AUGUST 2018

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VOLUME 63, NO.5/AUGUST 2018

On-Site

CANADA'S CONSTRUCTION MAGAZINE

2018 INFRASTRUCTURE REPORT

IN THIS ISSUE

COLUMNS

CONCRETE ON-SITE

Cut Ottawa some slack

Slagging slow-moving government projects and the lumbering Ottawa bureaucracy is a treasured Canadian pastime. I'm far from an exception, and enjoy heaping some well-deserved blame on Parliament Hill as often as it has it coming.

Occasionally though, I'm willing to grant the feds a bit of slack.

The slower-than-forecast flow of funds from Ottawa's $180 billion infrastructure plan is one such case. Putting aside the fact that politicians desperately need to work on making promises they can keep, doling out billions of dollars to fix aging bridges, roads and sewers, all while ensuring public funds aren't being misspent, is no easy task.

Ottawa has caught a lot of flak over the past few months, both from within the industry and without, over missed infrastructure spending targets and subsequent budget adjustments. For fiscal 2018-2019 alone, for instance, the spring budget delayed $896 million in new spending – about a quarter of the original total set aside for the year – reprofiling it to later in the 12-year plan. The budget did the same for six of the seven fiscal years following this one, meaning almost as much cash will be available in the final three years of the Investing in Canada Plan as in the first nine combined.

While certainly not ideal, these topline delays don't tell the whole story.

In reality, the federal government isn't spearheading most of the projects it's helping to pay for. It can do little when the Canadian provinces, territories and municipalities at the helm aren't ready to put shovels in the ground.

Meanwhile, even when construction is underway, the process for unlocking federal funds often underplays the extent of Ottawa's involvement. Typically, once a province, territory or city starts construction on a project, they assume the full cost. The bill is only passed along to Ottawa once the lower tier government files a claim. The feds then ensure the claim is aboveboard and free up the funds to cover eligible costs.

Because of this reimbursement process, federal spending on infrastructure lags behind the actual work.

So, while Ottawa has been forced to alter its budget forecasts, this doesn't necessarily indicate construction starts have stalled. In many cases, provinces, territories and municipalities have already begun jobs, but haven't yet passed along the costs to Ottawa.

With a spending plan as large as this one, some delays were inevitable. Though the federal government should likely have been more realistic about how quickly it could get projects off the ground from the start, the core aspect of the plan – all $180 billion of it – remains intact. For a cyclical industry prone to boom and bust, these federal infrastructure dollars should create a degree of stability over the next 10 years.

Not to let Ottawa off the hook entirely though, it's worth noting one major concern with the backloaded spending plan: further alterations. Much of the money earmarked for infrastructure won't be spent until well into the next decade. More than likely the government doling it out will be headed by someone not named Trudeau. As governments change, priorities change with them. It will be up to the construction industry and other infrastructure stakeholders to ensure the funds remain on the books.

David Kennedy / *Editor*
dkennedy@on-sitemag.com

MEET OUR CONTRIBUTORS FOR THIS ISSUE

SAUL CHERNOS / Freelance Writer

On ambitious efforts to complete Calgary's ring road:
"To meet the tight deadline, proponents have taken pains to expedite activity, reduce costs and avoid conflict with adjacent landowners and nearby residents."

NATE HENDLEY/ Freelance Writer & Author

On hybrid and electric equipment's role on the job site:
"In addition to environmental and regulatory considerations, manufacturers see other reasons to go electric."

JACOB STOLLER / Principal, StollerStrategies

On how virtual models support maintenance and operations:
"BIM adoption has a long way to go before maintenance and operations information is simply a byproduct of the models contractors produce."

DAVID BOWCOTT / Global Director – Growth, Innovation & Insight, Global Construction and Infrastructure Group at Aon Risk Solutions

On ensuring employees take risk management seriously:
"[Risk controls] are on the front line of risk management, but in order for them to be effective, you must also design incentives to ensure your workforce adheres."

KRISTA JOHANSON AND LINDSEY VON BLOEDAU / Borden Ladner Gervais LLP

On how much is too much:
"When an owner or contractor seeks to remove a claim of lien from title to land by securing the lien with money in place of the land, a debate sometimes arises as to whether the claim of lien has been inflated. In general, a lien should be secured for its face value."

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PHOTO: RYAN BURKLOW/OFFICE OF GOV. RICK SNYDER

Michigan Governor Rick Snyder and former Canadian Infrastructure Minister Amarjeet Sohi, among other officials, officially break ground on the project.

Feds pick construction team, break ground on Gordie Howe bridge

WINDSOR, Ont.—The federal crown corporation responsible for erecting the new bridge between Windsor, Ont. and Detroit, Mich. has selected the construction team that will build the multibillion-dollar project.

The Windsor-Detroit Bridge Authority (WDBA) announced the Bridging North America consortium as the preferred proponent for the Gordie Howe International Bridge July 5.

"This is an exciting time for WDBA and for communities on both sides of the border," said Dwight Duncan, chair of the WDBA board of directors. "The selection of Bridging North America as the preferred proponent is another step forward towards the start of construction."

The construction and financing group is made up of ACS Infrastructure Canada Inc., Dragados Canada Inc. and Fluor Canada Ltd., among several others. It will be responsible for designing, building, operating and maintaining the P3 project.

The new six-lane bridge is expected to have a 125-year lifespan and provide an "alternative" to the aging Ambassador Bridge, which is privately-owned. The design for the new span is also novel. It's expected to become the longest cable-stayed bridge in North America with a clear span of 853 metres.

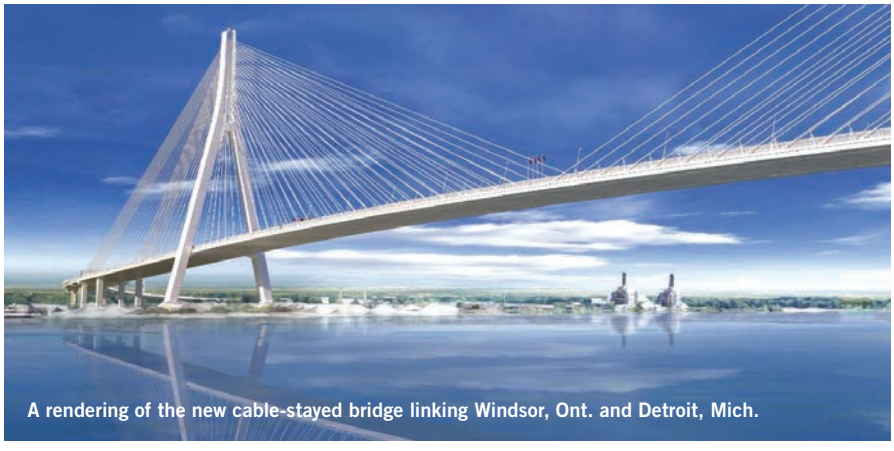

PHOTO: WDBA

A rendering of the new cable-stayed bridge linking Windsor, Ont. and Detroit, Mich.

Work is scheduled to begin in earnest this fall, but officials broke ground on early aspects of construction July 17. Michigan Governor Rick Snyder and former Canadian Infrastructure Minister Amarjeet Sohi were among the first to put shovels in the ground on the Detroit side.

The Gordie Howe project incorporates the span itself, ports of entry on both sides of the border and a connection to U.S. Interstate 75. The Herb Gray Parkway, the $1.4 billion connection on the Canadian side, opened in 2016.

The planning process for the bridge stretches back to 2000, with numerous milestones coming in the early 2010s.

By January 2016, the WDBA had shortlisted three construction consortia to compete for the contract. The construction teams included some of the country's largest contractors, including SNC-Lavlin, EllisDon and Aecon, the last of which eventually dropped out of the process.

Financial close on the new bridge project is expected by the end of September. At that point, the WDBA will reveal the final cost estimate for the bridge, as well as the construction schedule for what will be the largest infrastructure project along the Canada-U.S. border.

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Quebec-based contractor Broccolini to build sprawling new Amazon fulfillment centre in Ottawa suburbs

OTTAWA—Online retail giant Amazon has revealed plans to build a one million square foot fulfillment centre just east of Ottawa.

The Orléans, Ont. facility will become Amazon's fifth in the province and employ some 600 workers when it opens in 2019.

The sprawling new facility, where workers will pick and pack online purchases for shipment, will also be the largest industrial facility ever built in the Ottawa area, according to site developer Broccolini.

The Montreal-based construction contractor and real estate development firm said it will build the project in Canada's capital region on an accelerated timeline. Once complete, Broccolini will serve as the site's property manager with Amazon as a tenant.

"Amazon will benefit from our considerable and diversified expertise to coordinate all development and construction aspects from the outset through to delivery, as well as Broccolini's management experience that comes with its impressive portfolio and properties," said James Beach, director of Real Estate and Business Development at Broccolini.

Ottawa Mayor Jim Watson said the city has been working closely with the U.S. tech giant on the investment decision.

"This is a critical investment in our local economy and our community, which will provide significant employment opportunities for Ottawa residents," he said.

Along with the 600 positions at the warehouse, work on the facility is expected to create 1,500 jobs during construction.

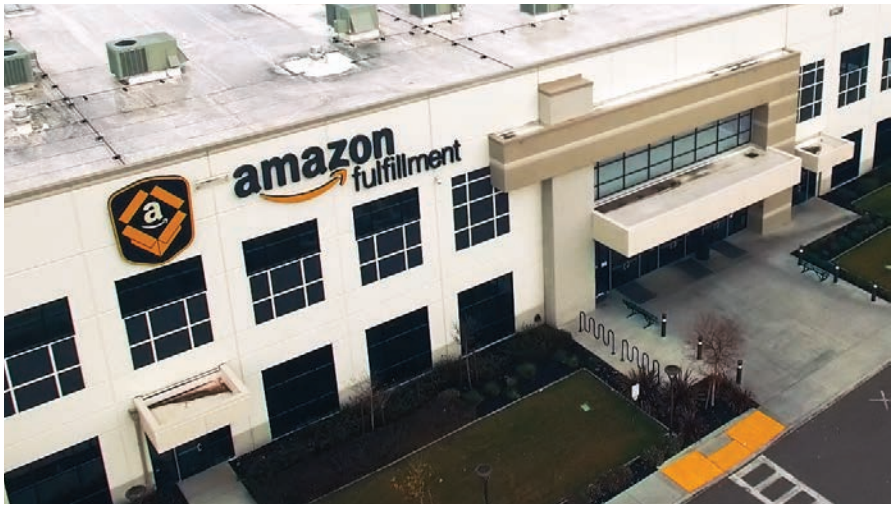

PHOTO: AMAZON

The tech company's fulfillment centres typically cover hundreds of thousands of square feet

Construction of new N.W.T. bridge, study of ambitious Mackenzie Valley Highway project moving forward

YELLOWKNIFE—Construction on a bridge over the Great Bear River in central Northwest Territories and a study looking at the feasibility of a wider project to build a new all-season road along hundreds of miles of the Mackenzie Valley are going ahead.

The federal and territorial governments committed a combined $140 million to the two infrastructure projects June 27. The funds will also pay for an all-weather road running from Wrigley, N.W.T. to nearby Mount Gaudet, about 15 kilometres north of the small community.

Continued on Pg 15

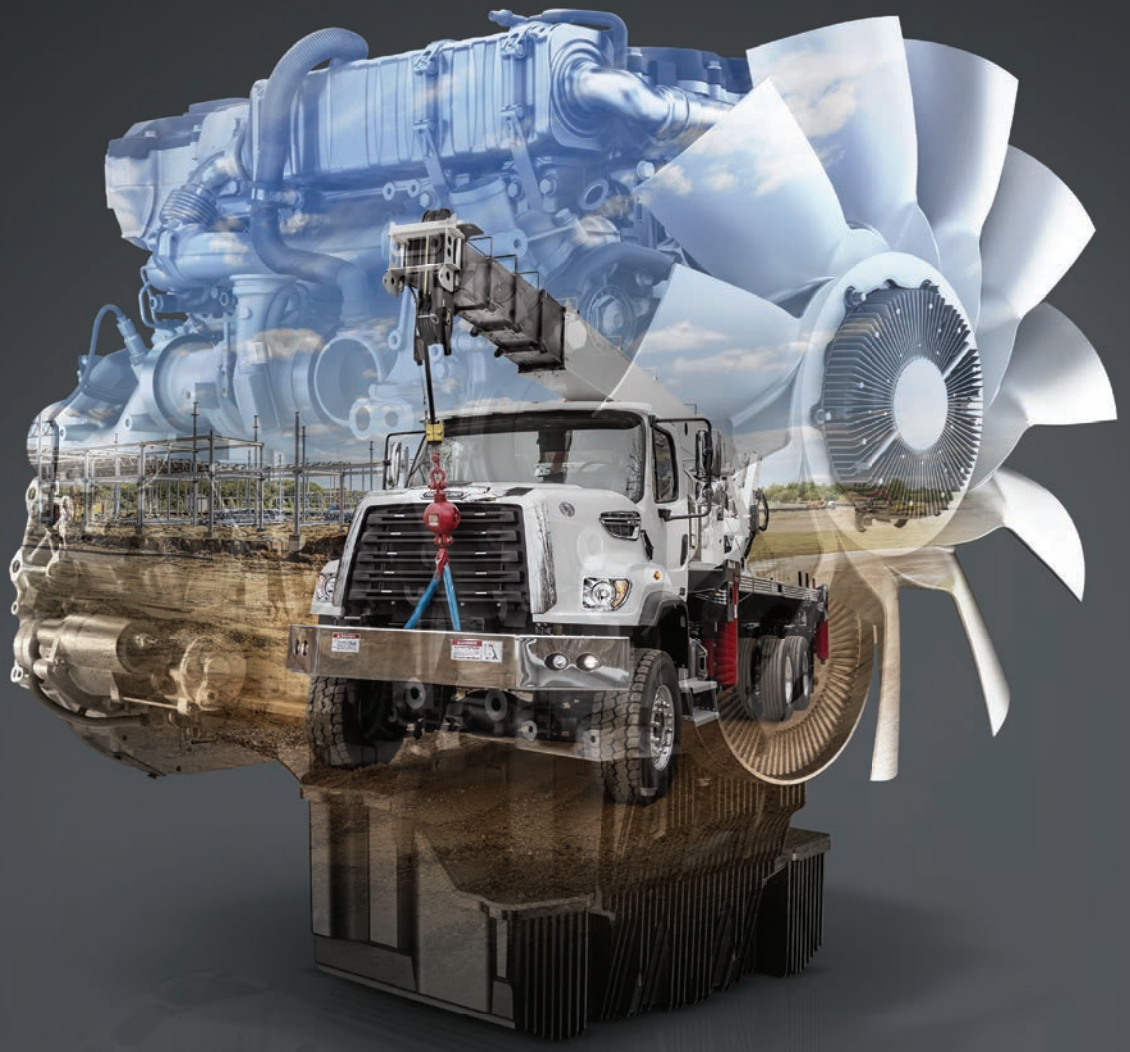

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PHOTO: GOVERNMENT OF NORTHWEST TERRITORIES

The proposed highway will link numerous towns situated on the east bank of the Mackenzie.

Continued from Pg 13

Situated on the Mackenzie River, Wrigley is the current northern terminus of the Mackenzie Highway, which links a number of remote towns in the territory to northern British Columbia and the rest of Canada. The latest funding is part of a wider effort to build a long-sought northern extension to the route known as the Mackenzie Valley Highway.

As the name suggests, the road would run north from Wrigley through the sparsely populated Mackenzie Valley, eventually connecting to the Dempster Highway south of Inuvik. It would span hundreds of miles and link towns on the east bank of the Mackenzie that currently use ice roads as their main access routes.

The recently completed Inuvik Tuktoyakyuk Highway is considered the northern-most segment of the Mackenzie Valley Highway, providing access to the Arctic Ocean.

"This funding will help advance projects that our communities, residents and businesses have been promoting for years, and allows for important planning work to continue to move the Mackenzie Valley Highway project forward," said Bob McLeod, the premier of Northwest Territories.

The study will help plot the final routing and design for the Mackenzie Valley Highway, as well as study the environmental impacts of the project. Current government estimates put the cost of building the segment between Wrigley and Norman Wells, N.W.T. – less than half the way to the Dempster Highway junction – at $700 million.

Meanwhile, construction of the bridge over the Great Bear River near Tulita and work on the 15-kilometre route north of Wrigley is expected to create some 400 jobs.

PHOTO: GOVERNMENT OF NORTHWEST TERRITORIES

The region's tough climate and sparse population make construction a challenge.

Construction ramps up as feds seek buyer for controversial Trans Mountain expansion project

OTTAWA—The federal government has yet to find a third-party buyer for Trans Mountain despite escalating tensions over its politically fraught decision to purchase the existing pipeline and expansion project for $4.5 billion.

Former Infrastructure Minister Amarjeet Sohi will oversee the expansion as minister of Natural Resources, a position he took over from Jim Carr in Prime Minister Justin Trudeau's July cabinet shuffle.

Following a swearing-in on July 18, Sohi told reporters the federal government is committed to moving the project back to the private sector.

If purchased, Finance Minister Bill Morneau said the federal government would extend its indemnity to protect any new owner from costs associated with "politically motivated" delays – namely opposition from B.C. Premier John Horgan.

"It does not matter who owns the pipeline," Horgan said in a statement. "What matters is defending our coast – and our lands, rivers and streams – from the impact of a dilbit spill."

Morneau announced the purchase in late May after weeks of "intense negotiations" with Kinder Morgan Canada Ltd., just days before the company's deadline to decide the fate of the project.

He dodged questions during a press conference about whether costs to twin the pipeline would exceed Kinder Morgan's estimated $7.4 billion project value. Morneau said that the project offered value to Canadians and the pipeline would have a "user-pay approach," meaning revenue from oil companies would help cover additional costs.

"To investors who are considering Canada as a place to build big, important, transformational projects like the Trans Mountain expansion, we want you to know you have a partner in Ottawa," he said.

Alberta Premier Rachel Notley, a fierce supporter of the expansion, announced shortly after that the province would provide up to $2 billion to cover "unforeseen" construction costs. If the backstop is required, Alberta will receive equity in the project commensurate with its contribution and would share eligible costs with the federal government.

Kinder Morgan halted non-essential spending on the project earlier this year due to uncertainty, but construction has begun ramping up following Ottawa's agreement to purchase the pipeline. The company expects the transaction to close late in the third quarter or early in the fourth quarter of this year.

PHOTO: TRANS MOUNTAIN

The pipeline expansion project would twin the existing pipeline running between Edmonton, Alta. and Burnaby, B.C.

Feds invest $167M to bolster infrastructure in and around Port of Vancouver

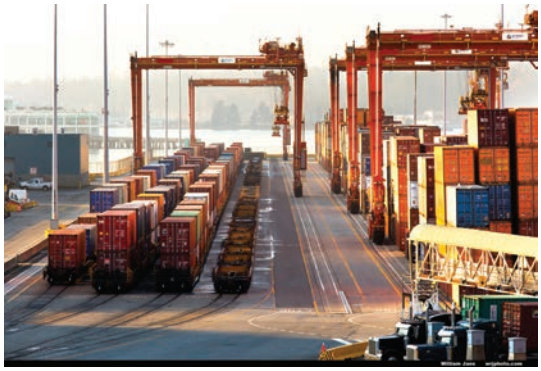


PHOTO: VANCOUVER FRASER PORT AUTHORITY

The three initiatives will increase the flow of goods in and out of Vancouver's cargo terminals.

VANCOUVER—Work on a series of road and rail projects at Canada's largest port is moving ahead with the backing of the federal government.

Ottawa pledged $167 million to three major projects involving the Vancouver Fraser Port Authority, Canadian National Railway and Canadian Pacific Railway June 22.

The construction work covers several areas of the city's south shore port area and aims to increase the amount of goods Vancouver's cargo terminals can handle.

The port authority is spearheading two of the initiatives with support from the two railways. The work includes the construction of 9.4 kilometres of new siding track within Vancouver and Burnaby, B.C., an overpass over Centennial Road, improvements to a 5.5-kilometre rail line and upgrades to the ventilation system in the Thornton Rail Tunnel that will increase its capacity.

CN Rail will lead the third project, which will see crews build a 4.2-kilometre secondary track parallel to the existing Burrard Inlet line within Vancouver. The railway expects the project to increase the flow of goods to and from the south shore port area.

Trudeau announces federal funding for $285M highway twinning project in Nova Scotia

SUTHERLANDS RIVER, N.S.—Safety-related upgrades to a "deadly" section of Highway 104 in northeast Nova Scotia has received $90 million from the federal government.

Prime Minister Justin Trudeau and Premier Stephen McNeil announced the contribution July 17 in Sutherlands River, N.S. The province will provide an additional $195 million.

A 28-kilometre stretch of the highway will be twinned between Sutherlands River, Pictou County and Antigonish. The project also includes a new 10-kilometre four-lane highway between Barneys River and James River, south of the existing Highway 104.

Construction on the P3 project is expected to begin in early 2020 and the province plans to complete the highway twinning component by 2024.

"We want shovels in the ground next spring," McNeil said. The province put out an RFQ to design, build, finance, operate and maintain the highway from Sutherlands River to Antigonish July 23.

Since 2009, the stretch of highway has seen 414 accidents and 16 fatalities. Trudeau said twinning this section would reduce the death toll by 80 per cent.

Joe MacDonald, chief of Barney's River Volunteer Fire Department, has long urged the federal and provincial governments to take action on the accident-prone road.

MacDonald, who spoke at the announcement, had written to the provincial government that the "deadly stretch of highway needed to be twinned as soon as possible."

Trudeau also pointed to Highway 104 as an "essential artery" for interprovincial trade. The route carries about half of all container and truck traffic destined for Newfoundland and Labrador.

CONSTRUCTION STATS

A selection of data reflecting trends in the Canadian construction industry

CONSTRUCTION EMPLOYMENT JUMPS AFTER TWO MONTHS OF DECLINE

Labour demands in Canada's construction industry bounced back in June after two months of decline.

Employers added 27,000 workers to payroll last month, according to Statistics Canada, largely offsetting 60 days of losses that saw the industry shed approximately 32,000 jobs. Ontario accounted for the lion's share of the new jobs, adding 18,500 new positions. The sector in British Columbia, meanwhile, shed 1,200 jobs.

The total number of workers employed in the construction industry increased to approximately 1.447 million in June, up from 1.420 million in May. That figure remains just shy of the year's high-water mark of 1.452 million set in March.

Construction continues to show strong year-over-year growth, with 43,600 more Canadians employed in the industry than in the same month last year.

WORKERS EMPLOYED IN CONSTRUCTION BY MONTH

2018	JUNE	1,447.50
	MAY	1,420.30
	APRIL	1,433.30
	MARCH	1,452.20
	FEBRUARY	1,433.90
	JANUARY	1,433.90
2017	DECEMBER	1,448.80
	NOVEMBER	1,441.30
	OCTOBER	1,425.10
	SEPTEMBER	1,406.70
	AUGUST	1,399.30
	JULY	1,394.30

Note(s): In thousands of workers, seasonally adjusted SOURCE: STATISTICS CANADA

SPENDING ON NON-RESIDENTIAL CONSTRUCTION INCHES UP IN SECOND QUARTER

Investment in non-residential building construction saw increases in two of three industry segments in the second quarter of 2018.

Increased spending in the commercial and industrial markets of 1.6 and 4.8 per cent respectively more than offset a 0.9 per cent decline in the institutional segment. Total investment in non-residential building construction ended the quarter at $14.3 billion, or up 1.4 per cent from the first three months of the year.

The decline in institutional building snapped a year of increases for the segment. Less spending on schools, nursing homes, courthouses and penitentiaries were part of the cause.

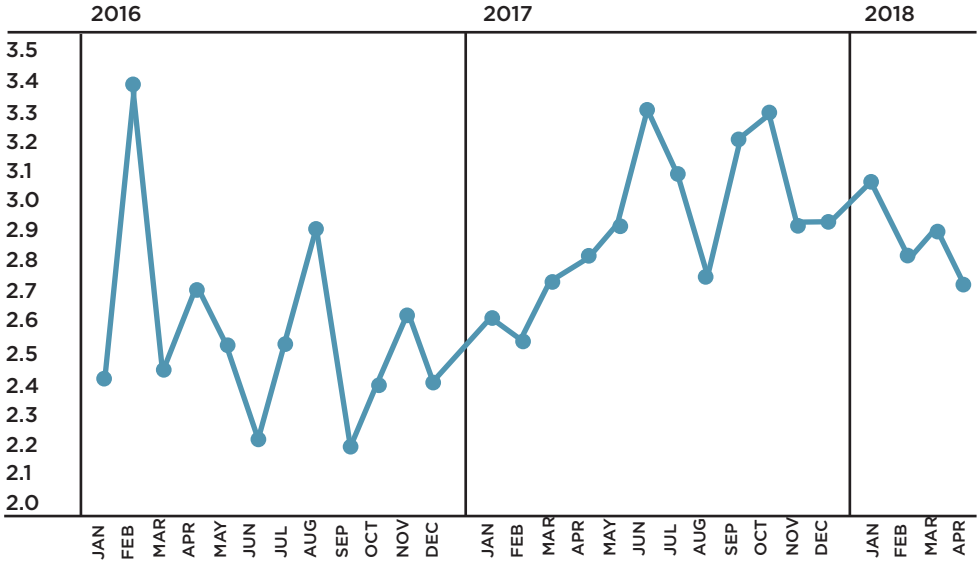
2013		2014		2015		2016		2017		2018	
Q1	12.75	Q1	12.76	Q1	13.28	Q1	13.15	Q1	12.99	Q1	14.15
Q2	12.24	Q2	12.79	Q2	13.44	Q2	13.18	Q2	13.2	Q2	14.3
Q3	12.59	Q3	12.91	Q3	13.47	Q3	13.12	Q3	13.6		
Q4	12.58	Q4	13.1	Q4	13.32	Q4	13.05	Q4	13.72		

Note(s): In billions of dollars. Data are seasonally adjusted. SOURCE: STATISTICS CANADA

KEY NON-RESIDENTIAL BUILDING INDICATOR DIPS AGAIN

In contrast to an upward trend in residential building, the value of permits issued for the non-residential sector declined for the second-straight month in May.

According to Statistics Canada permits issued by municipalities totalled $2.7 billion for the month, continuing what has been a gradual slide for commercial, institutional and industrial builds since the fall of last year. The value of permits have declined 18 per cent from their October high.



Note(s): In billions of dollars. SOURCE: STATISTICS CANADA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PICKING UP THE PACE

Canada's infrastructure plan starts hitting its stride

BY DAVID KENNEDY

It may have been a little slow off the proverbial mark, but the federal government's $180 billion infrastructure plan is now off and running.

As of August 2018, the federal government has approved funding for thousands of projects across the country – from small-scale jobs worth as little as a few thousand dollars, to megaprojects with price tags running into the billions. By 2028, the Investing in Canada Plan is expected to have doled out more than $180 billion, split nearly evenly between investments in new programs and funding for existing federal initiatives.

Though some concerns remain about the flow of funds, Ottawa has made substantial progress over the past few months. Of the $14.4 billion promised under the first phase of the plan, 88 per cent has been tied to specific projects that are either underway or complete – up from 70 per cent in April. The larger, second tranche of $81 billion in new spending, which Ottawa announced in Budget 2017,

has also begun to leave federal coffers.

14 federal departments and agencies, including Infrastructure Canada, Transport Canada and Natural Resources Canada are responsible for developing and overseeing the new spending programs.

For contractors, Infrastructure Canada's $33 billion allotment that will pay for projects such as highways, water infrastructure and transit lines through bilateral agreements with each province and territory is likely the highest-stake initiative. Ottawa has struck deals to unlock this funding with 10 of the 13 jurisdictions, up from seven in April. Only agreements with Saskatchewan, Newfoundland and Labrador and Prince Edward Island remain unsigned.

TAKING DELAYS IN STRIDE

Despite the progress, there have been slow downs along the way.

"Our partners asked that we design programs that are flexible and responsive to their needs," says former Infrastructure Minister Amarjeet Sohi, who was swapped off the infrastructure file in a mid-July cabinet shuffle. "And we have done just that – extending the deadlines under some of our programs and adjusting our forecasts under new programs to ensure that funding is available to their projects when they need it."

One of the largest of these adjustments came this spring in Budget 2018. While Ottawa did not alter the $180 billion figure promised a year earlier, it pushed back billions in spending until the tail end of the 12-year plan.

The result is the slower rollout of funds between 2018 and 2024, but higher spending between 2025 and 2028. Backloading the budget delays an average of $441.6 million in spending in each of the next seven fiscal years when compared to the original plan. So, while spending is still expected to ramp up, it won't be until 2025 that Ottawa truly opens the spigot. With the spring changes factored in, $36.1 billion – or 44.5 per cent of total new program spending – is earmarked for the final three fiscal years of the plan, bad news for contractors looking to secure new contracts today.

Mary Van Buren, the president of the Canadian Construction Association, acknowledged that there's been "some slippage" in the flow of funds, but says as long as the infrastructure dollars remain on the federal books, it's not cause for concern.

"The fact that there have been some delays is not great, but some of it is understandable," she says, pointing to some municipal governments with projects that weren't shovel-ready and capacity issues within the construction industry itself.

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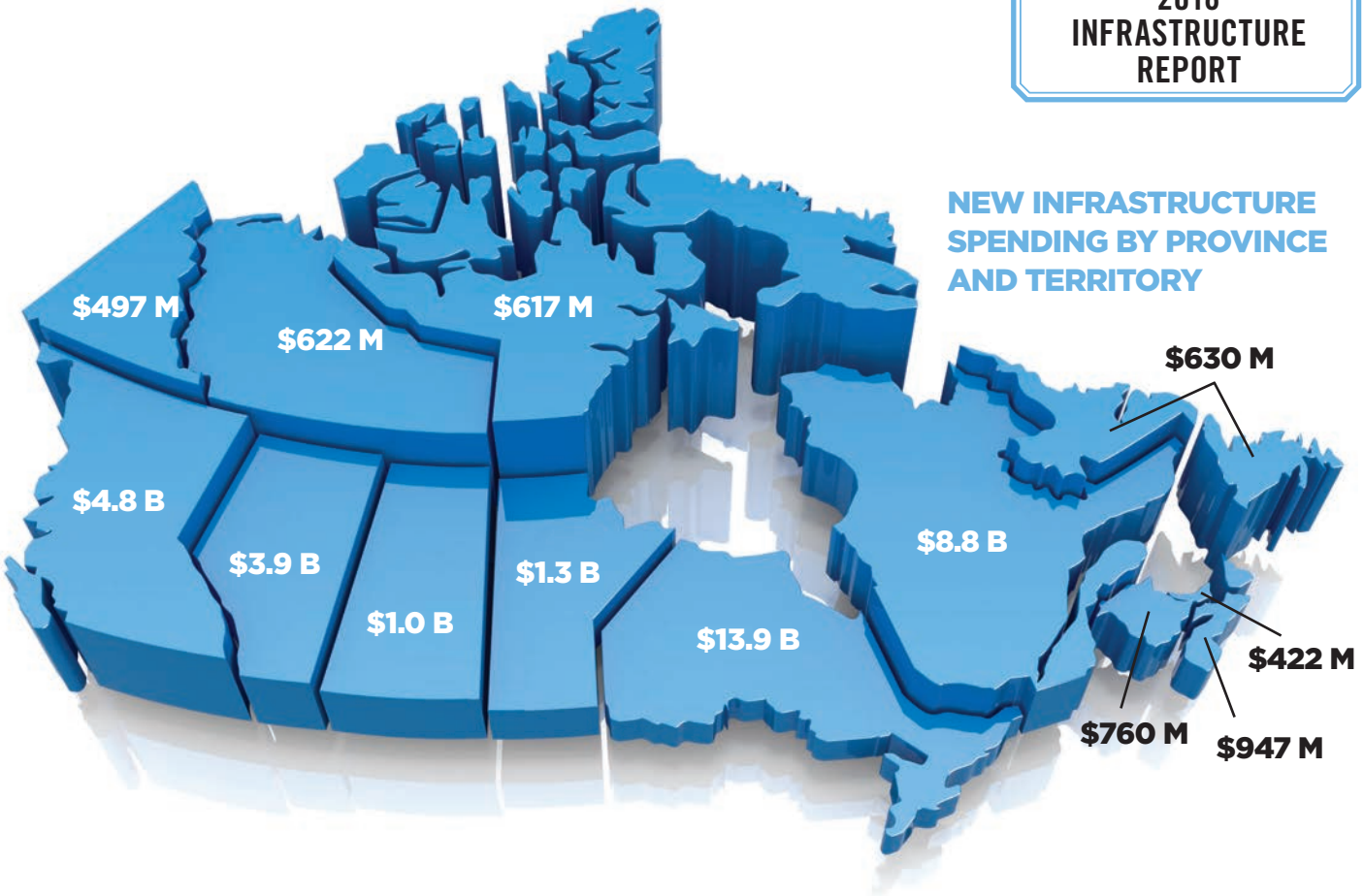


The
$180 BILLION
plan consists of more than $90 billion in both new and existing spending initiatives

44.5%
of the federal funding is earmarked for 2025-2028

Ottawa has inked infrastructure deals with
10 OF 13
Canadian provinces and territories

"Municipalities are working hard to get their funding requests in and there's no shortage of work that needs to be done. Canada has very aging infrastructure – it's very old. Whether that's sewers or roads or bridges, these are important investments that need to be made," she says, adding that the CCA is working with governments and industry groups at both the local and national level to help ensure any future funding problems are smoothed out and projects get underway.

P3S GO "A STEP FURTHER"

Much of the federal infrastructure cash will reach construction firms through tried and true methods, such as provincial and municipal contracts or public private partnerships (P3s). But there's at least one wildcard in Ottawa's infrastructure deck.

The much-touted Canada Infrastructure Bank, an institution set up to foster private sector interest in financing, building and operating major infrastructure, could coax a new breed of investors into what's traditionally been government territory.

Pierre Lavallée, who started work as the CIB's new president and CEO in June, says the arms-length government body could begin making investments next year. Though later than initially hoped, the novel investment vehicle has been allotted some $35 billion over the next decade to help lure private investors into the public works business. Far from chump change, the government dollars and potential for private profits could alter the infrastructure landscape, and greatly benefit builders in the process.

Lavallée says he believes the bank will be good for contractors. "Our intent is not to replace the successful P3 model," he says. "We will be a new option for funding infrastructure projects that might other-

A rendering of Kingston, Ont.'s Third Crossing bridge. The new $180 million span is one of thousands of projects to receive federal funding.

PHOTO CITY OF KINGSTON

wise not get built."

"P3 arrangements typically include payments from the government when an asset becomes available – this model transfers construction and operating risk to private parties. The bank will use a co-investment model that takes the involvement of the private sector a step further to assume risks relating to usage or revenue. The bank's co-investment can mitigate some of the usage and revenue risks for private-sector and institutional investors, or 'inject' capital at key points, making projects more attractive."

The bank's mandate encompasses revenue-generating projects that are in the public interest and at least partly within Canada. It expects to focus on public transit, trade and transportation as well as green energy projects.

Lavallée would not comment on specific projects, but says the bank has received several "promising proposals" that it's currently working on with its partners.

While most projects are expected to focus on Canada, at least one U.S. state is actively exploring using the new Canadian institution to its own advantage. A report prepared for the Washington State Department of Transportation released earlier this year says the CIB could provide a "key" source of funding for an ultra high-speed rail line connecting Vancouver, Seattle and Portland.

The potential project, and others like it, would likely require close cooperation between Canada and its southern neighbour. Given the current climate, this seems far from guaranteed.

UPHILL BATTLES

Uncertainty for Canadian infrastructure projects extends beyond the untested Canada Infrastructure Bank.

With fresh tariffs on steel and aluminum crossing the Canada-U.S. border, seemingly weekly threats of further hostile trade action from the Trump administration and some steep challenges within our own borders, many major building projects will be pressured in both the short- and long-term.

In the coming months, Van Buren expects the U.S. steel tariffs to inflict "some pain" on the construction industry, but if time drags on with no resolution, she anticipates a "real impact" on the industry.

"Our hope is of course that this is a short-term tactic on the U.S. side," Van Buren says. "The jury's still out on that, but we remain optimistic that the Canadian government... will come to a positive solution for Canada and the Americans are interested in doing that as well."

According to the Canadian Coalition for Construction Steel, Canadian manufacturers produce only half the steel the Canadian construction industry consumes. The sector relies on the U.S. for about a quarter of its total demand. With tariffs

BIG TICKET PROJECTS TO RECEIVE FEDERAL FUNDING

Project	Estimated total value
Calgary Green Line Light Rail Transit Project	$4.6 billion
Ottawa Light Rail Transit (LRT) Stage 2	$3.0 billion
Finch West Light Rail Transit Project	$2.5 billion
Southwest Calgary Ring Road Project	$2.2 billion
GO Transit RER - Kitchener Corridor	$1.5 billion

AS OF AUGUST 2018

A rendering of the soon-to-be-built Finch West Light Rail Transit Project.

PHOTO INFRASTRUCTURE ONTARIO

increasing prices for buyers, budgets for infrastructure projects will need to keep pace. In other words, $180 billion will not go as far as it used to.

Van Buren says the higher prices could also cause problems for contractors that have entered into contracts with certain assumptions about material prices. The CCA is already working on mitigation should the international trade turmoil continue.

Even within Canada, numerous roadblocks threaten several big-ticket infrastructure projects.

The Site C hydro project in British Columbia, for instance, was recently put through the wringer by its own government. It barely escaped cancellation, despite more than two years of construction. Several months later, the federal government spent $4.5 billion to purchase the Trans Mountain Pipeline from Kinder Morgan Canada Ltd. The deal safeguarded a project to expand the pipeline, which appeared increasingly uncertain due to opposition.

While both West Coast projects seem to be back on course, projects to build energy infrastructure like dams and pipelines face stronger opposition than ever. Still, so long as the work moves forward, contractors with expertise in the energy sector are poised for a busy few years as firms upgrade aging pipelines and build new routes to export Canadian oil and gas.

Along with the construction ramp-up on Trans Mountain, major pipeline operators Enbridge Inc. and TransCanada Corp. have committed billions to upgrading their systems within Canada over the next few years. Meanwhile, a consortium of energy heavyweights, including Shell, Petronas and PetroChina are inching toward green-lighting a $40 billion project to build a liquefied natural gas export terminal in Kitimat, B.C. ☐

The newly-formed Canada Infrastructure Bank has

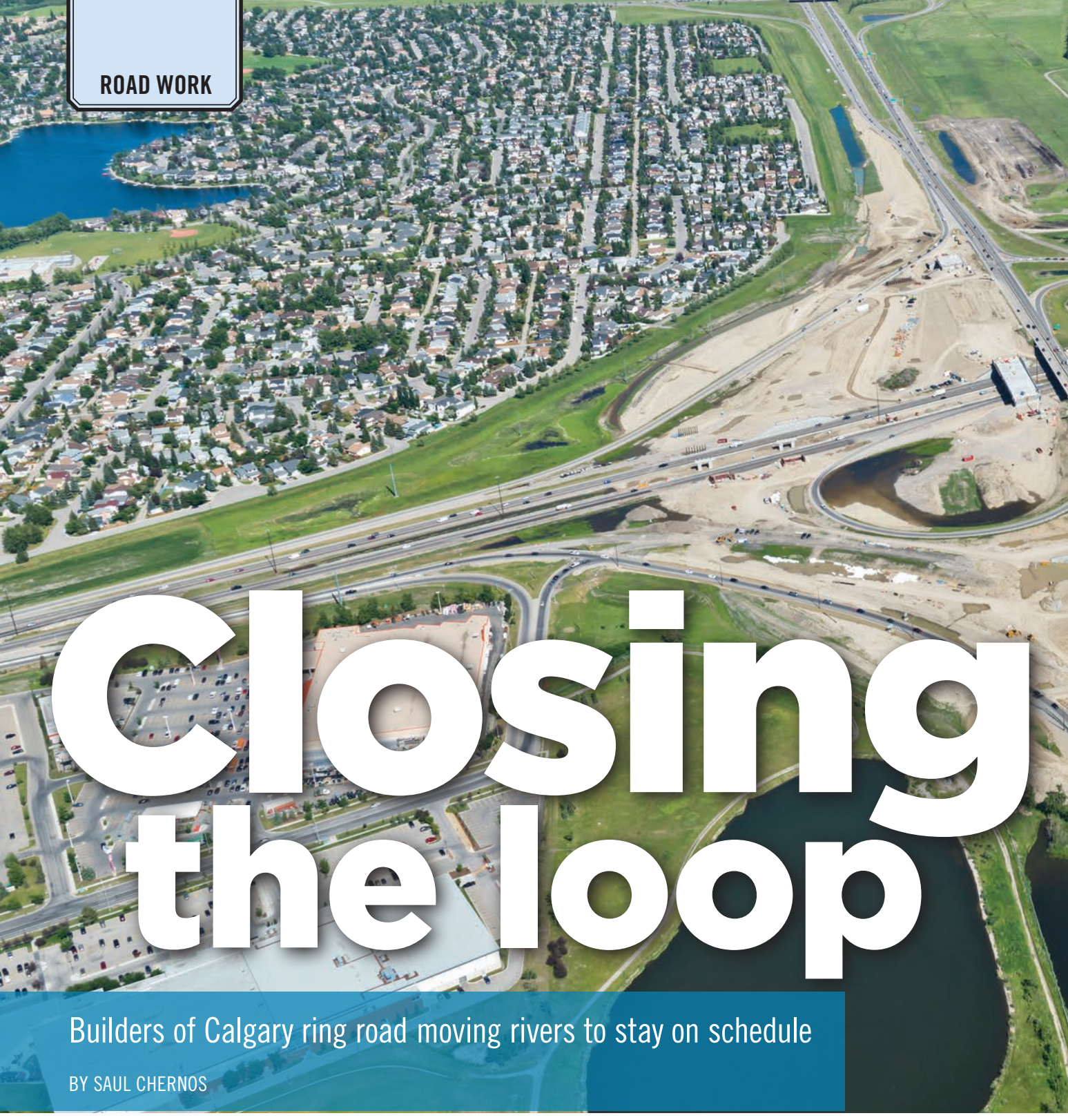
$35 BILLION

to invest over the next 10 years

More than

30%

of Ottawa's infrastructure spending will go toward public transportation projects



Closing the loop

Builders of Calgary ring road moving rivers to stay on schedule

BY SAUL CHERNOS

Calgary's new ring road is well on its way to becoming a full-fledged loop. Northeast and northwest sections opened to motorists wanting to bypass the city in 2009, and a southeast section was added four years later. If all goes according to plan, a southwest quadrant will open in late 2021, with the remaining nine kilometres on the westernmost fringe scheduled to be complete by 2022.

Ring roads hasten the flow of traffic around some of the world's biggest cities. The Boulevard Périphérique circumnavigates Paris, and rings feature prominently from Melbourne, Australia to Lahore, Pakistan. The terminology often differs – Washington D.C.'s Capital Beltway harbours Inner and Outer Loops, and the London Orbital runs 188 kilometres. In Canada, Circle Drive in Saskatoon opened in 2013, while Highway 216 in Edmonton ranks as one of the busiest roadways in Western Canada. Partial rings include Autoroute 30, which circumnavigates southeastern Montreal, and the Regina Bypass, which rounds just a portion of the prairie city.

Calgary's ring road, alternatively known as Stoney Trail and Highway 201, will still technically classify as "partial" even

with the southwest expansion. However, the work will add 31 kilometres of mostly eight-lane expressway to the current ring road, provide connections to several east-west highways, and serve as a major north-south corridor for avoiding Calgary's increasingly clogged arteries.

"The city's growing pretty fast and there's a need for more highways to ensure efficient movement of traffic," says Rizwan Hussain, who oversees construction of major capital projects for Alberta Transportation. "This is part of the long-term transportation and economic corridor. It will enhance safety, support the economy and improve quality of life because people will be spending less time in traffic."

Planning for the southwest component began in the 1970s, when the province started assembling land for a transportation utilities corridor (TUC). With development pushing outwards, the province approached the Tsuut'ina First Nation to negotiate for land.

"We were given only seven years from the date of the land transfer (2015) to hire a contractor and finish this road," Hussain says. "If we fail to finish in seven years, the land will go back to the First Nation, all the money the province has given to

PHOTOS:KGL CONSTRUCTORS

Along with all the conventional construction challenges, work on the new southwest segment of Calgary's ring road has involved diverting rivers and disposing of unexploded ordinance.

them will remain with them, and whatever infrastructure we have built will also go to them."

The province quickly put the project to tender and selected Mountain View Partners (MVP) to design, build, operate and partially finance the Southwest Calgary Ring Road project. MVP, in turn, subcontracted design and construction to KGL Constructors, and work began early last year.

The $2.2-billion total projected cost includes project planning, real estate, utility relocation and a $1.42-billion contract with MVP. That contract, in turn, covers design, construction, 30 years of operation and maintenance and has MVP raising 40 per cent of project financing. The private sector financing will arrive first and cover design and construction. Once the project is complete, the province will make monthly payments to MVP for ongoing operations and maintenance. The federal government will also provide roughly $250 million in infrastructure funding.

"It's a huge undertaking," Hussain says. "It's a 31-kilometre-long section with environmentally sensitive areas, 49 bridges and 14 interchanges."

To meet the tight deadline, proponents have taken pains to expedite activity, reduce costs and avoid conflict with adjacent landowners and nearby residents. Rather than trucking gravel from afar, crews are mining aggregate underneath the corridor and crushing it into useable gravel at two facilities on-site. "It means we're not transporting gravel using hundreds of trucks every day," Hussain says. Proponents have also located two asphalt plants within project boundaries.

To minimize noise from gravel and asphalt processing, proponents invested in low-noise mufflers and generators for the plants and opted against back-up alarms. As a result, Hussain says, noise levels average 50 decibels, well below the 65 dBA standard. To keep dust at bay, crews water gravel from the moment it's mined using special spray nozzles as well as filtering screens. The asphalt operations run on natural gas, further reducing emissions and odours.

"Alberta Environment and Alberta Health are checking our gravel operations and we are well within the thresholds in the regulations," Hussain says, noting that in the absence of provincial and federal standards for silica dust emissions, Alberta uses Ontario Ministry of Environment standards.

Environmentally sensitive areas have also proven challenging. Sections of the Elbow River and Fish Creek were relocated because the waterways happened to lie along the planned route. "We did it in stages," Hussain explained. "We built the new channels first, then we blocked the old channels." Crews transplanted 16,000 fish and worked to stabilize banks, prevent erosion and create suitable habitat for aquatic and shoreline vegetation.

Considerable attention is also being paid to flood mitigation and bridges are being designed to accommodate sudden storm surges and rapidly melting mountain snowpacks. "The 2013 flood was a significant event," Hussain says. "We've done all the hydraulic modelling and we'll be able to safely accommodate the flow of water underneath bridges."

Another challenge arose from the corridor partly sitting on a former military base, with unexploded ordinance left behind from weapons testing. "It's a huge risk for our contractors," Hussain says, adding that the Department of National Defence and Alberta Transportation scoured the area and decommissioned numerous potentially lethal explosives, while the contractors have unearthed a few additional ones.

Generally though, the challenges have

Bridges crossing the Elbow River and Fish Creek are being built with wildlife corridors for animals small and large. Corridors range from 15 to 30 metres wide and feature native grasses and shrubs. Fencing will direct wildlife away from motorists and towards these passages.

CALGARY SOUTHWEST RING ROAD BY THE NUMBERS

- 1 railway crossing
- 31 km of six and eight lane divided highway
- 49 bridges
- 14 interchanges
- 1 culvert set
- 1 tunnel
- 3 river crossings

been routine. To manage traffic, proponents have designed detour routes that match the number of lanes displaced by adjacent road closures. With multiple contractors and a crew of 1,400 strong, it's taken considerable effort to communicate effectively, build a coherent team and manage expectations. Nevertheless, Hussain sees the glass as half full. "When you have more contractors and more parties involved, there's more opportunities to innovate, brainstorm and have a better product. We're lucky to have experienced contractors and professionals working together to ensure safety, environmental protection and project quality."

While the province bears overall responsibility, the City of Calgary is significantly involved as the central stakeholder. "We're working closely with Alberta Transportation on all the interface issues we have with each other and to help them successfully deliver this project," says Julie Radke, the City of Calgary's manager of ring road integration and special projects.

Calgary isn't contributing any funding towards the ring road itself because it's built within the TUC and thus, under provincial authority. However, the city is funding connections and related integration, much of which is scheduled to open in advance of the ring road extension. "Our budget on that is $133 million," Radke says, adding that the money is coming from Calgary's capital infrastructure planning budget.

Some city work was completed even before crews began work on the southwest extension. One example is a pedestrian overpass at Anderson Road. "That was done so that not only can the pathway have a place to go while the construction is being done, but it will serve as the long-term link," Radke says.

There's also cooperation in other areas. While the province is overseeing traffic management, including detour designs and plans, Calgary's transportation division provides ongoing feedback because city roads are involved.

It's the same with utilities, drainage and flood-risk mitigation. "We've partnered with [Alberta Transportation] on a study review of river crossings," Radke says. "The city did quite an involved study [in 2015] to review the Elbow River Bridge, to make sure what they were proposing was appropriate and satisfactory from a flooding and water quality perspective."

While heavy machinery almost always hogs the spotlight at road-work sites, computer-driven digital technologies have been prominent both in project boardrooms and out in the field. In a written response to questions, Tim Rule, project director with KGL Constructors, says crews are using drones to take aerial photographs. "[It] allows us to plan material placement and reduce site congestion," Rule says. "KGL can use photogrammetry techniques to get 3D pictures of the current ground and calculate quantities to plan effective earthwork operations."

KGL has also equipped tablet computers with an app that lets team members see designers' models in the field within a five-metre accuracy. "Those who have it set up can determine what is happening and where it's happening with a few swipes of the finger," Rule says. "This technology is also very useful for identifying existing utilities in an area of operations."

With the project in full swing, all eyes are on the 2021 deadline and on what matters most in the end. While Alberta Transportation is driving the ring road's construction, the benefits to Calgary are considerable. "It's an important part of the good movement network for getting into and around the city," Radke says. "We've been lacking a north-south connection along the west side of the city, and this provides it for us. It will form part of our skeletal road network system and will help move people around."

Presuming all goes according to plan, Calgary's Ring Road will be just nine kilometres shy of forming a full circle when 2021 draws to a close. However, the province has already paved the way for the route's eventual completion. Just last month, Alberta earmarked the funds to pay for the final westernmost segment. The procurement process is expected to kick off shortly, while the province plans to fully complete its 101-kilometre ring by 2022. ☐

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GOING FORMLESS
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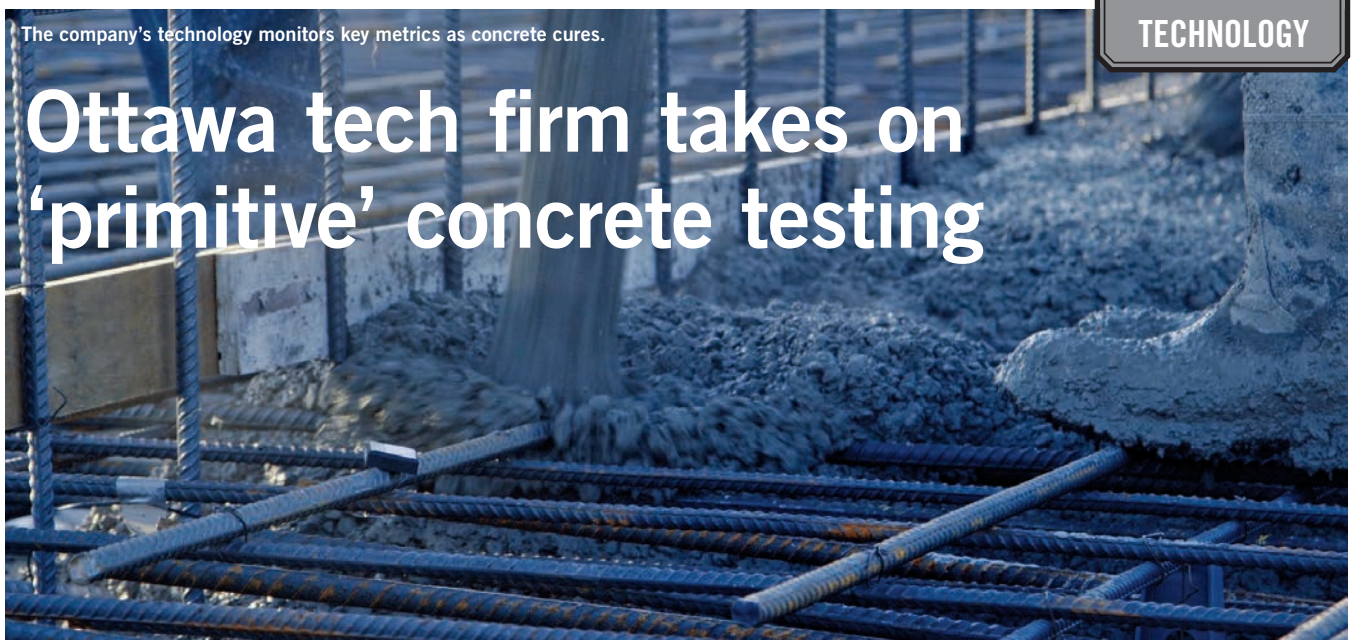

The company's technology monitors key metrics as concrete cures.

PHOTO GIATEC

Ottawa tech firm takes on 'primitive' concrete testing

BY JILLIAN MORGAN

With a little resistance from an industry sometimes seen as being set in its ways, Giatec Scientific Inc. is working to bring the world's second most consumed material into the 21st century.

Its smart concrete testing products offer an alternative to dated processes and focus on adoptability. The Ottawa-based company has also driven its novel technology into the international market.

With customers such as PCL Construction and Lafarge Canada, Giatec closes the gap between research and practice.

Its SmartRock concrete sensor, which hit markets in 2015, was lauded by the industry and earned co-founders Aali Alizadeh and Pouria Ghods the reputation of Silicon Valley-esque tech innovators.

The Ottawa Chamber of Commerce named Giatec one of the province's fastest growing companies for 2018 and awarded both Alizadeh and Ghods its Forty Under 40 distinction in 2017 and 2018, respectively – though, the company's humble start was in the lab as opposed to the boardroom.

Ghods and Alizadeh established Giatec in 2010 after completing PhDs in civil engineering at separate Ottawa universities. The duo decided to "give it a try," Ghods says, and set out to produce research- and science-based technology for the construction industry.

Giatec's product portfolio steadily evolved between 2012 and 2014 from lab-test devices to portable surface testing technology that measured corrosion, electrical resistivity, temperature and humidity of existing concrete structures.

"At that time it was advanced," Ghods says. "But soon after we noticed that the market is very niche."

With that, the newly-minted entrepreneurs levelled-up their offering with embedded sensor technology that allowed contractors to monitor concrete as it cures and hardens in real-time.

The release of the SmartRock sensor allowed Giatec to gain "significant traction" in the market, Ghods says, and the product, now in its second generation, continues to be a main driver of business growth.

Its installation is simple: the device is embedded on rebar with the twist of two wires. Concrete can then be poured normally and the end-user can monitor concrete temperature, maturity and strength via a smartphone. Data from the sensor is also transferred to Giatec's cloud server and can be shared with other team members.

Standard processes, such as cylinder break tests, can result in project delays of one to two days per pour, running up costs for construction companies, Alizadeh says.

"By sharing the same data to all those players in real-time, we empower them to do their task individually without having to communicate with each other," Ghods adds.

The product also offers benefits to ready-mix producers that can leverage the real-time data to upsell concrete mixes or optimize mix designs.

Ghods attributes SmartRock's quick adoption to its ease of use and compatibility with current building codes in the U.S. and Canada. Still, it's a slow process to get the conservative construction industry on board.

"We knew that adoption of any new technology in the construction industry would be slow, but we were confident in our product and the benefits it would provide to construction companies," Alizadeh says.

Ghods is unsure whether to chalk up the company's success to luck, smarts, or experience. Regardless, Giatec has carved out a niche market for itself.

Its revenues have grown more than 450 per cent over the last three years, paving the way for the company to add 20 employees to its current roster of 32. Alizadeh says these new hires will support Giatec's projected sales and the development of new sensor technologies.

Despite this growth, innovative products will remain at the core of the Giatec's business model. Eventually, it plans to play a role in the infrastructure of smart cities.

"We are on our path to revolutionize the concrete industry," Alizadeh says. "We have created a platform for smart and connected structures."

Giatec also hopes to develop technology for other materials such as gypsum, steel and wood. For now, though, it'll stick to concrete. ☐

PHOTO: METROLINX

Formless

How shotcrete is changing timelines, concrete crews and the jobsite

BY DAVID KENNEDY

Formwork has been a mainstay on construction sites for generations. The familiar timber, metal or plastic forms that support freshly-placed concrete as it sets aren't about to go extinct, but they're facing increased pressure from a method that can shave valuable days, or even weeks, off project timelines.

"When you look at our industry right now, time is money," says Ryan Regier, contract manager with Ontario-based HCM Shotcrete. "The less you can disrupt a road or a sewer or a dam, the more efficient and the lower cost your overall project's going to be."

Shotcrete, a century-old technology that has undergone something of a renaissance over the past two decades, is reaping the benefits of these shifting project priorities. The method uses a hose and pneumatic pressure to spray concrete at high velocity, allowing crews to forego all or most of the formwork needed for a traditional pour. The nozzle and high pressure involved also mean the compaction stage is built into the process. Unsurprisingly, sprayed concrete is another common name for the method, which has both dry- and wet-mix offshoots. The dry-mix technique is also still occasionally referred to by its original name, gunite.

Over the past 20 years, a wider pool of skilled nozzlemen, improved machinery and mix technology and an increased emphasis on time and labour savings on job sites have accelerated adoption of the technique.

Industry experts expect the shift to continue as a growing roster of contractors look to shotcrete for everything from reinforcing tunnels to rehabilitating bridges.

AN UNDERGROUND MOVEMENT

There's a common subterranean theme attached to many of the larger-scale projects currently putting shotcrete crews to work.

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PHOTO: METROLINX

Mechanical concrete spraying equipment in use during tunnel construction on Toronto's Eglinton Crosstown light rail project.

"You cannot build underground by excavating out the width of football fields and filling it back in anymore. It's just too expensive."
Andrew Stewart, Lafarge Canada

"You cannot build underground by excavating out the width of football fields and filling it back in anymore," says Andrew Stewart, general manager for Northern Ontario at Lafarge Canada Inc. "It's just too expensive, let alone the fact that this infrastructure is under or directly adjacent to buildings, parking garages and houses."

Work on multibillion-dollar light rail transit projects such as Vancouver's Evergreen Line, Ottawa's O-Train expansion and Toronto's Eglinton Crosstown, for instance, have all employed shotcrete.

The sprayed concrete method is also being adopted for small underground civil works such as sewers, according to Lihe Zhang, president of the American Shotcrete Association (ASA) and engineer at Delta, B.C.-based LZhang Consulting & Testing Ltd.

Zhang says contractors have traditionally used shotcrete for initial tunnel linings and ground support, but left the final linings to more traditional concrete methods. Not anymore.

"In the past 10 years, there's more and more jobs the final lining itself is being built by shotcrete," he says, pointing to Metro Vancouver's Seymour-Capilano Twin Tunnels, which connect much of the city to its water supply.

Unsurprisingly, mining companies also frequently employ shotcrete when building tunnels or stabilizing cavities.

NECESSITY BREEDS INNOVATION

As more and more Canadians flock to a handful of large cities across the country, the need for infrastructure and housing has forced the construction industry into overdrive. A number of public sector players have already embraced shotcrete; private builders aren't about to be left out. They've adapted the technique to demanding projects with tight timelines and often compact worksites.

In most of Canada's major hubs, for instance, high-rise contractors are turning to wet shotcrete to form concrete foundation walls on freshly-excavated sites. It replaces the one-sided formwork traditionally placed against the rock.

"Some types of rock will deteriorate rapidly once exposed to air for the first time in thousands of years, which is why shotcrete is a quick and effective way to stabilize the rock and continue to build," Stewart says.

"That's a booming industry here in Vancouver, Calgary [and] Edmonton," Zhang adds. "A lot of the downtown high-rise foundation walls are built by


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BORN READY.

Industry research shows using shotcrete can translate to timeline savings of as much as 50 per cent compared to traditional methods.

> ***"You can't just take any guy that's familiar with pouring concrete and throw him on the shotcrete team and assume he will pick it up that quick.***
> ***Ryan Regier, HCM Shotcrete***

using structural shotcrete technology."

Toronto, far and away the country's largest high-rise market, isn't far behind.

The use of shotcrete on smaller scale projects within cities, such as new residential foundations, foundation repairs and swimming pools is also becoming increasingly common.

According to ASA research, shotcrete can translate to timeline savings of between 33 and 50 per cent, compared to the traditional cast-in-place method. The industry association with members across North America also cites savings on cranes, hoists and other related equipment unnecessary when shooting concrete into place from a distance.

LOOKING HIGHER

The potential for time and cost savings don't end when moving above ground.

"Contractors often use shotcrete for retaining walls and soil stabilization during the roadbuilding process," says Scott Knighton, vice-president at concrete mixer and pump manufacturer Blastcrete Equipment. He also points to repair work on concrete bridge decks and concrete support columns as two other key roadwork applications.

Regier concurs, saying the process lends itself particularly well to the rehabilitation of culverts, bridges, underpasses, silos, tanks and digesters. He notes a recent HCM job for the Ministry of Transportation of Ontario that involved rehabilitating a culvert outside Barrie, Ont.

"Instead of sliplining the concrete boxes over it, we ended up just reshooting the areas that needed to be rehabilitated," Regier says. The method saved on time, materials and, perhaps most importantly for roadside work, resulted in no highway obstruction.

While Regier has no expectations of shotcrete replacing cast-in-place on easy-to-access sites where double-sided formwork is not a challenge, he says it's a different story on compact sites, or for jobs with hard-to-reach areas. Concrete mixes used for shotcrete cost more than those used for cast-in-place, but planners are often able to make up the investment through timeline and personnel savings.

THE ROLE OF NOZZLEMEN

Like all aspects of construction, shotcreting is an acquired skill.

"You can't just take any guy that's familiar with pouring concrete and throw him on the shotcrete team and assume he will pick it up that quick," Regier says.

"There's definitely a training and a

PHOTO BLASTCRETE EQUIPMENT

Becoming a certified nozzlemen requires overcoming a significant learning curve.

"The nozzleman is the key. If a nozzleman doesn't know what he's doing, he could do a low-quality job and most important, could hurt himself and his crew."
Lihe Zhang, American Shotcrete Association

learning curve that the guys have to take on."

While the sentiment is true for the whole crew – from the hose tender to the finishers – it's the nozzleman who truly makes or breaks a shotcrete operation.

"The nozzleman is the key," Zhang says. "If a nozzleman doesn't know what he's doing, he could do a low-quality job and most important, could hurt himself and his crew."

The American Concrete Institute began offering a concrete nozzleman certification in the late 1990s. Today, Zhang says the certification is a basic requirement for landing a job shooting concrete for commercial projects.

"That's like a driver's license for people that drive," he said, noting that recruits must log a minimum of 500 hours of shotcrete work, as well as pass written and practical exams before they can be certified.

As the industry has matured, however, many markets have moved away from handheld systems in favour of mechanical equipment.

"Nozzle carriers have become the norm in many parts of the world," says Robert Harmon sales manager for Shotcrete Technology at pump manufacturer Putzmeister America Inc. "They allow for higher output than handheld. They also keep the operator/nozzleman away from the actual application point."

For both methods, Harmon says the fundamental knowhow – how to apply material at the proper thickness – is the same. The trick is teaching a handheld operator how to use the control system. At times, he says, even an excellent handheld nozzleman may not be able to master the remote control on a sprayer.

Europe has widely adopted the newer technology, but the Canadian and U.S. shotcrete markets remain somewhat reluctant to give up their handheld systems.

"Some are firm believers that the hand application is better," Harmon says.

ADDING TO THE MIX

Improved access to skilled workers and modern equipment have each played a role in the shotcrete industry's growth, but they aren't the only factors.

A variety of new concrete mixes have made sprayed concrete far more adaptable.

"The quality of fibres has greatly improved in recent years, especially with synthetic materials giving shotcrete improved tensile strength," Stewart says. "With the admixtures available to delay set times and improve flow, we can pump shotcrete through steel pipes for kilometres, which opens up applications deep underground and difficult places to access we previously wouldn't consider."

Stewart says Lafarge is continuing to work on ways to adapt the high-density fibres used in some of its cast-in-place mixes to shotcrete.

"In my mind, it's just a matter of time before we figure out a way to spray it, instead of placing it into a form," he says. "When you think about the amount of infrastructure… across our country that imminently needs attention, it could be a very valuable repair solution."

Harmon also points to the quality of the new shotcrete mixes as a vital development. "Equipment builders have updated control systems… but the functionality of the machines is the same," he says. "What has changed is the quality of some of the mixes."

Despite the significant foothold shotcrete has gained in Canada's construction industry over the past two decades, there's plenty of room for wider adoption. "We're still going through the tried and true methods of the past," Regier says.

With more versatile admixtures and a clear payoff, the experts predict shotcrete will carve out a wider niche both underground and above. ☐

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Starting Small

Hybrid and electric equipment looks to earn its place

BY NATE HENDLEY

A new breed of compact equipment is starting to inch its way onto the job site.

This April at Intermat, German manufacturer Wacker Neuson revealed the all-electric EZ17e mini-excavator. One of the first machines of its kind, the EZ17e performs much the same as Wacker Neuson's diesel-driven equivalent – with both excavators offering equal power and performance.

Thanks to the absence of a combustion engine, however, the EZ17e produces zero on-site emissions, generates little noise and requires minimal maintenance.

The new mini-excavator is one part of an industry trend towards electric and hybrid (diesel/electric) construction equipment.

The EZ17e is scheduled to launch in Europe next year and will reach the North American market in late 2019 or early 2020. It, and other compact equipment like it, is particularly well-suited to hybrid and electric systems.

For Wacker Neuson, the emphasis on eco-friendly equipment is driven by concerns about the environment, customer demand and increasingly stringent government emissions standards.

"Our zero emission product range is focused very much on inner-city construction sites… In European cities, we have very strict [emissions] regulations," says Stefanie Wieland, head of Group Brand Marketing and Communication, at Munich-based Wacker Neuson Group.

The EZ17e easily meets European Union standards set for noise and exhaust – standards that are becoming more rigorous in North America as well. Since Wacker Neuson emphasizes inner-city construc-

PHOTO WACKER NEUSON

Volvo released a fully-electric compact excavator prototype last May.

PHOTO VOLVO

tion, the mini-excavator's diminutive size and 1.7-ton weight is a bonus, making it easier to transport on a trailer and operate in crowded urban settings. As a zero tail model, there's no rear overhang on the EZ17e, making it a handy piece of equipment for cramped spaces such as tunnels and building interiors.

The EZ17e's lithium-ion batteries offer up to seven hours of power and can be recharged overnight using a household electrical socket, or in four hours with a high-voltage current. The mini-excavator can also be connected directly to a power source for uninterrupted use.

The mini-excavator is far from the only piece of hybrid or electric equipment the company is working on. In addition to the EZ17e, the company offers battery-powered rammers, the 803 dual power compact excavator, two electric wheel loaders, a battery powered vibratory plate and the soon-to-launch DW15e electric wheel dumper.

With customer demands evolving, last May, Volvo Construction Equipment unveiled the EX2, a fully-electric compact excavator prototype. Its maker says the zero-emission EX2 is 10-times quieter than a conventional compact excavator and 10-times as efficient.

"It's the first fully electric excavator of its kind… You don't have the hydraulic system that a conventional machine has and you don't have the diesel engine a conventional machine has," says Scott Young, director of Electromobility at Volvo CE.

Instead of a combustion engine, the EX2 prototype is powered by a pair of lithium-ion batteries with an eight-hour duration. Conventional hydraulic architecture was replaced on the prototype by electromechanical linear actuators. The EX1, a previous Volvo dual power excavator prototype, could also run on electricity but required a cable connection.

A commercial release date has not been set for the EX2, but Volvo continues to develop its electric portfolio. It's currently working on what it calls an "electric site" in Sweden alongside academic and government partners. The site will test non-compact electric equipment, including HX2 autonomous battery electric load carriers, an LX1 hybrid wheel loader – which offers up to 50 per cent improved fuel efficiency – and the EX1.

The plan is to "really show how we can utilize connectivity, automation and electromobility in a [quarry site] to provide a total site solution," Young says, adding that if all goes to plan, Volvo will begin demonstrating the electric site solutions this fall.

In addition to environmental and regulatory considerations, manufacturers see other reasons to go electric.

"There are certain advantages if you use pure electric machines besides zero emissions," Wieland says. "It's also very low maintenance for the engines. Usually the electric engines are maintenance free."

Electric and hybrid equipment can be used near school, parks, offices, residential neighbourhoods and other settings where diesel machines might raise objections due to noise and smell. Silent running electric/hybrid equipment can operate into the evening, without fear of annoying residents.

"The technology opens the doors for new applications," Young says. "It can provide our customers with an opportunity to work in different environments or in different hours of operation because you have reduced noise. You can work closer to the public because you have fewer emissions and it is quieter."

Fewer emissions also mean a less toxic work environment for equipment operators. For instance, Wacker Neuson's earliest zero emission construction products were designed with user health and safety in mind. This equipment was well-received so Wacker Neuson continued innovating, launching the 803 dual power compact excavator in Europe in 2014 and in North America shortly thereafter.

"The machine by itself is a normal diesel machine but you can buy additionally external electro hydraulic aggregates," Wieland says. "You can plug in the external unit and then you can operate 100 per cent emission free."

Japanese heavy equipment maker Takeuchi Manufacturing introduced its own dual power compact excavator, the TB216H, in 2016.

"The TB216H was designed for customers that require a zero emissions

machine," says Takeuchi product manager, Lee Padgett. "Places like schools, hospitals, and food services are all applications where emissions and noise may be a concern."

"The TB216H was designed to give the customer the option to operate in diesel or electric mode. It also features compact dimensions and a retractable undercarriage that allows it be transported easily and work in applications where space may be limited."

The excavator has an operating weight of 1,940 kilograms (4,277 pounds) and a maximum digging depth of 2,390 mm (94 inches).

Takeuchi doesn't currently have any other similar equipment on the market, although it is "looking at some fully electric lithium-ion battery powered machines for the future," Padgett says.

Caterpillar, meanwhile, offers a dual-power mini-excavator called the Cat 300.9D VPS, with a hydraulic power unit. This diesel/electric machine has an operating weight of 1,088 kilograms (2,399 pounds) and a digging depth of 1,731 mm (68 inches).

While it's technically possible to build hybrid or electric construction equipment in a variety of sizes, compact gear seems readymade for such solutions.

"It comes down to the power and the application. With compact machines, you have a lower power demand," Young says.

Large equipment requires more power – an expensive consideration when pricy batteries are the mobile energy source.

"There's a limit to say it's still economical to put batteries in a construction machine… When you are going into bigger classes like five-ton, 10-ton machines, you would need too many batteries. The batteries are the cost driver. We only launch products that are affordable for contractors and can run an average working day on a single battery charge," Wieland echoes.

In general, there is a price premium on hybrid and electric equipment. Since the EZ17e hasn't been released commercially, Wieland cannot give an estimate of the cost difference compared to the conventional version. She does say electric wheel loaders are about 20 to 25 per cent more than a diesel machine.

As with any type of construction equipment, it's important to avoid scaring customers off because of price.

"If you look into the bigger machines, it's really hard to implement an [electric] solution that is affordable," Wieland says. "Our company philosophy is that the investment needs to pay off in two or three years through lower costs for electricity and maintenance because otherwise customers will not buy the machines."

> ***"With ever-increasing emissions regulations and a push for more clean energy, I see the demand for electric machines increasing in the future."***
> ***Lee Padgett, Takeuchi***

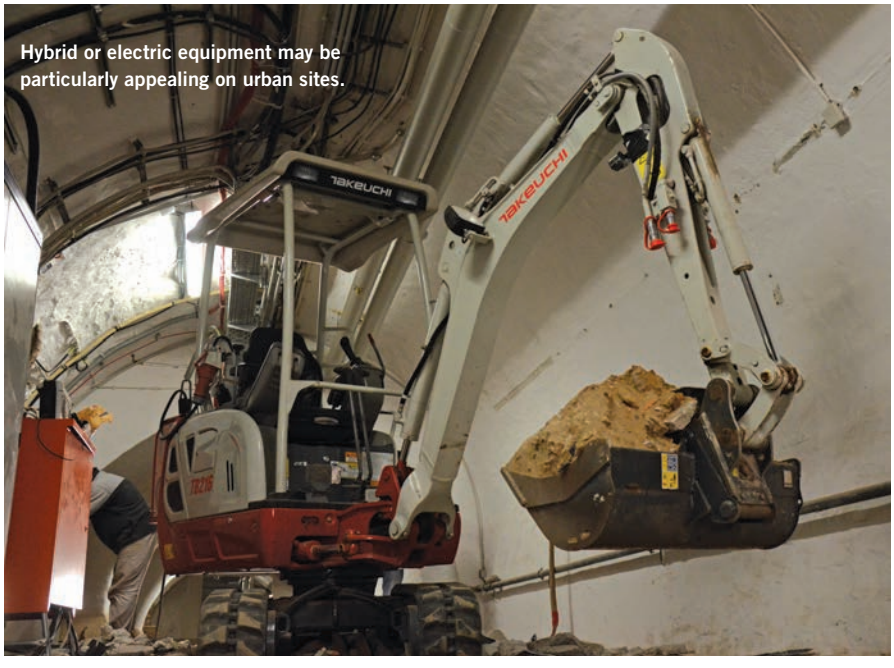
Performing well on crowded streets and in tight spaces, compact hybrid/electric technology lends itself particularly well to cities. Urban settings in turn are more likely than other locales to have the infrastructure needed to run full-electrics. "You have charging stations, you have access to power," Young says.

Given this, it makes sense for manufacturers to go fully-electric with compact equipment first.

Hybrid equipment, by contrast, has an edge in terms of recharging because machines can operate in either diesel or electric mode.

While the all-electric EZ17e and EX2 haven't hit the market yet, it's safe to say that the trend towards electric and hybrid construction equipment – particularly compact gear – will continue.

"With ever-increasing emissions regulations and a push for more clean energy, I see the demand for electric machines increasing in the future," Padgett says. "Electric machines are much cheaper to operate with less maintenance than their diesel equivalents so as battery costs decrease and run time increases between charges you will see more and more applications going to electric over diesel." ☐



Hybrid or electric equipment may be particularly appealing on urban sites.

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By Jacob Stoller

Virtual models that support maintenance and operations

One of the critical moments in a construction project comes when maintenance and operations files are handed over to the owner. Embedding this information in a BIM model adds considerable value, but the costs can be significant

A bid team at EllisDon recently received a two-sentence RFP addendum pertaining to documentation requirements. "It stipulated that the as-built model we were to produce had to be at the level that would allow the owner to operate and maintain the facility," says Omar Zuberi, Toronto-based VDC manager for EllisDon. "But what does that mean? Depending on the client's expectations, those two sentences could represent a $100K add."

Building Information Modeling (BIM) adoption has a long way to go before maintenance and operations information is simply a byproduct of the models contractors produce. In the meantime, creating a plug-and-play model can incur significant costs, even for a contractor with sophisticated BIM capabilities. Furthermore, it's not always clear who should bear those costs.

"This is the same information that we've always provided to owners," Zuberi says. "What's changed is the format – I tell people to think of BIM as the most intuitive filing system on the planet. But because of the potential cost, the requirement has to be very clearly spelled out, and we need to be able to show the owners what we're going to do."

There are other options as well. "Sometimes models aren't the best solution," says Denver-based Nick Kurth, manager of Virtual Construction for PCL Construction Enterprises Inc. "For example, due to the cost of building models for subcontractors who don't give us models, integrated PDF files coupled with bar codes might make more sense. There's no one-size-fits-all proposition."

Those who insist on operations-ready BIM models tend to be organizations with heavy involvement in maintenance and operations. "We've noticed that clients that have maintenance crews on staff, such as hospitals and universities, tend to find this more valuable," Kurth says.

The business case is probably clearest when the builder is also the facilities manager. Martin Payne, facilities general manager for EllisDon's Facilities Management division, oversees Ontario's Oakville-Trafalgar Memorial Hospital facility through a public-private partnership (P3).

"In P3, you'll often see a facilities management individual working within the project up to two years prior to substantial completion," Payne says. "In many cases, facilities management is actually involved in the decisions around construction in terms of the lifecycle perspective."

Having a BIM model makes this dialogue much easier, he says. "The advantage of BIM is that you can actually see things before they're built and identify potential problems earlier in the build phase. For example, you can ask, 'How do I access the meter if you've put all the cable trays in front of it?' That's better than having a more difficult conversation later on."

BIM models are also seeing growing use in the management of linear infrastructure such as bridges and highways. For example, managers of bridges and overpasses may rely on sensor data pertaining to vibration, stress, temperature and other factors impacting the safety and lifecycle of the asset. "With bridges, one of the things we're seeing is BIM combined with constant monitoring," says Jose Luis Blanco, a partner at McKinsey and Company, Philadelphia. "So when you're building or making a repair, you can constantly monitor deviations. Having that information is critical for preventive maintenance."

MANAGING THE LIFECYCLE

According to Blanco, all of this is part of a larger trend in construction management. "In the past few years there's been a push to bring together all the different stakeholders in the value chain and get them to think about the project lifecycle in a holistic way, not just their area," he says. "BIM is one of the technologies that's making this easier, because when it's done right, it effectively gives you a baseline for the whole lifecycle of the project."

The lifecycle picture also puts the contractor's role in a different perspective. "I tell my constructor colleagues, 'Your contract might be hundreds of millions to build it, but it's going to cost considerably more than that to run it over the next 25 years," Payne says. "When people hear that, they say, 'Oh, now I get it!'"

Kurth believes that paying closer attention to the maintenance and operations piece will help the industry in the long run. "This is all about coordination," he says. "When this is well done, it really helps a job flow smoothly. I'd say that the adage 'always keep the end in mind' is absolutely true here." ☐

Jacob Stoller is principal of StollerStrategies. Please send comments to editor@on-sitemag.com.

By David Bowcott

Managing risk: Getting your workforce on board

To be truly effective at managing risk, you must master the complex world of risk controls. Put in place before incidents occur, risk controls are the contractual agreements, the operational practices and the tools and technologies used to prevent or minimize risk. They are on the front line of risk management, but in order for them to be effective, you must also design incentives to ensure your workforce adheres to these risk controls.

Before we get into how to incentivize adherence, let's break down these risk controls in more detail. The following are the key risk controls your construction firm should be intimately familiar with in order to minimize exposure to risks that can damage your balance sheet (it's by no means an exhaustive list):

Contractual Models – The contracts entered into by your firm determine your allocation of risk. Commonly used contracts in today's construction economy include: design-build, design-bid-build, design-build-operate-maintain, construction management at risk, construction management agency and integrated project delivery. These contracts can also provide clear instruction on controls that should be used to manage risk. In some cases, the contractual risk allocation outlined within the contract itself becomes a risk control.

Operational Practices – Each party to a contract has operational practices within their organization that are meant to prevent and mitigate risk. For instance, general contractors employ safeguards to manage safety on the jobsite, ensure quality work is performed, guarantee subcontracts are properly crafted and prequalify members of its supply chain. All other parties to the contract (owner, design, subcontractors, suppliers) have similar practices that ensure optimal management of the risks they have been allocated.

Methodologies – Parties to a contract may have individual or collective methodologies that systematically help to identify, quantify and treat risks specific to the project they are all undertaking. Some call these Project Risk Assessment methodologies and they represent a system used to prevent and mitigate risks on a project.

Tools and Technologies – All firms utilize tools and technologies that complement their operational practices when managing risk. There are several new technologies coming to market that significantly lessen risk. Your team should be familiar with as many of these solutions as possible. They include: IoT/sensors, mobility/cloud solutions, AR/VR, robotics, artificial intelligence in design, scheduling and project management, as well as 3D printing.

The above are examples of risk controls that can be utilized to prevent and/or mitigate risk on your projects. They are only effective if your team adheres to them – so how can you incentivize knowledge of and adherence to these risk controls? The following are some techniques to ensure your team is utilizing these tools and practices:

Training – Perhaps the most important technique that can be used to incentivize adherence to risk controls, training ensures each person on your team not only understands how to use these solutions, but also what the consequences to themselves and others could be if they do not. Training should make adherence automatic.

Monitoring and Performance Assessment – Several operational platforms monitor adherence to risk controls using team member performance assessments. Transparency is a very powerful tool in ensuring adherence.

Rewards – Tying performance to rewards is a vital step that can incentivize adherence. Find out what individual employees want and provide them that reward for adherence. Often a monetary reward is utilized, but it doesn't always have to be a financial bonus.

Insurance Structures – Some firms are utilizing insurance structures as a vehicle to incent adherence to practices and tools that prevent and/or mitigate risk. For example, some insurance coverages utilize funded retentions. These retentions are released to the insured if there are no claims under the insurance policy to which the retentions apply. By allocating a portion of those returned retentions to the front-line employees that manage risk at "ground zero" you provide a significant incentive for those employees to adhere to the solutions that best manage risks insured under the policy.

The above are just some examples of how firms are incentivizing adherence to risk controls. By better engaging employees and encouraging them to adhere to these solutions, you can reduce risk, improve productivity and increase profitability. A knock-on benefit will be lower insurance premiums as adherence to risk controls invariably leads to fewer claims under your insurance policies, thus lower loss ratios for your insurance partners and a lower premium for you. ☐

David Bowcott is Global Director – Growth, Innovation & Insight, Global Construction and Infrastructure Group at Aon Risk Solutions. Please send comments to editor@on-sitemag.com.

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By Krista Johanson and Lindsey von Bloedau


How much is too much?

When an owner or contractor seeks to remove a claim of lien from title to land by securing the lien with money in place of the land, a debate sometimes arises as to whether the claim of lien has been inflated. In general, a lien should be secured for its face value.

The BC Court of Appeal has recently confirmed that a judge must order that security be posted for a claim of lien (or a component of it) as long as there is some evidence to support the claim (*Centura Building Systems (2013) Ltd. v. 601 Main Partnership*, 2018 BCCA 172). That means the lien must be secured unless the person seeking to reduce the security can show it is obvious the claim (or component) is bound to fail. Further, in assessing the appropriate amount of security for the lien, the court should exercise caution in favour of the lien claimant.

Where appropriate, the party securing the lien can apply to the court to post security in a lower amount. Owners considering applying to reduce security for a claim of lien should first confirm that evidence exists to show that the lien claim includes items that are obviously not lienable, such as interest or lost profits on other jobs, or that the contractor has obviously inflated the amounts of otherwise lienable claims.

A court will examine the evidence and if there is a dispute over the value of the lien that merits a trial, the lien will likely be secured for the full amount. That is the purpose of the lien remedy: to secure the claim until the dispute is resolved. Where the cost of securing a large lien with cash is prohibitive, a lien bond may be a more attractive option.

Lien claimants should continue to ensure that the components of their lien claims are squarely based on their records and their contracts. If a lien claimant records costs that are not properly the subject of a lien, or makes an obviously meritless claim, the courts can and will reduce or cancel security, impose adverse costs awards, or even award damages to the owner. It is also an offence, punishable by fine, to knowingly file a claim of lien containing a false statement.

A lien claim is for "the price of the work and material, to the extent that the price remains unpaid." We list below some examples of items that have been found in prior cases to be lienable and not lienable. Please note that whether a specific item is or is not lienable will depend on the particular circumstances of a case. Consult a lawyer if you are preparing a claim of lien. ☐

Krista Johanson and Lindsey von Bloedau practice construction law at Borden Ladner Gervais LLP. This article is for information purposes only and may not be relied on for legal advice. Please send comments to editor@on-sitemag.com.

VALID	NOT VALID
The price of work not yet performed	Unpaid invoices
Accrued, unpaid holdback	Interest on unpaid invoices
Taxes and bond premiums forming part of the price	Lost profit on other jobs
Legitimate claims for performance bonus or extra work, to the extent permitted by the contract	Extra work not requested by the owner or provided for under the contract
Legitimate extra costs incurred to perform the work as a result of the owner's delay, to the extent permitted by the contract	Costs incurred to remedy one's own deficient work

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