

# CANADIAN ■ CONSULTING engineer

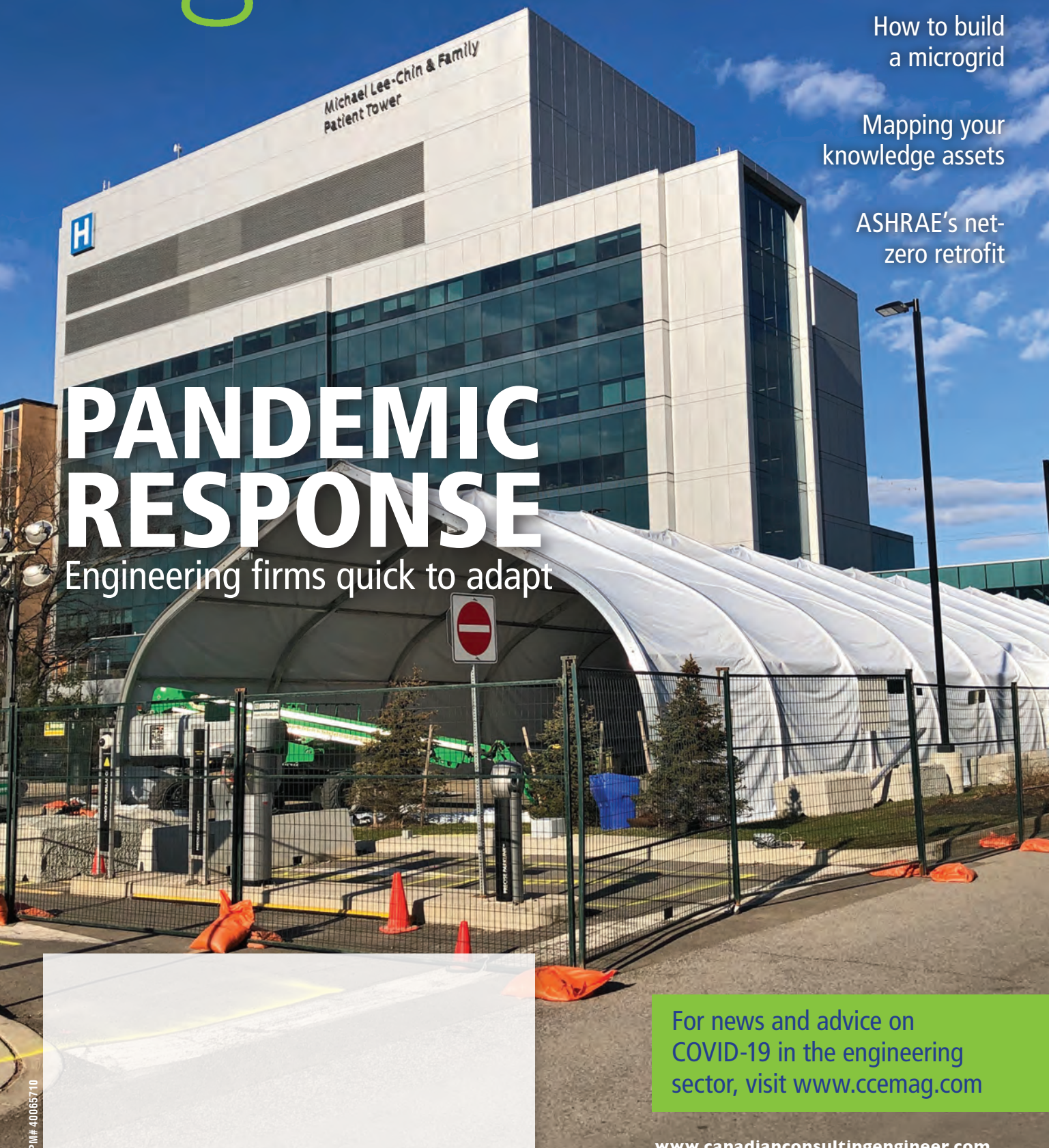
How to build  
a microgrid

Mapping your  
knowledge assets

ASHRAE's net-  
zero retrofit

## PANDEMIC RESPONSE

Engineering firms quick to adapt



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COVID-19 in the engineering  
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May 2020  
Volume 61, No. 3



Cover courtesy Joseph Brant Hospital  
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## Adapting to the new normal

Since joining this magazine last year, I've used this space to reflect on the industry events I've attended, which have been highly valuable in introducing me to the consulting engineering community and many of its activities. Examples range from the ACEC-Canada National Leadership Conference to a regional CanBIM event, from the Passive House Canada Conference to the Canadian Council for Public-Private Partnerships (CCPPP) Annual Conference, from The Buildings Show to the AHR Expo and ASHRAE Winter Conference.

Those last two took place in February, right before all such events started to be postponed and/or cancelled with the rise of COVID-19 as a global pandemic. International travel halted. Companies, including consulting engineering firms, sent their employees to work from home (WFH) rather than in offices or in the field. Indeed, large gatherings of people were prohibited. Our society changed. We all had to accept a 'new normal.'

As I write these words in April, we know much of the new normal will remain a reality in May when you read this issue ... and quite probably beyond. Business cannot yet resume as before. The risks are too great.

Yet, business has also adapted. Communications technology has made WFH much more feasible—and, indeed, more effective—than in the past. And some industry events have been transformed from in-person affairs to online forums.

Our own Canadian Consulting Engineering Awards program has had to follow this path. We extended our entry deadlines to give firms more time, though most had already been hard at work on their submissions well before the crisis hit. We no longer required entry fee payments by cheque, nor project descriptions in physical binders. Instead, we updated our own rules to accept credit cards and digital-only project files.

The next step will be our jury day. Traditionally, the program's judges have convened in downtown Toronto for a final session of deliberations. This June, they will meet 'virtually' instead, connecting in a specially developed online session that will determine this year's winners.

We will still announce the awards of excellence winners in our October/November issue. The awards gala is being postponed; we hope to reschedule the in-person event as soon as the situation allows, potentially for early 2021.

Thank you to all of the consulting engineering firms that have worked with us along this journey. Your support is greatly appreciated. We are here and will continue to offer our support in return, as we all weather this unprecedented crisis. We will continue to publish frequent, industry-specific COVID-19 updates in our weekly newsletter and on our website as part of our commitment to continuity. As always, feel free to let me know what you think; my email address is [psaunders@ccemag.com](mailto:psaunders@ccemag.com).

Peter Saunders



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## PEOPLE

**Dillon Consulting**

Shayne Giles

Dillon Consulting has appointed Shayne Giles, P.Eng., president. In the past, he served the firm as its executive director of technical skills and technology, executive director of innovation, technology and talent management and executive director of strategic projects and talent management.

**HDR**

Tara Erwin

HDR promoted Tara Erwin to a new role as the engineering firm's transportation lead for Eastern Canada. Based in Richmond Hill, Ont., she will provide strategic direction for the firm's transportation teams, diversify their technical offerings and co-ordinate staff resources for projects across the region.

**SNC-Lavalin**

SNC-Lavalin added three new roles to its senior leadership team. Louis G. Véronneau was named chief transformation officer (CTO). John Wilkinson was appointed president of infrastructure projects, with responsibility for overseeing the run-off of the lump-sum turnkey (LSTK) backlog, a contracting model the company is exiting. And Dale Clarke is now executive vice-president (EVP) of infrastructure services on an interim basis.

**Life sciences 'megahub' planned in Hamilton**

Photo courtesy McCallumSather

McMaster Innovation Park (MIP), a research facility near Hamilton's McMaster University, has announced a major campus expansion that will encompass 2.5 million sf of purpose-built facilities for life sciences innovation, commercialization and entrepreneurship.

MIP has retained architectural firm McCallumSather to lead the planning process, which will encompass a recently announced acquisition of an office and production complex on Frid Street and the development of additional assets within the existing 58-acre MIP at 175 Longwood Road South.

"Our plans are to create the best research park in the world and fill the equivalent of a bank tower—bigger than Toronto's Scotia Plaza and on par with First Canadian Place—with innovators and entrepreneurs," says Ty Shattuck, MIP's CEO. "At full buildout, 5,000 people will work here. The park will even be carbon-neutral, thanks to our resident energy expertise."

McCallumSather will also provide mechanical engineering. Other team members include Seguin Engineering for electrical, MTE for civil and GSP Group for planning.

**Engineers Canada transfers PIEVC Program to ICLR**

Engineers Canada agreed to transfer ownership of its Public Infrastructure Engineering Vulnerability Committee (PIEVC) Program—including the protocol for infrastructure climate risk and vulnerability assessment—to the Institute for Catastrophic Loss

Reduction (ICLR).

ICLR has partnered with the Climate Risk Institute (CRI) and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) to operate the program and offer the protocol in Canada and internationally.

Developed and co-funded by Engineers Canada and Natural Resources Canada (NRCan), the protocol is a process for assessing current and future climate risks and vulnerabilities of civil infrastructure and buildings. It has been applied to more than 70 projects to date, ranging from single buildings to water supply systems, around the world.

ICLR and CRI will partner to manage all aspects of the program as it is used in Canada, while GIZ will manage all international uses of the protocol.

**CaGBC and RAIC offer feedback on proposed NECB and NBC changes**

In April, the Canada Green Building Council (CaGBC) and the Royal Architectural Institute of Canada (RAIC) wrote a joint letter to Canada's National Research Council (NRC) and federal ministers, offering feedback regarding proposed changes to the National Energy Code for Buildings (NECB) and the National Building Code (NBC).

In particular, CaGBC and RAIC suggest new code requirements should address not only energy efficiency, but also the carbon emissions associated with the construction and operation of buildings, to help meet federal government objectives.

To this end, they recommend adding operational greenhouse gas (GHG) metrics to the NECB and NBC to align with the objectives of the Pan Canadian Framework on Clean Growth and Climate Change.

Further, they suggest the next code updates should include 'embodied carbon' reduction targets, using an approach that compares proposed buildings to baseline versions.

## SPECIAL REPORT

## COVID-19

By Peter Saunders

For a significant example of how COVID-19 has impacted Canada's consulting engineering community, look no further than Burlington, Ont., where Joseph Brant Hospital recently added a temporary on-site pandemic response unit to offer acute care for people suffering from the virus, with 93 beds.

The \$2-million-plus modular project was operational by Apr. 10, less than a month after the World Health Organization (WHO) declared COVID-19 a global pandemic—and only two weeks after an initial conference call and technical call.

"We have worked on temporary systems before, but typically in the context of a renovation to an existing building," says John Ferguson, design principal for The HIDI Group, a Toronto-based engineering firm that was part of the project's design-build team, led by BLT Construction Services as general contractor. "This is the

first structure of this kind for us."

It wasn't the last. Soon thereafter, the same team used the same approach for another temporary unit at Trillium Health Partners' nearby Mississauga Hospital.

"They have the same footprint and construction," Ferguson explains, "and very similar interiors and mechanical and electrical systems. The timelines dictated, to a great extent, our scope and schedule. We could not have erected an insulated structure in time, for example, so the systems are based on three-season use and specific subsystems are temporary. The water supply for the hand-wash sinks is sourced from an adjacent fire hydrant, with the co-operation and approval of the fire department and code-mandated safety features, such as a backflow preventer. Our commissioning team descended on the project to execute functional test plans that had been developed just



days before. Nothing focuses a group better than a challenging task!"

For both sites, BLT sourced tension fabric buildings from Sprung Structures in Aldersyde, Alta.

Meanwhile, Edmonton-headquartered consulting engineering firm Stantec announced it would also work with Sprung Structures, along with CANA Construction, to design Alberta's first temporary COVID-19 treatment centre, accommodating up to 70 patient spaces across 80,000 sf of additional space at Calgary's Peter Lougheed Centre (chosen because the Calgary zone had 63% of the province's confirmed cases of COVID-19).

At press time, the project team planned to turn over the facility to Alberta Health Services (AHS) on Apr. 27 to begin equipment installation and prepare for intake, so it is ready to accept patients in advance of a predicted infection peak in mid-May.

"We all want to do our part in supporting the response and recovery,"



Hospital lobbies and external spaces can be dedicated to pre-screening activities.

Images courtesy Stantec





The HIDI Group helped build this temporary 93-bed facility at Joseph Brant Hospital in Burlington, Ont. It entered operations on Apr. 10.

Photo courtesy Joseph Brant Hospital

says Todd Hartley, senior principal with Stantec, which is responsible for the project's electrical, structural and mechanical engineering. "Our teams feel privileged to support Albertans when they need us the most."

The firm has also advocated for designing hospitals with such modularity in mind from the start.

"In Canada, there have been significant strides toward building preparedness into designs since the SARS outbreak," says Tim Eastwood, a principal at Stantec's Toronto office specializing in the health-care sector. "A key element of preparedness is the ability for hospitals to reallocate or retrofit parts of their facilities."

Eastwood cites such measures as designating separate emergency entrances for contagious patients, using lobbies and external spaces for pre-screening, controlling separation between patients, visitors and staff and converting existing patient rooms into isolation zones.

"Ontario's ministry of health recommends the use of airborne isolation rooms (AIRs), which contain vestibules and filtered air to eliminate transfer contamination through the hospital, with negative pressure validated daily, but acknowledges a single room with the door closed can be used if necessary," he says. "Even in regular patient rooms, underlying engineering systems should be designed to maintain negative pressure to the adjacent corridor. The Public Health Agency of Canada (PHAC) advises a patient with COVID-19 symptoms should be cared for in a single room with a private

toilet and sink for their designated use and recommends infection prevention and control signage be placed at the entrance."

### Business continuity challenges

Even while such new projects have emerged and, for that matter, construction in general has continued in jurisdictions that have deemed it an essential service, Canada's consulting engineering firms also had to reconcile themselves with an unprecedented economic slowdown.

Aecon Group, for example, withdrew its financial outlook for 2020 to evaluate the impact of the temporary slowing or suspension of work on some of its projects, due to directives issued by clients and governments in light of the pandemic, as well as the deferral of certain project procurement processes in its bidding pipeline.

For the work that does continue, firms like Aecon have implemented more stringent site pre-screening processes, hygienic and disinfection practices, physical distancing, additional personal protective equipment (PPE), team separation, staggered work hours and, like many other industries, technology-enabled work-from-home (WFH) initiatives.

SNC-Lavalin, too, announced its 2020 financial outlook was no longer valid, given the unprecedented circumstances, but also reported most of its engineering services personnel had been able to continue servicing clients from non-office-based locations and to transition work among different jurisdictions as required. In another sign of the times, the firm planned a 'virtual' annual shareholders' meeting for early May to review its first-quarter results.

Bans on gatherings have of course also affected industry-related trade shows, conferences and other events. The Canadian Mechanical & Plumbing Exposition (CMPX) was postponed by a full two years, from March 2020 to March 2022. PM Springfest



Patient rooms can be adapted as airborne isolation rooms (AIRs).

was cancelled for the year. The Canada Green Building Council (CaGBC) postponed its Building Lasting Change (BLC) Conference, with new dates yet to be announced. And the Canadian Steel Conference, originally planned by the Canadian Institute of Steel Construction (CISC) to be held this September in Winnipeg, was postponed to 2021.

Even farther out, ACEC-Canada has decided to cancel its National Leadership Conference, which would normally be held in Ottawa in late October.

"Many of our member firms are facing challenging times as they navigate uncertainty," says Martine Proulx, the association's vice-president (VP). "The industry will continue to experience the impact well into next year. During this time, we anticipate the focus of our members will be on their firms, employees and clients."

Other events are going virtual instead. Examples include the newly established Fenestration and Glazing Industry Alliance's (FGIA's) Summer Conference and the ASHRAE Annual Conference and concurrent committee meetings, all still planned for late June, but online instead of in-person.

### Addressing challenges with opportunities

With all of this in mind, *Canadian Consulting Engineer* ran an unscientific poll

on its website, asking firms about the biggest challenges they were facing. Out of the four options provided, nearly all respondents selected either 'ensuring business continuity' or 'supporting employees' health, safety and livelihood,' with a fairly even split between the two.

Yohaán Thommy, a Mississauga-based consulting partner at MNP, agrees both are important and argues they can go hand-in-hand.

"Through business continuity planning and resiliency, many companies can get back to work safely," he says, "and some will even see an increase in business. There are huge opportunities to diversify their revenue streams, from supporting supply chains to helping clients who are not classified 'essential' make changes to get there, such as manufacturers who are now producing ventilators. Customers may be asking for help and you want to do what you can for them."

The construction industry needs consulting engineers' assistance more than before, he says, particularly in terms of implementing safety protocols.

"Together, we can get sites working faster," says Thommy. "As we know, there are things that can be done to greatly reduce the risk of workers catching the disease."

On the home office side, mean-

while, he recommends using the pandemic as an opportunity to upgrade information technology (IT) systems and adopt more cloud-based solutions, particularly for accounting purposes.

"COVID-19 can survive on paper and packaging, so cheques pose a risk," he says. "Wiping them down takes too much work at the busiest time of year for accounting departments. Clients should be paying electronically instead, via online portals. For smaller firms, especially, cash flow is king. There are free templates for managing it."

Nonetheless, the economic slowdown does pose an enormous threat to cash flow. Of the government programs currently in play, Thommy highlights Work-Sharing (WS), which was designed—well before the pandemic—to help businesses avoid layoffs during temporary reductions in activity beyond employers' control.

"It minimizes the reduction in pay," he says. "People can stay on the payroll for anywhere between two and 4.5 days a week, with the rest of their time covered by employment insurance (EI). This can be a competitive advantage for you when other firms are laying people off. Out of all the programs, it provides the greatest 'umbrella' of protection and the best available payout."

Other, more recently introduced federal government measures, Thommy says, can involve a longer wait, are shorter-term, do not provide as much protection and reduce flexibility.

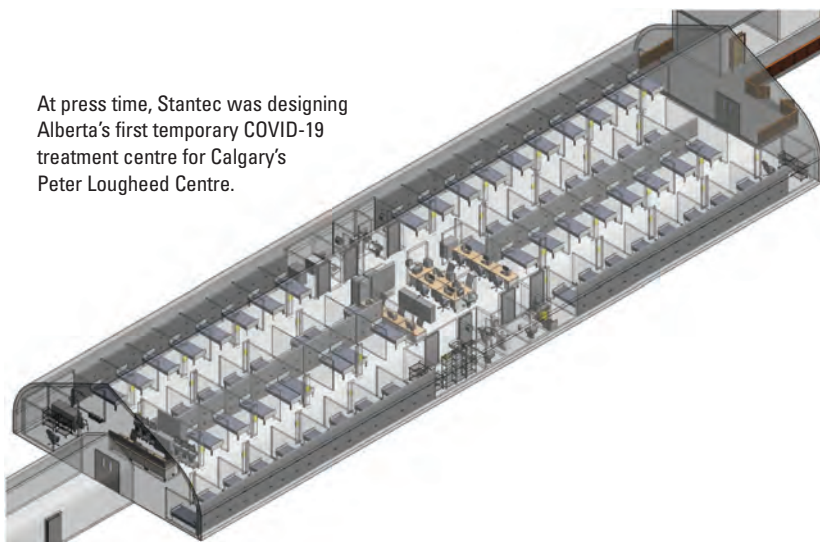
"With WS, you can get funds in 10 days and they last longer," he says.

Above all, however, he encourages firms to give back to their country.

"In this moment of crisis, as business leaders, please consider what you are doing to help," he says. "It's time to pay it forward. Donate to food banks, encourage more self-isolation throughout your business, don't apply for funding you don't need. We all need to do more."

CCE

At press time, Stantec was designing Alberta's first temporary COVID-19 treatment centre for Calgary's Peter Lougheed Centre.







## CHAIR'S MESSAGE

# Remaining connected and united critical for consulting engineering industry amid COVID-19 crisis



**A**t the time of writing this message in March 2020 amid the COVID-19 outbreak, I reflect on the effects of this global pandemic on daily life. The impact of COVID-19 is being felt across the country and around the world by industries, businesses, but most significantly by individuals.

In addition to the health and safety risks this pandemic has posed on Canadians and the incredible strain it has taken on our healthcare system, the unprecedented impact this crisis is having on the economy has implications for the viability of the economy. Businesses whose work have a direct impact on the social, economic, and environmental quality of life of all Canadians, like consulting engineering firms, will be critical to our ability to recover from this crisis.

We are all facing challenges we had not planned for and managing a business through this crisis is an even greater challenge. To support our member firms during this time, ACEC-Canada has implemented several measures including developing a COVID-19 dedicated section on the ACEC-Canada website featuring resources and information of interest to the Canadian consulting engineering industry. This section also includes updates on the activities ACEC-Canada is undertaking to support the industry through the crisis and recovery along with the communications they have distributed to their members. To view the latest information and developments pertaining to our industry and our response to this crisis, we encourage you to visit [www.acec.ca/covid19](http://www.acec.ca/covid19).

ACEC-Canada also outlined and delivered to the Prime Minister and several key cabinet ministers specific recommendations on how the consulting engineering industry can retain its capacity in order to help the government mitigate the current crisis and support the post-crisis recovery. These recommendations and the activities ACEC-Canada has taken to support our member firms are detailed on the next pages of our contribution to this edition of *Canadian Consulting Engineer* magazine. ACEC has also partnered with the Canadian Chamber of Commerce and over 60

other business associations across the country in recommending critical assistance to businesses including access to credit and wage subsidies that would allow them to retain employees. Many of these recommendations have been accepted and programs are now being put in place.

While this outbreak and the measures we have had to take to mitigate it are drastic but necessary, I encourage you to also consider the extraordinary ability that we and our industry have to unite in times of crisis. We must remember our industry's resilience over the years overcoming past recessions and other economic and political challenges.

As we self-isolate and socially distance ourselves from one another, let us not forget to remain connected. Coming together with a united voice and remaining connected to your provincial and/or territorial member organization and ACEC-Canada will provide our industry the best opportunity for success in overcoming this crisis. ACEC-Canada has connected with and been in regular contact with senior levels of the federal government and with key stakeholder partners, including provincial and territorial consulting engineering associations, with respect to the COVID-19 crisis and its impact on every aspect of Canadian life. Discussions surrounding policies that would provide assistance to businesses in protecting their employees, to ensure both the immediate and long-term survival of businesses, and to stabilize and rebuild the economy through the post-crisis recovery, have taken place. Your provincial and territorial member organizations have also undertaken similar activities with their respective governments.

While mitigating the impact of COVID-19 on consulting engineering firms and positioning our industry to assist with the eventual recovery will be the primary focus of ACEC-Canada and the provincial and territorial associations across Canada in the coming weeks and months, the thoughts of the Board of Directors and staff at ACEC-Canada are with you as your teams, families and friends navigate this difficult time.

LAWRENCE LUKEY, P.ENG.  
CHAIR, BOARD OF DIRECTORS, ACEC-CANADA



# ACEC-Canada Response to COVID-19

**A**t the time of writing this article (end of March 2020), the impact of the COVID-19 pandemic is in full force and the resulting crisis evolves on a daily – and often on an hourly – basis. During these uncertain times, ACEC-Canada applauds the “all of government” approach to protecting the health and safety of Canadians while ensuring the viability of our economy.

The consulting engineering sector can play an important role in mitigating this crisis and supporting the post-crisis recovery. In this spirit, ACEC-Canada has made recommendations to the Prime Minister and key federal departments such as Infrastructure Canada, Public Services and Procurement Canada, and Public Safety in the early days of the crisis to help Canada and Canadians in these extraordinary times. Because ACEC-Canada and its members across the country know that our industry represents critical and essential expertise that will be needed as we navigate the current crisis and look forward to the recovery.

The following outlines our recommendations to the government:

- ***Include the planning, design, construction and operation of important infrastructure in the list of essential services nation-wide***

While Canadians are coping with a variety of restrictions as a result of the health crisis, it is essential that they have access to our professionals to build and maintain essential services like transportation, water/wastewater treatment, power and our civic institutions like hospitals, as outlined in the *National Strategy for Critical Infrastructure*. These in turn require reliable electrical, plumbing, HVAC and IT systems. The consulting engineering sector is prepared to continue providing services needed to deliver critical projects in a manner that the health and safety of all involved is appropriately protected.

- ***Accelerate investments in existing infrastructure programs***

To facilitate the recovery in the longer term, the federal government should accelerate/re-profile some of its existing infrastructure commitments through the *Investing in Canada Plan* and other legacy programs from the later years of those programs into the next two or three years as stimulus. This would inject much-needed money into the economy in the short-term with less reliance on finding “new money” for stimulus. Furthermore, through an even distribution of investments over the entirety of the current infrastructure programs, both the owners of infrastructure and the sectors that deliver it could more effectively manage resources and long-term capacity throughout and beyond the recovery.

- ***Leverage the Gas Tax Fund as a vehicle to jump start the recovery***

The federal government can also quickly inject stimulus into the economy through the more agile *Gas Tax Fund* to jump start the recovery while provinces and territories agree to the acceleration/re-profiling of the *Investing in Canada Plan* and other federal-provincial legacy programs.

- ***Help retain capacity and expertise to assist with the recovery***

To effectively leverage infrastructure as stimulus, the design process usually requires several months to two years before there are shovels in the ground. Therefore, governments at all levels as well as project financiers need to be seen to be staying the course on, if not accelerating, current infrastructure projects, plans and commitments. The federal government will need to lead by example and send a clear message to provinces and



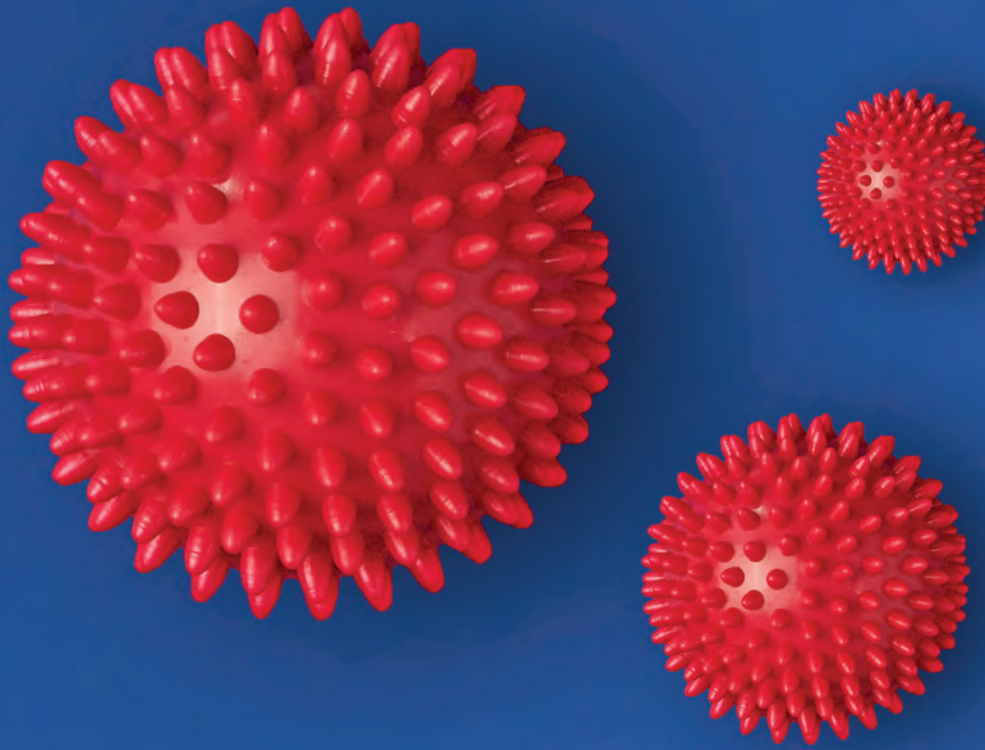


Photo credit: iStock.com/Kira-Yan

municipalities in this regard. Consulting engineering firms need to continue working through the crisis to ensure that they retain the capacity to deliver on projects during the recovery. Since most firms have significant ability to work remotely, it is feasible for most design work to continue in the coming weeks and months while adhering to recommended social distancing and self-isolation practices.

- ***Streamline and accelerate project approvals***

Clear and timely decisions on projects are needed for informed decision making by consulting engineering firms, contractors and the entire supply chain already under financial duress through this crisis. Streamlining and accelerating project approvals will also strengthen industry's ability to respond to immediate demands, retain capacity and expertise to effectively contribute to the recovery. Infrastructure Canada was very successful in implementing a streamlined approval process for these very reasons as part of the stimulus program introduced in response to the economic downturn circa 2009. The government should also allow for a single application process that would allow for the concurrent approval of multiple projects within a municipality's asset management plan.

- ***Make significant credit accessible to consulting engineering firms***

The federal government should develop policies to allow for a very significant amount of credit to be made available to consulting engineering and other firms that deliver critical infrastructure. Notwithstanding the recommendations above, some decrease in workload is inevitable should the health crisis continue for an extended period of time. Consequently, many firms will

lose much needed capacity to deliver projects during the recovery – either through downsizing or insolvency. If governments back-stop and underwrite loans, banks and lending institutions will be in a position to allow firms to retain their expertise and remain operational. Such policies, concurrent with a commitment to stimulus through infrastructure commitments, will greatly mitigate the risk for such loans and credit offerings.

ACEC-Canada has shared these recommendations based on the experience of past economic challenges across Canada and around the world, which have demonstrated that infrastructure is the single most effective form of economic stimulus. Its added benefit is the significant and lasting return on investment; once delivered, infrastructure assets continue to enhance our social, economic and environmental quality of life rather than being a one-time expenditure. Further, it improves a nation's resilience to future economic downturns and facilitates more rapid recovery. Investing in infrastructure is a means of growing and strengthening the economy – in addition to all the other societal benefits.

ACEC-Canada has also been working closely with many of our stakeholder partners, including the Canadian Construction Association and the Canadian Chamber of Commerce, on steps to protect and support businesses through the crisis. Most recently, we participated in a joint statement in support of a national effort to protect jobs issued by the Canadian Chamber of Commerce and over 60 other business associations across Canada.

In the coming weeks, we will continue to work with stakeholders, the government and elected officials to ensure the consulting engineering sector can retain its capacity to help mitigate the current crisis and support the post-crisis recovery. To learn more about our ongoing advocacy efforts, visit our COVID-19 response page at [www.acec.ca/covid19](http://www.acec.ca/covid19).

# Monitor Company Performance with Benchmarks



By Megan R. Miller, CPSM

As markets and client demands change, companies need to be able to quickly adjust their business to stay on top of their game. Benchmarking gives your team the tools to create realistic and achievable goals while driving your business forward. To effectively leverage benchmarks to monitor your company performance, you need to fully integrate it into your business processes throughout the year.

Think about the state of your company today and ask yourself these three questions:

- What are the top three goals for your company this year?
- What activities or tasks have you outlined to help your firm achieve these goals?
- How are you measuring success against these goals on a regular basis?

One fatal flaw many companies make is not setting realistic or attainable goals. But, it is often difficult to know what is realistic, and that is where benchmarking comes in. If you know your metrics you can compare your goals with other firms that are similar to see how you measure up.

The numbers themselves aren't the most important part of benchmarking. It's understanding your numbers. First, you need to know what your numbers are. Then, determine where you want them to be. And finally, establish the clear action items to help get you there.

By looking at what other firms are achieving, you can determine a realistic target and time frame. It might not all happen at once, but if you can see continued incremental progress towards whatever that goal is, and you've established that the goal is realistic, then you are going to be more successful and you're going to have more of your team on board moving towards that target.

## BALANCING YOUR METRICS

Another important aspect of benchmarking is the need for balanced metrics. If your utilization target is high, what part of the business will be impacted to achieve that goal? Does it prevent necessary business development time or make it difficult for employees to invest in professional development? There has to be balance among these metrics for you to be successful, because not all of them can be at the absolute top. Consider which ones you want to reach and why, and how that aligns with what your company needs to achieve this year.

## AGILITY AND FLEXIBILITY

Sometimes you set out to achieve a particular goal or improve a particular area of the business and unexpected circumstances stand in the way – personnel changes, project adjustments, client budget modifications, etc. So, it's critical that you are continuously monitoring your key performance indicators (KPIs), comparing to your goals so you know where you are at any given time and can adjust or pivot accordingly. This isn't to say you should lower your expectations just because it might be hard, but it's key to have the insight into your business to know that now might not be the best time for your business.

## MOVING THE NUMBERS

Benchmarking is an iterative learning process. What are your numbers telling you? If you have a target and it's not where you want it to be, what is preventing you from hitting the numbers? What you can glean from your metrics? This gives you the opportunity to dig in to find out if there's process failures, further education that needs to happen, or if there are targets that aren't realistic. It gives you the opportunity and the platform to open discussions that otherwise wouldn't happen.

## WHAT WILL YOU DO ABOUT IT?

How often are you reviewing your metrics and comparing them to your goals? As mentioned before, this can't be an annual thing. It needs to be an ongoing process so you can adjust and course correct. The industry and your businesses are constantly changing so you need to be able to adjust accordingly and drive toward your specific goals. Share your progress with employees so they are part of the solution and can share in your success.

## KEY METRICS AND TRENDS

There are numerous resources available to benchmark your company and many firms often struggle with which KPIs to focus on. Although there are some top metrics all firms should monitor, it's critical that your key metrics align with your strategic goals.

As you review your metrics, I encourage you to check out the *Deltak Clarity Architecture & Engineering Industry Report* – one of the longest running and most in-depth benchmarking resources in the industry.





# COVID-19 and standard CCDC/CCA clauses

A pandemic may trigger force majeure clauses and stop work orders.

By Gerry Argento

At the time of this column's writing on Mar. 30, 2020, Canada has reported 7,297 cases of COVID-19 (both presumed and confirmed). In a continued effort to 'flatten the curve' and slow the spread of the virus, our federal and provincial governments have introduced a series of emergency measures. So far, to varying degrees across Canada, these measures have included social distancing, limits on public gatherings, new highway checkpoints and the mandatory closures of all non-essential businesses.

The pandemic's impact on business cannot be overstated and the construction industry has not been spared. In particular, the adverse consequences on the availability of the industry's workforce and supply chains will challenge project teams and hamper effective project delivery.

In Quebec, for example, with the exception of emergency repairs or services required to ensure public safety, all construction sites were ordered temporarily closed. There have been calls across the country for other provinces to follow suit.

In this uncertain and unprecedented context, many industry stakeholders are questioning whether COVID-19 could trigger any force majeure clauses provided in their contracts. This column will address such clauses found in the Canadian Construction Documents Committee's

(CCDC's) and the Canadian Construction Association's (CCA's) standard documents.

## Force majeure

As it pertains to the construction industry specifically, the widely used CCDC-2 Stipulated Price Contract and corresponding CCA-1 Stipulated Price Subcontract do provide a force majeure clause in GC 6.5.3.

This clause reads as follows (with italics indicating this author's emphasis):

- 6.5.3 If the contractor is delayed in the performance of the work by:
- .1 labour disputes, strikes, lockouts (including lockouts decreed or recommended for its members by a recognized contractors' association, of which the contractor is a member or to which the contractor is otherwise bound);
  - .2 fire, unusual delay by common carriers or unavoidable casualties;
  - .3 abnormally adverse weather conditions; or
  - .4 *any cause beyond the contractor's control other than one resulting from a default or breach of contract by the contractor;*

then the contract time shall be extended for such reasonable time as the consultant may recommend in consultation with the contractor. The extension of time shall not be less than the time lost as the result of the event causing the delay, unless the contractor agrees to a shorter extension. *The contractor shall not be entitled to payment for costs incurred by such delays, unless such delays result from actions by the owner, consultant or anyone employed or engaged by them directly or indirectly.*

While the term ‘pandemic’ is not specified in the list of possible force majeure events included in GC 6.5.3, COVID-19 may qualify as one under subsection 4, given the rather broad and open-ended language, *i.e.* “any cause beyond the contractor’s control.”

Under GC 6.5.3, the qualification of COVID-19 pandemic as an event of force majeure would entitle the contractor to an extension of time to perform the works, as recommended by the consultant (engineer or architect). The contractor, however, would not be entitled to claim payment for any costs incurred as a result of such delay. This arrangement, as provided for under GC 6.5.3, corresponds to what is generally referred to as “excusable but not compensable” delays.

Parties should also note, pursuant to GC 6.5.4 of the CCDC-2, the contractor’s right to claim an extension of time is subject to the communication of a written notice not later than 10 working days after the commencement of the delay caused by the force majeure event. The time limit for subcontractors under the CCA-1 is seven days.

### Stop work orders

In light of the situation in Quebec, where the provincial government ordered a shutdown of most construction-related activities, GC 6.5.2 of the CCDC-2 and CCA-1 becomes highly relevant.

This clause reads as follows (again, with italics indicating this author’s emphasis):

6.5.2 If the contractor is delayed in the performance of the work by a stop work order issued by a court *or other public authority* and providing such order was not issued as the result of an act or fault of the contractor or any person employed or engaged by the contractor directly or indirectly, then the contract time shall be extended, for such reasonable time as the consul-

tant may recommend in consultation with the contractor. *The contractor shall be reimbursed by the owner for reasonable costs incurred by the contractor as a result of such delay.*

Under this clause, delays resulting from a stop work order issued by a public authority, such as the one issued in March by Quebec’s government, are “excusable and compensable.” This implies contractors (and subcontractors) are not only afforded the right to an extension of time to complete the work, but also to be reimbursed for reasonable costs incurred as a result of the delay caused by the stop work order.

It is also noteworthy, in such circumstances and where the work is delayed for a period of 20 working days or more, CG 7.2.2 affords the contractor (and subcontractors) the right to terminate their agreement.

As mentioned above, all stakeholders would be well-advised to pay close attention to GC 6.5.4 of the CCDC-2, which requires contractors to issue a written notice within 10 working days; while under CCA-1, the time limit for a subcontractor is seven working days.

### Clauses and conditions

In the event a contractor is delayed in the performance of work as a result of the COVID-19 pandemic, it is likely—pursuant to GC 6.5.3 of the CCDC-2 and CCA-1—both the contractor and the subcontractor

would be entitled to a reasonable extension of time to complete the work, as recommended by the consultant.

In the event a stop work order has been issued by a public authority, as was the case in Quebec, GC 6.5.2 of the CCDC-2 and CCA-1 likely entitles contractors and subcontractors not only to the extension of time, but also to be reimbursed for reasonable costs incurred as a result of such delay.

That said, it is important to note these clauses may be subject to amendments, notably by way of supplemental conditions agreed upon by the parties prior to the execution of the contract. As such, industry stakeholders should seek out legal advice and expertise to carefully review their contracts to determine whether such clauses are provided and whether and to what extent they may be applicable, in light of the specific circumstances of each case. **CCE**

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# How to build a MICROGRID

## Do you know what will you need?

By Erik Svanholm

**M**icrogrids are becoming more and more prevalent today, representing a modern approach to solving a variety of energy supply challenges. Their unique nature, however, can still trip up even the most advanced engineers and utility staff. Before starting to design a system, it is important to understand the process of bringing about a microgrid from initial concept to real-world operations. Most important is understanding how to actually build it.

### 1. Feasibility assessment

The first step is to conduct a feasibility assessment. This will help uncover a system's potential benefits, challenges and life cycle, with a unique site in mind. Financial, resiliency and sustainability opportunities will all vary from place to place.

It can be easy to overlook details at the beginning of the process, but missed details often result in increased costs and project delays. The following are some of the basic issues to address during the feasibility assessment:

- Have you mapped the microgrid's functions back to the problems you want solved?
- Which of your electrical loads are the most important?
- How fast must the microgrid come online when grid power fails?
- How long will it need to remain operational in 'islanded' mode?

Key to all of these considerations will be the power supply.

- Which types of power generation will you include in the microgrid?
- Will you 'own' new on-site power generation assets or will you sign a lease or service agreement with another party?
- How much power will be needed from the microgrid?
- How long will independent power generation be needed?
- Is fuel available and does it need on-site storage?

Often, it is easiest to analyze where generation assets already exist and build around them:

- What electrical infrastructure and equipment that can support a new microgrid are already in place at the site?
- How do existing and future planned energy assets line up with existing and future loads?
- How and when can power flow



Construction timelines should be planned with equipment procurement timelines in mind.



within the microgrid?

### 2. Preliminary system design

The next step (although it often happens in conjunction with the feasibility assessment) is to complete a 30% system design. This involves laying out the basic types and sizes of technologies involved, their intended locations, the methods for interconnecting them within a microgrid and a plan for working with the local utility. The goal here is to help set the course for future detailed design considerations.

With regard to location, one of the key considerations is determining the best place to build:

- Do the topology and site features match up with the type of power generation likely to be used?





Photo: ©sturt/Getty Images

- What are the potential local environmental concerns about the microgrid, such as visibility, noise and/or emissions?
- How might the microgrid affect the community and its infrastructure?
- How will buildings be connected to the energy source?
- How many switching procedures will be required to start or stop the power flow at different locations within the microgrid? (Note: The fewer the switching procedures, the better.)
- How can the microgrid leverage the site's existing data communications infrastructure?

### 3. Financial planning

Before beginning the full design process, it is also crucial to conduct financial planning and develop a cost estimate for the project. These are critical to a system's feasibility and can illuminate opportunities for third-party financing.

It is important to lay out all of the budgeting guidelines, so as to accommodate such assistance and equipment purchasing. The following are some questions to consider when evaluating financing options for the project:

- How will the microgrid be paid for, including capital and operations and maintenance (O&M) costs?
- Have all necessary regulatory

approvals been secured?

- Do you have buy-in from executives, customers and other stakeholders?
- Who will be working on this project and will it need support from specialized third parties?
- Will long-term maintenance of the microgrid be managed in-house or outsourced?

### 4. Integrator selection

Another important step before completing the full design of an advanced microgrid is the selection of an experienced integrator. Their expertise, based on a history of successfully developing other microgrid projects, can streamline the process from design through commissioning, to avoid foreseeable challenges and delays.

### 5. Full design

Once these steps have been taken and the logistics of the system have been determined, it is time to carry out the full design, moving forward from 30% to complete blueprints and documentation, including a utility interconnection agreement. A high level of expertise will be needed at this stage. The integrator assisting with the project should be very familiar with electrical distribution equipment, distributed energy resources and control software.

## 6. Equipment procurement and construction

After the design is agreed upon among the engineers, the utility staff and the integrator, the next steps are to procure the necessary equipment and begin construction. When procuring equipment, it is important to consider not just the initial costs of the components, but also their overall life-cycle operating costs. Also, many of the larger components needed for a microgrid, including energy storage systems and switchgear, will involve long manufacturing lead times. Construction timelines should be planned with procurement timelines in mind.

## 7. Commissioning

The completion of construction does not represent the completion of a microgrid project. Rather, before it can be fully operational, it must undergo system commissioning. This phase involves thorough factory and site acceptance testing to ensure all of the components and connections perform as a coherent system. This is also the time to educate relevant employees about the functions and features of the system and its operation.

## 8. Monitoring and maintenance

Even after a microgrid has been successfully commissioned, it will still require ongoing attention.

Microgrids are complex systems that will need more than just regular maintenance to keep them operating at optimal performance levels. Using a control system specifically designed for microgrids will help, as will having a well-trained and knowledgeable service staff. Some integrators offer long-term remote monitoring and diagnostics, which can provide a cost-effective means for maintaining peace of mind over the long term.

**CCE**

*Erik Svanholm is vice-president (VP) of non-wires alternatives for S&C Electric. For more information, including microgrid development guidebooks, visit [www.sandc.com/microgrids](http://www.sandc.com/microgrids).*

# Renovating ASHRAE's new HQ

Modern designs and systems will contribute to net-zero energy performance.

**D**arryl K. Boyce, based in Kemptville, Ont., has had the fortune to lead ASHRAE as president during a particularly eventful term. No, we're not referring to the COVID-19 pandemic, which forced him to self-isolate after a trip home from the U.S. and just before this interview. Rather, ASHRAE is in the midst of renovating its new 66,000-sf headquarters (HQ) at Technology Park in Peachtree Corners, Ga., with the goal of using modern designs and systems to achieve net-zero energy performance and plans to move in shortly after Boyce's term ends this summer.

## How is the project coming along?

So far, it has continued on schedule, taking all necessary precautions, including sanitizing and social distancing. It's a week-to-week situation, but we expect substantial completion by August or September and to move in October.

## How did you choose this location?

When we sold our previous 35,000-sf building in Atlanta to Children's Healthcare of Atlanta (CHOA) in 2018, the leasing market was very expensive, so we felt it was best to buy another building and renovate it. This one was built in the 1970s and had been vacant for the past couple of years, as its previous tenant had been bought up by another company.

## What shape was it in?

A physical assessment showed the building's structure was solid, but many of its systems were at their end of life. This



Photos courtesy ASHRAE

made it perfect for our goals of demonstrating modern improvements in indoor air quality (IAQ), employee comfort and net-zero energy consumption. We hired a design team, then sought the money and equipment to meet the design criteria.

That process has been very successful. NIBE donated \$5 million and its ClimaCool and ClimateMaster heat pumps



**"The building's structure was solid, but many of its systems were at their end of life. This made it perfect for demonstrating modern improvements in IAQ, employee comfort and net-zero energy consumption."**

— Darryl K. Boyce,  
president, ASHRAE



and air recovery systems. E.H.Price provided constant-volume boxes, reheat components and radiant ceiling panels. Other major donors have included Arkema, Daikin, Price Industries, Big Ass Fans, Belimo, Bell & Gossett (Xylem), Mitsubishi Electric Trane HVAC, Uponor and Victaulic, which delivered a co-ordinated HVAC piping model package whereby 70% of its scope was prefabricated prior to arrival on the job site, including modular vibration isolation pump drops and outlet headers, customized packaged coil piping kits, mechanical couplings, valves and strainers; the piping will be insulated with a modular system, as well.

Finally, Cisco has donated major information technology (IT) components to support building automation systems (BASs) in the type of next-generation network they foresee as “the fourth utility.”

#### *What have been the biggest challenges?*

One of the first challenges was the amount of hazardous substances in the ceiling spaces, which we had to dismantle and get rid of. Also, the radiant panels weren’t something Atlanta’s plumbers had installed before; these systems use piping that requires hiring a more expensive fitting installer.

We’ve learned that while it’s cost-effective to repurpose an existing building rather than construct a new one, the devil is in the details—particularly when you open up the walls and get a surprise!

#### *What’s next in the process?*

We’re still working on the building envelope. It had old, double-pane, floor-to-ceiling glazing that was not efficient. To achieve our intended energy performance, we needed to reduce the window-to-wall ratio by 40%. So, we are replacing the walls, but we also need to balance energy consumption reduction with

enough natural light to ensure a comfortable indoor environment.

Once our 114 employees from Atlanta move in, we will monitor and analyze the performance of the building’s equipment. We’ll use tools to see how best to use the BASs effectively

to ensure comfort without wasting energy.

We will also share those lessons with the industry. The Building Owners and Managers Association (BOMA), for example, plans to document our process as a case study. **CCE**

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# Knowledge MAPPING

## How competitive are your firm's assets?

By Bryan Leach, P. Eng.

**F**or consulting engineering firms, knowledge assets are a source of competitive advantage in the marketplace. These assets, also known as intellectual capital, include a company's human capital (*i.e.* the skill, knowledge and experience of its employees), structural capital (processes, systems and patents) and customer capital (relationships with and knowledge of customers).

Such assets may be rated as core (basic to 'playing the game'), advanced (making the firm competitively viable) or innovative (enabling the firm to lead in the industry, to the extent it is differentiated from its competitors).

To remain competitive, a firm needs to continually compare the status of its knowledge assets against those

of other companies and make any changes as necessary. To do this, the firm must first identify its competitors, then rate both its own and their knowledge assets on the aforementioned scale, awarding one point for core, three for advanced and five for innovative. These ratings help a company to characterize itself within the marketplace relative to its competitors using 'knowledge mapping' (see Figure 1).

### Going through the process

By way of example, an international consulting engineering and environmental science firm used knowledge mapping as part of a self-assessment process to investigate the competitive status of its knowledge assets within eight technical disciplines in one of its major offices.

Each discipline-specific leader identified three to six of their top competitors and rated their knowledge assets. The average rating of their own assets was 3.56, while that of their competitors' assets was 2.8. Indeed, with only one exception among 33 comparisons, the leaders rated their assets equal or superior to those of their competitors. All eight disciplines within the office were either competent competitors or market leaders.

The knowledge mapping process stimulated additional thoughts about the firm and its competitors, *e.g.* "Company X was a five, but their acquisition lowered them to three or four," "Company Y has a morale problem and is losing good employees," and "Our own company is untried in



these markets.” Another lesson learned was the need to focus knowledge mapping on specific—rather than broad—technical disciplines.

The exercise may also need to be very specific about the type of intellectual capital being considered at each step. For example, a firm may have superior human capital, but inferior customer capital, relative to its competitors, though both types of capital rely heavily on personal relationships between specific individuals in the company and with clients. Such critical knowledge needs to be transferred to the next generation.

### Filling the feedback gap

While knowledge mapping can be useful for assessing the competitiveness of a company's knowledge assets in the marketplace, it is important to note using self-assessment as a method of data acquisition can be flawed, leading to significant differences between

perception and reality. Research in the workplace consistently shows self-assessments of knowledge, skills and competence against objective performance are poor, at best, due to the so-called ‘above-average effect.’ That is, people tend to believe themselves to be above average because they lack the information and ability to adequately assess their own competence and that of their competitors.

This gap can be filled by seeking feedback on performance from independent third-party experts, especially clients of the various technical disciplines. Unfortunately, such feedback is often either sought or given infrequently or too late and may be sugar-coated by the client or considered too threatening by the consultant.

Rather than simply e-mailing a customer satisfaction survey, it is preferable to obtain meaningful feedback on performance by having senior personnel conduct face-to-face interviews. By

actively conducting post-project audits at their own cost and seeking honest input, a company can also greatly increase its clients' level of satisfaction with the firm.

### Opportunities for change

To remain leaders or to become more competitive in the marketplace, consulting engineering firms need to collect such honest feedback and then use it to assess the status of their own knowledge assets relative to those of their competitors. This is an opportunity to ask some key questions:

What differentiates the firm within the marketplace?

- Does the firm offer superior human, structural or customer capital?
- Based on this assessment, what does the firm need to do?
- By way of example, a firm may choose to integrate, reconfigure, gain or release internal and external knowledge assets.

Integration may involve using existing knowledge assets to develop new products and processes and/or to make strategic decisions regarding the direction of the company.

Reconfiguration may involve transferring knowledge assets across technical and geographic boundaries, developing collaboration networks and realigning assets in response to changes in the marketplace.

‘Gain’ refers to developing new thinking within the company and bringing in assets through mergers and acquisitions (M&A) or hiring.

Finally, ‘release’ refers to jettisoning those knowledge assets that are no longer required.

In all of these cases, maintaining a competitive advantage requires a company's leaders and managers to be proactive, rather than reactive, in the management of knowledge assets. **CCE**

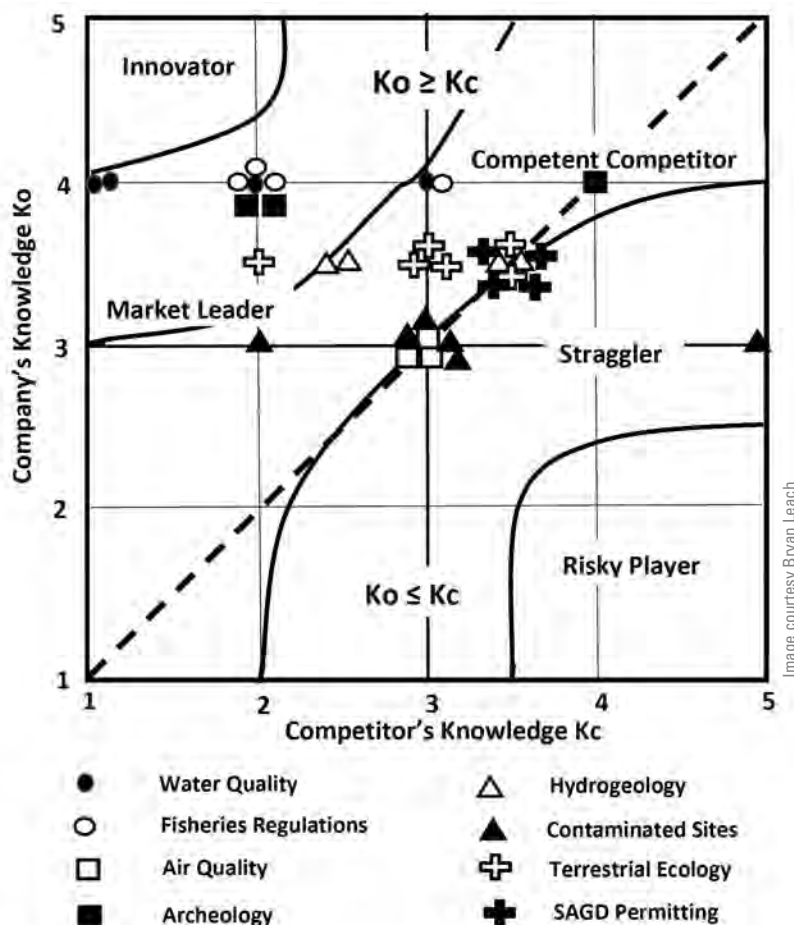


Figure 1.

*Bryan Leach is a retired Calgary-based engineer who has been designated P.Eng. in Alberta and C.Eng. in the U.K. and now focuses on helping organizations learn. He can be reached at [bryleach@telusplanet.net](mailto:bryleach@telusplanet.net).*

# ACHIEVING OPTIMAL BUILDING PERFORMANCE

It is time to embrace some change.

By Jeremiah Vanderlaan, P.Eng.

That annoying person on your team who wants to understand as much as they can about a current process or procedure, then may suggest a better way to do it? That's me! I want to know the 'why' behind everything ... and if the answer is, "because that's the way we've always done it," I am not satisfied.

Now, understandably, you cannot consistently reinvent the wheel—and sometimes the reason behind a certain procedure can get lost or forgotten. However, when a seemingly better way to do things is brought to the table, it may be time to re-evaluate and embrace a little change.

'Change' may be the only true curse word in the construction industry! Just like all other curse words, however, the more you use it, the less impact it will begin to have.

Today, it seems this industry, which in the past has been notoriously slow to adapt to changes, is finally starting to see major shifts in terms of thinking, methodology and technology. A new perspective is opportunely timed for the construction industry, given the rise of several trends and driving factors that demand buildings with optimal performance, in such areas as energy consumption, long-term maintenance, the building envelope and futureproofing.

## Sustainability guidelines

Two of the most relevant trends are

net-zero carbon and passive-house buildings.

The World Green Building Council (WorldGBC) is committed to promoting 100% implementation of net-zero carbon buildings—which are highly efficient and fully powered by renewable energy sources, either on- or off-site—by 2050, as required to achieve global emissions reductions outlined by the Paris Agreement within the United Nations (UN) Framework Convention on Climate Change. The Canada Green Building Council (CaGBC), for its part, has launched a Zero Carbon Building Standard, which uses carbon emissions as its key performance metrics.

The passive house standard, meanwhile, is an internationally recognized, voluntary set of principles for energy efficiency that can be applied to commercial, institutional and residential buildings. The science-based concept is so rigorous in its quantitative technical criteria, the standard leads to buildings consuming up to 90% less heating and cooling energy than conventional buildings.

## Building better

While these two trends largely address the environmental factors involved in optimal building performance, with regard to energy consumption and the building envelope, other factors are also driving the demand for long-term, full-life-cycle design, including



the need for more affordable and durable buildings. What they all have in common is the noble notion of 'building better buildings.'

In reality, however, other factors make it difficult for the construction industry to complete such projects on schedule. Even as many new products and systems enter the marketplace, the challenge of ensuring optimal building performance through net-zero carbon and passive-house principles may prove intimidating.

This issue points to the need to optimize the entire process with a more highly integrated project design and delivery model.

## Integrated design and delivery

Such a model involves taking a step back from the construction industry's traditional methods and looking for new opportunities to combine the functions of various building elements.

One example of integrated design would be to use a precast concrete slab as a structural floor element and include in-floor hydronic lines for overall heating and cooling through core activation, along with electrical





Photos courtesy Newton Group

Advances in off-site construction, prefabrication and modular design are facilitating a shift in thinking.

conduits and sprinkler lines for the level below. This way, one main part of the building can serve multiple purposes in the overall design, spanning structural, mechanical and electrical engineering disciplines.

Integrating all of these functional elements on-site is not simple, but advances in off-site construction, prefabrication and modular design can facilitate such a shift in thinking. And as higher levels of prefabrication bring challenges for the traditional project delivery model, this is where integrated design must be complemented by integrated delivery. For a structural element like a floor slab to also provide climate control, electricity and fire suppression, all team members must be involved in the overall project

from the beginning.

With an integrated design and delivery model, all parties come together to address the needs and specifications set out by the owner. This way, they can support each other in producing a set of designs to ensure efficient, optimal performance.

### Lessons from the automotive industry

While this concept suggests a level of risk-sharing and collaboration that is rare or non-existent in the construction industry, it is similar to how the automotive industry already works. If today's cars were delivered like today's buildings are, they would be much more expensive and their production schedules would take much longer—

but automotive manufactures have instead vertically integrated themselves, such that teams work directly with each other to manage the design, engineering, manufacturing and delivery of their products, ensuring efficiency in cost and function.

There is some precedent for the crossover. The American Institute of Architects (AIA), for example, has advocated for integrated project delivery (IPD), which it defines as “a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste and maximize efficiency through all phases of design fabrication and construction.”

IPD was conceived with heavy influence from the automotive industry—specifically, the Toyota Production System (TPS), also known as ‘just-in-time production’ and the precursor to today’s ‘lean manufacturing.’

Now, the integrated design and delivery concept is positioned to take the IPD model another step closer to the streamlined nature of automotive manufacturing. If the construction industry is ready for such changes and to achieve the same degree of productivity gains seen over the past few decades in other industries, then as its methods evolve with higher acceptance of prefabrication and modular elements, I believe we will start to see more vertical integration.

And just as today's automotive industry includes many original equipment manufacturers (OEMs), so too can engineering firms and other companies in the construction industry evolve into original building manufacturers (OBMs).

**CCE**

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# The Importance of MAINTENANCE DOCUMENTATION

By Michael Wrinch, P.Eng., and Matthew Keeler, P.Eng.

Operators of complex machinery are always faced with a challenge: equipment has a lifespan and without proper maintenance, a breakdown is inevitable. To ensure efficient operations and an acceptable level of safety, a system of regular documentation of maintenance can mean the difference between a safely managed facility and a catastrophic failure.

## Ensuring functional safety

'Functional safety' is an important process that mitigates hazardous events for active equipment. The International Electrotechnical Commission's (IEC's) most senior safety standard in this respect, IEC 61508, describes a holistic approach to engineering as a requirement to determine a new system's safety rating, with methods for designing, deploying and maintaining automatic protection systems.

Another benefit of this standard is it allows for proactive management throughout the equipment's life cycle, which begins with concept design and risk reduction, then continues with realization, maintenance and, eventually, decommissioning.

Without understanding the full scope of a system's integrity, the risk of failure will increase throughout its life. This can compromise safety and expose the operator to liability issues.

Record-keeping is essential to functional safety, throughout all stages of a product's life. Common wisdom may suggest the only required documents are design files and the manufacturer's operations manuals, but to ensure functional safety over the lon-

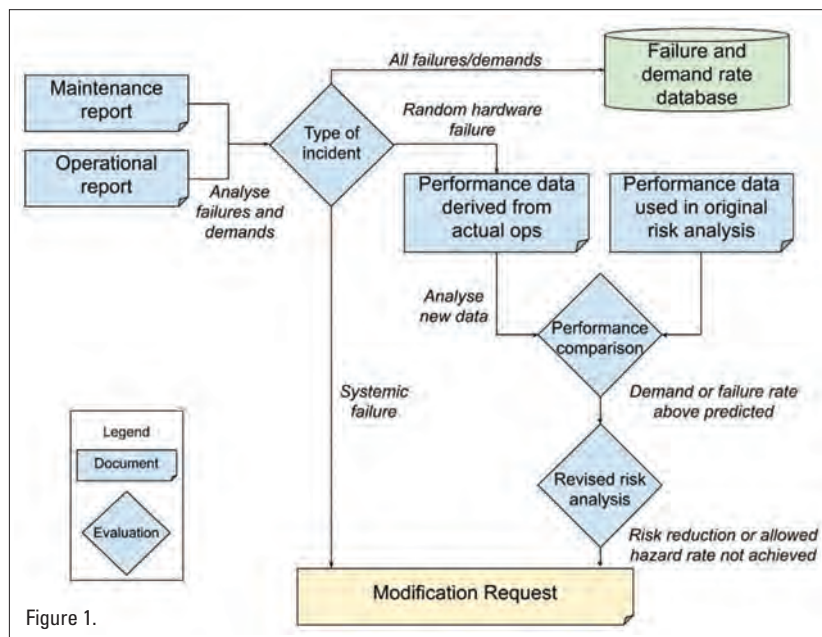


Figure 1.

ger term, it is crucial to keep records of all interactions with the machine.

This will involve documenting the product's various operations and maintenance (O&M) stages. Any time a part is serviced or altered in any way, those changes need to be recorded.

## Understanding failures

When a product enters O&M, there needs to be a management model in place (see example in Figure 1). The resulting reports should be stored in a database, so as to keep a record of all events regardless of their outcomes and then to determine if a failure can be considered systemic or random.

Systemic failures are difficult to detect, but historical data trends can support analysis. Random failures, on the other hand, involve comparisons between actual data and risk analysis

data. If there is a disparity, the risk analysis requires an update and a modification request can be submitted, so as to adjust the product accordingly. The outcome of a maintenance report does not mean the product should be modified, but it is a clear process that any operators who support the product can understand with ease. This transparency prevents non-essential replacements and reduces unforeseen hazards.

In North America, accountability for functional safety falls on the owner, who is ultimately responsible and liable for operations—but engineers can also find themselves liable if they are negligent in their duty of care. Indeed, owners can gain liability protection by hiring consulting engineers to oversee their system documentation. It is in the owner's best



interest to recognize severe risks, take the initiative to hire a consultant and have them help create a process to manage equipment, so in the event of failure, there will be a recorded history of preventative measures that can be reviewed.

### Lacking a plan

What if there is no maintenance plan for currently operational equipment? Don't worry. This is a very common issue.

The most important step is to get buy-in for the creation of a plan. This will involve ensuring managers know when tracking begins, as more incidents will seemingly appear throughout the process. A transparent maintenance system will reveal many recorded events for the machine in question; it is no different from what was happening prior to tracking, except now there will be an established record.

Once buy-in is achieved, the next step is to (a) develop an internal plan or (b) bring in a functional safety engineer to support the development of a maintenance plan and a process to maintain, track and monitor the product.

At this point, the organizational culture may require special attention, as the maintenance team will have access to the information, which brings up a concern with traceability. Having a conversation about the benefits with the team will address fears that if the records are stored, the team will increase their liability through documentation and might be subject to legal action or, if something goes awry, it will result in a personal loss of work or harm to their reputation. They should be reassured the process is only intended to foster continual improvement and safer experiences for users, operators and maintenance team members alike.

### Trusting the process

There are no guarantees when it comes to functional safety and even a well-tuned machine can experience a random failure, but what can

be controlled is the likelihood of risk exposure.

The involvement of a functional safety engineer can lead to a deeper comprehension of both the functionality and integrity of the system, so as to best mitigate any oncoming issues. Keeping on top of maintenance documentation is important to the success of the organization, the product's

lifespan and the users' safety.

**CCE**

*Michael Wrinch, P.Eng. and Matthew Keeler, P.Eng. are functional safety engineers with Hedgehog Technologies, a risk management and electrical engineering consulting firm based in Burnaby, B.C. They are also both certified to international safety standards through TÜV Rheinland.*

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# Becoming a B CORP

Sustainability certification can help attract and retain the best and brightest employees.

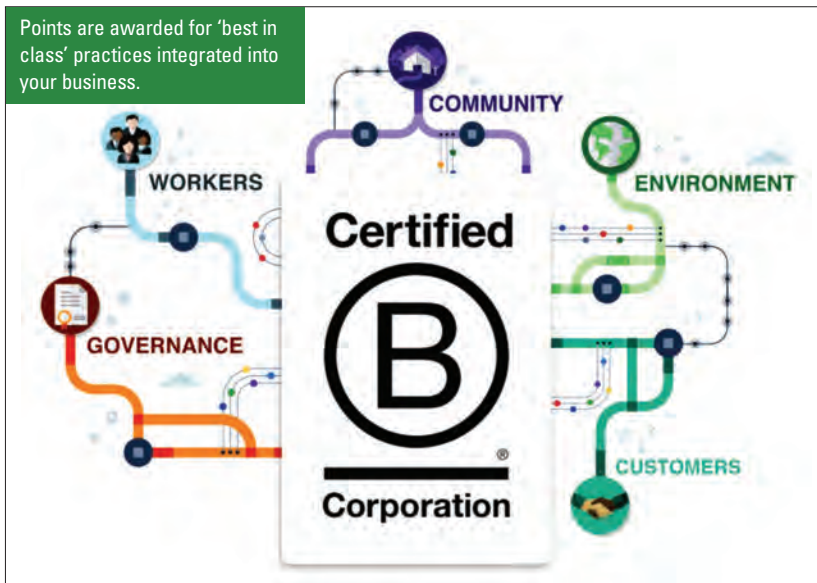
By Samantha Richardson, CPA ASA

Many engineering firms seek to gain an edge by attracting their choice of employees—in particular, individuals who are motivated, keen and taking an intentional approach to their work. One way to get their attention is by showing your firm lives out the values it preaches. Such commitment can be demonstrated by taking steps to change the firm's corporate structure to that of a 'B Corp.'

Benefit Corporation (B Corp) certification is to businesses what fair trade certification is to coffee producers, *i.e.* it signals to outsiders that a company measures up to a verifiable set of ethical standards. The concept originated in the U.S., where corpo-

rate law requires firms to operate with profit as their number one goal, to the exclusion of all else, but where savvy business owners are also aware that prioritizing short-term profit and shareholder value over client and employee relationships can threaten a firm's own long-term success.

With this in mind, B Corp certification allows for legal protections that permit a firm to prioritize other stakeholders, in such a way that will eventually lead to more profit and sustainable success. Indeed, certified B Corps are legally required to consider the impact of their decisions on their customers, suppliers, workers and community and the environment.



## Why you should consider it

As its name might suggest, there are many benefits to B Corp certification. Among the biggest advantages for small to medium engineering firms comes in addressing the constant challenge of hiring the best and brightest new workers.

According to multiple studies, millennials are more likely to choose to work for employers that exhibit higher commitments to sustainability. In fact, surveys show more than half of them consider sustainability when accepting a job offer and determining whether or not they will stay with the





Images courtesy B Lab

firm for the long term. Some are even willing to take a pay cut to work for a firm committed to sustainability.

B Corp certification allows a firm to express such values succinctly to potential hires and get them more excited about working there. Several examples of smaller, service-based businesses that certification has helped attract and retain outstanding employees include Fiix, OpenConcept and Enviro-Stewards.

Another benefit related to B Corp certification is going through the assessment process and examining your current business practices, as

many outdated and/or inefficient activities can be identified and then adjusted. Even outside a pandemic, taking expensive flights to remote construction sites is not always as important for today's consulting engineers, when the right technologies and safety checks are in place. Any reduction in such travel is likely to be welcomed by your staff and, in terms of profits, yourself.

### How to get certified

The certification process begins with the assessment, which is designed to be sufficiently flexible for small businesses. Through asking a series of questions about your organization, the assessment determines how to rate various facets of it. Points are awarded for 'best in class' practices integrated into your business.

As service-based businesses, engineering firms do not have much of a supply chain to worry about with regard to sustainability. So, questions about your suppliers will not be scored as heavily as they would for a fashion firm, where supply chain issues are much more important.

Instead, the most important facets for assessment purposes would include ongoing training/education for employees, banking with a credit union (to support the local economy), adequate parental leave and support, on-site renewable energy (where possible), paid volunteer days, environmental consulting services, carbon footprint reductions and actively inclusive hiring policies to encourage workplace diversity, to name a few.

That said, engineering firms are also advisors for how buildings and infrastructure are made, using which materials. As such, they are in a position to ensure vendors incorporate environmental policies into their operations. These policies, which can be checked for through supplier questionnaires, generally indicate which suppliers will be less risky to work with in an age of increasing environmental focus. Pursuing and incorporating these changes will show your own employees you are walking the walk,

not just talking the talk.

Employees are already an engineering firm's greatest assets, so consider asking them (perhaps anonymously) about where their priorities and interests lie. Do they want to work for an employee-owned firm? Would they like incentives for choosing environmental commuting options, such as transit subsidies or on-site showers for cyclists? Following through could enhance trust and morale.

### How to get recertified

A word of caution: after a firm goes through the assessment and becomes a certified B Corp, it is important not to forget about the process, as recertification will take place every three years.

As such, the documentation necessary for the recertification process should be incorporated into your yearly budget projections and financial reviews. That way, you will always have up-to-date information on hand, rather than enduring the additional stress of finding out too late if you have or have not earned enough points to requify.

An annual review provides a great way to engage your workforce, remind them about the certification's broader purpose and find ways to continually improve your B Corp status.

Indeed, I would highly recommend the B Corp process to anyone who wants to improve their business, even if they are not interested in pursuing certification. The assessment tool is an easy way to track your firm's progress over the years, which can provide valuable insights for you and your colleagues, and it is a great way to ensure your firm is creating a legacy that will be remembered in the future.

**CCE**

*Samantha Richardson, CPA ASA, is the author of the book, Ethical Profit A Guide to Increasing Profit Using Sustainable Business Practices, and founder of Ethical Profit Agency, Canada's second B Corporation accounting firm. For more information, contact her via email at [info@ethicalprofitagency.com](mailto:info@ethicalprofitagency.com).*



# Reducing Carbon with YYC's **EAST DEICING APRON**

For the first Canadian project of its kind, concrete was injected with waste CO<sub>2</sub> during mixing.

By Peter Saunders

From August to September 2019, CarbonCure Technologies installed a new deicing pad for YYC Calgary International Airport. The first of its kind in Canada, the East Deicing Apron was built with reduced-carbon concrete. PCL was the contractor for the project and the concrete was produced at an on-site portable batch plant.

"As YYC strives to be a leader in sustainability, we fully supported our airline partners in the decision to inject captured carbon into the new East Deicing Apron's concrete pavement," says Carmelle Hunka, general counsel and vice-president (VP) of risk and compliance for the Calgary Airport Authority, which operates YYC.

The amount of concrete poured to build the pad—approximately 25,300 m<sup>3</sup>—represents the second-largest

pour of CarbonCure concrete in a single project and the largest quantity to be used in Canada. It is estimated to reduce 160 tonnes of carbon, equivalent to the carbon dioxide (CO<sub>2</sub>) absorbed by 209 acres of forest over the course of a year. The only larger project of its kind so far has been an office tower at 725 Ponce in Atlanta, Ga., where 33,000 m<sup>3</sup> of the concrete was used.

The company injects waste CO<sub>2</sub>, captured by industrial gas suppliers, into its concrete during mixing. The resulting product is not just more sustainable than typical concrete—with each 1 m<sup>3</sup> reducing an average of 16 kg of carbon emissions, meaning an average high-rise building could save 120 tonnes of emissions—but also reportedly stronger.

CarbonCure reports its partners' total concrete production volume in

2019 surpassed 3.3 million m<sup>3</sup> and reduced CO<sub>2</sub> emissions by more than 55,000 tonnes, equivalent to that absorbed by more than 70,000 acres of forest or, to think of it another way, taking 12,000 cars off the road for the year.

"2019 was a record year, as our partners' total production volume and the associated carbon savings nearly doubled from 2018," says Robert Niven, the company's founder and CEO. "We are proud a project based in Canada was such a large contributor to these milestones. This is another instance of CarbonCure meeting rigorous performance standards, including the top-tier design and engineering standards required for airport paving."

The first airplanes to use YYC's new deicing pad began to do so in December.

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# Specifier's Literature Review



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## HVAC



Unlike a typical air-to-air heat exchanger, which creates a path that allows heat to flow from a higher to lower temperature more quickly than cooling can occur within an enclosure wall, the Pfannenberg Kinetic System (PKS) series creates a closed passive loop that, (a) unlike a filter fan, does not allow external and internal air to mix and, (b) unlike a cooling unit, does not involve an active compressor using energy to facilitate the heat flow.

The thermodynamic properties of the refrigerant cause it to move through the coils without a compressor, saving energy as it cools electrical enclosures. The closed loop prevents particulates in the ambient air from drifting into the enclosure and damaging components. Two fans move air across the heat exchanger which, in turn, allows heat to be absorbed from inside the cabinet and released into the ambient air. The system is intended for automotive and other climate-controlled factories that require careful cooling.

[pfannenbergsusa.com](http://pfannenbergsusa.com)



Nortek Air Solutions (NAS) has released 'catalogue' computer room air handlers (CRAHs) for data centres requiring option-configurable cooling units. Ranging from 63 to 430 kW in nominal cooling power capacity, the new models allow consulting engineers to specify the user's options. Featuring welded, heavy-duty structural steel tube cabinetry and dry powderbaked black or white finish, they are available with an optimized copper tube/aluminum fin A-frame coil or an optional high-capacity coil to achieve greater cooling within the same footprint. There are also two-, three- and four-fan options, plus downflow (for underfloor applications) or front-discharge configurations for supply air discharge. The catalogue CRAHs supplement NAS's legacy platform and mission-critical equipment lines, which continue to offer custom-built units to meet site-specific requirements.

[nortekair.com](http://nortekair.com)

## SENSORS



Victoria-based Reliable Controls has released the SS3 deep backplate as an accessory for its Smart-Sensor and Space-Sensor temperature detectors. The backplate facilitates surface-mounted instal-

lations on concrete and other solid surfaces without the need to cut an opening in the wall, including exterior walls where thermal bridging could influence sensor readings. It is suitable for use with the company's gas-sensing or wireless models and is designed to fit and cover single-device electrical boxes. The backplate has a knockout sized for Wiremold cable management. Alternatively, it can be ordered with a conduit coupler for use with wiring enclosed in 0.5-in. electrical metallic tubing.

[reliablecontrols.com](http://reliablecontrols.com)

## LITERATURE



The American Society of Civil Engineers (ASCE) has released the third edition of *Seismic Evaluation and Design of Petrochemical and Other Industrial Facilities*, which offers safety recommendations for new and existing facilities during and following an earthquake.

Prepared by a task committee within ASCE's energy division, the book interprets the intent of building codes and then goes further with practical guidance for new design details and considerations. For existing facilities, meanwhile, it presents evaluation methodologies based on experiences with past earthquakes to address seismic vulnerabilities not covered by building codes.

Intended for structural design engineers, the book also contains background information relating to seismic safety, such as contingency planning and post-quake damage assessment.

[ascelibrary.org](http://ascelibrary.org)

## INDUSTRIAL



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