A NEW CONCRETE?

Cellulose nanocrystals could be the future of concrete
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Lower carbon building materials and processes are the future

The earth is getting hotter. It’s a fact. While most of the world’s political and industrial leaders put their heads together to find solutions to lower CO₂ emissions and reduce the affects of global warming, certain products and their manufacturing processes have been signalled out as having particularly harmful consequences for our environment.

Concrete is one of those products. According to a recent Washington State University article, traditional concrete production contributes between five and eight per cent of greenhouse gas emissions worldwide. Identified as a significant contributor of carbon dioxide, many steps have been taken in recent years by industry to reduce the building material’s carbon footprint.

Between increasingly stringent government regulations and economic and environmental advantages, concrete recycling has become a fairly common practice in most countries. As for new concrete, researchers and companies around the globe are hard at work looking for ways to reduce its carbon footprint.

At Purdue University, Jeffrey Youngblood, a professor of materials engineering, is researching how cellulose nanocrystals (CNCs), a nanomaterial extracted from wood fibre, could be used in the production of concrete for improving its stress resistance (for the full story, turn to page 12).

In the article he mentions how an increase in a concrete’s strength could translate into less concrete being required for some projects.

Since 4.3 trillion tonnes of concrete are used around the globe annually, according to Michael Goergen, vice-president of innovation for the U.S. Endowment for Forestry and Communities, even a small reduction in the amount of concrete consumed could result in significant reductions in CO₂ emissions.

In Richmond, B.C., Lafarge is currently constructing a new $20-million alternative fuel co-processing platform that will allow the company to use anywhere from 50 to 80 per cent low carbon fuel materials in its cement manufacturing process (for more on this story, turn to page 8).

The low carbon materials include construction and demolition waste, wood waste, non-recyclable plastics, and nylon fibres supplied from across B.C.

The new system will replace the plant’s 10-year-old low carbon fuel pilot plant that currently processes about 40,000 tonnes of low carbon fuel materials annually. Once complete, the $20-million system is expected to process approximately 100,000 tonnes of low carbon fuel materials annually.

That’s a lot of waste being diverted from landfills.

The Richmond plant also accepts drinking water treatment residuals from the Seymour Capilano Filtration Plant for use as a replacement of some of its red shale, a raw material used in the cement manufacturing process. This diverts a minimum of 10,000 tonnes of per year water treatment process residuals from being landfilled.

These examples of CO₂ reduction during the building materials manufacturing process are only two of many different solutions being researched and tested around the globe.

With the hard work currently being performed by companies, governments and researchers worldwide, hopefully, one day, these types of building materials will one day not be synonymous with greenhouse gas emissions.

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**Hillhead 2018 sets new attendance record**

According to the official figures, a record-breaking 19,687 unique visitors attended Hillhead 2018, surpassing the show’s previous highest attendance record set in 2005. This year also saw more exhibitors (527-plus) in attendance than ever before, many of them occupying newly created space in the enlarged Registration Pavilion.

"With clear blue skies, record crowds and all the majors from the plant and equipment world in attendance, business was buoyant and the atmosphere amongst the exhibitors and visitors was superb," said exhibition director Richard Bradbury.

"Another highlight of this year's show was the Man Engine, which proved to be a real crowd-puller."

As always, the showground, pavilions and various demonstration areas were packed with all the latest plant and equipment for the quarrying, aggregates, concrete, asphalt, recycling and construction sectors, many of the products on show for the first time in the U.K.

Among the multitude of impressive new product launches were the JCB 220X excavator, Volvo L260H wheel loader, Komatsu WA480-8 wheel loader, Powerscreen Trakpactor 550SR impactor, Keestrack H4e hybrid electric cone crusher, Sandvik QE343 screener and EvoQuip Colt 1000 scalping screen, to name just a few.

The next Hillhead show will take place in late June 2020. Further details and precise dates will be announced in due course. [www.hillhead.com](http://www.hillhead.com)

**LafargeHolcim acquires Tarrant Concrete**

LafargeHolcim has acquired Tarrant Concrete, a leading provider of ready-mix concrete in the Dallas/Fort Worth area in Texas.

"The acquisition of Tarrant Concrete follows our Strategy 2022 – ‘Building for Growth’ by capturing growth opportunities in our most attractive markets," stated Jan Jenisch, CEO of LafargeHolcim. "By being highly complementary to our existing business, Tarrant Concrete will allow us to expand our ability to serve customers in a high growth area of Texas. I very much welcome all employees of Tarrant Concrete to our company."

Tarrant Concrete operates three ready-mix concrete plants, supplying high-quality solutions to major construction projects. With net sales of more than USD 40 million and 90 employees, Tarrant is one of the leading local ready-mix concrete companies.

Over the past decade, the Dallas/Fort-Worth metropolitan area has been one of the fastest growing regions in the US with average annual population growth of 2.0 percent and 1.3 million new residents.

**NHES returning to Mississauga**

The National Heavy Equipment Show is getting ready for another edition, with dates being announced for March 28 and 29, 2019 at The International Centre in Mississauga.

Coming on the heels of its 20th anniversary in 2017, the biennial event features cutting-edge products and big machine displays from the leaders of the heavy equipment and construction industries.

"Planning for our 2019 edition is already well underway," said Mark Cusack, national show manager. "We saw over 13,000 attendees in 2017, and we anticipate the upcoming show to attract an even bigger and more diverse crowd."

Attendees and exhibitors can look forward to the following features in 2019: Rock to Road’s Top 10 under 40; Snow & Ice Removal; The Gravel Pit – a large display of working aggregate machinery; The Rental Pavilion – equipment, tools, and products for contractors & road building professionals; Safety Products – a focus on employee safety and worksite security; and The ‘Recruiting Here’ program – connecting job seekers with hiring companies.

The 2019 show website is now live at [www.NHES.ca](http://www.NHES.ca).
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At LafargeHolcim, sustainability is a serious issue. The global building materials manufacturing giant created the LafargeHolcim 2030 Sustainability Plan in support of UN “Sustainable Development Goals” for the planet. The company aims to use more than 60 million tonnes/year of waste-derived fuels by 2020.

In Canada, the company has been hard at work retrofitting its various plants across the country to help reduce their carbon footprints. One facility Lafarge has been particularly busy working on is the Richmond Cement Plant. This plant is particularly special for Lafarge.

“It was the first plant Lafarge built outside of Europe,” Stephanie Voysey, Lafarge’s environment and public affairs manager for B.C. points out during a tour of the Richmond plant.

Despite being 60 years old this year, the plant remains a busy facility, operating 24 hours a day in two 12-hour shifts with 95 employees.

“A little over one million tonnes of cement is produced per year [at the plant],” Voysey says.
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Ten years ago, Lafarge Canada started up a pilot project that allowed the Richmond plant to add low carbon fuel materials to its cement production. Over the past decade, construction and demolition waste, wood waste, non-recyclable plastics, and nylon fibres (from tire recycling) have been used to fuel the plant’s cement production. The system has an alternative fuel capacity of approximately 40,000 tonnes per year.

“In the past 10 years, Richmond has worked up to 26 per cent [low carbon fuel materials], but we’re kind of at a standstill,” Voysey says.

To increase the amount of low carbon fuel materials the plant can accept, Lafarge Canada is building a $20-million alternative fuel co-processing platform, with some of the financing paid for by climate innovation grants from the Federal Government’s Department of Natural Resources and the Government of B.C. The new system is currently under construction.

“The new system will take us to a 50-per-cent minimum [of low carbon fuel materials]… up to 75 or 80 per cent,” Voysey says. “We are working with the non-recyclable materials from Lower Mainland – not displacing recyclable materials.”

The new system is expected to process approximately 100,000 tonnes of low carbon fuels materials annually that was previously destined for landfills.

Highlights of the system include a large storage hall; a completely enclosed system; a belt conveyor feed to the precalciner system; a weigh feeder dosing system; and an advanced screening system; a quick offloading system of materials; a world class fire suppression and explosion protection system; and fireproof materials and waste segregation.

To ensure the plant has enough non-recyclable materials to fuel the new system, LafargeHolcim’s waste management subsidiary, Geocycle, has signed contracts with industrial companies and municipalities from various residential, industrial and commercial sources across B.C. to accept low carbon fuels such as non-recyclable plastics that were destined for landfills or export markets. The lower mainland is the main supplier of the low carbon fuel materials. Construction of the new system is expected to be complete in late 2018.

THE PROCESS
First, the proper proportions of silica, alumina, iron and lime are mixed together to create a raw mix and are milled. The raw mix is then processed through the preheater/precalciner tower and kiln to heat it to 1,450°C. The low carbon fuels are then added in the kiln’s precalciner and the kiln itself where flame temperature can reach close to 2,000°C. The precalciner can accept larger low carbon fuels particle sizes than the kiln (up to 1” minus, compared to 3/8” minus in the kiln); can handle some contamination from oversized materials and metal that gets through, as well as higher moisture content than in the kiln, where little moisture and no contamination are necessary. The low carbon fuels are pre-shredded and trucked to the plant in trailers, and are then transported via the belt conveyor feed system to the precalciner and via a pneumatic line to the kiln.

ADDITIONAL PROJECTS
Built in 1956, the plant has required various retrofit and reconstruction projects.
over the years to remain competitive and align with constantly changing federal, provincial and municipal environmental and safety legislation. One of largest upgrades at the plant took place in 1999, when the plant’s original two wet kilns were replaced with a preheater/precalciner kiln and a vertical raw mill (VRM) as part of a massive upgrade. The implementation of a VRM allowed the plant to significantly reduce its production of sulfur dioxide ($SO_2$). The plant currently emits less than 100 mg per cubic metre of $SO_2$ – well under the legal limit of 450 mg per cubic metre. Continuous emissions monitors are in place on the stack, and Lafarge Canada conducts quarterly compliance tests to ensure everything is working properly and in compliance.

In 2017, Lafarge Canada and Metro Vancouver signed a three-year agreement for Lafarge Canada to accept drinking water treatment residuals from the Seymour Capilano Filtration Plant for use in cement manufacturing. The agreement was for a minimum supply of 10,000 tonnes per year of residuals from the water treatment process, which are a combination of sediments and naturally occurring elements from the source water, and treatment chemicals. The residuals contain a chemical profile similar to red shale, one of the raw materials used in the cement manufacturing process. By using the residuals, less virgin raw material is mined, and the residuals are kept out of landfills. Much like Lafarge Canada’s low carbon fuel system, this agreement is a winning scenario for all parties involved, and the environment.
In labs across the world, cellulose nanocrystals are being tested as an additive to all types of things – inks, bioplastics and construction products, to name a few.

“There aren’t a lot of things you can say are low cost, sustainable, improve the properties of something, and work out of the box,” said Jeffrey Youngblood, a professor of materials engineering at Purdue University. “That’s the unique thing about this whole line of research.”

Cellulose nanocrystals (CNCs) are a nanomaterial extracted from wood fibre. Researchers have had their interests piqued by the small particles produced from trees that can drastically strengthen a product. According to Natural Resources Canada, a small amount of CNC added to a material can increases the...
resistance to stress threefold. So it makes sense that when mixed with cement, tests have shown a stronger concrete.

Youngblood first took an interest in CNC about a decade ago.

He was “trying to figure out what we could dump cellulose in” at school after a U.S. Forest Service researcher was preaching the benefits of CNCs when he had to mix up concrete to fix a fence post at home. When he was adding water to the sack of concrete he got at the local hardware store, a light bulb went off. He came back to the lab, and got working on tests, adding CNCs to cement to see what would happen.

“We could double three-day strength,” Youngblood said. “That’s not anything to sneeze at.”

The nanoparticles are small, significantly smaller than the cement particles, Youngblood said. So when they mix with the cement particles, they’re small enough that they absorb to the surface of the cement particles, strengthening the final product.

Cement is influenced by how well it cures, and cellulose nanocrystals and nano fibrillated cellulose (NFC) — a similar substance that has slightly longer particles — control the curing, preventing cracks and increasing the strength of concrete.

HUGE MARKET

“What I was really excited about was the market size of concrete,” said Michael Gergen, vice-president of innovation for the U.S. Endowment for Forestry and Communities Inc., who said 4.3 trillion tonnes of concrete are used worldwide each year. “If you’re going to displace something, it’s got to be inexpensive, perform better, or people are going to look at it and say, ‘Why am I going to change my processes?’”

Canada is one of the world leaders in manufacturing both cellulose nanocrystals and nano fibrillated cellulose, in part because of the availability of the raw materials: trees.

“People recognize we’re a world leader,” said Jean Hamel, vice-president of pulp, paper and bioproducts at FPInnovations, a Canadian not-for-profit that works with partners like CelluForce, which produces CNC. “The patent space is pretty busy right now.”

Because of the nature of the research being done, not much more could be said about what FPInnovations is doing with CelluForce, beyond confirming they are “interested in concrete” when it comes to working with CNC.

Gurminder Minhas, the Vancouver-based managing director of Performance BioFilaments Inc., said the Canadian company started their work into infusing concrete with nano fibrillated cellulose mid-2016, completed a second “much more extensive” study in November 2017, and are excited about the results.

The company uses the NFC instead of the CNC because the longer particles cost less.

“We don’t have as high of a surface area,” Minhas said. “But with that said, the ability for our material to hold water within the concrete is still quite high.”

Right now, mixtures being used in research at Purdue have shown a 25 per cent increase in strength, Youngblood said. An increase in strength means less concrete could be used to achieve the same result.

That’s exciting from an environmental standpoint because less concrete means fewer CO₂ emissions, Goegen said.

At an estimated future cost of US$6 to US$8 per pound, it’s a cost effective way for the construction companies to improve Cement is influenced by how well it cures, and cellulose nanocrystals and nano fibrillated cellulose control the curing, preventing cracks and increasing the strength of concrete. Photos courtesy of U.S. Endowment for Forestry and Communities Inc.
their environmental footprint he said – and potentially save money at the same time.

The CNC can also replace some of the plasticizers that sometimes go into concrete mixtures, and can cost up to US$32 per pound, increasing the economical argument for its use.

“If you’re reducing the amount of cement, as long as the nanocellulose is going to be cheaper, you’re going to get a win,” he said. “That’s the way I pitch it to [people]. The environmental side of this, which is my personal passion, is a side benefit. I pitch it as ‘Look, this helps your material be positioned better, it’s more cost effective – you get all these additional wins.’”

ENVIRONMENTALLY FRIENDLY

“There are certain jurisdictions that are saying you have to reduce your CO₂ emissions,” Goegen said, such as state transportation department, which have a hard time finding ways to reduce what they’re producing. “You’ll see these demands on people, and [this is] a ready made solution that is really simple.”

He said four per cent of the world’s CO₂ is from concrete production, so a reduction of 15 to 25 per cent in the volume of concrete needed, once mixed with CNC, could have a clear impact, even if it’s not used worldwide.

And future use of the materials in precast products, that are often trucked distances, could result in more CO₂ savings.

“In the precast market, where a lot of these pieces are built, if you can use less concrete there’s a secondary savings of the weight of these pieces in transporting them around, typically in diesel trucks,” Minhas said.

LOOKING AHEAD

There’s still work to be done in figuring out exactly what the right combination of additives for optimization is, Youngblood said. Researchers are still figuring out the intricacies of how CNCs work in concrete, and there are still unknowns, like how it’ll react with road salt or high sulphate ground water.

“Once we understand why, we can choose the nanocrystal and choose the right cement to optimize behaviour,” he said. Right now, there are an “infinite number” of combinations that could be tested.

Goergen estimates CNC infused concrete will be used in three years time in smaller projects by companies; he was involved in a July 2017 test pour that laid the foundation for a planned bridge this year in California.

County approval is the only thing left that has to happen for the precast bridge deck to be made and installed in northern California, planned for this summer.

“We’ll make it ahead of time at a precast concrete facility, which is great because we can really fine tune the mix, and watch performance,” Goergen said. “Then once it’s finished, we’ll actually truck it down there and install it.”

Minhas said there are plans to conduct field trials in Canada potentially as early as this summer, though they won’t be as large scale as the precast bridge deck. And they’ll be working with a concrete manufacturer to develop products that would meet various quality and strength needs.

“The cool thing about nanocellulose … is it’s unlike almost every other material known to man,” Youngblood said. “This stuff works out of the box. You pour it in, and it works. Everything else is really optimization.”
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Thanks to a new round of provincial funding, the City of Timmins will move ahead with the next phase of its highway reconstruction plan, however financial concerns continue to plague the long-term project.

Known at various points as Algonquin Boulevard and Riverside Drive, Highway 101 serves as a main thoroughfare for the city as well as a provincial highway. The 21.35-kilometre stretch features both two- and four-lane sections running through the city of Timmins and sees approximately 30,000 vehicles per day. In recent
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years, however, the road has fallen into disrepair; deteriorated culverts, cracked road surfaces, and potholes are common along the route.

In a 2016 AECOM report, the Highway 101 reconstruction project was estimated to cost $95.5 million over 10 years, however that figure has since risen to $120 million. Its core focus will be the replacement of aging culverts and damaged road surfaces as well as critical infrastructure underneath the highway, such as water and sewage systems. City officials also plan to widen the road’s shoulders and install streetlights in certain areas to accommodate pedestrians, remove an overpass that has fallen into disuse, design an alternate crossing for snowmobiles, level out flood-prone sections of the highway, and potentially install a median in one portion of the road.

Earlier this year, the Ministry of Transportation of Ontario (MTO) announced that it would provide the city of Timmins with $3 million to repair Highway 101 through the Connecting Links program, a fund that supports the renewal, rehabilitation and replacement of provincial highway and bridge infrastructure passing through a community or leading to a border crossing. The Connecting Links fund covers 352 kilometres of highway and 70 bridges in 77 municipalities throughout Ontario, with Timmins’ 21.35-kilometre stretch of Highway 101 being the longest Connecting Link in the province.

In addition to this year’s funding, Timmins also received $3 million through the Connecting Links program in 2016, the maximum amount available per project per year. The city was passed over in 2017, however Timmins chose to move ahead with its reconstruction plans, funding the project on its own due to the urgent need for repairs.

“What we’ve been doing over the past couple years is chipping away at the smaller phases with no services underneath the road,” explains Timmins Mayor Steve Black. “The main stretch of the highway, which goes through the downtown, urban part of the community, those phases are much higher in cost and we don’t see ourselves being able to do them with a maximum funding of $3 million in any year from the province; so we’re trying to patch things up there and hold off in hopes that the province will come out with a larger program to access for funding.”

So far, the City of Timmins has completed reconstruction on approximately 2.5 kilometres of the 21.35-kilometre stretch, Black says, in addition to installing streetlights along a portion of the road to improve pedestrian safety. This year, the mayor was pleased to hear that Timmins would receive its Connecting Links funding, however with the program’s funding cap still in place, Black worries that the city’s plans for reconstruction will continue to fall behind schedule.

“If the funding plans don’t change from the government then it’s going to be a significantly longer project,” he explains. “When you take a program that has a $3-million maximum… that obviously adds up to a lot more than 10 years.”

This is not the first time the Timmins leader has been vocal about Connecting Links funding. Though it was briefly halted in 2013, the program returned in 2015 after public outcry over a shortage in funding for such projects. At the time,
MTO dedicated $15 million to the fund, a sum that Black criticized as inadequate to cover the needs of rural and northern communities. Since then, Connecting Links’ overall budget has grown to $30 million. However, with a $3 million funding cap for individual projects still in place, Black and other city representatives are working to persuade MTO to increase the maximum amount of available funding to $6 million per project in order to tackle larger portions of the Highway 101 reconstruction.

“We've had some good discussions with the ministers over the last couple years of the importance of allowing us – because our Connecting Link is such a massive project and can't be done under the Connecting Links program alone – to allow us to tap into some of those other infrastructure programs and pool our money toward our critical priority project in this case,” says Black.

For now, MTO senior media liaison officer Bob Nichols confirms that the ministry routinely reviews its program criteria and the maximum amount of Connecting Links funding remains $3 million per project per year. With respect to Highway 101 in particular, Nichols writes: “We understand the city's connecting link plans include more than road rehabilitation. Items such as sewer and water and recreational trails are outside the scope of the existing connecting link program. We encourage the city to seek out potential funding programs offered by the provincial and/or federal government.”

The Timmins mayor is doing just that. For more expensive sections of the project, Black is working to tap into additional government funding programs. In addition to Connecting Links, the city has also applied for the Ontario Community Infrastructure Fund (OCIF), a fund that assists with the development and renewal of infrastructure in rural and northern communities.

“Ideally, from an economic standpoint, it would be nice to RFP out a larger portion of the Connecting Link, if not the entire Connecting Link, because we'd probably get better bang for our buck,” says Black.

A recent bilateral agreement between the federal government and the Province of Ontario could also assist the City of Timmins in completing Highway 101’s reconstruction. The agreement, signed earlier this year, is expected to provide Ontario with $11.8 billion in infrastructure funding over the next 10 years, including up to $250 million dedicated to infrastructure projects in rural and northern communities. On the heels of the provincial election, few specifics are available regarding the bilateral agreement, however the government of Ontario is expected to provide its federal counterpart with an infrastructure plan under the agreement by September 30. For now, Black is optimistic that the announcement will lead to additional funding opportunities.

“We're hoping that there'll be more money in that pot when it officially gets rolled out so that we'll be able to apply for larger sums of money in a single year so that we don't have to keep going in four- or five-million-dollar increments for this project,” he explains.

In the meantime, Black intends to use this year’s Connecting Links funding for road reconstruction between the Bruce Avenue Y and Legion Drive east of downtown Timmins as he continues to seek additional sources of funding for the project.
Montreal will spend nearly $6.4 billion on capital works projects over the next three years.

> The City of Montreal will spend nearly $6.4 billion on capital works projects over the next three years, with most of the funds going towards repairing and improving the spaghetti-like network of roads and bridges, and renovating aging water pipes and sewers.

About $4.2 billion – or 65 per cent of the funds – are being set aside for renovations of roads and water infrastructure.

The investments are aimed at eliminating the deficits in road maintenance over the next five years and in the maintenance of waterworks and the sewer system over the next 10 years.

The program provides for expenditures of about $2.1 billion in 2018, $2.2 billion in 2019 and $2.1 billion in 2020.

Funds for the capital works program for 2018 to 2020 are 40 per cent more than the $4.56 billion spent from 2015 to 2017.

Montreal Mayor Valérie Plante says the program sets out the priorities and new projects the city will focus on over the course of a three-year mandate.

“As you know, mobility and the quality of our water infrastructure sit atop our priorities,” Plante explained at a press
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conference. “We have set aside important budget items for these long-term projects. Montrealers deserve quality, sustainable infrastructure and planning ahead is always a lot cheaper than reacting to emergency works.”

The capital works budget covers a variety of projects and programs that the city plans to carry out or undertake over the next three years to improve the quality of life of citizens. However, the main focus is roads and underground water and sewer infrastructure. Proponents of the plan maintain the infrastructure investments were necessary to offset the deficit of past years and, further, to maintain the assets in good condition for the future.

Over the three years, $2.2 billion will be spent on the repair, redevelopment and reconstruction of road structures and $1.9 billion is earmarked for underground infrastructures like water pipes and sewers.

The rest of the money is being allocated to buildings, parks, green spaces and playing fields and other assets like office equipment and furnishings, vehicles, machinery and tools.

Over three years, approximately $417 million is included for road levelling and resurfacing programs, $299 million is allocated for repair of main traffic arteries, $164 million is set aside for road rehabilitation projects and $224 million is for repair of local roads.

The budget to upgrade and replace street lighting is set at about $91 million and $62 million is allocated for the repair of road structures to ensure their safety and continuity.

A 2.2-kilometre redevelopment of Saint-Catherine Street West at $95 million is the priciest road project on the books. It will be completed in two stages. The first stage is between Bleury and Mansfield streets and the second is between Mansfield Street and Atwater Avenue.

Nearly $73 million is earmarked for the reconstruction and rehabilitation of Pie-IX Boulevard. The project involves reconstruction of the roadway, along with sewers and watermains and sidewalks and the addition of 430 trees to make the area pleasant for pedestrians.

Another $61 million is set aside for the redevelopment of St.-Hubert Street between Bellechasse and Jean-Talon streets, which is a major commercial artery of the city. Underground sewers and watermains are outdated and in need of replacement. In addition to unearthing of the underground infrastructure, public areas will be developed and improved.

The Jacques-Bizard Bridge, which was built in 1966 and used by 30,000 vehicles a day, will be replaced at a cost of $29 million.

Of the money for underground infrastructure over three years, about $1.7 billion is for water infrastructure, including $537.4 million in 2018.

The biggest chunk, about $513 million, has been allocated for a secondary watermain and sewer network renovation program, while approximately $208 million is earmarked for an ozone wastewater disinfection project, and about $162 million is set aside for work operations on the Rockfield, William, Lavigne, Leduc and Saint-Thomas retention structures.

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The budget to upgrade and replace street lighting is set at about $91 million and $62 million is allocated for the repair of road structures to ensure their safety and continuity.

A 2.2-kilometre redevelopment of Saint-Catherine Street West at $95 million is the priciest road project on the books. It will be completed in two stages. The first stage is between Bleury and Mansfield streets and the second is between Mansfield Street and Atwater Avenue.

Nearly $73 million is earmarked for the reconstruction and rehabilitation of Pie-IX Boulevard. The project involves reconstruction of the roadway, along with sewers and watermains and sidewalks and the addition of 430 trees to make the area pleasant for pedestrians.

Another $61 million is set aside for the redevelopment of St.-Hubert Street between Bellechasse and Jean-Talon streets, which is a major commercial artery of the city. Underground sewers and watermains are outdated and in need of replacement. In addition to unearthing of the underground infrastructure, public areas will be developed and improved.

The Jacques-Bizard Bridge, which was built in 1966 and used by 30,000 vehicles a day, will be replaced at a cost of $29 million.

Of the money for underground infrastructure over three years, about $1.7 billion is for water infrastructure, including $537.4 million in 2018.

The biggest chunk, about $513 million, has been allocated for a secondary watermain and sewer network renovation program, while approximately $208 million is earmarked for an ozone wastewater disinfection project, and about $162 million is set aside for work operations on the Rockfield, William, Lavigne, Leduc and Saint-Thomas retention structures.

Moreover, says Gauthier, the city will continue to use glass-powder concrete for sidewalks, as this represents an ecological solution that is less expensive and as resistant as regular concrete. In 2018, about 10 pavement projects will include this kind of technology.

Gauthier says the city also adopted a new policy aimed at better co-ordinating work between Bell Canada, Hydro-Québec and Énergir when construction planning is being done.

The Insurance Bureau of Canada (IBC) welcomed the public works plan, and specifically the amounts allotted for repairs to underground infrastructure and spending on water and roads.

“The P&C insurance industry is pleased about the City of Montreal’s actions, which will certainly help reduce the number of claims and thus improve the quality of life of its citizens,” says Johanne Lamanque, vice-president, Quebec, at IBC. “Water damage has been the leading cause of claims in home insurance for the past 10 years. In Quebec alone, water damage accounts for the more than $500 million paid out every year in claims.”

The greater frequency of extreme weather events in recent years has exposed the weakness of the country’s infrastructure in certain areas, Lamanque noted, and breaks in municipal infrastructure are, in fact, responsible for 60 per cent of the water damage while 40 per cent is due, in part, to water seepage and broken pipes or sanitary installations inside homes.

However, a number of politicians on Montreal city council, including councilor Lionel Perez, leader of the official Opposition, weren’t happy with the plan. He said, after the public works budget was adopted, that Mayor Plante and her administration were too keen on spending when they should be cutting costs. The budget demonstrates that the current administration, “is one that is keen on spending and does not have the capacity to make hard choices to limit expenses,” he said.

All suburban mayors on the council voted against the capital works plan saying too many of their priorities were left out and the debt being taken on by the city is too high.
After the success of the Calgary event in February 2018, Rock to Road is bringing Quarry Tech coast to coast in 2019!

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Workers expect to come home safely from their jobs. What happens when they don't? How does society move forward from workplace fatalities? Are fines enough? Are any lessons learned when a company is convicted, pays a fine and carries on with its work in silence?

The Alberta Occupational Health and Safety Act has provided a means of alternative sentencing for over 15 years. Historically this meant that, as opposed to a straight fine where funds are directed to general revenue, funds can be diverted towards improving health and safety at worksites through an OHS 41.1 Order instead. OHS is regulatory law that is public welfare law.

For many years, employers and workers have been convicted under the OHS legislation. The question has been: What are we achieving from straight fines and are we achieving the intended outcomes from the creative sentences ordered? For corporations, denunciation and deterrence from repeating the offense are the guiding principles for sentencing. The missing link has been the restorative aspect of it. Workers benefit from safer workplaces – society has comfort in knowing there are laws to protect their
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children, brothers, sisters, mothers and fathers. These workers need jobs in safe and fair work environments.

In 2014, Alberta Justice reorganized the Specialized Prosecution Unit. Karen Hewitt, QC, a seasoned homicide crown prosecutor who had some past experience with OHS, joined the Specialized Prosecutions – OHS Regulatory Unit for a two-year secondment. Susan McRory, a retired Alberta Environmental Crown Prosecutor, now with McRory Law, joined forces to examine the Alberta OHS sentencing regime. After all these years, a historic case, R vs General Scrap Iron Metal Ltd., 2003, was re-examined. Here, Judge Watson invited the courts to consider a creative means to sentence corporations. Corporations have the ability to affect major change in culture through knowledge, improving safety and giving back to society as a whole. Justice Watson recognized the potential to affect positive change and the need for sentencing to have a restorative aspect for the convicted and it was identified that this could be accomplished through alternatives also referred to as creative sentencing.

Alternative sentencing is an opportunity to right the wrong, cure the cause and “remove the blemish.”

Adele Tait with Alberta Labour was designated as the investigation specialist and part of the role is to work with Alberta Justice to research and oversee creative/alternative sentence orders. OHS has the regulatory expertise to identify what was the cause, how the legislation was applied and the lack of due diligence that resulted in a conviction. In their collective pursuit of constructing meaningful sentences, the team of Hewitt, McRory and Tait assembled. The courts were open to explore this approach to sentencing corporations, “Ms. Hewitt, you are pushing on an open door (R vs CNIL Roofing 2008 Ltd., 2014).”

In 2015, the first case involving the aggregate industry resulted after a worker was injured in an asphalt hopper while an operator inadvertently dumped material on the worker who was inside trying to remove a jam. Hewitt engaged OHS and Tait to research this employer and the industry as a whole. As part of the alternative sentencing process, Tait examined historical compliance/injury trends for both the industry and the employer. The aggregate industry was identified as requiring further attention and was part of an OHS-focused industry initiative.

As Tait researched, it became apparent there were several safety-related associations involved in the aggregate industry but only one that consisted primarily of gravel crushing companies. These people know their industry. They work in it every day. This incident could result in a meaningful sentence where the lessons could be communicated through the association and could reach many gravel crushing operations to improve workplace safety and awareness. There was a need to bring these experts to the table to share the best of the best and give back to the industry, which needed a specific safety foundation and a solid place to start.

The company was convicted and the conditions of corporate probation were designed specifically to address the contributing factors and the needs of the industry. It was identified that many employers in this industry required some focused safety awareness, so the conditions included that employer contribute to the Alberta Sand and Gravel Association (ASGA) to build a safety toolkit that would be made available to their members for free. Ken Santo, the ASGA Safety Committee chair, was especially passionate about the safety toolkit and the opportunity to provide safe work practices to the industry and templates for smaller operations that may not have the means to develop programs from scratch.

OHS had a seat at the table, not to develop the tool kit, but to oversee the terms of probation and ensure the objectives were met. As the months progressed,
the ASGA health and safety committee focused on and solidified the framework for this toolkit. The best procedures were put forward, the proven ones, the ones that worked for those in the industry, the ones that were successfully implemented and enforced. The safeguarding issues were also tackled and identified as an industry-wide challenge. The ASGA safety committee recognized that improving the safety awareness overall was going to benefit the industry as a whole. Although an employer’s safety program is a competitive advantage, it’s not the written words that matter; translating the program from the written word into real safe work practices and enforcing them is how to create a culture of safety and is what truly matters.

In 2016, another gravel crushing operation was convicted for the fatality involving a 15-year-old worker who became entangled in an unguarded tail pulley on a conveyor. There is no happy ending to this story. It’s simply tragic from start to finish. What can we do? How can we serve justice? Again, Hewitt was seeking an effective but meaningful sentence. Tait started the research and could see there were at least three associations that delivered safety training components to the sand and gravel industry. Tait saw this as an opportunity to engage all three to put their resources together in efforts to prevent anything like this happening again. There was a key nexus that needed to be made to the fact there was the young worker involved in this incident. Safety in Schools Foundation of Canada (SIS) became involved in the process and proposed to join in to develop high school safety training using the circumstances of the incident called, “Tragedy in the Quarry.”

The Alberta Construction Safety Association (ACSA), in collaboration with Alberta Roadbuilders and Heavy Construction Association (ARHCA), ASGA, and Safety In Schools proposed to develop and deliver best practices, a youth safety campaign and safety training specific to the sand and gravel industry. This was submitted to the courts along with an additional recommendation to place the corporation on probation for two years. Some of the probation conditions included mandatory training, safety audits, and making a public acknowledgement about the incident. Together, as a joint submission, Hewitt along with defense counsel proposed the alternative sentence to the court. Judge Grieve accepted the joint submission noting “this is going to be a legacy for Christopher Lawrence”, the young man who lost his life.

In January 2018, the corporate representative gave a public acknowledgment speech at the ASGA annual meeting. The tragic story was shared. Stepping out from the cloud of shame came a very powerful moment for this employer. There are many employers out there who simply don’t know how to move forward. Sharing the story with peers was not easy; the anxiety of facing a crowd and sharing one of the darkest experiences was a painful release. Out of this darkness the core message was: this is what happened, this is how it happened, it’s the worst thing that can happen, this is how not to have it happen to you.

As a regulator, Tait has given many presentations, but none have ever had the impact like these public acknowledgments do.

These stories are as real as the tears that are shed while sharing them. These stories are meant to increase awareness by sharing the emotion and the hard lessons learned to initiate a change in behaviour and attitude towards safety. This is not about not doing the same thing over and over again, it’s about increasing the awareness to change how things are done to achieve a better outcome.

Lianne Lefsrud, assistant professor at the U of A Faculty of Engineering, is putting the scientific research behind this kind of sentencing: How it works and why it works.

The aggregate industry has had its share of incidents. There is an opportunity to change and recognize the hazards of this work and learn from past mistakes. It’s time to move forward, embrace the future, learn and improve. Through OHS creative sentencing, the light has been cast onto the path forward. It has provided an opportunity to step out of the darkness of tragedy, share, learn and increase the awareness throughout the industry. A special thanks to Karen Hewitt for having the vision to make the world a safer place, one aggregate at a time.

Adele Tait is an investigation specialist within the OHS & Mining Unit of Alberta Labour.
In a recent Ontario case, a concrete subcontractor hired to form and pour a concrete slab drove stakes into the aggregate base, below. The stakes punctured a storm water drainage pipe, which later backed up through the penetrations into the finished building. The owner sued the subcontractor for negligence but did not sue the contractor. Because the subtrade had no contract with the owner, the case provides a good example of when, and how, a contractor or subcontractor can be considered negligent in the performance of its work.

The owner believed the subcontractor had a duty of care to ensure that, in installing the stakes, it did not damage the owner’s property. It argued that the trade should have confirmed the location of the pipes below and should have not installed the stakes while there was a risk of damage.

In reviewing the law of negligence, the Court firstly confirmed that a duty of care will exist where it is reasonably foreseeable that a careless act could result in injury or damage. The Court also, however, confirmed that the duty of care can be limited or eliminated by certain factors. It held:

“Conduct is negligent if it creates an objectively unreasonable risk of harm. To avoid liability, a defendant must exercise the standard of care that would be expected of an ordinary, reasonable and prudent party in the same circumstances. The measure of what is reasonable depends on the facts of each case, including the likelihood of a known or foreseeable harm, the gravity of that harm, and the burden or cost which would be incurred to prevent the injury”.

In addressing whether or not the trade was negligent, the Court held that the failure of the contractor to advise that there were shallow pipes located underneath the proposed concrete floor would not excuse the trade if there were other factors which should have alerted the trade to the possibility. After an eight-day trial involving a number of experts, the Court decided that the trade did reasonably assume that the underground works would be below the aggregate, that there were no indications otherwise. The action against the trade was dismissed.

The owner appealed and the Court of Appeal agreed with the trial judge. It held:

“Although contractual duties may, in some circumstances, modify the standard of care that would otherwise apply, the trial judge’s findings precluded such a finding in this case… The trial judge found that the respondent should have been aware that a pipe ran underneath its formwork, but he accepted expert evidence that the respondent had no reason to foresee that the pipe would be at a shallow depth… He accepted expert evidence proffered by the respondent that there was no reason not to put a stake in the ground at the location it did.”

The case, Mabe Canada Inc. v. United Floor Ltd., 2016 ONSC 1060 (Ont S.C.J.), affirmed at 2017 ONCA 879 (CanLII), provides a good example of how, in law, we can cause damage without necessarily being liable for it. Whether or not we are liable in contract will depend on the contract. Whether or not we are liable for negligence will depend on whether or not we breach “the standard of care that would be expected of an ordinary, reasonable and prudent party in the same circumstances.” This, in turn, will depend in part on whether or not the damage is reasonably foreseeable.

For Ontario readers, we note that Ontario’s Construction Lien Act became the Construction Act on July 1, 2018. Changes to lien timelines and the payment of holdback, among many others, came into force on that date. Whether or not the changes impact particular improvements will depend on a number of factors set out in the transition provisions of the new legislation. For more information on these changes, please see our blog at www.kennaley.ca.

Robert Kennaley has a background in construction and is now the principal of Kennaley Construction Law, a law firm with offices in Simcoe, Toronto and Barrie, Ont.

He speaks and writes regularly on construction law issues and can be reached for comment at rjk@kennaley.ca. This material is for information purposes and is not intended to provide legal advice in relation to any particular fact situation. Readers who have concerns about any particular circumstance are encouraged to seek independent legal advice in that regard.
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John Deere and Hitachi have been collaborating together for a long time. The two companies celebrated the 30th anniversary of the Deere-Hitachi Construction Machinery Corporation at its Kernersville, N.C. factory last week.

John Deere and Hitachi have actually been collaborating since the 1960s – and signed an OEM supply agreement for excavators in 1983 – but it was in 1988 that the two companies officially established the Deere-Hitachi joint venture and the Kernersville factory. The facility is 145 acres in size (1,338,168 sq. ft.) and employs more than 800 people. The models manufactured there include the 13- to 47-metric ton excavator models for Deere and Hitachi. The first model ever built there was the 200LC excavator.

Jonathan Chase, president of Deere-Hitachi Construction
Machinery Corporation, discussed the long-running joint venture during a tour of the Kernersville, N.C. facility on May 17.

“The 30-year Deere-Hitachi partnership is unlike any other joint venture in the industry, and is a testament to the longstanding mutual respect and dedication of our teams,” Chase said. “Combining the strength of Hitachi’s world-leading hydraulic excavator technology with the resources and might of the 180-year-old John Deere brand, the alliance produces excavators for the world’s best customers.”

Chase discussed how John Deere and Hitachi coming together have brought out the best of both companies for their North, Central and South American operations (the two companies operate as entirely separate entities in the rest of the world). John Deere brings its strong customer support, parts distribution network, and more localized engineering teams to fill the needs of the companies’ customers in the Americas, while Hitachi brings its global excavator leadership and a global footprint to the joint venture.

Today, 10 models of the two brands are manufactured at the Kernersville factory. John Deere and Hitachi dealers across the Americas have the option of selling John Deere branded excavators, Hitachi branded excavators, or both.

“We’re partnered to give choice to the customers,” Chase told the press.

**NEW PRODUCT OFFERINGS**

During the 30th anniversary festivities, members of the trade press were offered a chance to get up close and personal with several of the companies recently released excavators, including the new 345G LC, 350 LC and Zaxis 300 LC. There was also an opportunity to pilot one of Kespry’s latest drone models. Kespry and John Deere announced a strategic alliance during CONEXPO-CON/AGG in March 2017.

Deere-Hitachi also discussed its grade guidance feature for excavators and updates to G-Series models. The grade guidance system will be available on the 13- to 47-ton 210G LC, 350G LC and 470G LC models in the next year. They will have 2D reference or 3D design surface options. The system was developed in cooperation with Topcon, and is integrated with JD link so telematics data can be pulled from the machines. The system is fully supported by the Deere-Hitachi dealer network.

“Customers want to manage grade from inside the cab, quickly and accurately on precision excavation projects,” said Jonathan Spendlove, excavator product marketing manager, John Deere Construction & Forestry. “Integrated grade guidance on the 210G LC comes ready for the customer to put it to work, is fully supported by their John Deere dealer, and will enable them to rapidly achieve final grade using only the display in the operator’s station.”

John Deere WorkSight’s Andrew Kahler presented on how WorkSight can help customers with operational pain points, like downtime, skilled operators shortages, tight margins and schedules, managing cash flow, machine utilization and asset tracking.

“It’s very much about efficiency, making sure they hit their deadlines,” Kahler said, adding that their dealer network plays a key role in helping customers find solutions that work for them. “We’re really focused on productivity solutions for our machines. We’re enabling our dealers to be the one-stop shop for our customers.”

The Kernersville location is one of three Deere-Hitachi joint venture companies established. The other two are the Deere-Hitachi Specialty Products facility in Langley, B.C. established in 1998; and Deere-Hitachi Máquinas de Construção do Brasil S.A. (DHB) in Indaiatuba, São Paulo, Brazil established in 2011.
new products

Cone crusher for high-tonnage applications

Telsmith has designed and engineered a 900-horsepower cone crusher solution for aggregate and mining operations. The T900 provides all of the benefits of the Telsmith T-Series cone crusher product line, but with increased volume capacities, making it ideal for high tonnage production in tough hard rock mining and aggregate operations.

T900 offers up to a 15-inch feed size and can be placed in the secondary and tertiary position in the circuit. With a capacity throughput range from 500 to 2,134 mtph and largest in-class clearing stroke 254mm (10.0”), the T900 is the perfect fit for processing material for ball mill feed in mining applications or crushing and sizing material in aggregate operations.

Safety and uptime have been engineered into the T900 Cone Crusher by adding large clearing circuits that are designed to safely and quickly allow uncrushable materials to pass, avoiding costly damage and associated downtime for repairs. The patented anti-spin feature prevents head spin to help extend manganese service life. Like other key components, it’s mounted on top of the machine for safe, top-service access.

The T900 also includes Telsmith Inc. patented hybrid bearing technology that provides the ability to crush at lower horsepower from improved lift that helps carry the crushing forces when compared to roller bearing machines. Engineered to hold up to tough, abrasive aggregate and mining processes, the T-Series cones with hybrid bearings that deliver tested productivity, safety, and ease of maintenance with maximum uptime.

The T900’s anti-spin operates with pressure lubrication oil, eliminating the need for a gearbox, separate hydraulic circuit, and associated maintenance. The use of a single bowl for all liners over its range of operation helps reduce downtime and inventory costs while allowing optimum versatility, flexibility, and efficiency in any aggregate application. www.telsmith.com

TeleStacker Conveyor upgrades

Superior Industries recently unveiled new technology that allows its TeleStacker Conveyor to maintain level movement while in radial travel mode. Known as FD Auto Level Technology, this patent-pending system makes the manufacturer’s automated telescopic radial stacking conveyors to maintain conveyor structure. As a result, the TeleStacker Conveyors belt is less prone to mistracking. According to Superior Industries, uneven conveyor structure is one of the leading causes of inaccurate belt tracking.

Auto level technology is standard on all FD Axle model TeleStacker Conveyors equipped with PilePro Automation. Superior manufactures FD Axle models in lengths of 110 feet (33.5m), 130 feet (39.6m), 136 feet (41.5m), 150 feet (45.7m) and 158 feet (48.0m).

www.superior-ind.com

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EVENTS

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www.roadbuilders.bc.ca

> September 26-28  
SC&RA Crane & Rigging Workshop  
Louisville, Ky.  
www.scranet.org

> November 26-28  
CCA Fall Board Meeting  
Ottawa, Ont.  
www.cca-acc.com

> November 29  
Fort McMurray ASGA Lunch  
Fort McMurray, Alta.  
www.asga.ab.ca

> December 6  
Calgary ASGA Breakfast  
Calgary, Alta.  
www.asga.ab.ca

> December 6-8  
BRCB AGM  
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Good infrastructure is that which delivers the best life-cycle value to those who depend on it and those who have to pay for it. Good infrastructure can only be accomplished by sound planning and consistent investment, both in the context of new construction and in support of maintenance and refurbishment. This is true regardless of whether we are talking about clean water supply, wastewater treatment, transit, or, of greater interest to readers of this publication, roads and bridges.

A few years back, Ontario’s infrastructure deficit was estimated to be in the neighbourhood of $100 billion as a result of years, if not decades, of chronic underfunding. It was only in the past couple of years that Ontario established a long-term infrastructure plan that included funding contributions from the federal government. While much of the plan was back-end loaded, it was good to see a commitment to stable, long-term infrastructure investment.

But it’s a new day in Ontario – with a new government and new leader coming from a very different place on the political spectrum. The campaign platform of the Progressive Conservatives included substantial spending on infrastructure, but largely focused on transit issues in the GTHA. The question remains: Will the new government honour the long-term plans and commitments made by the previous government, or will we see changes reflecting their specific priorities?

Good transit is necessary in order for people to be able to commute and reduce congestion in urban centres, but good roads and bridges are essential to the movement of raw materials and manufactured goods to and from all corners of the province. As such, good road infrastructure becomes a powerful catalyst for economic growth, job creation and prosperity. During the election campaign, the new Premier of Ontario lamented the decline in manufacturing jobs and activity in Ontario during the tenure of the previous government. While that decline can be attributed to a multitude of policy decisions, actions or inactions during that period – a “death by a thousand cuts”, as it were – there is now an opportunity to turn that around. Good investment in road and bridge infrastructure should be the foundation upon which future growth and prosperity is achieved.

At Consulting Engineers of Ontario (CEO), we advocate for a life-cycle perspective on infrastructure projects – recognizing that design and construction are a small part of the overall costs of an infrastructure asset. Operating and maintenance costs over the life of the asset will typically dwarf the initial design and construction costs. Decisions made during design can have a significant impact on those future costs. As such, CEO is also concerned about the approach to procurement and contracting for the professional engineering design services that lead to the construction of new roads and bridges and the refurbishment of existing ones. Our message here is that “lowest price” does not equate to “best value.” For too long, professional engineering services have been undervalued and viewed as a commodity – with the same attitude being taken as if buying aggregate, sand or asphalt. The fact is that our member firms employ talented professionals who apply their knowledge, skill and creativity to be problem solvers and enablers of positive change for their clients.

CEO supports and promotes Qualifications-Based Selection (QBS) for engineering design services. Selecting the best-qualified firm and then refining project scope and negotiating price is the best way to mitigate risks during project execution, and maximize innovation, creativity and life-cycle value. A price-based approach to the procurement of engineering services has the effect of stifling creativity and innovation, resulting in greater project risk and poorer value in the long term. Research has shown that QBS results in a measurably lower risk of cost overruns and schedule delays during construction.

CEO and its member firms will continue to engage and work with government, at both the provincial and municipal levels, to address infrastructure deficits. We will also continue to help guide them in making good decisions with respect to infrastructure priorities, investment and procurement.

Bruce G. Matthews is the CEO at Consulting Engineers of Ontario.
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