

TERRATEC EPBMS READY TO TACKLE KANPUR METRO IN INDIA



Gulermak/Sam India JV gets ready to commence tunnelling on the Corridor-1 of Kanpur MRTS Project in India.

TERRATEC celebrated the successful site acceptance testing of two 6.52m diameter Earth Pressure Balance Tunnel Boring Machines (EPBMs) for Uttar Pradesh Metro Rail Corporation (UPMRC) for the Corridor-1 of Kanpur MRTS Project (KNPCC-05) in India.

The two 6.52m diameter EPBMs have started excavating for the first underground tunneling package (KNPCC-05) of the 32.4 km Kanpur Metro Phase 1

project's 8.6 km underground section by contractor Gulermak-Sam India JV.

Kanpur Metro has two corridors: IIT Kanpur to Naubasta Corridor and Agriculture University to Barra-8 Corridor. The TBMs for the package of the 23.8 km Orange Line-1 connecting IIT Kanpur to Naubasta has a length of 3619 meters and includes four stations. This includes an elevated section of 15.16km and an underground stretch of

8.62km.

Awarded to Gulermak-Sam India JV in Sept 2020, the contract also includes the construction of the four new underground stations at Chunniganj, Naveen Market, Bada Chauraha and Nayaganj each 215 meters long (see map below).

For the geology consisting of soil, clay, silt and sandy silt, the JV selected two Ø6.52m EPB Tunnel Boring Machines equipped with a Spoke-Type Type CutterHead

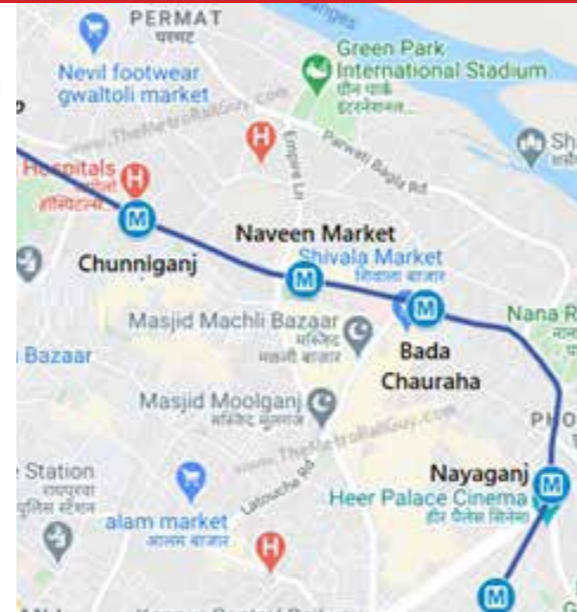
with 57% opening ratios, which had been proven to be very efficient excavating this type of soil.

The two EPBMs have been launched for the initial drives from Bada Chauraha station to Naya Ganj station. Expected challenges are typical for tunnelling in a densely populated, yet historical urban area.

Machine operation is 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. Tunnelling operations is carefully observed throughout the manoeuvre via a settlement monitoring programme.

Kanpur Metro is an urban mass rapid transit system (MRTS) being developed to meet the long-term traffic demand of the city of Kanpur in Uttar Pradesh, India. Anticipated to be completed in 2024, the 32km-long metro rail system will reduce traffics and pollution, shorten journey times and open up new career and educational opportunities in Kanpur, Uttar Pradesh's industrial capital.

The new metro will contribute to making Kanpur safer and more business-friendly. The project will benefit to climate change mitigation, by promoting a change from road to rail while reducing gas emissions, and expediting social and economic infrastructure & urban development.



TERRATEC EPBM BREAKS THROUGH IN THAILAND HELPING SAMUI ISLAND KEEP ITS TITLE AS A TOP ASIAN TOURIST DESTINATION

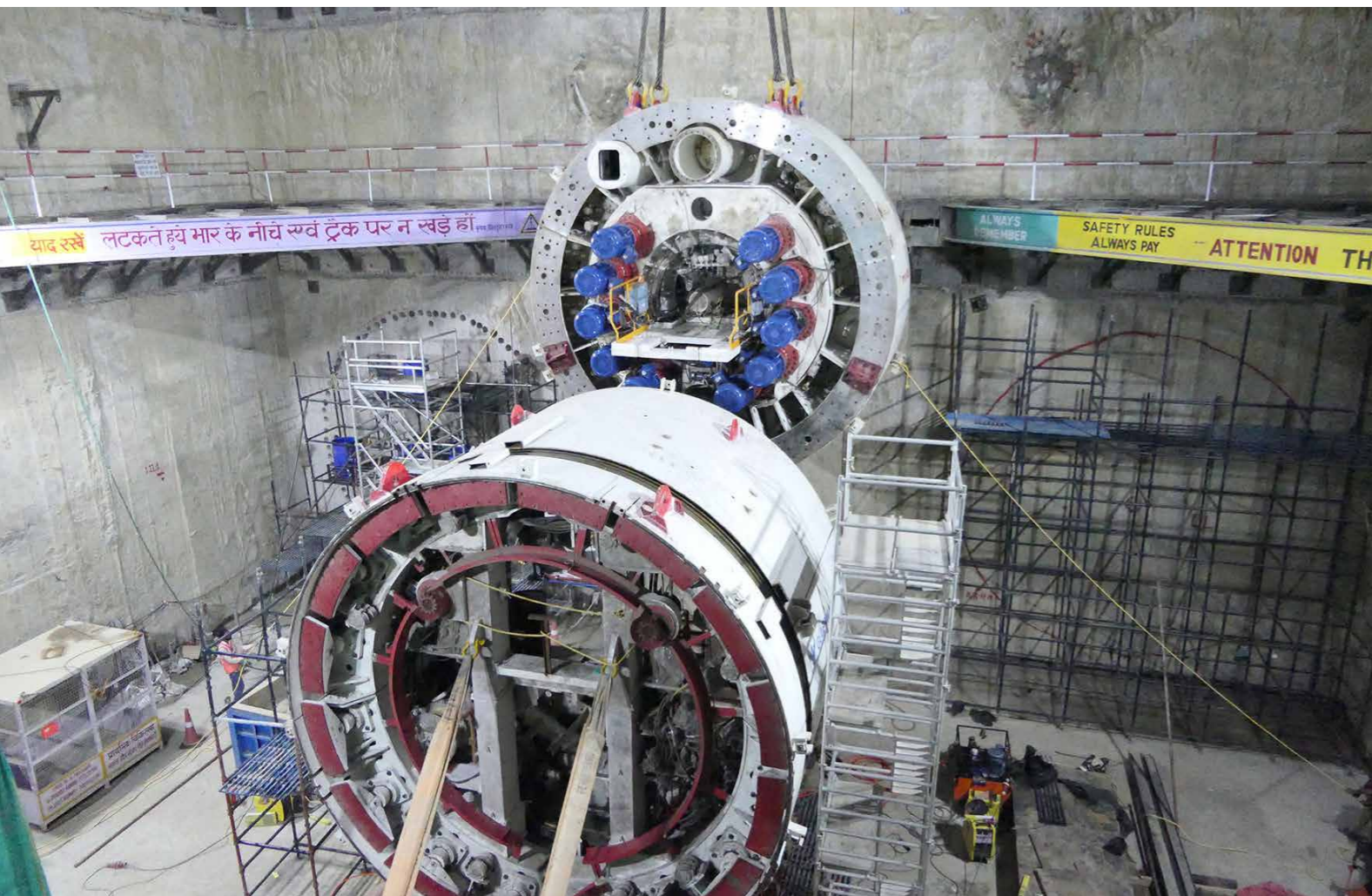
TERRATEC is proud to announce the completion of Samui Island Water Tunnel Project in Thailand. The tunnel was completed using a refurbished TERRATEC 3.2m diameter Earth Pressure Balance Tunnel Boring Machine (EPBM) by contractor SCG (1995) Co. Ltd.

The project owner, Department of Public Work and Town & Country Planning Authority had awarded the contractor SCG (1995) Co.

The contract is to construct a 1.1km long tunnel for the Samui Island flood control system. The tunnel is designed to alleviate flooding and to drain the flood water on Samui Island from busy areas to the ocean. Samui Island is an island off the east coast of Thailand and it is Thailand's second largest island after Phuket. Each year, there are more than 2.7 million tourists. The tunnel includes sandstones, siltstones, limestones and volcanic rock –

as well as other state-of-the-art features such as VFD electric cutterhead drives, tungsten carbide soft ground cutting tools that are interchangeable with 17" roller disc cutters, high torque screw conveyors and active The island faces severe flood problems and the tunnel is intended to ease the flood water. Being part of the main Ring Road revitalization and improvement project, the water tunnel will significantly improve the rainwater collection from roadway

Thai contractor SCG (1995) Co Ltd. uses TERRATEC S48C refurbished Earth Pressure Balance Tunnel Boring Machine (EPBM) to excavate a 1.1km tunnel for the Samui Island flood control system.





run-off along Samui's main ring road.

Featuring a classic soft ground open spoke cutterhead design, with knife bits to assist break-in and break-out of the steel fibre reinforced concrete shaft eyes, the EPB machine has coped extremely well with the geological conditions along the alignment, which consist of dense sand, stiff to hard day and decomposed rocks with a groundwater head of about 2 bars. The receiving shaft sized in 5 x 9 meter, is located at the bottom of two hills where the flood problem prolongs. The flood water will be drained through the new tunnel and connected with a 500m open canal to the ocean. With TERRATEC's non-tuck hose system, muck can be easily transferred to muck cars and out to the surface.

Machine operation was 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. Tunnelling operations were closely observed throughout the manoeuvre via a settlement monitoring programme.

Prior to the Samui Island Water Tunnel project, the 3.20m diameter TERRATEC S48 Earth Pressure Balance Tunnel Boring Machine (EPBM) was operated for Bangkok Metropolitan Electricity Authority's (MEA) Phra Khanong Cable Tunnel Project in Bangkok, Thailand. The machine was operated by Thai contractor Nawarat Patanakarn PCL to excavate a sharp 32m-radius curve as it exited the project's launch shaft in order to negotiate the piles of an adjacent expressway ramp. To achieve this challenging curved alignment, the TERRATEC machine

was manufactured with an extreme X-type articulation system that provided a maximum articulation angle of 6.6-degrees. Designed to accommodate a new high-voltage cable system, the Phra Khanong Cable Tunnel Project was the first of a series of planned tunnelling projects by the MEA that were being built to meet increased power demands in the Thai capital.

TERRATEC has a well-established regional base in Thailand, having sold its first machine in the country more than ten years ago for the Metropolitan Rapid Transit (MRT) Blue Line Extension Project. With outstanding tailor-made robust TBM design, prompt onsite assistance, readily available stock of TBM spares and specialised TBM support throughout the tunnelling operation, TERRATEC has become the country's leading TBM supplier.

TERRATEC DELIVERS MORE EPBMS FOR CHENNAI METRO PHASE-II TUNNELLING WORK

TERRATEC marks its latest milestone on the Chennai Metro Rail project in India with the delivery of the third out of five ordered 6.61m diameter Earth Pressure Balance Tunnel Boring Machines (EPBMs) for the project. Contractor, Tata Projects Ltd. will use these machines for its underground works contracts on Chennai Metro Rail Phase-II Corridors India.

The new TBMs will be used on Chennai Metro Rail tunnelling contract for Chennai Metro Rail Limited (CMRL) to build Phase 2 - Corridor 3, from Venugopal Nagar Station to Kellys Station. The work involves the construction of 18 km of bored

tunnels. TERRATEC is proud to be providing five out of the seven TBMs required for the package.

Being the leading TBM supplier for Chennai Metro Rail Project, TERRATEC started rolling out the TBMs earlier in the year. The first TBM S96 has been delivered on-site and is being assembled. While the second TBM S97 is on the way and due to arrive soon. The third TBM S98 has recently completed its FAT and been dispatched.

These TBMS will start excavating in the coming months and the field service team is on-site having started the pre-assembly work. Once

all the 3 TBMs are assembled, they will start digging for the 15 km tunnels for Package TU-01.

The TBMs will start excavating from the TBM Retrieval Shaft near Venugopal Nagar (of Line-5) to Kellys Station. The project includes the construction of diaphragm walls and entry & exit structures of Madhavaram Milk Colony Station, Murari Hospital Station, Ayanavaram Station and Purasaiwakkam High Road Station, including the launching and retrieval shafts at the above stations. Major challenges of the project will include tunnelling beneath historical structures in built-up areas.

TERRATEC delivers two more TBMs that will be used by Tata Projects Ltd. for the Chennai Metro Rail Phase-II Corridors in India.



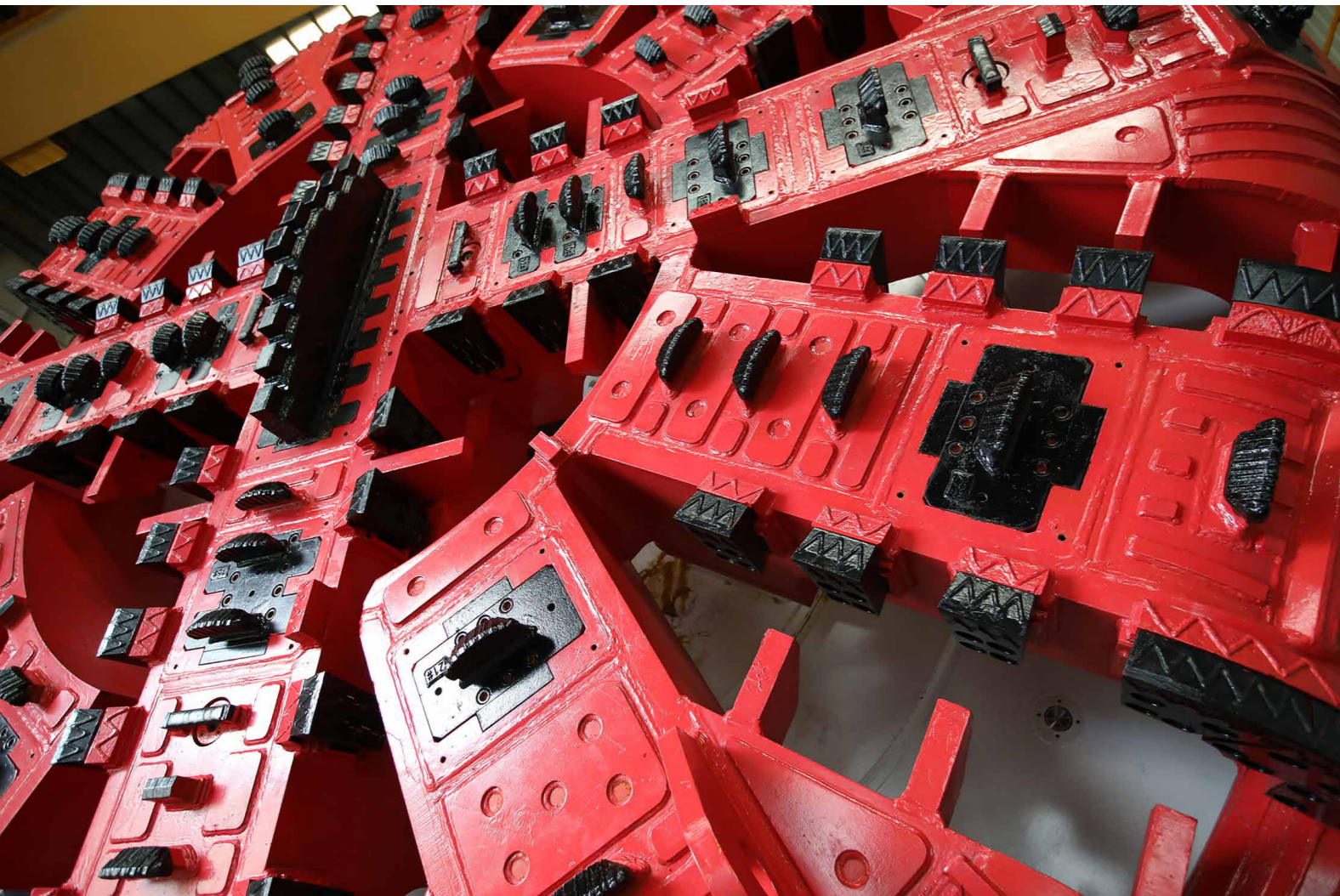
The TERRATEC TBMs have versatile mixed-ground dome-style cutterheads that have proven to work extremely effectively in mixed geology – which includes mainly sand, silt, clay on the tunnel drives with approximately 10% weathered rock. 1,400mm wide by 275mm thick universal reinforced concrete lining rings will be installed as the TBMs progress which consists of five segments plus a key.

Machine 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.

Large-scale urbanization with the rapid growth of the vehicular population has laid severe stress on the urban transport system in Chennai. As a result, the government of Tamil Nadu has decided to implement the Chennai Metro Rail Project. This project intends to offer the people of Chennai with a fast, reliable, convenient, and economical way of public transport. The project is on a tight schedule and is anticipated to be completed in about four years.

TERRATEC’s continuing success on projects such as Phase III of the Delhi Metro, Lucknow Metro, Ahmadabad Metro, Kanpur Metro, Surat Metro, Pune 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.



Chennai Metro is the fourth longest metro system in India. The network currently consists of two lines covering a length of 54.65 kilometres. The new Line 5 of Chennai metro will have 48 stations and connect from Madhavaram to Sholinganallur.

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