

TERRATEC TBM COMPLETES FIRST TUNNEL FOR MUMBAI METRO



HCC-MMS JV achieves major milestone with TERRATEC machine having broken through on the first full section of running tunnel to be completed for Mumbai Metro Line 3, in India.

In early-August, TERRATEC joined workers from the Hindustan Construction Company (HCC) – Moscow Metrostroy (MMS) JV to celebrate the breakthrough of a 6.68m diameter TERRATEC hard rock TBM, named 'Vaitarna I', on Mumbai Metro Rail Corporation Ltd's (MMRCL) Line 3 project, in India.

The major milestone saw HCC-MMS JV complete the 3.82km southbound running

tunnel between Chhatrapati Shivaji Terminal (CST) and Mumbai Central stations and become the first contractor on the project to finish an entire section of tunnel for one of the line's seven contract packages.

With production rates of up to 24m per day (holding the record for the project), the TBM tunnel was driven via NATM station boxes at Kalbadevi, Girgaon and Grant Road, at an average depth of 20m.

It was successfully completed on schedule despite numerous geological and logistical challenges, including the tunnel's proximity to the ocean, tunnelling through reclaimed land, congested working areas and excavating beneath some of the oldest buildings in the city, many over a century old.

"With TERRATEC's support, the HCC team completed this operation in a single drive, boring through geology

consisting of basalt, breccia and tuff and reclaimed sand with negligible settlement," said Ravi Ranjan Kumar, MMRCL's Chief Project Manager for UGC-02. "Most of the tunnel alignment is under the oldest and most densely populated area of south Mumbai with many dilapidated residential buildings. The performance of the TERRATEC dual-mode hard rock TBM in this geology was highly satisfactory and we now look forward to the similarly successful completion of TBM 02 'Vaitarna 2:'"

The machine is one of two new TERRATEC dual-mode TBMs being used on contract UGC-02. Five other TERRATEC TBMs are also achieving good progress on the new 33.5km-long underground corridor.

The versatile TERRATEC single shield TBMs are equipped to operate in either Open or Closed mode and have robust hard rock cutterheads that 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 8,500kNm to cope with more fractured zones of ground along the alignment – as well as active shield articulation and built-in two

component backfilling systems.

"Terratec supplied a robust, powerful, TBM for the recently completed southbound tunnel," said Hemant Sanghvi, Assistant General Manager for HCC. "The performance of the TBM, as well as the service and support provided by TERRATEC's field operations team, has been very satisfactory. We look forward to continued co-operation and support for the duration of the second TBM drive."

When complete, Line 3 will be the first underground metro

line in Mumbai. The project is divided into seven tunnel-and-station packages that were awarded to five contracting joint ventures in 2016. These five contractors have deployed a total of seventeen (17) TBMs with TERRATEC being the lead TBM supplier on the project with a 41% market share. To date, the seven TERRATEC machines have completed 65% of the 22.6km allocated to them – signifying almost half of the total 54km of tunnelling on Line 3 – and hold the production records for best day and best month on the project.



SECOND TERRATEC EPBM DELIVERED FOR ARGENTINA'S LANDMARK AGUA SUR WATER TUNNEL PROJECT

At the end of July, TERRATEC celebrated the successful factory testing of the second of two new Tunnel Boring Machines (TBMs) that will be used to excavate the Río Subterráneo a Lomas tunnel, in Buenos Aires, Argentina.

Along with its sister machine, the 4.66m diameter S74 TERRATEC Earth Pressure Balance Machine (EPBM) will be deployed by Italian contractor CMC di Ravenna on a 13.5km-

long tunnel that will carry drinking water from the newly expanded General Belgrano Water Treatment Plant, in the city of Bernal (Quilmes district), to the city of Lomas de Zamora.

The tunnel is a key component of the multi-billion-dollar Agua Sur system that is currently being built by Argentina's national water and sanitation company AySA. Financed by the Government and the Development Bank of

Latin America (CAF), it is the country's largest water infrastructure project in 40 years and will provide access to fresh water for 2.5 million inhabitants in the southern metropolitan area of Buenos Aires.

"AySA is confident that it has chosen the right contractor in CMC for this important project and we have witnessed the close relationship between CMC and its equipment

The second of two new 4.66m diameter TERRATEC Earth Pressure Balance TBMs to be delivered for a 13.5km potable water tunnel system, in Buenos Aires, Argentina.





TERRATEC RBM COMPLETES FIRST SHAFT AT BURITICÁ GOLD MINE

TERRATEC recently celebrated the successful completion of a 300m deep, 4.1m diameter, ventilation shaft at the Buriticá mine development project, in Colombia. Peruvian mining contractor INCIMMET deployed a custom-built TR2000 Raise Boring Machine (RBM) to excavate the shaft in challenging ground conditions, putting this highly-robust machine through its paces during its first bore at the mine.

of the world's largest remaining untapped high-grade gold deposits, encompassing an area of about 75,000 hectares in the Antioquia Department. The mining complex, which is in the early stages of development, is Colombia's first modern underground mine and has been designated as a Project of National Strategic Interest (PINES) by the Colombian government.

with intrusive hydrothermal gaps within the volcanic and sedimentary sequences. These mixed and fractured conditions provided a challenge both to the integrity of the reamer and the capability of this robust machine.

Mineralized gaps, which are frequently associated with the development and alteration of clay minerals, required constant monitoring of the excavation and appropriate advance rates to provide good progress in this difficult terrain.

Arguably the biggest challenge for the mine development project is the area's geology. Ground conditions at the Buriticá complex largely consist of andesite-porphyry, diorites and monzodiorites

"Not all Raise Boring equipment is capable of working with such robustness in these conditions,"

Located approximately two-hours northwest of Medellin, Colombia's second biggest city, Continental Gold's flagship Buriticá mining complex is one

supplier TERRATEC during this week of testing," said AYSA Argentina Project Manager, Pablo Estigarrivia. "It fills us with confidence that this strong team will work together with the goal of completing this project as rapidly as possible."

The 4.66m diameter TERRATEC EPBMs have been designed to tackle variable soft ground geology along the project alignment, which ranges from silts to sandy silts with some cobbles expected. The TBMs' high-torque soft ground cutterheads feature a spoke style design with a 49% opening ratio and cutting tools consisting of fixed and back-loading knife bits to

ensure rapid advancement and minimum interventions.

The tunnel will be excavated at an average depth of 25m, beginning with an approximately 400m radius curve and continuing along an essentially straight alignment, reaching a maximum slope of +/- 2.0%. As the machines progress, they will install a precast concrete segmental lining ring consisting of six (four parallelograms and two keys) 250mm thick, 1400mm wide, segments.

"From the initial concept to this point in the process it has been refreshing working with TERRATEC. We are pleased

that TERRATEC has delivered both of these machines on time and to specification and we look forward to getting to work on the project with them," says CMC di Ravenna's Project Manager, Pablo Guevara.

In recent years, TERRATEC's order book has demonstrated significant growth around the world. Machine performance and client satisfaction have provided the foundations of a loyal customer base making TERRATEC the first choice for more and more contractors. TERRATEC's large-diameter TBM facility has produced more than 20 new machines for international projects in the past twenty eight months.





Only a team as strong as this, with the technical support of our on-site staff, is able to carry out such a task successfully and not without difficulties."

Custom manufactured at TERRATEC's workshop in Tasmania, Australia, the TR2000 Raise Boring Machine was designed for ease of operation and maintenance, while providing a high level of reliability. The unit is designed to "comfortably" execute raises of up to 500 meters at 2.4m diameter and larger ones up to 4.1m diameter (of shorter depths). It has a maximum pilot drilling torque of 42,000Nm, a reaming torque of up to 209,000Nm and breakout to 236,000Nm. The maximum down thrust force is 665kN with upthrust being 4,150kN. The total installed power on the machine is 360kW.

says TERRATEC Regional Raise Boring Operations Manager, John Alejos. *"Without doubt, this changing terrain is almost impossible to drill at such depths and such diameters.*

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.

TERRATEC has numerous machines currently working along the American continent, in Canada, the USA, Mexico, Colombia, Peru and Argentina. These include the company's entire range of vertical drilling equipment, including Raise Boring Machines, Down-Reaming Machines and Box Holing Rigs, as well as a combination of these in the form of Universal Boring Machines, all of which have been recognised worldwide for their high-performance and innovative design.

WHEREABOUTS

Meet TERRATEC at the following conferences and exhibitions!



Tunnel Association of Canada
2019 Technical Workshop
Oct. 20-21 | Winnipeg,
CANADA



Cutting Edge Conference
Nov. 18-20 | Miami,
FL, USA



Excon 2019
Dec. 10-14 | Bangalore,
INDIA

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