TRAFFIC CONTROL TECHNOLOGY CO., LTD.

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IRSC 2025

Advancing Railway Safety through Innovations and Collaborations

Hong Kong, China 25th - 30th November 2025

Innovative Practices in Train-to-Train Communication: Pioneering a New Path for Signalling Safety on MTR Disneyland Resort Line

Reliable Assurance from the New-Generation Train Control Technology

Chunhai Gao
Chairman
TRAFFIC CONTROL TECHNOLOGY CO., LTD.

Agenda

1. Proposal of Train-to-Train Communication Technology
2. International & National Standards Compliance
3. Innovative Practices on MTR Disneyland Resort Line

1 Proposal of Train-to-Train Communication Technology

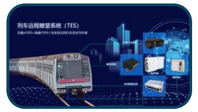
Perception based Train Autonomous Control System(PB-TACS)

1.1 Current Status of the Signalling System

With the rapid development of rail transit and the gradual formation of integrated networks, the industry is facing higher performance requirements as well as significant challenges.

02 Resilience

- Wide impact range of failures on operations
- Low failure recovery efficiency



01 Safety

- Lack of perception of abnormal environmental conditions
- Environmental monitoring methods need to be upgraded

03 Efficiency

- Complex equipment and large quantities
- Frequent switching operations at night
- Low maintenance efficiency

1.2 PB-TACS Proposal

PB-TACS was proposed to address these issues，with the following key characteristics:

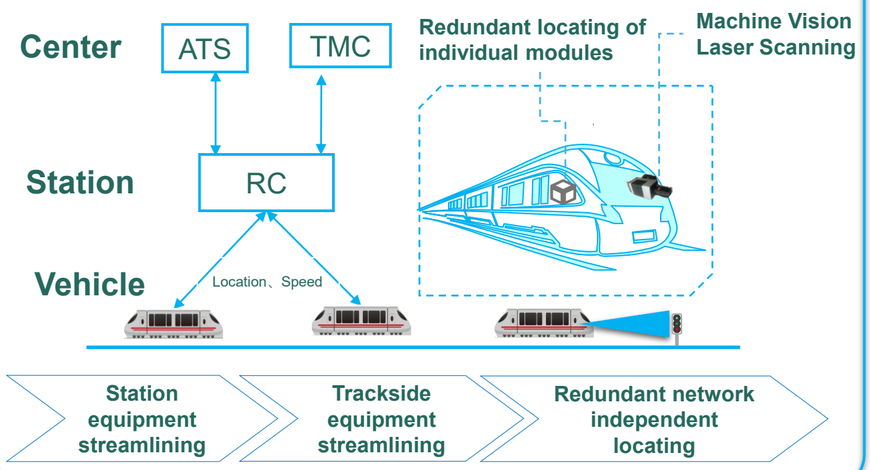
Difficulties

- How to further enhance system **safety**
- How to further improve **resilience**
- How to further enhance delivery & maintenance **efficiency**

Solutions

- Autonomous environmental perception
- Redundant network independent locating
- Equipment streamlining

PB-TACS



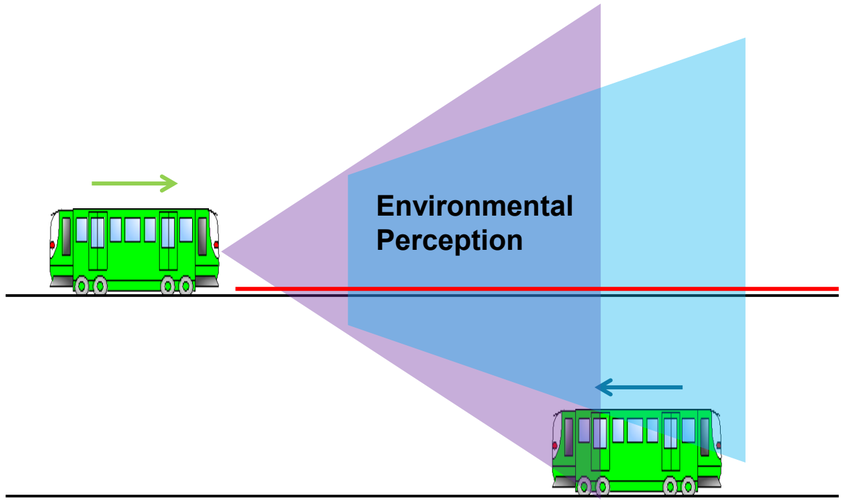
Expectations

- Intelligent Perception **Safety Assurance**
- Sustained Efficiency **Uninterrupted Operations**
- Short delivery cycle **High O&M efficiency**

1.2.1 Advantage: Enhanced Safety through Autonomous Environmental Perception

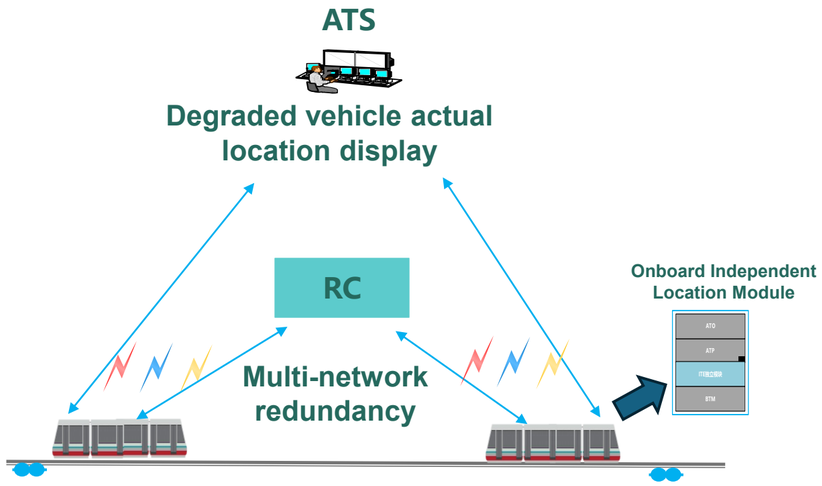
Intelligent Train Eye (ITE) system utilizes fused lidar and machine vision data to achieve autonomous perception of the train's operational environment, thereby enhancing system safety.

- Obstacle detection using wide-angle & telephoto cameras + LiDAR
- Upon obstacle detection, emergency braking is applied based on distance (SIL4).

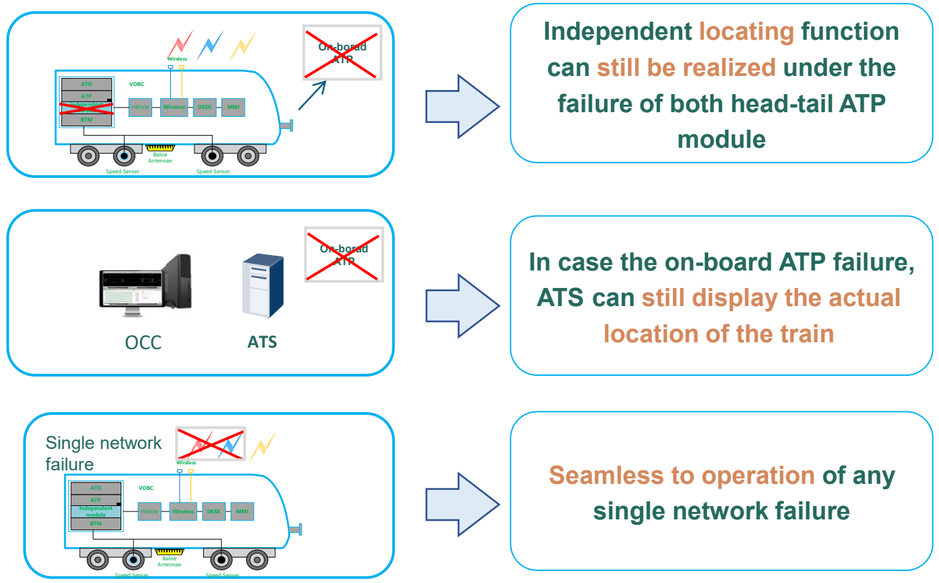


1.2.2 Advantage: Enhanced Resilience through Redundant Network&Location

PB-TACS utilizes heterogeneously redundant networks and location to further enhance system resilience.



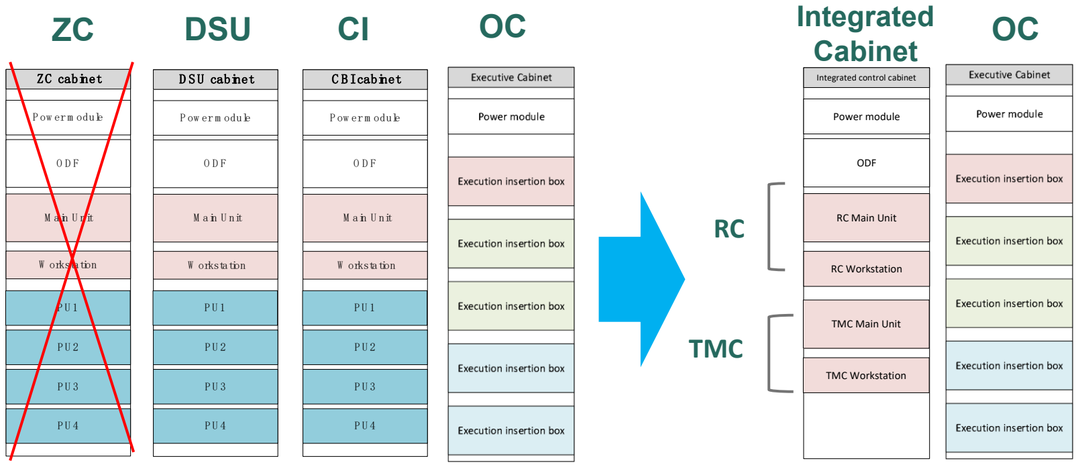
High efficiency of train operations recovery after equipment failure and significantly increasing the sub-system availability

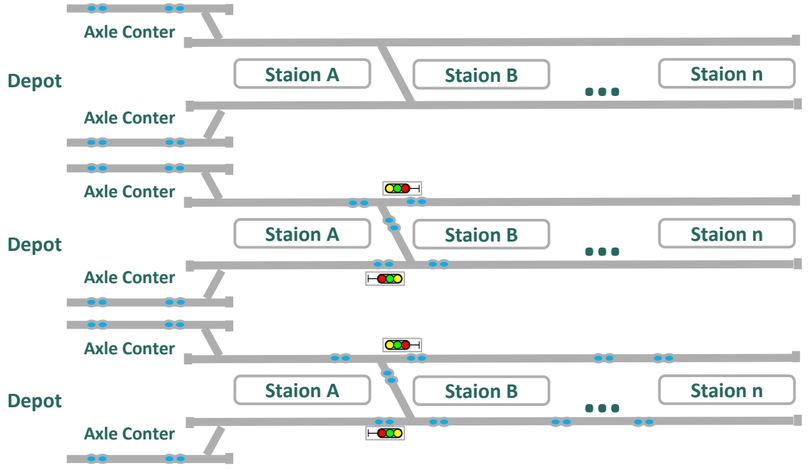


Post-failure system operation responding scheme

1.2.3 Advantage: Enhanced Efficiency through Equipment Streamlining

PB-TACS offers significant streamlined system architecture. By simplifying the RC hardware architecture and supporting the axle counter and signal head-free designs, PB-TACS not only optimizes the complexity of project extension / upgrading / renovation, but also enhance implementation and O&M efficiency





Station RC and TMC integrated into one cabinet

- Reduces station room space
- Reduces delivery and O&M complexity

Flexible trackside configuration

- Reduces trackside cabling and installation complexity
- Fewer changeover and reduced maintenance

1.3 PB-TACS Application Case Introduction

Beijing Metro Line 11

- Ready for delivery in July 2023
- National Development and Reform Commission Demonstration Project

Taiyuan Metro Line 1

- **Delivered in 2025**
- Since its delivery, there have been no failures or accidents affecting operations

Chengdu Metro Line 30

- Expected delivery: December 2025
- Dual-channel train-ground wireless communication to enhance resilience

Beijing Metro Lines 13/18 Replacement

- New section expected delivery: December 2025
- Replacement section expected delivery: December 2028
- Virtual-real integration + shadow mode to improve replacement efficiency

Beijing Metro Line 10 Replacement

- Expected delivery: December 2028
- CBTC+PB-TACS heterogeneous dual-active signaling system, offering ultrahigh resilience

2 International & National Standards Compliance

2.1 International Standards

IEEE standard

IEEE 1474.1 IEEE 1474.2
IEEE 1474.3 IEEE 1474.4

EN standard ATP/CI: SIL4 ATS/ATO: SIL2

EN 50126 (RAMS) EN 50716 (formerly EN 50128)
EN 50129 (safety related Electronic system) EN 50159

Cyber security standard

IEC 62443 TS 50701

IEC standard

IEC 62278, IEC 62279, IEC 62280,IEC 62267, IEC 62290;

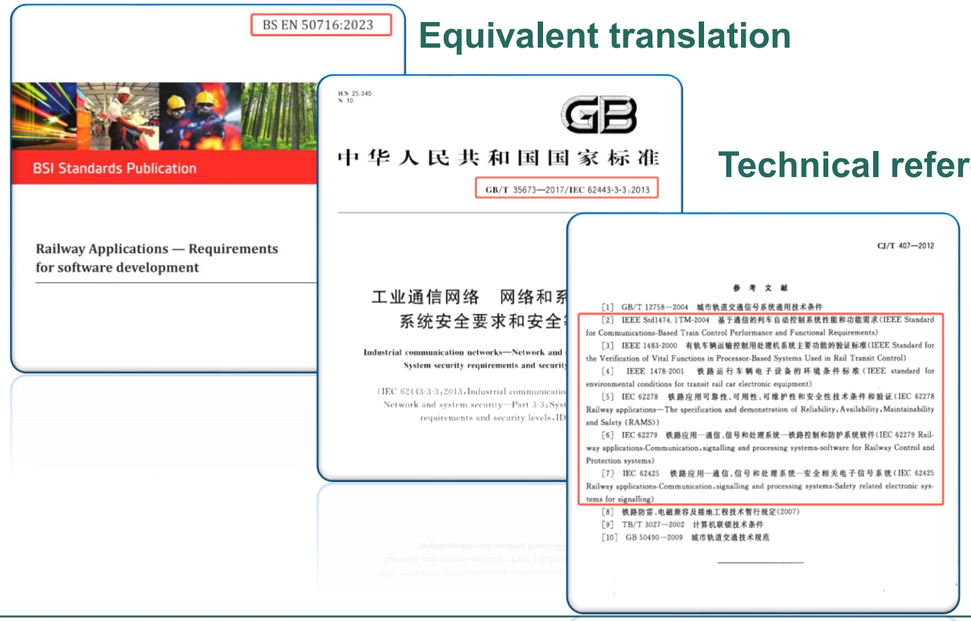
2.2 National Standards

China's urban rail transit standard system is formulated based on the active adoption of international standards, while taking into account national circumstances and industry development needs. It is mainly composed of national standards, industry standards, and group standards, and encompasses 42 core international standards for signalling systems.

Direct adoption

Equivalent translation

Technical reference



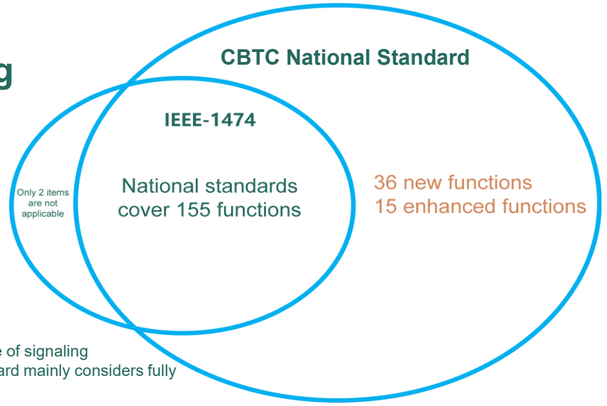
Type	International Standard	Corresponding Chinese National Standard
CBTC Standards	IEEE 1474.1	Technical Specification of Communication Based Train Control system for Urban Rail Transit, GB *****-2027
FAO Standards	IEC 62290-1:2014	GB/T 46097-2025
Hardware & Software Standards	IEC 60571:2012	GBT 25119-2021
	IEC 62279:2015(EN 50128)	GB/T 28808-2021
	EN 50716-2023	Direct quotation
Railway Safety & Protection Standards	IEC 62267:2009	GB/T 32588.1-2016
	IEC 62425:2007（EN 50129）	GB/T 28809-2012
	IEC 62278:2002（EN 50126）	GB/T 21562-2008
	IEC 62280:2014(EN 50159)	GB/T 24339-2023
EMC Standards	IEC 61000-4-2:2008	GB/T 17626.2-2018
	IEC 62236-1:2008(EN 50121-1)	GB/T 24338.1-2018
	CISPR 32:2015	GB/T 9254.1-2021
	CISPR 35:2016	GB/T 9254.2-2021
	IEC 61000-6-4:2018	GB 17799.4-2022
Cable & Wiring Standards	IEC 60332-3-24:2018	GB/T 18380.35
Environmental Requirements Standards	IEC 60529:2013	GB/T 4208-2017
	IEC 60068-1:2013	GB/T 2421-2020
	IEC 60068-2-1:2007	GB/T 2423.1-2008
	IEC 60068-2-2:2007	GB/T 2423.2-2008
	IEC 60068-2-78:2012	GB/T 2423.3-2016
	IEC 60068-2-30:2005	GB/T 2423.4-2008
	IEC 60068-2-13:1983	GB/T 2423.21-2008
	IEC 62236-4:2008	GB/T24338.5-2018
	IEC 60068-2-27:2008	GB/T 2423.5-2019
	IEC 61373：2010	GB/T 21563-2018
Quality Management Standards	ISO 9001	Direct quotation
Communication Standards	IEEE 802.11-2024	Direct quotation
	IEEE 802.3-2015	
Cybersecurity Standards	IEC 62443-4-1:2018	GB/T 42457-2023
	IEC 62443-3-3:2013	GB/T 35673-2017
	CLC/TS 50701:2021	Direct quotation
	BS ISO/IEC 27001:2022	
	BS ISO/IEC 27002:2013	
	BS ISO/IEC 27005:2022	

Standard correspondence

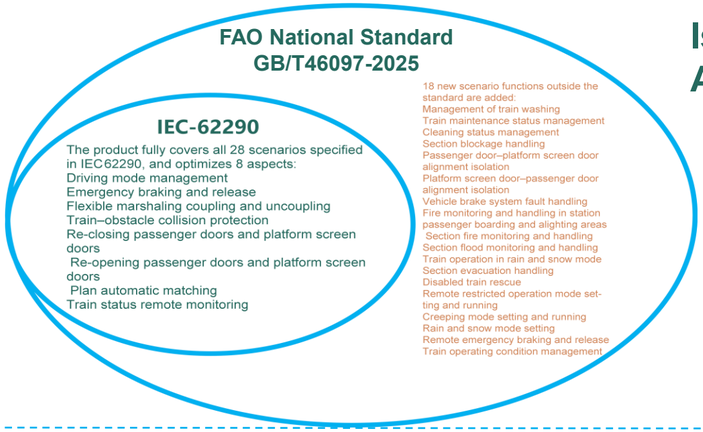
2.3 International vs. National Standards

- IEEE 1474 standard contains a total of 157 functional requirements. The upcoming CBTC national standard covers 155 functions, including 15 enhanced functions and 36 newly added functions; only 2 functions are not applicable.
- FAO national standard fully covers all 28 scenarios specified in IEC 62290 standard, surpasses IEC-62290 standard requirements in 8 aspects, and introduces 18 additional items.

Upcoming release



Explanation of nonapplicable items:
- Broken rail detection – outside the scope of signaling
- Level crossing warning – Chinese standard mainly considers fully enclosed lines



Issued in August 2025

- TCT participated in drafting

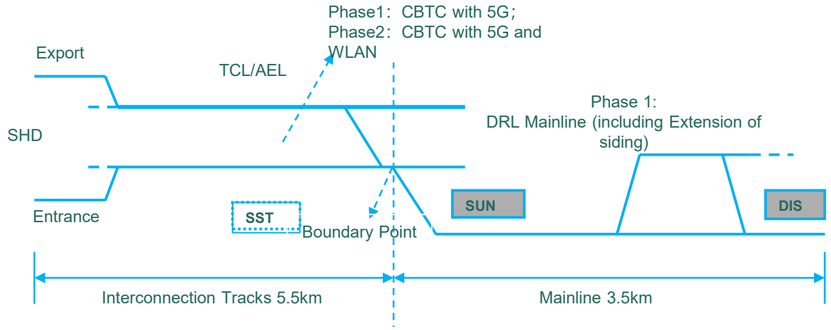
- English Version Review: 50% Completed
- MTR participated in the review

3 Innovative Practices on MTR Disneyland Resort Line

3.1 Innovative Practices on MTR Disneyland Resort Line

- Hong Kong's first new-generation signalling system (PB-TACS) application – Disneyland Resort Line replacement project, a pioneering model of integrated international & national standards.
- Main line to be delivered in 2028.

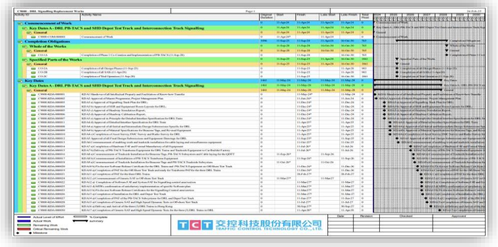
- MTR's first application to use Mainland China Signalling system supplier
- Project management and implementation strictly follow international standards
- Firstly obtain the Cyber Security international standard certification (e.g. IEC 62443) for signalling system



- AI-powered active obstacle detection enhances safety.
- WLAN+5G & ATP+ITE locating strengthens resilience.
- Co-creation with operators elevates intelligence, energy efficiency, intelligent O&M, to raises efficiency.

3.2 Project Delivery Assurance

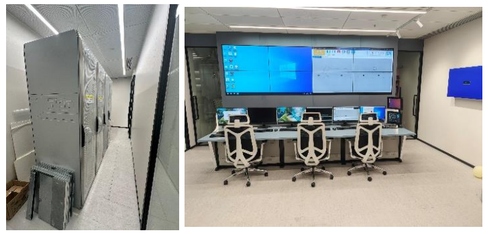
Project executed in full compliance with international project & technical management standards.



Use the P6 tool for refined project management.

The technical system fully meets international standards

Establish local FIVP/SIVP labs to reduce on-site commissioning time and improve baseline delivery quality.



The Science Park lab has been completed by the end of July.

The innovative testing platform at the Siu Ho Wan Depot will be delivered to MTR by 2026.

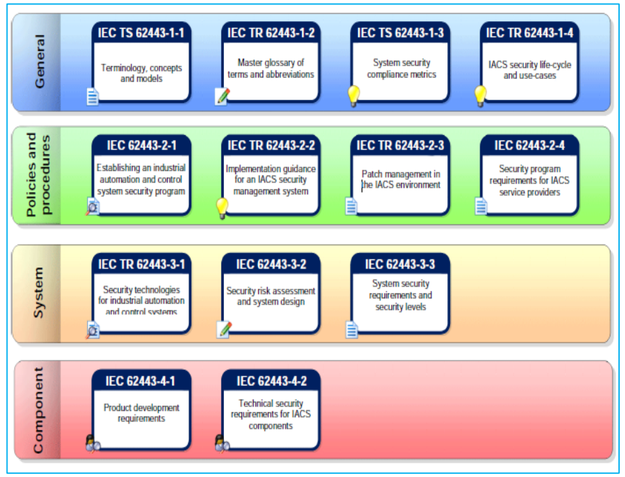
Build a local entity and assemble on-site teams for design, SIVP/FIVP, testing & commissioning, and project management.

Local Delivery Teams

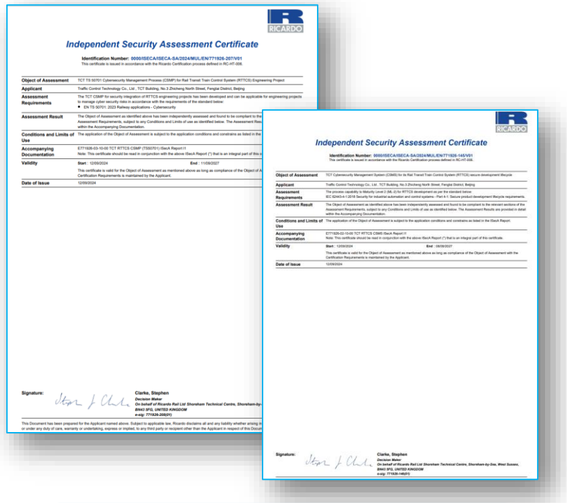
Local Office of Traffic Control Technology (Hong Kong) Co., Limited

3.3 Compliant with International Cybersecurity Standards

- In November 2024, TCT obtained the industry's first International Cybersecurity Product Certification for signalling systems.
- In line with IEC 62443-3-3 and TS 50701 international standards, DRL is to obtain the Cybersecurity Engineering Certification.



International Cybersecurity Standards



Cybersecurity Product Certification

RICARDO

IEC 62443-3-3

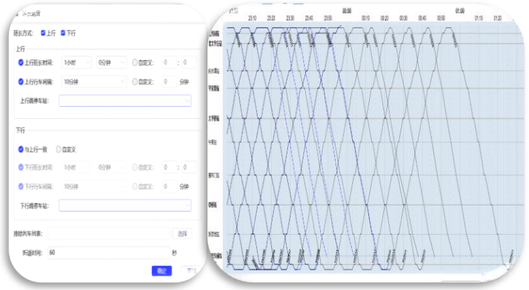
Edition 1.0 2013-08

PD CLC/TS 50701:2023

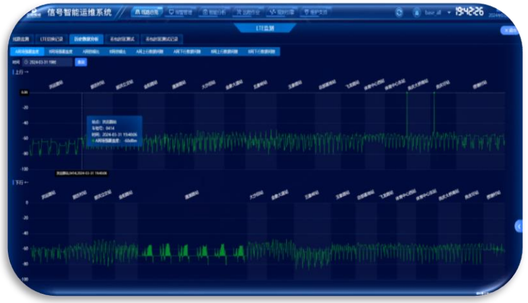
Cybersecurity Engineering Certification

3.4 Innovative Applications - Further Enhancing O&M Efficiency

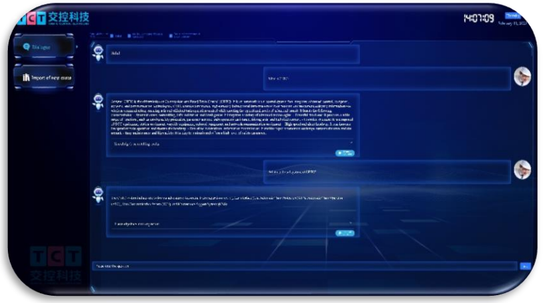
ATS Delay Prediction and Automatic Timetable Adjustment



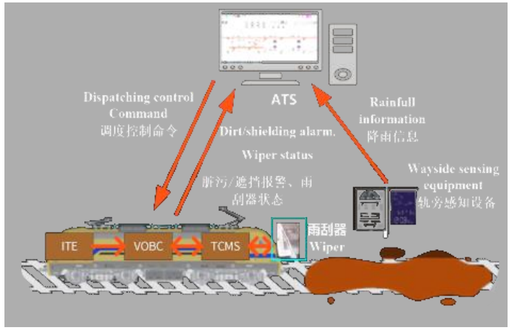
Access Points healthiness Monitoring and fault predicting technology



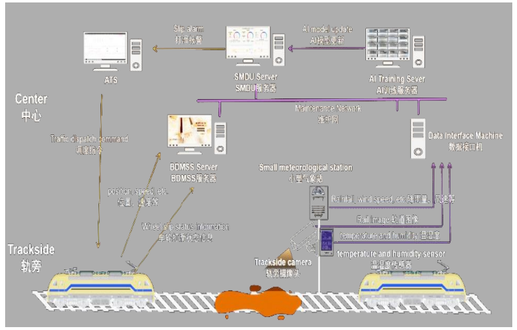
Urban transportation 'MSS ChatGPT'



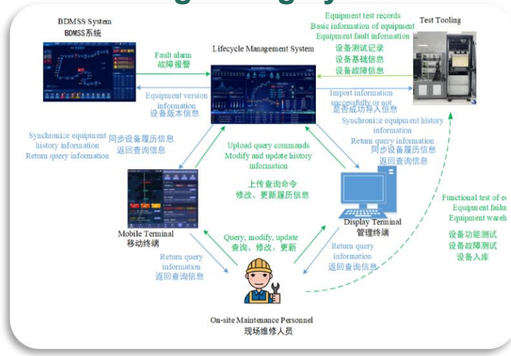
ITE Proactive obstacle Detecting and Train Locating



Wheel Slip-Slide Prediction and Prevention

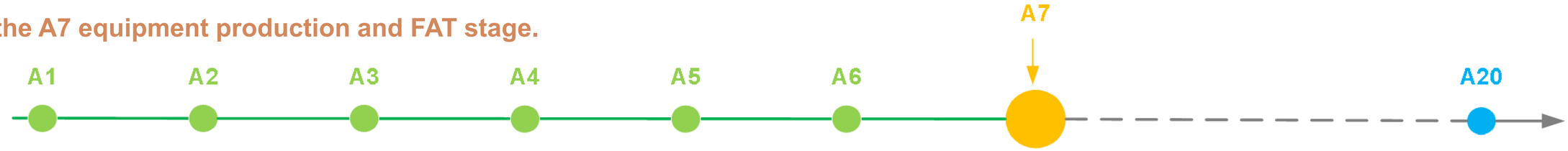


Asset full lifecycle management of Signalling system

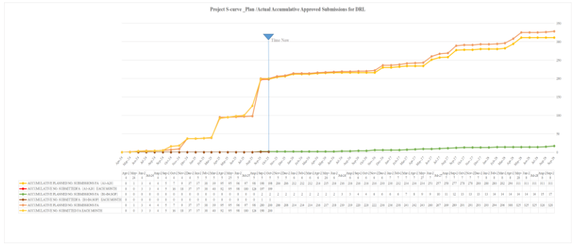


3.5 Project Achievements and Progress

The project has 20 key milestones during its construction phase. System final design has been completed, and it has now entered the A7 equipment production and FAT stage.



Project achievements and experience



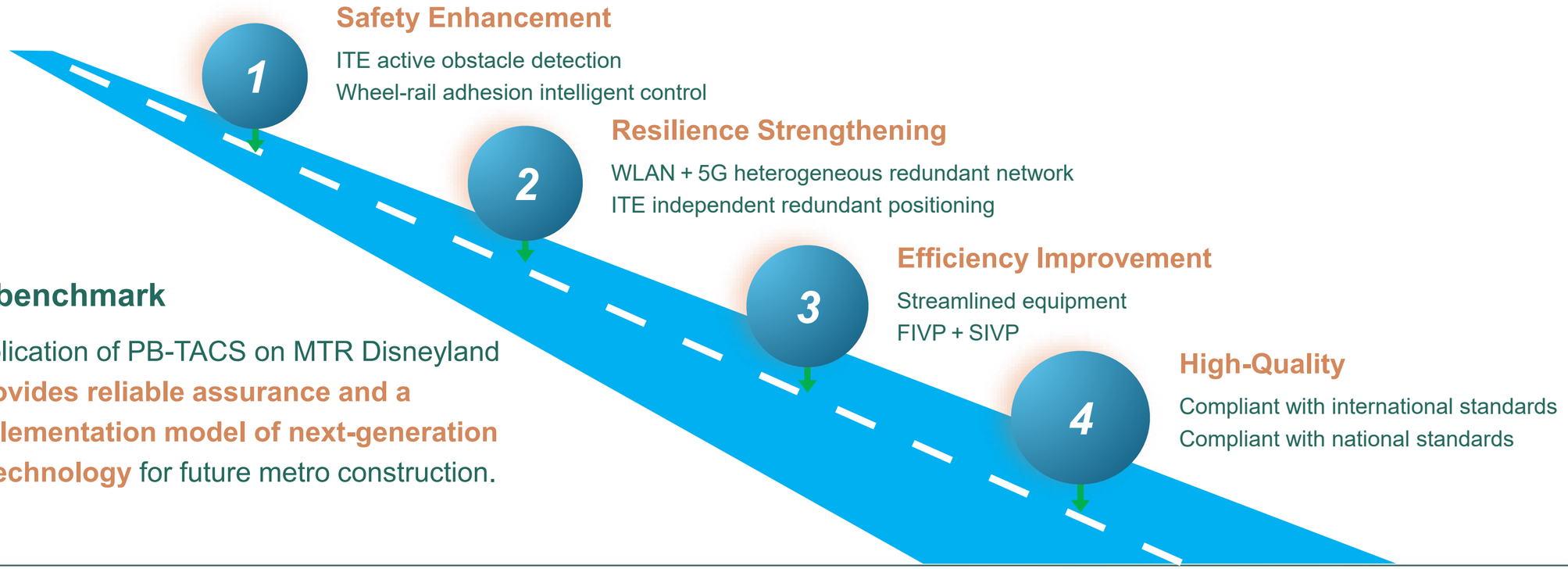
- Strictly executed according to MTR's international management standards.
- Project execution highly aligned with the overall plan.

- A total of 386 deliverable documents are planned for the Disney project.
- 200 documents have been completed, meeting international documentation standards.

- Equipped with a professional implementation team and rigorous project management.
- Provides a solid guarantee for efficient project delivery.

3.6 Project Outcomes

Scheduled for main line delivery in 2028, it will be Hong Kong's first demonstration line equipped with a domestically developed signalling system and operated under international and national high standards.



New safety benchmark

Successful application of PB-TACS on MTR Disneyland Resort Line **provides reliable assurance and a replicable implementation model of next-generation train control technology** for future metro construction.

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