



UNDERGROUND INNOVATIONS



A Robbins Crossover (XRE) TBM achieved a national record of 702.2 m (2,304 ft) in one month at Mexico City's Túnel Emisor Poniente (TEP) II Project.

A NATIONAL RECORD

CROSSOVER TBM FLIES BELOW MEXICO CITY

NORTH AMERICA'S FIRST CROSSOVER

TBM has proven itself below Mexico City, excavating a whopping 702.2 m (2,304 ft) in one month and setting a national record for tunnel boring machines. The 8.7 m (28.5 ft) diameter Robbins Crossover (XRE) TBM--a cross between a rock TBM and an EPB--is customized for the tunnel's unique geology.

The tunnel path travels below a mountain with cover as high as 170 m (560 ft), through fault zones and in a section with cover as low as 8.0 m (26.2 ft) above the tunnel crown. Much of the tunnel consists of andesite with bands of tuff, and softer material in fault zones as well as an 874 m (2,870 ft) long sec-

tion in soft ground at the tunnel's end.

The Robbins Crossover machine began its journey in August 2015 for the Aldesa/Proacon/RECSA JV. "We chose the Crossover because of the geology and size of this project, and because it can go from hard rock mode to EPB mode," said Andrés Alanís, CEO of RECSA group.

Project records were set in January 2016 after the machine achieved a best day of 42.8 m (140 ft) and a best week of 185.1 m (607 ft). By mid-March, the machine had bored through the first of several contact zones consisting of fractured and blocky rock. In summer 2016, the Crossover machine hit the national record for TBMs, and rates have stayed good

with an expected breakthrough in the last quarter of 2016. "The performance of the machine has been very good given the geology we have encountered during the project. We do plan to use Robbins for upcoming projects," said Alanís.

The machine setup includes a canopy drill and positioner for enhanced ground consolidation, as well as gear reducers to adjust torque and RPM based on conditions. The TBM, initially launched in hard rock mode, can operate in EPB mode by switching the belt conveyor with a screw and converting the cutterhead.

Once complete, the 5.8 km (3.6 mi) tunnel will supplement an existing and overtaxed wastewater line built in the 1970s. The deep drainage tunnel will serve to prevent recurrent flooding in Valle Dorado, and will benefit the cities of Cuautitl Izcalli, Tlalnepantla, and Atizapan de Zaragoza, an area with a total population of 2.1 million inhabitants.



The 3.8 m (12.5 ft) diameter Robbins TBM was built in 2.4 months using Onsite First Time Assembly (OFTA) for Atlanta, Georgia, USA's Bellwood Tunnel.

the project's construction manager at risk, sub-contracted with the Atkinson/Technique JV to operate the TBM and will oversee construction of various intake and pumping shafts as well as final lining operations. The project is of utmost importance for the City of Atlanta, explains Bob Huie, Sr. Project Manager for PC/Russell JV. "Right now, the downtown area's emergency water supply is just three days. With the tunnel the supply will increase to between 30 and 90 days. To

"To be a part of the city's emergency water supply solution is huge. This tunnel will protect the city for a very long time."

**-Bob Huie, Sr. Project Manager,
PC/Russell JV**

ATLANTA'S NEWEST TBM

"DRILLER MIKE" TACKLES BELLWOOD TUNNEL

AFTER A SWIFT ASSEMBLY, Atlanta Georgia, USA's newest TBM, dubbed "Driller Mike", is ready for launch. In a ceremony on September 21, 2016, Atlanta's Mayor Kasim Reed and city officials gathered with local and national media to celebrate the occasion.

Clocking in at 8.0 km (5.0 mi), the

Bellwood Tunnel travels below an inactive quarry as well as a water treatment plant and reservoir before ending next to the Chattahoochee River.

The project was green-lighted by the City of Atlanta's Watershed Department due to shortcomings in the city's emergency water supply. The PC/Russell JV,

be a part of the city's emergency water supply solution is huge. This tunnel will protect the city for a very long time."

The 3.8 m (12.5 ft) Robbins Main Beam TBM was built at the quarry using Onsite First Time Assembly (OFTA) in just three months. "The overall assembly process was well organized and supervised by the Atkinson/Technique JV and Robbins. We had a good team of folks to put it all together," said Huie. The TBM will excavate in granite, with at least 300 m (1,000 ft) of zones that will require continuous probing. The TBM is scheduled to launch in mid-October.

THE NEWS IN BRIEF

IN ONTARIO, CANADA

A 3.5 m (11.5 ft) Main Beam TBM operation below Lake Ontario for the Mid-Halton project is more than 90% complete.

IN DEVOLL, ALBANIA

A Robbins Crossover XRE TBM is ramping up for launch on the Moglicë Headrace Tunnel, following Onsite First Time Assembly.

IN MEXICO CITY, MEXICO

A mixed ground EPB boring 150 m (492 ft) below Mexico City makes an intermediate breakthrough at Túnel Emisor Oriente.

IN LOS CONDORES, CHILE

A 4.56 m (10 ft) Double Shield TBM is boring at depths up to 1,000 m (3,280 ft) below the Andes for the Los Condores HEPP.

IN KON TUM PROVINCE, VIETNAM

A Robbins Main Beam TBM has launched on the remote and challenging Thuong Kon Tum Hydroelectric Project.

HARD-WORKING HARD ROCK TBM

BORING BELOW INDIANAPOLIS

ON SEPTEMBER 6, 2016, one of the longest-running Robbins TBMs embarked on its most extensive project yet. The 6.2 m (20.2 ft) Main Beam machine, owned by the Shea-Kiewit (S-K) JV, is boring the 8.5 km (5.3 mi) long White River Tunnel as the first in the next phase of the DigIndy wastewater tunnels below Indianapolis, Indiana, USA. In addition to that work, the machine will bore the Lower Pogues Run, Fall Creek, and Pleasant Run Tunnels—a scope of work totaling about 28 km (17 mi) through limestone and dolomite rock.

The rebuilt Robbins TBM and customized continuous conveyor system were first used in Indianapolis on the 12.5 km (7.8 mi) long main tunnel, called the Deep Rock Tunnel Connector (DRTC). On that tunnel, the speedy machine achieved world records in its size class of 6 to 7 m (20 to 23 ft), including “Most Feet Mined in One Day” (124.9 m/409.8 ft); “Most Feet Mined in One Week” (515.1 m/1,690 ft); and “Most Feet Mined in One Month” (1,754 m/5,755 ft). “It’s nice to start the job with a machine that has already been proven and successful,” said Stuart Lipofsky, Project Manager for S-K JV.

However the DRTC was far from the TBM’s first job. The machine, originally built in 1980, has been used on New York City’s Second Avenue Subway, as well as

projects in Massachusetts and Canada. Once the machine has completed the DigIndy network of tunnels, it will have bored more than 51 km (32 mi) of tunnel—an achievement making it one of the hardest working Robbins TBMs ever put into service. “The age of the machine wasn’t a concern for us, it was a positive. We knew it could perform in harder, abrasive rock,” said Lipofsky.

The machine was launched from the 67 m (220 ft) deep White River shaft following a refurbishment that included new motors, gearboxes, electronics, and other elements. As of the last week of September, the TBM has bored over 300 m (1,000 ft) of the White River Tunnel. The

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Project Manager, S-K JV

S-K JV has until 2021 to complete the White River and Lower Pogues Run legs for owner Citizens Energy Group, and until 2024 to finish all the tunnels.



WORLDWIDE HIGHLIGHTS

+ In Gaziantep, Turkey, a Single Shield TBM launched in July 2016 for the Bahce-Nurdag High Speed Rail project.

+ In New York State, USA, a Remote Controlled Small Boring Unit (SBU-RC) excavated 9 m (30 ft) per day below a residential neighborhood.

+ A PROJECT RECORD IN CHINA

1,349 M

IN ONE MONTH

THREE

DOUBLE SHIELD TBMS

+ A Main Beam TBM was moved to the surface in August 2016 after excavating Hawaii, USA’s Kaneohe-Kailua Tunnel.

FEATURED PHOTO



At China’s Great Hydro Network, three Robbins Double Shield TBMs are navigating difficult ground while excavating at rates of up to 1,349 m (4,425 ft) per month.



The Robbins crew, BMRCL, and Coastal Projects Ltd. celebrate the breakthrough of TBM "Krishna" on September 28, 2016.

BANGALORE FANFARE

FINAL BREAKTHROUGH

BANGALORE'S LAST TBM for the city's metro project has now broken through, as of September 28, 2016. The Robbins-operated machine, known as "Krishna", bored a 750 m (2,460 ft) drive through challenging conditions between Chickpet and Majestic stations. Cleanup and final commissioning of the tunnel will be completed in 2017, and is the last obstacle before owner Bangalore Metro Rail Corporation Ltd. (BMRCL) can open the Malleswaram-Majestic link on the Namma Metro. The TBM's sister machine, "Kaveri", completed a parallel tunnel in June 2016.

The success follows a gauntlet of challenges on the two tunnel sites. Due to severe delays on the original tunnel drives, Robbins was approached and asked to take over the operations of the remaining two competitor-manufactured TBMs in February 2015. "We agreed to the proposal and Robbins took over the responsibility for all aspects of the underground operations. We provided a team of over 60 staff including TBM operators, TBM technicians, ring builders, a grouting team, and more. We were also responsible for running surface installations and equipment such as the grout batching plant, gantry cranes and power supply. Contractor Coastal Projects Ltd. (CPL) provided a team of people including surveyors, QC engineers, and loco operators who reported directly to our site management team," explained Jim Clark, Projects Manager for Robbins India.

The Robbins crew carried out tunneling operations while the Chickpet station was being constructed around them to mitigate delays incurred before they took over project operations. The project's most difficult challenges included a low overburden and unconsolidated ground along the alignment, and the discovery of several uncharted wells directly on the alignment. In addition, the majority of the tunnel was bored beneath sensitive building foundations. Difficult ground frequently prevented proper pressurization during cutting tool replacement, requiring a grout solution to be pumped in to fill voids and left to cure.

"This is an industry first, wherein a TBM manufacturer has utilized their in-house expertise and knowledge to take on this level of responsibility for a project," said Clark, addressing the magnitude of the successful breakthroughs. "The fact that it was 'a first' and we were successful in bringing this high-profile project back on track is a great achievement for The Robbins Company."

TRADE SHOWS & TECHNICAL PRESENTATIONS

+ BTS CONFERENCE

London, England

October 11-12

Live Discussion: The Future for TBM Technology with Lok Home

+ AUSTRALIAN TUNNELLING CONFERENCE

Sydney, Australia

October 11-12

Technical Presentation: Difficult Ground Solutions with Detlef Jordan

+ TAC CONFERENCE

Ottawa, Canada

October 16-18

Technical Presentation: Hard Rock Tunneling at Montreal's Rosemont Reservoir with Tom Fuerst and Brigitte Gagne

+ EXPOTUNNEL

Bologna, Italy

October 19-21

Technical Presentation: Hard Rock Tunneling through Squeezing Ground and Rock Bursts by Martino Scialpi

+ CUTTING EDGE

Los Angeles, California, USA

November 6-9

Technical Presentations: NYC's Rondout Bypass by David Terbovic Crossover TBM in Australia by Dennis Ofiara

+ TBM DiGs

Istanbul, Turkey

November 16-18

Technical Presentation: Difficult Ground Solutions for Turkey with Lok Home

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