

# Building Information Modelling – Asset Management - Railway Safety (BIM-AM-RS) to Enhance Railway Safety in Hong Kong

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Hong Kong SAR Government

15 Oct 2019



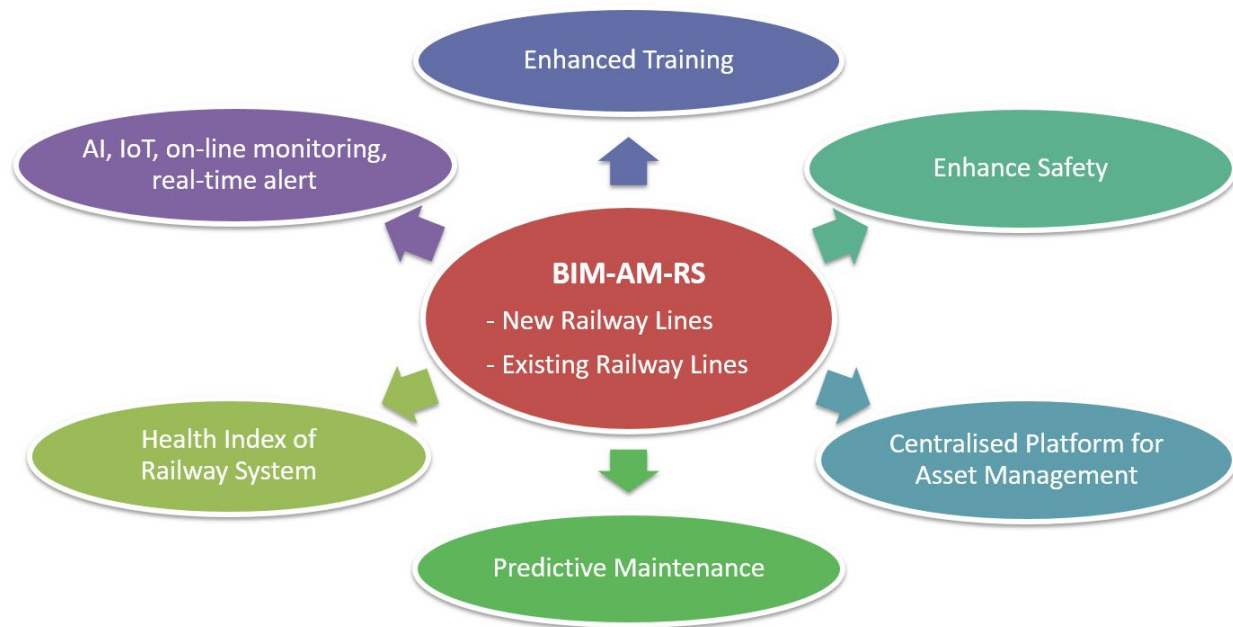
# Agenda

- Objective
- BIM-AM-RS on enhanced staff training
- BIM-AM-RS on predictive maintenance
- E&M InnoPortal

# Objective

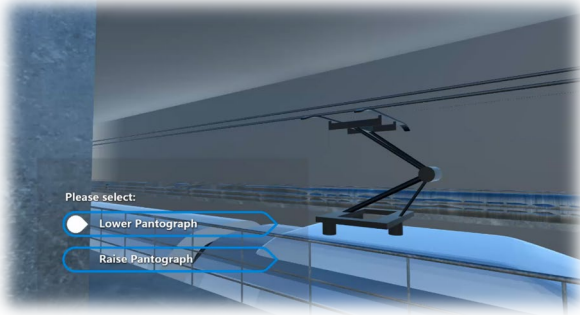
Extend the usage of BIM for asset management to enhancement of railway safety:

- improve operation safety and reliability
- enhance staff competence via 3D interactive training



# Enhanced Staff Training

Simulate past railway incidents for staff training



Promote BIM-AM-RS VR training



VR Training with Haptic Suit



# Enhanced Staff Training

Progress:

- EMSD provided sample training modules to MTRCL to promote BIM-AM-RS VR training
- MTRCL will develop more BIM-AM-RS VR training modules using haptic suit by end 2019

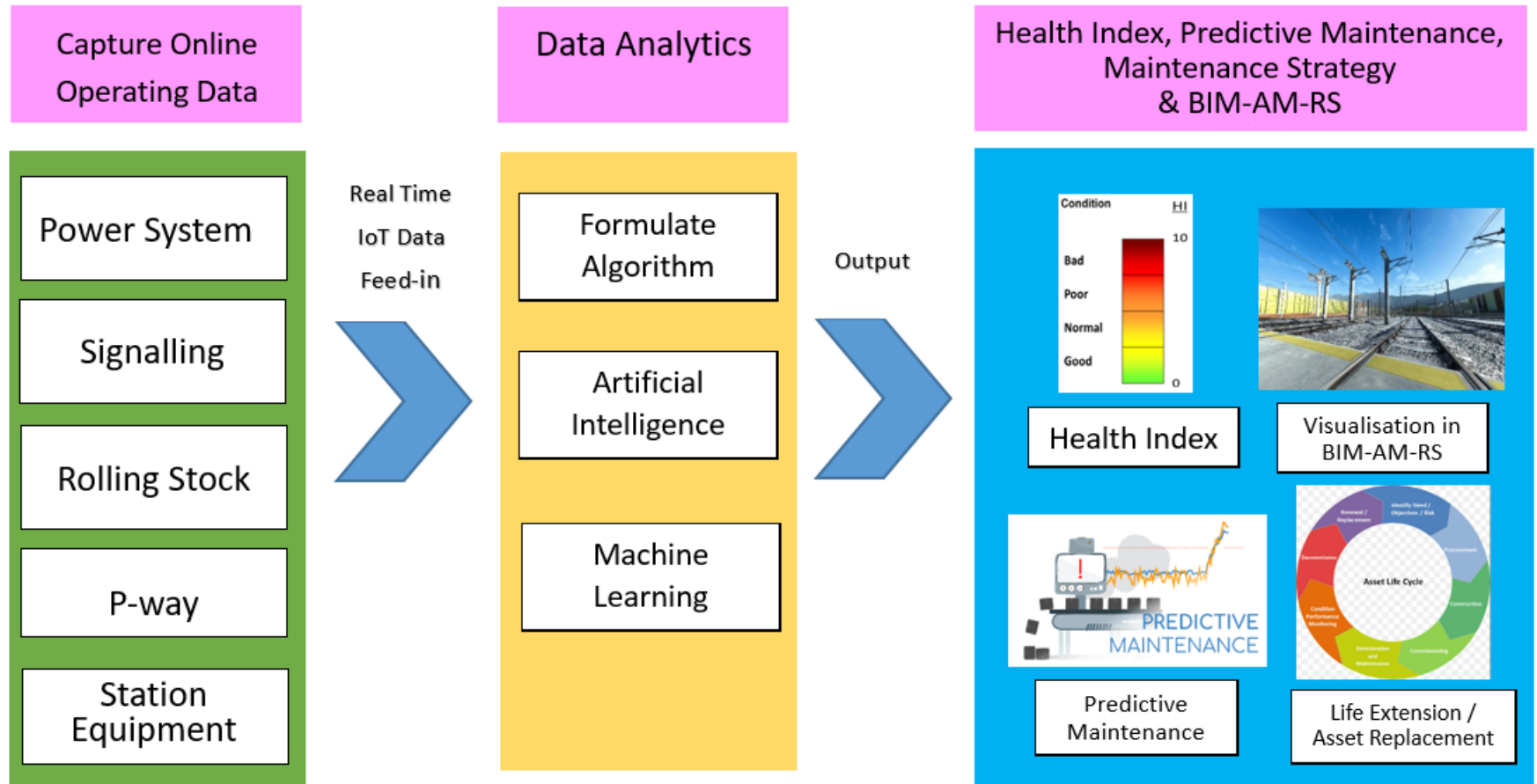


# Predictive Maintenance

- IoT for major railway systems
- AI algorithm for data analytics & providing alerts before equipment failure
- Health indices to keep track of asset conditions
- Visualize system performance via 3D BIM environment



# Predictive Maintenance - Implementation Framework



# Real Time Monitoring of Railway Assets

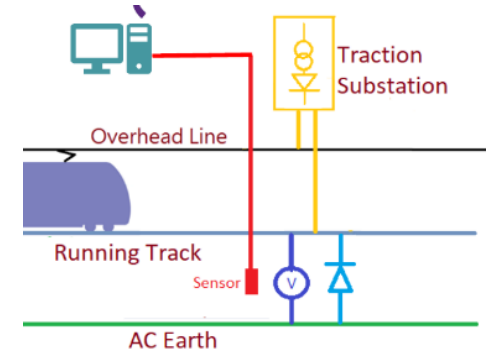


Dissolved Gas Analysis (DGA)



Partial Discharge (PD)

(i) Monitoring of Power System



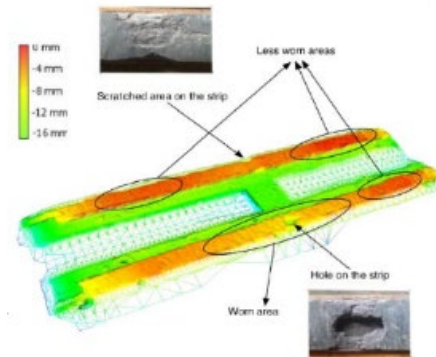
(ii) Monitoring of Stray Current



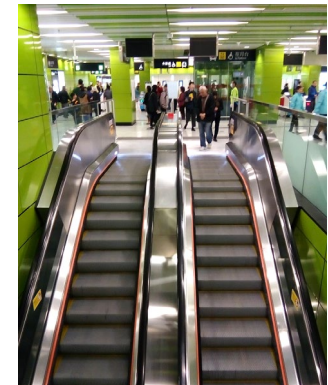
(iii) Point Switch Monitoring



(iv) Rail Crack Monitoring

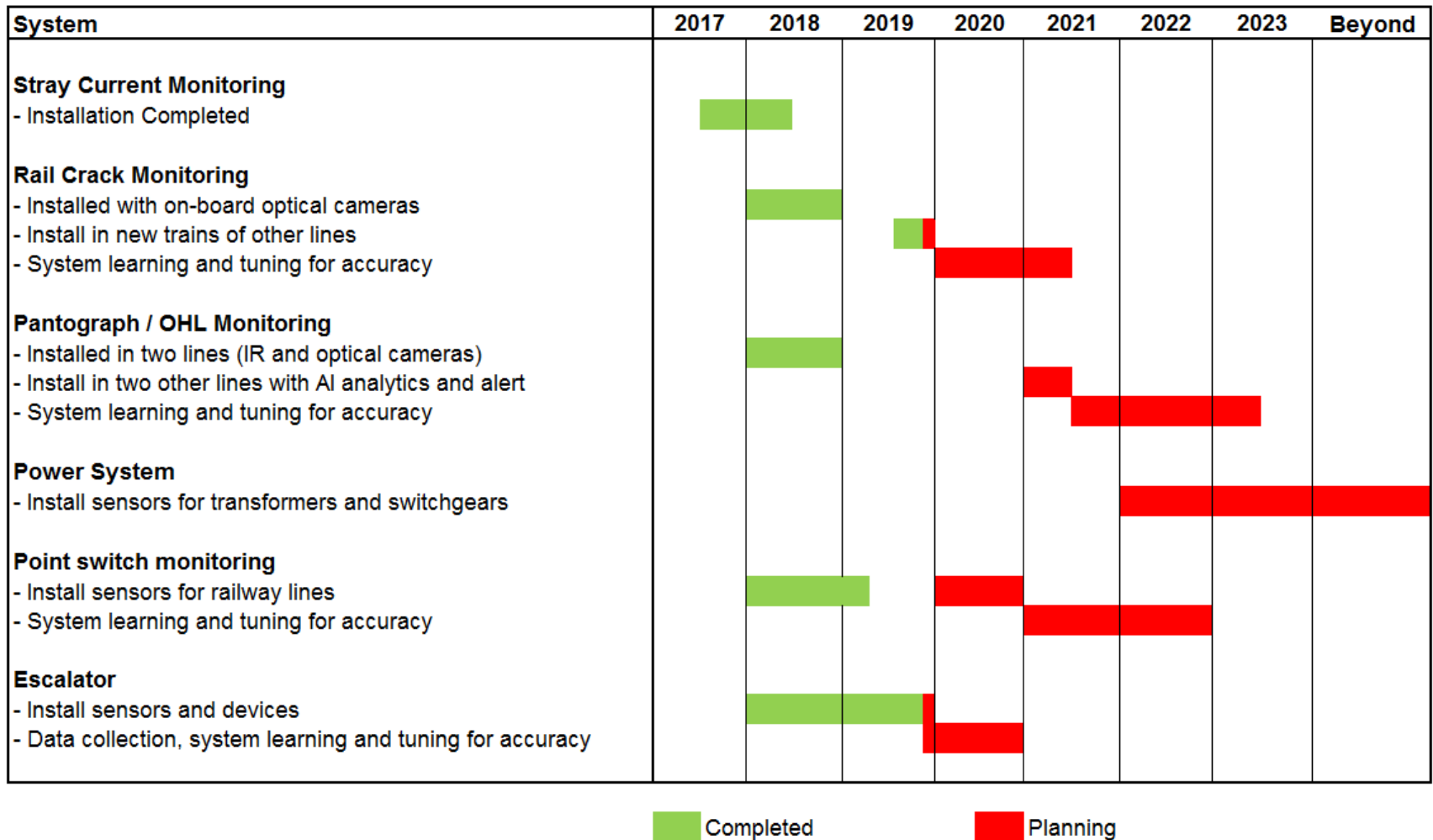


(v) Pantograph / OHL Monitoring



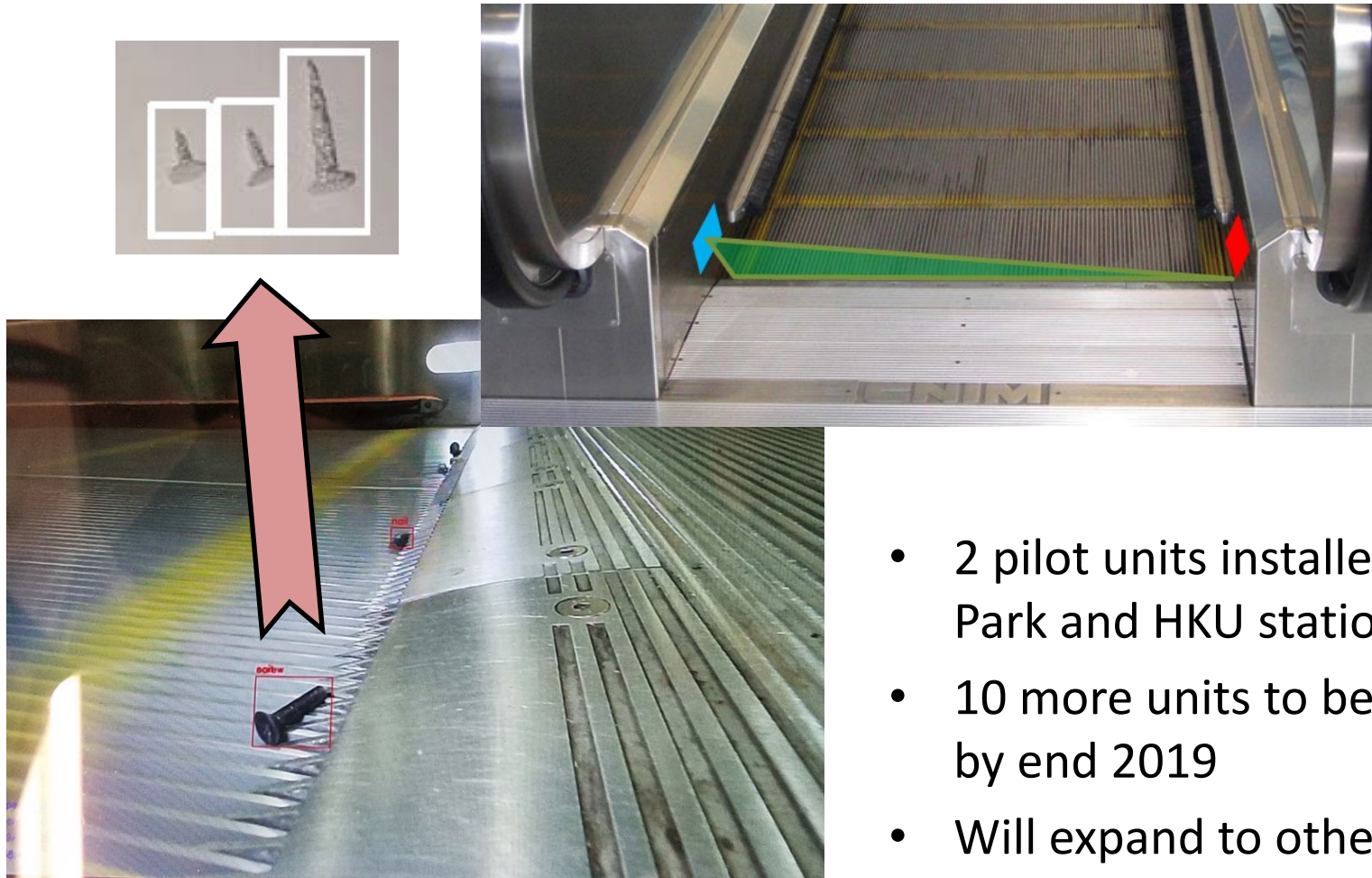
(vi) Monitoring of Escalator

# Facilitate MTRCL's new technologies implementation



# (i) Monitoring of Escalator

Small objects detection: issue real time alert to station staff



- 2 pilot units installed at Ocean Park and HKU stations
- 10 more units to be completed by end 2019
- Will expand to other MTR stations

## (i) Monitoring of Escalator

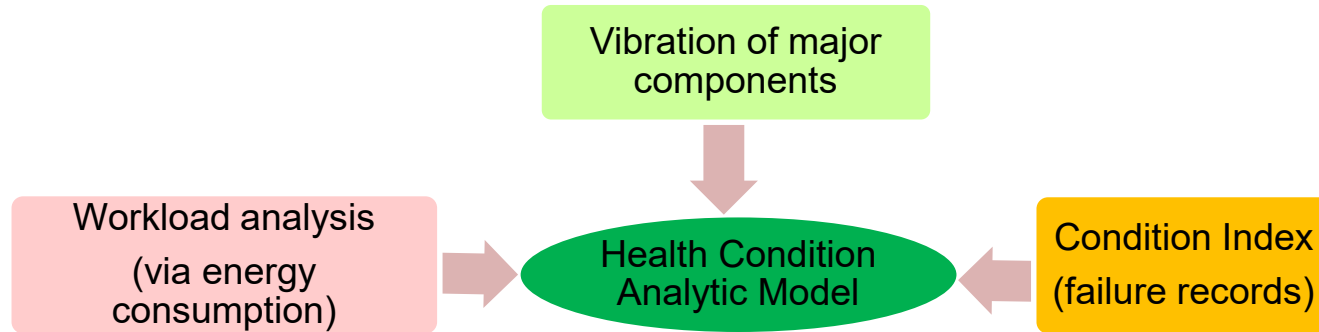
Bulky objects detection: issue warning messages to passengers and alerts to station staff



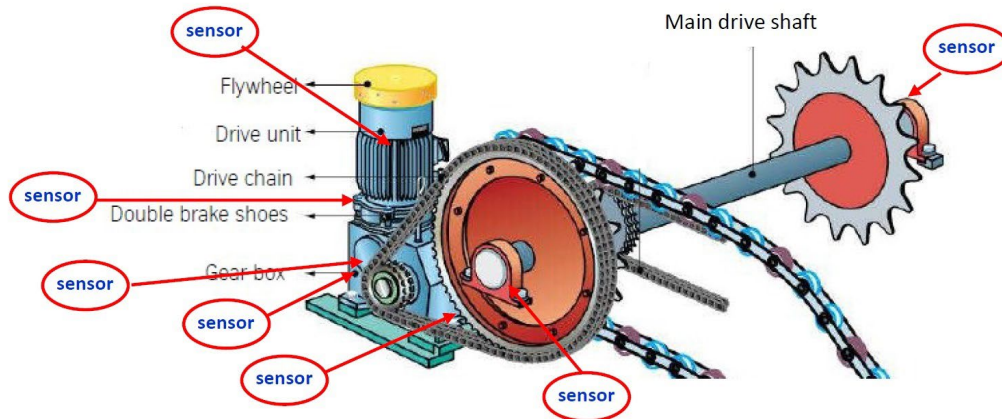
# (i) Monitoring of Escalator

## Condition Monitoring

- Phase 1 Determine Health Condition of Escalators (Q1-Q4 2019)



- Phase 2 Predictive Maintenance and Real Time Alert (mid 2019 to Q4 2020)
  - To formulate the data modelling and AI analysis for abnormalities

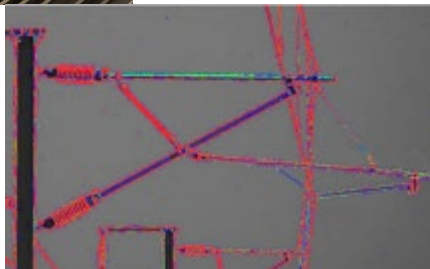


## (ii) Pantograph / Overhead Line Monitoring

- Phase 1: Train borne pantograph and OHL monitoring system installed
  - IR camera for arcing and high temperature monitoring
  - Optical cameras for monitoring of pantograph and OHL structural movement
  - Maintenance staff to review records



Installation



Cantilever monitoring



Arcing and High Temperature Detection  
at Section Insulator



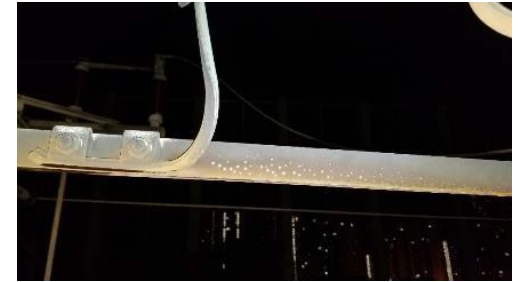
## (ii) Pantograph / Overhead Line Monitoring

Phase 2: Optical & infrared cameras with AI engine providing real time alert

- Two sets to be installed
- Will expand to other train lines on Q1 2021 to mid-2023



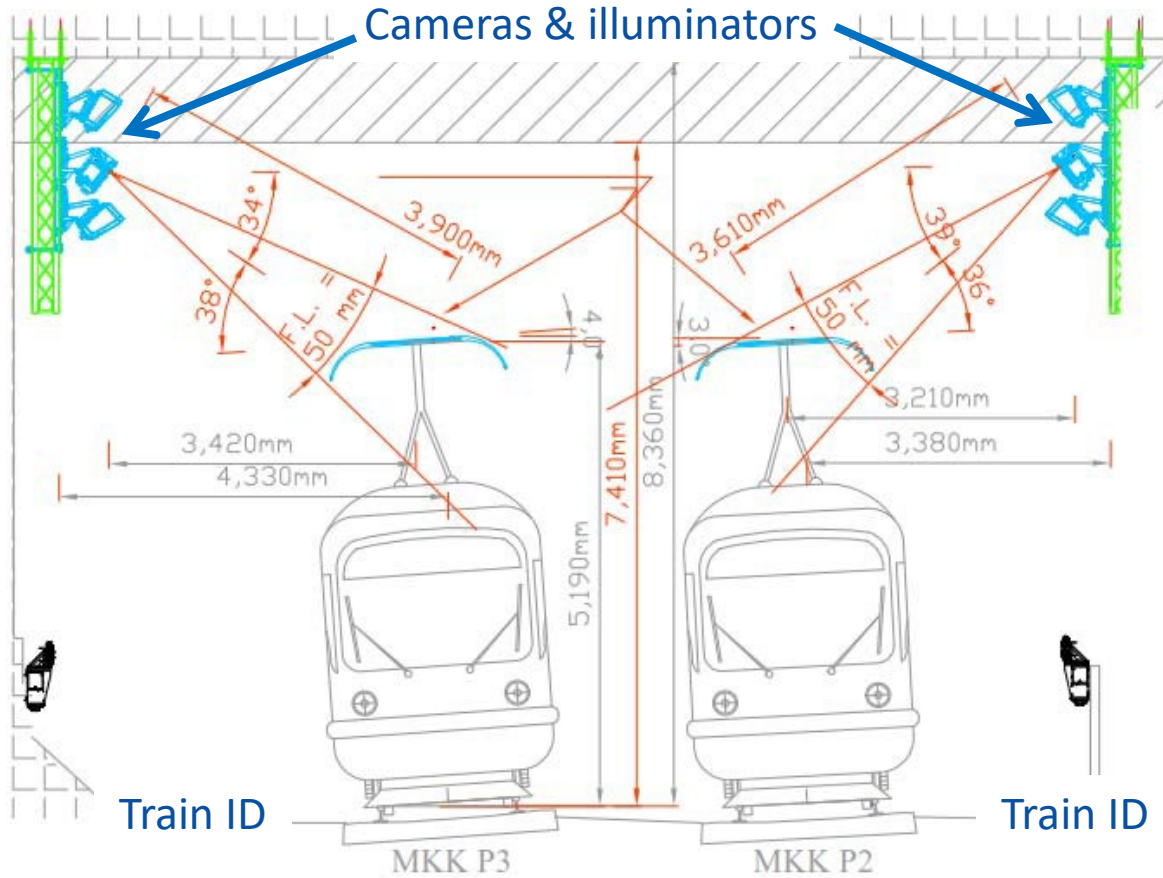
Detect repeated arcing alarms



Detect signs of arcing and high temperature on section insulator

## (ii) Pantograph / Overhead Line Monitoring

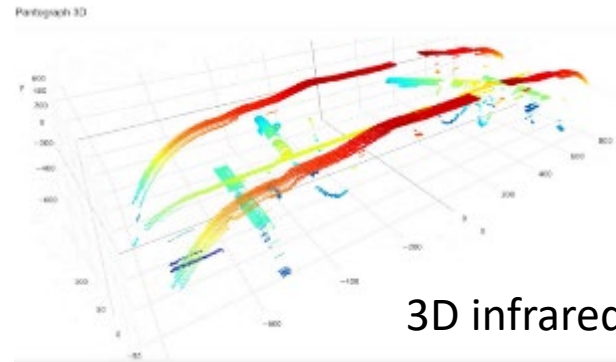
- Trackside 3D cameras installed in Jul 2019



# Mongkok East Station

## (ii) Pantograph / Overhead Line Monitoring

Visit overseas countries to appreciate the use of new technologies



3D infrared images of pantograph



Real time detection of  
pantograph defects

# BIM-AM-RS Platform

## Building Information Modelling - Asset Management for Railway Safety (BIM-AM-RS)

Logout

11 October 2019 11:48

User : Tom CHAN

Overview

Equipment

### Overall Health Index



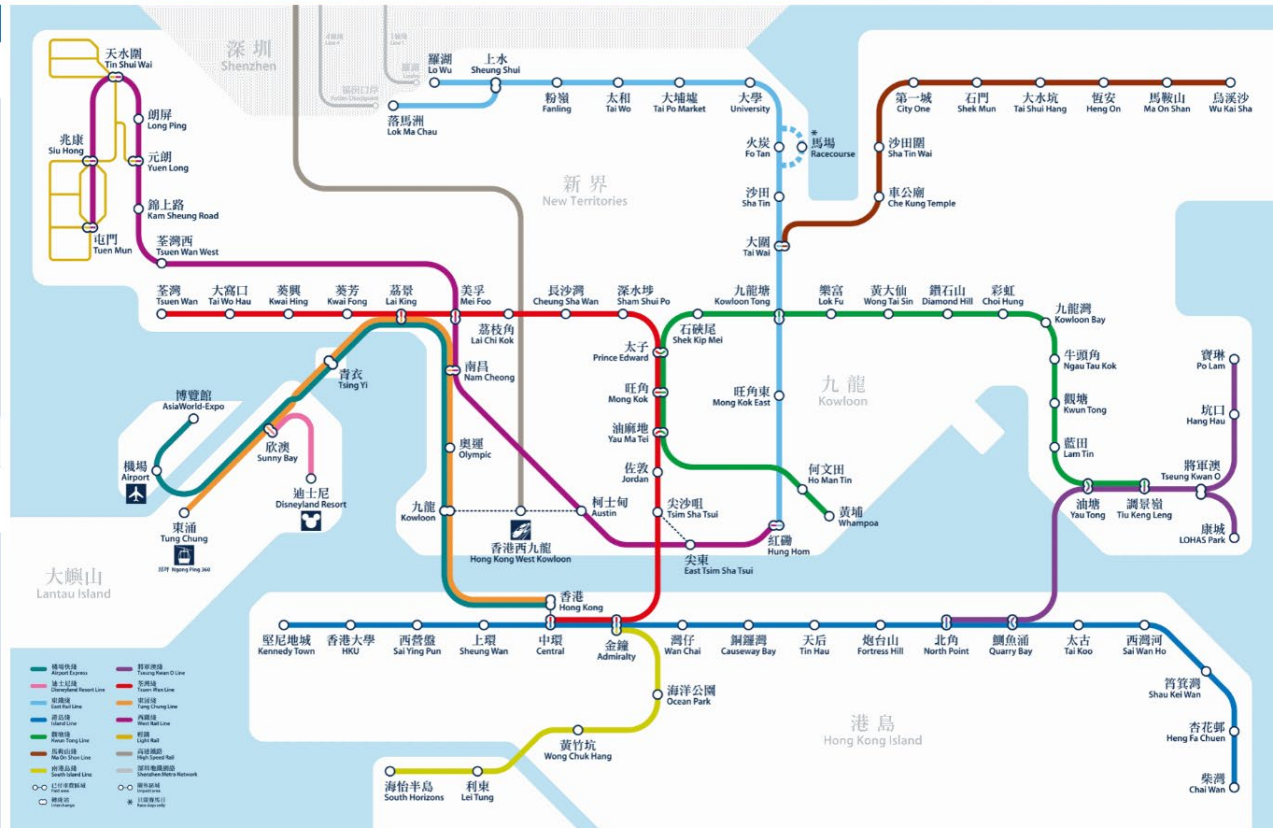
3.1

### Top Risk Asset

| Equipment                  | Asset ID | Line     | Distance (km) | Health Index | Alert |
|----------------------------|----------|----------|---------------|--------------|-------|
| Transformer                | 83829    | KTL UP   | 96.92         | 5.925        | -     |
| Transformer                | 50157    | KTL UP   | 82.61         | 5.4          | -     |
| Point Machine              | 56827    | KTL UP   | 107.99        | 5.525        | -     |
| Point Machine              | 11662    | KTL DOWN | 110.93        | 5.075        | ⚠️    |
| Pantograph                 | 65936    | KTL DOWN | 105.5         | 5.425        | -     |
| Pantograph                 | 97520    | KTL DOWN | 63.85         | 5.15         | ⚠️    |
| Pantograph                 | 18063    | KTL UP   | 106.51        | 4.875        | -     |
| Overhead Line / Cantilever | 69558    | KTL UP   | 60.26         | 5.85         | -     |
| Overhead Line / Cantilever | 47746    | KTL DOWN | 61.99         | 5.575        | ⚠️    |

### Watch List

| Equipment                  | Asset ID | Line     | Distance (km) | Health Index | Alert |
|----------------------------|----------|----------|---------------|--------------|-------|
| Transformer                | 50157    | KTL UP   | 82.61         | 5.4          | -     |
| Transformer                | 83829    | KTL UP   | 96.92         | 5.925        | -     |
| Track                      | 38940    | KTL UP   | 128.48        | 0            | ⚠️    |
| Track                      | 83424    | KTL UP   | 108.7         | 0            | ⚠️    |
| Stray Current              | 81989    | CHH      | -             | 2.25         | -     |
| Point Machine              | 78023    | KTL DOWN | 113.26        | 3.975        | -     |
| Point Machine              | 11662    | KTL DOWN | 110.93        | 5.075        | ⚠️    |
| Pantograph                 | 97520    | KTL DOWN | 63.85         | 5.15         | ⚠️    |
| Overhead Line / Cantilever | 10829    | KTL UP   | 102.79        | 4.475        | ⚠️    |



# BIM-AM-RS Platform

Building Information Modelling - Asset Management for Railway Safety (BIM-AM-RS)

Logout

11 October 2019 11:32

User : Tom CHAN

Overview

Equipment

Q Search Box

Input Asset ID

Q

Chainage

Station : YMT

Line : All

From : km To : km

System / Equipment Type

☐ Power System

☐ P-Way

☐ Signalling

☐ Rolling Stock

☐ Station Equipment

GO

# BIM-AM-RS Platform

**Building Information Modelling - Asset Management for Railway Safety (BIM-AM-RS)**

Logout

11 October 2019 13:42  
User : Tom CHAN

OverviewEquipment

Q Search Box

Input Asset ID

Chainage

Station : All

Line : All

From :  km To :  km

System / Equipment Type

☐ Power System  
☐ P-Way  
☐ Signalling  
☐ Rolling Stock  
☐ Station Equipment

GO

Real Time Monitoring

Asset ID : 11662

Point Machine

Health Index 5.075

Location KTL DOWN 110.93km

Make Thales

Model DY78

Year of Service 9

Serial No. ZT64651658253

Incident History

Maintenance History

Documents

Building Information Model

# BIM-AM-RS Platform

## Building Information Modelling - Asset Management for Railway Safety (BIM-AM-RS)

Logout

11 October 2019 11:47

User : Tom CHAN

Overview

Equipment

Search Box

Input Asset ID



Chainage

Station : All

Line : All

From : km To : km

System / Equipment Type

- ☐ Power System
- ☐ P-Way
- ☐ Signalling
- ☐ Rolling Stock
- ☒ Station Equipment
- ☒ Escalator

GO

Building Information Model



Asset ID : 27033

|                 |               |
|-----------------|---------------|
| Escalator       |               |
| Health Index    | 0             |
| Location        | YMT -km       |
| Make            | Kone          |
| Model           | GK67          |
| Year of Service | 4             |
| Serial No.      | MT38413696201 |

Incident History

Maintenance History

Documents

Real Time Monitoring



# BIM-AM-RS Platform

## Building Information Modelling - Asset Management for Railway Safety (BIM-AM-RS)

Logout

11 October 2019 11:44

User : Tom CHAN

Overview

Equipment

Q Search Box

Input Asset ID

Chainage

Station : All

Line : All

From : km To : km

System / Equipment Type

- ☐ Power System
- ☐ P-Way
- ☐ Signalling
- ☒ Rolling Stock
- ☒ Pantograph
- ☐ Station Equipment

GO

Building Information Model



Asset ID : 18063

Pantograph -

Health Index 4.875

Location KTL UP 106.51km

Make CRRC

Model FV26

Year of Service 12

Serial No. FS8734959069

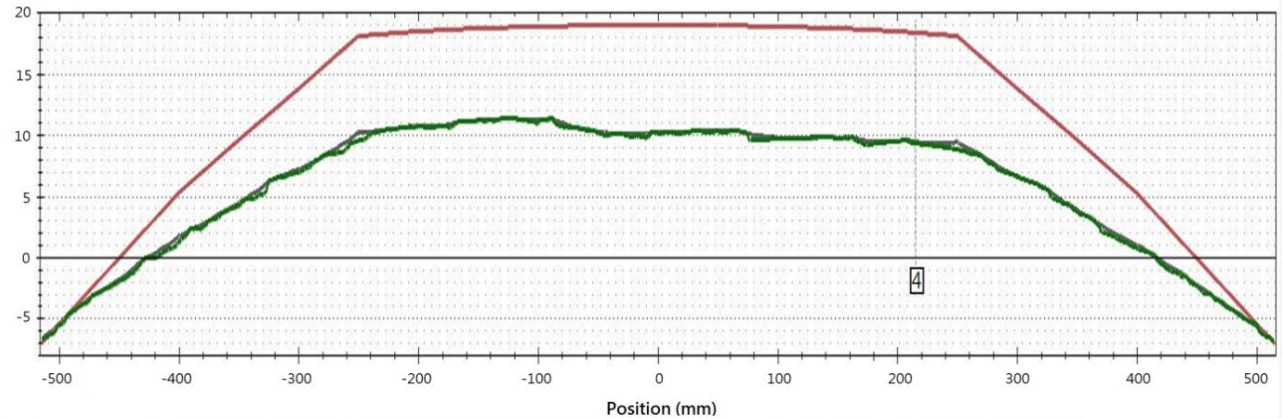
Incident History

Maintenance History

Documents

Real Time Monitoring

Thickness (mm)



Kooldikte grafiek Carbon profile 3D View

Carbon position: - Laser position

- Image position: -

Analyse details

Pantograaf 1, Koolstrip 2\*

| Label | Measurement       | Value | Status | Alarm Rule | Alarm Limits |
|-------|-------------------|-------|--------|------------|--------------|
| 1     | Gier hoek (Yaw)   | 0,3°  | Ok     | -          | -            |
| 2     | Rolhoek (Roll)    | 0,1°  | Ok     | -          | -            |
| 3     | Stamphoek (Pitch) | -0,7° | Ok     | -          | -            |
| 4     | Dikte koolstrip   | 9 mm  | Ok     | -          | -            |
| 5     | Opdruk            | 4 mm  | Ok     | -          | -            |
| 6     | Opdruk kracht     | 104 N | Ok     | -          | -            |



# E&M InnoPortal

<https://inno.emsd.gov.hk/en/it-wish-list/index.html>

**E&M InnoPortal**

Home

I&T Solutions

I&T Wish List

Success Cases

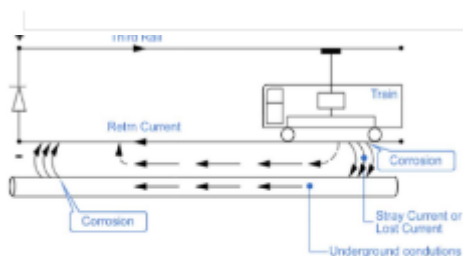
Highlights

More ▾

機電工程署  
**EMSD**



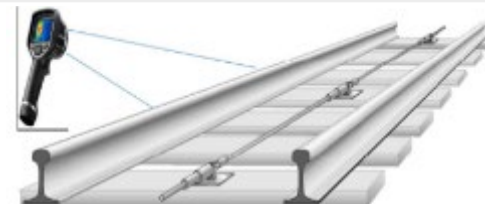
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SMART DC STRAY CURRENT  
MONITORING AND REDUCTION IN  
RAILWAY SYSTEM



TO ENHANCE ESCALATOR SAFETY



AUTOMATIC DETECTION OF RAIL  
CRACK TO ENSURE PASSENGER  
SAFETY



ENERGY DATABASE MANAGEMENT  
SYSTEM (MATCHED WITH I&T  
SOLUTION S-0049) **MATCHED**

# E&M InnoPortal

- Cooperation agreement signed on 11 June 2019 with 12 academic and research institutions to promote I&T in government



# Thank You

