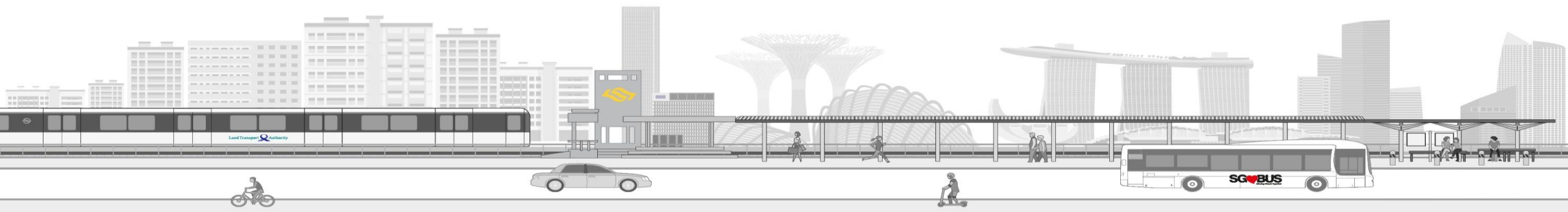


Theme 3: Safe Assets

Problem Statement 6:

Improve the road tunnel cleaning process through technology innovation (e.g. automation and/or standalone modular cleaning systems)

Presenter – Tan Yi Chong (Vertical Transport and Tunnel E&M)



THEME 3: SAFE ASSETS

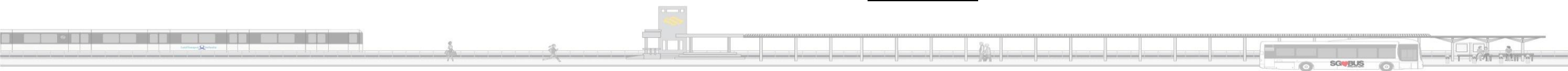
6. Tunnel Cleaning Operations

Why

- Manpower crunch, especially for manual labor.
- Vehicles are nearing the statutory lifespan
- Costly in terms of vehicle maintenance
- Occasional vehicle downtime and property damage during cleaning

Objectives

- Explore tech-enabled ways (e.g. automation, smarter machines, better materials, etc.) to be resource efficient
 - To automate and use less manpower
 - To explore ways to use less water, less chemicals, less energy
- To optimise the systems to achieve same or better outcome with less manpower and higher availability
- To reduce O&M cost



THEME 3: SAFE ASSETS

6. Tunnel Cleaning Operations

Current Cleaning Process

Tunnel Cleaning Team

- 1 x Supervisor
- 2 x Brush Operators (Front & Back)
- 3 x Niches Cleaning
- 3 x Walkway & Kerb Cleaning

Total 9 workers
(excluding 3 drivers)



Workers manually cleaning Niches housing sensitive equipment



Workers manually cleaning Walkway & Road Kerbs



Brush Operator controlling back brush

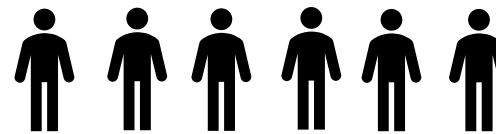
Cleaning Convoy



TMA



Water Truck (2000 L tank) with generator for jet spray



Manual Cleaning Team



TWV (5000 litres tank)



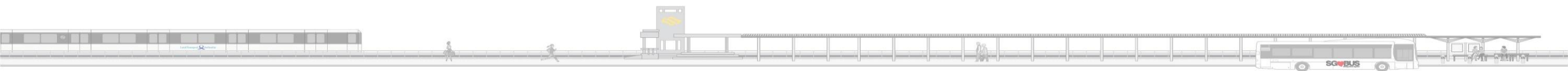
Brush Operators Supervisor

THEME 3: SAFE ASSETS

6. Tunnel Cleaning Operations

Pain Points

| S/N | Pain Points |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Truck and Washing system are integrated, resulting in <u>system downtime</u> if either module is down |
| 2. | Vehicle parts <u>not commonly available</u> and <u>overseas support</u> is required at times |
| 3. | Current <u>brushes are unable to clean the maintenance walkway & road kerb</u> , and are manually cleaned currently |
| 4. | Requires relatively <u>high manpower</u> per deployment: <ul style="list-style-type: none">• 6 x manual workers• 2 x brush operators• 3 x drivers |
| 5. | Workers are subjected to <u>traffic risk</u> |



THEME 3: SAFE ASSETS

6. Tunnel Cleaning Operations

Questions & Answers:

Q1: What is length of each tunnel, for those with claddings and no claddings?

A1: Estimated length of tunnels (left and right walls) to be washed : 32.15 km

Estimated tunnel length with cladding (Wash monthly): 26.3 km

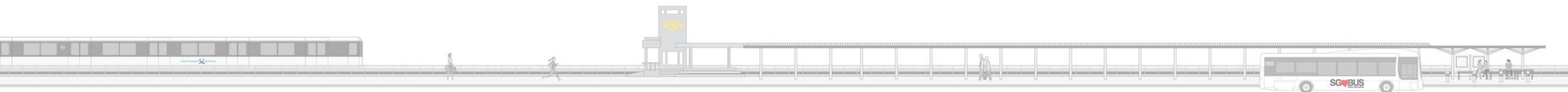
Estimated tunnel length with no cladding (Wash twice a month) : 5.85 km

Q2: What is the distance between niches – e.g. sensitive equipment? Are they at both sides of tunnel?

A2: 50m between niches at only the left tunnel walls

Q3: Tender duration of Tunnel Cleaning Operation

A3: ~ 3 years



Thank You



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