

# PILING CANADA

The Premier Publication of Canada's Piling Industry

\$4.50 CANADIAN  Q4 • 2014

## Shoring Up Superstorm Defense

RTG pile drivers from Equipment Corporation of America install steel sheet pile wall to avoid repeating hurricane damage history



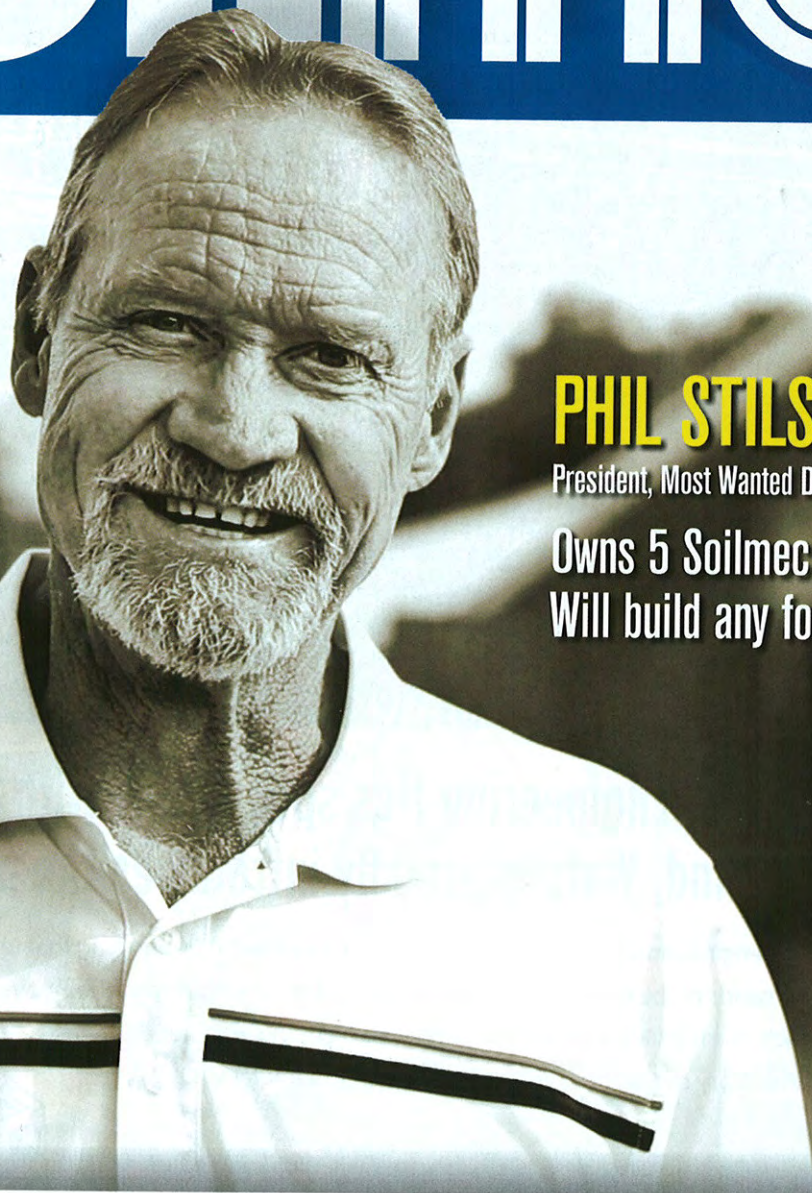
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Owns 5 Soilmec rigs

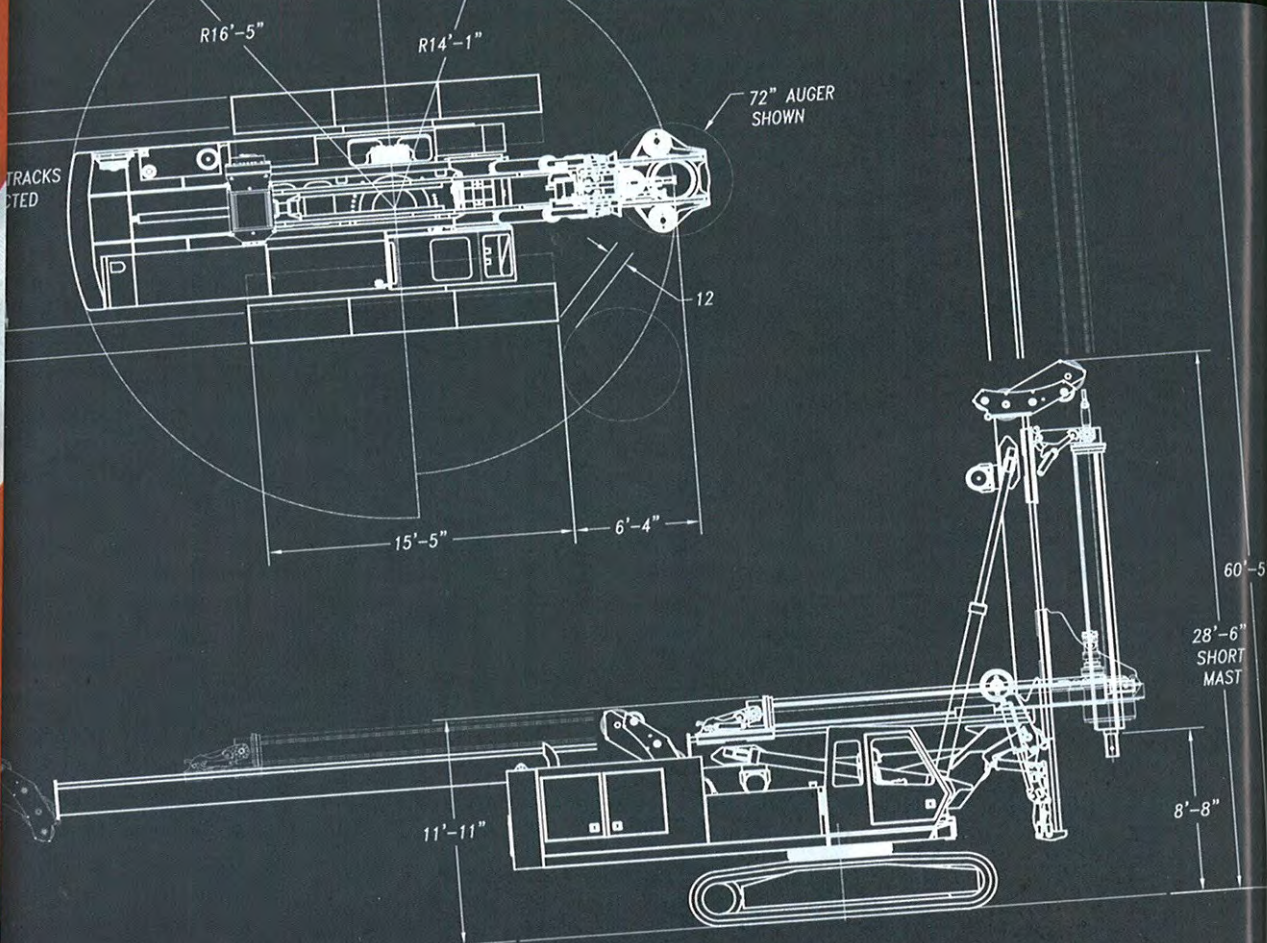
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**SPECIFICATIONS:**

TYPICAL HOLE DIAMETERS: 48 TO 120 INCH  
HOLE DEPTH - TALL MAST: TO 120 FEET  
HOLE DEPTH - SHORT MAST: TO 60 FEET

TORQUE - 130,000 FT.LBS  
FORCE - OUTER KELLY: 40,000 LB  
FORCE - ROTARY: 40,000 LB  
WINCH CAPACITY: 40,000 LB  
HOIST SPEED: 160 FPM  
CAPACITY: 12,000 LB

**STANDARD FEATURES:**

... POWER UNIT

**ENGINEERING**

While designing our rigs, my interaction with the customer and understanding their expectations is top priority. This collaboration ensures an outstanding design. - Chris

TRAVELING



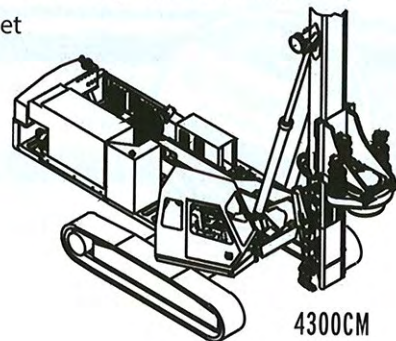
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Our engineering team has once again come together to design a rig that meets the ever changing demands of the foundation drilling industry. The new 4300 model will have many standard features such as a full sliding rotary, swing out cab, shipping width under 10 feet and rotary clearance sufficient to handle 48" diameter casing.

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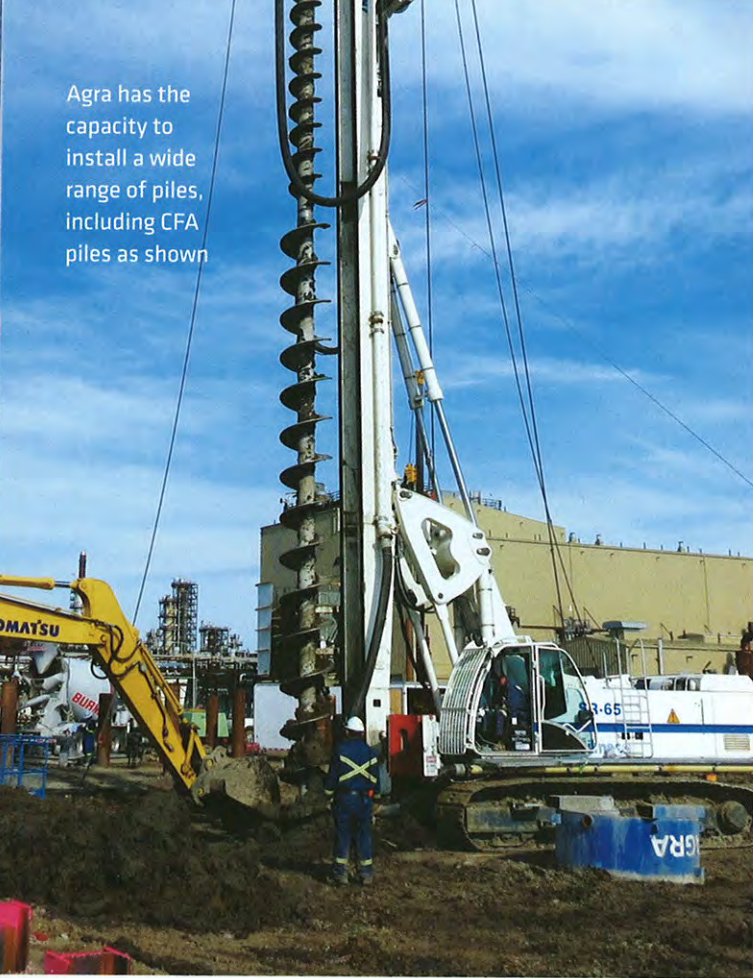
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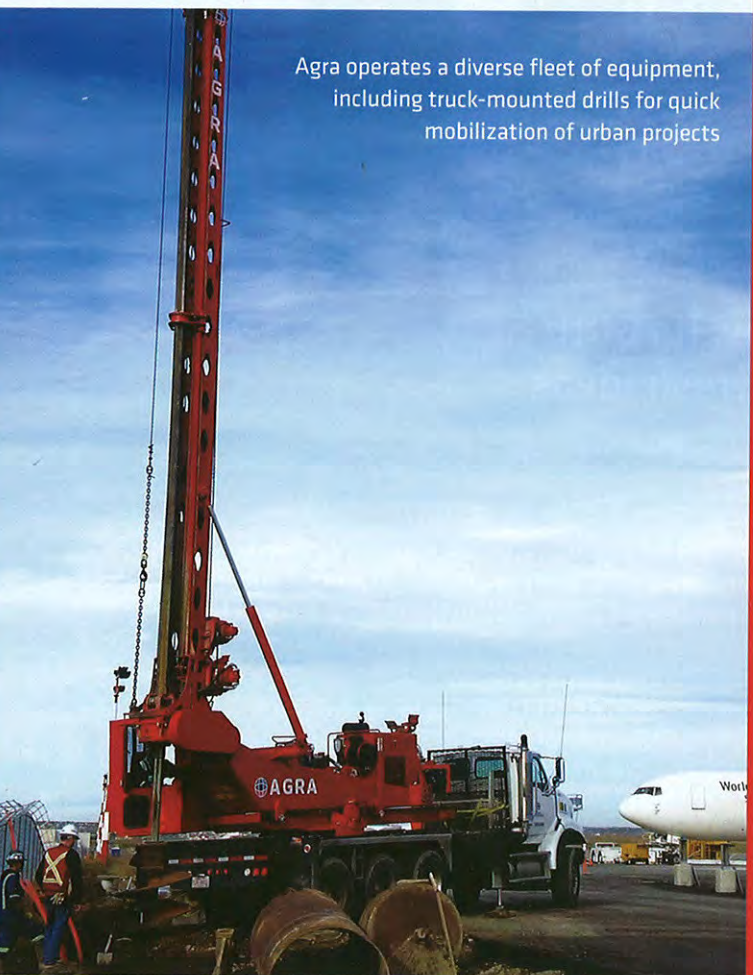
4300CM

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Agra has the capacity to install a wide range of piles, including CFA piles as shown



Agra operates a diverse fleet of equipment, including truck-mounted drills for quick mobilization of urban projects



soil mechanics and foundations engineering, the company rapidly expanded throughout North America, establishing itself as a leader in the design and construction of foundations.

Shortly after the initial headquarters in Saskatoon, a second branch was opened in Regina. The company reached Alberta in 1959 and Manitoba in 1960. Rebranded as Western Caissons Limited in 1966, it expanded to Ontario and Quebec in the mid-'60s and the United States in the early 1980s. In 1995, Western Caissons became Agra Foundations Limited.

The culture within Agra is keen to take on challenges, both technical and economic. Many of Agra's employees have been with the company throughout their entire career, learning the piling trade and enriching the business with a wealth of expertise developed in-house. To promote the growth and success of its people, Agra maintains comprehensive internal training programs and participates with industry-led initiatives to improve the skills of its workforce.

True to its roots, Agra is in constant pursuit of technological advancements and improved products for its market. Operating out of three branch offices in Vancouver, Calgary and Saskatoon and a head office in Edmonton, Agra's team of experts and extensive equipment fleet provides client-focused solutions through a full range of piling and shoring services.

Techniques that Agra can perform for its clients include:

- Drilled cast in place piling
- Driven Piling
- Continuous flight auger (CFA) piling
- Retaining walls and shoring
- Cut-off walls
- Diaphragm walls
- Tiebacks
- Jet grouting
- Micropiling
- Pile testing
- Design-build

Motivated by being a "solutions provider," Agra is often engaged at the early stages of projects to assist in the evaluation of the suitability of different foundation types. The company routinely undertakes pre-production pile installation and load testing programs for large-scale projects to optimize final designs. With its experience across Western Canada and beyond, Agra has a strong familiarity with typical ground conditions and maintains a comprehensive database of completed projects for future reference. Agra's geographical presence and diverse equipment fleet enables them to be competitive in the broad western piling market. Projects range from small urban jobs to large-scale industrial sites.

Recently completed works include several design-build deep foundations packages for commercial distribution complexes using the increasingly popular CFA piling technique, design-build secant pile shoring projects and numerous driven piling projects including both steel (H-pile, pipe) and timber piling.

During the summer of 2014, Agra partnered with its Soletanche Freyssinet-affiliated company, Geopac Inc., to

# THE PANAMA CANAL EXPANSION: WHAT YOU NEED TO KNOW

By Richard Armstrong

*This article was originally published by Pile Buck magazine.*

The Panama Canal was first opened in 1914 as a bridge between the Atlantic and Pacific oceans. By allowing ships to skip the long, treacherous trip rounding Cape Horn, it cut shipping times down exponentially. But a century later, much has changed in both shipping and canal construction. As it was originally built, the canal isn't big enough to take many of today's vessels. To stay viable amid tight competition from quicker and cheaper alternative routes, the canal has been undergoing a major upgrade since 2007. The Panama Canal Expansion project will take eight years and cost over \$5 billion before it is completed in 2015. As of April 2014, the project is 79 per cent complete, though due to delays there are concerns it won't be finished until 2016.

The project aims to improve the canal in a number of ways. The navigation channels will be dredged on both the Atlantic and Pacific sides, as will the channels in Culebra Cut

In addition to concrete, the project has required massive amounts of other materials: 279,000 tons of reinforcing steel; 47,200 tons of structural steel (for lock gates); and 20,000 tons of steel for the lock valves



ALL PHOTOS COURTESY OF THE PANAMA CANAL AUTHORITY (ACP)

The first four rolling gates arrived on the Atlantic side in August 2013. Fabricated by Cimoli SpA, the gates are 57.6 metres long, 30.18 metres tall and weigh over 3,000 tons.



The Panama Canal Expansion project will take eight years and cost over \$5 billion

and Gatun Lake. This will enable the canal to accommodate vessels with deeper drafts than it can presently take. New, larger Post-Panamax locks will be built on both entrances to the canal. These are the so-called “Third Set of Locks.” A completely new channel will be excavated on the Pacific side, north of the Third Set of Locks, which will connect the new locks to Culebra Cut and Gatun Lake. And finally, the canal’s water supply and draft dependability is going to be increased.

For the expansion of the navigation channels, the Belgian company Jan de Nul n.v. completed the dredging of the nearly 14-kilometre area on the Atlantic side in April 2013, after beginning the process in September 2009. Using several dredges simultaneously (including the hopper dredge Fillippo Bruneleschi and two cutter-suction dredges), the existing entrance was widened from 198 metres to 225 metres. In the process, nearly 18 million cubic metres of material was dredged and excavated.

On the opposite side of the canal, another Belgian company, Dredging International, worked from 2008 to 2012 to widen the navigation channel on the Pacific side to a minimum 225 metres. A number of dredges, among them the Vlaanderen XIX, Lange Wapper and D’Artagnan, removed 8.6 million cubic metres of material.

### Pacific Access Channel

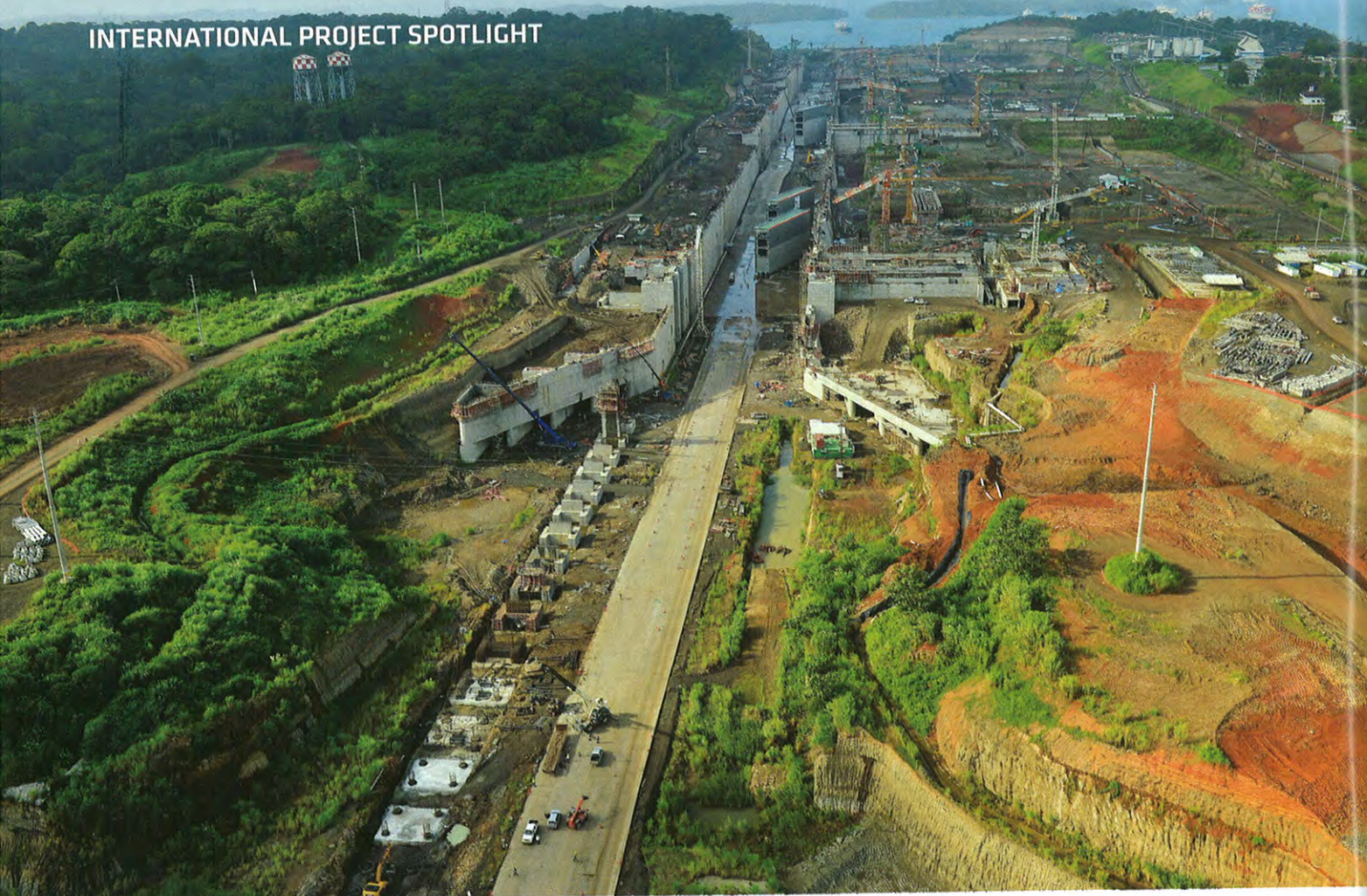
A new Pacific Access Channel is one of the big new additions to the Panama Canal. Once finished, this 6.1-kilometre channel will link the Third Set of Locks to Culebra Cut. But before work on the channel could get underway, a cofferdam was needed to separate the Miraflores Lake from the construction area. In a joint venture, Richard Goettle, Inc. and Ingeniería Continental, S.A. (ICONSA) of Panama were made subcontractor for the construction of the cofferdam needed

for construction and excavation of the Borinquen Dam. The resulting cofferdam consists of 58 circular cells and their respective connecting arcs. For these fabricated connectors, L. B. Foster provided important technical consulting regarding their strength requirements. Ultimately, PilePro® SWC Weld-On and WOM connectors were used.

For the pile driving equipment, Goettle was supplied by Hammer and Steel with a 4,400-inch lb vibratory hammer, which drove the PS-31 sheets to a subsurface hard layer. When they got deeper, they switched to using a 5 Dawson HPH 1800 double acting hydraulic impact hammers. According to Hammer and Steel’s website, this was then “fitted with specific flat sheet inserts to accommodate the centering of the hammers over the interlocks, and specially designed spreader plates that afforded maximum coverage over the sheets and would best accommodate Goettle’s requirements. Stiff clays and dense granular material are ideal driving conditions for the Dawson impact hammers, especially where vibratory hammers meet significant resistance.”

The subcontractors only had 37 weeks to complete the cofferdam by the project’s required deadline. The joint venture employed around 120 workers, working 18 hours per day, seven days a week in two shifts. Despite challenges from Panama’s violent weather in its rainy season, the multiple crews were able to cut and install the sheet pile needed.

The dredging of Gatun Lake and Culebra Cut was also a major endeavor. In order to deepen and widen the navigation channel for the lake, 30 million cubic metres of material had to be removed. Explosives were placed in holes that had been drilled in the lake bottom. This was completed by Jan de Nul n.v. and Dredging International, using mostly the Canal Dredging Division’s personnel and equipment and with the aid of the Boskalis-owned dredge Cornelius. They completed



Since construction started in 2007, the project has had to follow strict environmental standards, including reforestation projects and the rescue and relocation of animals in the areas of construction

their work by the end of 2012, but there is still dredging to be completed in Gamboa, Mamey and Juan Grande. So far 11.7 million cubic metres of material has been removed with the hydraulic dredge Mindi, the mechanical dredge Rialto Milhouse Christensen (RMC) and others. In addition to improving the navigation channels, work has also been done to improve the canal's water supply. The maximum operating level of the lake has been raised from 26.7 to 27.1 metres, which means increasing the water storage capacity by nearly 200 million cubic metres. To fill this larger capacity, all 14 existing spillway gates were opened, along with two new ones.

### The Third Set of Locks

The biggest component of the Expansion Project is the design and construction of the Third Set of Locks. The consortium Grupo Unidos por El Canal – made up of Spain's Sacry Vallehermoso, Italy's Impregilo SpA, Panama's Constructora Urbana, and Jan de Nul n.v – won the \$3.2-billion contract in 2009. Two sets of locks will be built on both sides of the canal. Work on design and construction was done around the world, including Cimoloi S.p.A making the 16 gates and Hyundai Samho Heavy Industries manufacturing the bulkheads, valves and trash racks in South Korea. By the time the project is completed, the pair of new locks will each have three chambers, nine water-saving basins, a lateral filling and

emptying system and eight rolling gates per lock as a redundant system.

The new locks will be more efficient and easier to service than the current ones. Their water-saving basins will require seven per cent less water than the current system, and will reuse 60 per cent of the water needed for each transit. Whereas the current filling and emptying system of the locks works through a series of ports on the chamber floor, the Third Set of Locks will use a lateral system with ports on the chamber walls. This means that filling each chamber will take only 10 minutes when the water-saving basins aren't being used, and 17 when they are.

### Gates

The first four rolling gates arrived on the Atlantic side in August 2013. Fabricated by Cimoli SpA, the gates are 57.6 metres long, 30.18 metres tall and weigh over 3,000 tons (once installed, they will be able to move at just 15 per cent of their actual weight thanks to their buoyancy chambers). They are going to be unloaded and installed (in the dry) by specialized self-propelled modular transports. The construction, transportation and installation of the new gate system will cost over half a billion dollars in total.

All told, six different types of gate are being made, each varying in size and functionality, depending on its location. To make up for the significant tidal variance at the Pacific



The main purpose of the expansion project has been to accommodate today's larger vessels

consortium threatened to suspend the work on the locks if its existing claims for \$1.6 billion were not met. After three months of tense negotiation, a deal was reached between the various parties to resolve the issue and continue work to complete the project.

The project has encountered other problems along the way. Because of the scale of the expansion, environmental concerns have been an issue. Since construction started in 2007, the project has had to follow strict environmental standards, including reforestation projects and the rescue and relocation of animals in the areas of construction. Long-dead animals have also been a concern; according to a story by AFP, thousands of fossils have been found on the site, including dinosaurs and teeth from a giant shark. Many valuable cultural artifacts have also been discovered, which have been recovered and catalogued through a partnership with the Smithsonian Tropical Research Institute. This includes artifacts from the early Spanish conquistadors, as well as items that predate the discovery of the continent by Europeans. More dangerous than shark's teeth and arrowheads, crews have stumbled on unexploded ammunition left behind by the United States military from its long presence in the Canal Zone. In the area where the Pacific Access Channel is being built, over 400 hectares had to be cleared of unexploded ammunition left over from firing and bombardment practice.

In addition to concrete, the project has required massive amounts of other materials: 279,000 tons of reinforcing steel; 47,200 tons of structural steel (for lock gates); and 20,000 tons of steel for the lock valves have been needed so far. For explosives, 1,500 tons of gelignite and 3,600 of ammonium nitrate was used. Blast furnaces have produced 436,000 tons of volcanic ash and slag.

### Moving forward

Once completed, what will all this work mean for the future of the canal? Its capacity will be significantly improved. The expansion will cut down the wait time on using the canal, which at the moment can sometimes be as long as a week. According to Mercatrade, the width and length of the locks will increase by 160 per cent. The total annual tonnage traveling through the canal is expected to increase from 275 million tons now to 600 million tons once the project is completed.

The main purpose of the expansion project has been to accommodate today's larger vessels. The canal will now allow ships up to 1,200 feet long and 160 feet wide to pass through, up from its current allowance of 965 feet and 106 feet, respectively. In terms of container load, the old limit was 4,800 containers per ship (or 4,400 TEU), but in the future this will be increased to 12,500 (or 14,000 TEU). Despite this massive increase in capacity,





In order to deepen and widen the navigation channel for Gatun Lake, 30 million cubic metres of material had to be removed

the Panama Canal still won't be able to handle ships the size of Maersk's Triple E Class, or even the new "smaller" megaships.

But for now, the expansion project has greatly added to what a century ago was the largest engineering project in history. 🇺🇸

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