

UNDERGROUND INNOVATIONS

NEWS FROM ROBBINS



ISSUE 29
AUTUMN 2013

BREAKING INTO BRAZIL'S MARKET

A MASSIVE PROGRAM IN FORTALEZA

is part of Brazil's extensive nationwide rail scheme, and brings the first Robbins TBMs to the country. Four 6.92 m (22.7 ft) Robbins Earth Pressure Balance Machines (EPBs) have been purchased by the Brazilian Government's Secretary of Infrastructure in the State of Ceara (SEINFRA) for Linha Leste (East Line) of Fortaleza's underground transit system. The new project is part of modernization efforts to transform the city's small two-line metro system into a high-speed, multi-track system for reduction of road traffic.

A low-bid contractor was recommended in October for the construction package, including 12.4 km of rail line and ten new stations. The contractor also proposed to remodel the Chico da Silva station to enable a connection with the existing Western Line.

The Robbins machines are highly customized for the mixed ground project. Core drills underneath the city verified that challenging geology should be expected, including abrasive basalt and silty sand below the water table at water pressures up to 2.5 bar.

Each machine is equipped with a durable mixed ground cutterhead powered by electric variable frequency drives (VFDs), and newly designed Robbins continuous foam and grouting systems for variable conditions. The machines are being built in Robbins' newest factory in Pudong, China, and are being shipped to Fortaleza. Behind each machine, Robbins continuous conveyors will maximize safety and efficiency during muck removal.

Robbins has also designed the segments for the tunnel. The segments will be installed in a 5+1 universal arrangement, and allow for 17 MPa (2,500 psi) push pressure--the maximum push force of the machine. The exceptionally high thrust force of nearly 62,000 kN (14 million lb) at 410 bar will enable the machines to keep moving in sticky ground. A trapezoidal ring configuration will allow the keystone to be placed at any one of 16 positions.

Once the project begins, the EPBs will bore sections of the Line 3 tunnel ranging from 4.3 km to 5.8 km (2.7 to 3.6 mi) long.

The first of four 6.92 m (22.7 ft) Robbins EPs destined for Fortaleza's Linha Leste Metro project. The TBMs mark the first use of Robbins machines in Brazil.





Robbins Field Service Technician Adam Sethman oversees the Onsite First Time Assembly (OFTA) of a 7 m (23 ft) Double Shield TBM in Lorain, Ohio, USA.

ONSITE FIRST TIME ASSEMBLY EXPEDITES OHIO'S **CLEAN WATER TUNNEL**

NEAR THE BANKS OF THE BLACK RIVER, assembly of a 7.0 m (23 ft) diameter Robbins Double Shield TBM and continuous conveyor system is nearly complete. The mammoth machine is being built using Onsite First Time Assembly (OFTA)--a Robbins-developed method that saves contractors in shipping time, costs, and man-hours worked.

Using the OFTA approach, individual

“OFTA is giving us a great opportunity for our people to work alongside Robbins. It’s a definite plus.”

--Mike Garbeth, Project Manager, Super Excavators

systems are tested prior to delivery but the machine is never fully assembled. Robbins field service technicians work on location with the contractor to assemble the machine and provide support.

“OFTA is giving us a great oppor-

tunity for our people to work alongside Robbins. It’s a definite plus,” said Mike Garbeth, Project Manager for Wisconsin-based contractor Super Excavators, Inc.

With the OFTA method, the team is ahead of schedule. “There’s a lot of coordination on the Robbins side, and we are not searching for parts, so we are quite pleased. The conveyor system alone required 30+ trucks for delivery,” said Garbeth.

Launch on the 1.6 km (1.0 mi) Black River Tunnel will take place at the end of October 2013. “We’re expecting decent production with minimal cutter wear, as the drive is in a softer shale. We are installing ring beams and lagging, and there will be a final monolithic pour after tunnel completion,” said Gregg Rehak, Tunnel Supervisor for Super Excavators.

Once complete, the EPA-mandated Black River Tunnel in Lorain, Ohio, USA will divert raw water overflows that currently go into the Black River to a water treatment plant. Tunneling is expected to last through spring 2014, and the completed tunnel will go online in 2015.

NEW TAKE ON A TRUSTED **FRAMEWORK**

A TIME-TESTED TBM DESIGN GETS A REVAMP

on Robbins Double Shield TBMs: Machines below 6 m (20 ft) in diameter will now be built using lattice cylinders rather than straight cylinders. The arrangement of the thrust cylinders echoes the setup of early Double Shield TBMs, and offers one advantage for smaller machines: space.

“Torque arms occupy a huge amount of space on Double Shield TBMs, and this design opens up more area for us to position the motors on smaller machines. It also leaves the invert open, which can aid in maintenance such as cutter changes,” said David Terbovic, Robbins Project Engineer.

The redux design will be used on a 4.2 m (13.8 ft) diameter Double Shield for China’s Great Hydro Network--a project with a total of three Robbins TBMs including twin 5.1 m (16.7 ft) Double Shields.

The machines will be built in Robbins’ Pudong, China facility, and will then be trucked to the remote jobsite in Taiyuan, about 1,000 km (620 mi) from Beijing.

China’s Great Hydro Network is an extension of the Yellow River Diversion Scheme excavated over a period of 20 years, and will provide drinking and irrigation water to an arid area of the country. Excavation of the 62 km (39 mi) of tunnels is expected to begin in Autumn 2014.



TEXAS TUNNEL BORER

SEES THE LIGHT AT JOLLYVILLE PROJECT

MORE THAN 100 M BELOW AUSTIN, TX, a Robbins Main Beam saw its first light of day in a year. The 3.25 m (10.7 ft) Main Beam TBM excavated a portion of the 10.5 km (6.5 mi) Jollyville Transmission Main for the Southland/Mole JV, holing through in August 2013.

"Mining over 20,000 feet (6 km) downhill with no intermediate shafts is an impressive feat. A lot of work remains, but it feels good to have this milestone behind us," said John Arciszewski, Project Manager for Southland Contracting.

The distance proved particularly challenging for ventilation and transport at small diameters: "The distance traveled by the locomotives on this drive alone was over 25,000 miles (40,000 km), or enough to go around the world at the equator, all while pulling loaded muck boxes weighing 35,000 lb (16 metric tons) up grade," said Arciszewski.

Conditions along the way consisted of uniform limestone and dolomite rock requiring little to no support. Although karst features were present throughout the formation, the depth of the tunnel circumvented these features. The depth of the tunnel was also chosen due to a sensitive aquifer containing endangered cave-dwelling invertebrates. Six species

of arachnids and insects thrive in and around the karsts and aquifer. Because of this, no probe grouting could be performed due to the risk of seepage into the water features.

The good ground conditions aided in a fast advance of up to 210 ft (64 m) per day on multiple days. "The machine performed well and availability was excellent.

"The machine performed well and the availability was excellent. The layout makes it feel like a much bigger machine."

--John Arciszewski, Project Manager, Southland

Although similar in design to other TBMs of this size, the layout makes it feel like a much bigger machine," said Arciszewski.

The breakthrough was the third and final on the project, following that of a Double Shield TBM rebuilt by Robbins, as well as a contractor owned machine.

The completed pipeline will transfer up to 190 million liters (50 million gallons) of water per day from Lake Travis to the Austin Water Utility's Water Treatment Plant 4.

CONTRACT SIGNED: ALTO MAIPO'S MAIN BEAM

In October 2013, a contract was signed with Chile's Constructora Nuevo Maipo S.A. for a 4.1 m (13.5 ft) diameter Main Beam TBM and continuous conveyor system. The machine will bore two sections of the Alto Maipo hydroelectric project beginning in October of 2014--the Alfalfal II and El Volcán headraces. A total of 10 km (6 mi) will be excavated in volcanic rock including pyroclastic breccias and andesite.

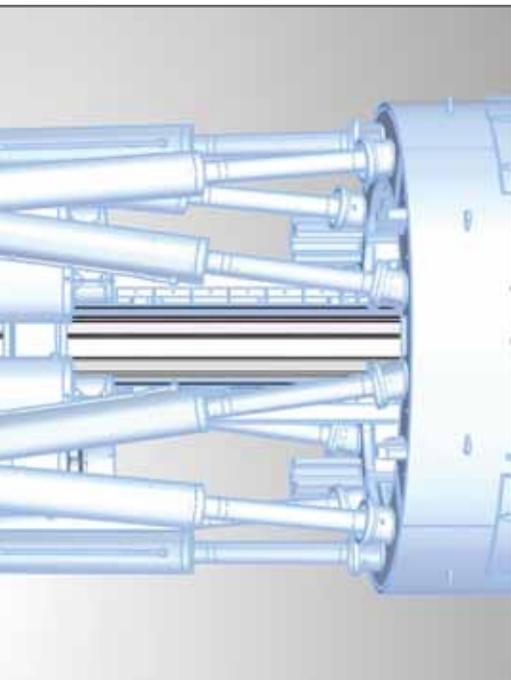
HYBRID EPB/SLURRY ENTERS THE MIX AT BAKU METRO

A new 6.26 m (20.5 ft) diameter Hybrid Robbins EPB/Slurry will soon become the second Robbins machine to run in Azerbaijan. An EPB for the Baku Metro project successfully completed its bore last year, and the hybrid machine will further extend the Baku Metro excavation for contractor Evrascon Joint Stock Company in 2014. Assembly will take place in Robbins' Solon, Ohio, USA facility.

The machine will bore 5.7 km (3.5 mi) of mixed ground including silt, clay, sandstone, and limestone at pressures up to 5 bar. The hybrid TBM will break through three stations along the way.

To tackle the difficult ground conditions, the machine will be built using standard EPB features including a screw conveyor, which can be switched over to slurry pipes within the machine shield for muck removal. Both systems will be installed on the machine before launch, so that a simple switchover can be done rapidly as the geology evolves.

The new tunnel is part of a metro expansion in Azerbaijan's capital city, which would connect up older lines built during the Soviet era. In 2010, the government announced a master plan calling for five new lines, 119 km (74 mi) of track and 76 stations by 2030.



LEFT: Lattice thrust cylinders offer more space on a small diameter Double Shield bound for the Great Hydro project in China.
TOP RIGHT: A crew member steers the Main Beam TBM at Jollyville.
BOTTOM RIGHT: The Southland crew celebrates breakthrough at Jollyville in August 2013.

AUTUMN 2013



LEFT: A 54 inch (1.4 m) diameter Robbins Motorized Small Boring Unit (SBU-M) was used on two mixed ground bores in Wyoming, USA. RIGHT: The SBU option, consisting of two larger diameter bores rather than five small bores, resulted in USD \$250,000 in project savings.

SMALL BORING UNITS OFFER CONTRACTOR **BIG TIME SAVINGS**

A PHOSPHATE PLANT IN WYOMING, USA may not seem like the most likely place for an SBU success story, but Utah-based contractor Claude H. Nix Construction / JASCO Inc. was up for the challenge. The plant, owned by The Simplot Company of Rock Springs, Wyoming, needed water cooling lines installed for phosphate production. The trajectory of the lines required crossing under State Highway 430.

"The original alignment was supposed to be for five 36 inch (900 mm) casings below the highway. When we dug a test hole, we hit a solid sandstone layer below clay, about 11 ft (3.4 m) down," said Jon Nix, Vice President & COO for Claude H. Nix Construction. The contractor already owned a Robbins Auger Boring Machine (ABM) and given the rocky conditions, contacted Robbins SBU Product Manager Kenny Clever to discuss the possibilities. "Kenny suggested a 54-inch (1.4 m) Motorized SBU (SBU-M) and did some CAD drawings to see how many 24-inch (600 mm) water pipes could fit in the larger casing. We reduced the scope to two crossings, which cut down on pit con-

struction costs and project duration," said Nix. The contractor proposed it to project owner Simplot and it was approved, resulting in USD \$250,000 in savings.

Robbins Field Service assisted the crew in launching the mixed ground SBU-M, which was specially designed for mixed face conditions consisting of rock and clay. The mixed ground cutterhead was mounted with both carbide bits and disc cutters, while large muck openings allowed muck to flow into an invert auger running through the casing to the ABM.

The first 300 ft (90 m) long crossing below the highway was completed in about six weeks, despite difficult ground including sticky clay that required a water injection system to be installed behind the machine. Hole through was within line and grade requirements--since the crossings were just 5 ft (1.5 m) apart, line was the more important of the two. Nix said that he would definitely use the machine again given the right ground conditions: "This was an awesome piece of equipment. I was very impressed with the construction quality of this machine."

2013 EVENTS CALENDAR

Robbins will participate in the following trade shows:

BTS

October 23-24
London, U.K.

Robbins Technical Session:

Extend the Life of Your Disc Cutters and Minimize Wear

Cutting Edge Conference

November 3-5
Seattle, Washington, USA
Robbins Project Featured:

Challenging Conditions at Mexico's Emisor Oriente Wastewater Tunnel

EXCON

November 20-24
Bangalore, India

27 Congreso Nacional de Ingeniería Civil

November 27-29
Mexico City, Mexico

STUVA

November 27-28
Stuttgart, Germany



© 2013 The Robbins Company

**TO SUBSCRIBE TO THIS NEWSLETTER,
PLEASE CONTACT:**

Desiree Willis, Technical Writer
e willisd@robbinstbm.com
p +1 253 872 0500

The Robbins Company
29100 Hall Street
Solon, Ohio 44139 USA

p +1 440 248 3303
f +1 440 248 1702

www.TheRobbinsCompany.com