

TERRATEC TBMS GET UP TO SPEED ON MUMBAI METRO



In early August, TERRATEC celebrated the assembly of its fifth new 6.68m diameter dual-mode hard rock TBM to go to work on Mumbai Metro's Line 3 project, in India, at the CSIA International Airport shaft on contract UGC-06. The first four of these machines are fully up and running on two other contracts (UGC-02 and UGC-05) and achieving production rates of up to 91m per week.

The versatile TERRATEC single shield TBMs are

equipped to operate in either Open or Closed mode in the predominantly fresh and slightly to moderately weathered Basalt and Breccia that are anticipated on these contracts. The robust hard rock cutterheads are mounted with heavy-duty 17" disc cutters, which are interchangeable with ripper tools, and feature large bucket openings that provide a 10% opening ratio.

Other state-of-the-art features include 2,000kW Electric

Variable Frequency Drives – that allow the cutterheads to cut efficiently in harder rock zones at maximum speeds of 7rpm and deliver an exceptional torque of 8,000kNm to cope with more fractured zones of ground – as well as active shield articulation and built-in two component grout systems.

"Four of the seven TBMs are now in operation and they are achieving rates of 15m per day on Package 2 and Package 5," says TERRATEC Site Operations



metro line in the city. The 33.5km-long line will connect Cuffe Parade business district in the far south to the Santacruz Electronics Export Processing Zone (SEEPZ) in the north-

central with 26 underground and one at-grade station. Construction of the line is divided into seven tunnel-and-station packages that were awarded to five contracting

joint ventures in 2016. These five contractors will deploy a total of seventeen (17) TBMs with TERRATEC being the lead TBM supplier on the project with a 41% market share.

TERRATEC EPBM DELIVERED FOR BANGKOK'S ORANGE METRO LINE

TERRATEC, celebrated the delivery of a new TBM for the first phase of the Mass Rapid Transit Authority of Thailand's (MRTA) Orange Line metro project, in Bangkok, following successful factory acceptance testing in June.

The robust 6.39m diameter

TERRATEC EPB machine will be deployed by contractor Italian-Thai Development PCL (ITD) on one of three underground civil works contracts for the first 23km-long (East) phase of the project, which comprises 11.38km of twin single-track tunnel alignment and 9km of elevated track running from

the central Thailand Cultural Centre station to Suwinthawong station in the east.

Contract E3, which was awarded to ITD in May 2017, totals over 6km of TBM driven tunnel and three underground stations, extending from Hua Mak to Khlong Ban Ma. The

Manager, Bill Brundan. "The machines are performing very well, accomplishing combined production rates of over 40m per day, and the fifth and sixth TBMs are being assembled. By the end of the year all seven machines – including two 6.61m diameter mixed/rock Earth Pressure Balance Machines (EPBMs) – are expected to be mining simultaneously."

Two of the 6.68m diameter dual-mode hard rock TBMs (T58 and T59) are being used by the Hindustan Construction Company – Moscow Metrostroy JV to build the twin tunnels on the line's 4.049km UGC-02, which was awarded by the Mumbai Metro Rail Corporation Ltd (MMRCL) in July 2016. Both machines were deployed from the Chhatrapati Shivaji Terminal

(CST) TBM launch shaft and are currently mining towards the Mumbai Central Station shaft.

The other three new TERRATEC dual-mode hard rock TBMs are being used by the J. Kumar – China Railway No. 3 Engineering Group JV for the excavation of sections on the line's 4.94km contract UGC-05 (Dharavi Station – CSIA Domestic Airport shaft) and 4.45km contract UGC-06 (CSIA Domestic Airport – Marol Naka receiving shaft), which were also awarded last July.

In addition to the hard rock TBMs, TERRATEC has supplied two re-manufactured 6.61m diameter mixed/rock EPBMs (S63 and S64), which will also be deployed by the J. Kumar – China Railway No. 3 Engineering Group JV. These

TBMs were recently used on Delhi Metro's new Pink Line and have since undergone extensive refurbishment in order to fulfil a section of highly weathered ground on contract UGC-05.

"This is not the first time that we have selected TERRATEC as a project partner. We used four TERRATEC TBMs on our Delhi Metro contracts (CC20 & CC24), which allowed us to complete our tunnelling operations on time and without any issues. We believe our goals of safe and timely tunnelling will once again be achieved using TERRATEC technology and TBM performance," said UGC-06's Construction Manager, Urin Wanbanterng.

When complete, Mumbai Metro's much-anticipated Line 3 will be the first underground





TERRATEC TBM has been designed to tackle the complex and variable soft ground geology of the city, which ranges from soft and medium to stiff and very stiff clays, with lenses of dense sand and the potential for high pressure groundwater inflows.

In order to handle these challenging conditions, the TBM's soft ground cutterhead features a spoke style design with a 43% opening ratio and the addition of back-loading knife bits to assist break-in and break-out of the concrete station shaft eyes. In addition, the machine is fitted with an active bentonite face support injection system and double gated screw, to ensure face stability and mitigate ground settlement during excavation within areas of flowing sands and high groundwater pressure.

"We would like to thank our long-time business partner, TERRATEC, for being a great supporter of our projects

through many challenges encountered. Despite the complex works that lie ahead of us, we are very confident in the design of the machine and that it will perform well in the expected conditions," says ITD Project Manager, Sanya Thirakajornwong. *"The TBM will arrive on site at the end of July, with tunnel excavation due to begin in December, proving that TBM production has been on schedule and that the delivery was well-prepared. It will be a pleasure to work with TERRATEC's field service team once again, allowing us to meet project completion effectively and efficiently."*

As the machine progresses along the alignment, it will install a precast concrete segmental lining consisting of five x 1200mm wide Universal style segments plus key, with an internal diameter of 5.7m. These are being produced by ITD at the same factory used for segment manufacture during its MRT Blue Line

underground works contract five years ago, which also employed a TERRATEC TBM.

TBM operation will be assisted at all times by TERRATEC's highly-experienced Field Service staff, providing quality after sales support to ensure optimum performance and successful project completion.

Bangkok's new Orange Line will eventually total about 35.4km with 26.2km aligned underground with 23 underground stations. The route starts underground at Taling Chan station (west of the city) and terminates at Suwinthawong.

When complete, in 2023, the Orange Line will provide a vital transportation link from Bangkok's city centre to districts in the east, reducing traffic congestion and paving the way for improved economic growth and new residential and commercial opportunities along the alignment.

TERRATEC SUPPLIES CUSTOM RAISE BORER TO MOUNT ISA

In early October, at the TERRATEC workshop in Hobart, Tasmania, TERRATEC successfully completed the Factory Acceptance Testing of a custom TR3000 Raise Boring Machine (RBM), which will be deployed at the Glencore Group's George Fisher underground mine, in Queensland, Australia.

Manufactured at TERRATEC's workshop in Tasmania, the TR3000 Raise Boring Machine is a highly robust piece of

equipment, designed for ease of operation and maintenance, providing a high level of reliability. The unit has a nominal boring size of 3.0m in diameter and 400m in depth and has a standard pilot hole diameter of 311mm.

It has a maximum pilot drilling torque of 78,000Nm, reaming torque of up to 237,000Nm and breakout to 266,000Nm. The maximum down thrust force is 1,600kN with up thrust being 4,500kN. The total installed

power on the machine is 360kW.

The RBM has a modular design that makes disassembly of the major components (for inspection, transport or repair) very easy to achieve. The Derrick Configuration includes a powerful near-ground loading pipe loader that results in a very low profile in relation to drill string length. Rotation is powered by a hollow shaft hydraulic motor, affording protection to the drill string



when operating at near maximum capacity, as well as unrestricted flow of flushing water through the drive train into the drill pipe.

Custom features incorporated on this machine also include an upgraded proprietary gearbox design, which allows for some flexibility in alignment when raise boring and adding drill pipe, and powered wrenching at the drive-head and work-table to make adding and removing drill strings a safer operation.

TERRATEC has numerous Raise

Boring Machines currently working around the world, chiefly in Australia, Canada, the USA, Mexico, Colombia, Peru and Argentina. These include the company's range of Raise Boring Machines, Down-Reaming Drills and Box Holing Rigs, as well as combination of those in the form of Universal Boring Machines, all of which have been recognised for their innovative high-performance design.

TERRATEC's experienced Engineering and Field Service Team can assist buyers from the planning stage, including

custom design specifications, assembly and operation of Raise Boring Machines on site, and lifetime servicing and maintenance support.

To read a recent case history on the TERRATEC UB1000-R16 Universal Box-Hole Borer's work in the Western Australian Gold Fields, click here:

["Rugged, Reliable & Flexible: The UB1000"](#)



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