Sustainable Construction Practice Through Trenchless Technology

by Ir. Syed Rajah Hussain Shaib Bin A.H. Mohd Haniff

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On 12 May 2018, Ir. Md Zuki Muda, a General Manager with Indah Water Konsortium (IWK) was invited to give a talk during the TUSTD pre-AGM. The topic of his talk was *Sewerage Maintenance and Construction in Malaysia – Sharing IWK's Challenges and Experiences.*

In his Opening address, Ir. Md Zuki shared 3 main objectives of his talk. The three objectives can be summarised as follows:

1. To share IWK experiences in managing Sewer Systems in Malaysia which involves Planning, Design, Construction, Commissioning, Operations and Maintenance
2. Highlights of IWK's experiences with usage of Trenchless Technologies in its sewerage scheme/projects.
3. To highlight the use of Trenchless Technology as a Green Technology approach towards a Sustainable Construction Practice.

Ir. Md Zuki started his talk by travelling back in time into the formation of Indah Water Konsortium. IWK was formed in 1994 as a Malaysia National Sewerage Company and in year 2000, it was fully taken over by the Government of Malaysia and operates under the Ministry of Finance Malaysia. Indah Water Konsortium operates in 10 states and 3 Federal Territories, serving an equivalent population of 24.48 million people. Indah Water Konsortium operates and maintains 6,691 sewage treatment plants and a total of 19,031km of sewerage lines.

The Malaysia sewerage system uses the Non-Combined Sewer System and typical sewerage pipe materials are listed as follows:

TYPICAL SEWER PIPES MATERIALS

1. Vitrified Clay Pipe (VCP) & HDPE - for gravity sewer
2. Reinforced Concrete pipe - for gravity sewer larger than 700mm diameter.
3. Ductile Iron - high load application such as pressure sewer, in pumping stations.
4. GRP pipe – typically used for vacuum sewer.

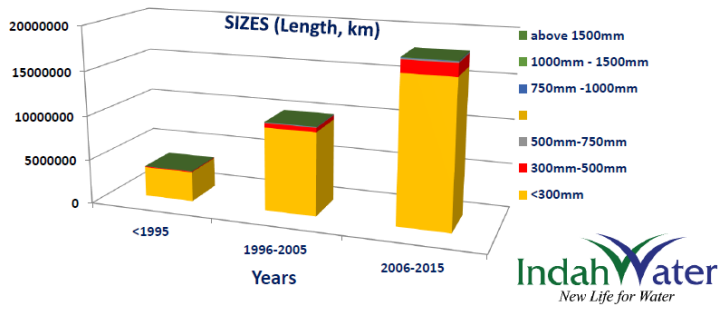

Figure 1: Showing the increasing in sewerage length from 1995 to 2015 Governmental publication, i.e. in the Malaysian Sewerage Industries Guideline.

The sewerage industry in Malaysia can be divided into 4 main categories where only a small percentage is in the Rehabilitation category. It is expected that this category will increase as rehabilitation of old sewer becomes more critical as in lieu of replacing the pipeline. Hence the amount of tunnelling work involving new pipeline is of considerable quantity. The most common method is pipejacking, whlist a slightly less common method - the segmental. The difference between both of these methods could be reflected in the constructability of a small to a larger diameter tunnel,

Method (Normally used in Sewer in Malaysia)	
Rehabilitation Repair	Resin Patch Repair
	Top Hat Lateral Seal
Rehabilitation Renovation Structural	CIPP (Cured in Place Pipe Lining)
	Spiral wound lining
Rehabilitation Replacement	Pipe Bursting
New Installation Trenchless	Pipe Jacking
	Micro tunneling

Figure 2: COMMON TRENCHLESS METHODS USED IN MALAYSIA

The Pantai Trunk Sewer Project was an example of segmental tunnel constructed between the years 2004 and 2007. It consisted of a 5.4km ŀlong of 2.5m and 2.8m internal diameters segmental tunnel built as a trunk sewer to serve the Pantai area to its new Pantai Sewage Treatment Plant. The sewer network subproject totalling 13km long involved the diversion of 5 sewerage lines.

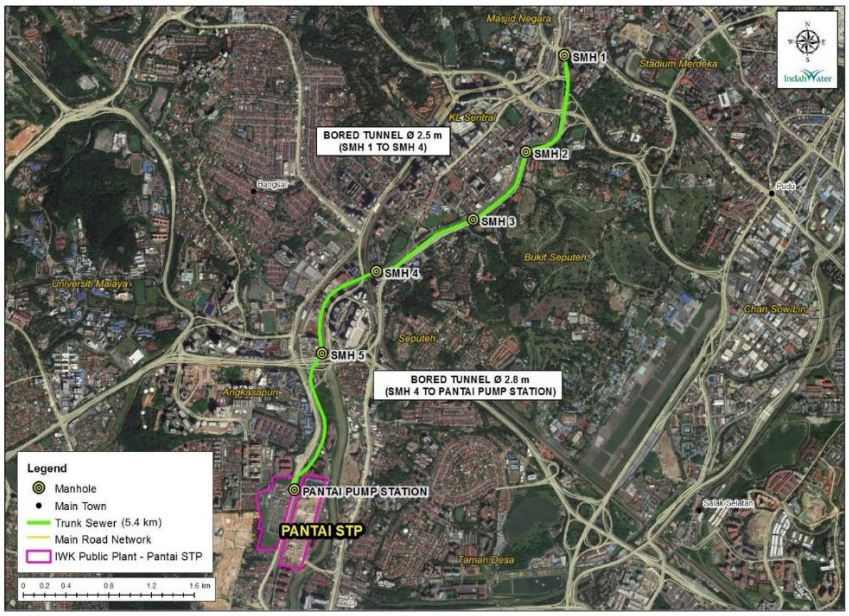

Figure 3: The Pantai Trunk Sewer Tunnel Line

The talk continued with the revealing of the current projects Under Greater Kuala Lumpur. It was revealed that Trenchless Technologies especially on sewer rehabilitation has been introduced in the Greater Kuala Lumpur (GKL) projects since year 2012.

A majority of Trenchless Technologies used for construction added up to a bulk costs of RM2.3 billion with 7% for trenchless rehabilitation works. Rehabilitation covered 46km long and new trenchless construction covered 207km long.

PROJECT LOCATION	SCOPE OF WORKS INVOLVING TRENCHLESS METHOD	LENGTH (m)
PTG056, Jalan TP5 Subang Jaya, Selangor Darul Ehsan.	· Pipejacking at Jalan TP5 - 600mm dia.RCJP	30
	· Pipejacking crossing KESAS Highway -600mm dia. RCJP using 1500mm dia. RCJP as pipesleeve	210
Subang Jaya, Selangor Darul Ehsan.	· Pipejacking at Jalan Subang Utama SS13- 300mm dia.RCJP	220
PJA363, Taman Medan, Petaling Jaya, Selangor Darul Ehsan	· Pipejacking at Jalan PJS 2/D7 ~~hingga ke~~ to PJA363, Taman Medan - 225mm dia.RCJP	500
Taman Seri Muda, Shah Alam, Selangor Darul Ehsan.	· Pipejacking at Jalan Harapan 25/29 ~~hinggake~~ to SAM001, Taman Seri Muda - 375mm, 450mm & 525mm dia. RCJP	687
SAM010 Persiaran Kelang, Seksyen 27, Shah Alam, Selangor Darul Ehsan.	· Pipejacking at Persiaran Kelang, Seksyen27, Shah Alam - 225mm & 300mm dia. RCJP	567
GBK009 Taman Bidara Selayang, Selangor Darul Ehsan	· Pipejacking at Taman Bidara, Selayang -225mm dia. RCJP	426
	TOTAL LENGTH	2640m

Figure 4: CURRENT SEWER REPAIR PROJECTS

Figure 5: Pipejacking is one of the most common methods of tunnelling in Malaysia

Why Trenchless Technologies?

1. PUBLIC

    I. Prevent traffic congestion
    II. Environmental Protection- Control from CO2 & dust pollution
    III. Safety Precaution – Public encroachment to excavation site minimised

2. AMENITIES

    I. Avoiding damaging nearby structures
    II. Prevent in damaging other utilities
    III. Prevent disturbance to existing soil condition

3. PROJECT

    I. Less movement of constructional machinery
    II. Cost saving at Congested area e.g. not requiring mill & pave for road reinstatement
    III. Circumventing impractical site condition, e.g. crossing river

Ir. Md Zuki informed of Malaysia's commitment to the 2015 Paris Agreement on Green Technology Policy. Malaysia's Green Technology Master Plan describes the 6 sectors identified for sustainable construction practice where the Construction Industry Transformation Programme (CITP) encourages proper planning to reduce the impact of construction industries to the environment. And Trenchless Technology can be one such ways to reduce impact to the environment.

Figure 6: Green Technology Master Plan

Ir. Md Zuki also explained the challenges that the contract faces especially in terms of unpredicted ground conditions. He explained that even with the acceptable numbers of SI boreholes done, ground condition changes drastically. For instance, a Tunnel Boring Machine had sank under very soft ground condition and immediate action was required to safe the tunnel alignment. The proposal to improve the ground condition through grouting works had proven to be of vital importance as this had contributed to the successful completion of the tunnelling works

Ir. Md Zuki ended the talk by giving a few salient points with respect to the as below.

1. With new innovation and automation, repairing and rehabilitation method for sewer network has been changed to suit rapid development areas.

2. Trenchless Technology should be promoted as a Green & Low Carbon Footprint Construction Practice.

3. Efforts from all stakeholders for a widespread use of Trenchless Method as a Sustainable Construction Practice is paramount.

4. Trenchless Technologies may have many advantages in the near future – economics of cost need to be addressed for competitive of applications locally and elsewhere.