

ONE

THE MAGAZINE OF AECON GROUP INC.
WINTER 2018, VOLUME 5



ONWARD AND UPWARD
Eglinton Crosstown
LRT Project

WE HAVE TAKEOFF!
Bermuda Airport
Redevelopment Project

LIGHTING THE WAY
Spotlight on
Tristar Electric Inc.

AT THE FINISH LINE
Update on Regina Wastewater
Treatment Plant Upgrade



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AECON'S VISION:

To be the first company people go to for building things that matter.

ONE is a magazine published by Aecon Group Inc. for its employees and clients. For more information about Aecon, visit our website at aecon.com.

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ON THE COVER:
 Bermuda Airport Redevelopment Project

ON THE BACK COVER:
 Night paving on the Highway 410 Widening Project

This magazine includes certain forward-looking statements that contain information concerning possible or assumed future results or operations of Aecon. These forward-looking statements are based on current operating plans and competitive, financial and economic data but are subject to risks and uncertainties. Although Aecon believes the expectations reflected in these forward-looking statements are reasonable, it can give no assurance the expectations of any forward-looking statements will prove to be correct.



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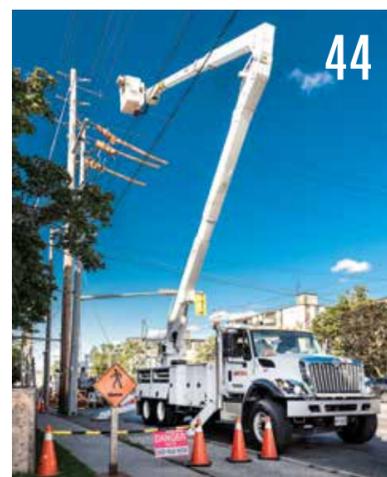
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ARE YOU AWARE OF, AND DO YOU UNDERSTAND, THE HAZARDS AND RISK?

- ALWAYS ASSESS YOUR WORK TO IDENTIFY HAZARDS.
- NEVER UNDERESTIMATE A POTENTIAL HAZARD. FOLLOW BEST PRACTICES – EVERY DAY, EVERY TASK, EVERY TIME.
- ALWAYS ADOPT A QUESTIONING ATTITUDE TO IDENTIFY POTENTIAL HAZARDS AND RISK.
- IF A SITUATION CHANGES: STOP, STEP BACK AND REASSESS.

SAFETY MATTERS ... MOST!



MOVING AECON FORWARD AMIDST A DYNAMIC ENVIRONMENT OF GROWTH AND OPPORTUNITY

By John M. Beck
*President & Chief Executive Officer,
Aecon Group Inc.*



John Hart Generating Station
Replacement Project

It's an exciting time for construction and infrastructure development in Canada.

All levels of government – federal, provincial and municipal – have committed to many billions of dollars in construction spend over the next decade, which will manifest itself in the refurbishment of aging assets (bridges, roadways and nuclear plants) and the development of new infrastructure (pipelines and transportation networks), as well as renewed private-sector investment in the energy and mining sectors. It's all good news for Aecon, as we are fully committed to pursuing this robust pipeline of project opportunities and growing our company.

The year ahead will be focused on optimizing our value proposition in the marketplace. While some resource-market sectors currently present more limited opportunities, Aecon's overall strategy of diversification has strengthened our resiliency and flexibility in leveraging our "ONE Aecon" solution to clients. When added to our vertically integrated capabilities and proven expertise in both private- and public-sector partnerships, the future looks very promising.

Internally, Aecon continues to shape and restructure our company in response to the ever-changing economic landscape in

Canada. We've seen a dramatic paradigm shift in our industry in the last several years when it comes to how projects are procured and executed. Today's mega-projects are infinitely more multifaceted than ever, with contracts incorporating design, build, finance, maintenance and operations, all of which demand broader competencies to fully understand and carry out a contract's requirements. To meet the need, we are committed to the ongoing enhancement of robust systems and processes, such as SAP, so that we have the best tools in place to continue to effectively execute and manage risk, while still ensuring high-quality, on-time/on-budget project delivery, and consistently meeting our financial targets.

Another way in which we are ensuring that we're ready for the next step in Aecon's evolution is by accelerating our focus on innovation. The globalization of today's construction and infrastructure development industry dictates that, to be successful in this fast-paced environment, we must adopt an innovation lens in all that we do. I'm convinced that innovative thinking is alive and well at Aecon. The creation of our Aecon Innovation Council emanated from a need to harness that leading-edge, transformational thinking

for the purposes of pursuing, developing and sharing best practices across the organization so that we can further enhance Aecon's value proposition when bidding and executing work for our clients.

Innovation is a pivotal element in the overall success of a company, but it must never come at the cost of the organization's core values. Safety is – and always will be – our number one core value. We continue to make significant strides in further strengthening our safety culture through a strategic focus on behavioural-based safety practices and proactive safety initiatives, such as risk assessments, hazard identifications, workplace safety meetings, workplace inspections, worker inductions, and training and education. Moving forward, we must remain diligent and relentless in our ongoing pursuit of a safe and incident-free workplace, even more so as our industry increasingly moves toward large and complex projects. Aecon has been a proud partner of choice on multiple joint venture projects and, in many cases, we've led the way when it comes to safety best practices within those partnerships. I consider it a testament to our commitment to our number one core value.

ONE MAGAZINE HIGHLIGHTS

I'm pleased to present this issue of *ONE Magazine*. It provides our employees, partners and clients with an in-depth look at projects across all our operating sectors. While it is by no means an exhaustive representation of what we do, it does speak to who we are, the scope of work we are capable of delivering, and the pride we take in the work we carry out every day.

Our Major Projects at a Glance feature provides a quick overview of Aecon projects with a contract value exceeding \$100 million. Our feature articles offer a more in-depth look at our multi-year national and international projects. Some of our major projects reached completion in 2017, such as the Regina Wastewater Treatment Plant and Vancouver's Port Mann Tunnel. Some projects continue to move forward, such as Toronto's Eglinton Crosstown LRT and the Darlington Refurbishment. Other projects, including Bermuda's L.F. Wade International Airport Redevelopment and B.C.'s Annacis Island Wastewater Treatment Plant, are just beginning their journey.

In this issue, you will also find two Aecon business profiles. The first profile highlights our Concessions business and

“Innovation is a pivotal element in the overall success of a company, but it must never come at the cost of the organization's core values.”

the pivotal contributions of this key operating segment to Aecon's overall business strategy and success. Our second profile features Aecon's Tristar business unit, which continues to grow its reputation as a world leader in airport lighting and traffic technology.

As per tradition, our employee profile this issue highlights one of our longest serving and most respected senior

leaders, Don Brophy. Don has had a prolific career with Aecon and we thank him for his expertise and contributions to our success over the years.

With dynamic people leading the way, a well-developed safety culture and a diversified business strategy to capture unprecedented marketplace opportunities, I am very optimistic for what the future holds for Aecon. It is an exciting time.

MAJOR PROJECTS AT A GLANCE

Current and recently completed projects with a contract value of > \$100 million
(amounts represent total contract value)



JOHN HART GENERATING STATION REPLACEMENT
CONTRACT VALUE: **\$375M**



SUNCOR FORT HILLS ORE PREPARATION PLANT
CONTRACT VALUE: **\$105.9M**



NORTH WEST REDWATER REFINERY
CONTRACT VALUE: **\$339M**



NORTHEAST ANTHONY HENDAY DRIVE
CONTRACT VALUE: **\$1.81B**



PORT MANN MAIN WATER SUPPLY TUNNEL
CONTRACT VALUE: **\$240M**



ANNACIS ISLAND WASTEWATER TREATMENT PLANT STAGE 5 PHASE 1 EXPANSION
CONTRACT VALUE: **\$252M**



BERMUDA AIRPORT REDEVELOPMENT
CONTRACT VALUE: **\$274M (USD)**

ENBRIDGE LINE 3 REPLACEMENT
CONTRACT VALUE: **\$242M**



REGINA WASTEWATER TREATMENT PLANT
CONTRACT VALUE: **\$158M**



1 YORK VIVA BUS RAPID TRANSIT
CONTRACT VALUE: **\$261M**

2 HIGHWAY 410 WIDENING
CONTRACT VALUE: **\$156M**

3 TTC SHEPPARD SOUTH STATION TUNNEL
CONTRACT VALUE: **\$279M**

4 METROLINX EGLINTON CROSSTOWN LRT
CONTRACT VALUE: **\$5.3B**

5 EGLINTON CROSSTOWN LRT TUNNELLING
CONTRACT VALUE: **\$177M**

6 UNION STATION TRAIN SHED REVITALIZATION
CONTRACT VALUE: **\$196M**



DARLINGTON NUCLEAR RE-TUBE & FEEDER REPLACEMENT (DEFINITION PHASE)
CONTRACT VALUE: **\$600M**

DARLINGTON NUCLEAR RE-TUBE & FEEDER REPLACEMENT (EXECUTION PHASE)
CONTRACT VALUE: **\$2.75B**

DARLINGTON NUCLEAR TURBINE GENERATOR REFURBISHMENT
CONTRACT VALUE: **\$265M**

DARLINGTON NUCLEAR RE-TUBE WASTE PROCESSING BUILDING
CONTRACT VALUE: **\$127M**



REGION OF WATERLOO'S ION STAGE 1 LRT
CONTRACT VALUE: **\$583M**

DAWN-PARKWAY EXPANSION
CONTRACT VALUE: **\$250M**

DID YOU KNOW?

THE JACKSON-LEWIS COMPANY

The Jackson-Lewis Company, an Aecon predecessor company, was founded in Toronto in 1913 and was responsible for several landmark buildings in the Greater Toronto Area.

Some of the company's most notable regional projects, which have stood the test of time, include Woodbine Racetrack, Holt Renfrew's flagship department store and Mississauga Civic Centre.

Over the course of its operations, the Jackson-Lewis Company was part of Banister Pipelines, which also included the Foundation Company of Canada Limited – the same company that built the CN Tower. By 1997, Banister was renamed BFC. It was acquired by Ambro Construction in 1999, and the new company was rebranded as Aecon Group Inc. in 2001.



1

1 HOLT RENFREW

Holt Renfrew's Toronto flagship store was built in 1979 at 50 Bloor Street West. The 73,000-square-foot retail space cost \$6.5 million to build. Today, the store remains Holt Renfrew's busiest and most prestigious location.

2 WOODBINE RACETRACK

Originally opened in 1956 close to the shores of Lake Ontario in Toronto's Beaches neighbourhood ("The Beach"), Woodbine Racetrack made the move north in 1993. The Jackson-Lewis Company built the current racetrack, equipped with three racecourses, on land just northeast of Toronto's Lester B. Pearson International Airport.

In 2010, Queen Elizabeth II visited the racetrack as part of her state visit to Canada, viewing the 151st running of The Queen's Plate, as well as taking part in the presentation of trophies.

The facility continues to attract millions of visitors each year and is home to the Canadian Horse Racing Hall of Fame. It is also the only horse racing track in North America that can stage thoroughbred and standardbred horse racing programs on the same day.

3 MISSISSAUGA CIVIC CENTRE

The Jackson-Lewis Company acted as both project director and construction manager for this \$60-million project. The 750,000-square-foot building, designed by Toronto's Jones & Kirkland Architects and completed in 1987, includes an office tower, Council Chambers and the Great Hall. It is still the fully functioning seat of the municipal government for the City of Mississauga.



2



3

CONCESSIONS GROUP: AECON'S EXPERTS IN P3 DEVELOPMENT

For more than two decades, Aecon's Concessions group has led the way in securing, financing, designing, building and operating many of Aecon's milestone mega-projects, all the while becoming experts in the domestic and international P3 market.

Cross Israel
Toll Highway



Top row: Stephen Payne, George Nohos, Ross Ardeshiri, Steve Nackan, Sakthi Arumugam (Assistant Controller), Mano Yogaratnam (Senior Controller), Eitan Ladizinsky, Melanie Starke (Project Coordinator)
Bottom row: Renee Vital (Assistant Administrator), Cassandra Siwek, Jennifer Villabroza (Executive Assistant), Colin Sam (Associate General Counsel), Rafael Midence, Vincent Rallon (full titles found under **Project Profile** on page 13)

The functions of a Concessions group are diverse and complex and call upon a specific skill set that is highly valued but not easily explained. When it comes to the Aecon Concessions group, perhaps the best way to describe the contributions of President Steve Nackan and his team is to say that without their leadership and expertise, we simply wouldn't be the company we are today. Aecon's elevation to multi-billion-dollar mega-projects, our ability to sit at the table and partner with some of the world's largest infrastructure development players, and our success in the competitive Public-Private Partnership (P3) market – both at home and abroad – are largely due to the strategic efforts and successful track record of this talented group.

As one of Aecon's core business segments, the Concessions group specializes in the development of domestic and international P3 projects, as well as other infrastructure development projects requiring private financing solutions. Within these project structures, which span toll roads, airports, rail, energy and utilities, Aecon has the ability to play a pivotal role as financier, investor, constructor and/or operator.

"The vision for the Concessions group from the very start has been to develop opportunities for Aecon in the infrastructure segment and to build a

portfolio of multi-dimensional projects while generating value for the company," explains Nackan. "We have the skills and experience to put together the pieces of the puzzle and fit the overall picture together when it comes to major P3 projects."

First introduced to Canada in the 1990s, the P3 model has, over the last two decades, signalled a dramatic shift in the way governments carry out major public infrastructure projects. Both the federal and provincial governments have increasingly turned to these formal collaborative arrangements between the private and public sectors to meet the redevelopment needs of Canada's aging infrastructure.

"Canadian governments at all levels (municipal, provincial, and federal) have become more sophisticated in the sense that they have turned to the private sector not only for designing and building a major project but also financing it and then managing the long-term operations and maintenance," says Nackan. "A company like ours has the capabilities to pull together a long-term package for these mega-projects while understanding how their assets perform in the long run. Our Concessions group specializes in creating proposals that look after these projects in a more holistic way, which is also more cost-efficient for our governments."



Skyport President Aaron Adderley (left) and Aecon Concessions President Steve Nackan

Eglinton Crosstown LRT rendering courtesy of Norm Li for Crosslinx



A SHIFT IN THE MARKET

Although the P3 procurement model arrived in Canada in the mid-1990s, its origins can be traced to the United Kingdom in the 1980s. At the time, the British government was exploring alternative means of building and financing large, complex infrastructure projects by engaging the private sector. This collaborative partnership approach spread across Europe and Australia, eventually making its way to Canada a decade later.

Aecon, under the banners of its predecessor companies, was considered a P3 pioneer in those days. Our company was involved in two of the first Canadian projects to be completed under this new cooperative framework: the 407 Express Toll Route (407 ETR) in Ontario and the Cobequid Pass Toll Highway in Nova Scotia.

"These projects were procured in a way that didn't just require construction knowledge," says Nackan. "They involved expertise in design, financing, long-term asset management and rehabilitation. Each project was seen as a transfer of risk in exchange for the expertise the private sector had to offer."

CHANGING WITH THE TIMES

The shift toward P3 procurement delivery in the 1990s meant some significant changes in how Aecon approached the market, namely the need to add depth and dimension to its service offering.

"We began looking for partners who could bring financial, operations and maintenance capabilities, so we could continue to be a strong player in the construction market," says Nackan of Aecon's strategy in the early years of P3 procurement. "We had to develop the skills outside of construction necessary to address all the elements of and deliver these kinds of projects. That's why we started to build a team, even before I arrived at Aecon."

In 1993, Aecon predecessor companies Armbro Construction Ltd. and BFC Construction Corporation joined AGRA Monenco Inc. and Dufferin Construction Company to form the Canadian Highways International Corporation (CHIC). It aimed to offer a fully integrated package of expertise in project financing, design, construction and operation. It had the capabilities to apply any combination of these resources to the development of turnkey infrastructure projects around the world. CHIC soon became a highly respected international transportation infrastructure development company specializing in P3s.



Bermuda Airport Redevelopment Project

Quito International Airport



Cross Israel Toll Highway



Quito International Airport

It was under the CHIC partnership that Aecon, in 1994, became involved in the 407 ETR, Canada's first all-electronic toll highway, in Ontario. The Ontario government selected CHIC as its private-sector partner to design, build, operate and maintain the \$1-billion 407 ETR. By 1996, the company had been selected to develop and build the Cobequid Pass Toll Highway in Nova Scotia and to manage its toll operations.

"CHIC was our response to the 407 ETR opportunity, which then led to the Nova Scotia highway opportunity and the Cross Israel Highway," explains Nackan. "The plan was to really take that vehicle on the road and essentially to do toll roads around the world."

By the 2000s, CHIC was translated to what was then called Aecon's Infrastructure group. After Nackan joined the group in 2005, he made the decision to officially change the group name to Aecon Concessions, and Aecon's civil and utilities group then took on the Infrastructure banner.

NOTABLE PROJECTS

Since the group's inception, every project Aecon Concessions has undertaken has included some combination of expertise in project finance, design, construction, operation and maintenance.

For example, the Eglinton Crosstown LRT project – the group's largest undertaking to date – involves the overall development, financing, operations and maintenance of the project. Concessions is also an equal partner and shareholder in the operating company. A similar scenario played out during the Cross Israel Highway project, in which the Concessions group was a controlling shareholder of the highway operator. Through that model, the group picked up three additional P3 projects for operations and maintenance in Israel.

For the 407 ETR and Cobequid Pass projects, Aecon Concessions was the toll operator. For Ecuador's Quito International Airport and the (current) Bermuda Airport Redevelopment Project (full story on page 16), the group assumed airport operations, as well. Aecon Concessions' portfolio of work also includes several privately financed Infrastructure Ontario (IO) healthcare projects.

"The whole idea is that these are not just investment projects," says Nackan. "They involve the responsibility of actively overseeing and constructing or operating the infrastructure component of the project to properly manage all of the assets."

STRATEGIC THINKING

The Concessions group has developed multiple strategies for securing work and generating overall value for Aecon. One such strategy is to leverage the company's existing relationships. By establishing solid alliances with both Aecon's internal businesses and external partnerships, as well as accessing resources available from the Government of Canada for international work, the Concessions group positions itself to successfully develop, bid on and execute, any number of different projects.

Another key strategy is the group's ability to be a pioneer within the construction industry by developing leading-edge, customized, integrated solutions for projects.

"We're entrepreneurial and we don't simply respond to procurements," says Nackan. "We are always looking for new opportunities and actively thinking about how to do things that are interesting and different."

The most recent project win for the Aecon Concessions team is the Bermuda Airport Redevelopment Project. The largest of its kind in Bermuda to date, the project calls for Aecon to assume operations of the existing airport under a newly created entity called Skyport, as well as maintain operations of the new airport for a period of 30 years, upon project completion in 2020. A signature project, the Bermuda Airport Redevelopment Project is a significant contribution to Aecon's existing project portfolio, a noteworthy boost to Bermuda's local economy, and a testament to the Concessions group's reputation as being a "value generator" for Aecon and our clients.

For a complete profile of the Bermuda Airport Redevelopment Project, please see page 16.

PROJECT FILE

AECON CONCESSIONS

OFFICE LOCATION: Toronto, Ontario

NOTABLE PROJECTS: Bermuda Airport Redevelopment project, Eglinton Crosstown LRT project, Waterloo LRT project, Quito International Airport project, UP Express Air Rail Link project, Cross Israel Highway, 407 Express Toll Route (407 ETR), Cobequid Pass toll highway

COVERAGE: Across Canada and internationally

NUMBER OF EMPLOYEES: 76

KEY AECON CONCESSIONS EMPLOYEES:

Steve Nackan, President
Eitan Ladizinsky, Vice President
Stephen Payne, Technical Services Senior Director
David Eyles, Operations & Maintenance Director
Simon Allard, Operations & Maintenance Manager
Cassandra Siwek, Operations & Maintenance Senior Specialist
Rafael Midence, Senior Project Analyst
Vincent Rallon, Senior Project Analyst
Orlando Tudor, Senior Project Analyst

KEY SUBSIDIARY/SECONDED EMPLOYEES:

David Levett, Chief Technical Officer, Crosslinx Transit Solutions
George Nohos, Fixed Infrastructure Director, Crosslinx Transit Solutions Maintenance
Ross Ardeshiri, Mechanical & Electrical Manager, Crosslinx Transit Solutions Maintenance
Wally Caldwell, General Manager, Atlantic Highways
David Ling, Toll Operations Manager, Atlantic Highways
Aaron Adderley, President, Skyport
Myron Burchall, Director of Maintenance & Engineering, Skyport
Marcia Pringle, Human Resources & Training Manager, Skyport
Bob Withers, Director of Operations, Skyport
Donald Gray, Quality & Safety Manager, Skyport
Ken Hassard, Commercial Director, Aecon International Management Services
Shazar Hack, Technical Director, Aecon International Management Services
Moe Kamleh, Technical Manager, Aecon International Management Services
Ken Villanueva, Finance Director, Aecon International Management Services
Jean-François Laberge, Finance Manager, Aecon International Management Services

TAKEDOFF!

WE HAVE



BERMUDA AIRPORT REDEVELOPMENT PROJECT

On the tiny island community of Bermuda, Aecon Concessions builds upon its proven expertise by leading a multi-disciplinary team in the redevelopment and operations of a major new international airport.



3,500

TONNES OF STRUCTURAL STEEL

\$274M

CONSTRUCTION CONTRACT VALUE (USD)

A NEW BEGINNING

Located more than 1,000 kilometres from the U.S. mainland, the tiny island nation of Bermuda – just 24 miles long and one mile wide – relies heavily on its international airport to service the needs of its 65,000-plus residents. Add in tourism and international business as the two main pillars of Bermuda’s economy, and the reliance on an effective transportation hub becomes even greater. Yet, after 75 years in operation, the country’s L.F. Wade International Airport was decidedly in need of a major upgrade. Enter Aecon and the genesis of Bermuda Skyport Corporation Limited.

Led by Aecon Concessions President Steve Nackan and his team, Aecon announced in March 2017 that it would finance, operate and redevelop the L.F. Wade International Airport in partnership with the Government of Bermuda and the Canadian Commercial Corporation (CCC), a Crown corporation of the Government of Canada.

The Public-Private Partnership (P3) project calls for the construction of a new, larger, state-of-the-art airport terminal while operating and improving traffic flow throughout the existing terminal, as well as the renovation of existing facilities and provision of new retail spaces. The ultimate goal of this signature redevelopment

project is to transform Bermuda’s aviation infrastructure and airport service offering, and to increase the airport’s overall capacity for international flights. This will, in turn, dramatically enhance the country’s tourism opportunities.

The Bermuda airport project is an important achievement for Nackan and Aecon Concessions. The team has been actively focused on this opportunity for more than two and a half years. But Nackan is the first to say his team could not have accomplished what it has without the “ONE Aecon” contributions of so many internal Aecon groups, including Infrastructure, Human Resources, Legal & Commercial Services, Corporate Affairs, Finance and Information Services.

“As the overall developer of this project, we had to create a roadmap that would lead us toward this culmination point,” says Nackan. “This is a prestigious landmark project that doesn’t come along every day but does fall squarely in line with our motto of ‘Building Things That Matter.’ And since we’ve had a hand in building many important landmark projects, including airports in Canada and internationally, we are in a solid position to take this on.”

The Bermuda airport project is being delivered under a government-to-government framework agreement

between the Government of Bermuda and CCC, which has fully subcontracted the construction work to Aecon under a contract valued at US\$274 million. Financing for the project has been arranged by Aecon Concessions and includes a US\$285-million fixed coupon US private placement, amortized over a 25-year term, with approximately US\$70 million of shareholder equity committed at financial close and injected during construction.

“Arranging 25-year, fixed-rate, non-recourse financing for a small island airport project was one of our most significant challenges,” explains Concessions Vice President Eitan Ladizinsky. “Ultimately, we were able to put together a competitive financing package that delivered exceptional, long-term value without in any way impacting our client’s sovereign balance sheet.”

Nackan adds: “Creating the groundwork for this project has been an exciting process because there are so many different factors that have to be dealt with when it comes to not only an international airport but also an essential national asset for Bermuda. It’s a tailor-made solution that is based on the ability of CCC to sign government-to-government contracts, and on Aecon, as developer and builder, to work with CCC as the developer making this a signature Canadian project.”

SKYPORT LAUNCH

In preparation for the unveiling of the Bermuda Airport Redevelopment Project, Aecon launched Bermuda Skyport Corporation Limited – a special-purpose Bermudian company wholly owned by Aecon Concessions – to manage and coordinate the overall delivery of the project, and to operate and maintain the airport until 2047. Since its launch in March 2017, Skyport has assumed all existing airport operations, maintenance and commercial functions under the leadership of President Aaron Adderley, who is the former General Manager of the Department of Airport Operations (DAO). When the project reached financial close in March 2017, the entity formerly known as DAO ceased operations, and the majority of its staff accepted employment with Skyport. The Government of Bermuda introduced the Bermuda Airport Authority (BAA) to oversee Skyport's operation of the existing airport and overall performance under the agreement.

The formal launch of Skyport took place in Bermuda in April 2017. It was commemorated by a team of dedicated Aecon employees who were on site in Bermuda to join new Skyport employees at a joint press conference co-presented by the governments of Canada and Bermuda.

By taking over a publicly-managed asset that was previously run by government agency DAO, Aecon Concessions took on the responsibility of overseeing an existing team of experienced (and former) DAO managers and staff, bolstered by new hires, to increase and improve the existing airport's operations.

"Approximately 80 per cent of the staff previously working for DAO chose to transfer over to Skyport," says Aecon Human Resources Vice President

Gordana Terkalas. "Skyport then went on to fill all vacant positions with a mix of local Bermudian hires. The team is supported by the deployment of a team of experienced international airport professionals, such as Ken Hassard, who has managed the commercial aspect of numerous airports over his career, and Ken Villanueva, who brought his operational finance experience from the Quito Airport Project."

With the added support of significant financing raised by the Concessions team in preparation for this project, Skyport has greater resources at its disposal, enabling an improved airport experience for both Bermudians and visitors while training airport staff to provide superior service levels.

BREAKING GROUND

The project got under way on April 28, 2017, with a formal groundbreaking event on the premises of the existing airport. Representatives of the Government of Bermuda, CCC, Aecon and Skyport joined together to officially kick off construction on the new 277,300-square-foot airport terminal.

It is one of the largest infrastructure projects ever undertaken in Bermuda, with a schedule calling for work to be completed over a span of 40 months. The Aecon team struck a delicate balance; it came up with a plan that allows work to be completed near the fully functioning airport without disruption to daily operations, and with minimal impact for nearby residents.

"This required a cohesive and well-thought-out approach to construction," explains Stephen Payne, Senior Director, Technical Services, Aecon Concessions. "There were literally a lot of moving parts, but we managed to successfully capture all the requirements."



CONSTRUCTION MILESTONES

After months of excavation to prepare the base of Bermuda's new passenger terminal, construction crews began pouring concrete for the first new taxiway at the L.F. Wade International Airport in 15 years.

On May 28, 2017, crews began the loudest part of the project: driving piles into the ground. The work entailed driving 719 steel piles to a depth of 115 feet, forming the footprint of the new terminal building. The steel piles were installed using two rigs, one provided by Aecon Foundations and the other by Bermudian subcontractor Correia Construction.

Committed to minimizing construction noise for area residents and businesses, crew members from Aecon Foundations and Correia Construction, as well as 28 local labourers, worked seven days a week to complete the work. Impressively, the team not only met the challenge, but they did so in record time, completing the pile-driving work four months ahead of schedule. It was a remarkable achievement and a significant indicator that reflects Aecon's commitment to going above and beyond to reduce construction impacts.

On the evening of July 26, 2017, crews began to pour concrete for Taxiway W, which has replaced Taxiway S as the second pathway in and out of the existing airport's terminal apron. Once again, time was of the essence. Work was carried out at night to minimize disruption to aircraft arrivals and departures. Frank Ross, Executive Advisor to Aecon Infrastructure, says crews worked diligently each night to prepare the surface and then pour approximately 100 cubic metres of concrete until this portion of work was completed in September 2017.

Taxiway S remains closed due to the construction of the new terminal, but Taxiway W reached completion and was opened for use on October 16 – marking another major transitional milestone.

By July 31, 2017, project crews had also begun to place concrete for the foundation of the new terminal structure.

In September 2017, structural steel fabrication for the main building began. The first loads of structural steel, totalling 3,500 tonnes, arrived on site by the end of October and assembly commenced on November 20, ahead of schedule.

61%

OF THE CONSTRUCTION WORKFORCE IS BERMUDIAN

89%

OF SKYPORT EMPLOYEES ARE BERMUDIAN

HIRING LOCALLY

As the new airport constructor, Aecon is committed to engaging the local workforce. To date, the team has optimized a maximum number of Bermudian subcontractors, even exceeding the initial contractual requirement.

“The project has already, and continues to, boost the local economy and help provide jobs for local workers,” says Payne.

Indeed, the Bermuda Airport Redevelopment Project has been a major catalyst for job creation in Bermuda. After awarding the first set of contracts in April 2017, both Aecon and Skyport recruited construction workers and employees for day-to-day operations and maintenance of the existing airport facilities. At this phase in the project, Bermudians make up an impressive 61 per cent of the project’s construction workforce and 89 per cent of the Skyport team.

But there’s another impressive chapter in this project’s employment story. Aecon Infrastructure, in collaboration with Aecon Human Resources, has developed an innovative and foundational program, the Aecon Bermuda Internship Program. Launched in the spring of 2017, the program offered interested Bermudians an opportunity to pursue training opportunities in the construction industry across Ontario. Following a thorough application and vetting process, Aecon helped to place six chosen candidates from various backgrounds – including engineering, architecture, and mechanical and electrical engineering – with several consultancy companies across Ontario involved in the Bermuda Airport Redevelopment Project. Since completing the six-month internship and returning to Bermuda, several of the candidates have been placed with Aecon Constructors and Skyport to continue working on this project.

“This has been a tremendous success story for Aecon, Bermuda and Skyport,” notes Ross. “This program has truly started these interns on a career path.”

The local employment and internship programs take place within the broader context of the Aecon and Skyport Corporate Social Responsibility and Social Investment platforms, which have seen more than 200 Bermudian firms participate in the project’s development.

A LOOK AHEAD

With construction work well under way and firmly aligned with the project schedule, the future looks bright for the Bermuda Airport Redevelopment Project. The world-class project not only embodies the value of the long-standing bilateral relationship between Canada and Bermuda, but it is set to have a positive economic impact for Bermudians and international visitors for generations to come.

“We are honoured to be able to work with Bermuda on such a historic project,” says Steve Nackan. “Over the past two and a half years, we have developed many relationships with Bermuda’s businesses, people and the community, and we look forward to building on these. We are invested not only in Bermuda’s airport but also in its future.”

PROJECT FILE

BERMUDA AIRPORT REDEVELOPMENT PROJECT

CLIENT: Government of Bermuda

LOCATION: St. George’s, Bermuda

TYPE OF CONTRACT: Government-to-Government / Public-Private Partnership (P3) / Design-Build-Finance-Operate-Maintain

CONSTRUCTION CONTRACT VALUE: US\$274 million

CONCESSION TERM: 30 years

AECON BUSINESS UNITS: Concessions, Constructors, Social Infrastructure, Foundations, Utilities, AME, Tristar

SCOPE OF WORK: Development, design, financing and construction of a new state-of-the-art airport terminal and associated infrastructure. The contract also includes the operation and maintenance of the existing and new airports under a 30-year concession.

CONSTRUCTION PERIOD: March 2017 to July 2020

EMPLOYEES ON SITE AT PEAK: 450 - 475

SAFETY: 0 Lost Time Injuries (LTIs) as of November 2017

KEY AECON CONCESSIONS EMPLOYEES:
Steve Nackan, President
Eitan Ladizinsky, Vice President
John Saczkowski, Vice President
Stephen Payne, Senior Director, Technical Services

KEY AECON CONSTRUCTORS EMPLOYEES:
Frank Ross, Executive Advisor, Infrastructure
Don Brophy, Senior Vice President, Heavy Civil
Conor Smythe, Project Director
Dale Beaton, Project Manager
Albert Furlong, Financial Manager
Frank Ayer, General Superintendent
Scott Bell, Environmental Health and Safety Manager

SKYPORT MANAGEMENT TEAM:
Aaron Adderley, President
Ken Hassard, Commercial Director
Bob Withers, Director of Operations
Ken Villanueva, Finance Director
Shazar Hack, Technical Director
Myron Burchall, Director of Maintenance & Engineering
Donald Gray, Quality & Safety Manager
Marcia Pringle, Human Resources & Training Manager
Moe Kamleh, Technical Manager
Jean-François Laberge, Finance Manager
Steve Nurse, Head of Security

KEY AECON SUPPORT EMPLOYEES:
Gordana Terkalas, Vice President, Human Resources
Nicole Court, Director, Corporate Affairs
Colin Sam, Associate General Counsel



ONWARD & UPWARD

The Eglinton Crosstown Light Rail Transit (LRT) continues to be Aecon's largest infrastructure project to date, promising millions of Torontonians an enhanced public transit route across the city upon its completion in 2021. Just two years after financial close and construction kickoff, the project has made significant progress as a result of the combined efforts of Aecon and its joint venture partners under the Crosslinx Transit Solutions (CTS) consortium, including the start of construction on all underground stations and a maintenance and storage facility.

EGLINTON CROSSTOWN LRT PROJECT

Aecon continues to be a driving force behind one of North America's largest transit infrastructure projects.

THE BACKGROUND

In September 2008, the provincial agency Metrolinx launched a massive 25-year, \$50-billion regional transportation strategy to coordinate and integrate transportation and public transit in the Greater Toronto Area. By 2010, the City of Toronto had approved a key project in that plan – the Eglinton Crosstown LRT line, which bisects the city at its midtown point, running from Weston Road in the west to Kennedy Station in the east. Following a competitive process, CTS was awarded a contract in July 2015 to design, build, finance and maintain the Eglinton Crosstown LRT line under a Public-Private Partnership (P3) model.

THE PROJECT

The state-of-the-art, 19-kilometre LRT line features a combination of 15 underground stations and 10 at-grade surface stops. Nine kilometres of the Crosstown line will run below ground, while 10 kilometres will be built above ground, and remain separated from regular traffic. The project also calls for construction of the Eglinton Maintenance and Storage Facility (EMSF) at the site of the former "Kodak Lands" at Black Creek Drive and Eglinton Avenue. Overall, the Crosstown LRT is an intricate transit communications network

that will link to 54 bus routes, three subway stations, the regional GO Transit system and Toronto's Union Pearson (UP) Express route.

THE PLAYERS

Proud to be playing a key role in bringing the Eglinton Crosstown LRT to fruition is Aecon, along with equal joint venture project partners ACS Infrastructure/ Dragados, EllisDon and SNC-Lavalin under the consortium name of Crosslinx Transit Solutions (CTS). CTS is designing, constructing and financing the project, and it will also maintain the LRT system for 30 years, including all lifecycle repairs and renewals of building and system components.

As a project owner, client Metrolinx is responsible for overseeing all design and construction, determining the project scope, acquiring land, and conducting testing and commissioning in coordination with public transport agency Toronto Transit Commission (TTC).

From a project agreement perspective, clients Metrolinx and Infrastructure Ontario are managing this massive P3 project and leading the alternative financing and procurement process, providing oversight on both quality control and project agreement execution.

Rendering of Mount Dennis Station courtesy of Norm Li for Crosslinx



AND SO IT BEGINS...

A project to construct a \$5.3-billion LRT system across the largest and busiest city in the country takes teamwork. It also requires the project development expertise, size and pedigree of companies like Aecon and its joint venture partners.

Right from the beginning, this project was about bringing together the best and brightest companies in Canadian infrastructure development to undertake an incredibly complex task.

As a member of the CTS consortium, the Aecon Concessions team has played a major role in developing the Eglinton Crosstown LRT project. Led by Aecon Concessions President Steve Nackan and Vice President Eitan Ladizinsky, the Concessions group functions as an extension of Aecon that focuses on developing, financing, investing in and the long-term management of, projects that Aecon constructs.

When it came to the Crosstown LRT project, the Concessions team was responsible for building a partnership with the other developers under the name of CTS to oversee everything from the management of the bid, to negotiating the contract, liaising with lenders, and working with the clients – Infrastructure Ontario and Metrolinx – to reach a successful bid submission and subsequent financial close.

“Given its scale and complexity, this project was the first of its kind for Aecon and one in which our team’s role has been more prominent than on prior Canadian P3 bids,” explains Ladizinsky. “The due diligence and legwork required to win the project, get to financial close and now execution has required many more resources and a laser focus.”

Apart from acting as a developer on this project, the Concessions group is also in charge of establishing and overseeing the Operations & Maintenance (O&M) portion of the project along with the three other Crosstown consortium partners under a separate 30-year contract. An exceptional achievement, this particular O&M contract – in the P3 LRT sector – is also the first of its kind for Aecon. It forms part of the company’s 25-per-cent equal share of the operation, maintenance and lifecycle of the Eglinton Crosstown LRT and its vehicle fleet.

“Considering that this was the first time Aecon had bid on this kind of O&M contract, it is a significant success for our team,” explains Aecon Concessions Senior Director Stephen Payne. “It was new territory for Aecon, but we were able to join an established group of players and become a meaningful member of the joint venture team.”



INNOVATION ON THE FLY!

At the intersection of Oakwood Avenue and Eglinton Avenue West stands a large steel structure that is easily visible from afar. For the first time ever in Canada, an overhead crane has been assembled on a pile wall above an open excavation, to assist with construction of the Crosstown LRT’s Oakwood Station. The crane represents the significant collaboration of the Oakwood Station construction team as they worked together to find an innovative solution to the challenges they faced.

“At Oakwood Station, the footprint of the open pit is the footprint of the station, so there was no extra space for us to install a tower crane or a luffing crane, which is typically used on other construction sites,” said Paula Oliveira, Oakwood Station Project Manager. “We had to find a creative solution, and an overhead crane was our answer. It will provide us with the load capacity we need and is easier to assemble and disassemble.”

The 35-tonne capacity overhead crane stands 12 metres tall and will help lower and lift materials and equipment, as needed, for Oakwood Station’s mining and construction activities.

“Installation of the overhead crane was challenging because engineering firms in Toronto have never designed something like this before. But, we successfully worked together to make it work for the first time in Canada!” adds Oliveira.

The overhead crane was called into action in September 2017, with mining activities at Oakwood Station beginning in October.

Fun fact: Oakwood Station’s overhead crane and beams weigh 73,000 kg, which is equivalent to 12 African bush elephants.

Construction of the main entrance station box for Mount Dennis Station.



PROJECT FILE

EGLINTON CROSSTOWN LRT PROJECT

CLIENTS: Metrolinx, Infrastructure Ontario

LOCATION: Toronto, Ontario

TYPE OF CONTRACT: Public-Private Partnership (P3) / Design-Build-Finance-Maintain

CONTRACT VALUE: Aecon is an equal partner in the \$5.3-billion Crosslinx Transit Solutions (CTS) consortium to develop the Eglinton Crosstown LRT.

JOINT VENTURE PARTNERSHIP: Aecon, ACS Infrastructure/Dragados, EllisDon, SNC-Lavalin

AECON BUSINESS UNITS: Concessions, ACML, AME, AUE, Constructors, Utilities, Foundations, Tristar (formerly AGITT)

SCOPE OF WORK:

- A 19-kilometre route of LRT track running along Eglinton Avenue (10 kilometres underground and nine kilometres at-grade), from the future Mount Dennis Station in the west to Kennedy Station in the east
- 25 LRT stops, of which 15 are underground stations and 10 at-grade surface stops, separated from traffic
- A maintenance and storage facility
- Communications systems
- 30 years of maintenance and lifecycle activities

TIMING: Construction on stations began in Spring 2016; project is scheduled for completion in 2021.

EMPLOYEES ON SITE AT PEAK: 3,500

KEY CTS EMPLOYEES:

John Bisanti, Chief Executive Officer
David Levett, Chief Technical Officer (Aecon)
Jorge Del Solar, Chief Commercial Officer
Ignacio Ugarteche, Chief Financial Officer

KEY CTS CONSTRUCTORS EMPLOYEES:

Bill Henry, President & Project Director
Geoff van der Lee, Implementation & Deputy Project Director
Ken Johnson, Contracts & Performance Director
Andy Lederman, Commercial Director (Aecon)
Roger Belair, Program-Wide Health & Safety Director
Scott Thorburn, Technical Director
Steve Riddell, Construction Health & Safety Director
Kristin Jenkins, Communications Director
Gabriel Patron, Deputy Segment Director (Aecon)
Tim Russell, Deputy Segment Director (Aecon)
Anders Persson, Segment Director (Aecon)
Manuel Ruiz, Segment Director
Steve Plyler, Segment Director
Juan Azofra, Segment Director
Murray Heppner, Segment Director
Eric Mumm, Segment Director
Denisa Leiba, People & Culture Director (Aecon)
Charles Todd, Contracts Director (Aecon)
Phil Holliday, Project Director, Revenue Vehicle Task Force (Aecon)
Spencer Cameron, Project Manager (Aecon)

KEY CTS MAINTENANCE EMPLOYEES:

Ernesto Capillas, Maintenance Director
Alex Sivakov, Finance & Administration Director
George Nohos, Fixed Infrastructure Director (Aecon)
David Dixon, Vehicles, Systems & Operations Director



EARNING A "SOCIAL LICENCE"

Given the sheer expanse of the Eglinton Crosstown LRT project and its respective construction timeline, the CTS project team decided early on that a prime focus would be determining how best to add value to the multiple neighbourhoods that dot the 19-kilometre construction route. In fact, developing the "social license" to collaborate with and contribute to these communities has been a top objective since day one, says Crosslinx People & Culture Director Denisa Leiba. With a project schedule that calls for another four years of active construction, followed by 30 years of LRT system maintenance, the opportunity to contribute to the development of vibrant and economically healthy neighbourhoods was seen as essential to building a strong foundation as a community partner. Local job creation and skills development were two areas of immediate actionable interest.

"At Crosslinx, it's all about collaboration, and we can rely on our 58 local workforce agencies to help us recruit from the communities in which we build," explains Leiba. "Hiring local residents means that our project benefits from knowing the ins and outs of the neighbourhoods on the alignment, and that inside knowledge is critical to being a good neighbour."

By understanding these neighbourhood dynamics, fostering relationships with community stakeholders, identifying how CTS can assist in addressing community needs, and looking for every opportunity to add value to the community, Leiba says the team is making great strides in its community integration plan.

CROSSLINX AND THE COMMUNITY BENEFITS PROGRAM

Introduced by Metrolinx, the Community Benefits Program recognizes the correlation between major infrastructure investments and the need to provide benefits for the communities affected by these major projects, including employment, apprenticeships and local supplier opportunities, wherever possible. The program is part of Metrolinx's commitment to include a Community Benefits Program for all major Toronto transit projects, beginning with the Eglinton Crosstown LRT.

"Crosslinx's Community Benefits Program creates economic and social value for Eglinton-area communities by engaging in workforce development and training, diverse employment, social procurement and community improvement activities," explains Patience Adamu, MPP, Lead, Community Investments & Programs, Crosslinx. "We recognize the unique and diverse nature of neighbourhoods along Eglinton Avenue and are working to produce – and have produced – benefits that precede the ultimate benefit of new transit infrastructure."

The program is divided into various streams, one of which is Employment, Training and Workforce Development. As an inclusive employer, CTS has been building relationships with local workforce agencies that work with individuals facing barriers to employment. As part of its efforts, the team has participated in job fairs, offered resumé review tips and provided pre-orientation details to help improve job matches and support applications to CTS.

The program also focuses on a commitment to maximize procurement and supplier opportunities for social enterprises and local businesses. The CTS team has taken steps to produce community murals and partner with local businesses on various initiatives, such as washing storefront windows along Eglinton Avenue.

Finally, as part of the Community Benefits Program, the CTS Builds Communities program demonstrates care and stewardship of the neighbourhoods along Eglinton Avenue with successful initiatives such as: sorting Thanksgiving donations at a local food bank (near Kennedy Station); including students from a local high school (near the future Science Centre Station) in mentorship opportunities at a Habitat for Humanity GTA build project; and organizing a three-part Women in Construction series in partnership with the YWCA Toronto (near Kennedy Station) to empower and provide mentorship to more than 20 Eglinton-area girls.

aCROSSTOWN

aCrosstown is a traffic application that was created to make it easier for people in surrounding communities to better navigate Eglinton Avenue during the Eglinton Crosstown LRT construction. Delivering real-time information about traffic and transit conditions along the corridor, the app is a user-friendly planning tool that puts safety first. It also features hands-free, audible features so that drivers can keep their hands on the wheel and their eyes on the road.



A SURPRISING FIND

Excavation at construction sites often unearths very surprising finds! In August 2017, crews working on the Fairbank Station site of the Eglinton Crosstown LRT line uncovered bone fragments and what appeared to be ceramics while carrying out hydrovac activities at the future station's secondary entrance.

They acted quickly; stopped work, cordoned off the area with a suitable buffer, and contacted the project's designated environmental team, including an archaeologist and the Toronto Police Service.

The archaeologist soon confirmed the bones were, in fact, horse bones, likely buried in the 18th century when the site was a farm. The Fairbank team handled the event professionally, and the area was cleared in a matter of hours so work could continue.



Laird Station excavation



GREAT PROJECTS START WITH GREAT DESIGN

The cornerstone of a major project like the Eglinton Crosstown LRT is design. Project design that meets all client needs while being cost-effective from a constructability perspective provides the requisite solid foundation.

The Design-Engineering Joint Venture (DEJV) consortium on this project consists of SNC-Lavalin Inc., IBI Group and several specialty consultants. Together, the DEJV consortium members created a design narrative defined by four elements: Simplicity, Iconography, Transparency and Urbanity (SITU).

Simplicity is rooted in the idea of implementing only what is needed and no more. Through the use of simple forms and lines, the design establishes a pure, articulated and inspiring aesthetic that is visible throughout the different project elements.

KEY DESIGN MANAGEMENT PARTNERS

- Aecon Utility Engineering
- Daoust Lestage Inc.
- DIALOG Ontario Inc.
- Dr. G. Sauer & Partners Corporation
- Entuitive Corporation
- H.H. Angus and Associates Limited
- IBI Group
- Jensen Hughes Inc.
- LEA Consulting Ltd.
- NORR Ltd.
- Read Jones Christoffersen Ltd.
- SNC-Lavalin Inc.
- Thurber Engineering Ltd.

Iconography is an important element in creating visual recognition and branding clarity. Visual identifiers – readily recognizable and depictive components – brand the LRT line and present a consistent language of image, materials and colour that enable users to identify, enter, and experience the new Eglinton Crosstown LRT.

Transparency calls for the transition between the public realm and the transit system to be seamless, uplifting and safe. The architecture of the stations provides unobstructed views to facilitate orientation and the perceived sense of security. The glass facades of the stations allow for natural light to penetrate deep below into the concourse levels and minimize the buildings' impact on the surrounding community.

Urbanity speaks to how the transit system design relates to its immediate surroundings and the local community. Eglinton Avenue along which the new LRT track will run – either above or below ground – involves varying levels of economic, cultural, ethnic, urban and topographic diversity. These variable demographics directly impact the design of each station, while the overall design of the project strives to maintain consistency and pay homage to the changing landscape.

To further elevate the design and performance standards of the new LRT system, the design team put a lot of thought into features such as short- and long-term bike parking, dedicated pedestrian routes, High Solar Reflectance Index paving, green roofs, water conservation, shielded exterior lighting to prevent off-site light trespass, sheltered waiting areas, energy-efficient LED lighting and heat recovery systems, landscaping and the use of native, drought-tolerant plants and large trees.

\$5.3B
CONSTRUCTION CONTRACT VALUE

3,500
EMPLOYEES

600k
CUBIC METRES OF EXCAVATION

THROUGH A GLOBAL LENS

A world-class public transportation project like the Eglinton Crosstown LRT calls for world-class expertise. In addition to local boots-on-the-ground knowledge and experience, CTS President and Project Director Bill Henry says Crosslinx has attracted an internationally diverse, highly skilled workforce that continues to steer the project forward.

“Our partner companies have supplied much of the talent, and we have brought on talent from all over the world. Having a broad range of knowledge, skills and experience helps productivity and innovation to ensure the project is carried out safely and with quality. I’m incredibly proud of how this team of people, from different companies and different countries, has come together to build the new Eglinton Crosstown LRT.”

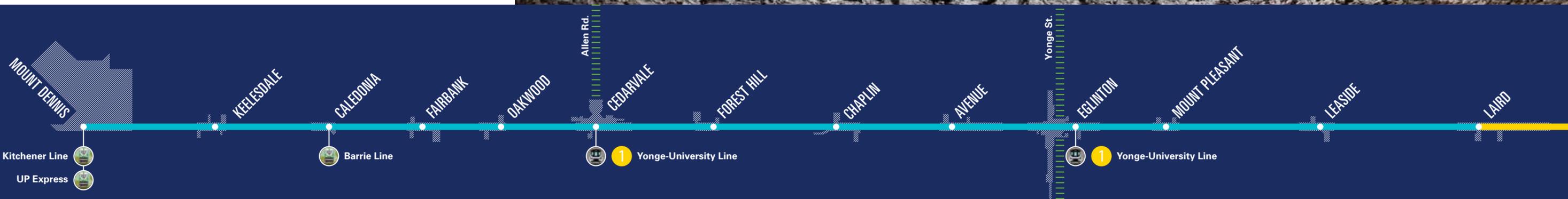


LAYING DOWN THE TRACK

August 10, 2017, marked a major milestone for the Eglinton Crosstown project; it was the day crews installed the first piece of the LRT track, along the Eglinton Crosstown line. On hand for the milestone were Toronto Mayor John Tory, Aecon President & CEO John M. Beck and Crosslinx President and Project Director Bill Henry at the future Eglinton Avenue site of the Mount Dennis Station and the EMSF.

The first track that crews installed that day was a turnout track, which is a part of the track system to move vehicles through the maintenance and storage areas in the EMSF. The metal is sourced from H.J. Skelton, a company in London, Ontario, and the track is manufactured by DT in the Czech Republic. As the first portion of the Eglinton Crosstown LRT to be completed, the EMSF will be ready to receive light rail vehicles in October 2018.

Keelestadale Station under construction





Eglinton Maintenance and Storage Facility (EMSF) under construction

CONSTRUCTION UPDATE

Since the fall of 2015, the CTS consortium has been preparing the LRT line for construction of the underground stations and surface stops. Even prior to both eastbound and westbound tunnels being completed under separate tunnelling contracts and transferred to CTS control (see *ONE Magazine, Winter 2017*), the consortium began construction of all underground stations in March 2016, beginning with the stretch between Keele Station in the west end and Science Centre in the east. The concrete pour work for the two tunnels began in April 2017, while a number of the underground stations saw shoring work nearing completion.

The year 2017 marked the “Year of the Dig,” when nearly 50 per cent (or approximately 600,000 cubic metres) of the excavation for station entrances took place. It also signalled the start of excavation and mining for the main station boxes.

Crews have also begun work on the first stop at the west end of the LRT line, Mount Dennis Station, which is located at grade at the former site of the sprawling Kodak factory complex, known as the “Kodak Lands.” The deliverable in the construction of Mount Dennis Station required workers to temporarily relocate the remaining landmark, Kodak Building Nine, about 200 feet from its original 1939 footprint to make way for the new station build. The old basement of Building Nine was demolished to make way for the station’s new concourse level, which will become part of a new transit hub joining the LRT line with the Georgetown GO line and the UP Express route. In the fall of 2017, Building Nine was moved back to its original location and tied into its new

foundation. It’s set to become the secondary entrance to the new transit hub, joined to the main entrance at Weston Road and Eglinton Avenue by the new Mount Dennis Station pedestrian tunnel.

The pedestrian tunnel will be built along with two new tail track tunnels, both of which are the terminating points on the LRT line. To build the pedestrian tunnel, crews were required to demolish the old Photography Drive Bridge deck, which ran over Eglinton Avenue West, between Black Creek Drive and Weston Road. In February 2017, they shut down that part of Eglinton to dismantle the bridge. In the fall of 2017, the project team began piling activities for the new south abutment between the station box and the bottom of the slope excavation on the south side of Eglinton Avenue West. Excavation for the pedestrian and two tail track tunnels began in December 2017.

While construction activity has been full speed ahead on the underground stations, crews have also been busy with preparation work for all designated surface stops running from Sunnybrook Park Station on the west end of the line to Kennedy Station on the east end.

Key to any major public transit project is the Equipment Maintenance & Storage Facility (EMSF). Construction on Eglinton Crosstown’s massive 57-acre EMSF got under way in July 2016. Designed to service and store more than 160 light rail vehicles (LRVs), the facility is set to be completed by October 2018 and will allow for the daily cleaning, inspection, maintenance and repair of the LRVs. Located next to Mount Dennis Station, the dedicated EMSF will feature a green roof, two artificial ponds and green tracks in order to better integrate with the adjacent parkland in the Black Creek Valley.



MILESTONE TIMELINE

SEPT 2008

Metrolinx unveils a 25-year, \$50-billion regional transportation plan to coordinate and integrate transportation and transit in the Greater Toronto and Hamilton Area. The largest project in this plan is the construction of the Eglinton Crosstown LRT.

FAST-FORWARD TO...

MAR 2016

Crosslinx begins construction on Keele Station – the first of 25 planned stations and stops – located second from the western end of the line.

JUN 2016

Crosslinx begins construction on the future Laird Station – the second underground station.

JUL 2016

Excavation work begins for the construction of the maintenance and storage facility at the former “Kodak Lands” at Black Creek Drive and Eglinton Avenue.

AUG 2016

The TBMs reach Yonge Street, completing the Crosstown tunnelling work. Building Nine of the former Kodak factory complex is temporarily moved to make way for one of three entrances to Mount Dennis Station – the westernmost station on the Crosstown route.

JUN 2017

MINING WORK BEGINS AT LAIRD STATION.

AUG 2017

CREWS INSTALL THE FIRST PIECE OF LRT TRACK ALONG THE EGLINTON CROSSTOWN LINE.

NOV 2017

BUILDING NINE IS SHIFTED BACK TO ITS ORIGINAL LOCATION, FOLLOWING THE CONSTRUCTION OF A NEW FOUNDATION FOR THE BUILDING TO SUPPORT ONE OF MOUNT DENNIS STATION’S FULLY ACCESSIBLE ENTRANCES AND CONNECTIONS TO THE LOWER CONCOURSE AND PLATFORM BELOW.

NEXT UP...

OCT 2018

The Eglinton Maintenance and Storage Facility (EMSF) at the site of the former “Kodak Lands” will be completed.

MAR 2020

The Eglinton Crosstown is scheduled for testing and commissioning.

FALL 2021

Expected completion date for the Eglinton Crosstown LRT project.

SUNNYBROOK PARK

SCIENCE CENTRE

Don Valley Pkwy

AGA KHAN PARK & MUSEUM

WYNEFORD

SLOANE

O’CONNOR

PHARMACY

HAKIMI LEBOVIC

GOLDEN MILE

BIRCHMOUNT

IONVIEW

Stouffville Line



KENNEDY

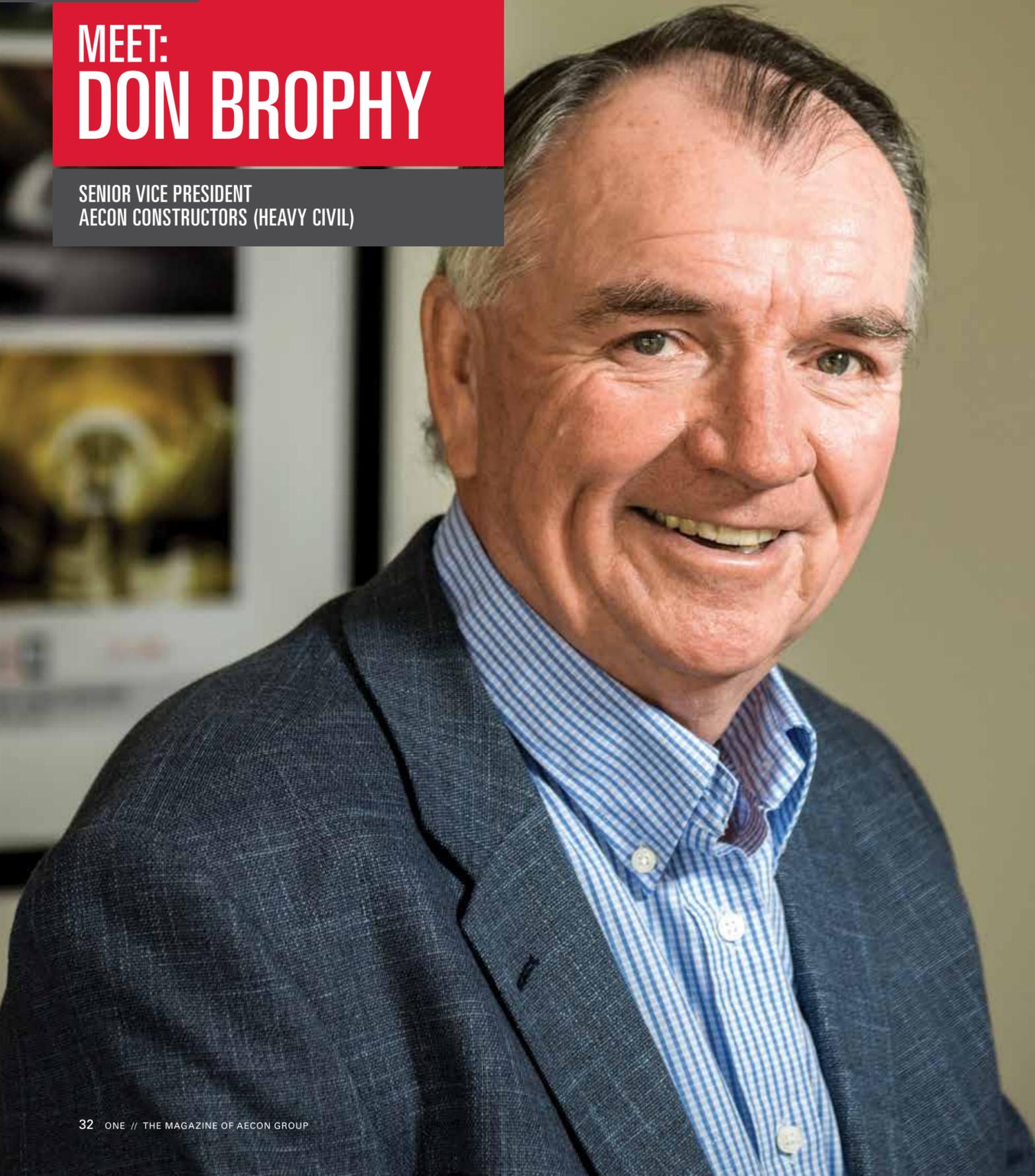
Bloor-Danforth Line 2

Scarborough Line 3

PEOPLE MATTER

MEET: DON BROPHY

SENIOR VICE PRESIDENT
AECON CONSTRUCTORS (HEAVY CIVIL)



FAMILY MATTERS

For Aecon Constructors Senior Vice President Don Brophy, working with the company for more than four decades has been a family affair. Starting from his first day on the job with Aecon predecessor company Pitts Engineering Construction, and all the way through the numerous milestone projects he worked on across Eastern Canada, Don's growing family was by his side at every step, helping to ensure his success.



When did you decide to work in construction?

The day that I got hired on at Pitts Engineering Construction as a Surveyor in 1973. Although interested in construction, I never really had a clear idea about what I wanted to do before then. I was brought up on a farm and worked with my family from the time I was five or six years old, through my school years. When I was hired on with Pitts Construction to work on the Arnprior Hydro Dam in Ontario, I knew this type of construction would be my future.

What kind of schooling did you have?

I went to Algonquin College and graduated as a civil technologist in 1973. One year later, I went back to school, to the University of Ottawa, and graduated with a bachelor of science degree in engineering in 1977.

My wife and I were married in June of 1974, and I went back to school, to the University of Ottawa, that fall. I graduated

with a bachelor of science degree in engineering in 1977. After that, we started moving around for work.

Why did you decide to go back to school?

At the time, my wife was working with the government in Ottawa, and we agreed that this was a good opportunity to get my degree in engineering. I could see that taking this step would open up the directions I could go within a company like Aecon. It was an area in which I could see advancement come quicker with a degree than without it.

During technical school, I studied surveying, and it just so happened that I got involved with the right project – the Arnprior Hydro Dam – at Pitts Construction, at the time, and that's where it all started for me.

What have you enjoyed most during your years of working at Aecon?

It's mostly been about the people that I've met and worked

EMPLOYEE FILE

DON BROPHY

POSITION: Senior Vice President

DIVISION: Aecon Constructors (Heavy Civil)

EXPERIENCE:

- 1973 – 1978 Pitts Engineering Construction –
 - Surveyor
 - Party Chief
 - Project Engineer
- 1978 – 1986 Banister Foundation –
 - Project Manager
- 1986 – 1991 BFC / Foundation –
 - Project Manager
- 1991 – 1999 BFC Construction –
 - Senior Estimator
 - Chief Estimator
 - Vice President of Estimating
- 2001 – present Aecon Constructors (Heavy Civil) –
 - Vice President of Operations
 - Senior Vice President of Operations

EDUCATION:

Algonquin College (1973) – Civil Technology
University of Ottawa (1977) – B.Sc., P.Eng

AECON FAMILY CONNECTION:

Stephen Brophy (son) – Aecon EHS Advisor

HOMETOWN: Ottawa, Ontario

CURRENT HOME: Pickering, Ontario

HOBBIES AND INTERESTS: Church, family, volunteering

ASSOCIATIONS:

- Toronto and Area Road Builders Association
- Heavy Construction Association of Toronto

with over the years. I couldn't have asked for better people to work with. Throughout my whole career at Aecon, I've had strong and positive relationships with people who really knew how to work hard and enjoyed the work that they did.

Why have you stuck with Aecon for all these years?

From the beginning, I have enjoyed the type of work Aecon does and have never found anything better. I've been approached on several occasions over the years with other opportunities, but when I considered it all, Aecon was the right place for me.

How did you manage to balance a busy work life with having a family?

I've been in the business for 43 years, and I've learned that it's very difficult for me to have a job in one place and have my family live someplace else. In the first 15 years of my career, 15 different projects brought us to 10 different cities. During the first seven years, our five children were born in five different cities. Although I worked long hours on all these projects, being together allowed me to be home most nights while our children were growing up.

Once we moved to Toronto, where Aecon's head office is, I'd typically travel alone from there to the various sites, making it back home to the family most weekends.

Anne and I have now been happily married for 43 years. Our children are all married and we have eight grandchildren.

What are some of your hobbies outside of work?

My wife and I are very involved with family and church activities. I am on a church board of directors and have been involved in building a new facility over the last few years.

Anne and I enjoy travelling, and I do a little golfing and skiing.

We try to get out to visit my oldest daughter, Jennifer, her husband and our two granddaughters in Whistler, B.C., a couple of times a year, and we travel regularly to Lennoxville, Quebec, to visit my oldest son, Gregory, his wife and their son.

Our other three children – Stephanie, Stephen, Christine – and five grandchildren live close to our home in Pickering, Ontario, and we see them all the time. We've got a pool in our backyard at home, so it's perfect for when all the grandkids come over to spend time with us. Sometimes, when we have the five of them over, it gets quite wild!

You are leaving your post as Senior Vice President at Aecon but continuing to work with the company; how come?

I have thoroughly enjoyed working with Aecon for more than four decades with a primary focus on domestic projects but also having a keen interest in our international work. So, when the opportunity was presented to me to give executive oversight to the Bermuda International Airport Project for the next couple of years, I discussed this with my family and agreed to delay full retirement from this great company and the people I enjoy working with.

What do you think of the technological advancements that have been happening within the construction industry over the past few years?

Technology advancement is good. There are many new and better ways to do things nowadays, but you still need to know the basics of how to approach a construction project in order to build it. You need the hands-on experience of



building a project, even though every bit of technology helps.

I don't think we will ever reduce staffing requirements through advances in technology. More and more people join our teams with each new year. When I was working as a Project Engineer, our team consisted of about five people. Now, for the same size and complexity of project, we have about 25 people managing a project because of what's required today.

What advice would you give to someone who is just starting out in the construction industry?

I think if someone wants to advance in the business, they really need to spend a good amount of time on different projects in various roles, be it as a Project Engineer or a Project Manager and so forth, through the ranks. I find that a lot of young people today want to get into an executive role fairly quickly, but I was nearly 50 years old when I became a Vice President. That's not to say that it has to be that way, but there's no replacement for the experience and time that you need to spend out in the field, growing in your understanding of the business from the ground up.

The reason behind why I've

done fairly well in my executive role is the type of background I have and my flexibility when it comes to working remotely. I think the flexibility is a little more difficult to accomplish nowadays because both heads of the family are working full-time, but a lot can still be done, depending on your situation.

What are some key lessons you have taken away from this industry over the years? Which ones had the most impact?

The biggest aspect of my job that made an impact on me was the people that I surrounded myself with. In my previous roles, I've had the responsibility of building the teams for the various projects we worked on, and it was clear that selecting the right people for the right roles made everyone's job so much easier.

As I look back at some of the projects I have worked on in the past, I realize that I was surrounded by some of the best people in the industry, which is why we were successful in our work. All of these relationships have been long-lasting, and some I still enjoy to this day. Whenever I'm travelling and have the opportunity, I still visit with different people I've had the pleasure of working with across Canada.



Highway 410 at
407 Express Toll Route

EASING THE DAILY COMMUTE

HIGHWAY 410 WIDENING PROJECT

Aecon's Highway 410 reconstruction project has been a major undertaking, but once completed, it will bring welcome relief to the almost 200,000 drivers who travel its route every day.



Highway 410, also known as King's

Highway 410, interconnects with several of the major 400-series highways that make up the massive road network linking much of southern Ontario. Operating since the 1970s, Highway 410 has over the years expanded to connect to Highway 407, Highway 403 and Highway 401 (one of the world's busiest highways).

In 2014, the Ontario Ministry of Transportation (MTO) selected Aecon Construction and Materials Limited (ACML) to tackle a major reconstruction of "the 410" to better accommodate the region's ever-growing population and improve traffic flow and safety. The move came as part of a broader economic plan by the provincial government to upgrade highways, roads and bridges while investing in people, job creation and modern infrastructure.

At the time of tender, this project represented the largest Bid-Build release by the MTO. The scope of work called for ACML to widen and reconstruct a 12-kilometre swath of road stretching south of Highway 401 to just north of Queen Street in Brampton. Construction officially began in September 2014 and is scheduled for completion in November 2018.

LOOKING BACK

Highway 410 first opened in 1978 as a two-lane arterial road with at-grade intersections. The roadway was built after it became apparent a major route was needed to connect the sprawling suburbs to the heart of downtown Toronto. During the following decade, the highway was restructured into a six-lane freeway with full interchanges at Derry Road, Steeles Avenue and Queen Street. Later on, partial interchanges were constructed at Courtneypark Drive and Clark Boulevard,

both with access to and from the south on Highway 410. In the early 1990s, the interchange with Highway 401 was reconfigured to include the connection to Highway 403 to the south. By the end of the 1990s, Highway 410 was connected to the 407 Express Toll Route (407 ETR), which opened in 1997. Most recently, Highway 410 was widened again at the northern end of Brampton to connect with the smaller Highway 10 (Huronario Street), which carries commuters on to Orangeville and parts north.

SCOPE OF WORK

This latest round of reconstruction on the most congested portion of Highway 410 has been more than a formidable task. The addition of four extra lanes to the existing six-lane highway will bring much-needed relief to the more than 188,000 vehicles that use the stretch from Queen Street in Brampton south to Highway 401 on a daily basis. The main scope of work has entailed repairing, repaving and expanding a section of Highway 410 from six to 10 lanes, including the building of one general-purpose lane and one High Occupancy Vehicle (HOV) lane in both northbound and southbound directions.

Other significant elements of the project included the widening and rehabilitation of seven bridge structures along the 12-kilometre stretch, construction of two new ramps at the highway 401/403/410 interchange, and opening two new carpool parking lots at the Courtneypark Drive and Clark Boulevard interchanges. Installing concrete median tall wall barriers, high-mast lighting, traffic cameras and an Advanced Traffic Management System (ATMS) with the help of Tristar Electric Inc. are among the next steps.



617

SEWER STRUCTURES

180k

CUBIC METRES OF ROCK EXCAVATION

420k

CUBIC METRES OF EARTH EXCAVATION

900

METRES OF TUNNELLING



Night paving

TRAFFIC AHEAD

Although this project isn't unique or particularly different from other Aecon road rehabilitation contracts, the one thing that has made it a stand-out project is the immense volume of traffic that both crews and motorists contend with daily. And it's not surprising. In addition to the barrage of vehicles travelling the route each day, regional public transit services have also been impacted, including GO Transit, Brampton Transit and MiWay, a public transport agency serving Mississauga.

"The biggest hurdle on this entire job has been the traffic," confirms Senior Contracts Manager Brent McIntosh. "I've worked on every major 400-series highway, and I've never seen traffic like this."

To get the work done on time and in such a highly congested area, the MTO placed strict working constraints within this contract. From the start of construction, ACML was committed to following a strict work schedule that fluctuated depending on the portion of highway under work and included a high degree of night work to ease traffic disruption. A more than average amount of rainfall in 2017 also meant that crews ended up working weekends to mitigate delays to the asphalt paving schedule.

Beyond the traffic hurdle, this job has

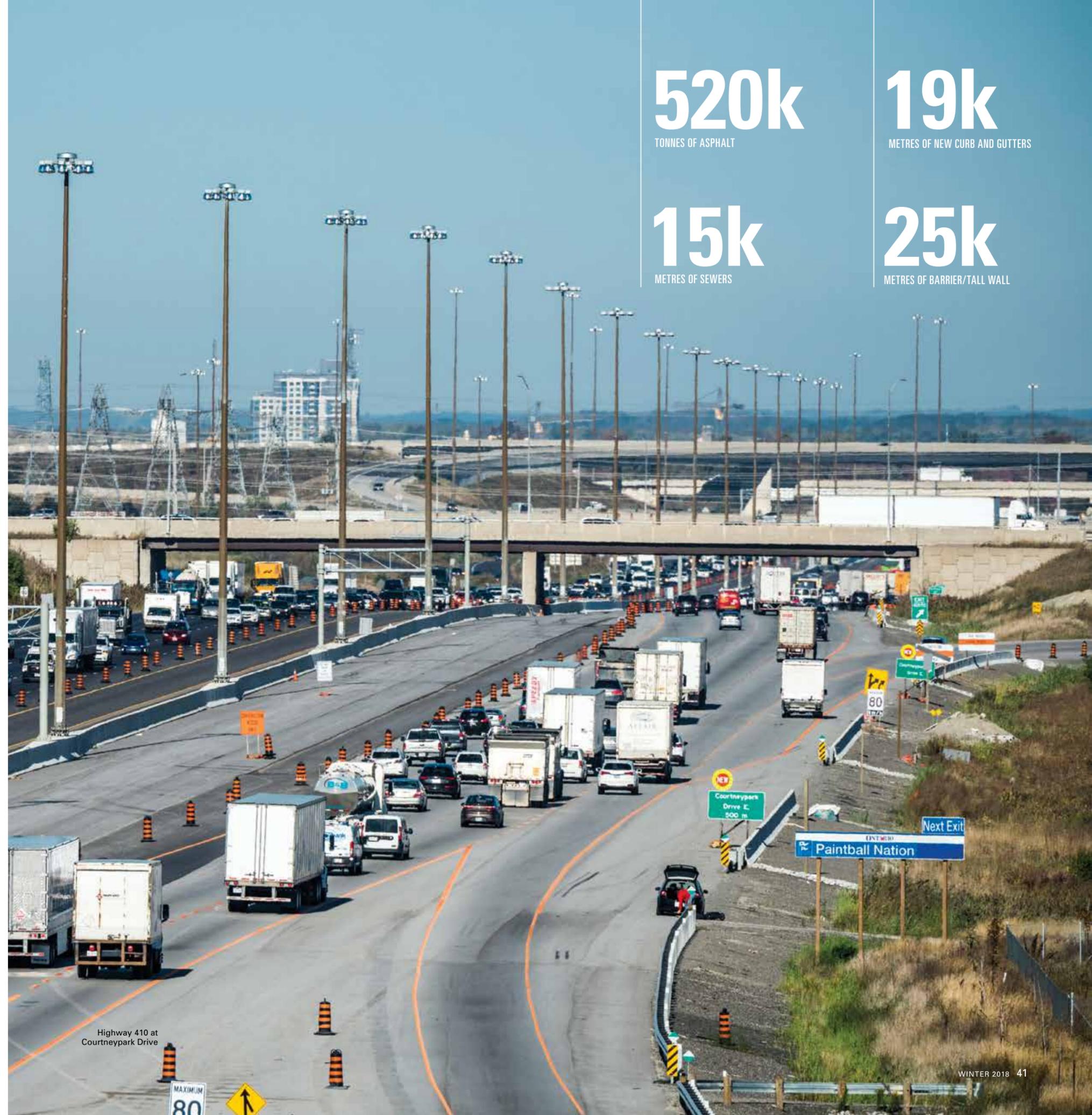
been straightforward and included several "ONE Aecon" opportunities for Tristar (see our profile of Tristar Electric Inc. on page 50), Aecon Materials Engineering (AME), Aecon Utilities and asphalt cement supplier Yellowline.

"Our groups have an excellent working relationship," explains McIntosh. "We help each other constantly for the greater good of the job. Having our own asphalt cement supplier, asphalt plant and materials testing has really helped to expedite the results, fully control the schedule and assure the level of quality."

STEADY ON!

With project completion scheduled for Fall 2018, the crews have completed about 75 per cent of the work and are steadily nearing the finish line. Over the course of construction, this project has not only promised to bring relief to one of the most congested portions of Highway 410, but it has also created and sustained more than 1,550 construction jobs.

As evident throughout its history, it's unlikely this will be the last restructuring of Highway 410. With more people moving into the regions north of the Greater Toronto Area, the MTO has already indicated plans to continue widening the roadway north of Brampton's Queen Street in coming years.



Highway 410 at Courtneypark Drive

520k
TONNES OF ASPHALT

19k
METRES OF NEW CURB AND GUTTERS

15k
METRES OF SEWERS

25k
METRES OF BARRIER/TALL WALL



“Using Bedrock as our foundation has afforded us the opportunity to introduce new tools that can really help advance Aecon’s in-field project execution and further support client relations.”

— Information Services Vice President, Natty Cidado

INNOVATION FROM WITHIN

With SAP rollout and implementation across Aecon, Bedrock Release 2 opens the door on innovative new custom applications aimed at making the job easier in the field.

FIELD DATA CAPTURE (FDC) MOBILITY SOLUTION

The Field Data Capture (FDC) Mobility Solution, currently in-use on Aecon’s Highway 410 Widening Project, is proof positive that the right kind of application can offer effective, time-saving solutions in the field. Developed in the latter part of 2016 and piloted in the first two quarters of 2017, FDC is a mobility solution that allows project teams to capture field information data at the source, as it occurs. Instead of manually entering information into an Excel spreadsheet or using paper timesheets, FDC enables users to input information, such as time, equipment usage, and daily progress and production directly into a device agnostic mobile phone

or tablet. Through SAP integration, FDC enables real-time data to be at the users’ fingertips as they execute projects, enabling decision making based on the best and most current information available.

“FDC is a first-rate example of how we’re reaping the benefits of the investments we’ve made in Bedrock as a foundational support for Aecon,” says Aecon Information Services Vice President Natty Cidado.

FDC is also representative of the kind of customized solutions Cidado’s team has begun to explore and build for Aecon’s in-field project teams under Bedrock Release 2, the next generation of Aecon’s initial SAP implementation under the Bedrock banner. Bedrock 2 is focused on

introducing more flexibility and further refining company-wide processes by providing a new intuitive and scalable “execution toolset” to meet the company’s diverse needs. The focus with Bedrock 2, says Cidado is on the frontline user.

Beyond the Highway 410 Widening Project, the FDC mobility application has been piloted on other Aecon projects, such as the Lobo D – Union Gas site in southwestern Ontario. Members of the Bedrock support team travelled to various pilot sites in 2017 to coach over 150 new field staff, from foremen to project managers, on FDC’s functionality.

“The hands-on support from Aecon’s Information Services team really did the trick,” notes Patrick Beswick, a member of

the FDC Pilot team. “Any obstacles we had were quickly overcome, and the project team was off to the races using the solution. In turn, we learned valuable lessons that led us to revise some of the processes to streamline and improve implementation at other project sites.”

As with most things involving change, there was a hint of trepidation from some in the field at the thought of introducing a new mobile application. Following initial FDC deployment, however, many project sites reported little in the way of a learning curve. There were no major issues using the solution after only a 30-minute training session and a few days of in-field practice entering time using their tablets.

“FDC has definitely helped streamline the data collection process,” says Mitch Davis, Project Coordinator on the Highway 410 project. “Gone are the days of waiting for timesheets or driving around to collect them. The tablets are user-friendly, and comments from the foremen have been generally very positive. With buy-in from site personnel, FDC can be fully utilized to include daily production entry from the foremen to provide the most accurate representation of work being completed on site.”

The benefits of the new tool quickly became apparent as the different teams began recording information, such as production quantities, which they had previously been unable to capture using a manual, paper-based process. And yet, even with this additional data capture, some sites noted a more than 80 per cent or greater reduction in time spent recording the data. In some cases, time savings amounted to almost three business days per week.

“Overall, the implementation of this application will be a significant cost savings for site overheads because of streamlining this process,” adds Warren de Leur, Aecon Energy Senior Project Coordinator on the Union Gas LOBO project.

In fact, things have gone so well since the new implementation that the FDC Pilot team quickly realized sites had begun using their new tablets in interesting ways they hadn’t envisioned. At an Aecon site in Powassan, Ontario, for example, Project Coordinator Mukhtar Galan set up shared folders on his tablet, allowing for real-time updates and distribution of site documents and drawings within his project team.

Galan’s intuitive use of the FDC mobile tablet supports the domino effect that can come from an initial, collaborative solution once implemented, proving innovation is thriving at Aecon, both behind the scenes and in the field.

Project Coordinator Mitch Davis using the FDC Mobility Solution on the Highway 410 project site



BEDROCK

PROJECT FILE

HIGHWAY 410 WIDENING PROJECT

CLIENT: Ontario Ministry of Transportation

LOCATION: Mississauga/Brampton, Ontario

TYPE OF CONTRACT: Bid-Build

CONTRACT VALUE: \$156.7 million

AECON BUSINESS UNITS: ACML, Tristar, AME, Yellowline

SCOPE OF WORK: The widening and reconstruction of a 12-kilometre stretch of highway, from Eglinton Avenue/Highway 403 in Mississauga to north of Queen Street/ Highway 410 in Brampton

TIMING: September 2014 to November 2018

EMPLOYEES ON SITE AT PEAK: 140

SAFETY: 0 Lost Time Injuries (LTIs)

KEY AECON EMPLOYEES:

Brent McIntosh, Senior Contracts Manager
 Rob Covassin, Director, EHS, Transportation
 Shane Fuller, Senior Superintendent
 Angelo Cornacchia, Senior Superintendent
 Manuel Cota, Senior Paving Superintendent
 Trevor Yantha, Paving Superintendent
 Darrin Szczygiel, Assistant Superintendent
 Abed Mater, Superintendent
 Jim Redman, Project Coordinator
 Mitch Davis, Project Coordinator
 Darlene Halliday, Senior Project Administrator
 Anne Osborne, Project Administrator
 Jamie Borutski, Grading Foreman
 Fraser Phillips, Traffic Control Foreman
 Ron Haley, Sewer Foreman
 Jesse Hughes, Paving Foreman
 Joaquim Ramos, Structures Foreman
 Victor Freire, Structures Foreman
 Joao Araujo, Structures Foreman
 Joe Smith, Grademan
 Filipe Ferreira, Flatworks Foreman
 Abdalah El Tannoukhi, Project Manager, Tristar
 Adam Barroso, Project Coordinator, Tristar
 David Gray, Civil Foreman, Tristar
 Vincent Gaudet, Electrical Foreman, Tristar

QUANTITIES:

520,000 tonnes of asphalt
 686,000 tonnes of granular
 420,000 cubic metres of earth excavation
 180,000 cubic metres of rock excavation
 19,000 metres of new curb and gutters
 25,000 metres of concrete barrier/tall wall
 617 sewer structures
 15,000 metres of sewers
 900 metres of tunnelling
 31,000 metres of electrical conduit
 50 new overhead sign structures

LIGHTING THE WAY

TRISTAR ELECTRIC INC.

Aecon's Tristar Electric Inc. has gained international acclaim for its airport lighting installation techniques, but its service offering extends well beyond the runway.

Calgary International Airport



Tristar Electric's star has been known to shine brightly when it comes to innovative lighting installation solutions for today's busy international airports. But a recent merger with Aecon's AGI Traffic Technology (AGITT) has catapulted Tristar into a business now capable of a myriad of services, including intelligent transportation systems, roadway and high-mast highway lighting, and underground and overhead power distribution.

"In the airport industry, Tristar is an international name known throughout the world," says Tristar's General Manager Brian Farrell. "But we've also been very successful with our other services."

AIRFIELD ELECTRICAL WORK

Known as Tristar Airports under the Tristar Electric umbrella, the group's airport division is focused on critical runway guidance systems, which includes the development of new lighting installation techniques as part of that mandate. In essence, Tristar is capable of delivering any lighting typically found on an airport runway. Project scope includes navigational systems that consist of approach lighting, guidance signs, as well as elevated and flush to grade inset lighting, all of which are used to guide aircraft along the axis of the runway or taxiway.

"We concentrate on all lighting systems that get the aircraft to the runway, and from the runway onto the taxiways and to the terminal," explains Farrell. "It's anything and everything that's required to do that."

Some of Tristar's more high-profile airport projects, such as Toronto Pearson

International Airport and Ecuador's Quito International Airport, reflect the strength of Tristar's symbiotic relationship with Aecon and its business segment opportunities. For example, the Tristar team in charge of successfully completing Quito airport's airfield lighting work is now working on the Bermuda Airport Redevelopment Project.

Even so, Tristar's client base extends well beyond Aecon. One of its more unique and challenging projects of late has been an airfield rehabilitation program at Billy Bishop Toronto City Airport. Tasked with installing inset lighting on the runways while the airport remained fully operational, Tristar had to schedule all work – including concrete pours – to be carried out through a series of night shifts over the course of three months. What's more, the schedule called for all work to be completed each morning by 6 a.m. to allow for aircraft to be back on the runways and ready for takeoff. Tristar continues to work on this three-year project but has taken great pride in knowing they pulled off the initial three-month lighting installation stage with great success.

"Working for Tristar's airport division has truly been one of the most rewarding experiences for me," says Farrell. "I've been able to work with different people at many different airports, which all have their own needs. All airport operational rules are similar, but each airport has its own individual way of doing things. It's been a fun process trying to solve their unique challenges."

2016 SAFETY PERFORMANCE AWARDS

In September 2017, Tristar was recognized with two safety awards at the Utility Contractors Association of Ontario's annual convention. Tristar Airports and Traffic Technology each received the 2016 Safety Performance Award of Excellence for Lowest Accident Frequency Rate (for contractors with less than 100,000 hours).

"These awards demonstrate how the Tristar teams are deeply committed to getting their people home safely every day, while working in dynamic and complex environments in Canada and on international sites around the world," says Eric MacDonald, Senior Vice President, Aecon Utilities.



Runway lighting installation at Vancouver International Airport



ROADWAY AND HIGHWAY LIGHTING

The Traffic Technology division of Tristar Electric provides a customer-focused approach and specializes in everything from high-mast lighting and conventional lighting to street lights, traffic signals, pedestrian crosswalk signals, temporary traffic signals, underground conduits and wiring, duct bank work, electrical maintenance services and freeway traffic management systems (FTMS).

“One of the projects that we’re currently working on and are very proud of is Ontario’s 407 ETR,” notes Farrell of the Traffic Technology group. “We have been, and are, heavily involved with this project. We’re upgrading all the high-mast, high-pressure sodium lights to LED fixtures.”

In fact, the 407 ETR job currently classifies as the largest high-mast-to-LED conversion job for a highway authority in Canada.

“On this job, we’re responsible for all the electrical maintenance work on the 407 ETR,” says Farrell. “This includes very large geographic areas and all of the high-mast illumination, as well as the preventative maintenance around existing traffic signals and any emergency pole knock-downs.”

Leveraging solid relationships built on consistent, quality work is a big part of Tristar’s success. The Traffic Technology group’s roots run deep with the 407 ETR. As the former AGITT, its predecessor company, BFC Traffic Technologies, was responsible for all lighting work on the inaugural section of the electronic toll highway when the 407 ETR was originally

built in the 1990s. Today’s Traffic Technology group under the Tristar banner is a descendant of that company and continues to proudly foster innovative solutions in partnership with the 407 ETR.

POWER DISTRIBUTION

Tristar Electric’s power distribution segment is a separate entity and valuable service offering in its own right. This group installs the pole lines that distribute electricity to individual homes within entire neighbourhoods. The work in this sector represents another Tristar niche market and includes dedicated clients, such as Toronto Hydro and the City of Toronto, as well as several local distribution companies in Ontario. The general scope of work includes building new hydro pole lines to service residential and commercial spaces, setting up new distribution transformers – which are commonly found within close proximity to residences and function to lower voltage so that it can be used by household appliances and lighting – and rehabilitating existing areas with new hydro lines while transferring the power from the old systems to new ones.

“In addition to providing power to local residents and businesses, Tristar’s power distribution segment installs various SCADA (Supervisory Control And Data Acquisition) switching equipment to allow authorities to remotely control and monitor their distribution systems,” explains Director Chris Manielly.

One of Tristar’s largest contracts involves the implementation of full overhead distribution relocation for Aecon’s Eglinton Crosstown LRT Project.

Billy Bishop
Toronto City Airport

INTELLIGENT TRANSPORTATION SYSTEMS (ITS)

Intelligent transportation systems (ITS) enable users to be better informed and make safer and more coordinated use of transport networks. These advanced applications provide innovative services for different modes of transport and traffic management.

Reflecting its range and expertise, Tristar Electric can install an entire ITS from start to finish. Some of the group's most notable ITS projects include the Highway 7/vivaNext Rapidway in Markham and Richmond Hill and the Davis Drive Project in Newmarket.

"An intelligent transportation system involves a lot of components and hardware," explains Tristar's Operations Manager Nick Di Martino. "We are involved in everything from installing the underground infrastructure, piping, conduit and manholes to pulling in all of the fibre optic cables and installing all the intelligent switches and dynamic information displays."

The group has also been involved in setting up CCTV cameras and induction, or loop detectors, which are

electromagnetic detection systems used to detect traffic volumes and automatically send signals to the large displays commonly found on highways that inform drivers of the traffic ahead.

EXPANDING INTO THE FUTURE

While Tristar Electric's airport work is international in scope, the group's roadway lighting, power distribution and ITS work is primarily focused in Ontario.

"The airport work is our strength, but we are looking to expand the high-voltage and highway division internationally, as well as broaden it within Canada," notes Farrell.

The group has prepared several prequalification packages for power distribution work within Western Canada and is anticipating bidding on work within the provinces of Alberta, Manitoba and Saskatchewan in the coming years.

"We have a lot of experience within our group, and we have a lot to offer," says Farrell. "It makes it very rewarding to walk onto a project and be able to offer our expertise and be successful in achieving the end goal to make the customer happy. We really pride ourselves on what we've accomplished."

Bottom: Clamping in of a conductor that was installed during an overhead stringing operation for the Eglinton Crosstown LRT at Kennedy Road and Eglinton Avenue

Right: Traffic lighting rearrangements for the Eglinton Crosstown LRT – Fairbank Station at Dufferin Street and Eglinton Avenue



PROJECT FILE

TRISTAR ELECTRIC INC.

OFFICE LOCATIONS: Mississauga and Scarborough, Ontario

STARTED: 1983

RANGE OF SERVICES: Airfield electrical; intelligent transportation systems (ITS); roadway lighting; underground and overhead power distribution

NOTABLE PROJECTS: Eglinton Crosstown LRT project (overhead hydro distribution relocation); Bermuda Airport Redevelopment Project (airfield lighting); Highway 407 ETR (roadway lighting); Highway 7/vivaNext (ITS installation)

COVERAGE: Across Canada and internationally

KEY CLIENTS: Ontario Ministry of Transportation, 407 ETR Concession Company Limited, Union Gas, Toronto Hydro, Kingston Utilities, York Region Transit (YRT)

NUMBER OF EMPLOYEES: 160

KEY EMPLOYEES:

- Brian Farrell, General Manager
- Chris Manielly, Director
- Nick Di Martino, Operations Manager
- Jackie Gregorash, Business/Procurement Manager
- Pedro Sandoval, Project Engineer
- Paul Van Sydenborgh, Superintendent
- Lucy Jamison, Supply Chain/Procurement Manager
- Chad McDonald, EHS Advisor
- Domenic Spalvieri, Superintendent
- Tom O'Donoghue, Superintendent
- Steve Smith, Superintendent
- Mike Papais, Superintendent
- Frederick Oliver, Superintendent
- John Tomasi, Superintendent

REDEFINING INNOVATION

JOHN HART GENERATING STATION REPLACEMENT PROJECT

With its project completion date now in full view, the John Hart Generating Station Replacement Project has become a first-rate example of how innovation and ingenuity can reduce an environmental footprint.

60k

CUBIC METRES OF POWERHOUSE EXCAVATION

300k

CUBIC METRES OF ROCK EXCAVATION

57

COFFERDAM PILES

For almost seven decades, it functioned as one of Vancouver Island's most important power-generating facilities, but the original 126-megawatt John Hart Generating Station in Campbell River, British Columbia, was beginning to show its age. In order for it to keep delivering clean, reliable energy, withstand earthquakes and protect downstream fish habitats, the station needed a major overhaul.

The John Hart Generating Station Replacement Project began with a contract award in 2014, making it the first Public-Private Partnership (P3) hydroelectric construction project in Canada, and one of the largest on record. BC Hydro named SNC-Lavalin Inc. as the preferred general contractor and subsequently signed a contract with InPower BC (SNC-Lavalin). Aecon, in turn, joined SNC-Lavalin Inc. in a joint venture partnership (ASL-JV) to carry out the civil construction portion of the contract, which was notable for its innovative underground powerhouse to ensure the continued delivery of reliable energy while improving the facility's environmental footprint.

"With the help of our project partner SNC-Lavalin, our team was the only project proponent to come up with a design option that was different from the traditional layout of a surface powerhouse, yet still meet the needs of the client," explains ASL-JV Project Manager Scott Marshall.

AN INNOVATIVE APPROACH... OR TWO

The original John Hart hydroelectric facility operated above ground for many years on BC Hydro property in the middle of Elk Falls Provincial Park in mid-Vancouver Island. Given its setting, the facility was a necessary yet somewhat lamented infrastructure within an otherwise pristine landscape. Replacing it with a modern, underground powerhouse would improve the park and give BC Hydro an opportunity to bolster generating capacity to 132 MW.

With work beginning in 2014, the first portion of project scope focused on open-cut excavation to gain access to the portal face in the bedrock. Project crews switched to a drill-and-blast operation to

create the two tunnel portals needed to lead to the powerhouse and water passage tunnels. Over the course of 2017, crews have completed the underground powerhouse work by installing concrete placements and hydroelectric components.

Marshall says the ASL-JV project team has proved to be innovative in more ways than one.

"People often think that innovation only has to do with building something new," he notes. "We actually introduced other innovative approaches, such as using existing equipment for tasks other than their traditional use." At one point, Marshall explains, his crews enlisted the help of an excavator to erect formwork and place concrete – something it's not generally used for – so that the team could stay on schedule. "I thought it was unique to use standard equipment in different ways to move the job forward."

The innovation didn't stop there. The contract for this project also included the building of a new water bypass facility to provide flow continuity below the generating station and protect downstream fish habitats, since approximately 95 per cent of the Campbell River flows past the station.

Prior to construction, there was no water bypass facility at John Hart Generating Station. If one or more of the six generating units in the powerhouse were to go down, it could mean a delay up to 60 minutes long before recovering water flows arriving from the upstream John Hart Dam. As a result, the downstream river flow could be reduced, stranding fish or exposing salmon eggs in the gravel.

"One of the key design constraints on this project was to build a water bypass facility that would ensure that if any of the generating units go offline, the water flow into the river would not be interrupted," explains Marshall. "The purpose of the new bypass facility is to provide an almost instantaneous transfer of flow from the powerhouse units to the bypass system and the river."

To date, crews have completed the construction of the water bypass facility and all related tunnelling and excavation work.

Formwork and concrete placement at intake tunnels

"One of the key design constraints on this project was to build a water bypass facility that would ensure that if any of the generating units go offline, the water flow into the river would not be interrupted."

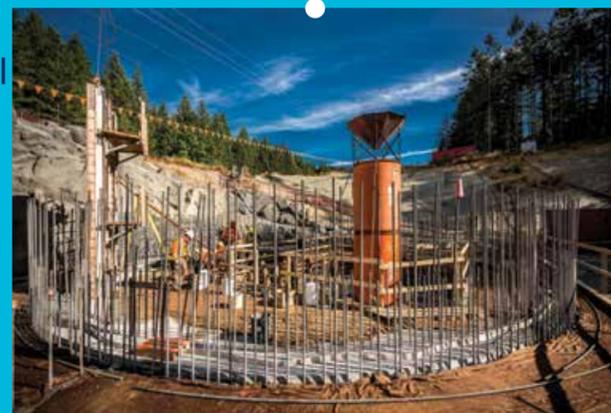
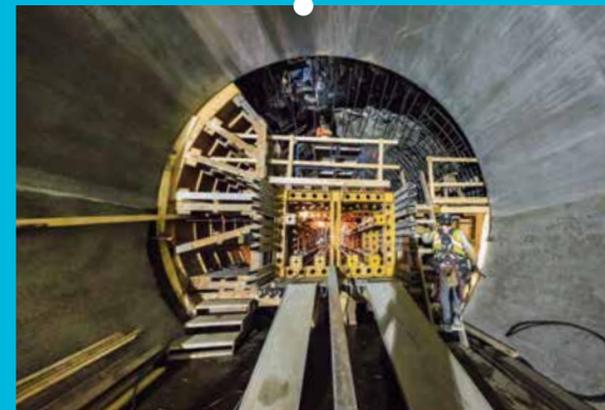
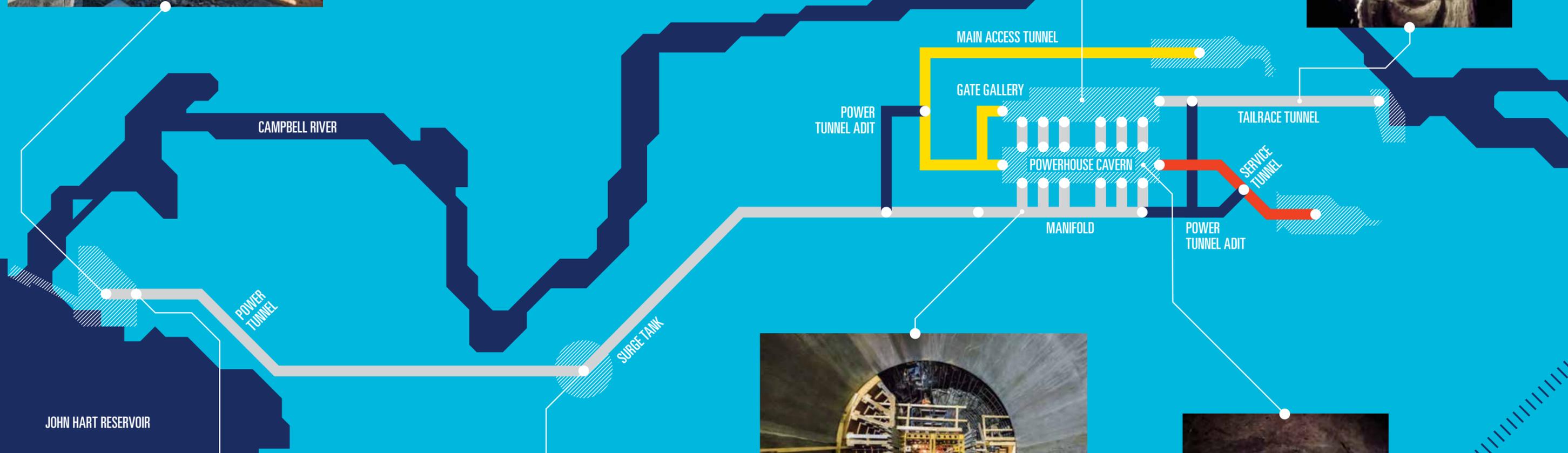
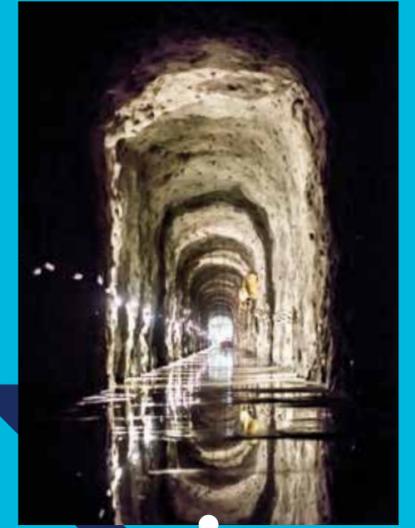
— Scott Marshall, ASL-JV Project Manager



PROJECT OVERVIEW

Hydroelectricity plants capture the energy of moving water to provide safe, clean, renewable energy with virtually no greenhouse gas emissions.

About 95 per cent of the Campbell River flows through the John Hart Generating Station. It has a capacity of 132 MW – enough electricity to power 80,000 homes.





One of the turbine/generator outlets leading into the surge chamber

GOING ABOVE AND BEYOND

The ASL-JV team, along with Hatfield Consultants, also took an innovative approach to meeting and exceeding the environmental standards initially established for this project. Starting in the planning stages, well before the crews broke ground three years ago, virtually every aspect of the replacement project has been viewed through an environmental lens. Given the project's provincial park location, that awareness has been further heightened, with project crews addressing everything from nesting barn swallows to endangered snails. At one point, they even had to build a new home for a colony of bats that were discovered living in the existing powerhouse. On several occasions, workers had to be mindful of the frogs that insisted on making their way down into the deepest section of the project's newly excavated tunnel.

The winter of 2016/2017 proved to be a particularly difficult one for the ASL-JV team, as they were met with especially harsh ice conditions and very high snowfall. The turbulent weather challenged the project's environmental management team to think on their feet to find successful ways to continue meeting all environmental standards during the snowfall – and the expected melt – while still ensuring construction progressed on schedule.

"It was absolutely one of the harshest winters we've had on the project," ASL-JV Executive Committee Chairman Greg Steels says. "But we anticipated it and knew we had to come up with a good solution."

To keep the workways clear of ice, the team came up with the idea of using fine gravel instead of salt and sand to spread over the roads. Typically, when the snow and ice start to melt, the salt and sand run off into the wetlands, harming the nearby habitat. Alternatively, using fine gravel to give the work roads traction allowed for construction work to progress according to schedule and mitigated any

further risks to the surrounding environment.

"Using salt to melt the snow can put a real strain on our water treatment facility," explains Steels. "If the runoff that flows into our treatment facility contains high levels of salt, we would need to treat and neutralize it with different chemicals before it's released back into the river, which can overload the facility. Sand is taxing, as well, because it creates turbidity in the water, or makes it cloudy, which is why, with the help of our aggregate supplier, we decided to use fine gravel instead."

Anticipating large amounts of meltwater, the crews prepared by cleaning out the tunnel entrance sumps and removing snow from the main construction site and high-traffic areas. Any water that did make it into the treatment facility was much easier to neutralize because it contained very low levels of sand and salt to begin with, ensuring the processed water was in pristine condition once it was released back into Campbell River.

AT JOURNEY'S END

The project team anticipates reaching substantial completion by December 2018. The final portion of the work entails the removal of the above-ground penstocks, two of the three surge towers, and the existing station. The commissioning of the powerhouse and all generating units must also be completed before the station can officially begin operating in October 2018.

"The constant collaboration between the production and environmental teams, as well as all the participation at the local level, really helped the morale of the job," notes Steels. "With everyone's input and hard work, we've really been able to come up with innovative solutions on the go and keep things on track until the very end."



2,730
TONNES OF REBAR

500
TONNES OF STRUCTURAL STEEL

45k
CUBIC METRES OF CONCRETE

15k
CUBIC METRES OF SHOTCRETE

Intake tunnel at the John Hart Dam

PROJECT FILE

JOHN HART GENERATING STATION REPLACEMENT PROJECT

CLIENT: BC Hydro

LOCATION: Campbell River, British Columbia

JOINT VENTURE: Aecon Constructors and SNC-Lavalin Constructors Pacific Inc. (60/40 ASL Joint Venture)

CONTRACT VALUE: \$225 million (Aecon's share)

AECON BUSINESS UNITS: Aecon Infrastructure (Heavy Civil)

SCOPE OF WORK:

- New water intake at existing John Hart Dam
- Replacement of three 1.8-kilometre, above-ground penstocks with a 2.1-kilometre tunnel
- New underground generating station
- New water bypass facility
- New tailrace outlet structure

TIMING: June 2014 to December 2018

EMPLOYEES ON SITE AT PEAK: 52 staff and 500 trade workers

KEY EMPLOYEES:

- Greg Steels, Executive Committee Chairman of the ASL Joint Venture
- Don Brophy, Senior Vice President
- Blair Brandon, Senior Vice President
- Scott Marshall, Project Manager
- Dale Mogielka, Quality Control Manager
- Frank Trauzzi, Business/Labour Relations Manager
- James Dow, Safety Manager
- Richard Tame, Construction Design Manager
- Nathalie Dinnissen, Project Engineer
- Drew Reicheld, General Superintendent
- Joe Hetherington, Superintendent
- Walter Boutilier, Superintendent
- Todd Ryan, Superintendent
- Bradley Chow, Project Coordinator
- Cesar Velez, Project Coordinator
- Francis Gonella, Project Coordinator
- Jerome Boucher, Project Coordinator
- Logan Schrum, Project Coordinator
- Rory Peters, Project Coordinator
- Noella Tarasoff, Senior Project Administrator
- Johnna Seccareccia, Nurse

QUANTITIES:

- 2,730 tonnes of rebar
- 60,000 cubic metres of powerhouse excavation
- 300,000 cubic metres of rock excavation
- 57 cofferdam piles
- 500 tonnes of structural steel
- 45,000 cubic metres of concrete
- 15,000 cubic metres of shotcrete

AT THE FINISH LINE

REGINA WASTEWATER TREATMENT PLANT

The largest Public-Private Partnership (P3) water project ever executed in Canada, the Regina Wastewater Treatment Plant Upgrade Project has delivered on new environmental standards for its city and accolades for the Aecon-partnered joint venture team responsible for constructing on time and under budget.

PROJECT TIMELINE

- JUN 2014** Excavation begins (early works)
- JUL 2014** Project agreement signed
- AUG 2014** EPCOR begins plant operations
- AUG 2014** Greenfield site excavations complete
- OCT 2014** Two tower cranes erected
- NOV 2014** Bioreactor base slabs complete
- MAR 2015** Grit Removal Tanks construction begins
- JUN 2015** Secondary Clarifiers construction begins
- NOV 2015** Grit Removal Tanks construction complete
- MAR 2016** UV system in service
- APR 2016** New BNR & Secondary Clarifiers begin operations
- AUG 2016** Secondary Clarifiers construction complete
- SEPT 2016** Digested Sludge Tank erected
- OCT 2016** Biogas System in service
- DEC 2016** Substantial completion

400k

CUBIC METRES OF EXCAVATION

1.8k

TONNES OF REINFORCING STEEL

3k

SAFETY MEETINGS

17k

CUBIC METRES OF CONCRETE

2.5

KILOMETRES OF UNDERGROUND DUCTING AND PIPING FOR NEW ELECTRICAL FEED

12k

METRES OF CABLE INSTALLED FOR MAIN ELECTRICAL SYSTEM



One of the plant's bioreactors and piping used for process air

It was a scenario that continues to play out in multiple major urban centres across the country: a growing populace putting unprecedented pressure on aging infrastructure. In this case, it was the City of Regina's wastewater treatment facility. For years, it had been approaching capacity limits in servicing an estimated 200,000 residents. The year was 2013, and the City was facing additional pressure from the provincial Saskatchewan Water Security Agency, which had invoked a deadline to introduce significant new wastewater effluent standards to protect public health and the environment.

Following extensive planning, analysis, discussion and debate, as well as a local referendum, the City turned to the Public-Private Partnership (P3) model to facilitate the substantial overhaul of its aging wastewater plant. A \$350-million P3 project proposal was tendered, and the project was subsequently awarded to

EPCOR Water Prairies Inc. in what became the largest water project then-tendered in Canada and the City of Regina's largest and most complex capital project to date. The consortium formed to carry out the work consisted of EPCOR Water Services, Aecon Water (Lockerbie Stanley), Graham Infrastructure and Stantec Inc.

A SOLID PARTNERSHIP

Construction on the Regina Wastewater Treatment Plant Upgrade Project got under way in June 2014. It was a first-time venture for Aecon Water (Lockerbie Stanley) working with Graham Infrastructure as part of the Graham-Lockerbie Stanley joint venture (GLS JV) project team. Graham took the lead on the civil elements while Aecon led the mechanical, electrical, instrumentation and programming portions of the work. It turned out to be an ideal partnership.

"I didn't really know what to expect going into it," says Jamie Abernethy, Aecon Water Project Director, "but we ended up developing really good relationships on site. I was impressed with what everyone was able to accomplish; so much in such a short amount of time. It really was a positive joint venture experience."

UNDER CONSTRUCTION

A solid JV working partnership is imperative when there's an immense amount of work to complete, and the GLS JV team had their hands full from the start. Work included the excavation of more than 375,000 cubic metres of soil (equivalent to 124 Olympic-size swimming pools), the pouring of more than 17,000 cubic metres of concrete, and the installation of more than 1,650 tonnes of reinforcing steel.



Lower level of blower building

“The main challenge was keeping the existing facility fully operational while making the upgrades,” notes Abernethy. “It required an intimate knowledge of both the current process and the upgraded process to avoid or mitigate shutdowns.”

And while the heavy construction was the most visible part of the project, the GLS JV team also upgraded the existing facilities and installed sophisticated technology, including new turbo blowers and fine air bubble diffusers. The purpose of the turbo blowers – which are equipped with magnetic bearings that make them frictionless due to magnetic levitation – is to support the high oxygen requirements, while the fine air bubble diffusers increase oxygen transfer efficiency to allow for a decreased footprint.

The work also included the installation of two prefabricated stainless steel tanks for a dissolved air flotation system, more than two kilometres of underground ducting for a new primary 25-kilovolt electrical feed, about 2.5 kilometres of underground piping up to 54 inches in diameter, and more than 40,000 weld and groove inches for the process piping.

TESTING, TESTING

In December 2016, two years after construction began, the GLS JV team reached substantial completion. With all new process systems in service, the project was proudly delivered on time and under budget. In fact, notes Abernethy, the construction portion was actually finished several months ahead of schedule.

“The original project duration was 30 months, which is something the owners didn’t believe could be done,” explains Abernethy, “but we did it; our crews did a fantastic job, which was a difficult task to achieve given the tight timelines.”

This last year – 2017 – has been all about the requisite commissioning of the new facility. This is a vital and often challenging aspect of any project, with equally demanding timelines and high

expectations. In the case of the newly upgraded Regina Wastewater Treatment Plant, all testing to date has been carried out while the plant has been fully operational, which is a challenge in itself, as conducting these tests calls for the water levels to reach extreme conditions.

“Every wastewater treatment facility is different,” explains Abernethy. “There are so many unique criteria that need to be taken into consideration. So far, our testing has been meeting all of the requirements, but we’ve been experiencing some challenges with the extreme conditions, which is why we’ve worked with Stantec to implement some changes.”

With tests conducted daily, the team has been able to collect a significant amount of data for engineering firm and project partner Stantec to input into a biodel, which, in turn, simulates treatment at those most extreme conditions to determine if the modifications are effective.

Commissioning continues with the aim to turn over the facility by the end of 2017.

MIND YOUR SURROUNDINGS

From an environmental perspective, the plant’s location and operating system dealt the crew several challenges throughout the project’s construction phase.

The original plant operated as a facultative lagoon system, with multiple lagoons attracting thousands of Canada geese every spring. During the first spring of construction, the crews didn’t anticipate the thousands of geese that would flock to the lagoons to nest. They had to enlist the help of partner Stantec and its environmental officials to carefully relocate the existing nests to a safer location before work could continue. With the benefit of knowledge and experience now on their side, the team proactively scheduled around nesting season the following spring and managed to successfully avoid project delays as a result.



Settling tanks used for primary sedimentation

REGINA WASTEWATER TREATMENT PLANT UPGRADE AWARDS

2014 WINNER:
C.W. Chuck Wills Award for Municipal Infrastructure, 2014 National Awards for Innovation and Excellence in Public-Private Partnerships



2015 RUNNER-UP:
P3 Award for Best Waste/Energy/Water project category, P3 Bulletin



2017 WINNER:
WCW Exceptional Municipal Water/Wastewater Project Award, Western Canada Water (WCW)





Another environmental consideration for the team was the plant's location adjacent to Wascana Creek, a stream that originates in the fields east of Regina, close to the village of Vibank, and travels southeast for approximately 45 kilometres before turning west again at Tyvan. Working alongside it called on the crews to comply with the local stormwater discharge requirements, including controlling and treating site runoff. The team followed a strict set of guidelines that helped to reduce pollutants in the stormwater runoff, including the implementation of a proper erosion and sediments control plan. The GLS JV team also installed an ultraviolet system at the plant to disinfect water before it enters Wascana Creek.

SAFER SYSTEMS

The City of Regina's newly upgraded wastewater treatment plant was built to sustain 30 years of growth. In this regard, its design is ahead of its time. Aside from the secondary treatment facilities that now include biological reactors and secondary clarifiers, sludge thickening, UV disinfection upgrades, and improvements to the existing anaerobic digesters and biogas systems, the plant also boasts a

refurbished grit removal system and implements the strictest approval requirements to protect both public health and the environment. This is done with the help of an upgraded SCADA (supervisory control and data acquisition) network, which has improved the overall automation of the plant.

"The upgraded SCADA network provides the operations staff with dial-out alarms, which is when a computer calls the on-call staff, allowing them to check the status of the plant simply by using their mobile devices," explains Abernethy.

In addition to this, the plant's new treatment solutions have the capacity to reduce nutrients that can damage the environment from re-entering the river and to improve conditions for all aquatic life in Wascana Creek and the Qu'Appelle River system.

Adds Abernethy: "The plant uses the modified 'Johannesburg' process for biological nutrient removal to meet the more stringent effluent requirements imposed by the regulatory bodies."

Finally, the new facility includes a wet weather flow treatment system used to temporarily store large storm flows that might overwhelm the plant's capacity.

Another one of the plant's bioreactors



AECON WATER: LEVERAGING JV EXPERIENCE FOR NEW OPPORTUNITIES

The value in a successful joint venture experience often extends beyond the project itself. The baseline established by Aecon Water and Graham in their inaugural GLS JV working partnership not only garnered industry accolades (see page 69) but also set the foundation for future work.

The Aecon-Graham JV team leveraged the knowledge and expertise gained on Regina's mega wastewater project to truly understand how to bid on – and subsequently win – a new project as a unified, proven consortium. The JV is now leading the Annacis Island Wastewater Treatment Plant Stage 5, Phase 1 Expansion Project in Delta, B.C., carrying out a similar scope of work that will see the facility increase its capacity and also meet seismic impact requirements. Construction began in May 2017, with an estimated completion date of April 2021.

PROJECT FILE

REGINA WASTEWATER TREATMENT PLANT UPGRADE PROJECT

CLIENT: EPCOR, for the City of Regina

LOCATION: Regina, Saskatchewan

CONTRACT VALUE: \$158 million

JOINT VENTURE PARTNERSHIP: Graham-Lockerbie Stanley JV (GLS) (Aecon Water and Graham Construction)

AECON BUSINESS UNITS: Aecon Water Infrastructure Inc.

SUMMARIZED SCOPE OF WORK:
- Conversion of a lagoon treatment plant into a new biological nutrient removal treatment facility
- Retrofit, refurbishment and new construction

TIMING: June 2014 to December 2016 (substantial completion)

EMPLOYEES ON SITE AT PEAK: 45 - 50 staff and 200 trades

KEY EMPLOYEES:
Glen Sinclair, Vice President, Aecon Water
Jamie Abernethy, Project Director
Bill Morrow, Senior Superintendent
Garry Germscheid, Construction Manager

QUANTITIES:
400,000 cubic metres of excavation
17,000 cubic metres of concrete
1,800 tonnes of reinforcing steel
2.5 kilometres of underground ducting for new electrical feed
2.5 kilometres of underground piping (up to 54-inch diameter)
3,300 safety meetings
12,000 metres of cable installed for main electrical system

UNDER

PRESSURE

PORT MANN MAIN WATER SUPPLY TUNNEL

Aecon cements its role as an innovative partner-of-choice in B.C.'s heavy civil sector with Vancouver's Port Mann Main Water Supply Tunnel — the region's ambitious response to the growing demand for fresh drinking water.

Interior of a Port Mann Main shaft



A formidable engineering project

located far beneath British Columbia's Fraser River, the Port Mann Water Supply Tunnel is a fitting example of what can be achieved when challenge meets innovation. The project – the first in a series of major water transmission system upgrades planned for the Metro Vancouver region – challenged its McNally-Aecon joint venture team early on with adverse riverbed soil conditions and the highest groundwater pressures ever observed in Canadian soft-ground tunnelling. The team attacked the problems with careful planning, innovative techniques and a comprehensive understanding of underground construction, resulting in the project successfully reaching substantial completion in January 2017.

"By working as a team, we were able to successfully complete this challenging project," says Frank Huber, Director, Major Projects, Management Systems & Utility Services, Metro Vancouver.

Originally built in 1974, the Port Mann Water Main is one of several key water supply links between Metro Vancouver's watersheds and the municipalities located south of the Fraser River. The region's ever-growing population and demand for clean drinking water spurred the construction of a new water main tunnel to double the supply capacity and provide enhanced earthquake and river erosion resiliency. The new tunnel is located 30 metres below the Fraser River bed (45 metres below the river's surface level) and completely replaces the old tunnel.

The key partnership bringing this project to fruition was the formal joint venture (JV) team of McNally Construction Inc. and Aecon Constructors (now called Aecon Major Projects West).

"We were truly an integrated JV," says Aecon Project Manager Andrew Rule. "McNally brought the tunnelling experience and we brought the heavy civil, concrete and piping experience; it was really one team that worked together on everything."

Aecon has worked with McNally in the past, so becoming one team on this joint venture was an easy task, says Rule. "They're a really great crew; excellent tunnellers, and they have the right people and experience."



Workers lowering TBM cutterhead down the shaft

26,000

CUBIC METRES OF CAST-IN-PLACE CONCRETE

1.6M

KILOGRAMS OF REINFORCING STEEL

41,000

CUBIC METRES OF EXCAVATION

1.5M

KILOGRAMS OF STEEL WATER PIPE

2016 TUNNELLING ASSOCIATION OF CANADA AWARD

Praised by the Tunnelling Association of Canada (TAC) for exceptional engineering skill, a comprehensive understanding of underground construction and an innovative approach to modern tunnelling, the Port Mann Water Supply Tunnel project was awarded TAC's Canadian Innovation Project of the Year Award in October 2016.

“The new Port Mann Water Supply Tunnel enables Metro Vancouver to meet peak demands for water long into the future and, at the same time, mitigates concerns about possible damage from earthquakes or high flows in the Fraser River.”

— Marilyn Towill, Director, Operations & Maintenance, Metro Vancouver

PROJECT OVERVIEW

It's safe to say the new Port Mann tunnel couldn't have happened without the help of "Squirrel." As is tradition in big tunnelling projects, the nickname affectionately assigned to the tunnel boring machine (TBM) on the Port Mann project delivered big time, despite its small-stature moniker. Squirrel was tasked with boring a 3.5-metre-diameter tunnel that ran from the south side of the Fraser River in Surrey, B.C., to Maquabeak Park in Coquitlam. Before Squirrel's work could begin, however, crews first needed to excavate and build two massive shafts on either side of the river.

Following the completion of the south shaft, Squirrel began to tunnel north, as crews installed the precast tunnel liner sections that would protect and support the 2.1-metre-diameter, welded-steel water pipe that would eventually carry drinking water to area residents.

In keeping with one of the stated objectives of the overall project, both the new shafts and tunnel are fully earthquake resistant to mitigate the risk of any future seismic damage causing a threat to the region's water supply.

BUILDING THE SHAFTS

The first phase of construction included excavating the 60-metre-deep south-side shaft. Because of its close proximity to the river and associated geology, crews spent a significant amount of time installing the slurry wall primary ground support and removing materials from the base of the shaft in preparation for pouring the concrete base. And since the bottom of the shaft was below water level, specialized divers were employed to work underwater to complete the task.

The next step was to strengthen the interior of the shaft with a reinforcement system consisting of rebar cages, which were first assembled on the surface and then lowered into the shaft. Crews would then fill the reinforcement area around the shaft walls with approximately 140 cubic metres per lift, totalling 2,200 cubic metres, of self-consolidating concrete. A unique product, self-consolidating concrete offers a "runnier consistency" that allows for flow around very heavily reinforced structures, and is able to set without the need for any mechanical vibration.

Crews used a large hopper to transport the concrete down the shaft and then place it through an opening in the form.

Construction of the north-side shaft began while Squirrel tunnelled underneath the Fraser River from the south shaft. With the north shaft excavated, the crews could then begin work on a similar reinforcement system found in the south shaft.

Deeper and smaller in diameter than its south-side counterpart, the north shaft required special consideration when it came to preparing for an anticipated future seismic event. The design called for the installation of an isolation layer between the slurry walls and the permanent lining. The isolation layer consists of a grey, plastic fabric called UHMW, or ultra-high molecular weight, and it functions as a slippery separation layer that prevents the slurry wall from making contact with the permanent lining, thereby decreasing the seismic loading on the permanent lining of the structure.

Like the south shaft, the north shaft also serves an additional purpose. After the TBM reached the north side and was hoisted out of the north shaft, crews used the top of the north shaft to construct a valve chamber that controls the flow of water to the other side of the river.

Interior view of tunnel from portal

TO THE RESCUE!

At one point during Squirrel's journey under the river, the TBM encountered mechanical problems in the excavation chamber, which is located at the front section of the machine. To fix the problem, crews needed access to it, which becomes a challenge when you're dealing with a massive machine...in a tunnel... under the water. The project team grappled with the conundrum and came up with a practical, innovative solution: they installed a large marine platform at the surface of the Fraser River directly above the TBM.

"After we installed the platform, we used in-ground cooling tubes to freeze the area around the head of the TBM so that we could gain entry into it and make repairs," explains Rule. "That was a pretty big challenge and very unique for this type of work."

In fact, not only was the installation of the marine platform not part of the original scope of work, it ended up being the stroke of brilliance that helped the joint venture team win the Tunnelling Association of Canada's (TAC) coveted Canadian Innovation Project of the Year award in 2016.



PREPPING FOR SQUIRREL

In November 2013, the first major milestone for the Port Mann Water Supply Tunnel project had been realized; the south shaft reached the end of construction and crews began preparing for tunnelling.

As work on the north shaft commenced on the opposite side of the river, the crews were also prepping to receive the first set of a very large order of precast concrete segments that would be used to line the tunnel deep below the Fraser River. It took a third-party company nearly one year to manufacture 6,000 of these individual sections, which, when assembled together, create the 1,000 ring segments that make up the interior liner of the one-kilometre-long tunnel.

Since the weight of the earth and groundwater above the tunnel is considerable, the thick concrete segments were built to withstand the extreme pressure far below ground, protecting both the workers in the tunnel during construction and the water supply pipe that would be installed within it.

Once the precast concrete tunnel liner was completed, an earthquake-resistant, welded-steel pipe was inserted inside. The annular space between the steel pipe and precast tunnel liner was backfilled with 2,300 cubic metres of cellular concrete.

SQUIRREL GETS TO WORK

In December 2013, the Port Mann Water Supply Tunnel south shaft job site was where Squirrel, the massive TBM, was lowered into the 50-metre-deep shaft to begin its boring duties far beneath the river's surface. It took a total of 30 days to lower Squirrel into the shaft and assemble it. Once boring commenced, Squirrel worked its way toward the north shaft at an average speed of 10 metres per day.

For the Port Mann project, it was crucial that Squirrel be an earth pressure balance (EPB) machine, designed to tackle both the high pressure associated with the tunnel's depth and the challenging geology under the Fraser River.

"The pressure from the weight of the water – and in our case, there was a lot of it – and the difficult geology required this particular type of tunnel boring machine be used," explains Rule. "It uses a technique that holds the water and earth pressure back using an internal screw conveyor system that allows the inside of the machine balance to remain at atmospheric pressure, which is why it's called 'earth pressure balance.'"

In fact, one of the greatest challenges of the project proved to be the ground conditions under the river. The water pressure was calculated as being the highest ever observed in Canadian soft-ground tunnelling. This, along with

the required and continuous maintenance of the TBM, meant that the first 100 metres of the tunnel took a few months to complete.

"It was a real geological challenge getting across the river," says Rule. "The riverbed was made up of a combination of clay, large boulders, sand and cobblestones, and then, to add to that, the water pressure was pushing the limits of existing technologies in North America."

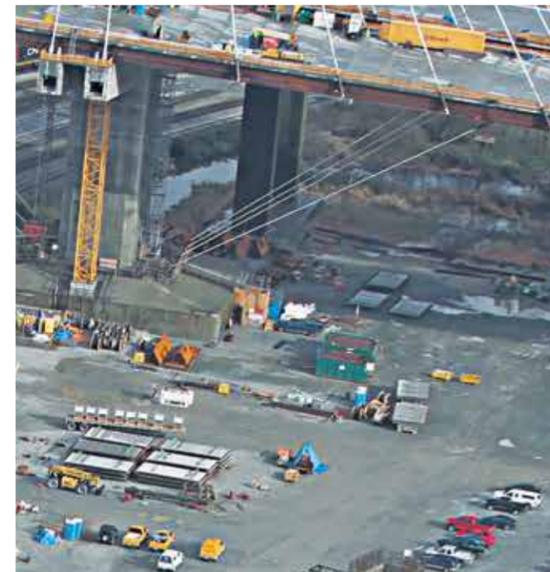
In order to keep Squirrel moving, a team of 15 to 20 people was required to be on hand at all times. The machine was operated by a crew of five people while other workers operated the locomotives and transported materials out of the tunnel and shaft.

Squirrel was equipped with two skins – outer and inner. Once it reached the north shaft at Maquabeak Park, Squirrel's forward and head sections, as well as its inner skin and all of the hydraulic rams, were removed from the shaft. The outer skin remained in the ground to form the permanent seal between the shaft and the tunnel.

Following 18 months of tunnelling, Squirrel dutifully completed its job. Upon removing the machine from the ground, workers were impressed to see the TBM had remained in reasonably good condition, which meant it could be refurbished for a future project and continue its lifecycle.



Pipe travelling within the tunnel



TRANSPORTING THE WATER

After completing the tunnelling portion of the massive project, crews began to install the lined steel pipe that would transport the region's drinking water. The steel pipe was made of nine metre-long segments welded together underground. After it was fitted into the tunnel, workers filled the 40-centimetre gap between the tunnel and the steel pipe with cellular concrete, which securely held the tunnel liners in place.

On December 17, 2016, the project's final milestone was achieved in a quiet Surrey, B.C., neighbourhood when the last piece of pipe was installed by Metro Vancouver's crews, linking the new tunnel to the existing drinking water network.

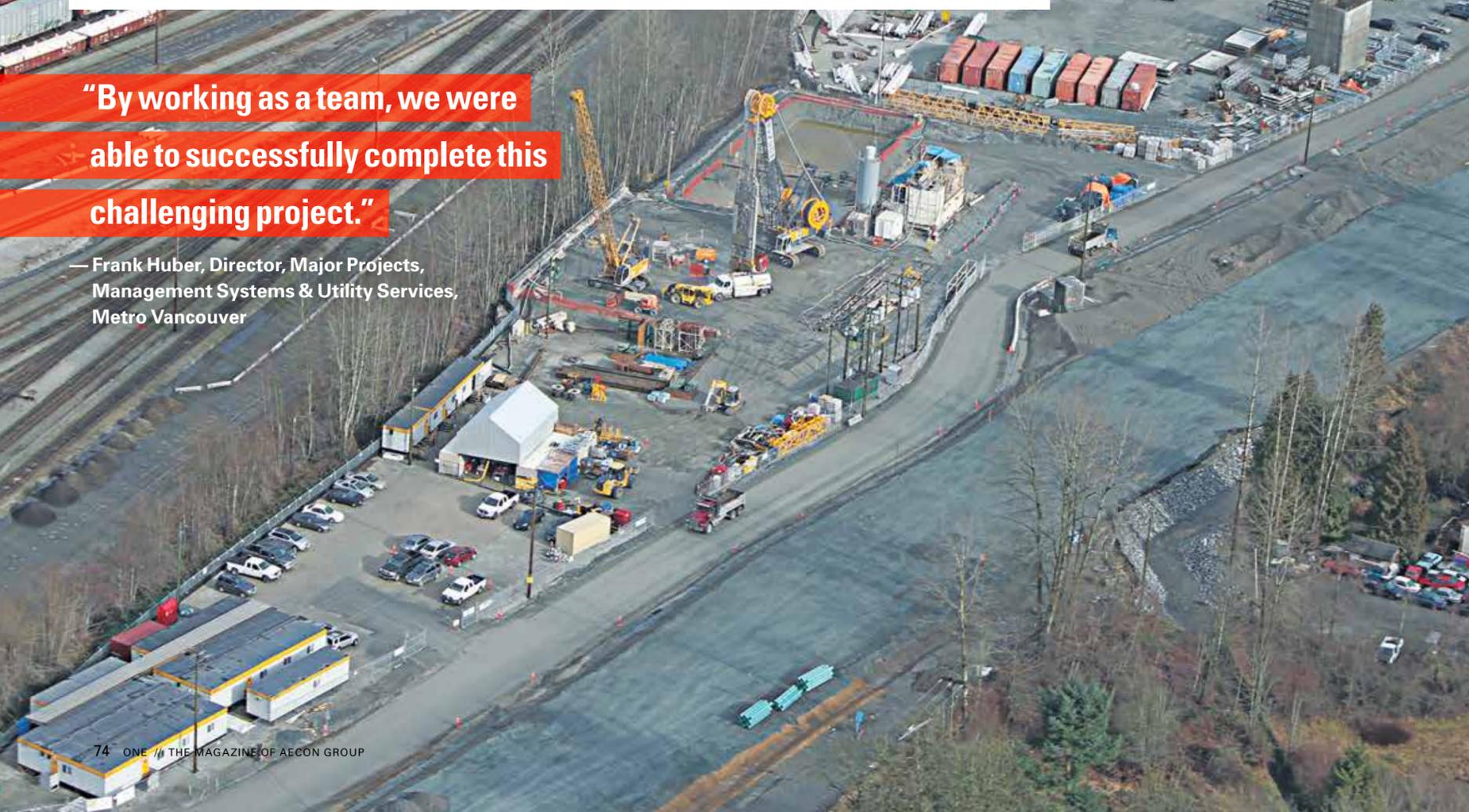
"The entire project was an engineering challenge that both the engineers and our crews had to face," says Rule. "We worked with very tight construction tolerances and numerous geological constraints. It was tough, but it turned out to be such an innovative and incredible job in the end."

OUT OF SIGHT, OUT OF MIND

Following project completion and extensive landscaping touches, the Port Mann Main Water Supply Tunnel is now fully functioning, delivering double the capacity of clean, safe drinking water from Metro Vancouver's reservoirs to Surrey and neighbouring communities south of the Fraser River.

"The new tunnel enables Metro Vancouver to meet peak demands for water long into the future and, at the same time, mitigates concerns about possible damage from earthquakes or high flows in the Fraser River," says Marilyn Towill, Director, Operations & Maintenance, Metro Vancouver.

Although so much of the work that went into this project is hidden deep beneath the ground, locked out of sight for those who live in the surrounding area, the project team and workers who invested many hours working on the new Port Mann Main Water Supply Tunnel will forever know what a magnificent feat of engineering, determination and hard work rests beneath the surface.



Port Mann Main Water Supply Project site

"By working as a team, we were able to successfully complete this challenging project."

— Frank Huber, Director, Major Projects, Management Systems & Utility Services, Metro Vancouver

PROJECT FILE

PORT MANN MAIN WATER SUPPLY TUNNEL PROJECT

CLIENT: Metro Vancouver

LOCATION: Vancouver, British Columbia

CONTRACT VALUE: \$170 million

TYPE OF CONTRACT: Lump Sum (Bid-Build)

JOINT VENTURE PARTNERSHIP: McNally Construction Inc. – Aecon Constructors (Construction Management provided by Hatch Infrastructure)

AECOM BUSINESS UNIT: Aecon Major Projects West

SUMMARIZED SCOPE OF WORK:

- Set-up of two shaft sites and sinking of two 60-metre-deep shafts (Coquitlam and Surrey)
- One-kilometre excavation of EPB (earth pressure balanced) tunnel with precast segmental lining under the Fraser River, from Surrey to Coquitlam
- Installation of welded-steel pipe lining
- Construction of two near-surface valve chambers

TIMING: Spring 2011 to January 2017

EMPLOYEES ON SITE AT PEAK: 70 - 80

KEY EMPLOYEES:

- Andrew Rule, Project Manager
- Mark Thompson, Project Controls Manager
- Steve Skelhorn, Tunnel Manager
- Sean Gamble, Tunnel Superintendent
- Arash Foadi, Civil Superintendent
- Brian McInnes, Planning & Engineering Manager
- Peter Lyon, Safety Manager
- Paul Babstock, Quality & Environmental Manager

QUANTITIES:

- 26,000 cubic metres of cast-in-place concrete
- 1,600,000 kilograms of reinforcing steel
- 41,000 cubic metres of excavation
- 1,497,000 kilograms of steel water pipe

BETWEEN THE LINES

By Mike Archambault
Senior Vice President,
Chief Safety Officer



Aecon has built much of the transportation infrastructure that spans our country, including highways, urban roadways and bridges. We're proud of this contribution to our nation and its connection to our employees, who rely on this critical infrastructure on a daily basis.

Whether the drive is part of a daily commute or to a required job site location, for our employees and contractors, each day can bring a new driving challenge. Some of these destinations can be remote, locations with little traffic along the way, while others require driving through bustling suburban and metropolitan areas and on some of the busiest highways across North America. Not only do our routes change, but so do the conditions and potential hazards, such as rain, ice, snow and proximity to the public.

Considering the size of Aecon's vehicle and equipment fleet, it's clear that Aecon employees are exposed to potential road hazards every single day.

We have approximately 1,100 pickup trucks and 170 dump trucks, as well as 1,200 additional pieces of equipment, including vans, trailers, hydrovac trucks, bucket trucks and service vehicles. Last year alone, these vehicles drove approximately 37 million kilometres.

To put that into perspective, this equates to:

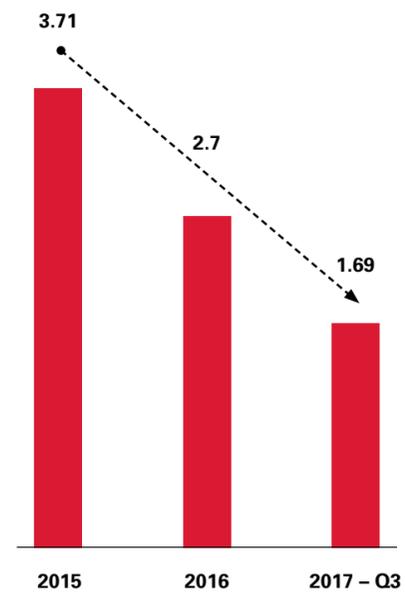
- Driving from St. John's, Newfoundland, to Vancouver, B.C., approximately 5,224 times
- Driving around the circumference of Earth approximately 925 times

As a result, Aecon relies on robust training and our employees to help operate our fleet in a safe and professional manner. Although everyone must pass certain testing standards to obtain a license to drive different classes of vehicles, does this mean that everyone is a safe driver? The answer is "no."

Consider this: Aecon measures the frequency of at-fault vehicle accidents per one million kilometres driven. This enables us to measure improvements made to the company's motor vehicle incident frequency.

In 2015, Aecon's at-fault frequency was 3.71 per one million kilometres driven. That same year, we introduced a comprehensive driver training program that addressed high-risk drivers and included both in-class and practical training. Some 1,400 employees participated in this program. By the end of the third quarter of 2017, Aecon's at-fault frequency had notably dropped, to 1.69 per one million kilometres.

AT-FAULT VEHICLE INCIDENT FREQUENCY FROM 2016 TO 2017 (END OF Q3)



Frequencies are per one million kilometres driven

Although these metrics are considered "trailing indicators," there is a correlation between training and a reduction in at-fault vehicle accidents.

This significant reduction highlights the basic principle that when best practices are followed every day, it's possible to reduce vehicle incidents.

Aecon's comprehensive driver training program focuses on basic principles that anyone can use to immediately reduce potential hazards and risks on the road. It's important to never become complacent or hold on to bad habits that may contribute to an incident when you're behind the wheel or in the passenger's seat.

With proper training and due diligence, such as the implementation of safe driving practices, we can all contribute to safer roadways and reduce our risk of at-fault incidents, no matter how remote our destinations or how busy our commutes.

REMEMBER TO ALWAYS IMPLEMENT SAFE DRIVING PRACTICES:

- Complete a circle check to ensure there are no immediate hazards around the vehicle before use.
- Always follow the speed limit and adjust speed to accommodate road and weather conditions.
- Remain focused on driving and avoid potential distractions, such as electronic devices.
- Always wear your seat belt.
- Keep a safe distance between your vehicle and others so you can avoid potential hazards or dangerous situations.
- Familiarize yourself with your travel route for long or non-routine travel.
- Keep an emergency kit in your vehicles – for yourself or to help someone else.
- Take breaks and rest accordingly during long trips.
- Always signal and let others know your intentions before changing lanes or turning.
- Check mirrors regularly and be aware of vehicles around you at all times.
- Slow down and watch for pedestrians in populated areas.
- Ensure your vehicle is properly maintained and safe for use on the road.
- Be ready for changing conditions, such as rain, snow, ice or fog.
- Be winter ready; consider snow tires, changing tire pressure with the temperature, the type of washer fluid in your vehicle, etc.
- If driving a rental car or other vehicle know how to control the lights, windshield wipers, etc.



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