

**Name:** The Institution of Engineers, Malaysia

**Type of structure:** A non-profit, learned society whose primary function is to promote and advance the science and profession of engineering in any or all of its disciplines and to facilitate the exchange of information and ideas related to engineering.

**Number of members:** Over 40,000 members inclusive of corporate members, graduates, associates and students. It is the Secretariat of ASEAN Engineers, APEC Engineers and International Engineers.

## ASSOCIATION ACTIVITIES DURING 2017 AND TO DATE

Tunnelling and Underground Space Technical Division of The Institution of Engineers, Malaysia (IEM TUSTD) has been very active and continued working to undertake activities related to the promotion and advancement of the science and engineering of tunnels and underground space technologies. Six talks, 3 courses/seminars and 2 technical visits have been conducted in 2017.

IEM, together with IEM Training Centre (IEMTC), organised the first Southeast Asian Conference and Exhibition in Tunnelling and Underground Space 2017 (SEACETUS 2017) in Kuala Lumpur on 18th – 19th April 2017 which was well attended by 370 participants with over 20 exhibitors. Separately IEM also organized a Two-Day Short Course on Principles for Tunnel Design which was supported by ITACET Foundation. Both events are endorsed by ITA. IEM Academy (IEMASB) and IEMTC also conducted ITACET Training courses in 2000, 2006, 2011, 2015 and 2017. Hence IEM is committed to growing tunnelling and underground space technology training and education.

Being an active Member Nation of ITA, IEM submitted a bid to host the World Tunnel Congress 2020 and has successfully won the bid at the recently concluded ITA-AITES 43rd General Assembly in Norway. On 6th October 2017, IEM organized a One-Day Short Course on TBM Technology with Herrenknecht which is part of the satellite events of the World Tunnel Congress 2020. A joint China/Malaysia Seminar is in the pipeline scheduled in September 2018.

## CURRENT TUNNELLING ACTIVITIES

### Klang Valley Mass Rapid Transit (Line 1 & 2), SBK Line & SSP Line

The Klang Valley Mass Rapid Transit (KVMRT) is the first largest-of-its-kind transport infrastructure project in Malaysia, which involves the construction of a rail-based MRT



### Klang Valley Mass Rapid Transit (Line 1), SBK Line

system, together with the existing urban rail network, and will form the backbone of the public transport system in the Greater Kuala Lumpur/Klang Valley region. Line 1 (SBK Line) - The 51km long alignment, runs underground for a distance of 9.5km in twin bored tunnels beneath the centre of Kuala Lumpur while the rest of the alignment is elevated. The line, with 31 stations of which 7 are underground, was recently completed ahead of time with substantial cost saving (i.e. MYR21bn from the budgeted MYR23bn). The Government of Malaysia has allocated MYR32bn for the implementation of the MRT Line 2 (SSP Line) in which the construction and tunnelling is on-going. The 52.2km line will include a 13.5km of underground tunnels and 38.7km of viaduct. There will be 37 stations, 26 of which will be elevated with 11 underground stations.

### Ulu Jerai Hydroelectric Project

The Ulu Jerai Hydroelectric Power (HEP) scheme was initiated by the Tenaga Nasional Berhad, Malaysia to provide additional 326 Gigawatt hours (GWhr) power generation for the increase in electricity demand and to improve the reliability of the electricity supply. The HEP scheme is located in the Cameron Highlands, Pahang state, West Malaysia. The project involves the construction of an underground plant, which will house two Francis turbines with a power out of 191MW each and the construction of approximately 26km of hydraulic tunnels, of which approximately 15km is excavated by TBM and the remaining by conventional tunnelling

### Pahang – Selangor Raw Water Transfer Tunnel

In June 2009, Malaysia began a project to build the Pahang – Selangor raw water transfer tunnel. It is to be one of the longest and biggest tunnels in Southeast Asia and the sixth longest in the world – a 44.6km long, 5.2m in diameter tunnel with a water delivery capacity of 1.89bn litres per day, laid underneath a mountain range between Pahang and Selangor states. This huge excavation project was successfully completed in February 2014 and overcame various challenges (e.g. over 50m high empty cavern inside a mountain, pressurized spring water that shot up as much as 24.6tons of water per minute, rock burst, etc.) thanks to the strong solidarity of its multinational team consisting over 1,000 people from 15 countries.

### Bukit Berapit Rail Tunnel

Bukit Berapit Rail Tunnel, at 3,300m, the twin tunnel is the longest rail tunnel in Malaysia. It is located at Bukit Berapit near Bukit Gantang, Perak state, Malaysia. It was made as a part of Ipoh-Pahang Besar Electrified Double Tracking Project. The tunnel was constructed as an alternative to the old winding tracks with many tunnels.

### Stormwater Management and Road Transport Tunnel (SMART)

An example of successful urban underground development to help solve urban problems, the innovative SMART project is a dual-purpose tunnel. The project provides a stormwater diversion scheme including flood-water storage reservoir and a 9.7km, 11.8m diameter bypass tunnel, sufficient to save the Kuala Lumpur city from flooding at the time of inclement weather in the foreseeable future. With no major flood events over most of the years, the dual-purposes tunnel was engineered, with a waterway beneath the double-decks motorway built into the central 3km section, relieving traffic congestion by providing 2x2 traffic lanes for cars connecting the city centre to the southern gateway, the Kuala Lumpur - Seremban Highway.

## FUTURE TUNNELLING ACTIVITIES

### Klang Valley Mass Rapid Transit (Line 3), Circle Line

The Circle Line which is the third line of the KVMRT project is at its reference design stage and tendering stage (build and finance



### Ulu Jerai Hydroelectric Project

contract), of which is estimated to cost about MYR40bn. Line 3, a 40km long alignment with 32km underground and total of 26 stations (19 underground stations), aims to interconnect all other transit system and serve the key major developments surrounding the Kuala Lumpur centre business district. Recently, the Government of Malaysia has decided to expedite the implementation of Line 3 with target completion in 2025.

### East Coast Rail Link

To unlock the potential growth of the East Coast Economic Region (ECER), the East Coast Rail Link (ECRL) has been identified as a key enabler for the east coast region (Kelantan, Terengganu and Pahang states) that can connect economic centres including industrial areas and provide a link to Greater Kuala Lumpur/Klang Valley efficiently. ECRL is a high impact infrastructure project that will form the backbone of ECER's multimodal transport infrastructure in complementing existing road/expressway infrastructure and KTMB East Coast Line and ports. A total of 688km railway (including approximate 80km connecting ITT Gombak to Port Klang), involves construction of 49km of tunnel at 19 different locations with the longest, the 17.9km tunnel at Bukit Tinggi – Gombak crossing the Titiwangsa mountain range. The project was awarded to China Communications Construction Company (CCCC) at a cost of MYR55bn and construction commenced in early 2018.

### Light Rail Transit No. 3

The Light Rail Transit (LRT 3) connecting the Bandar Utama and Johan Setia districts in the western corridor of Klang Valley, the 37.7km line would run mostly on an elevated alignment, with 2km of tunnel. 25 stations will be positioned along the route. Construction began in 2017 with the expected completion in 2021.

### Kuala Lumpur – Singapore High Speed Rail

The High Speed Rail (HSR) serves as an alternative mode of public transport between Kuala Lumpur and Singapore. It is seen to be in line with the transformation of the nation as it links two urban agglomerations to meet growing demand, catalysing economic growth and enhancing long term economic competitiveness while improving the quality of life of its people. The HSR will connect 6 cities in Malaysia to Singapore, following a coastal route. The stations that have been identified are the terminus station in Kuala Lumpur (at Bandar Malaysia), Bangi-Putrajaya, Seremban, Ayer Keroh, Muar, Batu Pahat, Iskandar Puteri and the final stop in Singapore (at Jurong East). The KL terminus station at Bandar Malaysia will interchange with Mass Rapid Transit (Line 2 & Line 3), Airport Line (ERL) and KTM Commuter. The alignment will be expected in tunnel for the first few kilometre heading south of the Kuala Lumpur city. The railway will travel in further lengths of tunnel (total 14.9km), on viaduct and at-grade as it heads south on its 327.7km journey

before crossing the border into Singapore. The travel time will be 90 minutes. The construction cost is estimated to be MYR50-60bn. It is looking forward to commencing construction by next year to enable operations to start in 2026.

### Penang Undersea Tunnel

The Penang Undersea Tunnel is a 6.5km

tunnel which will connect Butterworth, Seberang Perai in the east to George Town, Penang island in the west. When completed, it will become the first undersea tunnel in Malaysia and second in the Southeast Asia. There will be a toll plaza at the undersea tunnel. With a cost of MYR6.3billion, the tunnel will be the largest privately funded public works project in Malaysia.

## APPENDIX A: List of Major Tunnelling Projects in Malaysia (as in 2018)

Project	Total Length of Tunnel (m)	Construction Period
<b>Water Supply</b>		
Pedu/ Muda Dam - Saiong Tunnel	6,800	1967-1973
Ahning Dam	*	1980s
Upper Muar Dam	*	1990s
Sg. Kelinci Dam	6,200	1994-1996
Beris Dam	*	2000-2004
Sg. Selangor Dam	~700	2000-2003
Kinta Dam	60	2006
Triang Water Transfer	12,600	2010-2011
Pahang-Selangor Interstate Raw Water Transfer	44,600	2011-2014
Langat 2 Water Transfer	2,530	To be constructed
<b>Railway</b>		
KTM Butterworth – Singapore Line		
• Seremban	122	1901 (1995)
• Kuala Lumpur	152	1926
• Bukit Berapit	851	1990
KTM Gemas – Tumpat Line		
• Cegar Perah	137	1925
• K Pergau	1,332	1929-1930
• Ulu Temiang	852	1930
Light Rail Transit (LRT) Kelana Jaya Line	4,400	1994-1999
Ipoh – Padang Besar Electrified Double Track		
• Bukit Berapit	3,300	2008-2013
• Larut	390	2008-2013
KVMRT Sungai Buloh – Kajang Line	9,500	2011-2015
KVMRT Sungai Buloh – Serdang – Putrajaya Line	13,500 + 69 + 180	Under construction
KVMRT Circle Line	Est. 32,000	To be constructed
Light Rail Transit (LRT) No. 3	Est. 2,000	To be constructed
East Coast Rail Link	Est. 49,000	To be constructed
KL – Singapore High Speed Rail	Est. 14,900	To be constructed
<b>Road/ Highway</b>		
Karak Highway – Genting Sempah Tunnel	1,000 + 800	1978, 1997
Changkat Jering Highway – Menora & Meru Tunnel	800	1983-1986
Penchala Link	720	2003-2004
Jelapang – Selama – Batu Kawan Expressway	Est. 2,400	To be constructed
Penang Undersea Tunnel	Est. 6,500	To be constructed
<b>Sewerage</b>		
Pantai Trunk Sewer	5,400	2004-2006
<b>Hydro-electric Power</b>		
Batang Padang HEP	41,000	1959-1968
Temenggor HEP	3,100	1974-1978
Tenom Pangli HEP	4,400	1978-1984
Kenyir Dam	2,800	1978-1985
Pergau Dam	30,200	1991-1997
Sg. Piah HEP	24,000	1992
Murum Dam	2,700	2008-2013
Bakun Dam	4,500	2011
Hulu Terengganu HEP	1,290	2010-2016
Ulu Jerai HEP	24,000	2011-2017
[Mining]		
Sg. Lembing Tin Mine	Reaching >700m deep	1905-1986
Kaki Bukit Tin Mine	*	1909-1960s
Batu Arang Coal Mine	As deep as 300m b.g.	1913-1960
[Other Special Purposes]		
SMART (Dual-purpose Tunnel)	9,700	2003-2006
Ammunition Depot, Tg. Gelang (Storage Tunnel)	*	*

\* Not available