

# Tunnelling

The international journal for the tunnelling industry

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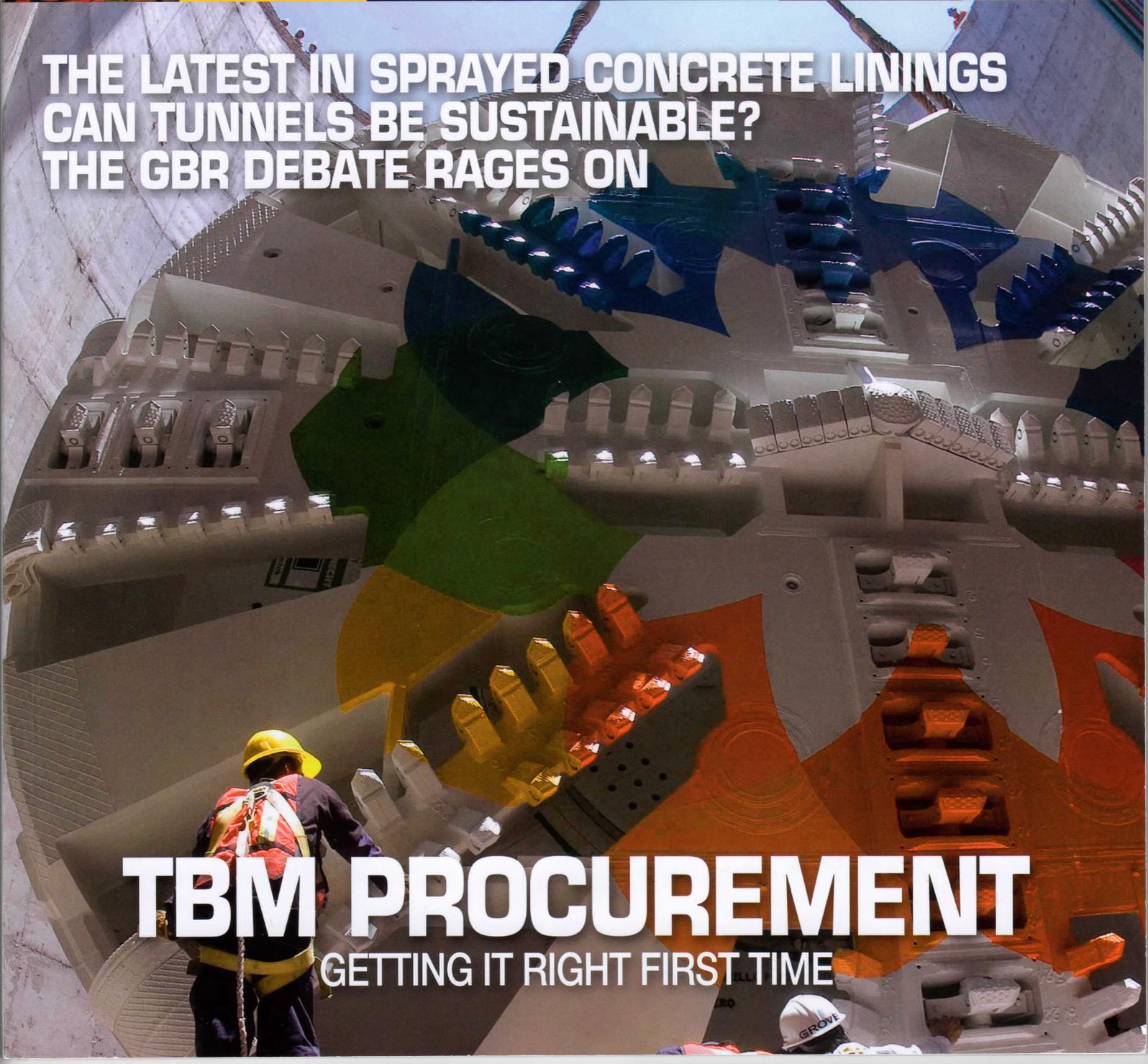
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# TBM PROCUREMENT

GETTING IT RIGHT FIRST TIME

### ToolWatch for Thames Tunnel

ToolWatch Corporation will implement the full ToolWatch Enterprise suite on the London Crossrail C-310 Thames Tunnel contract. The US\$306M contract is part of the US\$22.5bn London Crossrail project that will connect the east and west London rail routes. The project will use the Enterprise suite to track heavy equipment, machinery (or plant), vehicles and tools, as well as monitor equipment servicing schedules and fuel consumption.

Hochtief/Murphy JV is the principal contractor on the project. Hochtief/Murphy selected ToolWatch after conducting an extensive global search for a solution that best fit its diverse needs, including comprehensive tool and equipment tracking and

management features, real-time access at anytime from anywhere, and a secure, centralized database.

"The Crossrail project is the largest construction project currently under way in Europe and the U.K., and the scope of the Thames Tunnel contract demands that we have the capability to keep strict control over every item, from small to large, accurately and instantaneously. ToolWatch Enterprise will give us the macro- and micro-level knowledge we need to keep the project on track and on budget," said Martin Edwards, Plant and Senior Office Manager of the Thames Tunnel project for Hochtief/Murphy.

When completed in 2018, Crossrail will connect 37 rail stations, including Heathrow

airport, and is estimated to serve more than 200 million passengers per year. The 2.6km Thames Tunnel project will connect the district of Plumstead to North Woolwich and link the existing North Kent rail line to Crossrail.

"We are happy to be working with Hochtief/Murphy, and we are proud of ToolWatch's key role on the Crossrail Thames Tunnel contract," said Don Kafka, ToolWatch president. "This is the single largest project ToolWatch has undertaken in the U.K. to date, and we hope it has opened the doors to other joint venture partnerships with Hochtief/Murphy and future projects in the U.K."



### Novel Shotcrete shortens Schedule for three Robbins TBMs

At 44.6km, Malaysia's Pahang Selangor Raw Water Tunnel will be the longest tunnel in Southeast Asia when complete. The three 5.23m diameter Robbins Main Beam machines excavating the tunnel are advancing well with a novel type of shotcrete used as primary ground support under high cover.

The shotcrete is applied manually and consists of a continuous mixing and charging pump system, customized dry mortar mix with polypropylene fibers, and a fast-acting accelerator. The shotcrete, developed by MCM Co., Ltd. and DENKA of Japan, has been used on numerous hard rock TBM and NATM projects in Japan, though this is the first time the system has been used internationally. "The dry mix system is advantageous because it can be started and stopped whenever necessary, and can be mounted in the TBM back-up. Wet systems, by comparison, generate unused mortar if frequently started and stopped, requiring downtime for cleaning," said Mr. Nobuo Suematsu, Marketing Director for MCM Co., Ltd.

MCM and DENKA worked with Robbins to create a near-zero rebound L1 shotcrete system to be used in the granitic hard rock of the tunnel, with rock strengths of up to 200MPa. The shotcrete is applied to the top 180 degrees of the tunnel following each TBM stroke in a 2cm layer directly behind the cutterhead support. This layer is accompanied by ring beams depending on the ground conditions. Compressive strength of more than 15MPa is achieved within 24 hours of application. "The shotcrete is very quick setting with no rebound, and the mortar does not require high pressure application," said Mr. Yoshikuni Nakano, Deputy Project Manager for contractor SNUI JV (a consortium of Shimizu Corporation, Nishimatsu Construction, UEM Builders Bhd, and IJM Corp).

The shotcrete system has so far resulted in less downtime compared to conventional ground support, as the shotcrete can be applied during excavation. In the somewhat fractured ground conditions currently being encountered, the machines would have required an estimated two hours of ground support work per excavated meter with conventional methods. This would have added up to 210 days to excavate and support the ground. With the fiber mortar system this time has been reduced to 158 days - a time savings of 52 days.

With the three TBMs now between 4 and 6km into their respective 11km long sections, benefits such as dust reduction are also becoming clear. "The shotcrete offers environmental benefits, because it is transported in sealed cars without exposure to the surroundings," said Andy Birch, Robbins Site Manager. Bonding, according to Birch, has been good and rebound has been minimized compared with standard shotcrete mixtures.

The Pahang Selangor Raw Water Tunnel, for the Malaysian Ministry of Energy, Green Technology, and Water (KeTTHA), will transfer water from the Semantan River in Pahang State to the Selangor/

Kuala Lumpur region, traveling as far as 1,200m beneath the Titiwangsa mountain range in varying rock conditions with some ground water. TBM excavation is expected to be complete in 2013.



### Innovative Gasket by CBE Group

Thanks to the co-operation of a leading manufacturer of gaskets for tunnel construction, CBE Group, has employed, for the first time, the technology of directly anchored gaskets in concrete segments on a large-scale project in England – the lining of the Lee Tunnel in London – as a mass production. CBE now offers these gaskets, with the aim of providing quality improvements whilst reducing production costs and the use of solvent based compounds.

As an innovative technology, gaskets that are directly anchored in the concrete segment offer a variety of advantages:

- 1) Shortened processes in the segment factory due to time-savings for correction of imperfections and cleaning of the groove area.
- 2) Saving costs for glue and gluing equipment as well as time for mounting the gaskets.
- 3) No environmental pollution due to solvents of the contact glue.
- 4) Remarkably higher adhesion between gasket and concrete (no detachment while installing the key-stone).
- 5) Higher tightness because of maximizing the distance for the water between gasket and concrete.

CBE Group is a world leader in the design & manufacture of segment moulds, their handling equipment & their automated pre-cast facilities for tunnel lining. Founded in 1987, CBE Group started supplying moulds and precast carousel for the Channel Tunnel. CBE Group has to date created 13 000 segment moulds and 250 precast facilities worldwide.