Enhancing Railway Safety in Permanent Way through Big Data Analytics and Artificial Intelligence (AI) for Smart Maintenance

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The MTR Network has >240 km of total route length. To allow uninterrupted daily train service, inspection and all maintenance work are done in the 2-hour Golden Window in Non-Traffic Hour. The latest smart technology were implemented to improve efficiency and effectiveness of Pway Maintenance.

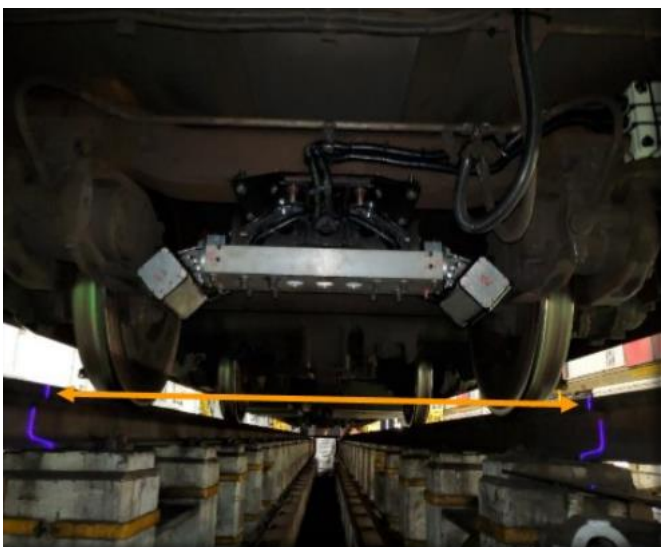## Solution Approach

Smart Technology → Modern Data Infrastructure → Advanced AI and ML Development → Data-driven Maintenance Prioritization
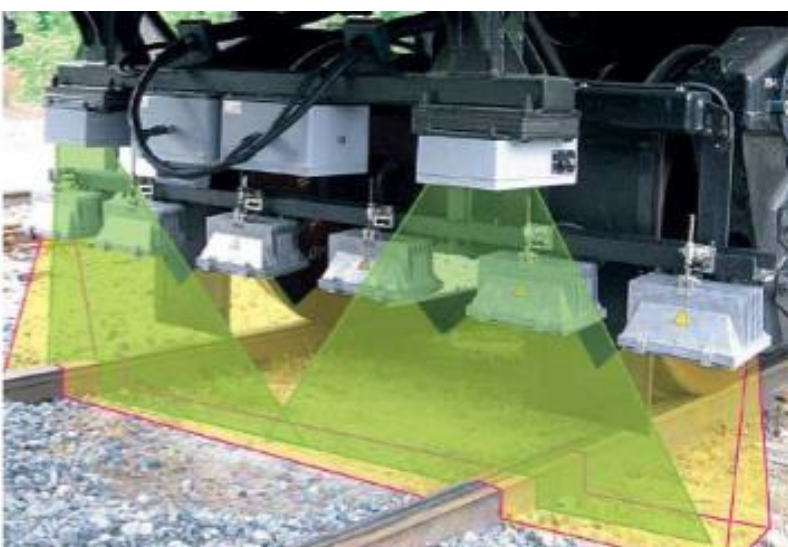
Smart Technology

To retrive data and measurement with different smart technology systems

DTGMS and SPIRT

Installed under the train cabin to measure dynamic track gauge and vibration
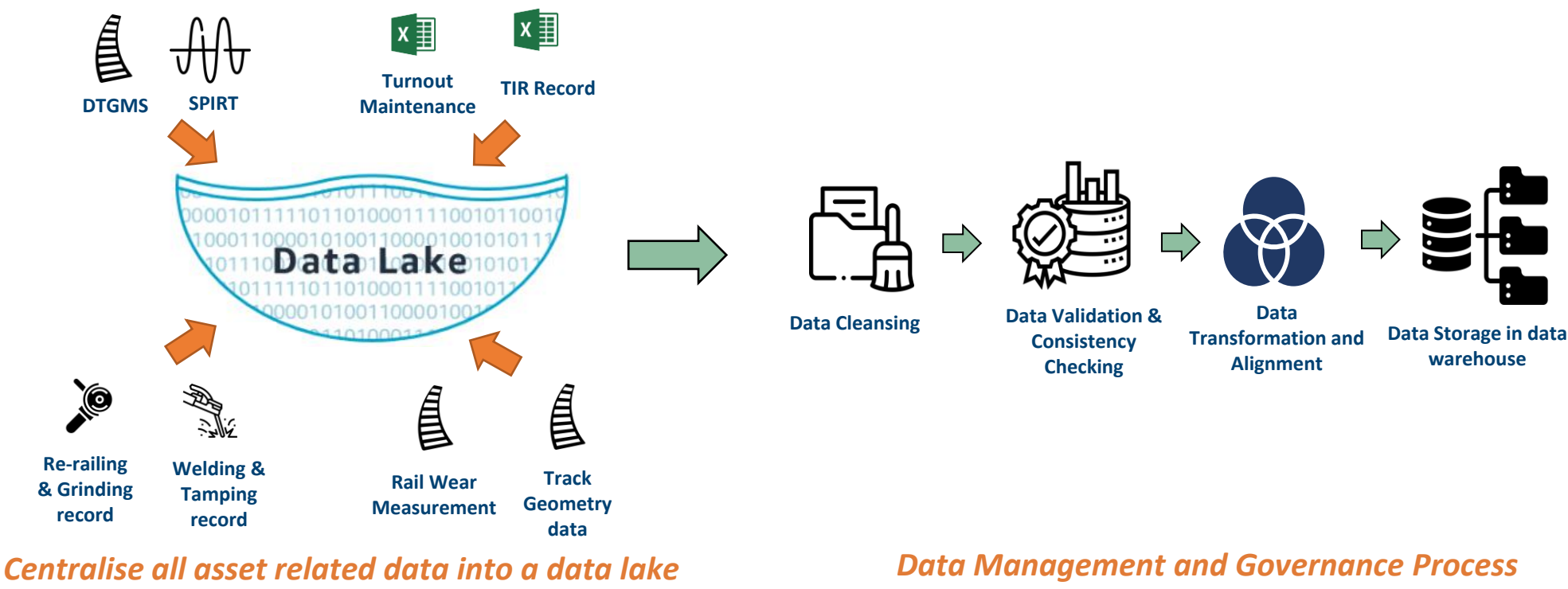
ORIS

Installed under the train cabin to capture the rail condition when operating

Modern Data Infrastructure

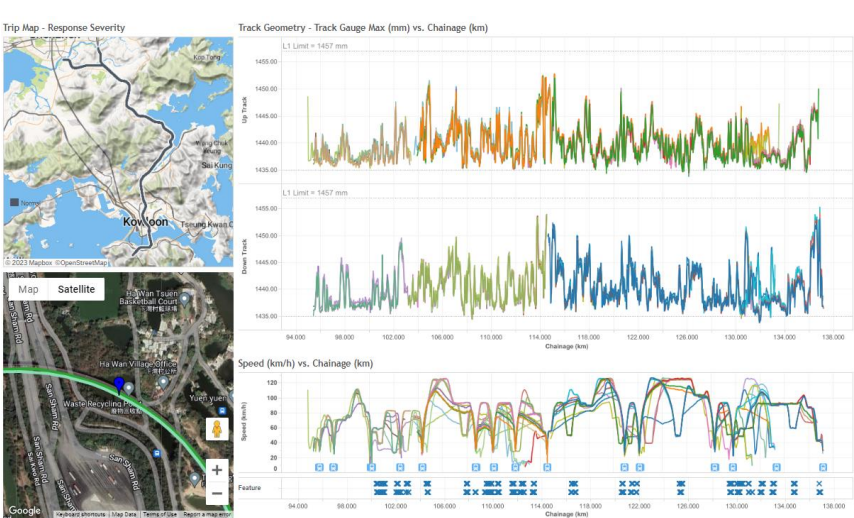**To manage and maintain the big data in a centralised cloud platform**

DTGMS, SPIRT, Turnout Maintenance, TIR Record, Re-railing & Grinding record, Welding & Tamping record, Rail Wear Measurement, Track Geometry data → Data Lake

Centralise all asset related data into a data lake

Data Cleansing → Data Validation & Consistency Checking → Data Transformation and Alignment → Data Storage in data warehouse

Data Management and Governance Process
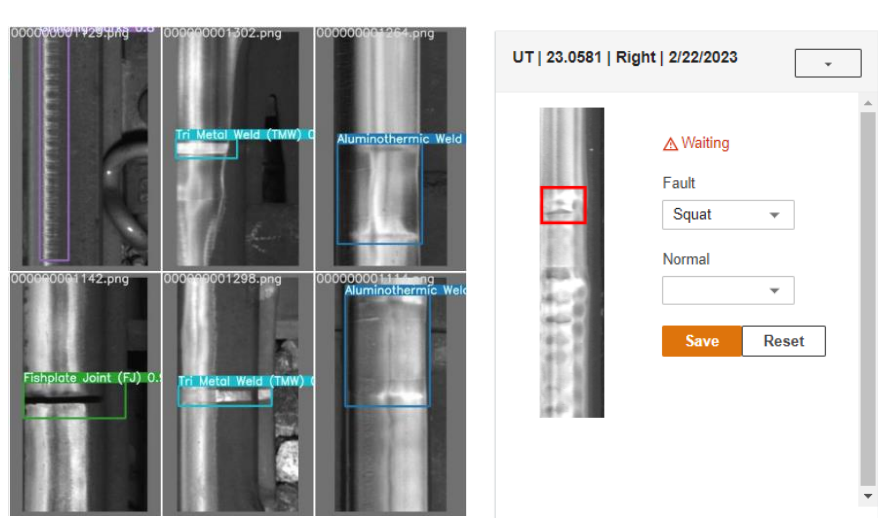
Advanced AI and ML Development

To identify the potential risk location for early handling
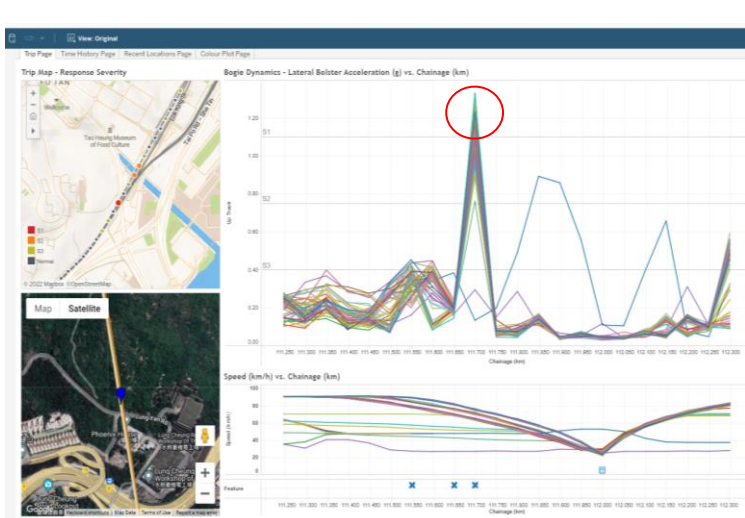
Data Visualization

Visualization dashboard with embedded ML algorithm to monitor the track condition
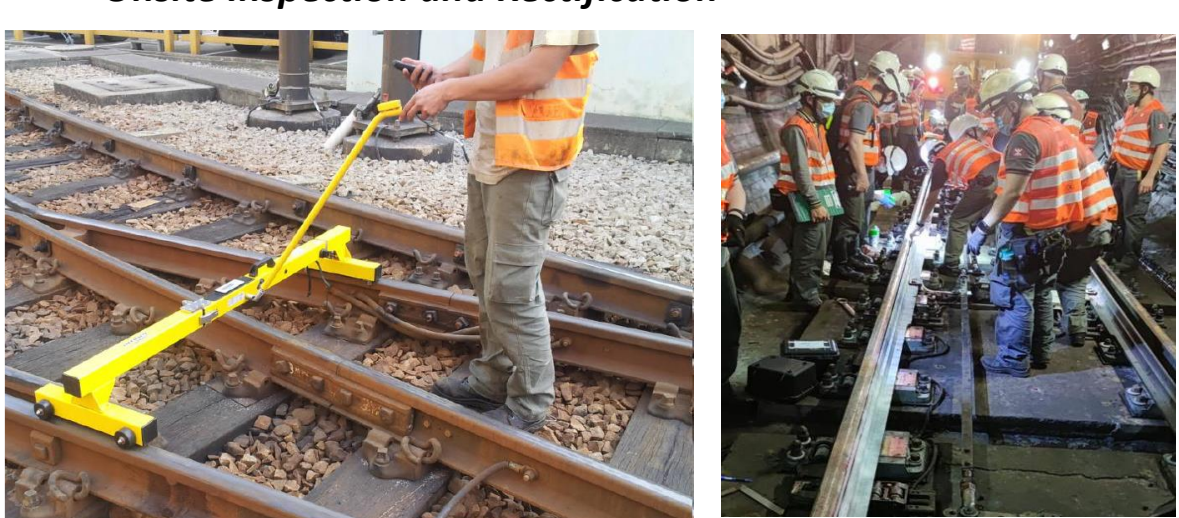
AI Application

AI object detection algorithm to monitor the track condition and identify rail defects

Data-driven Maintenance Prioritization

To allow maintainer making more informed decision based on big data

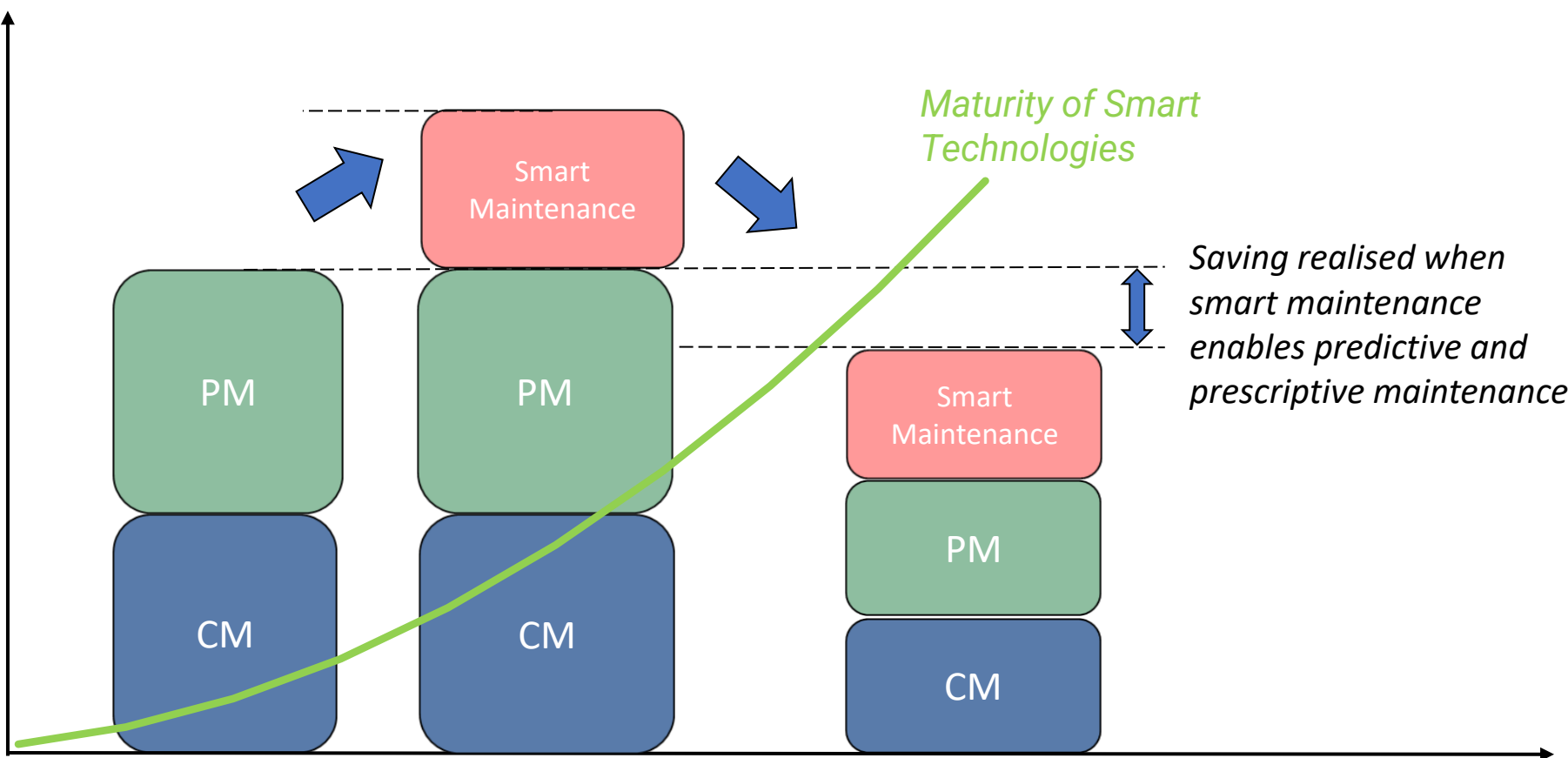### Identify exception location

Embedded ML algorithm identify the potential risk location and alert our maintainer to follow up

Onsite Inspection and Rectification

Maintainer can make informed decision based on data to prioritize the maintenance activities and developed a maintenance regime for P-Way asset management

Invest to Save

Maturity of Smart Technologies

Saving realised when smart maintenance enables predictive and prescriptive maintenance

Smart Maintenance / PM / CM

Benefit

Data-drive Smart Maintenance

- Improve Service Reliability
- Increase asset efficiency
- Improve Safety
- Lower Maintenance Cost
- Better decision-making

IRSC INTERNATIONAL RAIL SAFETY COUNCIL SOUTH AFRICA