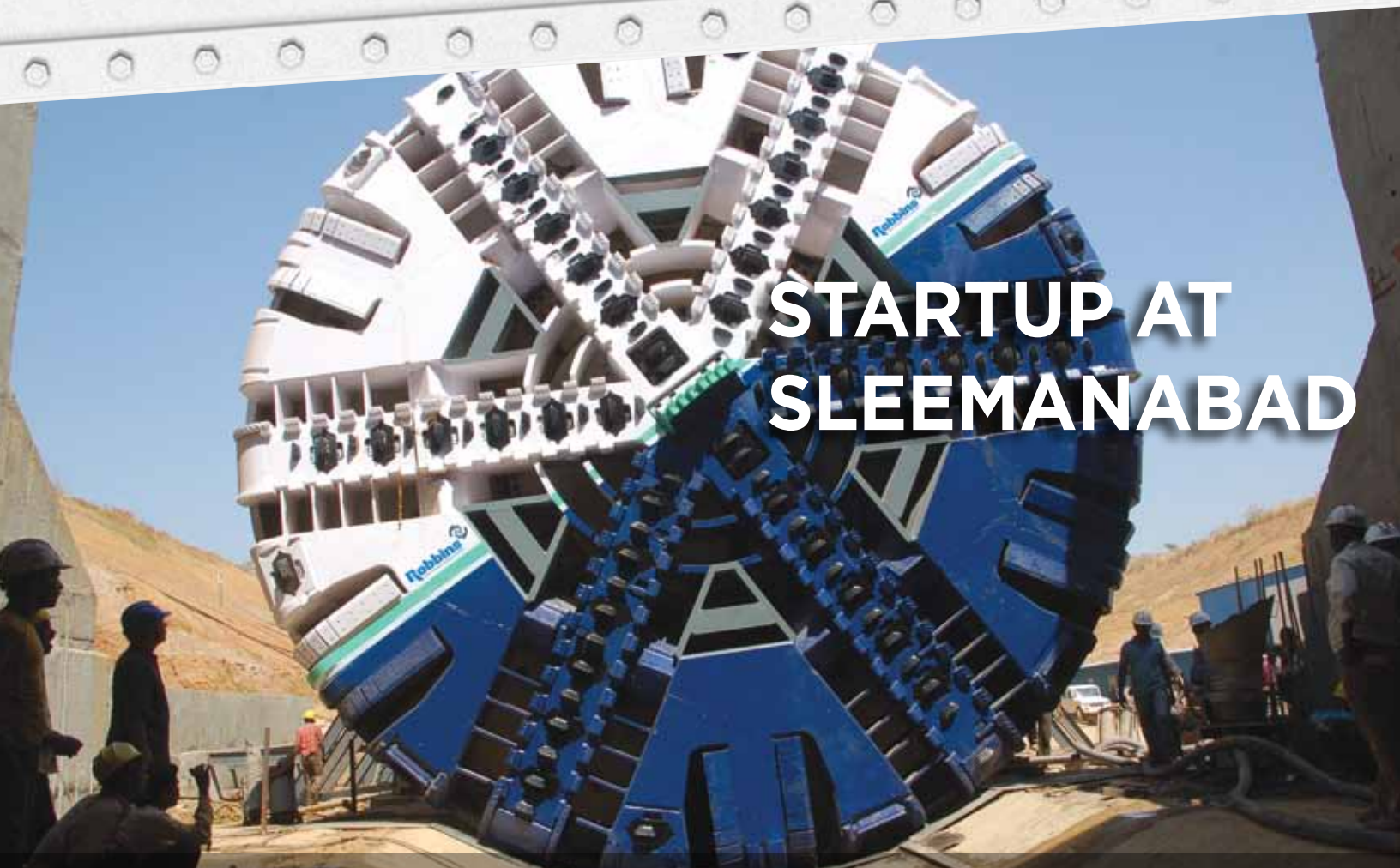
UNDERGROUND
INNOVATIONS

NEWS FROM ROBBINS

Robbins

ISSUE 19
SPRING 2011

STARTUP AT SLEEMANABAD



The 10.0 m (32.8 ft) Robbins Hybrid EPB was launched on March 14, 2011 following Onsite First Time Assembly (OFTA) in Madhya Pradesh, India.

Onsite First Time Assembly (OFTA) of a 10.0 m (32.8 ft) Robbins Hybrid EPB was completed in Madhya Pradesh, India on March 14, 2011. A commissioning ceremony marked the launch of the TBM at the 12 km (7.5 mi) long Sleemanabad Carrier Canal, a water transfer project that will bolster both irrigation and drinking water supplies in the arid region.

The project also marks the first time OFTA has been used on a hybrid EPB. The Robbins-developed method allows TBMs to be initially assembled on location, rather than in a manufacturing facility. Critical subsystems, such as the electrical and hydraulic systems, are tested before being shipped to the jobsite.

The unique machine is a fully functional hard rock Single Shield and soft ground EPB TBM, built to bore in long sections of 180 MPa (26,000 psi) UCS jointed rock and marble, interspersed with clay with gravel. The machine is the first of its type produced by Robbins—in sections of soft ground, the machine runs as a standard, pressurized EPB with shaft-type screw conveyor. When short sections of rock or mixed ground are encountered, the machine can be run in non-pressurized open mode. In longer sections of rock, the machine can be converted to a hard rock Single Shield setup by switching out the screw conveyor with a TBM belt conveyor.

Excavation began on March 31 in soft ground conditions. Ole Pederson, Robbins India Site Manager, cited the remote project location and transport of parts as challenging aspects. Local support is easing these difficulties while providing an economic boost to the area. "The launch of this project has brought work to some of the local farmers in the region, who are performing support functions at the jobsite. Parts delivery and food at the jobsite are also being provided by local businesses," said Pederson.

The Sleemanabad Carrier Canal is part of the larger Bargi Diversion Project, a major trans-valley canal stretching 194 km (120 mi) from the existing Bargi Dam on the Narmada River to arid areas. The completed Bargi Diversion Project will transfer 152 cubic meters (40,000 gallons) of water per second to Katni, Satna, Panna, and Jabalpur districts, irrigating over 100,000 hectares (250,000 acres) of land.

The world's largest hard rock TBM, a 14.4 m (47.2 ft) diameter Robbins Main Beam, completed an initial breakthrough on March 1, 2011 at Canada's Niagara Tunnel Project.

MAMMOTH TBM MAKES INITIAL BREAKTHROUGH AT NIAGARA

A 14.4 m (47.2 ft) diameter behemoth, the world's largest hard rock TBM, completed an initial breakthrough at Canada's Niagara Tunnel Project on March 1, 2011. The Robbins Main Beam machine entered a pre-existing grout tunnel excavated using drill and blast. The TBM, for contractor Strabag AG, is continuing another 300 m (985 ft) up to the intake structure to make a final breakthrough in mid-May.

"We have a group of up to 500 people directly and indirectly involved with the project. Their determination, hard work, and willingness to work as one team while keeping focused to get the job done safely have all contributed to this project's success," said Ernst Gschnitzer, Project Manager for Strabag.

The completion of the project comes after multiple highs and lows, from significant over-break to a world record. Poor rock conditions in Queenston shale at the beginning of the TBM drive required the tunnel alignment to be raised by 45 m (150 ft) into more stable rock. While in the difficult ground, crews undertook significant measures to safely scale down loose rock from the tunnel crown, as loose rock was not permitted behind the final concrete lining. A redesigned ground support system was employed, consisting of spiles, rock bolts, wire mesh, steel straps, and shotcrete.

Once in better ground, the TBM excelled--achieving a landmark month of 467 m (1,535 ft) in July 2009. The rate is a record for TBMs in the 14 to 15 m (46 to 49 ft) diameter range.

While the tunneling portion of the project is nearly complete, two years of work still remain. Approximately 30% of the continuous concrete lining was finished during tunneling, with about two thirds of the work to be completed.

The final 12.8 m (42 ft) diameter tunnel will be fully lined with both 600 mm (24 in) thick continuous concrete and a polyolefin waterproof membrane to prevent leakage. Other construction includes the outlet structure, gates, and cofferdam, which are expected to be complete in 2013.

FOUR EPBs FAST-TRACKED FOR NANJING METRO

Nearly 750,000 people currently ride the rails daily on two existing metro lines in Nanjing, Jiangsu Province, China. That number is slated to dramatically increase with the municipal government's extensive plans to improve access across the Yangtze River Basin by 2030. Construction of new rail lines has already begun, with the majority of work proceeding as TBM tunneling.

Robbins is providing four 6.5 m (21.4 ft) diameter EPBs for two different metro lines. The two pairs of EPBs will excavate Line 3 Lot 11 and Line 10 Lot 5, for the China Railway Construction Corporation (CRCC) 13th Engineering Bureau and 23rd Engineering Bureau, respectively.

Both sections of tunnel will be excavated in similar mixed ground conditions including clay, sand, pebbles, and weathered rock. Mixed ground cutterheads on both machines will utilize 17-inch single and twin disc cutters, as well as carbide knife bits. The TBMs will also be designed with high-speed, high-torque screw conveyors for swift excavation in the varied geology.

All four Robbins machines will be manufactured and assembled at a facility in Jiangsu Province and launched by the end of 2011.

RECORD RATES FOR ROBBINS AT ZHENGZHOU METRO

One of two Robbins 6.3 m (20.7 ft) diameter Robbins EPBs boring China's Zhengzhou Metro Line 1 achieved intermediate breakthrough on March 29, 2011.

Soft ground tunneling has made a speedy entrance in Zhengzhou, China. The metro's first TBM, one of two 6.3 m (20.7 ft) diameter Robbins EPBs for Zhengzhou's Line 1, achieved a project record of 720 m (2,362 ft) in one month. Daily rates have been as high as 22 rings (33 m/108 ft) in two 10-hour shifts. The rates are not only a project record amongst nine other machines, but also rank as some of the highest rates ever recorded for Chinese EPB TBMs in the 6 to 7 m (20 to 23 ft) diameter range.

"Several factors have resulted in the high advance rates, including optimized EPBs, relatively good ground conditions, strong technical support, and an experienced crew," said Steven Zhu, Robbins Project Manager. The Robbins machines were launched in November and December 2010, in conditions including soft, powdery soils.

Left: A 6.2 m (20.3 ft) Robbins Double Shield overcame tough ground conditions, breaking through in March 2011.
Above: A 10.0 m (32.8 ft) Double Shield is currently excavating the main rail tunnel for Complex #3 in Sochi, Russia.

ROBBINS DOUBLE SHIELD CROSSES THE FINISH LINE IN SOCHI

In early March 2011, a 6.2 m (20.3 ft) diameter Robbins Double Shield broke through in Sochi, Russia. The machine completed a 4.5 km (2.8 mi) long section of tunnel that will ultimately become part of the transportation infrastructure for the upcoming 2014 Winter Olympic Games.

The TBM advanced through difficult ground at average rates of 100 to 120 m (330 to 390 ft) per week for contractor OJSC Bamtonnelstroy, a division of the SK Most Company.

The completed section of tunnel will ultimately become a service tunnel for Complex #3—a section of Sochi's transportation infrastructure under construction, which includes road and rail tunnels. A second, 10.0 m (32.8 ft) diameter Robbins Double Shield TBM is currently excavating the parallel 4.6 km (2.9 mi) long main railway tunnel using a continuous conveyor system for efficient muck removal. A 13.2 m (43.3 ft) diameter highway tunnel is also under construction.

"SK MOST asked The Robbins Company to manage the refurbishment and commissioning process of the 10 meter TBM, and commissioning of the 6 meter machine. Robbins was also asked to provide field support to the contractor's team while the machines were boring. They agreed and they have been onsite ever since," said Vadim Bocharov, General Director for the project.

The 6.2 m (20.3 ft) Robbins TBM achieved high rates despite difficult conditions. The tunnels run through mixed ground including massive to completely fractured limestone with clay seams.

In May 2010, the machine was stopped after encountering a significant fault zone consisting of broken rock and running soft ground. Field service personnel and crew successfully freed the machine by excavating a bypass tunnel around the TBM, freeing the cutterhead. Following the restart, a combination of continuous probe drilling and ground treatment with cement silicate and foam kept the machine moving forward.

While the service tunnel is now complete and lined, work still remains on the main rail tunnel. The 10.0 m (32.8 ft) diameter Double Shield was modified and repaired by Robbins site personnel prior to the start of excavation. The TBM is 726 m (2,382 ft) into its portion of tunnel, with an expected completion date of March 2012.

TOTAL SUPPLY FOR VIETNAM'S LONGEST TUNNEL

Kon Tum Province, central Vietnam, is the location of the unique Thuong Kon Tum hydroelectric project, set to go online in five years. The scheme will draw water from the DakNghe River, requiring a 17.4 km (10.8 mi) long tunnel that will be the longest ever constructed in Vietnam.

The tunnel will be bored with the second Robbins machine to operate in the country, a 4.5 m (14.8 ft) diameter Main Beam TBM. Other Robbins supplies include the back-up, cutters, spare parts, and a continuous conveyor system for muck removal.

The tunnel will be excavated in granite, biotite, gneiss, and basalt up to 200 MPa (29,000 psi) UCS. Some water inflows and up to 42 fault lines are expected. To combat the difficult ground conditions, support including rock bolts, mesh, ring beams, and shotcrete will be applied throughout tunneling.

The tunnel work is part of Phase II of the hydroelectric project, for the HydroChina Huadong Engineering Corporation / China Railway Construction 18th Bureau Group Co., Ltd JV. The Thuong Kon Tum hydropower plant has a 220 MW annual generating capacity, and is expected to supply more than 1 billion kilowatt-hours per year to the central Vietnam region.

Left: *Contractor S.J. Louis Construction is using a 2.2 m (7.3 ft) Double Shield TBM.*
Above: *The 1.8 km (1.1 mi) wastewater tunnel will be accessible by several shafts near the course.*
Photo credit: Zachary West/S.J. Louis

DOUBLE SHIELD LINES UP FOR DRIVE UNDER TEXAS GOLF COURSE

Residents in the Onion Creek neighborhood of Austin, Texas, USA have long dealt with wastewater sludge being trucked through streets from a local water treatment plant. That will change with the excavation of a new pipeline, which will allow wastewater to be conveyed to the larger-capacity regional treatment plant, thereby allowing the future closure of the local site.

The Onion Creek Golf Course Wastewater Interceptor stretches 2.3 km (1.4 mi) long below the course and residential areas. General contractor S.J. Louis Construction is excavating 1.8 km (1.1 mi) of the tunnel with a 2.2 m (7.3 ft) diameter Robbins Double Shield TBM.

The machine began excavation in April 2011 from a 17 m (55 ft) deep, 6 m (20 ft) diameter shaft on city-owned property less than 60 m (200 ft) from the green for Hole 13--a setup that will allow the course to stay open during construction. The TBM will also tunnel below Interstate 35, a major highway in the region, before holing through into an exit shaft.

Ground is expected to consist of soft limestone of less than 20 MPa (3,000 psi) UCS, also known as Austin Chalk. Ground support will consist of ring beams and lagging and will only be erected in areas where ground conditions are weakened.

"We chose this machine for its ability to productively excavate chalk. It also allows us to erect ground support in potentially adverse conditions," said Gevan McCoy, Tunnel Division Manager for S.J. Louis.

The Double Shield TBM, built in Robbins' Solon, Ohio, USA manufacturing facility, is utilizing a hard rock cutterhead mounted with 12-inch disc cutters to excavate the material. Muck is being removed by single-track muck cars.

Once complete in September 2011, the pipeline will be lined with fiberglass-reinforced polymer carrier pipe. The project is one part of the City of Austin's I-35 Water/Wastewater Infrastructure Improvements Program, which aims to increase drinking and waste water capacity in southeast Austin through multiple projects by the end of 2011.

EVENTS CALENDAR

Robbins will exhibit at the following trade shows:

2011

World Tunnel Congress
May 20 - 26
Helsinki, Finland

RETC
June 19 - 22
San Francisco, California, USA

IUT
September 14 - 15
Sargans, Switzerland

ICUEE
October 4 - 6
Louisville, Kentucky, USA

AFTES Congress International
October 17 - 19
Lyon, France

STUVA
December 6 - 8
Berlin, Germany

The Robbins Company
29100 Hall Street
Solon, Ohio 44139 USA
voice: +1 440 248 3303
fax: +1 440 248 1702

www.TheRobbinsCompany.com
To subscribe to this newsletter, please contact: Desiree Willis, Technical Writer at willisd@robbinstbm.com
voice: +1 253 872 0500

© 2011 The Robbins Company