of new cannabis regulations on the public works industry. He emphasized the need to focus the conversation on impairment, treating employee health and safety much in the same way that the influence of alcohol is

treated, in order to develop proper policies for cannabis use.

Eric Peissel, national business line executive for transportation at WSP in Canada, discussed how the model for project delivery is evolving in Ontario. He explored why the evolution has occurred and discussed how new ideas for project procurement continue to emerge, pointing at the recently announced first-ever Canadian use of the Integrated Project Delivery model, which is being used in the construction of the Third Crossing Bridge in Kingston.

ReNew Canada’s managing editor **Andrew Macklin** led a discussion on the federal infrastructure landscape, and how it could change in the countdown to the 2019 election and beyond. Both panellists, Enterprise vice president of marketing and communications **Dennis Matthews** and

Tactix co-president **Alan Young**, suggested that the level of spending by the current Liberal government has been strong even though funds have had a tough time flowing to some communities due to difficult negotiations and delayed agreements. Matthews speculated that, should the Conservative government come to power in October, infrastructure spending levels should remain strong even as that government would likely push to find ways to find savings in order to quickly return to balanced budgets.



For more information on the OPWA’s annual conference, along with a list of 2019 award winners, visit opwa.ca

Turbines and Waterton Range west of Pincher Creek.

Credit: Bryan Pastlume

POWER TO THE PRAIRIES

Alberta and Saskatchewan commit to wind energy. *By Robert Hornung*

Alberta and Saskatchewan have emerged as leading markets for wind energy investment, in addition to their long-standing status as Canada's oil and gas heartland. While this is an important development, it's more a matter of continuity than a point of departure. Harnessing the wind resource to mill grain was once common place on prairie farmsteads, after all, and Alberta is also where Canada's modern wind energy industry was first commercialized.

Today, a vibrant wind energy industry is providing growing amounts of much-needed renewable electricity at a competitive price across Canada, and particularly in these two neighbouring provinces.

Alberta and Saskatchewan have excellent quality wind resources. In fact, the Pan Canadian Wind Integration Study (GE Energy Consulting 2016) has shown both provinces could reliably integrate enough wind energy to meet up to half of total electricity requirements, which is well above current ambitions.

Equally important is the ability of wind energy developers to deliver at a levelized cost that is now below that of any other option for new electricity generation. The new benchmark was set with contract awards in Alberta in late 2017 that had

a weighted average price of 3.7 cents per kilowatt hour. In 2018, the average market price for electricity in Alberta was five cents per kilowatt hour—higher than the cost of this new generation.

Additional and highly-competitive contract awards in 2018 totaled 763 megawatts in Alberta and 200 megawatts in Saskatchewan—collectively representing an eight per cent boost to national installed wind capacity—and were awarded at prices very comparable to the 2017 record-low. This is consistent with recent U.S. analysis (Lazard 12.0) showing a 69 per cent drop in wind energy costs since 2009.

Well-crafted market mechanisms have helped secure this price advantage for energy consumers, while providing predictable returns to wind energy developers. In Alberta, this includes indexed-renewable energy credits, which are a made-in-Alberta form of a contract-for-difference under which wholesale electricity prices are topped up for producers when they fall below the contracted price, and refunded by producers when they exceed it.

Public support for wind energy is also strong. Six in 10 Albertans support provincial efforts to facilitate wind energy development, with fewer than two in 10 opposed; while in Saskatchewan supporters

represent more than eight in 10 people.

Alberta and Saskatchewan have made commitments to thousands of megawatts of new wind energy development by 2030. Analysis of Alberta's Renewable Energy Program indicates that by 2030 it could deliver a total of 15,000 person years of employment, \$3.7 billion in local investment, and tens of millions in property tax and lease payments in rural communities. The Alberta program is also enabling Indigenous ownership of wind energy projects.

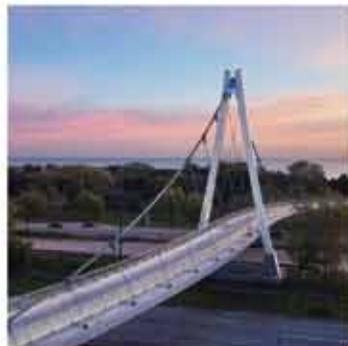
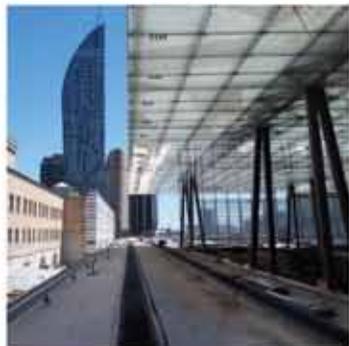
With the recent contract awards, wind energy projects in Alberta and Saskatchewan will account for much of what Canada's National Energy Board believes will be more than 600 megawatts of new wind energy capacity coming online annually in the years ahead, even under a modest business-as-usual scenario. The average annual growth rate for Canada's wind energy industry over the past decade has been in the 1,000 megawatt range. ✻



Robert Hornung
is the president of
the Canadian Wind
Energy Association.



let's explore the possibilities.



EXP has the right blend of expertise and experience to
understand, innovate, partner, and deliver.

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Question today *Imagine tomorrow* Create for the future

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