

# TERRATEC'S EPBM COMPLETES BANGKOK ORANGE LINE METRO TUNNEL



*TERRATEC celebrated on the completion of the Orange Line metro project in Bangkok, Thailand, with the final breakthrough of the Eastbound tunnel on Contract E3.*

**E**arlier in March, TERRATEC joined workers and officials in celebrating the completion of the 3.3km MRT Orange Line (East section) project at Hua Mak Station. TERRATEC 6.39m diameter S70 EPB machine has been chosen by contractor Italian-Thai Development PCL (ITD) on one of three underground civil works contracts for the first 23km-long (East Section) phase of the Mass Rapid Transit Authority of Thailand's (MRTA) Orange Line

Project. The Eastbound tunnel breakthrough on Contract E3 has achieved way ahead of schedule.

Contract E3, which was awarded to ITD in May 2017, totals over 6km of TBM driven tunnel and three underground stations, extending from Khlong Ban Ma to Hua Mak. After completing the Westbound tunnel on Jan. 20, 2020 with the best month ever in Thailand progress of 663.4m, TERRATEC

S70 machine began mining eastwards from the Khlong Ban Ma station box on April 26, 2020, and quickly got up to speed following its initial drive. By mid-June 2020, the TBM was achieving the best rates of up to 33 rings per day (46.2m/day – another best every advance rate per day) and had already undertaken its first intermediate breakthrough.

In March 2020, The Westbound tunnel breakthrough on

Contract E3 took place a full month ahead of schedule. The Eastbound tunnel breakthrough on Contract E3 has achieved 118 days ahead of schedule.

TERRATEC S70 TBM was designed to tackle the 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 – as well as the need to mine through numerous diaphragm wall shafts and potentially, concrete piles.

In order to handle these challenging conditions, the TBM's soft ground cutterhead features a spoke style and the addition of back-loading knife bits to assist the break-in and break-out of the shafts. In addition, the machine is fitted with an active bentonite face support injection system and

double-gated screw, to ensure face stability and mitigate settlement during excavation in areas of flowing sands and high groundwater pressure.

As the machine progresses along the alignment, it has been installing a precast concrete segmental lining consisting of five x 1400mm 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.

In total, TBM tunnelling operations for ITD's Orange Line (East) contract has lasted two years and are being assisted at all times by TERRATEC's highly-experienced Field Service staff – who's quality after sales support

service has created very loyal client-base in Thailand – to ensure optimum performance and successful project completion.

Bangkok's new Orange Line will eventually total about 35.9km with 26.2km aligned underground with 22 underground stations and another 9km and seven stations on elevated structures. The line is scheduled to open in March 2024. When completed, 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 accessibility, economic growth and new residential and commercial opportunities along the alignment.

## TERRATEC'S EPBM GEARS UP FOR AGUA SUR TUNNEL

TERRATEC is pleased to announce that the 4.66m diameter Earth Pressure Balance Tunnel Boring Machine (EPBM) named Eva is performing well. It has passed the site acceptance test and is excavating the Río Subterráneo a Lomas tunnel, in Buenos Aires, Argentina.

Italian tunnel contractor CMC di Ravenna is constructing 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.

In June 2020, a cutterhead lowering ceremony was held in the presence of Argentina's President, Alberto Fernández, as well as numerous government officials and representatives from Argentina's national water and sanitation company AySA and CMC di Ravenna.

The tunnel project is significant as it is Argentina's largest water infrastructure project to be carried out over the last 40 years. Being the main element of the Agua Sur system. The new system will provide access to freshwater for 2.5 million

inhabitants in the southern metropolitan area of Buenos Aires.

The 4.66 diameter TERRATEC EPBMs are designed to undertake the variable geology along the project alignment. The TBMs' high-torque soft ground cutterheads feature with a spoke style design with a 49% opening ratio and cutting tools consisting of fixed and back-loading knife bits that will ensure rapid advancement and minimum interventions.

Each TBM cutter head has eight hydraulic motors with a total a power of 792 kW. The

*Italian tunnel contractor CMC di Ravenna has completed TBM testing and initial drive on the Agua Sur tunnel.*





## TERRATEC TBM BEGINS WORK FOR DELHI METRO PHASE 4

A refurbished 6.52m diameter TERRATEC Earth Pressure Balance (EPB) Tunnel Boring Machine has been delivered to a Joint Venture between Hindustan Construction Company Ltd. of India and Vensar Constructions Company Limited, for the Line-8 – Magenta Line of the Delhi Metro, in New Delhi, India.

Followed by a successful Site Acceptance Test, the JV began work to install the first tunnel ring segment for constructing a 2.03 km underground extension of the Delhi Metro's 38.235 km

Magenta Line (Line-8) from the Viaspuri Park Shaft to Viaspuri Ramp near Keshopur. As part of this tunnelling drive, two tunnels (for up and down movement) with a length of 1400 metres will be bored between Viaspuri and Krishna Park Extension.

The Contractor selected TERRATEC Ø6.52m EPB Tunnel Boring Machine with a traditional soil configuration, equipped with a Spoke-Type Cutter Head with a 57% opening ratio which has been proven to be very efficient

to excavate this type of soil in previous DMRC Phases. This refurbished machine has previously completed tunnels for Delhi Metro project CC-34 and Lucknow Metro project LKCC-06.

TERRATEC has designed the CutterHead to allow the cutting tools to be exchangeable for 17" roller disc cutters, making the TBM to be able to bore through the D-walls and cope with the presence of any unexpected obstacle on its way, such as old wells or foundations. The geology is

*HCC/VLCC JV gears up to commence tunnelling on Phase 4 DC-06 of the Delhi Metro in India.*

project requires the two boring machines to be launched and received from shafts. The tunnel will be mined at an average depth of 25m, using precast segments with an outer diameter of 4.4m and an inner diameter of 3.9m and continuing along an essentially straight alignment, reaching a maximum slope of +/- 0.25%.

The first launch shaft is composed by 4 circular sectors that interconnected with each other in the bottom area. The total length of the shaft is around 45m, width 12m and around 25m high.

"The fact the machines are launched from a shaft has required us to make full use of

a modular design and umbilical launching system to work in the confined space, this is why a hydraulic drive solution was chosen" explained Emilio Saraniero, TERRATEC Project Manager.

The new Agua Sur System forms a series of major framework that includes a raw water intake, the expansion of the General Belgrano Water Treatment Plant – which will increase its water production capacity from a current maximum of 1,950,000m3 per day to 2,950,000m3 per day – 23km of water conveyance tunnel (built-in two stages), two pump stations and 46km of pipe connections. The whole project is anticipated to take

approximately 10 years to complete.

In recent years, TERRATEC's order book has shown significant growth around the globe. Machine performance and client satisfaction have provided the foundations of a loyal customer base making TERRATEC the first choice for more and more contractors.





composed of silty sand, fine sand & sandy silt and clayey silt.

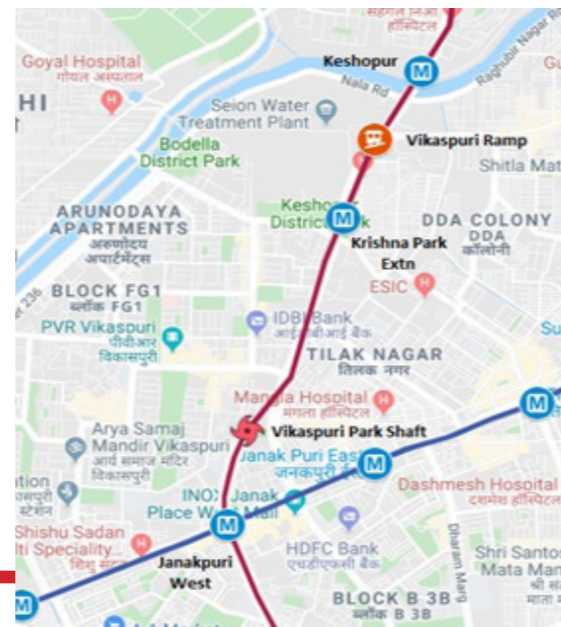
The segment lining will be made of RC segments with an outer diameter of 6,350mm, inner diameter of 5,800mm and width of 1,400mm. The total distance that the TBM will bore to is approximately 2,030 metres.

The tunnel will be excavated at an average depth of 14-16 metres. As the drives progress, the machines will install reinforced concrete Universal-style, pre-cast lining rings – comprising five segments + key. This section includes a 365 meter long ramp and approximately 220 meter long station, hence roughly 2100 segments will be installed.

In January 2020, DMRC had awarded a contract to the consortium of HCC-VCCL for building the construction of twin tunnels from the VIKASPURI Park Shaft to VIKASPURI Ramp, with one underground station at Krishna Park Extension under contract package DC-06 of Delhi Metro Phase 4. The work is expected to be completed in 36 months.

After successful completion of Delhi Metro Phase III, Terratec has been chosen again for the first underground tunnel package in DMRC Phase-IV which proves that Terratec is the first choice for the contractors. TERRATEC's continuing success on projects such as Phase III of the Delhi Metro, Lucknow Metro, Pune Metro, Ahmadabad

Metro and Mumbai Metro is a result of tailor-made robust TBM design, prompt onsite assistance, readily available stock of TBM spares and highly-skilled specialised TBM support throughout tunnelling operations.

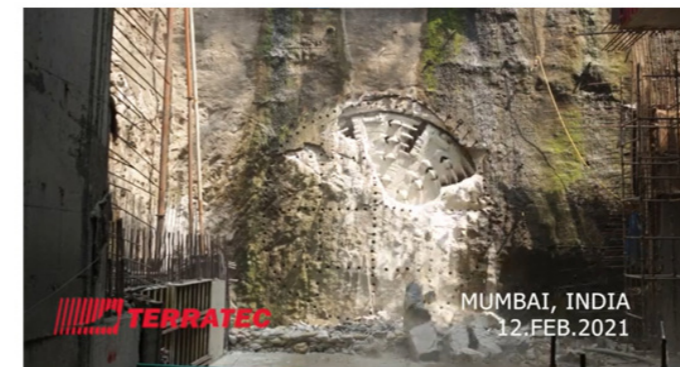


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TERRATEC's S70 final breakthrough on Bangkok Metro Orange Line C3



TERRATEC's T62 breakthrough on Mumbai Metro Line 3



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