
SPECIAL FEATURE
May 28, 2021
ROADBUILDING &
HEAVY EQUIPMENT
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Daily Commercial News
by ConstructConnect®

Fischer-Hallman Road widening a journey through the past

REGION OF WATERLOO

Wood archaeologist William Kearney screening soils for artifacts.

DAN O'REILLY
CORRESPONDENT

At a carefully staged road widening project in southwest Kitchener, Ont., a team of archaeologists and several Indigenous field liaison representatives are as critical to the project's success as truck drivers, heavy equipment operators and labourers.

The project is a planned three-kilometre-long, four-phase widening of Fischer-Hallman Road from Bleams Road south to Plains Road to meet traffic demands in that area.

But this is not a traditional, straight-forward road widening for Waterloo Region, consultant Associated Engineering, and Capital Paving, the first phase contractor.

Fischer-Hallman Road is the site of a massive and intensive archaeological study that has uncovered thousands of Indigenous artifacts, which are hundreds of years old and, in some cases, dating back more than three millennia. And the investigation is only at the half-way mark.

In 2016, an archaeological investigation on private property to the west, as part of an unrelated development, uncovered significant indigenous artifacts including evidence of a village site, says Waterloo Region project manager Justin Armstrong.

Archaeological assessments are required to be completed as part of developmental processes and, because the village site had been identified on the private lands, the region knew there was there was high potential the village site would also be within its property and that has now been confirmed, he says.

In May of last year Fischer-Hallman Road was closed from Bleams Road south to Seabrook Drive was closed so that Wood's archaeological assessment could be conducted undisturbed, he says.

More than 40,000 artifacts in east half of the road corridor were discovered and catalogued and are now being analyzed, says Barbara Slim, associate archaeologist with Wood Plc.

The consulting engineering firm conducted a top-tier Stage Four Assessment, a process which required excavating 800 one-square metres of soil and then sifting the soils through small meshes to recover any artifacts, she explains.

Some of the finds included pottery, clay smoking pipes, chipped stone drills, arrowheads, darts, knives, blades, and scrapers; faunal bone from deer, beaver, turtles, and fish; plus stone beads and bone jewelry. Most of the objects were connected with a Late Woodland Iroquoian village site which probably existed from approximately 1350 to 1600, says Slim.

"Amid several immovable soil 'features', our team discovered remnants of fire pits, refuse deposits and wooden posts used in traditional longhouse dwellings. Soil samples even led to the discovery of 600-year-old carbonized corn and beans."

Asked why a First Nations group would have lived in the area, Slim says the presence of a nearby creek would have been a very important resource area where people returned seasonally and eventually established a permanent settlement.

However, there is evidence that Indigenous peoples passed through the area more than 2,000 years before the village was established. Several projectile points dating to the Late Archaic period from approximately 1900 to 1500 BC were also discovered, says Slim.

Near the end of last year Wood received clearance from the Ministry of Heritage, Sport, Tourism and Culture Industries that the objects from the eastern portion of the right-of-way had been removed and shifted its investigation to the west side of the road corridor.

The site is fenced off and team of Wood archaeologists and field technicians are working with several Indigenous field liaison representatives who are monitoring the excavation, says Slim.

Constructing a road through a rich archaeological resource area has required a phased approach, says Waterloo Region's Justin Armstrong.

A twin box culvert was installed at Strasburg Creek to south between May to August of last year. Following the Ministry of Heritage's clearance for the eastern half of the right-of-way in November, the contractor installed two temporary lanes allowing the road to be partially reopened to traffic.

Then, in April, the contactor began the construction of a new roundabout at the intersection of Fischer-Hallman Road and Bleams Road. This is well away from the excavation work being carried out by Wood, he says.

The archaeological investigation is expected to be completed later this year and, once Heritage Ministry clearance is issued for the western half of the right-of-way, the road widening will commence, says Armstrong.

REGION OF WATERLOO

A decorated pottery shard.

Economic Snapshot

Electric vehicles: there are more on the road, but bumps ahead

John Clinkard

After posting double-digit percentage gains for the past eight consecutive years, sales of zero-emission vehicles (ZEVs) in Canada stalled in 2020 due to the impact of COVID-19 lockdowns. However, the decline in ZEV sales of -3.2% (from 56K to 54K) was relatively mild compared to the -25.7% drop in total vehicle sales excluding ZEVs. As a result, the share of total Canadian vehicle sales that were ZEVs increased from 2.9% in 2019 to 3.5% in 2020.

Global EV sales did not get COVID in 2020

So how do Canadian ZEV sales compare to other countries? In 2020, global sales of electric vehicles, made up of battery electric (BEVs) and plug-in hybrid electric vehicles (PHEVs), increased by +43% to 3.2 million units. This gain was driven by a +137% rise in European sales, followed by a +12% rise in Chinese sales and a +4% increase in U.S. sales. In Japan, sales of ZEVs declined by -28%.

The combination of a +43% y/y increase in electric vehicle purchases and a -17% drop in sales of vehicles with conventional internal combustion engines (ICEs) caused the global share of ZEV sales to increase from 2.5% in 2019 to a record high of 4.2% in 2020. Factors contributing to the surge in European sales included a variety of existing policy supports that were augmented by additional stimulus measures.

Almost all Canadian EV sales are in three provinces

From a regional perspective, as they have for the past eight years, over 95% of ZEV sales in Canada occurred in just three provinces. Although it is home to just 22% of Canadians, Quebec accounted for almost half of the country's ZEV sales. After more than doubling in 2019, sales of ZEVs in British Columbia retreated by -10.4% in 2020. However, despite this pullback, sales in the Pacific Province accounted for 28% of the national total.

Following a -40% drop in 2019, sales of ZEVs in Ontario rose from 9,800 to 10,500 (+7.7%) in 2020. However, despite this modest gain, the province with almost 40% of the country's population accounted for only 20% of total national electric vehicle sales.

Demand for EVs should strengthen in 2021 and 2022

After collapsing due to COVID-19 in the first half, sales of ZEVs briefly rebounded in the second half of 2020 fuelled in part by ultra-low interest rates and a solid recovery of employment. While the second wave of COVID-19 dampened sales late in 2020, they recovered early in 2021.

Going forward, stronger jobs growth, a vaccine-induced increase in consumer confidence, plus the incentives offered by the federal government, British Columbia, Nova Scotia, Quebec, and the Yukon territory will boost demand.

Also, the network of charging stations, which now total 6,160 across the country, increased by 22% over the past twelve months. This will partially allay EV drivers' fears of falling off the charging network.

Nevertheless, according to a recent KPMG survey, several factors are preventing potential buyers from choosing a ZEV. These include their relatively high cost, their limited (especially in the winter) driving range, the lack of a nationwide charging network and the potential cost to replace a vehicle's battery. Prices (before incentives) for the 17 brands of ZEVs in Canada range from a luxury-end high of $120,000 to a not so low $39,000 and average in the range of $40,000 to $50,000.

Scarcity of essential minerals may hobble EV production in the medium term

While, in the near term, demand for EVs appears quite strong, the same cannot be said for their supply. The global shortage of semiconductor chips has contributed to a significant slowdown in the manufacture of electronics and motor vehicles. Electric vehicles affected include Tesla, Ford, Mercedes Benz, and Nissan. Moreover, it is uncertain how long the chip shortage will dampen vehicle production.

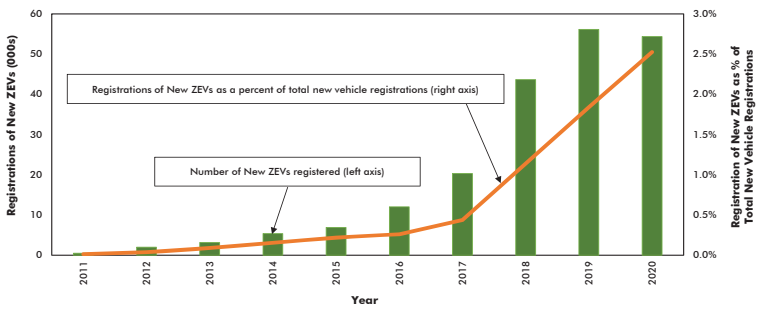
Regarding the longer-term outlook for EV supply, a recent newsletter produced by the International Energy Agency highlighted that electric vehicles use six times the mineral inputs of a conventional vehicle. Moreover, several of the key minerals used in ZEVs are available only from a small number of countries, some of which are likely to be unreliable suppliers.

While forecasts of future electric vehicle demand are highly speculative there is evidence that a 'heating up' has already contributed to higher prices for EV essential minerals. For example, over the past six months, the price of lithium (the major element in an EV battery) has increased from $7,616 Cdn/ton to $16,900 Cdn/ton. Also, over the past year, the price of copper has doubled and according to Trading Economics, it is expected to remain high since it is a key component in electric vehicles, in windfarms and in the expanding electricity grid.

While motor vehicle net zero carbon emissions by 2050 is a theoretical possibility, the shortcomings of the EVs currently available (i.e., high cost, a limited charging network and the Canadian climate) indicate that several high hurdles stand in the way of achieving such a goal.

John Clinkard has over 35 years' experience as an economist in international, national and regional research and analysis with leading financial institutions and media outlets in Canada.

Canada – Registrations of New Zero Emission Vehicles (ZEVs) – Total and % share of all vehicles



Data Source: Statistics Canada/Chart: ConstructConnect — CanaData.

constructconnect

83-year-old York Region bridge makes way for the future

DAN O'REILLY
CORRESPONDENT

Like the incalculable number of trains which have rumbled across it since it was erected in 1938, a single-lane Canadian Pacific bridge spanning Highway 27 between Royal York and Martin Grove roads in the City of Vaughan Ontario has come to the end of the line.

Or more specifically, the bridge on CP's MacTier subdivision rail line — which extends from Toronto to MacTier — has reached the end of its service life.

In a joint $24.9-million joint Region of York/CP undertaking, it will be demolished and replaced with two adjacent 37.5-metre-long north and south bridges. The general contractor is Soncin Construction and the design consultant is WSP.

More than the structural condition of 83-year-old bridge spelled its demise. Also at play was the need for long-term planning to accommodate future vehicular and rail growth, says Region of York project manager David Atkins.

"Both bridges will be long enough to span a future six-lane Highway 27, which is four lanes now."

CP will use the new north bridge only until such time as they twin the lines in this corridor and when that occurs the second rail line will use the south bridge, he explains.

Construction started in December 2019 and will continue until spring 2022. The north bridge will be placed in the exact same location of the existing one, while the south bridge has already been installed 7.5 metres away and is now carrying trains.

Both are through-plate steel girder bridges on concrete abutments.

"While trail movement has not been impeded, a number of selective weekend highway closures have and will be required," says York Region project manager David Atkins.

The region is the project lead. However, CP has been involved throughout the detailed design and construction stages and is conducting its own track work, he says.

Erecting two new bridges and demolishing the existing one on an active rail line with between eight to 10 trains daily, requires intensive planning, co-ordination, and sequencing, says Atkins.

In the summer of 2020, the contractor began the construction of abutments for the south bridge. Using a 600-tonne crane sub-contractor Niagara Rigging & Erecting Co Ltd. lifted the fabricated steel girders into place in December. It was an operation which required a weekend closure of Highway 27, he says.

North Bay Ontario-based Central Welding & Iron Works was the steel detailer/fabricator.

Work on the installation of 800-metre-long detour track to that south bridge by a CP crew had started in November and then stopped for the winter shutdown. In early April of this year CP returned to the site and completed the track commissioning (or switchover) overnight on April 26-27 and that necessitated a five-hour halt to rail traffic, says Atkins.

Demolition of the old bridge is scheduled for this August and, once it has been removed, construction of the new north (or main) bridge will get underway. Once that bridge is operational, train traffic will be reverted back to it. At this point, fabrication of the girders is about 25 per cent complete, says Atkins.

The need for a longer bridge was first identified in a 2011 environmental assessment study which examined future transportation requirements in the west half of the City of Vaughan. Planning for the demolition/replacement began in May 2014, with detailed design by WSP starting the following April, he says.

However, in the planning negotiation stage CP advocated for two bridges in anticipation of the time the rail line corridor will eventually be twinned, says Atkins.

"That (the expansion) will be very long term."

REGION OF YORK

The Highway 27 and CP rail bridge taken April 26, 2021, the day before train traffic was switched over onto the new south bridge.

REGION OF YORK

The Highway 27 and CP rail bridge taken May 6, 2020, shortly after construction started.

3D scan technology used in Ontario highway work

GRANT CAMERON
CORRESPONDENT

CONTROL SYSTEMS CA

A 3D scanning technology new to Canada was used to shave-and-pave stretches of highway in Sudbury, Ont. and Orangeville, Ont.

A new-to-Canada 3D scanning technology developed by a Czech company called Control Systems CA has been successfully used to shave-and-pave stretches of highway in the Sudbury and Orangeville areas.

The scanners provide a very precise, in-depth profile of a roadway to determine how far down asphalt needs to be removed. Only the necessary asphalt is stripped during the road rehabilitation process, thereby reducing the construction time and surplus materials on a project.

The process is quite technical but has the potential to reduce the amount of wasted materials, and slash construction time by 25 per cent which results in cost savings, and lower carbon emissions.

"Using advanced and very complicated computer processing we prepare an optimal digital design model for milling and paving," explains Vitek Obr, chief technology officer and business development manager at the firm, which specializes in laser scanning technologies for mining and construction.

"In this digital process we can identify all problematic areas and solve all problems before we start the milling. This process is very complicated but saves a lot of time in the field which is significantly more expensive."

Road rehabilitation in Canada often does not involve any type of scanning. Traditionally, milling machines are set to take off a fixed depth of asphalt. Control Systems CA uses Exact Street 3D differential milling which enables operators to use data to adjust the amount of asphalt to be removed.

The technology runs a scan that enables operators to see abnormalities in the pavement and issues like soft spots or areas where water pooling may be present. The data is automatically relayed to the operators.

The technology reduces milling depth in areas of a road that are already low, such as sunken culvert, ruts or potholes, and increases milling in higher points of the road.

According to Control Systems CA, the precise measurements enable pavers to improve the water drainage profile of roads, provide uniform asphalt depths, and lay down a smoother surface.

The technology is used to create a so-called "digital twin" of the road to be rehabilitated. The replica is essentially a very detailed digital model of the road surface. The models are uploaded to a differential milling unit computer which automatically controls the hydraulics of milling machines.

> "The milling machine knows exactly what the correct milling depth in any road location,"
>
> Vitek Obr
> Control Systems CA

The milling control does not require assistance from a surveying crew or specialist to guide the milling machines. It uses horizontal positioning data from a GPS to set the correct milling depth.

The milling machine "recognizes" the correct milling depth of any road location from the data of the GPS horizontal position, which ultimately results in less asphalt being transported for disposal.

"The milling machine knows exactly what the correct milling depth in any road location, based on GPS horizontal position data," explains Obr.

Three-dimensional milling is especially helpful for projects in remote locations, where recycled asphalt is in high demand, he says.

For example, a project could have its profile adjusted so that additional recycled asphalt is generated to increase nearby quarry stocks. Alternatively, for a project in a busy, urban centre where existing recycled asphalt stockpiles are significantly full, the model could be adjusted so that the resulting recycled asphalt production is limited.

Obr says the technology will make roads smoother, safer and more comfortable for driving on and also lead to roads that last longer.

"The road construction time and amount of excess milled materials will also be reduced, which will therefore result in fewer CO2 emissions from milling."

While each project is different, Obr notes that the technology can achieve more than 25 per cent savings on materials as a result of less milling.

"The milling operation is often taking place in full traffic and is dependent on its intensity as well as on the weather," says Obr. "The project manager often has to make quick decisions when and where to mill based on these factors. The Exact Street precalculated database of milling depths enables the milling to start and re-start anywhere as required without any extra preparations."

While there are several global players in the 3D scanning technology market, they are producers of surveying equipment and focus on selling hardware and not the entire process of milling.

In addition to the Canadian projects, the technology has been used on thoroughfare rehabilitations in Norway, Sweden, Finland and the Czech Republic.

In 2019, the technology was used on a seven-kilometre road rehabilitation in Orangeville and saved 46 per cent of the asphalt from going to the dump. Last summer, it was used on a five-kilometre stretch of Highway 17 near Sudbury and the project was finished days ahead of schedule.

Ontario's Ministry of Transportation has been working on new specifications for public road tenders that would require 3D milling on some thoroughfares which is a big step forward, according to Obr.

Meantime, the company is setting its sights on rehabilitating runways at airports. The runways could be milled using several machines at the same time. The technology was used at Stockholm International Airport in Sweden and also at the Prague International Airport in the Czech Republic.

CONTROL SYSTEMS CA

The use of 3D scanning technology can achieve 25 per cent savings on materials used for a road project thanks to less milling being required. Advocates also state that 3D milling is very helpful in remote locations.

CONTROL SYSTEMS CA

The use of 3D scanning tech ensures precise measurements resulting in improved water drainage profiles for roads.

Kingston's Third Crossing bridge begins to take shape

GRANT CAMERON
CORRESPONDENT

After 50-plus years of studies, the above-water form of the $180-million Third Crossing bridge over the Cataraqui River at Kingston is taking shape, with installation of massive concrete girders for the super structure now under way.

Ninety-five reinforced girders, manufactured by DECAST at a plant near Barrie, will support the bridge deck. At 180,000 pounds and over 150 feet long, they are some of the longest and heaviest concrete girders ever built for a transportation project in Ontario.

"We are at about the halfway point of the pier caps being constructed," says Mark Van Buren, deputy commissioner of the major projects office at the City of Kingston. "The west abutment was completed in late April, and the east abutment will be finalized before summer. That would conclude the sub-structure works."

Once completed, the new 1.2-kilometre bridge will connect the east and west sides of Kingston over the river. It is the largest transportation investment in the city's history.

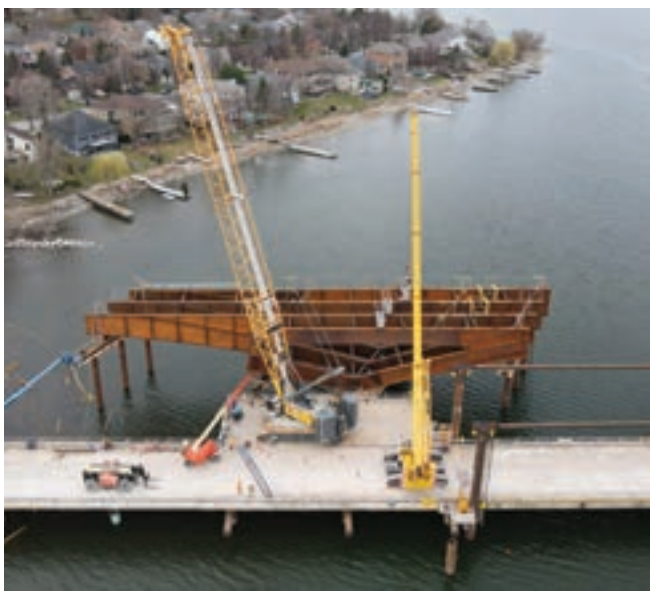
Crews began working on the in-water part of the project in June 2020. The bridge foundations and in-water piles were completed two months ago and installation of the concrete girders started in March.

To support the bridge, caissons have been cored into depths of over 40 metres to embed into solid gneiss bedrock.

The superstructure component was started in February. Concrete girder installation continues and the first of 48 pieces for steel erection for the main span started in mid-March. Some pre-cast concrete deck panels have been installed and component installations are moving along.

CITY OF KINGSTON

Kingston's 1.2-kilometre Third Crossing bridge is Canada's first bridge project to use the IPD (integrated project delivery) model. The $180-million bridge is the city's largest transportation investment in its history.



CITY OF KINGSTON

A temporary bridge was built to help the crew move equipment from shore to shore so permanent bridge construction can continue.

"It gets a bit windy and some crane picks were put on hold but are made up on subsequent good weather days," Van Buren says. "Deliveries of major components such as concrete girders, steel girders, deck panels, expansion joints, formwork materials, stormwater pipe, etcetera, continue to keep feeding the work."

> "The city is the first in Canada to use an Integrated Project Delivery model for building a bridge,"
>
> Mark Van Buren
> City of Kingston

Ironworkers, formworkers, labourers, crane operators and surveyors are working on site, just to name a few of the trades. Various types of cranes and heavy equipment, including excavators, dozers, rollers, loaders and telehandlers are also on hand.

As part of the project, a temporary bridge over the navigation channel was built and will remain in operation this year. The temporary bridge allows the team to move equipment from the east to the west shore in order to continue building the permanent bridge. The temporary bridge is in an "open position" allowing boaters to safely pass underneath with a minimum clearance of 6.7 metres.

Kiewit and Bauer Foundations recently won a Transportation Infrastructure Innovation Award from the Ontario Road Builders Association for the project. It acknowledges the team's use of innovative building techniques and methods, such as a lift bridge instead of a drill rig, and a rock causeway over the navigation channel.

The bridge is jointly funded by the Government of Canada, the Province of Ontario and the City of Kingston. The city is using an Integrated Project Delivery (IPD) model for the design and construction of the bridge. Kiewit is the contractor and Hatch and IBT SYSTRA are the designers.

Van Buren says the City of Kingston chose the IPD model to ensure the project was delivered on time and on budget.

"In this model the budget of $180 million is set and the city, contractor and designer work together to deliver the project within that budget. Together all partners share the risk and reward to deliver the best possible project. The city is the first in Canada to use an Integrated Project Delivery model for building a bridge."

The project is on budget and scheduled to be completed at the end of 2022. But it has had its share of challenges due to COVID-19.

"There were uncertainties with how the government would categorize the Third Crossing, but we kept working with the supply chain and vendors to put procedures in place that would permit continued work if we were deemed essential works," says Van Buren. "Fortunately, the Government of Ontario deemed the Third Crossing as essential and since all of our health and safety plans had COVID protocols, we were prepared in advance of the announcement and the project team was able to keep on schedule with minimal disruption."

A combination of buried and deep bedrock and low boat draft also created a challenge as the river was too shallow for a barge yet too deep and expensive to install a full trestle. The team engineered a causeway-trestle solution which provided a combination of rock causeway and steel trestle for a working platform to build the bridge.

The project is creating an economic benefit for the region, jobs for local trades and sales for local businesses. The city has worked with local unions and is purchasing local materials where possible.

So far, nearly $8 million has been paid for 70 local contracts. Crushed rock for the causeway and embankments, cast-in-place concrete for the caissons and upcoming deck pours, walls and abutments, and lumber for formwork are from local vendors.

The city is also doing presentations at schools to share stories from the design and construction sectors about the project.

CITY OF KINGSTON

The Third Crossing bridge will have 95 reinforced girders to help support the bridge deck. At 180,000 pounds and over 150 feet long, they are among the largest concrete girders used on an Ontario transportation project.