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PILING CANADA

The Premier Publication of Canada's Piling Industry pilingcanada.ca $4.50 CANADIAN Q4 • 2019

STATE OF THE INDUSTRY

Experts on both sides of the Atlantic weigh in on some of the challenges facing the construction sectors in Canada and in Europe, and how they're being addressed

Plus: Henry Foundation Drilling Inc. innovates to complete unique piling project in Nunavut

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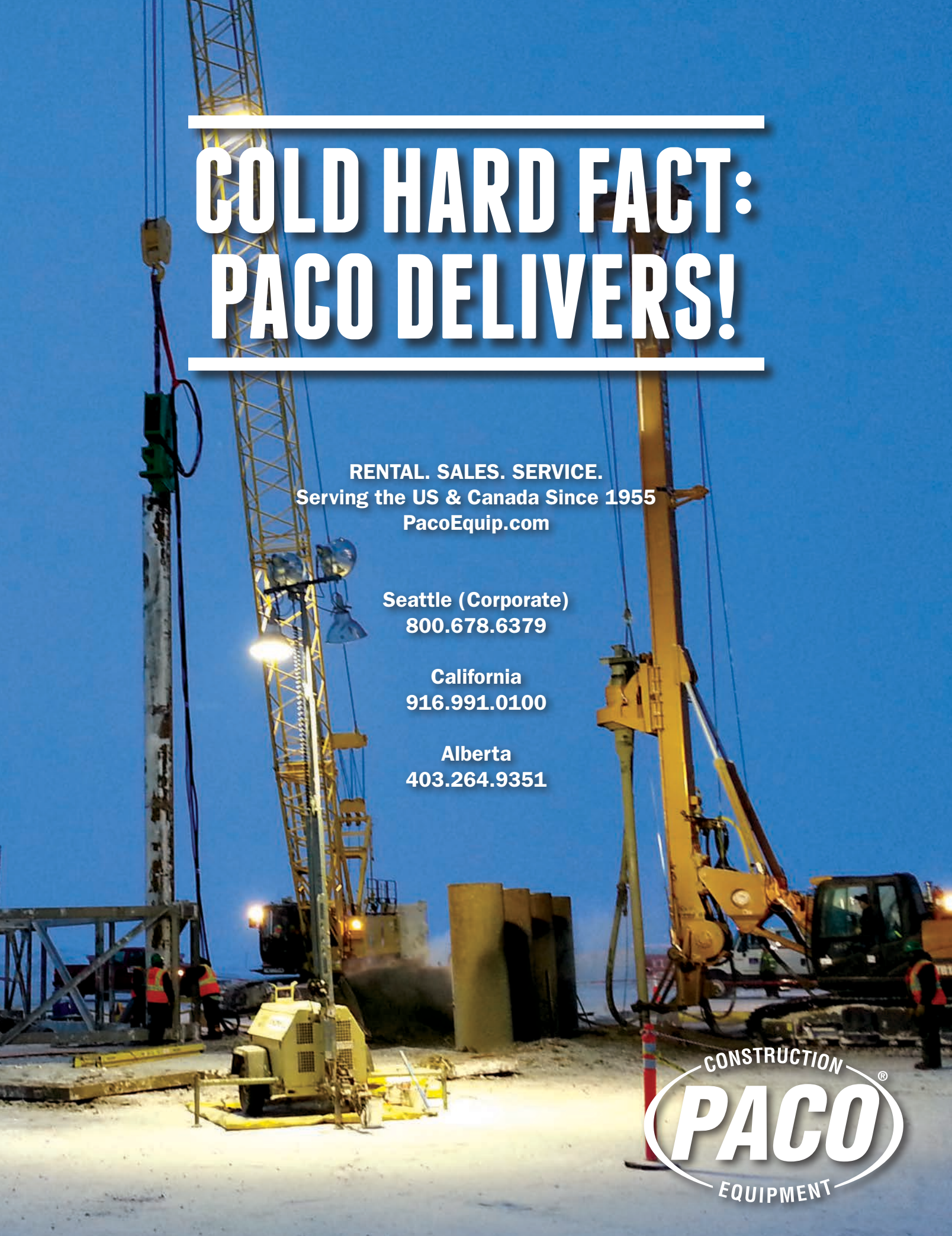
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ON THE COVER

The deep foundations industry world-wide has reached a point of disruption unlike anything seen in previous years. New technologies, the skilled trades shortage, political uncertainties and the ever-growing threat of climate change are just a few of the stressors industry is facing. *Piling Canada* investigates what is being done at home and aboard to help curb the impacts of these changes. That story starts on page 28.

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Foresight is 2020

Welcome to the final issue of *Piling Canada* for 2019! There was much excitement this year with new technologies hitting the market, growth and expansion for many companies and a federal election. Of course, the year hasn't been all rosy. Uncertainty continues to swirl around the future of skilled trades as industry faces an ongoing labour shortage.

In times of uncertainty, it can feel as though we are facing these difficulties alone. However, the skilled labour shortage, political and economic uncertainties are not only Canada issues – or North American for that matter. Writer Mark Halsall caught up with Aarsleff Ground Engineering out of the U.K. and Keller Canada to discuss the "State of the Industry" on both sides of the Atlantic, and what is being done to solve these issues. Head over to page 28 for the whole story.

In February, I received an email from Jacob Schönberg over at Scandinavian Pile Driving (SPD), located in Sweden. Schönberg informed me that SPD would be landing in Canada soon as they had just sold a rig to Quebec-based Preco-MSE. Congratulations Preco-MSE on your new rig, and to SPD for its Canadian debut. Flip to page 17 to learn more about these two companies.

One of the new technologies this year comes from industry veteran Liebherr. The company has introduced to market the world's first rig with "Local Zero Emission." Find the full story on page 21 to learn more about the LB 16 unplugged. Drop me a line if you find yourself working on this rig in the future, I'd love to hear about the experience!

With a new federal cabinet announced in November, it might be time for you to get political. You can help steer the changes that impact your business by becoming involved with local, provincial and federal governments. Although, that may be easier said than done. There is no doubt that speaking up to ensure your voice is heard can be intimidating. On page 57, find the article "Let's Get Political" for some great tips and advice on how and why you should advocate for your business and industry to government.

As always, I hope you enjoy this issue of *Piling Canada*. I'm always on the lookout for great stories from our industry to share, so please feel free to drop me a line. You still have time to submit your projects for the third Great Canadian Projects issue. I can't wait to see what everyone has been busy with all year! If you haven't yet, don't forget to follow us on Facebook, LinkedIn and Twitter!

Happy piling,

Lindsay Risto
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2019/20 DEEP FOUNDATION CONSTRUCTION INDUSTRY EVENTS

Below is a list of events hosted by various organizations for the North American deep foundation construction industry. For more information on any event, visit the organization's web page. Attending industry events is a great way to learn about new products and technologies, and network with like-minded individuals.

If you have an event that you would like added to this list, please send an email to lristo@lesterpublications.com.

December 2019

- ***Dec. 11–13***
  International Accelerated Bridge Construction Conference
  Miami, Fla.
  Florida International University
  www.abs-utc.fiu.edu

January 2020

- ***Jan. 27–31***
  ADSC Annual Meeting
  Tucson, Ariz.
  The International Association of Foundation Drilling
  www.adsc-iafd.com

February 2020

- ***Feb. 25–28***
  Geo-Congress 2020
  Minneapolis, Minn.
  Geo-Institute
  www.geocongress.org

March 2020

- ***March 8–10***
  Geosynthetics Conference 2020: CASE STUDIES
  Charleston, S.C.
  Geosynthetic Materials Association
  www.geosyntheticsconference.com
- ***March 10–14***
  CONEXPO-CON/AGG 2020: International Construction Trade Show
  Las Vegas, Nev.
  www.conexpoconagg.com
- ***March 11***
  DFDTA 2020 Orlando Seminar & Workshop
  Orlando, Fla.
  Pile Driving Contractors Association
  www.piledrivers.org
- ***March 22–27***
  ASCE Week: A Continuing Education Event
  Orlando, Fla.
  American Society of Civil Engineers
  www.asceweek.org
- ***March 23***
  Stability Analysis of Embankment Dams
  Phoenix, Ariz.
  Association of State Dam Safety Officials
  www.damsafety.org

April 2020

- ***April 5–8***
  Structures Congress 2020
  St. Louis, Mo.
  Structural Engineering Institute of ASCE
  www.structurecongress.org
- ***April 20–24***
  16th Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impacts of Karst
  San Juan, Puerto Rico
  National Cave and Karst Research Institute
  www.sinkholeconference.com
- ***April 23–25***
  GBA Spring Conference
  Ponte Vedra Beach, Fla.
  Geoprofessional Business Association
  www.geoprofessional.org

May 2020

- ***May 6–9***
  PDCA's 2020 Annual Conference
  Phoenix, Ariz.
  Pile Driving Contractors Association
  www.piledrivers.org

June 2020

- ***June 2–4***
  Basic Soil Mechianics Related to Earth Dams
  Chicago, Ill.
  Association of State Dam Safety Officials
  www.damsafety.org
- ***June 3–5***
  SuperPile '20
  St. Louis, Mo.
  Deep Foundations Institute
  www.dfi.org
- ***June 23–25***
  Seepage Through Earth Dams
  Baltimore, Md.
  Association of State Dam Safety Officials
  www.damsafety.org

August 2020

- ***Aug. 4–6***
  S3: Slopes, Slides and Stabilization
  San Francisco, Calif.
  Deep Foundations Institute
  www.dfi.org
- ***Aug. 16–19***
  International Symposium for Offshore Geotechnics
  Austin, Texas
  Deep Foundations Institute
  www.dfi.org

September 2020

- ***Sept. 13–16***
  CGS Annual Conference – GeoCalgary
  Calgary, Alta.
  Canadian Geotechnical Society
  www.cgs.ca
- ***Sept. 20–24***
  Dam Safety 2020
  Palm Springs, Calif.
  Association of State Dam Safety Officials
  www.damsafety.org
- ***Sept. 23–24***
  DICEP 2020
  New Orleans, La.
  Pile Driving Contractors Association
  www.piledrivers.org

October 2020

- ***Oct. 13–16***
  45th Annual Conference on Deep Foundations
  National Harbor, Md.
  Deep Foundations Institute
  www.dfi.org
- ***Oct. 22–24***
  GBA 2020 Fall Conference
  Minneapolis, Minn.
  Geoprofessional Business Association
  www.geoprofessional.org
- ***Oct. 28–31***
  ASCE 2020 Convention
  Anaheim, Calif.
  American Society of Civil Engineers
  www.asce.org

November 2020

- ***Nov. 15–18***
  10th International Conference on Scour and Erosion (ICSE-10)
  Arlington, Vir.
  The Geo-Institute of ASCE
  www.2020icse.org

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Masters of the Pivot

Reliable Welding Services' ability to adapt to the sudden ebbs and flows of industry ensures their clients can rely on them

By Bilal Rana

Rick Morawski started his business as a construction company in 1978. Forty years later, fueled by a unique blend of optimism, versatility and grit, he's still in business.

Morawski's first major test as an entrepreneur happened in the early 1980s. The National Energy Program brought major construction projects to a halt. At the same time, interest rates hovered between 24 to 27 per cent.

Morawski knew he had to adapt. So, in 1985 he expanded the scope of his business offerings to include welding projects.

Morawski partnered with Rudy Gruger. While Gruger ran the welding shop, Morawski focused on growing the business. Things continued on that trajectory for 15 years.

The fleet-footedness Morawski exhibited in the mid-'80s served both himself and Gruger well and continues to inform the rest of their joint careers. "That versatility, we both have it," said Morawski.

In 2000, Reliable pivoted once again to capitalize on Canada's flourishing energy sector.

Having changed the company name from Reliable Excavating to Reliable Welding Services, the business partners built a shop on a five-acre property in Nisku, Alta. Morawski and Gruger got out of the construction business and pivoted to focus exclusively on welding projects for energy sector clients.

PHOTOS: RELIABLE WELDING SERVICES

A loaded truck of screw piles

The downturn

At its peak, Reliable Welding Services had 42 employees and the business was thriving. They built drill rig components for the energy sector, as well as floc tanks, dog houses and mud tanks. Reliable Welding clients were among the best-known firms in the Canadian energy sector.

However, that all came to an abrupt end when oil prices plummeted in 2014. It seemed as though every other week a different energy company was declaring bankruptcy. Reliable Welding clients either couldn't, or simply wouldn't, pay their accounts. Seemingly overnight, the work dried up.

During the energy boom, Reliable Welding achieved annual sales in excess of $5 million. After the downturn, annual sales contracted to just over $1.5 million.

Reliable Welding's 42-person staff was cut to a skeleton crew of six, and according to Morawski, "They were mostly sweeping floors."

Describing how they broke the difficult news of job cuts to staff, Morawski claims that he and Gruger always strived to be frank and matter of fact with their team. They told staff, "We're going to do our best to keep you employed. But you also have to work with us."

They were equally candid with anyone they owed money to. They met with the banks and explained their circumstances. They were forthright, saying to the banks, "If you push the panic button, you'll sink the ship and get nothing." They tried to persuade lenders that, "everyone had to work together, including the banks."

"We didn't hide," Morawski said, "no matter how much we owed."

Asked if they were ever tempted to walk away and follow in the footsteps of their energy sector clients, Morawski said that they had the benefit of historical perspective. "We'd been here before in the '80s with the National Energy Program. Besides, I think that entrepreneurs are all optimists anyhow."

The rise up

When their energy sector clients closed shop, Reliable's management decided that they couldn't afford to wait around for the industry to recover. The Reliable Welding team knew that drastic measures were called for.

They had dabbled previously in building piling products. "Before the downturn, about two per cent of our work was making piles."

They decided to abandon making drill rig components altogether and to simultaneously ramp up manufacturing of piling products. They chose to steer Reliable Welding towards the infrastructure side of things.

One of the first things they did was sit with a consulting company. "They encouraged us to really develop our website to showcase our new product lineup," said Morawski, "They helped us understand that we had key selling features that we didn't realize we had." These unique strengths included "our five-acre property and our very large loaders. The consulting firm helped us realize that we were well suited to taking on the manufacturing of larger foundation products."

A bucket pile being manufactured

Reliable Welding could leverage both its large loaders and the storage capacity of the large yard in Nisku.

"We can handle bigger pipe. We can handle 30-inch pipe, with one-inch walls, up to 80 feet long. We have loaders that can carry that."

Pile caps

A major part of Reliable Welding's transition involved sourcing new clients. Initially, Reliable's management sought out one major client at a time. "We hunted for that business," Morawski said. "We started with one and worked up."

Morawski concedes that there was a bit of a learning curve his team had to negotiate at first. "It took us a good year-and-a-half to two years to fully ramp up," he said.

Fortunately for Morawski and Gruger, Reliable Welding didn't have to do too much on the research and development side; their clients specified what they wanted.

When clients want something specialized, say, a custom drive shoe, "we'd sit down together and work out something on a napkin. We'd then work with the client and the engineers we contract out until we got it right." Morawski and Gruger's can-do attitude has undergirded all their efforts at Reliable Welding, and they have been well served by it.

Their larger clients also helped source material quantities that Reliable may not have otherwise been able to obtain on their own.

From the outset of Reliable Welding's foray into deep foundation products, Morawski and Gruger consciously cultivated highly collaborative working relationships with both their clients and suppliers.

They also set out to purposefully operate in their own lane. They reached out to other firms operating in the piling space and signalled as clearly as they could that Reliable Welding doesn't want to operate on the installation side at all. "We made a conscious decision not to venture into installation. We only want to manufacture."

Looking forward

Prior to the Canadian oil industry's downturn in 2014, piling products comprised only a small fraction of Reliable Welding's product offerings. Today, piling products account for 90 per cent of the company's output.

Driven pile products account for most of the company's present success, but Reliable also manufactures helical piles and sheet pile products.

"We work with a lot of pipe suppliers these days," said Morawski. "We do a lot of splicing work, making 40-foot-long pipes into 80-foot-long pipes. A lot of large plants, gas plants, production facilities and port projects require those depths."

While Reliable Welding clients are exclusively Canadian, Morawski and Gruger have nevertheless shipped products all over the globe. "We've shipped to Venezuela, Argentina, Mexico, Dubai. We ship worldwide."

Reliable Welding sales are slowly recovering to pre-downturn levels. Still, Morawski admitted, "We didn't think it would take five years to do it."

For now, Morawski and Gruger plan on growing the company. They're aiming to double sales in the next five years. "It's doable," Morawski said in a tone that is at once both confident and optimistic. "Our facility is certainly large enough to accommodate that growth. If we're not running three consecutive shifts, then there's room to grow. And we're always looking for ways to optimize."

Reliable Welding's staff complement is also steadily increasing. There are currently 25 employees. "Many employees that left Reliable Welding during the downturn have now returned and we're very proud of our staff," said Morawski.

Explaining their management style, Morawski said, "We don't have a devoted HR person. We just try to treat people right."

Morawski and Gruger strive to be as open as possible with their team. "We come into the lunchroom. We walk the yard every day. They see us. We try to give our staff the right tools to do the job. If we see someone not doing something correctly, we ask ourselves if we gave that employee the right information or the right tools to do what they're supposed to."

They must be doing something right. Reliable Welding's longest serving employee has been on the team for 36 years.

> **"We made a conscious decision not to venture into installation. We only want to manufacture."**
>
> **– Rick Morawski, Reliable Welding Services**

Morawski claims that they'll be growing the company for the next five years at least. They're presently in the process of acquiring a firm to bolster Reliable Welding's screw pile manufacturing capacity. They are also actively exploring opening a plant outside of Alberta and are investigating potentially suitable locations.

Reliable Welding also just opened a satellite office in Alliston, Ont., in an effort to source more work from Eastern Canada.

Speaking with Morawski, one certainly gets the impression that the Reliable Welding team is certainly gearing up for something. "The economy will pick up again," he said, "When it does, we plan on being ready."

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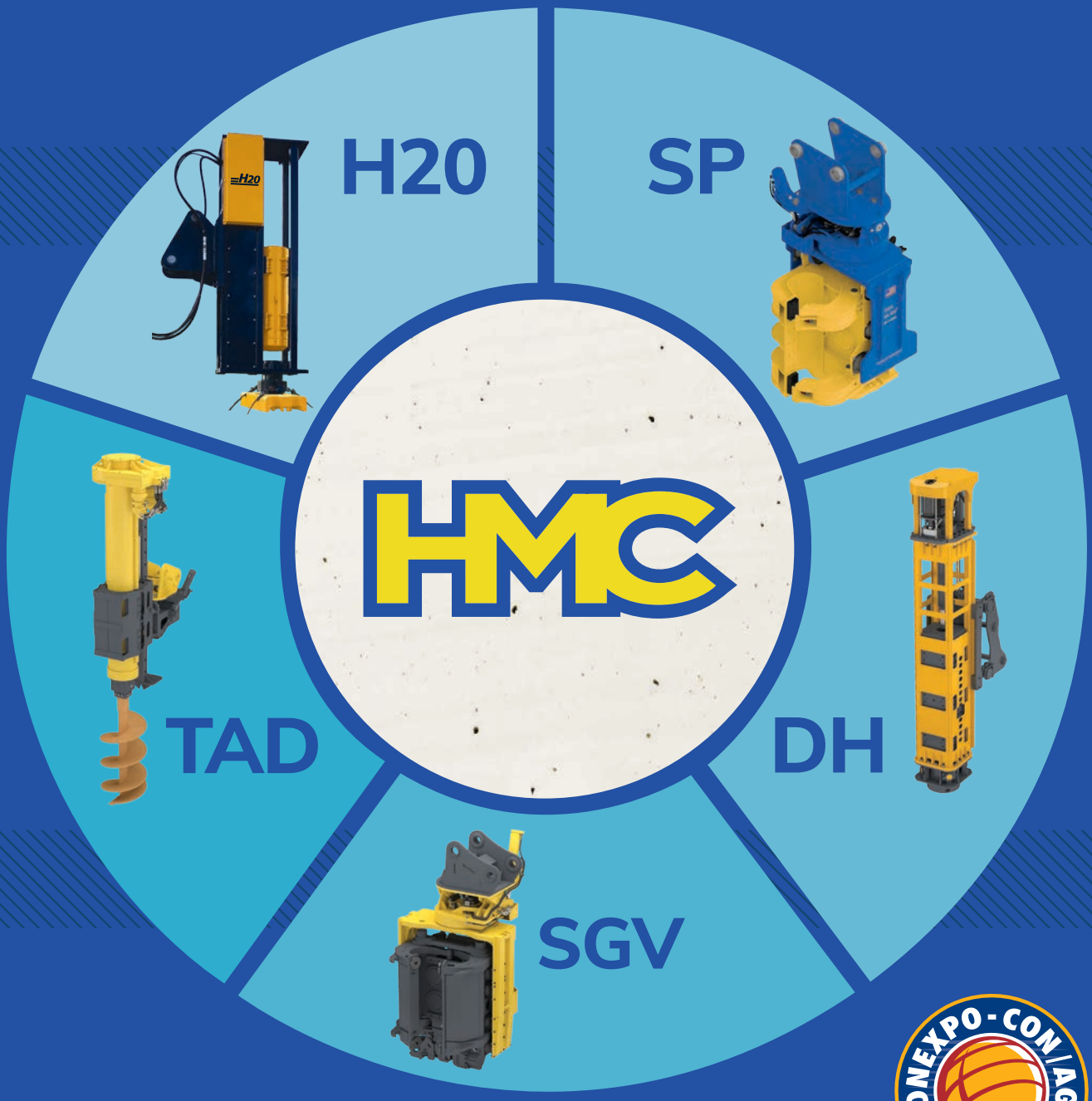

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SPD Enters the Canadian Market

A major player in Scandinavia's drilling industry sells its first rig in Canada

By Jim Timlick

Scandinavian Pile Driving (SPD) has become a major player in the foundation drilling industry in Scandinavia since the company was established by founder Magnus Andersson in 1993, and has been mentioned as one of the region's fastest growing companies.

While SPD has made major inroads to European countries like Norway and Finland in recent years, it has remained something of an unknown entity in Canada. That is likely to change very soon. Earlier this year the company landed its first deal in this country to supply one of its DT145 EC300 drill rigs (the DT stands for drill mast telescopic) to Quebec-based Preco-MSE.

> **"The machine is very easy to learn (to operate). You can learn all of the functions almost by instinct."**
>
> **– Marco Lessard, Preco-MSE**

PHOTOS: SCANDINAVIAN PILE DRIVING

It may not register an industry-changing transaction, but sales manager Jacob Schönberg says it's his company's hope that the deal will help SPD establish a firm foothold in the Canadian market.

"Yeah, that's exactly what it is," Schönberg said when asked of the significance of the deal. "Preco is a big company in Canada and they're well-known in the business. We hope that if they use the machine and they do a good job with it, people will look at it and say, 'That's a nice machine,' and we can sell some more in Canada."

Entering the market

SPD had been looking to break into the Canadian market for several years prior to signing a deal with Preco-MSE. The deal closed prior to the start of Bauma, the world's largest trade fair for the construction industry that is held every three years in Munich, Germany, and where the DT145 was on display.

The two companies were a natural fit for one another. Preco-MSE already had a close working relationship with SPD's parent company, German-based ABI Maschinefabrik, having purchased several rigs from the latter's line of drilling systems. In fact, more than half of Preco-MSE's $30 million fleet was manufactured by ABI.

Preco-MSE CEO Marco Lessard was invited to tour SPD's Swedish operations last year and was so impressed by what he saw, he ordered the DT145 soon after. So far, the Vaudreuil-Dorion-based company has used the unit, along with a reverse circulation system, on a handful of projects to drill piles for lagging walls that prevent soil from shifting into excavation sites.

Lessard has nothing except positive things to say about the unit's performance.

"So far we have had very good results. Even though we had never used that kind of machine before, after a couple of days my driller was already feeling comfortable with the machine. The machine is very easy to learn (to operate). You can learn all of the functions almost by instinct," said Lessard, whose company does more than $100 million in annual business across Canada.

One of the primary reasons Preco-MSE chose the DT145 unit, according to Lessard, was the fact it offers a completely remote-controlled operating system for both the mast and the excavator units, which he says significantly increases operator safety. It was also adaptable enough that it could be modified to incorporate a reverse circulation drilling system that collects all of the cuttings or spoils from construction sites into a single location away from pedestrians and motorists as well as features such as an automatic greasing system and a winter heating system to keep its hydraulics warm.

"Even though they are a big company in Sweden and have sold…machines all over the world, they are still listening to what their customers' needs are and adjust. That's what I liked from Day 1. They were sensitive to our needs," Lessard said.

Preco-MSE's SPD rig on display at Bauma

Magnus Andersson, CEO of SPD (left) and an employee

Interloc AN150 – the first built in Sweden – on display at Bauma

SPD sales rep, Jacob Schönberg at Bauma

Sweden's FDS AB micropiling with a DT145 EC300

Logistical challenge

Of course, shipping a 92,000-pound piece of equipment halfway around the world poses something of a challenge. First, it had to be sent via a cargo ship from Stockholm, Sweden, to Newark, N.J. It then had to be transferred to a float trailer and driven to Montreal. All in all, the process took about three weeks to complete and it went off without a hitch.

Simple in its design and easy to use, the DT145 EC300 is one of SPD's top selling machines and can tackle even the toughest drilling job. With a mast weight of 6,500 kilograms and measuring 15.5 metres in length with the telescopic section extended, it attaches to the boom of a Volvo EC300ENL excavator and delivers 140 kilonewtons of crowd force, making it ideal for Canada's extremely challenging surface conditions.

"I think that's one of the reasons we want to get into Canada is that you have pretty much the same kind of soil conditions as in Scandinavia," Schönberg said. "This is the perfect machine for that."

One of the more unique features of the DT145 is the 13-metre stroke that it offers, which is much longer than what most conventional drill rigs can offer.

"It will give you a 13-metre stroke and I think that was kind of a game-changer in Scandinavia," Schönberg said. "Before that, most companies used machines with a six-metre stroke. They could only put in six metre casings one at a time. With our machine you can use a 12-metre casing. It's much less time-consuming to make the casings with less joints."

SPD's remote control interface

> **"I think that's one of the reasons we want to get into Canada is that you have pretty much the same kind of soil conditions as in Scandinavia....This is the perfect machine for that."**
>
> **– Jacob Schönberg, Scandinavian Pile Driving**

Remote control advantage

Another advantage of SPD's drill rigs is that they can be controlled remotely. That means instead of being stuck in the cab, the operator can locate their self anywhere within viewing distance of the rig and can get a much better view of how the machine is operating.

"With the remote-control system, the driver gets more control over [the rig] and [they see] what's going on all around the machine," Schönberg said. "With the drilling, you have to be around where it actually happens. With our machine you have [the operator] outside and [they have] a remote control. [They have] a much better view of what's going on and is also much safer."

Over the years, SPD has earned a reputation for its attention to detail with all of the machines it manufactures. This is especially true when it comes to safeguarding the people who operate those machines.

At Bauma, SPD unveiled one of its newest innovations: replacing the safety cage around the DT145's drill head with an infrared rotary sensor system that can shut down the machine as soon as it detects an object moving towards it. The hardware for the system can be mounted on all of the company's machines and Schönberg says SPD is in the final stages of fine-tuning the software the system requires. The company has also adopted a system with over-centre valves that provides greater operator safety. Three-inch screens that are part of the remote-control operating system allow the operator to see the inclination of the rig, and will warn the operator if there is too much inclination.

In addition to manufacturing its own foundation mast attachments, SPD also offers a complete line of ABI rigs for a variety of piling and drilling applications through its German ownership group. It also carries a number of Swedish-built Interoc rigs including the AN150 which has been dubbed the "drilling machine of the future." The fully remote-controlled system features a colour display, 60 per cent less hydraulic hose which reduces the risk of oil leakage, software that allows for more effective communication between its controls and hydraulics, and consumes less fuel than many rigs on the market.

Innovation has been a staple of SPD since Andersson founded the company just over 25 years ago in Sala, a small Swedish town of about 30,000 people. Andersson started his career as a mechanic before launching the company. He remains actively involved in the company's day-to-day operations as its CEO with much of his attention focused on construction and development.

A strategic partnership

Anxious to expand his company's reach in Europe, Andersson realized he would need some help to do so. Two years ago, he sold a majority stake in the company to ABI to form a strategic partnership with the German manufacturer. The partnership helped SPD add some of its own touches to the AN150 including its remote-control system.

"The sale was actually [Andersson's] idea. He felt like he wanted a strong partner when going into an international venture like this," Schönberg said. "I think it was a very good idea. It's opened a lot of doors for us in the rest of the world. ABI is big in the foundation drilling business all over the world. It's one of the biggest manufacturers of multifunctional rigs. When we call customers now and talk with them and tell them we're part of ABI, they already know about ABI. It's really helped us get a foot in the door in a lot of other countries. People notice us more now."

Drill rigs remain an important part of SPD's core business, but the company has branched out to other areas. It sells a full line of spare parts for all of the machines it sells, including ABI, Delmag, Eurodrill and Interoc, and has a large rental fleet for businesses in Sweden and some of its Scandinavian neighbours. They are also the Scandinavian dealer for Eurodrill products.

Despite its increasing global reach, SPD remains very much a small business at heart. Its corporate headquarters in Sala employs a staff of about 30 full-time employees with 10 office staff and another 20 in the workshop, including a handful of travelling field technicians. Andersson is quick to say much of the credit for his company's success belongs to its employees.

"A good working environment makes the production more effective," he told a Swedish magazine.

As for the future of SPD in Canada, Schönberg believes the recent deal with Preco-MSE is a sign of things to come.

"I think we can sell a couple of more machines there," he said. "I think it would be a good fit. We just need to reach out to people."

Deep Foundations Work Goes Electric

First application of global innovation

Submitted by Liebherr

It is a trouble spot in the western Austria road network: the Bludenz-Bürs junction of the A14 motorway. There are frequent traffic jams and delays due to congestion. To avoid dangerous tailbacks on the motorway, by the end of 2021 ASFiNAG – a publicly owned Austrian corporation which plans, finances, builds, maintains and collects tolls for the Austrian autobahns – is to build a large roundabout with two bridges over the A14, as well as two new connections to regional roads, also with a roundabout and water protection facility.

The local company i+R is carrying out the deep foundation work on the west side and will use the world's first drill rig on the market with "Local Zero Emission." The LB 16 unplugged, recently launched by Liebherr, has an electro-hydraulic drive concept and can also be used cable-free thanks to the battery, hence "unplugged."

The challenge

Certainly aware of corporate responsibility for the environment and society, the alternative drive concept has been well received by the customer. "Sustainability in the construction industry is not a foreign concept, but common practice for ASFiNAG. Innovative developments like the world's first drilling rig with zero emissions show that also on ASFiNAG construction sites there is enough room for environmentally-friendly construction practices," said Andreas Fromm, managing director of ASFiNAG Bau Management GmbH.

The challenges for i+R are the narrow construction site itself, as well as the restricted working height. The pile foundations must be placed directly under a power line. Therefore, the drill rig is designed as a low head with a shorter lead. During the project i+R is installing 148 piles and

PHOTO: LIEBHERR

The battery is designed to last one working day (10 hours) and can be charged easily overnight using a standard construction site electric supply (32 A, 63 A).

drilling 1,742 metres total into the ground. Approximately 1,200 cubic metres of cement are being poured. The piles vary between 10 and 14 metres in depth and have a diameter of 900 millimetres. Due to the restricted working height, two metre casing pipes have to be used and the reinforcement cages have to be inserted in sections. The machine achieves approximately two piles per day.

The benefits

The absence of a combustion engine has two particular advantages: the LB 16 unplugged produces no local exhaust emissions and also generates considerably less noise. "You don't have to shout all the time. You can talk normally and your colleague hears, even when standing further away. Otherwise, when the engines are running at full power, they are very loud and you always have to raise your voice, which is a burden in itself. You also don't hear little things in the surrounding area, which you do now during ongoing site work," said foreman Sebastian Timpe. Therefore, the quieter environment is also a safety-relevant aspect in regular construction site operations.

The machine has no restrictions in terms of performance and application compared with the conventional version. The battery is designed to last one working day (10 hours) and can be charged easily overnight using a standard construction site electric supply (32 A, 63 A).

Local zero emission

Sometimes the cement for this project is delivered by the Liebherr concrete mixer ETM 905 with electric drum drive. In normal operation the battery capacity is sufficient for the entire working day. As a plug-in hybrid, the battery can be charged during the journey or externally via a plug at a concrete mixing plant. i+R also uses an electric compact excavator. Thus, deep foundation work on a construction site is carried out for the first time using almost exclusively electrically driven machines. Therefore, the best possible combination of customer benefit, environmental compatibility and efficiency is achieved. Estimated over one year, approximately 35,000 litres of diesel fuel can be saved and more than 92 tonnes of CO_2 emissions can be avoided.

"The construction site at Bludenz-Bürs is a win-win situation for everyone: enhanced safety and fewer traffic jams for the local Vorarlberg people, and environmentally-friendly use of construction machines on the currently largest ASFiNAG construction site in Vorarlberg," said Fromm.

To see the LB 16 unplugged in action, visit youtu.be/yZ96D4ZTtw8 and visit www.liebherr.com for more information.

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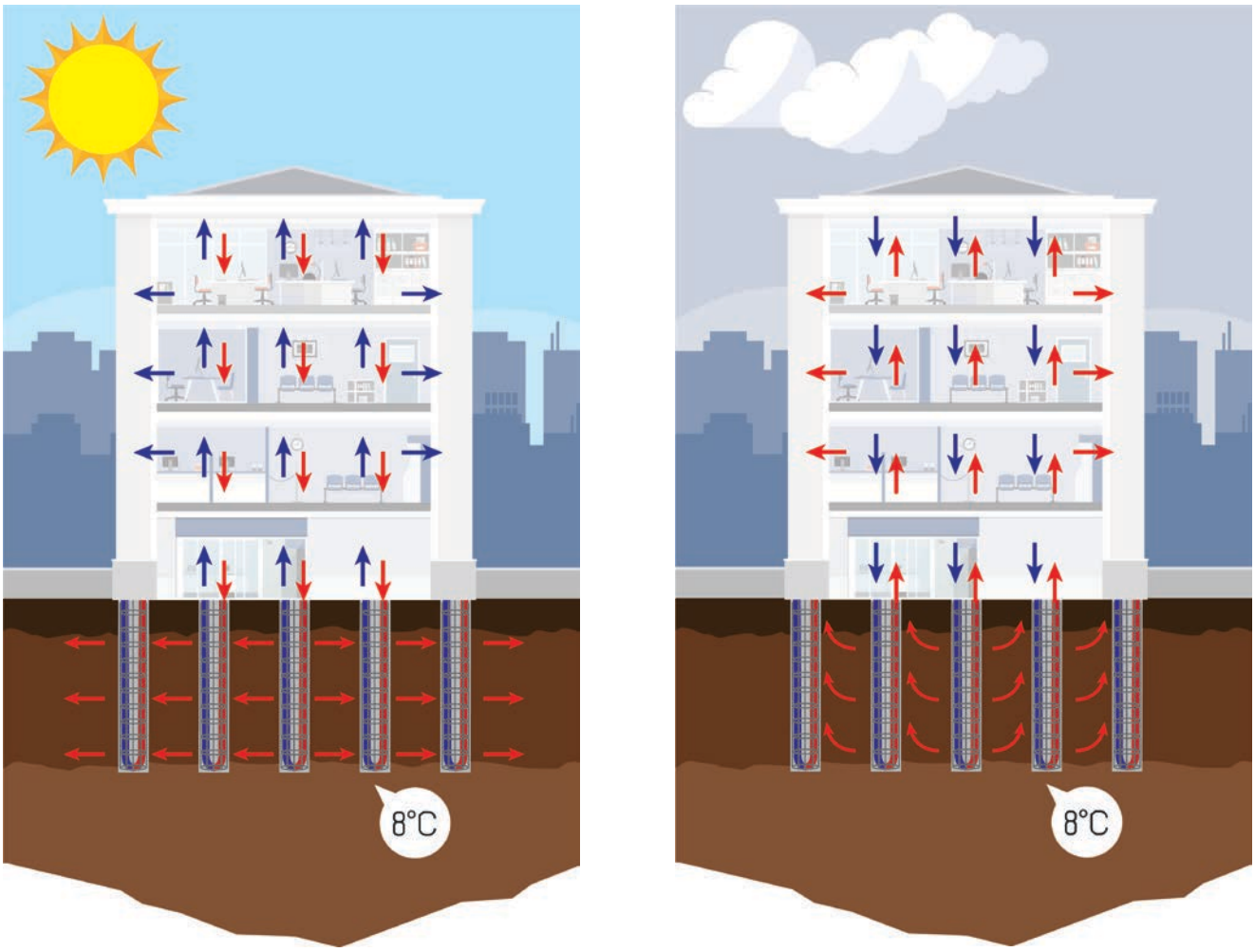

Operation Energy

Danish company re-introduces piles that harness geothermal energy

By Heather Hudson

One answer to the increased demand for renewable energy lives right here in the piling industry.

A Danish manufacturer of precast concrete foundation piles is using "energy piles" that use geothermal energy to help heat and cool the buildings they hold up. Jonas Henriksen, sales engineer for Centrum Pæle A/S, says that the technology has been around for decades, but a new dimensioning tool and the call for more sustainable building practices has inspired the company to relaunch the product in earnest.

"Geothermal energy is the second most abundant source of heat on earth, after solar energy. Energy piles are the perfect opportunity to combine mechanical stability with energy supply. As we see it, this is a great way of harvesting energy and storing it efficiently," said Henriksen.

What are energy piles and how do they work?

Energy piles are precast concrete piles with PE tubes cast inside them. The PE tubes serve as ground source heat exchangers by circulating fluid through them when connected to a heat pump. Their efficacy is twofold: they're able to transfer the load from construction into the bearing layer and exchange heat with the soil.

They're usually installed using soil displacement techniques or soil excavation systems. With increasing energy costs and the introduction of greater renewable energy requirements for new buildings, energy piles are becoming more and more in demand.

Typical energy piles come in dimensions from 30 centimetres by 30 cm up to 45 cm by 45 cm, in lengths from seven to 18 metres. To allow connection with tubes outside of the precast

IMAGES: CENTRUM PÆLE A/S

piles, the energy piles have an inlet and outlet section in the top of the pile. Inside the pile, the PE tubes run down in a "single-u" configuration, allowing liquid to flow from the inlet section down into the pile and up to and out of the outlet section.

The PE tubes are pressure tested with arc welding, which fuses two pieces of a workpiece together by using electrodes. The same welding method is used when connecting the energy pile to tubes outside of the pile.

Installation is similar to standard piles, although Henriksen points out that it's important to be extra careful on the building site to avoid damaging the piles or the in-outlet tubes once the piles are installed. "After ramming the energy piles into the ground, it is necessary to connect the piles to a heat pump through a series of tubes," he said.

Although energy piles require a significant capital cost investment, the low operational costs can result in a positive return on investment over time. "It is possible to achieve pay-back periods downwards of five to seven years in ideal thermal soil conditions and with the right system setup," said Henriksen.

What are the advantages of energy piles?

Energy piles make use of shallow geothermal energy. This is the energy provided to the ground by the sun, reaching a depth of 0.5 to 20 metres. This is not to be confused with more traditional geothermal energy which comes from the core of the earth further down.

In the seven to 18 metres that energy piles are placed, the temperature of the ground is constant all year at temperatures ranging between 8°C to 10°C. There is limited fluctuation in the available energy source to supply a building's energy demands compared with the upper layers of the ground that are subject to the changing seasons.

The advantage of using energy piles is their efficiency in establishing a ground source heat exchange system by combining heat exchangers with the foundation of the building in a two-in-one solution. This is especially advantageous for buildings

where space for drilling and laying traditional geothermal heat exchangers is limited.

Another advantage is their cost-efficiency. Energy piles usually deliver heating to the building at a co-efficient of performance (COP) of between 3.2 and five. Also, energy piles are even more effective at cooling than heating. They provide a natural cooling effect during the summer, when the cool fluid from the energy piles (8°C to 10°C) is circulated throughout the building. The fluid draws out the excess heat in the building, lowering the temperature and providing efficient comfort cooling at an energy efficiency of 20 to 30 kilowatt hours of cooling per one kilowatt hour of electricity provided. This excess heat is transferred to the ground below the building, creating a heat storage by providing energy to the ground, which can be extracted when heat is needed.

A further benefit to using energy piles is their environmental sustainability. "Since the energy provided for heating and cooling comes from the ground, all it takes to operate the system is the added electricity, which – at least in Denmark – often comes from wind energy. Thus, the energy piles provide 100 per cent renewable energy on days where electricity is provided through wind, sun or hydro technology," said Henriksen.

In collaboration with Centrum Pæle A/S, researcher Maria Alberdi-Pagola studied the design and performance of energy piles. Her subsequent 2018 thesis simulated the long-term effects and feasibility of the technology.

"[Alberdi-Pagola] developed a tool that can accurately determine how many energy piles are needed to satisfy the energy demand and also if the ground beneath is able to supply the necessary energy. The tool also suggests a foundation plan that outlines how to place the energy piles to avoid them cannibalizing on each other's energy," said Henriksen.

Energy piles in Canada: Realistic?

The way Henriksen sees it, energy piles can be used in most parts of the world.

"You need to start working with them from the earliest stages of a project as it does take quite a bit of planning between the heat pump manufacturer, plumbing installer and the producer of the piles themselves to make the right dimensioning of the system," he said.

He says the perfect stage to start thinking about energy piles is when the geographical location of the building is decided, the building drawings are available and the energy demand profile for the building is known.

"These factors allow us to use our dimensioning tool to determine whether or not energy piles will be feasible for the given project. This investigation uncovers whether they can provide the necessary energy stated in the energy demand profile for the building without depleting the ground of heat, resulting in permafrost which renders the system useless."

Centrum Pæle A/S was founded in Vejle, Denmark in 1965, and has expanded to include five factories across Europe. Together, they produce four million metres of precast concrete piles every year. For more information on energy piles, check out a two-minute video at youtu.be/7ZsnIxbi1z8.

STATE OF THE INDUSTRY

Drilling and grouting operations by Aarsleff in Prudhoe, Newcastle

AARSLEFF GROUND ENGINEERING

Experts on both sides of the Atlantic weigh in on some of the challenges facing the construction sectors in Canada and in Europe, and how they're being addressed

By Mark Halsall

There are numerous challenges facing the building industry these days, not just in Canada but in many other parts of the world. For one, there's generally a lack of skilled trades workers entering the construction business. Environmental sustainability and risk mitigation seem to be ever-increasing tasks for building contractors, and geopolitical events like Brexit and ongoing trade wars are restraining new construction efforts in some regions.

Piling Canada touched base with two companies that specialize in ground engineering and piling solutions – Keller Canada headquartered in Acton, Ont., and the British firm Aarsleff Ground Engineering Ltd. that's based in Newark, England – to get their take on how the construction business in Canada as well as in the United Kingdom and elsewhere in Europe are faring and coping with today's industry challenges.

Impact of Brexit

Kevin Hague is managing director for Aarsleff Ground Engineering. He says the impact of Brexit on the construction industry in Britain has been profound and continues to resonate as the long, arduous process of negotiating a withdrawal from the European Union, which started in 2017, continues to drag on; months past the original March 2019 deadline.

"There is a general feeling of uncertainty in the money markets. Investors seem to be slowing down a little bit, which as a result turns into delays on site and projects stalling. Once that starts, everyone else starts to think the same way, so we end up in a position where we actually also talk ourselves into delays on projects," said Hague.

"We're seeing that daily here. We've got a fairly sizable project in Sheffield in the U.K. that we have had on our books now for three years, and we haven't actually done anything yet. It's not uncommon for that to be the case."

Hague says there's also the matter of supply chain uncertainty surrounding Brexit. He notes that Aarsleff Ground Engineering often relies on German equipment and support services as well as steel supplied by mills in Germany and Spain – but what happens once Britain leaves the European Union is unclear.

"If Brexit goes through, how easy will it be to get the parts we need through customs?" Hague wondered.

Hague says Brexit is also raising concerns about the construction workforce and a possible shortage of skilled trades workers in Britain's building industry.

"There's uncertainty about movement of people and skills shortages, especially in the area of ground engineering," Hague said.

"If we close up the borders with Brexit, what do we do next? We've got some very good, very skilled migrant workers from Europe. If we should shut the doors to them, where do we go from there?"

Hague says one bright light for the construction industry in the U.K. has been a commitment from the British government to fund a number of new major infrastructure projects. Among them is the High Speed 2 (HS2), a new high-speed railway line linking London to Birmingham and eventually Manchester.

"That has been talked about for a long time, and it will be the stimulus for a lot of construction in the U.K.," Hague said. "There's a lot of work happening on it, demolition work, site preparation, but there's no physical permanent work of any magnitude starting at the moment."

Hague says aside from large capital projects like the HS2, the construction market in Britain "starts to look a little bit more challenged.

"There's been a shortage of domestic housing in the U.K. We need to be building around about 200,000 homes per year to keep up with population growth and demand. We simply aren't doing that," he said.

"There will always be demand in the domestic market for residential builds, but it's very slow at times. The market is saturated for construction, which drives the prices down and it puts pressure on the margins."

Hague says dealing with all the uncertainty surrounding Brexit has been very difficult, and not just for people in the construction industry.

"If we went back to referendum, I think we'd have a very different outcome, but that's only my personal opinion," he said.

"Companies are wanting to place package work more so if they can offer more techniques, more solutions. It's certainly a trend that we're seeing more and more in the U.K. and in the rest of Europe as well."

– Kevin Hague, Aarsleff Ground Engineering

Soil nail slope stabilization by Aarsleff at Haddricks Mill, Newcastle

AARSLEFF GROUND ENGINEERING

A screenshot of Aarsleff's virtual reality simulator

AARSLEFF GROUND ENGINEERING

"It's been so long since we took the vote, and you're starting [to] hear things from some people like, 'Just get it done,' or, 'I'm an actioner,' meaning: 'I just want action to get us out of this almost no-man's land that we're in.' It's very frustrating for us all."

Impact of tariffs

Fazli Shah is senior project manager for Keller Canada. He says the U.S. government's decision to impose tariffs on important metal building materials (25 per cent for steel and 10 per cent for aluminum) in 2018 has had a "very significant" impact on the construction industry in Canada.

The tariffs were removed earlier this year, but prior to that, the duties led to a sizable increase in material costs for building projects in this country.

Shah says the tariffs also resulted in a great deal of uncertainty around steel prices that made it difficult for piling companies and others in the construction sector in Canada in terms of cost control.

He says the Canadian construction market is feeling the effects of political uncertainty in some regions of the world as well as a slowdown in important global markets in China and elsewhere that's putting a damper on the Canadian economy.

"In general, the construction industry is always driven by the economic growth. With Canada being a commodity- or natural resources-based economy…when an economic slowdown happens, as it is right now, that slows everything down," he said.

However, Shah expects the Canadian construction market will bounce back quickly once global economies start to heat up again.

"The construction industry is very much at the front end of this process because it gets affected really rapidly as soon as a slowdown happens. The same goes for when an economic rise happens – some other sectors of the society may see the trickle-down effect a little later, but the construction industry is usually one of the first to react to it."

Market conditions in Europe

Hague says Aarsleff Ground Engineering, which is a subsidiary of the Danish civil engineering and construction company Per Aarsleff A/S, does business in number of other European countries aside from the U.K., including Germany, Poland, Sweden, Norway, and Denmark.

Hague describes the current building situation in other European markets beyond the U.K. as "a bit of mixed bag," with no construction market either extremely strong or extremely weak at the moment.

"From what we see in Germany, there is definitely construction going on, but it seems to be more specialist activity," he said. "It's a broad mix in France. There are some major capital projects, such as [a] large metro system being built in Paris right now that's taking up a lot of resources and a lot of equipment.

"In Sweden, we're seeing reasonable market conditions for the type of ground engineering work that we're involved with there," Hague added. "Denmark has been a good market for us this year, with a lot of construction activity going on."

Piling solution differences

Hague says there's a wide range of piling methods employed across Europe, with different regions, countries or even cities favouring different kinds of piling solutions.

"There are differences. They are regional. They are cultural. And ground conditions also drive these differences," he said.

"In the U.K., the traditional piling method is rotary bore. The driven pile is not the natural choice. In Europe, it's very different. The natural choice is a driven pile mostly. There will

be some rotary bored pile, but it's the less favoured method. So, we have two very different approaches," Hague said.

"Even within Europe, we've got different types of driven piles, different sizes which are accepted and also different design philosophies to drive the different pile types. For example, in the city of Gothenburg in Sweden there's something called 'Gothenburg pile,' which is a timber pile with a precast top. And it's because of the specific ground conditions there that we only really see that in Gothenburg."

Shah says there are regional differences within Canada too in terms of what piling solutions are the most prevalent.

"In the east, people use drill shafts and secant pile walls a lot more," he said. "Some of this is driven by geological conditions and the technical needs and requirements of a [given] project."

It's perhaps not surprising that such differences exist in a country such as Canada, which comprises a vast area and has a wide range of environmental and climatic conditions. However, Shah contends some of this may be driven by personal or institutional biases as well as a lack of information.

"If some people are not aware of what [different options] exist and what can be done differently, then obviously they will be resistant to it," he said.

Shah says one example is the how continuous flight auger piles, which have been used in Canada for 20 years, still aren't accepted by the Alberta Department of Transportation.

"If the need [for one option] is driven by Mother Nature, that's no problem because people need to respect Mother Nature and treat it accordingly," he said. "But if the decision is made because of a lack of information, then [different options] should be examined in a neutral way."

Skilled trades shortage

Hague acknowledges that his company, like so many others in the European construction sector, often struggles to find good caliber skilled individuals to fill positions.

"It's very difficult to attract the right kind of person or a quality stream of people because many people who work in factory conditions or wherever else are used to working inside for good money without the travel," Hague said. "People just prefer to be a little bit warmer and not as wet; I suppose. We see that daily.

"We need to attract more young people because the average age of our workforce is increasing and that's not necessarily a bad thing. But, you know, we've got to look at a succession plan," he added.

Hague notes that many construction companies in the U.K. will rely on career and trade fairs as well as structured training programs to recruit and retain workers, which is something Aarsleff Ground Engineering offers.

Hague says his company is considered somewhat of a trailblazer when it comes to trying to appeal to the hearts and minds of young people.

"What we're trying to do now is a little bit unique. We've developed a virtual reality construction world to try and appeal to the younger generation in the gaming world," he

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said. "For young people leaving school who don't necessarily want to go on to university, this provides them with a platform so they can get a sense of what a construction environment looks like.

"So far, our recruitment drive and our focus and our message seems to be stirring up interest," Hague added. "Time will tell."

According to Shah, Canada's building industry has long benefitted from Ottawa's immigration policies. Canada, he says, is one of the most welcoming countries in the world for immigrants, many of whom have stepped in to help fill the need for skilled trades workers in this country.

Shah says construction companies in Canada have a number of options for recruiting and retaining quality staff, which include good training opportunities and health and safety programs.

He adds that ensuring skilled trades jobs are more sustainable, in other words, that they pay enough and last long enough for workers to make a decent living, are other measures companies can take to make careers in the building industry more attractive.

Climate change

Hague notes that due to climate change, there's been an increase in extreme weather events like excessive rainfall that are causing problems related to flooding, mudslides and slope stability issues in many areas of Europe.

For this reason, he says, there is more construction work going on to address these issues and come up with engineered solutions like flood defense systems and slope stabilization projects.

"We do work actively in all sectors in the U.K. and in Europe on flood defense systems. We'll do two or three of them every year," Hague said.

Shah says a significant issue related to climate change that's affecting the construction industry in Canada is the melting of the permafrost across wide swaths of the warming arctic.

Across the North, many communities are undergoing profound changes due to the damage caused by unstable soils that result from permafrost thaw. Pilings driven down into the permafrost layer are used extensively to support structures in the Canadian arctic, so when that layer melts it can affect the stability of a driven pile foundation.

Environmental sustainability

According to Shah, there is increasing awareness of the need for environmental sustainability within the building sector in Canada.

"Everybody is aware of the environment and that there are things that need to be done. All people can do is try to be efficient and always reduce, recycle and reuse when they can. I think the construction industry is well-placed to address those challenges," he said.

Shah notes LEED certification of building projects is one example of the initiatives introduced in recent years aiming at making Canada's construction sector greener.

Another measure is the new carbon taxes being brought in by different levels of government within Canada. Shah

KELLER CANADA

says the building industry in general has taken the new tax in stride.

"I'd say the construction industry has reacted to it as it would to any other new tax," he said. "Things have become a little bit more costly, but that's what the tax system is all about. Everything is done for a purpose, for a bigger purpose."

According to Hague, the U.K. also has numerous initiatives aimed at promoting environmental sustainability within the construction sector.

For instance, the sovereign state has a legally binding commitment to achieve an 80 per cent reduction in carbon emissions by 2050, which could make precast piles that are produced offsite a more favoured piling option in the foreseeable future.

"The carbon zero target is becoming more and more of a buzz word, but I'd say it's not necessarily happening. There is still a lot of in situ work happening, a lot of large diameter in situ pile, a lot of large bridge abutment in situ pores," said Hague. "However, there are one or two companies who are trailblazing the use of pre-cut foundations and precast piles, which is what we do."

Hague contends that the precast offsite manufacturing option is more environmentally friendly "because it is a much more controlled environment and there's less traffic movement as well.

"Something that's hidden is the quality side of it. If we get it right off-site, we'd like to think it will be right in installation. If it's right in installation, it's a one-time process. And if it's a one-time process, it's executed only once," he said.

"There's no corrective work, which means it's more efficient and things get built more quickly, therefore reducing the overall build program and in theory, reducing the environmental impact of the project."

Hague says other initiatives aimed at increasing environmental sustainability within Britain's building industry involve promoting plants with low greenhouse gas emissions as well as the use of alternate construction materials.

"We are very carbon conscious in our factory. We target some Green KPIs (Key Performance Indicators). We recycle rainwater and we also recycle waste products. We're looking at more sustainable materials, trying to incorporate waste products into construction materials such as glass, PFA (Pulverised Fuel Ash) and shredded tires," said Hague.

"We're modernizing our fleet, using technology more and bringing in more efficient engines and machines which can actually react to the ground conditions," he said.

"We're not just sticking the machine on high rev and letting it burn off diesel oil all day," he added.

"We're educating our people as well. Green has become a topic of conversation in our briefings [and] we are constantly reminding the guys, 'Switch your engines off on a break if you don't need to use the machine.'"

Technological innovation

Hague says one of the ways new technology is having an impact on the construction industry in Britain involves virtual reality.

"We're starting to embrace virtual reality analysis in the U.K. It's more of a virtual world where people can experience construction in the virtual space," he said.

Hague notes that his company plans to eventually roll out virtual reality training for its workers, enabling them to see and experience what they're meant to be doing on the job site while they're in the virtual space.

Shah says computerized, remote control data acquisition and sharing systems are among the new tools and techniques that are transforming the construction industry in Canada.

According to Shah, these systems make communication between the company office and the job site much more efficient.

"The office always knows what is going on, and if anything needs to be changed, they can communicate with operators and the crews in real time," he said.

"It also gives the designer more timely control of their design assumptions and changes if needed, and it gives the worker more insight into what they are doing and why they're doing it."

One-stop shopping

According to Shah, more and more construction companies in Canada are adopting a one-stop shop approach to project procurement.

"Perhaps years ago, the construction industry and piling companies specifically might have been doing only one technique, let's say either drilled piles or driven piles," he said.

"Now, many cannot sustain their business if they don't offer more. Sometimes single projects require two or three different techniques, so a client may want to go to someone

"Everybody is aware of the environment and that there are things that need to be done. All people can do is try to be efficient and always reduce, recycle and reuse when they can. I think the construction industry is well-placed to address those challenges."

– Fazli Shah, Keller Canada

who is one-stop shop rather than dealing with two companies."

Shah notes the benefit to piling companies and their customers is that it can be more cost effective.

"For example, if a company is able to offer two or three different techniques, they can sometimes share resources [internally] because some of the resources may not be needed all the time," he said.

"So, if you have support equipment and it can serve two rigs working two different techniques, you save money and then ultimately the savings can be passed on to your client as well."

Hague says within Europe, there's also a growing movement by construction businesses to adopt more of a package approach to services rather than offering a single service.

"Companies are wanting to place package work more so they can offer more techniques, more solutions," Hague said. "It's certainly a trend that we're seeing more and more in the U.K. and in the rest of Europe as well, especially in Poland.

"Instead of splitting a contract to different elements, there'll be a single order for a multiple-discipline contract. Some feedback we get is that it's more manageable with the single commercial terms and there's more ownership."

However, Hauge notes that this approach may not always be the best decision.

"If the project is price focused, sometimes splitting up the packages is more commercially beneficial," he said. "Plus, from a risk point of view, you may want to spread your risk across a number of packages."

Application of Non-Destructive Testing Solutions

In Integrity Evaluation of New and Existing Foundations

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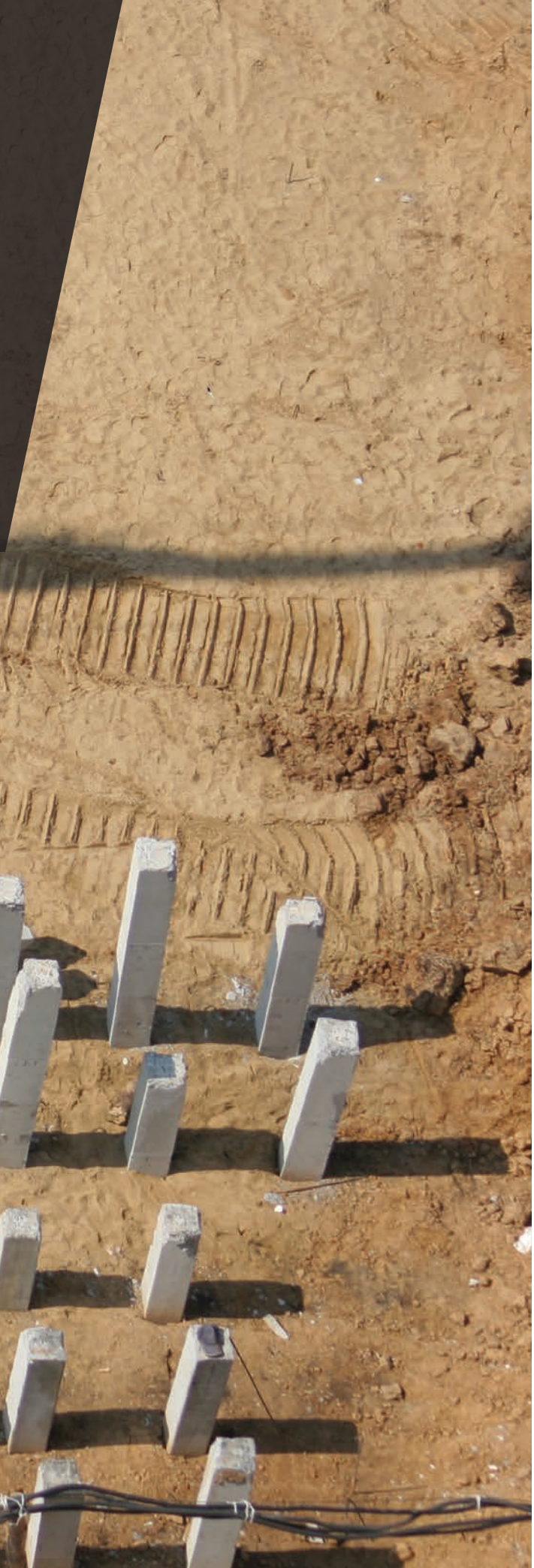


By Farid Moradi and Hamed Layssi, FPrimeC Solutions Inc., and Ignacio Zulaga, geotecnia.ONLINE

Evaluating the load bearing capacity of existing and newly constructed deep foundations and piles has been of interest to engineers and piling contractors for years. Various testing solutions have been developed over the decades to determine the static load bearing capacity as well as dynamic load testing of piles (ASTM D4945, 2017). However, the main emphasis of these tests is on the global response of the piles. Since this group of tests are generally expensive and difficult to deploy, their application is limited to critical elements.

Certain defects in pile materials, quality of workmanship and errors in pile construction can negatively impact the load bearing capacity of these elements. Therefore, quality control of pile elements is key during the design and construction processes.

Traditional methods for evaluating pile integrity involve massive excavation of surrounding soil and extraction of continuous core samples. This practice is extremely difficult for testing existing structures. In the case of new construction, such intrusive methods could increase the cost of the quality control and impact the construction timeline.

Non-destructive test (NDT) solutions for evaluating the quality of piles were developed in the 1960s. Electronic developments significantly helped non-destructive pile integrity tests become widely and globally available to the geotechnical engineering market. Modern electronic and computer techniques allow the processing of signals that facilitate the subsequent presentation and interpretation of the results. These NDT solutions have helped engineers gain additional knowledge about the quality and integrity of existing and new foundations. NDT solutions help reveal potential defects that might have happened during pile construction (in the case of cast-in-place piles) or transportation and installation (in the case of precast piles).

Among NDT solutions for piles, the pile integrity method (ASTM D5882, 2016) is certainly the one with the highest economic return. The test is easy to perform and requires minimal preparation. However, interpretation of test results require engineering knowledge, information about the soil profile and an understanding about soil-pile interaction. The test method is less accurate for piles of large diameters or when dealing with very large length to diameter aspect ratios (>30).

Crosshole Sonic Logging (CSL) (ASTM D6760, 2016) has been developed to address some of these challenges. CSL

works on the concept of ultrasonic pulse velocity that is measured along the pile length. To perform the test, access tubes should be installed in the steel case ahead of pile construction. While CSL provides critical information about the quality of pile material at different depths, it does not provide information about potential defects outside of the steel case.

Thermal integrity profiling has gained popularity among engineers over the past few years. The test uses temperature history, which is collected at different depths, to study the strength gain across the pile length. The test is easy to implement and provides information about the entire cross section of the pile (inside and outside the steel cage). The practice has been standardized as ASTM D7949 (2014).

Parallel seismic tests have been used for evaluating the unknown length of existing piles and deep foundations. The procedure has been described by the ACI 228.2R guideline.

Quality control of deep foundations

New construction

Quality control of new construction is an integral component for successful construction of deep foundations. Quality related issues with material and workmanship or defects that can occur during placement of concrete or installation of driven shafts can impact the load bearing capacity of the piles and affect the performance. Non-destructive tests have long been utilized by engineers for this purpose, mainly because alternative methods such as removing soil, visual inspection or extracting cores are relatively expensive, create delays in construction timelines and might adversely impact the quality and integrity of the elements.

Existing structures

Existing infrastructure was designed and built in accordance with older design codes and construction practices and guidelines. Reusing these foundations is considered a time and money saving practice. However, this requires obtaining critical information about these elements. Access to structural designs and drawings for these elements is usually very difficult, if not impossible. Engineers need to obtain information about the load bearing capacity as well as integrity of these elements before using them as part of new construction.

Non-destructive quality control for new deep foundations

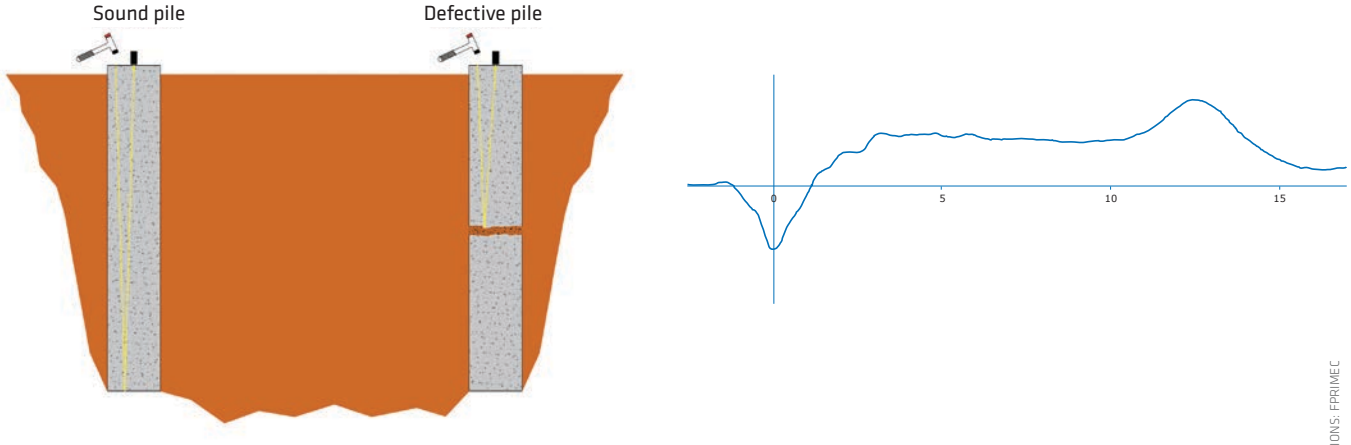
Different methods have been developed to evaluate the quality of newly built deep foundations. Apart from general fresh concrete tests such as a slump test, air content test and taking concrete cylinder samples, various NDTs have been developed to evaluate the integrity of piles. These tests help identify and quantify integrity and quality related issues in deep foundations. Depending on the type of deep foundation, and surrounding soil condition, a proper NDT method can be deployed to obtain critical information about the safety and reliability of the piles.

Among existing methods, acoustic methods based on propagation of stress waves have been widely used for evaluating integrity and consistency of pile materials and structures. Low strain pile integrity tests (PIT) and CSL are two widely accepted methods in this category. Over the past few years, other test methods based on temperature monitoring (referred to as Thermal Integrity Testing) of piles have gained popularity. These tests help identify and quantify the location and extent of defects in deep foundations. Like any other test, these methods have certain limitations that need to be considered.

Low strain impact integrity testing

Low strain pile integrity testing, known as PIT, is the most widely used NDT method for the evaluation of deep foundations. PIT provides a cost-effective and easy to deploy test for rapid assessment of integrity in piles and deep foundations. PIT was developed based on the concept of impact-echo and is customized for slender structural elements. In this test, stress waves and compression mode of deformation are used to obtain information about the location of anomalies and defects within pile elements. Fig. 1a schematically shows a pile integrity test on a sound pile and defected pile.

PIT uses stress waves generated by a hand-held hammer strike over the pile head. A motion transducer placed on the pile head records echoes (reflections) from the pile toe or other internal defects and anomalies. The recorded signal is amplified, digitalized and used for data interpretation and analysis.



a) Pile integrity test setup

b) Sample of pile integrity results

ILLUSTRATIONS: FPRIMEC

Fig. 1. Pile integrity test on sound and defective pile

PIT can be used for cast-in-place concrete piles, driven piles, steel tube filled concrete piles, augured piles, drilled shafts, structural columns and timber piles. PIT is not recommended for integrity testing of steel sheet piles, H-piles or unfilled steel tube piles because the dominant mode of vibration changes from compression to bending. The main features of the PIT can be described as:

- Pile preparation is relatively easy.
- The process of testing and data collection is rapid and inexpensive.
- PIT can identify major defects (location of defects and severity).

Some of the main disadvantages of the test can be summarized as:

- Interpretation of test results requires experience.
- PIT cannot be conducted over the pile cap.
- PIT is sensitive to pile length (L) to pile diameter (D) ratio. The test results might be unreliable for piles with an L/D ratio over 30. Surrounding soil friction and change of dominant mode of vibration from compression to bending affects the PIT results (Massoudi et al, 2004).
- Piles with highly variable cross sections or multiple discontinuities/anomalies may be difficult to evaluate using PIT.

Ultrasonic crosshole testing

Ultrasonic Crosshole Testing (or CSL) is the most common test for integrity evaluation of large diameter cast-in-place shafts. This test is an extended form of the ultrasonic pulse velocity test and provides information about homogeneity and integrity of concrete material over the pile profile. Fig. 2 schematically shows a general setup for CSL. This method includes two ultrasonic transducers (i.e. one emitter transducer; one receiver transducer).

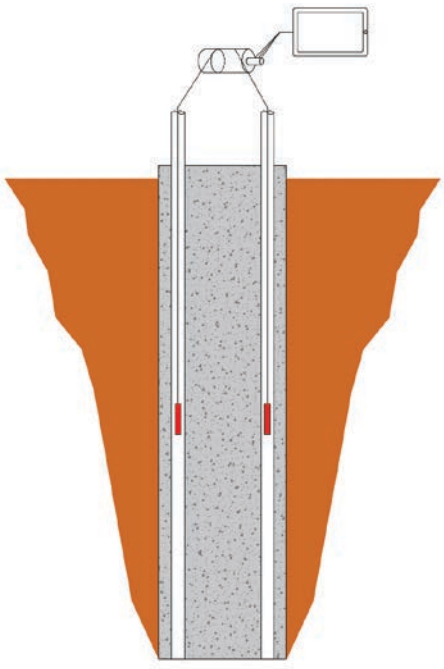


Fig. 2. General setup for crosshole sonic logging test in deep foundations

The concept behind this method is supported by the ultrasonic pulse velocity (UPV) concept. UPV measures the transmission time of stress waves between emitter and receiver transducers. This travel time can be converted to wave velocity if the stress wave trajectory between emitter and receiver probes is known. The wave velocity is directly correlated with the quality of material. Poor and/or damaged concrete has a lower wave velocity when compared to sound concrete. Table 1 shows the relationship between wave velocity and quality of concrete (Saint-Pierre et al, 2016).

Table 1 – Correlation between quality of concrete and ultrasonic pulse velocity

Quality of Concrete	Pulse Velocity (m/s)
Excellent	Greater Than 4,500
Good	3,500 – 4,500
Mediocre/Fair	3,000 – 3,500
Poor	2,000 – 3,000
Very Poor	Less Than 2,000

To perform a CSL test, a number of vertical boreholes (tubes) are made during concrete placement using parallel metal or plastic (PVC) tubes. The recommended number and configuration of boreholes depends on pile diameter. Fig. 3 schematically shows the configuration of boreholes for piles with different diameters. This figure has been adapted by ASTM standard as ASTM D6760 (2016).

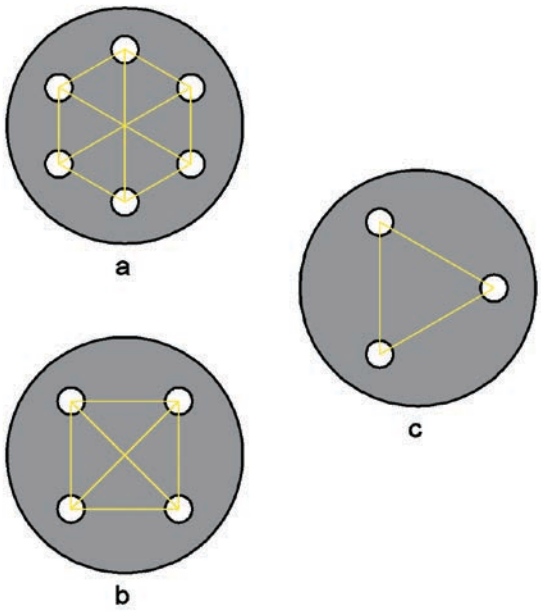


Fig. 3. Configuration of holes in CSL test (adapted from ASTM D 6760)

The boreholes should be filled with water to ensure there is constant contact between the device probes and surrounding area. Both transducers (probes) are pulled upward at the same rate and the transmission time between the two probes is measured at each level. If a significant change in transmission time (or wave velocity) is observed, it might be correlated to internal anomalies of defects. The tomography

concept using two probes is applied to identify the extent of the defects at a specified depth (ASTM D6760, 2016).

The advantages of deploying a CSL test in integrity assessment of new piles include:

- Ultrasonic crosshole testing is an ideal test for evaluation of large diameter piles.
- There is no limit on the shaft length.
- Provides precise information about the location and the extent of defects.
- Soil profile does not impact the test results.
- Easy data interpretation.

The CSL method has some disadvantages:

- This method is expensive and is not fast enough for condition assessment of piles.
- Boreholes should be installed before placement of concrete. Boreholes might break or experience damage during construction that results in inconclusive test results.
- Stress waves cover areas between emitter and receiver probes. Therefore, larger diameter piles need a number of boreholes to achieve conclusive results.
- The test does not provide information about concrete sections outside the steel cage.
- This test is not commonly used for existing piles and deep foundations because it usually needs pre-construction preparation (i.e. boreholes need to be installed before concrete placement).

Thermal Integrity Profiling

Thermal Integrity Profiling (TIP) uses the temperature variation of cement paste of concrete for integrity evaluation of piles and deep foundations. This method covers a wide range of piles and deep foundations including drilled shafts, bored piles, micropiles, augured cast-in-place piles, continuous flight augured piles, drilled displacement piles and more. The concept behind this technology is to record temperature changes and history during the curing time of cement. This temperature can be correlated to the strength gain of concrete and integrity of piles and deep foundations. Fig. 4 shows a typical temperature history of normal concrete over the pile depth.

This technology includes a number of temperature sensors along pile length, connected by wire to a data acquisition system. The sensor holding the cables is attached to longitudinal steel rebar of the reinforcing cage. Each sensor logs the temperature of its surrounding area in a specified time interval to track and record temperature variations and the evolution of concrete strength. The temperature at any location of deep foundations depends on the pile size and diameter, concrete mix design, concrete cover thickness outside of the reinforcing cage and other factors.

The temperature history is compared with a reference graph for integrity evaluation. It is obvious that TIP measurements colder than the reference graph indicate a lack of sufficient cement which can be caused by necking, soil inclusion or poor-quality concrete; while warmer than normal measurements are indicative of an increase in cross-sectional dimensions (Mullins and Kranc, 2007). TIP has several advantages compared to previously described methods:

- Can be used to evaluate the portion of concrete outside the steel cage.
- Provides real time data on pile quality, which can shorten the construction timeline.
- Data interpretation is relatively easy.

TIP measurement has some limitation for integrity testing of piles and deep foundation including:

- Can only be used for integrity testing of new piles.
- Measurements need a reference graph for comparing recorded logs for integrity evaluation.
- Wires and sensors may be damaged during installation and concrete placement.
- Measurement is a comparative method for integrity evaluation. Change in mix design may result in a huge difference when compared to the reference graph even though the concrete pile is sound.

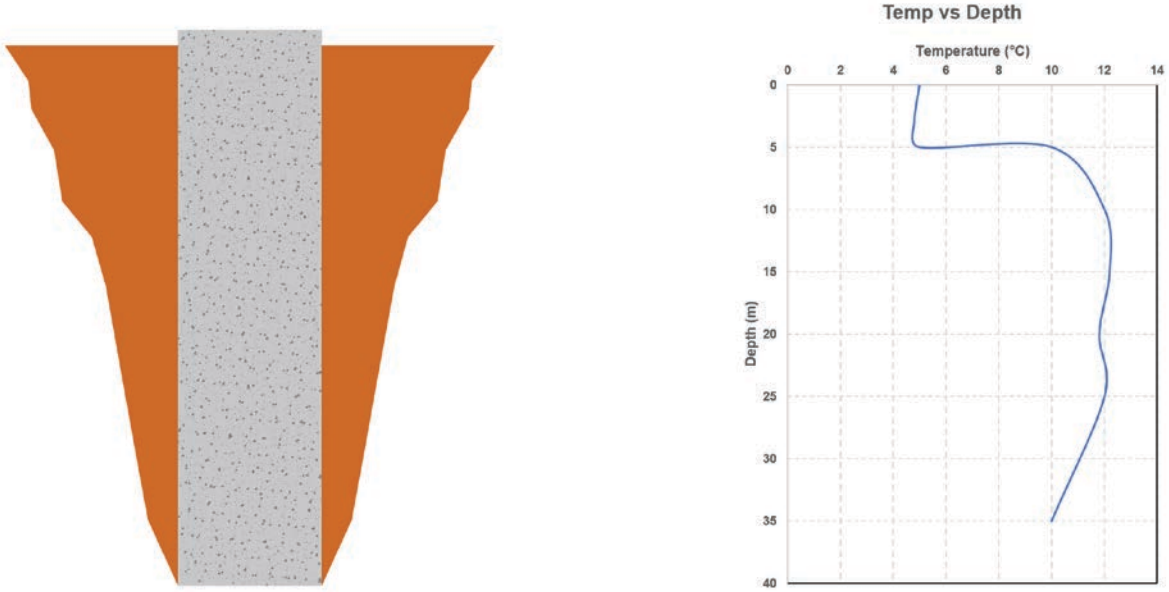


Fig. 4. Thermal integrity profiling

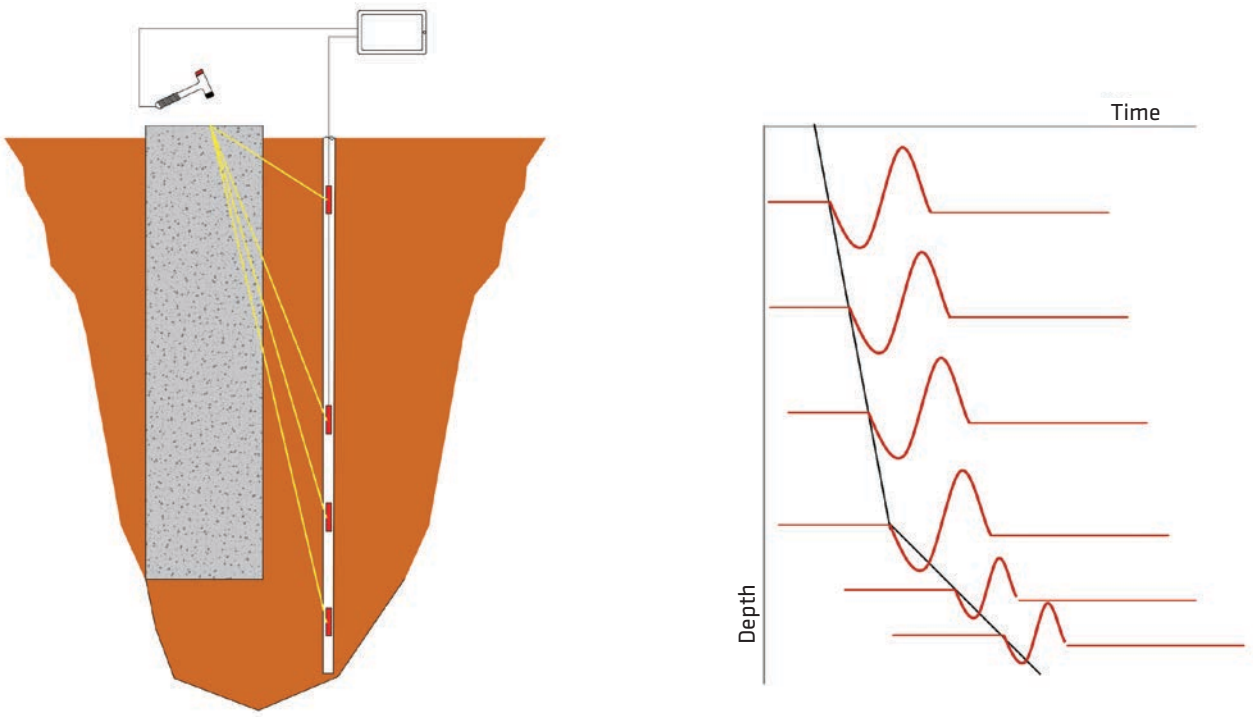


Fig. 5. Parallel seismic test setup and sample results

Non-destructive quality control for existing deep foundations

The majority of existing NDT solutions are designed to address integrity evaluation in new construction. When it comes to existing piles, engineers and researchers need tools that can help gain information about the quality of materials. This is challenging because in most scenarios, no information is available about the quality of materials used. In some projects, no structural drawing is available to verify the load bearing capacity of the piles.

Another major issue regarding integrity evaluation in existing piles is that access to these elements is often difficult if not impossible. This becomes an even bigger problem when dealing with a group of piles covered by a pile cap.

Engineers and researchers have tried using different techniques to evaluate the quality and integrity of existing foundations.

Pile Integrity Test (ASTM D 5882)

When pile heads are accessible, a low strain impact integrity test might be used to obtain information about the unknown pile length and the integrity of pile elements. However, implementing a PIT on existing piles is often challenging. Access to the pile head is the first challenge. In most cases the pile head, even if accessible, provides little room to place a motion transducer on the surface and apply vertical impacts. Another challenge is estimating the speed of the wave. One practical method is to evaluate the pulse velocity speed using other NDT methods. A special setup which involves installation of two motion sensors along the pile at certain spacing can be used to measure the wave velocity in piles.

Parallel Seismic Testing (ACI 228.2R)

Even though Parallel Seismic Testing has not been standardized, this method is used for integrity evaluation of existing piles and unknown foundations. A borehole is drilled close to the concrete pile, longer than the pile length. Boreholes are lined with a plastic or metal tube and filled with water for coupling between the device transducer and surrounding surface.

The signal receiver transducers placed at the bottom of the tube, move upward with a constant speed. At each level, the pile head or pile cap is hit by a hand-held hammer impact. The generated stress waves travel through the pile length and surrounding soil before reaching the receiver probe. Fig. 5 schematically shows a parallel seismic setup for testing piles and deep foundations.

The stress waves are recorded at each level and a stack graph of time against depth is recorded. Each recorded signal is plotted in sequence. The first arrival time of the wave from each depth is marked on a single graph and connected to each other. In sound and continuous foundations, this slope can be used to determine an unknown depth of deep foundations (sudden change in the slope). The pile toe depth is determined when the transit time of the first wave increases and an inflection is apparent in the line linking first arrival points. The concept of "inflation of linking line" can be used to find out the locations of internal anomalies in deep foundations. The transmit time and stress wave velocity changes at the location of anomalies and defects.

Parallel seismic testing has been introduced in the ACI 228.2R (2013). Parallel seismic testing provides useful information about the depth of existing deep foundations, as well as the location of potential defects within the pile profile.

However, the test has certain limitations:

- This method is expensive and requires drilling boreholes parallel to existing piles.
- Parallel seismic testing is commonly used for estimation of pile length, not pile integrity. The stress wave generated by hammer impact travels through the pile and surrounding soil. The soil profile may significantly affect stress waves, resulting in a poor or misleading signal for data interpretation.
- Accurate data interpretation requires knowledge about soil profile.
- The borehole should be longer than pile length. This makes drilling challenging when there is no knowledge about the pile length.

Concluding remarks

Alternative methods, such as removing soil, extracting core samples and visual examination are generally expensive, provide little information about other locations and create significant delays in the decision-making process and/or in the construction timeline. In addition, intrusive methods such as extracting cores might negatively impact the safety and reliability of an existing pile.

Non-destructive testing has widely been used for quality control of deep foundations in new construction, as well as forensic evaluation and condition assessment of existing piles. NDT methods provide cost-effective and easy to deploy tools for the evaluation of integrity in piles and deep foundations.

Some codes and guidelines strongly recommend performing integrity tests of deep foundations either for new construction or for comprehensive evaluation of existing structures. Some other codes and guidelines consider integrity testing as an optional quality control test. However, these codes and guidelines authorize engineers and designers to increase the superstructure loads should the integrity of piles have been verified through NDT methods.

Low strain pile integrity testing, ultrasonic crosshole testing, thermal integrity profiling and parallel seismic testing are widely used for quality control of new construction and integrity assessment of existing deep foundations. Among these methods, PIT is very cost-effective, fast and easy to implement for both new construction and existing structures. It is recommended to evaluate integrity initially by the PIT method, then proceed to use advanced non-destructive integrity testing methods if PIT results are not conclusive or PIT shows an integrity issue. Application of the PIT method for existing structures is more complicated because access to pile heads is often limited due to the presence of superstructures or pile caps.

Moreover, it is recommended that non-destructive integrity testing be performed by a trained technician in order to collect reliable data during field work. Interpretation of integrity test data requires basic knowledge on the concept of non-destructive integrity testing. Complementary information (i.e. knowledge of the construction record, design documents, soil profile, concrete mix design, compressive strength) help to interpret field data and analyze test results more accurately.

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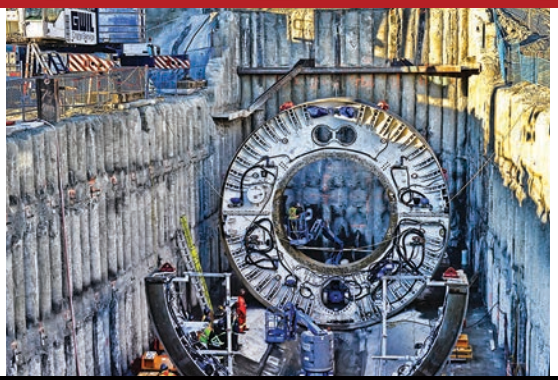


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WHALE TAIL DIKE

Henry Foundation Drilling Inc. innovates to complete unique piling project in Nunavut

By Olive Taylor

When Don Henry, the president of Henry Foundation Drilling Inc. (HFDI), learned his team had been awarded the contract to construct a secant pile wall in the middle of Whale Tail Lake in Nunavut, he knew the project would be unlike any other.

HFDI's winning bid combined innovative design, aggressive scheduling and competitive pricing. Although the Langley-based team anticipated the project would be tough due to the logistics of working in a remote location and the painstaking measures required to conserve the sensitive terrain and wildlife, working in temperatures that plunged to -50°C with only two and a half hours of daylight in the middle of winter is an experience the crew will never forget.

Project overview

Situated approximately 130 kilometres north of Baker Lake, a hamlet known for its famous Inuit artists, the project site was right on Whale Tail Lake, specifically on a dike that split the lake in half so the lake could be dewatered and mined. Between August and December 2018, HFDI constructed an 800-metre-long secant pile wall of overlapping piles socketed into bedrock.

One thousand secant piles, one metre in diameter, were socketed into bedrock. "Pile deviation was paramount," said Henry. "Every pile had to be measured for deviation."

Due to the remote location in Nunavut, HFDI had to mobilize an onsite automated grout plant as well as mechanics and welding shops to complete the job. "Extensive planning

PHOTOS: HENRY FOUNDATION DRILLING INC.

went into ensuring that every piece of equipment and all the materials required were onsite so that the team could be self-sufficient," Henry said.

The team used conventional tools for drilling, including segmental casing, augers, core barrels and bailing buckets. Upon hitting bedrock, a 7-bit hammer was used to create a one-metre socket.

All holes were filled with grout made by HFDI. At the onsite grout plant, the team mixed cement and bentonite as well as a retarding admixture to create the final grout product. After being pumped into a vacuum truck, the mixture was transported to the dike for use. The crew used insulated pump skids to transfer the grout from the truck and placed the mixture using a tremie pipe in the pile.

Logistics of working in a remote location

HFDI was awarded the project in March 2018. However, since barges can only travel when the ice is melted, the team was left with a small window of three months to prepare all the equipment and support loads. Specialized containers were built for the mechanical, fabrication and other support services.

Approximately 25 loads were dispatched on the long journey to the work site. The mobilization started with a cross-country trek from Vancouver, B.C., to Becancour Port, Que., located on the south shore of the Saint Lawrence River, where the containers were loaded on a barge. The barge travelled around Newfoundland and Labrador to the mouth of the Baker River, where a mid-ocean transfer moved everything from the ocean-going barge to the river barge. The equipment and supplies were offloaded and trucked north on a gravel road that extended from Baker Lake to the mine site at Amaruq, situated 130 kilometres northwest of Baker Lake.

The sourcing of a crew to work at the remote location while the existing team members continued to work on projects during the busy 2018 season was another obstacle. Project manager, Owen Langton, hired seasoned workers from across Canada. Under the direction of Cole Allestor, HFDI's senior superintendent for the project, the crew proved to be a hardy, competent team.

Getting the crew to the worksite also required several modes of transportation for the two-day trip. Members of the crew, who all lived in different parts of Canada, first flew to Montreal. From there, a second mine-chartered flight brought them north to the Meadowbank complex in the Kivalliq District of Nunavut, where buses and pickup trucks covered the final 50-kilometre stretch. To return, the crew took the same two-day journey in reverse. From Day 1 until the completion of the final pile, three crews worked a rotating schedule to keep equipment running 24/7.

Phases I and II

Kivalliq Contractors Group (KCG), the general contractors, were responsible for the first phase of the work that involved building the berm through the middle of the lake. The berm had to be built during the summer, which left KCG with a short window of time for construction. HFDI's work could not begin until the berm was finished.

"The construction of the berm was a sizeable undertaking and it was necessary to complete this work in the summer before the lake froze over," said Langton. "KCG proved to be a very able partner in completing the work. The group had acquired the necessary skills of working through the northern winter and they were always willing and able to support HFDI in the daily challenges that presented." The Whale Tail Dike was constructed as a zoned rockfill dike with a

Getting the crew to the worksite also required several modes of transportation for the two-day trip.

core composed of a fine filter dynamically compacted. The construction of a cement-bentonite secant pile wall in the middle of the berm transformed it from a berm to a dam wall. The outer parts of the berm were built from a larger aggregate that protected the inner core.

Phase II began in the middle of August. HFDI crews constructed workshops and laydown areas. Next, equipment was assembled and tested. "All the innovative ideas that had seemed so bulletproof in the warmth of the office in Vancouver met the reality of the Canadian North," said Henry. "Things didn't always go as we thought they would."

Even though the HFDI crew brought significant expertise in secant pile construction to the project, every pile required a one metre rock socket, which translated into nearly 10 per cent of the 10,000 linear metres that were drilled being rock. The schedule did not afford the team sufficient time for the rock sockets to be cored using traditional drilling tools.

The crew realized that to complete the required 1,000 piles before the Christmas Day 2018 deadline, they needed to come up with another strategy. "Centre Rock provided two cluster drills and considerable know-how, which combined with Don Henry's fertile imagination, lead to the creation of a hybrid system in which the drills could as easily pick up the rock hammers as an auger," said Langton.

An air hard line was built that could be broken down and moved as the construction progressed. The hard line enabled the drills to stay connected to the bank of compressors that powered the rock hammers.

Environmental precautions

From the outset of the project, environmental concerns were addressed concomitantly with operational planning. To protect the pristine water, two rows of silt curtains were installed in the lake, both upstream and downstream, of the construction area. All fish were removed in the areas between the silt curtains and the construction area; potential adverse impacts of vibrations created by construction activities on the fish were carefully monitored.

During the project, all refueling was undertaken with the utmost care and hydraulic oils in the drills were swapped for environmentally friendly equivalents. Refuelling always occurred off the dike.

To assess the risk of permafrost thawing, extensive geotechnical analyses, including thermal analysis, were conducted over multiple years with the objective of determining the effect of the construction of the dike on the thermal regime in the foundation. The engineering team concluded that most of the core of the dike should stay frozen during the lifetime of the structure.

"There were no spills or incidents throughout the project," said Henry. "All equipment and supplies were safely removed when the project was complete."

Innovative solutions to overcome obstacles

Throughout the project, the crew innovated and adapted to overcome obstacles. For instance, a grout plant needed to be built that could produce sufficient volumes of the specialized design of cement and bentonite required to build the cutoff wall. It was not an easy feat with the time constraints and crews still doing final assembly as the containers were being loaded, but the plant's production capacity allowed the team to stay on schedule.

The crew was thrown another curveball when the production of the grout-bentonite mixture clogged up pumps and lines. "On the ground, mechanical and software changes were implemented as everybody got on board to help resolve

issues presented by the never-before-used grout-bentonite mix," said Langton.

HFDI constructed Portable Agitation Tanks (PAT). The PATs were designed to be carried on the forks of the large front-end loaders that were available at the mine site. The PATs were intended to be used to transport the cement-bentonite mixture from the plant to the piles. When this approach proved flawed, the team re-engineered and implemented an alternative delivery system using a tanker truck.

At every phase of the construction, the extreme cold caused issues. For instance, a heated tent had to be constructed for the grout plant to operate in with an adjoining tent that held the cement hopper. The design helped manage the dust that was generated when cement bags were opened. A screw conveyor system linked the two areas.

"KCG's expertise in the North proved invaluable as a multitude of obstacles were addressed and overcome," said Langton. "An innovative solution provided hot water for the grout plant and site."

Preventing the workers from getting frostbite was another ongoing concern. The team received extensive training about working safely in such extreme weather. No crew member had to be treated for frostbite and the project had an impeccable safety record.

"This was the kind of project that brings the best out in a company. HFDI personnel rose to the occasion and despite tough conditions, which included the cold, numerous equipment failures and the need to innovate methodologies on the ground," said Henry. "All this and a host of other issues

that can only be presented by one of the harshest terrains in the world and we were able to bring the project in ahead of schedule and on budget."

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SAFETY FIRST

Midwest Caissons helps spearhead much-needed drill rig operator certification program

By Heather Hudson

Every industry has its blind spots.

For technology companies, it's the failure to protect the privacy of customer data. In retail, it's dangerous and unfair labour practices in overseas manufacturing facilities. Once identified, measures can be taken to address and eradicate a blind spot, but it often takes a tragedy before industries are moved to act.

The piling industry's long-time blind spot was arguably the absence of certified training to operate the most enormous and powerful piece of machinery on a job site: the drill rig. Although the vast majority of operators have managed to avoid catastrophe, some professionals in the business weren't willing to stand by and wait for one to happen.

Midwest Caissons, a cast-in-place piling contractor operating out of Acheson, Alta., takes safety very seriously. It had long bothered co-owners Todd Smith and Neil Sutherland that drill rig operators didn't need special training.

"We have to have a certificate to run a skid steer or a loader and many other pieces of equipment onsite. But you take the biggest piece of machinery out there and you don't need one. We felt we needed to be in the forefront to try and get our guys the certification they all need to do this job," said Smith.

PHOTOS: MIDWEST CAISSONS

Brad Lamb operating a MAIT HR 130 for Graham Construction

Practical exam setup for the drill rig operator program

Sutherland points to the variables that can affect safe operations. "When it's good clay or clay till and the drilling is good, not too much can go wrong. Unfortunately, we're in conditions where it could be very sandy, we could get into water, boulders…you name it under there. There are lots of underground variables that make it very difficult for the operator to adapt and figure out how to install in those conditions."

Midwest Caissons' construction manager Andy Sneddon points to the dangers associated with the sheer size, and often awkward positioning, of the drill rig. "It's a three-dimensional thing; you've got risk and potential hazards above you, hazards around you and below you. That's what makes a drill rig unique and that's where the need for training comes in."

The entire company, including geotechnical engineer David Watmough and health and safety co-ordinator, estimating and HR specialist Cody Gravel, often discussed the need for better training.

When Gravel got the opportunity to collaborate with the Northern Alberta Institute of Technology (NAIT) and the Western Canadian chapter of the Association of Drilled Shaft Contractors (ADSC) to help create a drill rig operator certification program, he jumped at it.

"We started out by forming a small task force that went around the industry to get support to develop a program for drill rig operators," said Gravel.

The task force met with NAIT over two years, offering advice on the most critical components of being a drill rig operator, including practical and leadership skills. "We came up with a goal to have a certificate that's government-approved and industry recognized," said Gravel.

NAIT began offering the two-year certification program online as a continuing education course in January 2018. It's a first of its kind in North America. The nine online courses that make up the program include:

- Foundation Drill Rig Operator Levels I & II
- Principles of Drill Rig Operations
- Safety in Drill Rig Operations
- Introduction to Drilling Equipment
- Mechanics and Maintenance Levels I & II
- Calculations and Rigging
- Installation of Drilled Shafts
- Project Documentation/Communication/Leadership
- Blueprint Reading

"The fact that it's online is helpful because it means people can take it remotely. A lot of times guys are working up in camps or out of town. They can do the written component from anywhere," said Gravel.

The requirements also include a total of 1,500 hours of on-the-job experience. These hours must be monitored, recorded and signed off by a mentor and sponsor company.

Potential students must have a minimum of 250 hours of experience in the construction industry in drill rig operations or a related position, a letter of support from their employer and an assigned mentor, usually a supervisor approved by the company that can vouch for their competency as a drill rig operator.

Smith says the ultimate goal of every piling company should be to have their operator(s) certified. Prior to the availability of this course, Midwest Caissons, along with most other piling companies, groomed ground team personnel to take on the responsibility over time.

"We'd typically hire someone on the ground team and develop them and coach them from that level and get them into the seat eventually, but it's not an overnight process," he said.

"If a drill rig operator hasn't seen varying ground conditions over the course of their crane operator employment, how do they know how to deal with issues as they come up and do it in a way that the product [pile] meets the standard required by the structural and geotechnical engineers on site?"

Since the program became available, all of Midwest Caissons drill rig operators have become certified. Smith notes that their final exam took place when they were working on a major project for which schedule was key.

"We have to have a certificate to run a skid steer or a loader and many other pieces of equipment onsite. But you take the biggest piece of machinery out there and you don't need one. We felt we needed to be in the forefront to try and get our guys the certification they all need to do this job."

– Todd Smith, Midwest Caissons

Three rigs on an air purging for methane mitigation site

A truck rig and track mount on the Tamarack Theatre jobsite

"We told our client in advance that our guys were doing the practical exam on this day and needed to be off and they were all for it. Even though they lost a day of production, they knew that, in the grand scheme of things, it was important to be able to provide them an additional layer of assurance that they're not going to have a safety issue on their site, now or in future projects. Customers care about this certification."

NAIT informs students that they stand to gain enhanced knowledge of safety, including the ability to minimize risks, more credibility that allows employers to have increased confidence in their skills and employability and job security by providing a leg up on others who are uncertified.

"If I'm looking at a resume and see that someone was driven to complete the program, it would definitely give them an advantage," said Smith.

About Midwest Caissons

There's a reason Midwest Caissons was keenly interested in helping to spearhead the drill rig operator certification program: a concern for safety is in its DNA.

"The four core values that drive our company are safety, integrity, quality and competency. The drill rig operator program hits all of them. It made a lot of sense for us to get involved," said Gravel.

The original company was founded by Albert and Rose Smith in 2001. When they were looking to close the business in 2014, employees Todd Smith and Sutherland incorporated as Midwest Caissons. "At that point, we focused on cast-in-place piling. Over the last five years, we've expanded our fleet and have ventured out into different areas such as screw piles, value engineering and pile load testing," said Smith.

They exclusively focus on commercial projects, including recreation centres, commercial retail units, schools, hospitals and fire halls in B.C., Saskatchewan and Manitoba, although most of their work is in northern Alberta.

"Predominantly our customers would be general contractors such as Clark Builders, Scott Builders, Cove Properties, Bird Construction, Carlson Construction and others who we regularly work with," said Sutherland.

Since Smith and Sutherland took over, the number of employees has roughly doubled to 30, including eight administrative staff, five full-time drill rig operators and two relief drillers, plus a mechanic, welder and small ground team. They have six drill rigs in their fleet, one screw pile rig and static load test equipment. With Watmough's geotechnical expertise, they do their own in-house engineering.

Smith says the quality of their employees has been integral to their success and growth. Many have been with the company for 10 or more years and they experience very little turnover.

In his HR capacity at Midwest Caissons, Gravel is proud to highlight the "can-do" attitude of the business. "Everyone looks out for one another and that's what drives the culture here. I think that is probably our greatest strength. We get a lot of repeat business and it's because of the work we do, the guys on site and the relationships they build on the front line."

Sutherland emphasizes the importance of developing long-term relationships with every job, whether it's one building or 100. "If they're building one, there's a chance they'll build another one day. And I think our best practice is doing the right thing the first time. We ask our guys to do their best and we support them as they do that."

As construction manager, Sneddon says it's important to take a client's problem and provide a solution. "We want to give them the confidence that we can execute and that includes our guys, our equipment, our in-house engineering and our ability to prove our solutions."

Watmough says a good example of this ethos is their work on Edmonton's Dr. Anne Anderson High School, a two-year build that required more than 800 piles and an intensive static load test. "With our customer, Clark Builders, we went through design a couple of times and we managed to decrease the size of piles by around 10 to 15 per cent. This impacted the cost, size and schedule in a very positive way."

Gravel remembers a concerning situation that arose on that project, but the quick-thinking and planning of Midwest Caisson employees controlled the problem. "We ran into sub-surface conditions that were unknown and there was methane

> **"If a drill rig operator hasn't seen varying ground conditions over the course of their crane operator employment, how do they know how to deal with issues as they come up and do it in a way that the product [pile] meets the standard required by the structural and geotechnical engineers on site?"**
>
> **– Todd Smith, Midwest Caissons**

A swamper and a driller working together to safely install a belling tool

throughout the whole site. Our guys mitigated the risk once it became apparent and we had a stand down on the site while we worked with the methane experts Clark had on hand.

"The experience our guys had and the strategy they suggested to complete the remaining 700 piles took planning and thinking. Rather than just telling the client it's their responsibility to mitigate and we need X, Y and Z, we worked with them in collaboration in the most cost-effective way and still managed to meet the proposed timeline," said Gravel.

Big jobs for a growing company

Among the many projects they're proud of, they point to a few in particular that have helped them learn and grow, including a project that saw them install more than 6,000 piles for three residential buildings in Fort McMurray and a City of Edmonton sewer project for which they drilled a 12-foot-diameter hole 40 feet deep.

Safety remains at the forefront of every job. As a COR-certified company, they regularly collaborate with the ADSC, including participation on a committee working to create standardization on working platforms for foundation drilling equipment.

"We're involved with industry to try and make sure that other contractors aren't going out and working on sites with working platforms that visually look okay, but they're soft and could lead to the overturning or collapse of equipment. We want all workers to know they have the right to refuse unsafe work if it doesn't look okay," said Gravel.

On their own projects, Smith and Sneddon conduct pre-mobilizations by inspecting sites and giving advice to contractors on how to prepare the working platform so crew members aren't at risk.

When it comes to future plans, Smith says they're looking at getting into confined space or low overhead work. "That's where we'd like to expand. We currently offer it to a small degree, but we'd like to get into smaller equipment to get into tighter areas.

"These new markets would be a challenge for us and there's a growing demand for it. People are not building new structures as much, but are instead refurbing what they have to meet their changing needs."

Although they expect to continue to branch out into the load testing market, Sutherland says that, otherwise, they're comfortable remaining at their current size.

For more information about the drill rig operator certification program, visit www.nait.ca/coned/foundation-drill-rig-operator.


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Let's Get Political

Getting involved with local, provincial and federal government can help steer the change that impacts your business

By Melissa Campeau

When you consider a deep foundations contractor's long list of responsibilities, political activism doesn't usually spring to mind – but business owners who ignore government affairs do so at their own risk. That's the view of Marty Fiorentino, president of The Fiorentino Group, one of the largest government affairs and business development firms in the state of Florida. Fiorentino is speaking from experience: His firm provides government relations expertise to some of the biggest companies in the world, and he's also active in local, state and national politics.

When you begin to unpack how businesses run, it becomes clear that taxes, regulations, trade, employment laws and all of these government-generated measures have a huge impact on your company. That's the case whether you plan to get involved in politics or not.

"A recent survey of CEOs found they felt that one of the top threats to their business was government – particularly government intrusion and regulation," said Fiorentino. "Those regulations can have quite a negative impact on their bottom line, how they run their business, their market and how they interact with their own employees."

"First, it's important to get to know elected officials so they know who you are."

– Marty Fiorentino, The Fiorentino Group

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The best thing a business owner can do to combat a threat is take action.

"It's important not only to stay aware of and on top of regulations, but to also be part of the process and part of the policy discussions," said Fiorentino. "You can let all those forces impact you or you can take action. You're either at the table or you're on the menu."

Impact at every level

Business can be affected by government policy at every level. At the local level, for example, bylaws concerning when a city might impose noise restrictions can dictate schedules, timelines and budgets.

"What if the local government said no noise between 10 p.m. and 7 a.m.?" he asked. "That timing might seem logical and reasonable. But what if they expand it to 4 p.m. and 9 a.m.? Then things start to get different. It affects timing, it affects the business model, it affects cost. That's a simple example that shows that even at the local level, pile driving can be affected."

At the state or provincial level, said Fiorentino, "There are employment issues, wage rates, tax implications – all kinds of issues at this level that could impact businesses of all kinds."

And then at the national level, Fiorentino says taxes are one of the biggest implications of regulations.

"For example, there's the transition or sale of one company to another, or a merger of one company with another or an acquisition. Tax laws around these could negatively impact the transactions."

Regulations around trade can have a big impact on business as well. He points to the current situation between the U.S. and China as one high-profile example.

"If your equipment becomes expensive – or if it's suddenly non-existent because you used to purchase it overseas – that's going to be disruptive," said Fiorentino. "Or, it might be that [you were] selling equipment overseas and now you're not allowed to." Those regulations can cause anything from a headache to a nosediving bottom line.

The upsides of getting involved

The most successful companies tend to be well aware of the importance of getting involved in politics and they invest the time and effort to create a strategy to get the change (or status quo) they're after.

"There's a reason Amazon, GE and some of the largest companies in the world have Washington offices, and government relations departments at the federal, state and local levels," said Fiorentino. "These companies recognize the importance [of] participating in the government process because of the negative impact it could have on their companies if they don't."

He holds Uber up as an example of a company that's used political engagement to its advantage.

"In most local communities and U.S. states, their business model was not allowed. But city by city, state by state the company was able to rewrite those laws so they were beneficial to the company," said Fiorentino. It took widespread diligence on a micro level to help them grow the business on a global scale. "But to get that growth, they had to change local ordinances and state law so they could operate the way they do today."

On the other hand, he says, some industries miss an opportunity to influence policy. He points to the pharmaceutical industry as one example.

"I'm sure there are reasons certain drugs are very expensive," said Fiorentino. Although, if that's the case, it's not a sentiment widely understood across the U.S. "You have to tell a story about why you feel your position is correct." That needs to be shared with customers, employees and all stakeholders. "And then you can tell that story to an elected official."

Side benefits of involvement

"Becoming active in the government process can be a marketing tool," said Fiorentino. That means developing relationships with people. "Business owners involved in the government relations process are active in their communities. They want to know who their representatives are and who their senators are, who people are in their capital cities. That puts them in touch with other like-minded people who also have businesses." That, he says, opens up opportunities to participate and engage with other businesses who are active at the various levels of government.

Can you be "too political?"

Supporting particular politicians and regulations may seem like falling in line with one political party over another. Fiorentino doesn't see that as a problem, necessarily. There's nothing to fear when it comes to taking a political stand, he says, as long as you clearly articulate your story.

"The owner of XYZ Company may be a fervent democrat or republican or whatever, but if they're a smart business person, they'll ask, 'What are the business objectives that are good for my business, good for my employees, good for my community, and how do I look at the politics around that?'" He adds that businesses will want to support the politicians and issues that are best for their business, employees and community, and allow them to prosper and thrive.

Employees, too, need to be engaged in the process.

"They should know about issues that are important to the company, since those issues are also important to them. That's true of shareholders and customers, as well," said Fiorentino. "If issues lean one way or another in terms of a political party, then so be it."

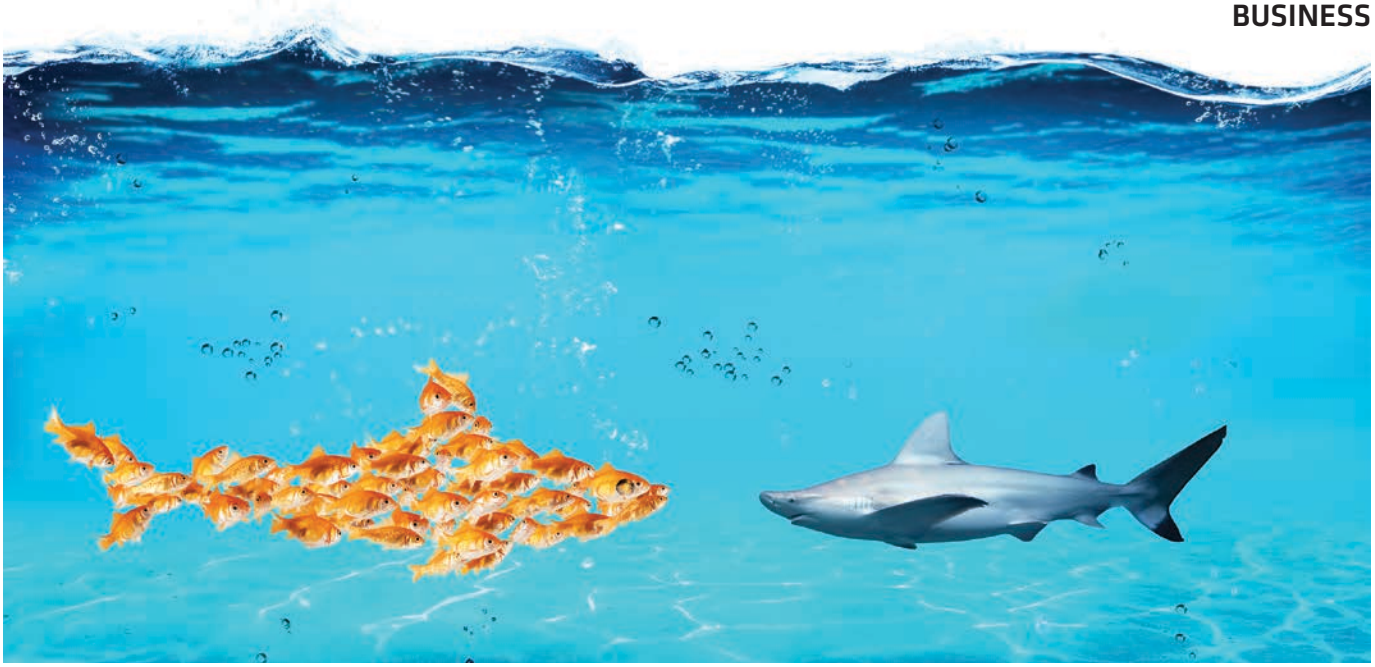
Rules of engagement

So how should business owners take those first steps to political engagement?

"First, it's important to get to know elected officials so they know who you are," said Fiorentino. "To the extent you can meet them face to face, that's important."

However, that doesn't necessarily require a pilgrimage to Washington, D.C. or Ottawa.

"All politics are local," said Fiorentino. "Politicians come back to their districts, their hometowns, all the time. Meet them there. All politics start at home. That's a good time to meet them because they don't have the same pressures they might have when they're in session."



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Beyond that he suggests writing letters, making phone calls and joining a local action committee.

"Meet and support the candidates that are going to support you."

As Fiorentino says, the pace of change is faster than ever.

"Change is going to happen. It can either happen in a way that's detrimental to you or in a way that allows you to acclimate and benefit from it, and that takes participating in it."

The key, he says, is to get ahead of the curve.

"It's too late to try to act when something is impacting your company – to rush and try to go get some help politically – because people don't know you and they don't trust you. You need to build trust with your elected officials. Participate in the process and make your friends there – before you need them."

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Is Your Bias Showing?

How to spot and change unconscious bias in the workplace

By Ron Price and Stacy Ennis

Unconscious bias matters. Greatly. Not just for the people on the receiving end of bias, but also for the leaders, teams and companies who are missing out on a team that is diversified through age, race, gender and other factors.

Where is the diversity?

During a session at a recent leadership training afternoon that was focused on hiring practices, the presenter spent the better part of an hour laying out his strategies for attracting and retaining top talent. These processes, he said, were effective beyond his company. They were attractive: online forms, spreadsheets, detailed reports, company transparency – all the latest and greatest in finding and keeping the best of the best.

Then he pulled up a slide.

The slide contained an organizational chart with about 30 employees. Rather than just names, it also included faces. The trouble was, nearly everyone in the company looked alike. It was like a carbon copy of the same person with slightly different smiles and hair colours. With some exceptions, nearly everyone was the same gender and about the same age.

He went on to explain how his process vets through several layers and has steps and stages for every potential hire, plus onboarding and technology that encourages collaboration post-hire. Was this process fostering diversity? The answer, plainly, was no.

Wired for bias

Like many of us, this presenter was dealing with unconscious bias, also known as implicit bias. The company's practices were clearly favouring recruitment, hiring and retention of a specific group of people – preferring one set of individuals with certain qualities (gender and age range) over others.

The fact is, our brains are wired for this sort of thing. We've all seen the studies: men are more likely to consider male candidates more qualified, want to hire other men, give those men a higher salary than women and are willing to invest in those men. We also know age-based stereotyping is prevalent in the workplace; one group of researchers call such biases the "silent killer of collaboration and productivity."

While it's normal to think, "Well, that's not me," science says otherwise.

In one study, MRI scans showed that when we're confronted with someone who is different than us (in this study, a different race), the amygdala – known as the emotional processing centre of the brain that deals with fears, threats and more – lights up. The frontal cortex, which is involved in "forming

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impressions of others and in measuring empathy," also lights up, leading toward unconscious decision-making.

We are all wired for unconscious bias – even those who are dedicated to equality. Without even realizing it we're making judgments about others, which are influencing our decisions. At work, this plays out in hiring, promoting, mentoring and much more.

Bias and the bottom line

Research also tells us that "being around people who are different from us makes us more creative, more diligent and harder-working." This is, in part, because our brains have to work a little harder.

When someone presents a fresh viewpoint – or even a similar viewpoint from a different lens – we tend to pay closer attention. Diversity disrupts intellectual autopilot and causes us to be more engaged and aware.

Also, diversity is good for the bottom line. According to a study by McKinsey, companies in the top quartile for racial and ethnic diversity are more likely to have above-average financial returns. A study by the University of California, Davis, found that "among the 25 firms with the highest percentage of women executives and board members, researchers found that median returns on assets and equity in 2015 were at least 74 per cent higher than among the overall group of companies surveyed."

There are also exciting opportunities for mentorship across generations. Findings from one study show that 96 per cent of Millennials believe "Boomers bring substantial experience and knowledge to the workplace." Likewise, 90 per cent of Boomers believe "Millennials bring new skills and ideas to the workplace."

Awareness and action for change

If we're wired for bias, how do we change? First, continue learning about unconscious bias and watch for it in yourself and within your teams.

Second, measure. If in a leadership position, take an honest look at your company's organization chart. Do you see much of the same? Don't be fooled by a few diverse employees peppered throughout – objectively analyze the employee base.

Third, set real metrics. Aim not just for a "more diverse workplace," or "more women and people of colour on the board." Instead, set measurable goals like 50 per cent women and 50 per cent non-white. When real numbers are attached to the goals, you'll be amazed at your team's ability to find solutions and create best practices to get your company closer to those goals.

Fourth and finally, check in with yourself. Do you notice that you listen more to the people on your team who are like you? Do you find yourself mentally dismissing opinions that don't validate your own? Awareness needs to be paired with action. Invite people who aren't like you to contribute; give opportunities to someone who is deserving, but maybe wasn't your first pick; and encourage others on your team to seek out and foster divergent thinking rather than falling into group think.

We may be wired for bias, but we aren't destined for it. There is a brighter, more diverse, more creative and more effective workforce ahead. It's up to us to make it happen.

Ron Price is an internationally recognized business advisor, executive coach, speaker and author who has worked in 15 countries and served in nearly every level of executive management over the past 40 years. The former president of a multi-million-dollar international company, in 2004 he started Price Associates, a global leadership advisory firm.

Stacy Ennis is a creative consultant, success coach, speaker and writer, as well as the co-founder of Next Level Women Leaders, a leadership training company. The former executive editor of Healthy Living Made Simple*, a magazine reaching roughly 11 million readers, she has written or edited dozens of books, including* The Editor's Eye *(2013).*

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THE ART OF NETWORKING INSIDE YOUR COMPANY

How to build camaraderie, co-operation and a cohesive team

By Liz Goodgold

When we hear the term "networking," most of us think about meeting folks outside of our company. However, the true power of networking resides with making a connection inside of your company.

Three benefits of networking within your company

After all, you spend more time working with people inside your company than out. It's these connections that build camaraderie, co-operation and a cohesive team. In essence, internal networking is your secret weapon to:

1. **Forge Deeper Connections** – Similar to the old adage, the more you share, the more you care. Without a common bond, you'll never meet your next mentor, friend or champion.
2. **Understand Your Industry and Company Better** – Tapping into the brilliance of your colleagues is an informal way to gain essential knowledge. Ask your colleagues how they're tackling a particular issue; question how they're seeing the industry transform; uncover successful solutions facing your team. The bottom line: information is career currency.
3. **Discover Opportunities for Advancement** – Co-ordinating with someone and partnering on a project allows your expertise to shine. Of course, it also sets you up for the next advancement or promotion.

The deadly sins of networking

Even if you don't know exactly what to do to facilitate a conversation and connection, ensure you avoid these deadly sins:

1. **Screening Yourself with Screens** – Your phone, laptop and tablet are the enemy. Entering a meeting room or job site and immediately delving into your technology broadcasts that you are unavailable for conversation.
2. **Replying with "Busy, Busy"** – Your answer to, "How's it going?" could end with a sure-fire conversation stopper. Instead, reply with specifics of a project under construction.
3. **Talking Politics** – Regardless of your favourite political candidate, someone is ready to disagree with you. The advice: bite your tongue. Switch the conversation quickly to a non-controversial one.

Give 'em something to talk about

Networking is simply having a conversation and then culturing a relationship; it's a mutually beneficial relationship where you share industry trends, concerns, solutions and relevant personal information. The old adage about not mixing business with pleasure is wrong. If you don't share anything, you don't learn anything! Further, how do you convert a conversation into a connection if you have nothing to say?

A landmark University of Chicago study concluded that people who "talk to strangers" felt a greater sense of self and well-being than those

RAWPIXEL/123RF

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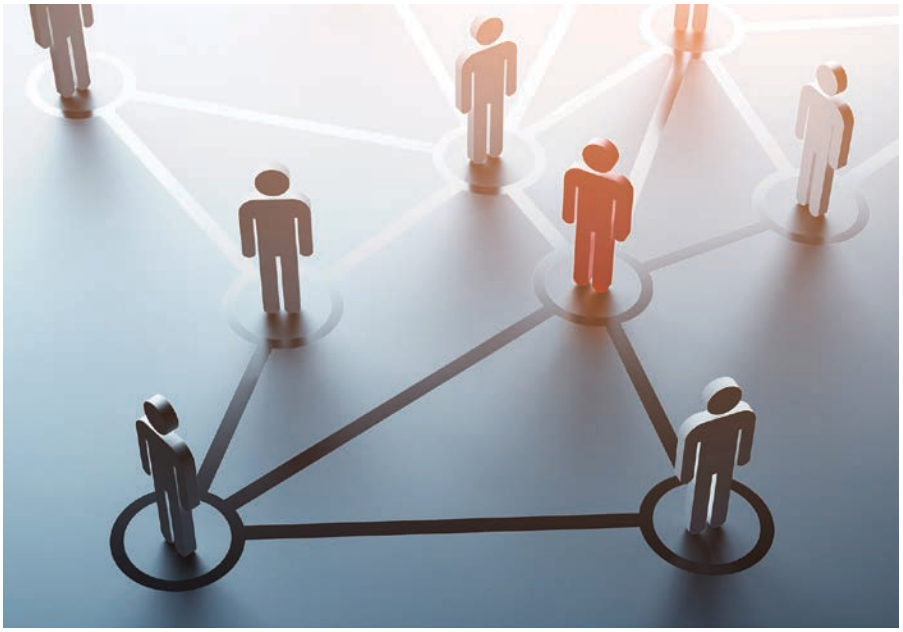

PESHKOVA/123RF

who remained silent. However, the number one fear in talking to others was what to say. Networking should be logical and *sensible*, here are sensible recommendations to fire start a conversation:

1. **Sports** – Go ahead and ask about the Oilers, Blue Jays or Raptors. Sports brings out the passion in a fan and gives you a continuous stream of content.
2. **Entertainment** – What is the latest with the Kardashians? What shows are you bingeing? Understanding someone's tastes allows you to compare notes and make recommendations.
3. **News** – The IPO of We Work crashed and burned; what do you think? Juul is laying off 500 employees; is vaping a big deal in your world? As long as you avoid politics, abortion and religion, get ready for great conversation.
4. **State/Province** – Letting someone talk about where they grew up is golden. No need to limit it to birthplace, talk about landmarks you visited, which ones you missed and where your kids or parents are residing.
5. **Industry** – How are you dealing with the labour shortage? Are you able to find masons? How has the legalization of marijuana impacted your hiring? Here is the kernel that forges a career connection.
6. **Breezy Weather** – Yep, you can always talk about the weather, your commute in the snow and why drivers can't drive in the rain. It's an easy form of connection that works.
7. **Leisure Activities** – Do you play golf too? Are you in love with murder mysteries? Where's the best hamburger you ever had? What are your vacation plans?
8. **Events** – What conferences are you attending? Which ones delivered the most benefit? Are there any events you recommend? Why or why not?

Don't forget the follow-up

Follow-up is the best building block of a relationship. If you simply have one conversation, the connection remains at a dead end. However, if you share articles, recommend a particular book, suggest an industry event, email a PowerPoint, you are converting the connection into a relationship. Then you know that your networking is working.

Liz Goodgold is a leadership keynote speaker and trainer who specializes in the construction industry. Her work as a partner and for women in the industry builds better communication, teams and results. For ideas on how to support your team, connect with her at Liz@LizGoodgold.com.


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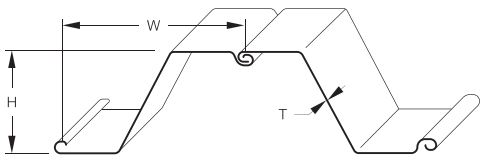

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Underground Investigation and Risk Management PART 2

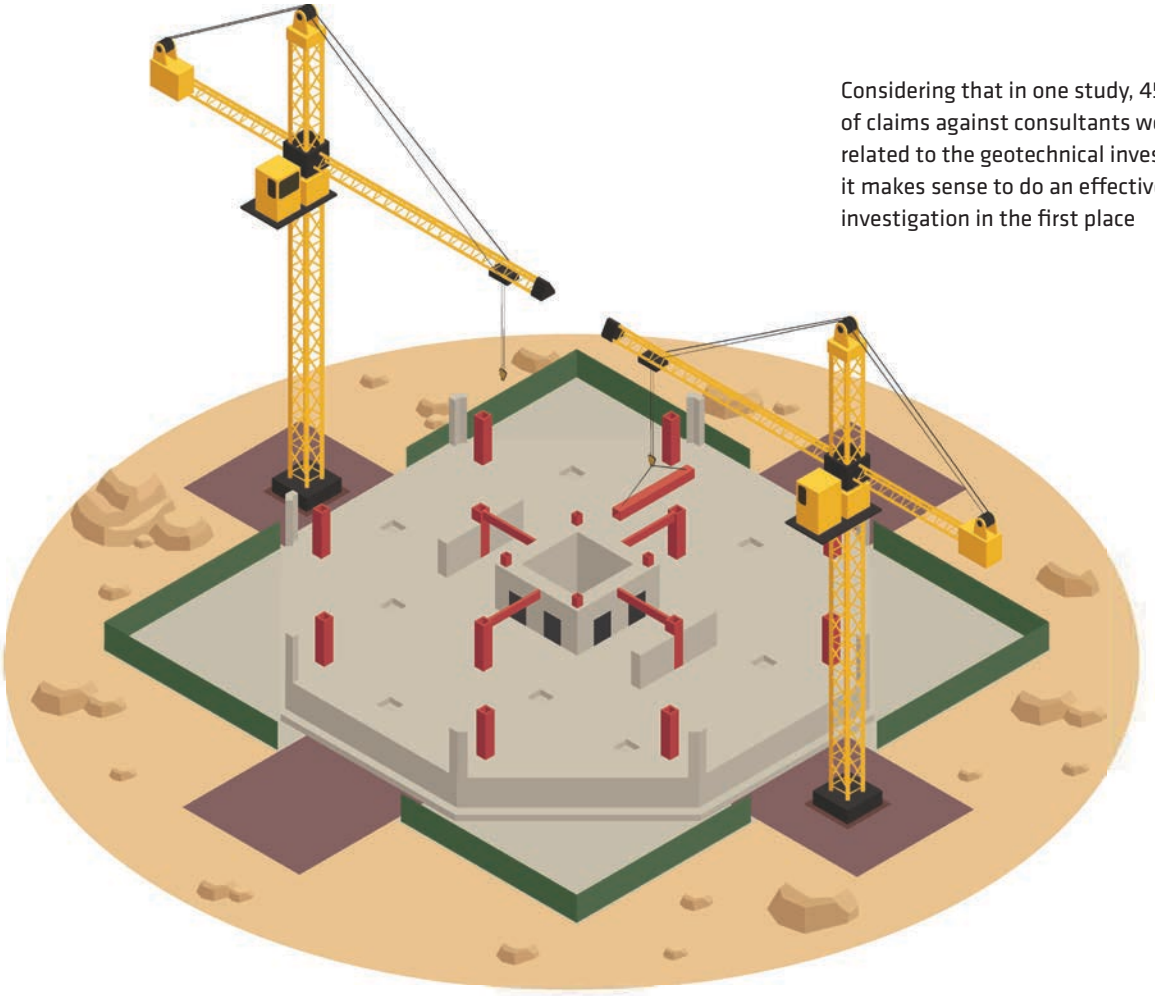
Risk and projects

By Masoud Manzari, P.Eng. and Mark Tigchelaar, P. Eng., GeoSolv Design/Build

The first article of this series covered "What is Risk?" Now we will discuss how risk and projects interact.

There are many complex models and references for geotechnical risk management from the beginning (conceptual design stage) to the end of a project (construction and operation). A proper geotechnical risk management plan has many detailed steps involved in it, such as identifying the hazards and sharing risk. Although a geotechnical investigation is just one step in the process, it is by far the most important one.

A geotechnical investigation done improperly can cause significant construction delays, increased cost overruns, redesigns and much more; ultimately and negatively impacting a project. A recent study of 41 legal court cases, where the claim was related to geotechnical issues, revealed that 55 per cent of the claims were the result of "changed soil conditions." This type of claim is directly related to the geotechnical investigation. Other types of claims such as "design inaccuracies" may also be rooted in the geotechnical investigation. This same study also found that approximately 45 per cent



Considering that in one study, 45 per cent of claims against consultants were directly related to the geotechnical investigation, it makes sense to do an effective site investigation in the first place

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Risk is the effect of the threats, not the threat itself. Therefore, the project affects a difference on the risk level and hence a difference on the required level of geotechnical investigation.

of the claims against consultants were directly related to the geotechnical investigation.

What can be done to bring these numbers down? Conduct more borehole tests? Or maybe it just makes more sense to do an effective site investigation in the first place?

Geotechnical unknowns usually exist in reverse correlation to the scale and quality of the investigation. We are always asked by project managers, "What is the reduction in risk for each dollar I spend on a geotechnical investigation?"

Unfortunately, the correlation between the scale of geotechnical investigation (i.e. the number of boreholes) and risk is not a universal one. Different geological regions have different soil deposits/property variability. Even for a site or region with natural variations of geotechnical conditions, different construction methods have different sensitivities to the geotechnical condition. Risk is the effect of the threats, not the threat itself. Therefore, the project affects a difference on the risk level and hence a difference on the required level of geotechnical investigation. For example, an underground tunnel excavation is more sensitive than an open trench installation. Subsequently, one conducts more boreholes for a tunnel as compared to an open trench excavation.

No single geotechnical investigation can function universally, but here is the good news: it is possible to arrive at an upper bound for necessary geotechnical work!

This idea started by studying cost overruns in tunnelling projects. The study shows an upper bound correlation between the ratio of total length of boreholes over tunnel length as compared to the cost overruns. The common median ratio of Borehole:Tunnel Lengths is 0.42 and there are tunnel projects with 50 per cent, or more, cost overruns when the scale of geotechnical investigation is this low and at this median BH:Tunnel Length ratio. The same data suggests that if the number of the boreholes are increased to a ratio of 1 (Borehole:Tunnel Length), the upper estimate of possible cost overrun can be reduced to a more reasonable estimate of 15 to 20 per cent. The study also suggests there is not much benefit going beyond a Borehole:Tunnel Length ratio of 1.5.

Generally, we prefer to have this type of information in the context of the investigation cost. For major infrastructure projects, it is recommended to budget, for all phases of the geotechnical investigation, costs ranging from 1.5 to 2.2 per cent of the construction cost and have a contingency up to three per cent of construction cost (for complex conditions). For low-rise buildings, that number is as low as 0.2 to 0.4 per cent of construction costs. It is safe to say all construction projects generally sit somewhere between a low-rise building and a major infrastructure project.

The cost of an investigation is not always an accurate indication of its effectiveness. Appropriate choice of investigation methods, research on the project area (other construction, existing geotechnical information), geological modelling, quality of the investigation and a proper engineering assessment all play a key role in conducting a truly effective investigation. By employing these principles the geotechnical risk can be greatly reduced while spending the same level of money on the investigation. Don't just spend money, do the right investigation!

Masoud Manzari is a senior geotechnical and hydrogeological engineer with over 23 years of experience and has been involved in a wide range of civil engineering projects, specifically for structures built on challenging soil sites.

Mark Tigchelaar is president and founder of GeoSolv Design/Build Inc. Tigchelaar is a licensed engineer in Ontario and Alberta, the chair of the industry Advisory Board of York University and the past chair of the Canadian Geotechnical Society-Southern Ontario section.

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Check out the *Piling Canada* Project Map. This interactive map makes it easy to explore the many Company Profile and Project Spotlight articles that have been featured in the pages of *Piling Canada* over the years.

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DFI's Efforts are a Success

The numbers are in and show that women are making substantial ground in the deep foundations industry

Five years ago, as part of a five-year strategic plan, the Deep Foundations Institute (DFI) launched the Women in Deep Foundations (WiDF) Committee with the goal "to enhance professional opportunities for women in the deep foundations industry."

As the current five-year plan comes to an end, the results are in and show through measures of success (attendance, technical contributions and roles, and leadership roles), the committee is succeeding in its goal.

Prior to 2013, DFI did not track the number of women attending and participating in the organization's initiatives. However, using available data, the increase of female members of DFI's other technical committees (not including WiDF committee) from 2014 to 2019 is an astounding 816.67 per cent (98 women in 2019, up from 12 in 2014). Another notable increase, the number of female authors presenting at the DFI Annual Conference has increased three-fold since 2016 (24 women in 2019, up from eight in 2016).

Through an expansive program of lectures, networking receptions, professional development grants and workshops, regional networking groups, industry-academia partnerships and the coveted WiDF lanyard – available for purchase, proceeds support WiDF initiatives – the committee has been able to achieve this growth. It's "not about calling anyone *out*, it's about calling everyone *in*."

The successes of the last five years do not mark the end of the need for programs such as the WiDF Committee. Rather they should serve as a bold reminder to continue encouraging more women to enter this industry. These successes signal that change is occurring, but more still needs to be done; only 12 per cent of DFI Annual Conference attendees this year were women.

Don't let the name fool you, WiDF is open to women *and* men who advocate for retaining women in the deep foundations industry. Visit www.dfi.org for more information on the WiDF Committee.

DFI Annual Conference

Year	# Women	Total Attendees	% Women	# Female Org Comm Members	# of Female Authors
Chicago 2019	177	1169	12%	5	24
Anaheim 2018	116	1050	11%	4	12
New Orleans 2017	114	963	11.8%	7	15
NYC 2016	111	1096	10%	8	8
Oakland 2015	103	912	11%	7	9
Atlanta 2014	43	729	6%	1	7
Phoenix 2013	41	630	6.5%		3

DFI Technical Committees

Year	Female WiDF Members	Female Members of Other DFI Technical Committees
2013		
2014		12
2015	36	35
2016	40	43
2017	47	59
2018	55	75
2019	68	98

WHAT'S YOUR STORY?

If your work is deep under Canadian soils, *Piling Canada* wants to know about it and share it with our readers.

Make sure the industry knows who you are. To inquire about being featured in a company profile or highlight your company's performance in a project spotlight, contact Lindsay Risto, editor of *Piling Canada*. The process is easy – let's get started.

Phone: 866-953-2189
Email: lristo@lesterpublications.com

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News Pile

DFI publishes new white paper on Crosshole Sonic Logging (CSL)

DFI announces the release of a new white paper, "Terminology and Evaluation Criteria of Crosshole Sonic Logging (CSL) as applied to Deep Foundations."

The paper was produced by a CSL Task Force comprised of members of the DFI Codes and Standards Committee, Drilled Shaft Committee and Testing and Evaluation Committee. The CSL Task Force was chaired by E. Anna Sellountou, PhD, PE, Pile Dynamics.

The white paper reviews the state of practice (including experience gained over the past 20 years), proposes improved CSL rating criteria and makes recommendations for additional assessment, as well as educates the industry on the proper interpretation of CSL testing.

Non-destructive testing of drilled shaft foundations via CSL is often performed as part of the quality assurance process to assess the soundness of concrete. The intent of CSL testing is to identify irregularities such as soil intrusion, necking, soft bottom, segregation, voids and other defects that could result in poor structural performance of the foundation. Over time, CSL rating criteria based on first arrival time and relative energy have often incorrectly evolved to be the sole means of determining the acceptability of a shaft. Some of these criteria have found their way into regulatory agency specifications, with acceptance values often differing from agency to agency. The 17-page paper is available at no cost at www.dfi.org/publications.asp?goto=1058#P1058.

Steel Piling USA, a new competitive supplier of cold rolled steel piling

Based in Erie, Mich., Steel Piling USA combines the decades of knowledge and experience of world leading manufacturers to offer its customers a complete spread of cold formed steel piling products. Steel Piling USA products include steel spiral welded pipe piles, steel sheet piles and heavy wide flange beams, which can currently be produced in lengths up to 130 feet, as well as sealants and coatings.

Production lengths are expected to increase when Steel Piling USA's permanent facility is built; construction on the 375,000 square foot facility will begin in 2020. The manufacturing facility will be built at the Port of Monroe in Monroe, Mich., about 10 miles from the current facility. The location at the Port is expected to provide approximately 110 local jobs. Additionally, the proximity to Lake Erie and its shipping routes offers Steel Piling USA superior distribution capabilities throughout North America to fully meet its customers' needs.

Exclusive mill technology and capacity allow Steel Piling USA to duplicate or improve on the shape of any hot rolled or cold formed steel sheet piles with thicknesses up to 0.65 inches and the highest section modulus properties in the industry. The steel spiral welded pipes, which are double submerged arc welded, can be produced in diameters ranging from 16 inches to 120 inches, and up to one-inch thick.

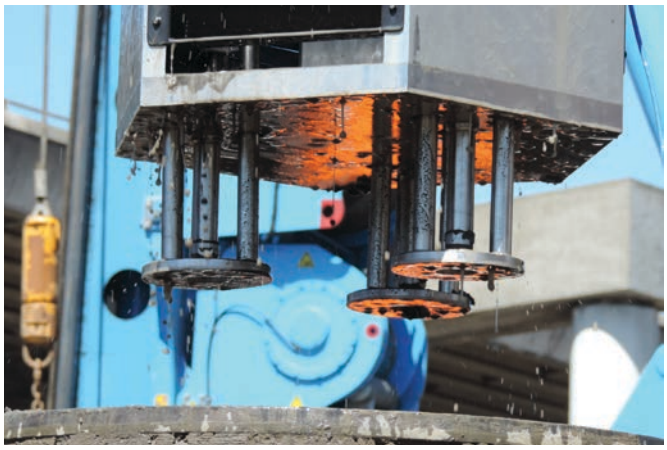
Steel Piling USA is ready for your orders today! For more information, please visit www.steelpilingusa.com.

PILE DYNAMICS, INC.

Innovative QA solutions driven by Pile Dynamics, Inc.

As the use of drilled foundations continues to increase, innovative manufacturers look for ways to optimize these foundation elements. Coming from a strong background in deep foundations, Pile Dynamics, Inc. (PDI) can offer the competency and expertise to develop solutions for testing drilled shafts. The research and development team at PDI recognizes areas of concern in drilled shaft practice that can impact the structure's performance. The team has determined several quality control methods that could be greatly improved.

One of the desired improvements in shaft quality control is the verticality measurement of the excavation. With no



testing method or data to reassure the verticality, the performance of the structure could be compromised. Looking for a way to collect and assess data from the excavation, PDI created the Shaft Area Profile Evaluator (SHAPE). This QA technology offers measured views of the shaft, with a 3D visualization. The SHAPE is lowered into the slurry-filled shaft via attachment to the Kelly bar, identifying irregularities that affect shaft performance. Built with ultrasonic scanning capabilities, the SHAPE scans up to eight channels simultaneously, while advancing in the excavation at a rate of one foot per second. The built-in wireless capability allows the SHAPE data to be quickly sent to the field tablet immediately upon exiting the excavation.

Additional improvement needed for improved quality control of drilled shaft construction was the cleanliness at the base of the shaft. If the base of the drilled shaft isn't properly cleaned, the shaft may not perform as designed. Verifying the conditions at the base of a drilled shaft can be challenging, but PDI created the Shaft Quantitative Inspection Device (SQUID) to help verify these measurements. To improve the inspection method, SQUID takes accurate measurements of force versus displacement at the base of the shaft, providing an objective, quantitative assessment. The SQUID is lowered into the excavation via attachment to the Kelly bar and provides an accurate measurement of debris at the base as well as resistance to penetration in the bearing material. These results can be sent wirelessly from the drilled location to the SQUID tablet, which allows for quick and effective testing.

These innovations offer quantitative data that can improve the quality of drilled shafts in an efficient manner. With wired and wireless options, the SQUID and the SHAPE are versatile systems with quality results.

"We felt the market needed a modern and rugged device where we eliminate common points of failure such as electronic cables running from the surface to the device to provide increased accuracy and performance," said George Piscsalko, president of PDI. "Both SHAPE and SQUID's wireless capabilities allow shaft integrity discussions to happen in real time, at the jobsite or remotely via PDI's SiteLink® technology, saving time and money."

SHAPE and SQUID are the latest additions to PDI's extensive line of quality assurance and quality control systems for the deep foundations industry. The company is located in Cleveland, Ohio, with offices and representatives worldwide. For more information visit www.pile.com or contact info@pile.com today.

Pile Master air hammers hit the pile driving market

Foundation Hammers, LLC, has breathed new life into the Pile Master Air Hammer line. Originally designed for the dock building industry, the product line has been expanded to suit the entire pile driving industry.

"Many air hammers are very heavy, require a lot of air to operate and are not efficient," said Mike Roberts of Foundation Hammers. "We designed the Pile Master hammer to be lightweight, require less air and [be] able to produce up to 90 per cent impact energy transfer with an air compressor as small as 185 CFM."

CONTINUED ON PAGE 79

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FOUNDATION HAMMERS, LLC

Foundation Hammers, LLC has expanded the Pile Master line of air hammers to bring value to the entire pile driving industry

Roberts was named director of Pile Master Products in early 2019. His duties include overseeing manufacturing; setting up a national dealer network for distribution, sales and rental; and developing training programs for sales, service and repair. Roberts is a pile driving equipment veteran who started his career in 1999, as parts manager for Florida-based Pile Equipment.

Pile Master hammers can be guided with 21- or 26-inch (53- or 66-centimetre) leads, or freely suspended with an extended base to drive timber piles, H-piles, steel pipe and pre-stressed concrete piles. An optional sheet pile adapter makes the hammers ideal for driving sheet piles in soil conditions where a vibratory hammer cannot achieve the required depth. Pile Master hammers are also environmentally friendly, using a biodegradable anti-freeze as the only lubricant.

There are currently four Pile Master models available. The 24-900 offers an adjustable stroke from six to 24 inches and 450 to 1,800 foot-pounds of energy; the 24-2500 offers 1,250 to 5,000 foot-pounds of energy; the 36-3000 offers six to 36 inches and 1,500 to 9,000 foot-pounds of energy; and the 36-5000 offers 2,500 to 15,000 foot-pounds of energy. The 24-900 and 24-2500 models require a 185-CFM air compressor, while the 36-3000 and 36-5000 models require only 375 CFM.

Contact Mike at mroberts@pilemasterus.com to inquire about becoming a Pile Master distributor.

Revolutionary new side gripper offers higher reliability

Dieseko Group B.V. has recently launched a revolutionary new side gripper: the 2308SG.

"Dieseko is using over 45 years of experience in vibratory hammers to be applied in their new side gripper, making it a unique and reliable machine. Unique in the side clamp-principle and in elastomer geometry and reliably applied by proven vibratory technology," said Dirk Smulders, CEO of Dieseko Group.

"During the development phase of our Side Gripper, Dieseko's R&D engineers focused on providing a concept which improves the challenges experienced with side grippers currently available, without neglecting Dieseko's design philosophy (limited number of moving parts, protected hoses; both resulting in a high reliability, only three hoses for connection)."

Four major differences compared to existing systems are:

1. Unique linear side-clamping system results in a more efficient clamping load transfer.
2. Modular side-grip clamping system results in less downtime during exchange of the side-grip inserts for various profiles.
3. Clamp opens up to 330 millimetres for sheet piles and H-beams, and 550 millimetres for casings.
4. Unique multi-directional elastomers create a more stable and predictable movement of the dynamic part of the side gripper.

DIESEKO GROUP B.V.

The exchangeable excavator connection adapter allows the side gripper to fit onto any excavator adapter type, and the unlimited 360-degree rotary head with +/- 35-degree tilting adapter makes it possible to operate the side gripper in any position while handling a profile. Its distinct design is easily accessible for maintenance.

After extensive testing, partly by experienced side gripper operators, the results and experiences are promising. The 2308SG uses an oilflow of 214 litres per minute at 350 bar. A 35 tonne excavator is required for best performance. Operating the side gripper can be done by a remote control joystick or excavator controls.

More information at www.diesekogroup.com.

The 3rd Annual **Great Canadian Projects** Issue

Enter your project now

Piling Canada is officially accepting submissions for this year's "Great Canadian Projects" issue. If your firm completed an interesting project in 2018 or 2019, *Piling Canada* encourages you to complete an entry and submit it to *Piling Canada* no later than Jan. 24, 2020. All entries are free and companies can submit an unlimited number of projects for consideration. The selected projects will be featured in the Quarter 1 2020 issue of *Piling Canada*.

Why submit?

After 2018's well received inaugural "Great Canadian Projects" issue, the *Piling Canada* team decided to bring this issue back as an annual edition to celebrate the innovative work being done here in Canada and by Canadian companies. This issue acknowledges the ingenuity, hard work and commitment that goes into each deep foundation project and recognizes excellence in construction projects from coast to coast.

Through the "Great Canadian Projects" issue, *Piling Canada* recognizes those companies that have integrated unique design considerations, problem solving, value engineering, cost savings, innovative applications and benefits to the community or owner into their projects.

How to submit

All Canadian companies that have completed a deep foundations project – domestically or internationally – between Jan. 1, 2018, to Dec. 31, 2019, inclusively, are eligible to submit their projects for consideration.

International companies that have completed a deep foundations project within Canada between Jan.1, 2018, to Dec. 31, 2019, inclusively, are eligible to submit their projects for consideration.

If you have any questions or require any assistance during the submission process, contact *Piling Canada*'s editor, Lindsay Risto, at lristo@lestpublications.com or 204-953-2181.

All participating companies must focus on the completeness in addressing each of the criteria outlined in submission form.

General requirements

There are three categories projects can be submitted under:

- Deep foundation projects by a Canadian company within Canada, completed on or before Dec. 31, 2019.
- Deep foundation projects by a Canadian company outside of Canada, completed on or before Dec. 31, 2019.
- Deep foundation projects by an international company within Canada, completed on or before Dec. 31, 2019.

Submissions must be entered with the permission of the principals or officers of the firm.

Submission must include

Completed submission form (www.pilingcanada.ca/magazine/gcp).

- A brief article overview including (if applicable):
  - Special innovation in construction techniques, equipment and/or materials used.
  - Unique application of piles or design considerations.
  - Construction problems and creative solutions.
  - Cost saving measures such as value engineering.
  - Innovative project management.
  - Design changes/challenges.
  - Management or mitigation of environmental considerations.
- Minimum three (3) high-resolution (1 MB or larger) photos of the project.

Disclaimer

By submitting your project to *Piling Canada* for the "Great Canadian Projects" issue, you are agreeing to have your project featured – if selected – in the Quarter 1 2020 issue of *Piling Canada*. Selected firms can choose to submit their own article or work with a *Piling Canada* writer (at no cost to you) to craft the article. Assistance in identifying applicable photos (captions and credits) will also be required.

Please send all completed submission materials to lristo@lesterpublications.com.

We thank everyone in advance for your participation. However, only those selected for the "Great Canadian Projects" issue will be contacted.

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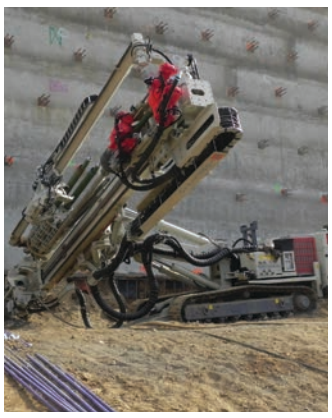

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