

TERRATEC DOUBLE SHIELDS HEAD TO LANDMARK WATER TUNNEL



Australian-based TBM manufacturer, TERRATEC, celebrated the delivery of two hard rock machines for the second phase of tunnelling on the Royal Irrigation Department's Mae Tang-Mae Ngad water diversion project, in northern Thailand, following successful factory acceptance tests in late October.

The robust 4.74m diameter TERRATEC Double Shield TBMs will be deployed by Thai contractors Right Tunnelling Co. Ltd. and Siamphan Enterprise

PCL on two contracts – totalling over 15km of TBM driven tunnel – for the 25km-long Phase 2 tunnelling works, which traverse the challenging mountainous terrain north of Chiang Mai city.

These TBMs have been designed to confront the highly complex and variable geology of the region, which ranges from granite, gneiss, quartzite and schist, to sandstone, siltstone, shale, slate, mudstone and claystone, and varies from massive to highly fractured and

weathered rock masses (with a UCS range of 8MPa to 220MPa), including numerous fault and fracture zones and the potential for high ground water inflows.

In order to handle these challenging conditions, the tough yet versatile TERRATEC cutterheads have each been equipped with heavy-duty 17" disc cutters and feature large bucket openings, as well as anti-wear plates and lubrication systems for the injection of foams and polymers to assist with wear prevention and dust



suppression. The 1,500kW Electric Variable Frequency Main Drives (VFD) will allow the cutterheads to cut efficiently in harder rock zones at a maximum speed of 9rpm and deliver 2,896kNm of torque of to cope with fractured zones of the alignment.

In addition, the machines are fitted with state-of-the-art probe drilling systems, located behind ring gear style segment erectors, that provide 360-degree coverage for probing and grouting of the ground ahead of the TBMs; as well as dewatering pumps that have the capacity to manage groundwater inflows of up to 100lt/sec.

"We are delighted to be working with TERRATEC as our

partner on this landmark water tunnel," said Mr. Teerapon Wangmontri, President of Siamphan Enterprise PCL. *"Due to the complex geology expected on the project, we wanted to choose a tried and tested manufacturer of hard rock machines such as TERRATEC, whose double shield TBM experience is exceptional."*

As the two machines progress along their respective alignments, they will install precast concrete segmental lining rings consisting of four x 1400mm wide honeycomb style segments, with an inner diameter of 4m, which will be backfilled with pea-gravel and grouted in place. Excavated muck and supplies will be conveyed through the tunnel

via rail-bound systems. The Mae Tang-Mae Ngad water diversion tunnel is located about 55km north of Chiang Mai, in northern Thailand, and is designed to convey 28 cubic metres per second of raw water from the Mae Tang River to Mae Ngad and Mae Kuang reservoirs. The project aims to augment the current water supply to the Chiang Mai and Lampun Provinces involving over 50km of tunnel that is being built in two Phases.

When the overall project is complete, in 2021, a saving of more than 160 million cubic metres of water will be seen each year. The extra water will help support a range of industries and sectors, such as the consumer sector, agriculture and tourism.

TERRATEC TIGHT RADIUS SHIELD PROGRESSES IN BANGKOK

Thai contractor Nawarat Patanakarn PCL gears up for its second TBM drive on the Bangkok Metropolitan Electricity Authority's (MEA) Phra Khanong Cable Tunnel Project.

On September 22, 2017, a TERRATEC Tight Radius Shield successfully completed a technically challenging tunnel drive for the Bangkok Metropolitan Electricity Authority's (MEA) Phra Khanong Cable Tunnel Project, in Bangkok, Thailand.

The 3.20m diameter TERRATEC S48 Earth Pressure Balance Tunnel Boring Machine (EPBM), which is being operated by Thai contractor Nawarat Patanakarn PCL, was required

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 provides a maximum articulation angle of 6.6-degrees. *"The TBM was specifically designed to cope with small radius curves,"*

said Mr Pakpong Phongsaisri, Project Engineer for Nawarat Patanakarn. *"It is a highly efficient machine and has done an excellent job in difficult conditions."*

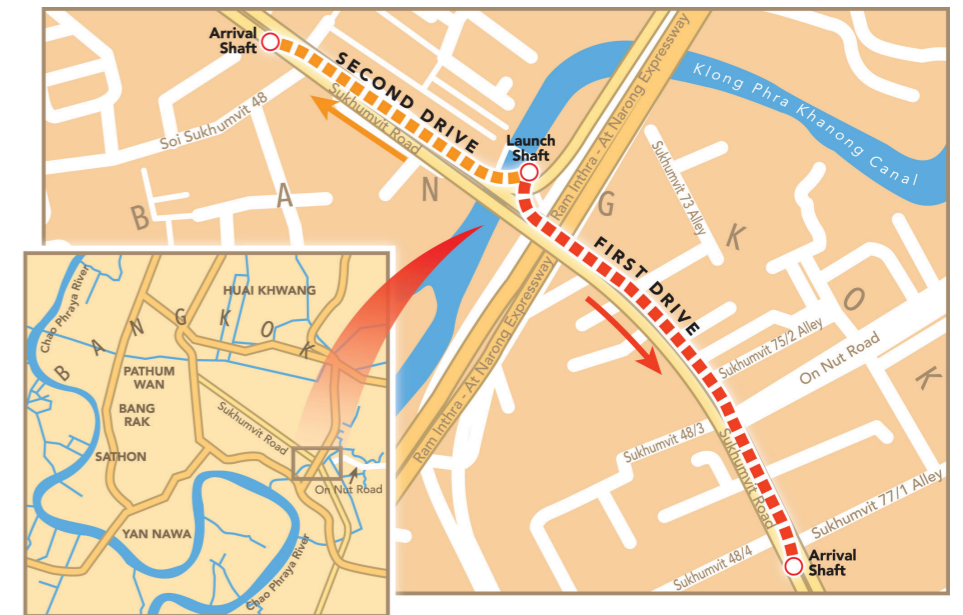
Designed to accommodate a new high-voltage cable system, the Phra Khanong Cable Tunnel Project is the first of a series of planned tunnelling projects by the MEA that are being built to meet increased power demands in the Thai capital. Located at the intersection of





passing under the Phra Khanong canal and heading northwards to a second retrieval shaft.

Throughout the duration of the project, machine operation is being assisted at all times by TERRATEC's highly-experienced Field Service team. "We are extremely pleased with the service and support offered by the Terratec team and are looking forward to successful completion of the tunnelling works in the coming months," says Phongsaisri.



the Phra Khanong canal and Sukhumvit Road the project is situated in one of the busiest areas of downtown Bangkok and is subject to tight alignment constraints.

The TBM was launched on its first, 495m long, drive in early February from a 7.0m diameter shaft located beneath an elevated expressway ramp with limited working head room. Due to the presence of the expressway piles, the TBM was required to embark on a sharp 32m-radius curve immediately upon exiting the shaft.

Tunnelling operations were closely observed throughout the manoeuvre via a settlement

monitoring programme that demonstrated minimal impact on the existing above ground structures. As the machine progressed through the curve it installed a tunnel lining of short 300mm wide x 125mm thick steel sets, before transitioning to 1.1m wide x 225mm thick traditional tapered precast concrete segments (left/right/straight).

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

fine sands and stiff clays with a groundwater head of about 2 bars.

Prior to the TBM's breakthrough last month, the machine completed a second, 30m long 99m-radius, curve on its approach to the reception shaft, which was handled with ease.

Since then, the TBM has been retrieved and is currently being prepared for its second, 293m-long, drive from the central launch shaft, which will commence in mid-November. Once again, the TBM will launch into a tight curve, this time with a 43.7m-radius on a 2% up-grade trajectory,

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