



# IRSC 2023

INTERNATIONAL RAILWAY  
SAFETY COUNCIL

**“Reshaping Railways in an Uncertain World”**

CAPE TOWN, OCTOBER 1 - 6, 2023

HOSTED BY





HW Chan, Deputy General Manager;  
Shera Lai, Senior Technology Development Manager  
MTR Corporation

## Machine Vision-Based Tunnel Equipment Inspection System



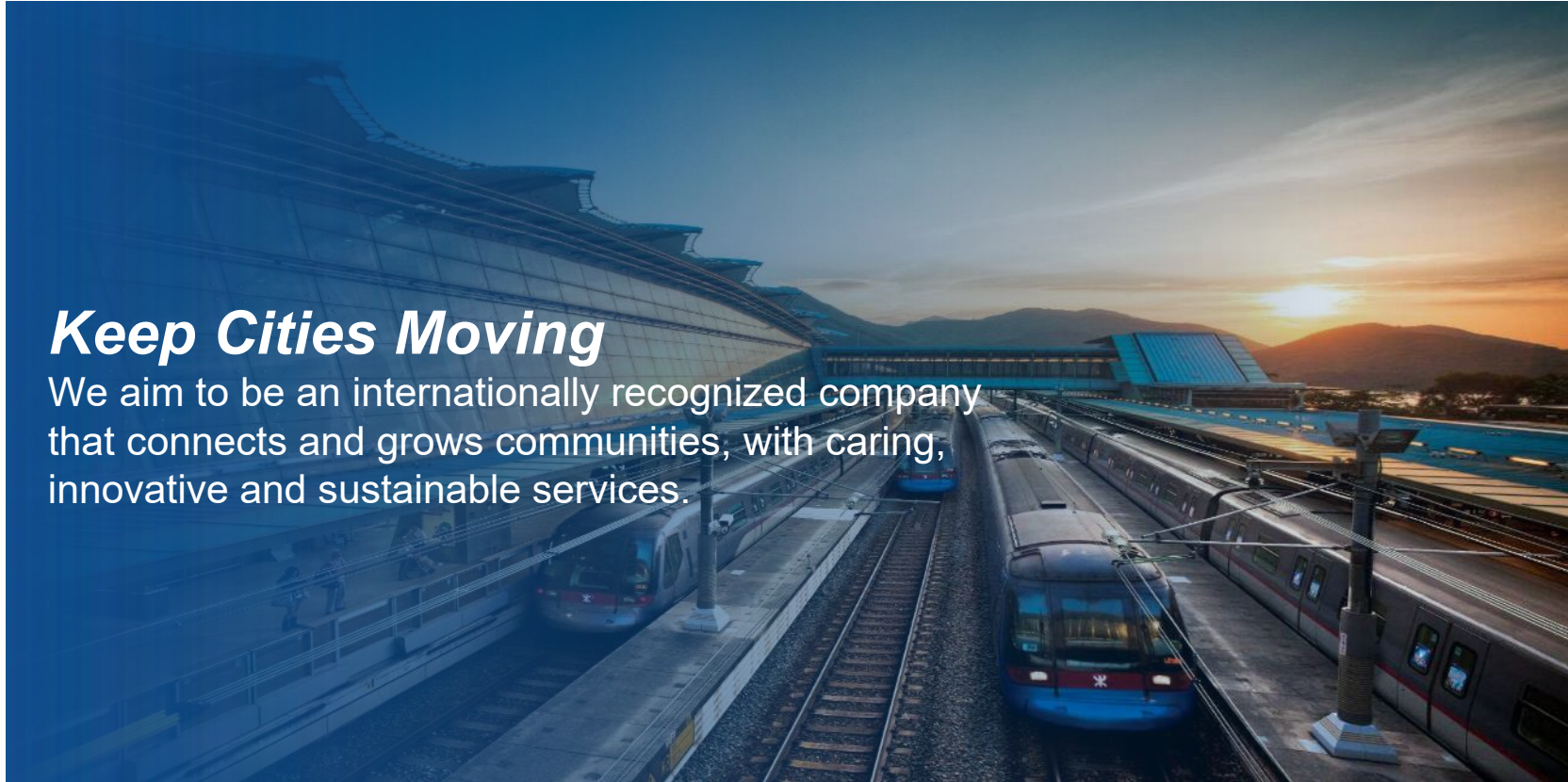
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# Our Mission

## *Keep Cities Moving*

We aim to be an internationally recognized company that connects and grows communities, with caring, innovative and sustainable services.





# Steady Growth in Our Global Portfolio

**Mälartåg**

- 25k, 1060km
- 44 stations

**Stockholm Metro**

- 874k, 108km
- 100 stations

**Stockholm commuter Rail**

- 331k, 247km
- 54 stations

**MTR Express**

- N/A<sup>o</sup>, 462km\*
- 7 stops

**Elizabeth Line**

- 1.9M, 128km
- 41 stations

**South Western Railway**

- 414k, 998km
- 210 stations

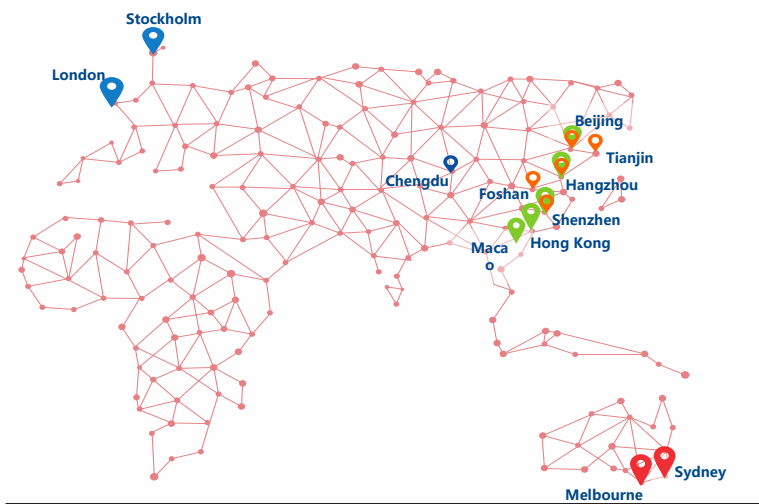
=PPP

=O&M

=Open Access

=Property

• Patronage numbers are taken on an average weekday (as of end-Dec 2022)



As at end-Dec 2022	
Route Length	3,321 km **
Average Weekday Patronage	7 Million
Staff	~35,000 ***

**Sydney Metro North West and City & Southwest Line**

- 50k, 66km
- 31 stations

**Melbourne Metropolitan Rail Service**

- 434k, 432km
- 222 stations

**Property Development (TOD)**

- Tiara, Shenzhen
- Chencun Station, Foshan
- Dawayao Station, Beijing
- Hangzhou West Station, Hangzhou

**Investment Property**

- Ginza Mall, Beijing
- TIA Mall, Shenzhen
- Beiyunhe Mall, Tianjin

**Property Management**

- Shenzhen Tiara
- Beijing AO City Fortune Ctr

**Chengdu Station Commercial**

- Station Retails inside station boxes
- Station Commercial Opportunities
- Consultancy of utilization of underground spaces

**Beijing Metro Line 4, Daxing<sup>1</sup>, 14, 16<sup>2</sup>, 17<sup>3</sup>**

- 1.4 M, 200km
- 33 stations

**Hangzhou Metro Line 1<sup>4</sup>, 5**

- 1.2M, 110.6km
- 33 stations

**Shenzhen Metro Line 4<sup>5</sup>, 13**

- 451k, 53.7km
- 39 stations

**Macau LRT Taipa Line**

- 9.3km
- 11 stations

# Service in our Home City - Hong Kong

**1.5+ billion**

Total Patronage

**99.9%**

Passengers Journeys On-time

**98 stations**

Heavy Rail Service

**68 stops**

Light Rail Service



# Embracing Technology and Innovation



## Seamless

Customer journey smarter, more connected & in-control



## Personalised

Experience **more tailored, engaging & caring**



## Inclusive

Better care for **disabled (social inclusion)**



## Efficient

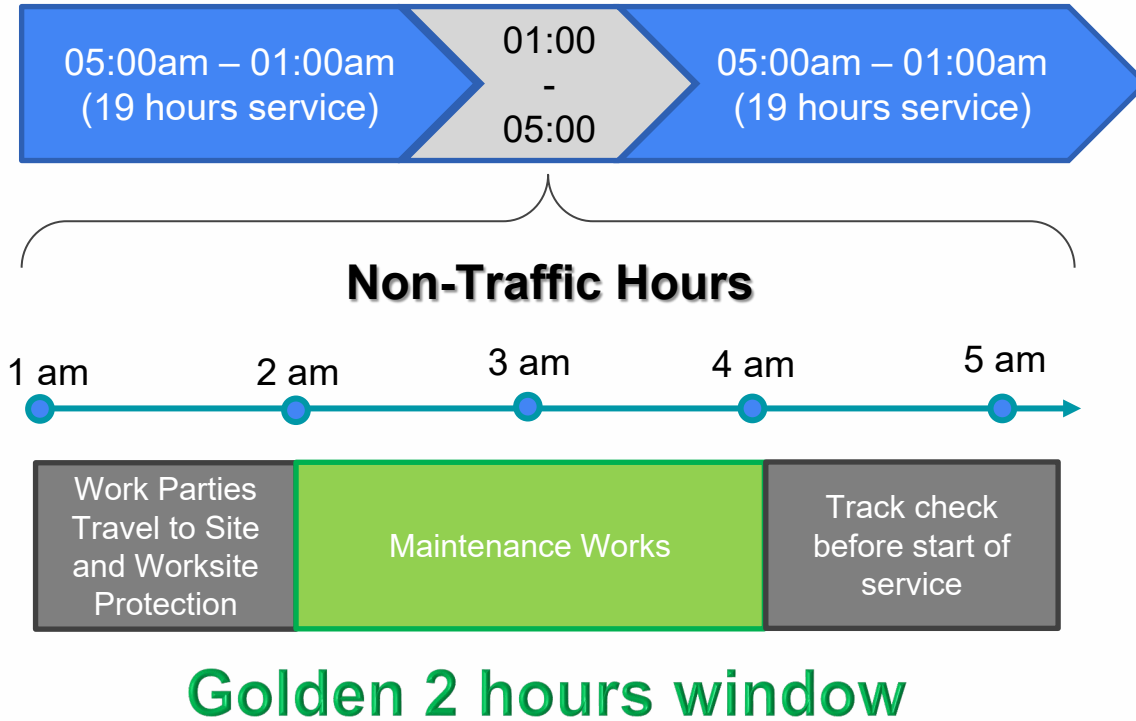
More **efficient** and **optimize operations** & resource allocation



## Sustainable

More **green & financially sustainable**

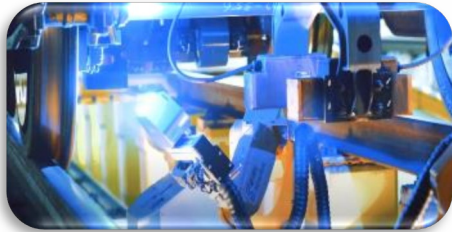
# 19 hours Daily Service and Maintenance during Non-Traffic Hours



# Unleash Maintenance Productivity



**Conduct more inspection tasks with the same maintenance resources**



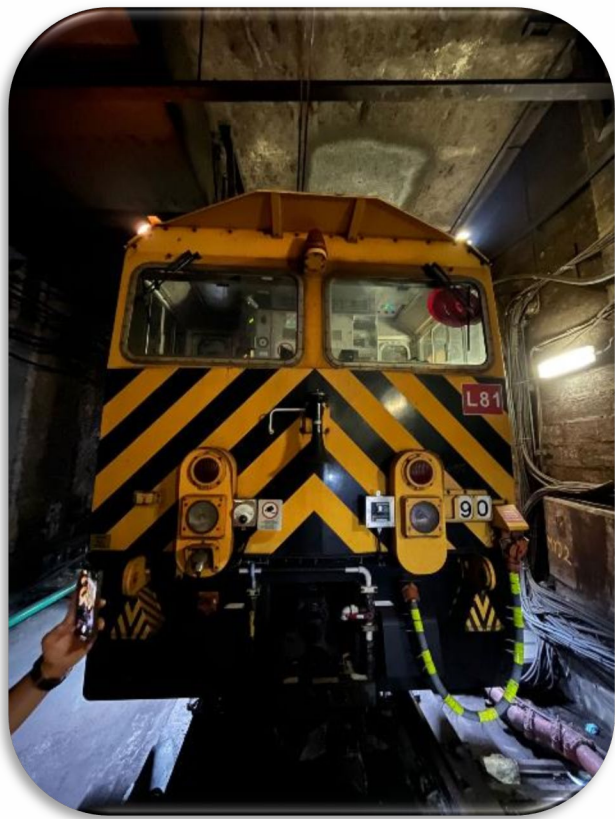
**Apply smart technologies (e.g. Machine Vision; AI) to identify early failure symptoms**



**Minimize the need for human intervention so that staff can focus on higher priority tasks**



# Machine Vision-Based Tunnel Equipment Inspection System



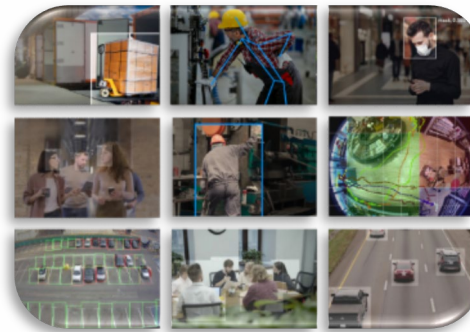
# Machine Vision-Based Tunnel Equipment Inspection System



Maintenance Locomotive



High Speed Low Lux Camera



Computer Vision



Automatic identification of tunnel equipment by AI computer vision while Locomotive is in operation

Rail infrastructure innovation in a changing world

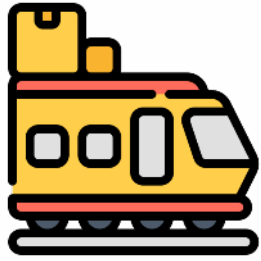
# Demonstration of System Functionalities



Items being identified as dislocated were simulated results

# Seamless User Experience to Complement Maintenance Regime

## Minimal manual operation needed



Locomotive dispatches for assigned maintenance

- Imaging system turned on automatically

Locomotive travels to the maintenance site

- Images being captured along the way

Locomotive finishes duty and returns to shed

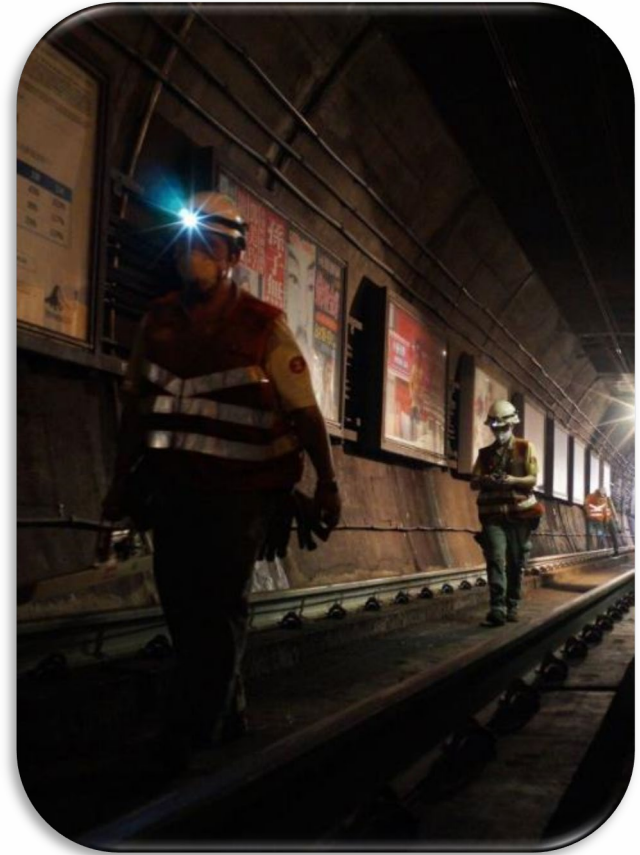
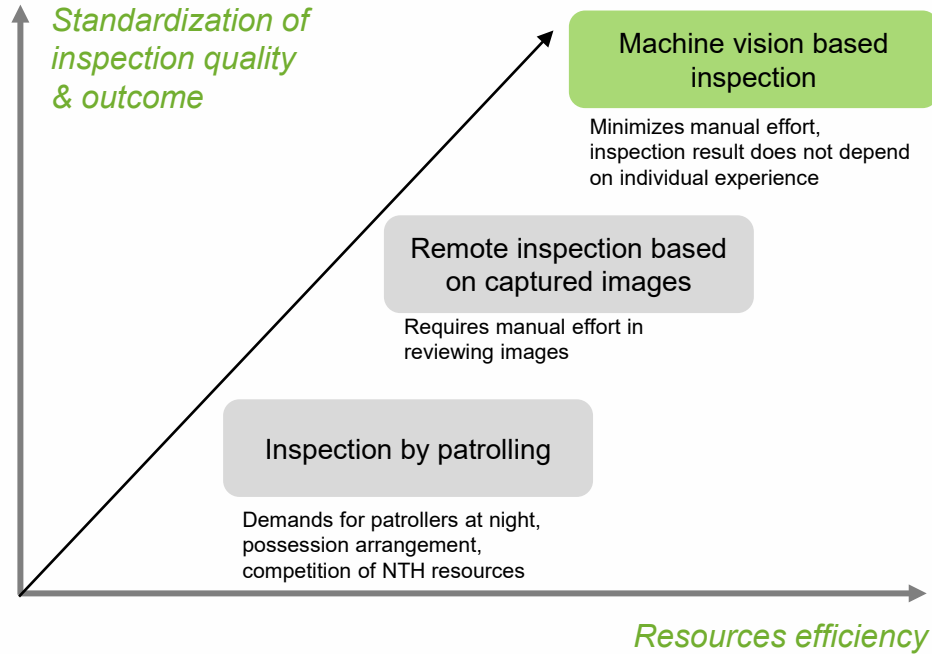
- Images uploaded to server automatically

- System generates inspection report to maintenance team



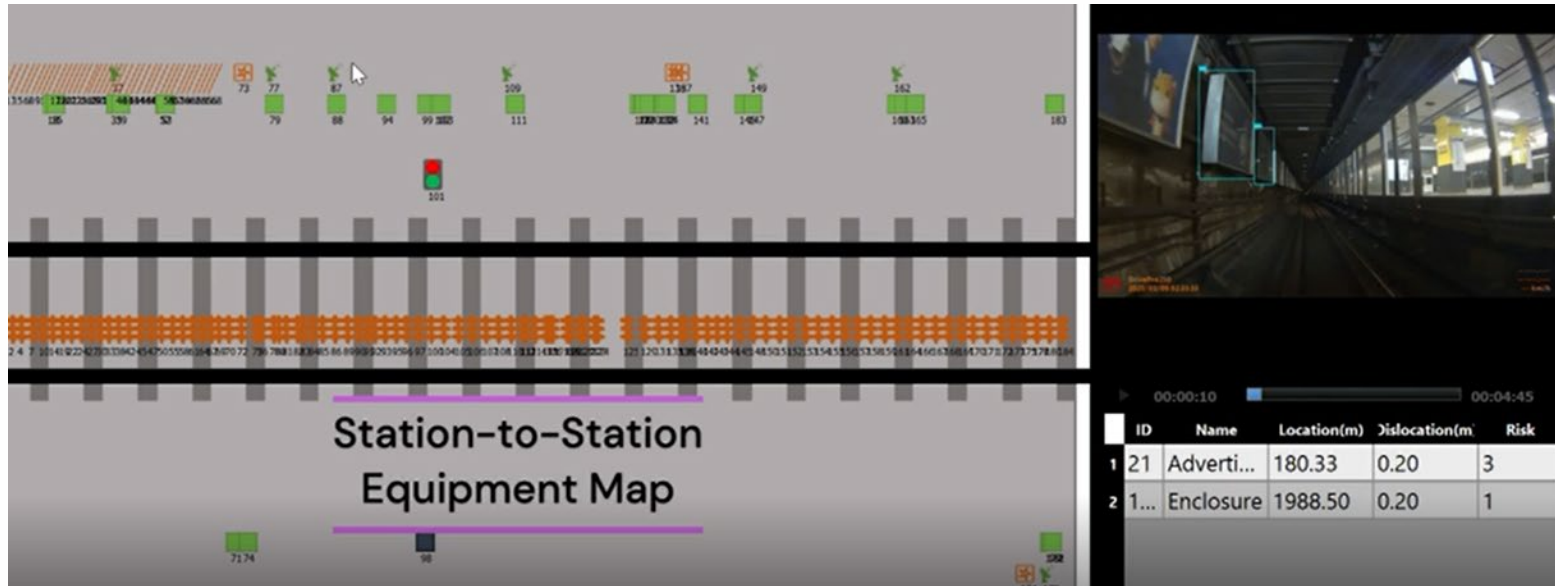
# Key System Functionalities

- The system compares captured inspection images and automatically generates alarms when abnormalities are identified.



# Key System Functionalities

- The system creates a base-map of the as-built environment, which is particularly useful for pre-site survey preparation and as training materials.



- Equipment types in the defined area
- Actual location of individual equipment
- Total number of equipment per type
- Video image for easy visualization

# Key System Functionalities

➤ Registry of tunnel equipment locations in as-built environment (based on image capturing results)

	ID	Name	Location(m)	Height(m)
12	121	OHL/ORCR Support	1553.17	0.20
12	122	OHL/ORCR Support	1557.50	0.20
12	123	OHL/ORCR Support	1589.67	0.20
12	124	OHL/ORCR Support	1596.17	0.20
12	125	OHL/ORCR Support	1675.83	0.20
12	126	Enclosure	1707.33	0.42
12	127	Enclosure	1716.33	0.43
12	128	Enclosure	1719.67	0.91
12	129	OHL/ORCR Support	1724.67	0.20
13	130	Enclosure	1734.50	0.52
13	131	OHL/ORCR Support	1759.83	0.20
13	132	Enclosure	1771.00	0.51

# Smart Systems in MTR



Integrating Data from Different Systems  
↓  
Real Insights and Intelligence



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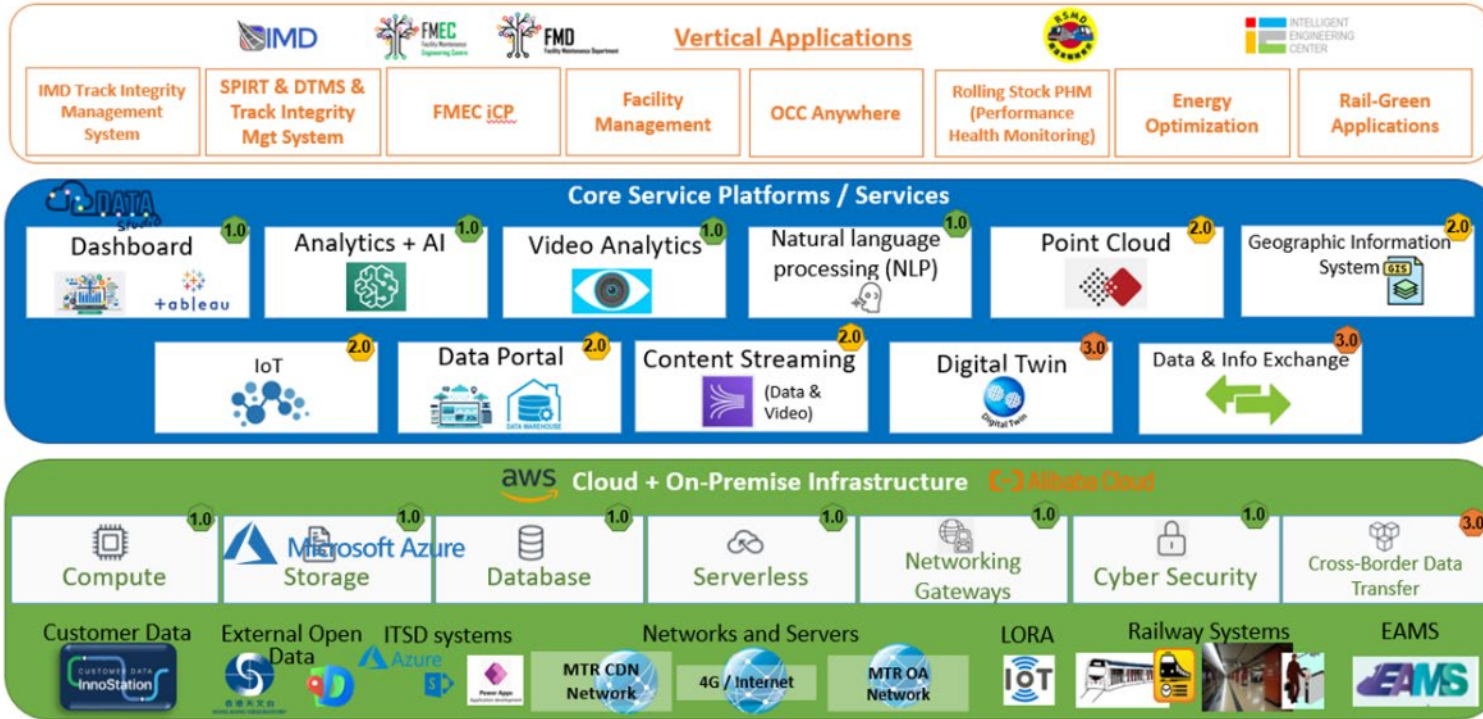
# Operations Data Studio



## Centralized Data Hub:

- Connectivity to over 30 systems data
- Early detection of failure symptoms
- Pre-emptive alerts and follow-up
- Better asset life performance monitoring
- Consolidated operation report to be shared with Line Managers in real time to support on-site decision making (e.g. crowd control and additional train service during festive holiday)

# Smart Information for Operations and Maintenance



Cyber Security Operations Center (SOC)



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