

The Tunnelling and Underground Society has a total membership of 632 which is made up of individual and corporate members.

During 2010 monthly technical seminars were held at the SMRT auditorium with a capacity of 140 participants followed by networking sessions at the Bobby's bar.

Two Training Courses, one on the "Planning and Design of Tunnels" and another on the "Construction of Tunnels", were conducted with attendance by local and regional participants.

The Hulme prize paper competition for young engineers below the age of 35 years was held in September 2010.

This was won amid stiff competition by Rizwan Muzzamill of Mott MacDonald with his paper on "Quick assessment of ground settlement limits to restrict building damage to "Slight" category".

This years' TUCSS Annual Lecture was given by Dr. Alastair Biggart which was a repeat of his Harding Lecture to the BTS entitled "The Development and Use of Closed Face Tunnelling Machines". The event was attended by over 150 members and guests. A dinner gathering was held after the lecture at the famous Jumbo sea food restaurant.

TUCSS Annual Dinner was held at the Resorts World Sentosa in October 2010. This event was attended by over 600 members, spouses and guests.

The winners of the Hulme Prize 2010 were presented with their awards during the dinner by Prof. Zhao Jian.

The recipients of the Geotechnical Awards 2010 from NUS and NTU were also presented with their certificates by TUCSS Vice President, Mr. Kulaindran Ariaratnam. TUCSS President Mr. Ow Chun Nam gave a welcome address and acknowledged the generosity and contribution of the five Annual Dinner sponsors.

Other notable events held during the year include two TUCSS Golf Tournaments, Technical site visit and participation at the Singapore International Water Week.

TUCSS renewed the Memorandum of Understanding (MOU) with Institution of Engineers Singapore (IES) and Association of Consulting Engineers Singapore (ACES) in 2010 for the IES/ACES Accreditation Scheme for Site Supervisory Staff (Tunnel).

During 2010 TUCSS Sub-Committee considered and responded to applications for RE/RTO (T) submitted through IES.

A brief description of the tunneling works in the railway, roads, utilities and bulk

storage that are being planned, designed or under construction during 2010 is given below.

Underground Railway Tunnels

During 2010, Stages 1 & 2 of the fully underground Circle Line (CCL) railway that connects from Bishan to Dhoby Ghaut interchange stations were opened for revenue service. This was after the opening of Stage 3 in 2009. The construction works for the remaining Stages 4 & 5 of the 33.3 kilometre long railway with 29 stations at a cost of approx \$8 billion, are now complete and are expected to become operational in late 2011.

The construction works of the Downtown Line Stage 1 (DTL1) have been progressing well in 2010. The works comprise 4.3 kilometre route length of tunnels with 6 stations in the Central Business District. In order to minimise access disruptions to the financial centre and offices, major traffic diversion measures including the construction of a temporary viaduct were put in place.

Site works related to the 16.6 kilometre long Downtown Line Stage 2 (DTL2) which comprises one depot and 12 stations, including three interchange stations at Little India, Newton and the Botanic Gardens were commenced in 2010. These 3 interchange stations will link to the North East Line (NEL), North South Line (NSL) and Circle Line (CCL) respectively, giving commuters greater accessibility to the rest of the island and significantly improving travel time.

The 21 kilometre long Downtown Line Stage 3 (DTL3) is the final stretch of the 42 kilometre Downtown Line. It will enhance rail connectivity in the eastern corridors to the Central Business District and developments in the Marina Bay area. Fully underground, DTL3 comprises 16 stations, including three interchange stations at MacPherson, Tampines and Expo. These interchange stations will link to the Circle Line (CCL) and the East West Line (EWL), providing greater accessibility and significantly improving travel time for commuters. Detailed design of this line was completed during 2010 and tenders for construction contracts are being invited/awarded at present. DTL3 project will require the use of 28 tunnel boring machines (TBMs) and the Land Transport Authority (LTA) has directly placed orders for 6 EPBMs from Shanghai Tunnelling and 4 EPBMs from Herrenknecht recently.

DTL project is fully underground and caters for driverless 3-car train sets that offer a line capacity for 500,000 passengers per day. It is being implemented at an estimated cost of approximately \$10 billion.

LTA called consultancy tenders during 2010 for the design of 25 kilometre long fully underground Thomson line comprising of 23 stations. Thomson Line will travel northwards from Marina Bay through the Central Business District and up through Ang Mo Kio all the way to Woodlands connecting estates such as Sin Ming, Kebun Baru, Thomson and Kim Seng which do not now have a direct MRT link. The consultants will be appointed in early 2011 for this line which is expected to become operational in 2018.

Underground Road Tunnels

The dual five-lane, 5 kilometre long Marina Coastal Expressway (MCE) will be the tenth expressway in Singapore. It will form a key element of the strategic island-wide road network to support the long-term growth of Singapore.

In January 2009, LTA awarded the last of six major civil construction works contracts for the MCE. In addition, LTA has also awarded four contracts for the provision of various Electrical & Mechanical (E&M) and cladding systems with a total value of \$4.1 billion. Works for the MCE have commenced in April 2009 following the ground breaking ceremony at Marina South. Good progress was made during 2010 with some sections reaching formation level.

The Singapore government has recently approved the alignment of the North-South Expressway (NSE) between Admiralty Road West and Toa Payoh Rise. The NSE, announced under the Land Transport Master Plan, will be Singapore's 11th expressway. One of the most challenging engineering undertakings to date, the NSE will serve the North-South corridor, bringing faster travel from residential estates such as Woodlands, Sembawang, Yishun, Ang Mo Kio, Bishan and Toa Payoh to the city centre.

To meet the long term growth in travel demand generated by developments in the North and North-Eastern sectors of Singapore, the dual three-lane carriageway will consist of a combination of viaduct and road tunnels to provide a new high speed road link. The NSE will also connect to existing expressways, such as the Seletar Expressway (SLE) and major arterial roads like Marymount Road.

LTA will be building a new 1.3 km long two lane road tunnel to meet demands from the expected growth in traffic as a result of the continued development in the Sentosa Island and Harbour Front areas. The Sentosa Gateway Tunnel will complement a suite of road improvement measures that LTA announced in February 2008 to cater for the increase in traffic demand from the Resorts World development at Sentosa. Construction of the tunnel by the sprayed concrete tunneling method will commence in early 2011 and is expected to complete by end of 2015.

Utility Tunnels

The Public Utilities Board (PUB) is undertaking a water supply programme known as the NEWater Infrastructure Plan Transmission Mains Extension. This project is to extend the NEWater (NW) transmission network to Jurong Island, to meet the increasing demand of NEWater by industries on Jurong Island. It consists of the installation of approx 5.5 kilometres of 2.2 metre diameter and 9.0 kilometres of 1.6 metre diameter NEWater pipelines on mainland and Jurong Island by surface laying and pipe jacking methods. The construction of an approximately 3 kilometres long, 6 metre diameter undersea tunnel, with twin 2.2 metre diameter pipelines from Jurong Island to mainland Singapore forms part of this project. The construction contracts for these works were awarded in 2010.

The Singapore Power is proposing to construct 34 kilometres long, deep cable tunnels of 6 metres internal diameter. Design consultancy contracts for these tunnels and shafts were awarded in 2010 and construction works are expected to start in 2012 and continue till 2018.

Jurong Cavern

The first underground hydrocarbon bulk storage facility in Singapore and South-east Asia is being constructed in Jurong Island. Construction contract was awarded to Hyundai E&C in 2009 to construct 8 km long tunnels and five caverns from the two completed access shafts. Each cavern is made up of two storage galleries of 20metre (W) x 27metre(H) x 340metre(L), approximately nine storey high. The overall storage capacity is approximately 1.47million cubic metres. Phase 1 of this project is expected to be completed by 2014.