

## The Pahang-Selangor Interstate Water Transfer Tunnel

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The talk on “The Pahang-Selangor Interstate Water Transfer Tunnel” was presented by Mr. Takayuki Matsumoto (Shimizu Corp.), deputy project manager, on 7<sup>th</sup> December 2012 at the Department of Geology, University of Malaya.

Sdr Matsumoto gave a comprehensive account of the project, including site geology/engineering geology, tunnelling methods/TBM/D&B, in-situ stress measurements, problems of ground collapse and water ingress into the tunnel when intersecting major fault zones, and rock burst due to high ground stresses and brittle rock behavior (granite). Further details of the project are provided in the abstract attached below. To-date (Dec 2012), ~ 80% of the project has been completed, with good progress recorded for the TBM's.

As usual, there were lively discussions at the end of the talk.

Tan Boon Kong,

Chairman, Working Group on Engineering Geology, Hydrogeology & Environmental Geology



**Abstract:** This project includes the long distance water transfer tunnel project which links the state of Pahang and Selangor in Malaysia. The tunnel length is 44.6 km with diameter of 5.2 m and it constitutes as one of the largest infrastructure projects in Asia. The completed project will aim to relieve the shortage of water supply for daily life and industries of Kuala Lumpur and Selangor State in the future (Supplying Approximately 1.89 million m<sup>3</sup>/ day). Of 44.6 km length, 3 sections comprising 34.6km excavated by Tunnel Boring Machine (TBM), 4 sections with length of 9.1km is by New Austrian Tunneling Method (Conventional Tunneling), and 1 section with length of 0.9 km by Cut and Cover method. In this paper, the challenges in long-distance tunneling (with TBM drives up to 11.6 km length) in order to achieve high-speed TBM excavation under hard rock conditions with high overburden, adverse geological conditions and heavy water ingress are discussed.

The TBMs have to excavate through granite rock with uniaxial compressive strength of 150-200 MPa. It is expected that more than 85% of the tunnel alignment consists of hard granite in good condition (Rock Classification A&B). In addition, the maximum overburden depth is 1,246 m. During the excavation of TBM we have encountered the heavy water ingress rate of 10t/min, rock burst and hot spring water in some areas.

Under the conditions mentioned above, in order to achieve high-speed TBM excavation, the countermeasures below have been considered and executed;

- Sufficient Thrust Force for hard rock excavation (14,000 kN)
- Use of 19-inch cutter disk (19 inch; 27 pieces and 17 inch; 8 pieces)
- Development of cutter monitoring system
- Use of sprayed fiber mortar system for early support installation
- Use of Tunnel Seismic Prediction (TSP) in order to detect unforeseen ground condition and water ingress location
- Use of high-performance drilling system for probe drilling and drilling data analyzing system
- Analysis of real-time TBM machine data during excavation in order to determine rock class
- Use of real-time TBM guidance system

The application of the above measures has provided steady improvement in TBM excavation progress. At present the maximum monthly progress is 660m. We are still challenging to improve our rate.



Progress of the Pahang-Selangor Interstate Water Transfer Tunnel.