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The joint venture Malcolm-Petrifond installed the access shaft for the tunnel-boring machine that will drill 200 ft under the Burrard inlet from North Vancouver to the City of Burnaby for Vancouver's $203-million Second Narrows Water Supply Tunnel project.

Underground Today III

A Depth of Knowledge

With the growing need for belowground construction, specialty contractors further develop their expertise

By Karin Tetlow

WHAT'S INSIDE

Creating Tunnels That Meet Modern Infrastructure Demands

Tunneling continues to serve as the answer to an increasing number of challenges facing infrastructure demands today. From solving transportation needs across larges bodies of water to avoiding extended road closures in dense and busy cities, digging a tunnel is often the only feasible solution. Tunnels often serve to secure water and wastewater storage, and they are safer in earthquakes than aboveground units, as vibrations in the earth increase toward the surface. Large tunnels today are drilled by tunnel-boring machines (TBMs) that require the creation of two shafts—one for launching the TBM and the other for its recovery—and the employment of both specialty contractors highly experienced in the demanding work of shaft installation and photographers skilled enough to record their efforts.

Malcolm used a hydrocutter to cut a 4-ft-wide trench for the slurry walls of the north shaft for the Second Narrows Water Supply Tunnel project currently underway in Canada.

One challenging project currently underway is the Canadian Second Narrows Water Supply Tunnel under the Burrard Inlet, east of the Ironworkers Memorial Bridge between the District of North Vancouver and the City of Burnaby. It will replace three tunnels and is designed to meet current seismic standards to ensure reliable delivery of drinking water. By October, the TBM was launched from the 280-ft-deep northern shaft installed by joint venture Malcolm-Petrifond and had begun its 3,600-ft journey.

"Cutting the 4-ft-wide trench for the slurry walls for the north shaft was one of the most challenging projects I have done because of the geotechnical ground formations and the depth of the shaft," says Ihab Allam, slurry wall director at Malcolm. Using a hydrocutter and clam bucket for shallower depths, Malcolm excavated through cobbles and boulders down to 110 ft before reaching silty and clayey materials. Equally challenging was maintaining verticality of the slurry walls that required a deviation limit of only 13 in. at the bottom of the 280-ft shaft to ensure that the slurry panels maintained a compression ring all the way to the bottom. Malcolm crews checked every 50 ft of slurry wall using a Koden ultrasonic drilling monitor and, by careful excavation with the hydrocutter, kept production rates steady.

Malcolm checked the verticality of the slurry wall with a Koden ultrasonic drilling monitor.

After the slurry walls were completed, general contractor Traylor-Aecon excavated the shaft. Following partial dewatering, divers completed the excavation in the wet. To maintain shaft stability, a 13.5-ft-deep tremie concrete slab was poured at the base of the shaft. After the slab has cured in place, dewatering of the shaft was concluded by pumping water out.

"We went very carefully with a lot of checking and quality controls," Allam says. "With all of these challenges, we still finished ahead of schedule." ◆

PHOTOS: BILL@CONSTRUCTIONIMAGES.COM

MALCOLM

Solutions for Tunneling

Malcolm delivers innovative solutions for tunneling projects. Our extensive tunnel-related ground improvement techniques include jet grouting, soil mixing, permeation grouting, and compensation grouting. Our shoring capabilities include pile and anchor drilling for shaft construction, ground stabilization, and excavation support coupled with dewatering services. Learn more about how Malcolm can support your next tunnel project at **Malcolmdrilling.com**

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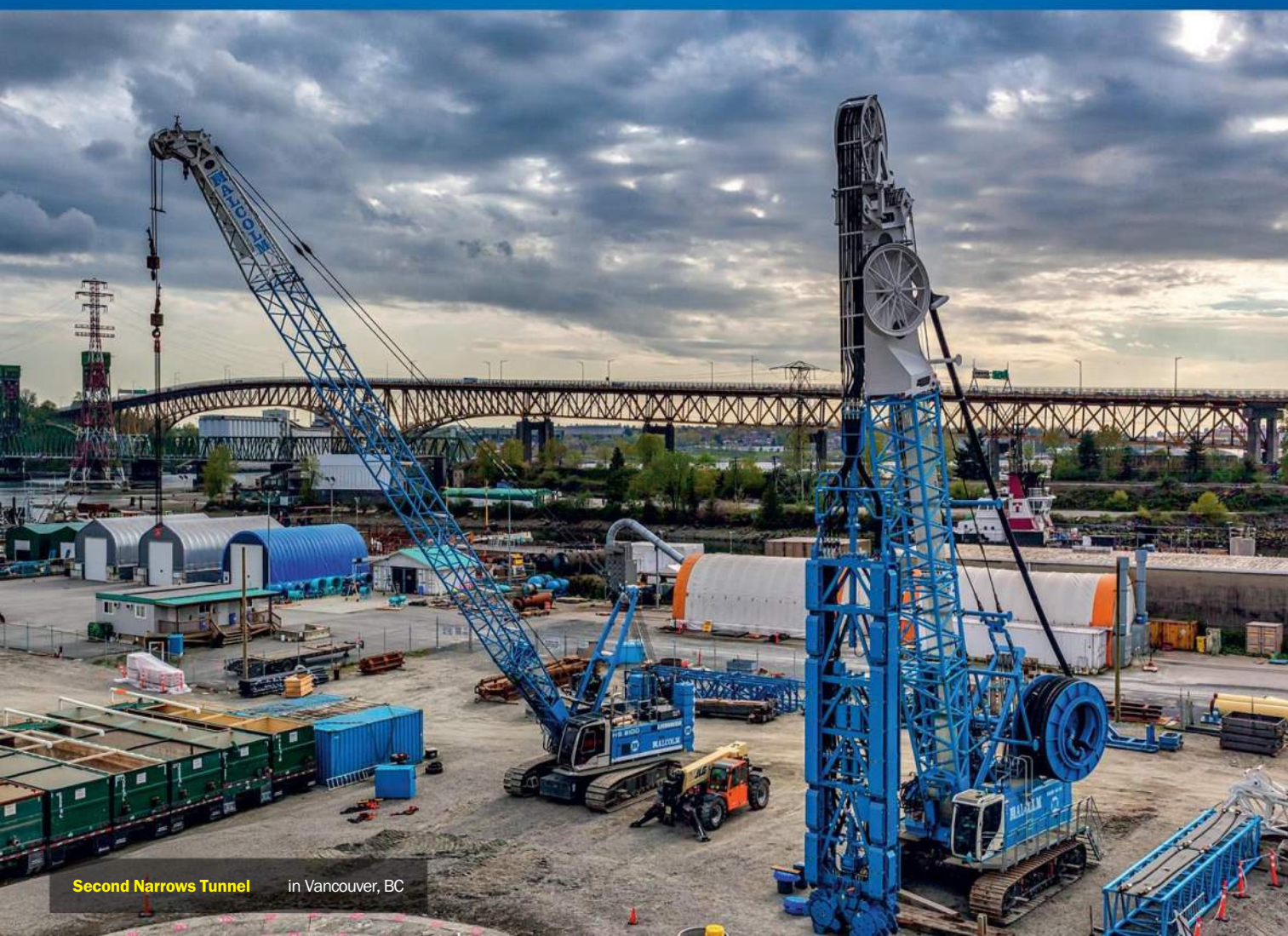

Second Narrows Tunnel in Vancouver, BC

Installing Supports for the Cable-Stayed Gordie Howe International Bridge

The Gordie Howe International Bridge is a planned border crossing spanning the Detroit River, connecting Detroit to Windsor, Ontario, Canada. It is named in honor of Canadian-born ice hockey player Gordie Howe who played much of his professional career in Detroit. The complex cable-stayed design for the bridge calls for a main structural support tower on each side of the Detroit River to support what will be one of the largest bridge structures in North America. These support towers (expected to be more than 700 ft above grade elevation) are founded on Malcolm-installed drilled shaft supports that extend down through various geological soil layers and into the limestone bedrock below. In addition to the main support tower, the cable-stayed bridge is anchored back with a series of back span/anchor piers. Similar to the main support tower, these back span/anchor piers are founded on drilled shafts that extend down into the limestone bedrock below.

In addition to the general complexity of large-diameter shaft drilling, Malcolm was also challenged by nearly 20 ft of artesian water pressure, hard rock (15,000 psi limestone), the presence of hydrogen sulfide and typical Detroit winter weather. To combat the artesian water pressure, the company applied an additional 25 ft of fluid head above grade during the entire shaft installation process. To handle the hard rock drilling, Malcolm put its BG50 300-ton rotary drilling machine to work with a set of custom-made drill tools that are specifically designed to drill both quickly and efficiently, even under the constraints of the hard rock formation. ◆

Construction proceeds on the Detroit side of the Gordie Howe International Bridge, the new border crossing between Michigan and Ontario, Canada. Malcolm installed shafts for the main structural support tower and the back span/anchor piers.

Using its BG50 drilling machine fitted with custom-made drill tools, Malcolm drilled through various geological soils to reach hard limestone rock.

PHOTOS: COURTESY OF MALCOLM