

APM SIGNALING SYSTEM

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Management System
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Driverless Signaling System for High Density Operation



Kyosan's signaling systems are in ever increasing use globally at large international airports, and unmanned transportation systems in developed innovative concept towns, offering the same high reliability and safety the world over.

CONCEPT

The system is based on the following key solutions.

Safety

Proven railway signaling technology is employed in order to realize a highly safe system with regard to vehicle collision avoidance and protection in guideway switching areas.

Operability

A state-of-the-art traffic control system with various automated functions and properly designed human interface is used in order to maximize system operability.

Hierarchical structure

The system is constituted in a hierarchical structure with redundant configuration in order to ensure high-availability.



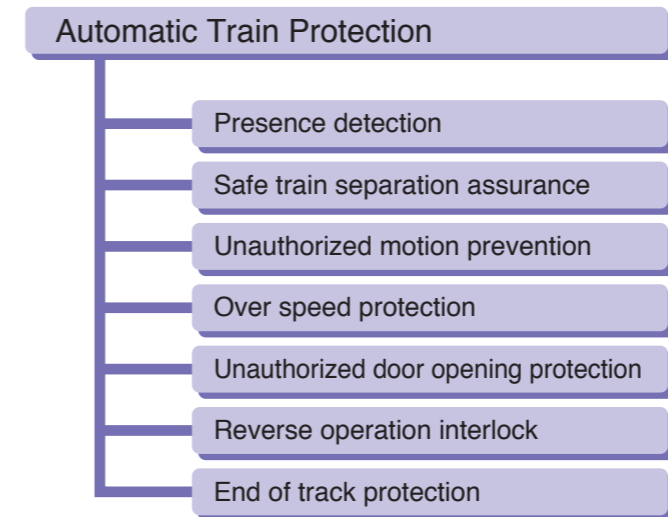
ATP (Automatic Train Protection System)

Overview

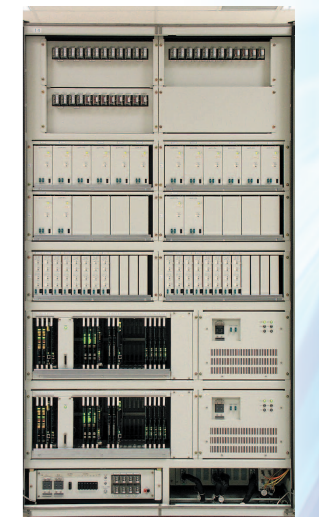
The ATP's microprocessor-based state-of-the-art design with a highly versatile modular scheme achieved centralization of all track circuits to the CCER (Central Control Equipment Room) along the entirety of each guideway, including in the Depot.

TD (Train Detection)

The contact-less TD(Train Detection) system uses loop antennae laid on the guideway. It employs the electro- magnetic induction principle, best suited to rubber-tired transits for presence detection. It uses the Check-in and Check-out scheme that has a proven record of safety and reliability. Despite the fixed blocking scheme, the shortly subdivided blocks have allowed it to achieve high-density operation.



ATP/TD Rack

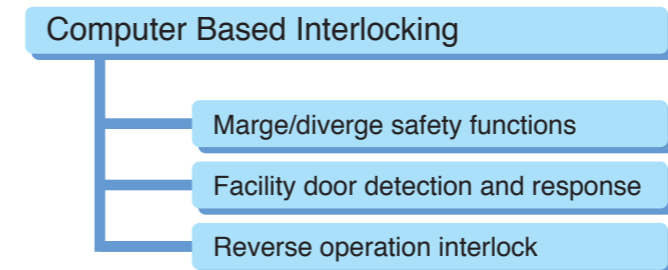


ATP/TD Bay

CBI (Computer Based Interlocking System)

Overview

The CBI is a microprocessor-based interlocking that governs overall traffic safety for APM in centralized mode. It works in coordination with the ATP, ATO and ATS subsystem, all incorporated into the system through the common fail-safe network. Remote electronic terminals are used to interface with the field equipment connected through fiber-optic cables.

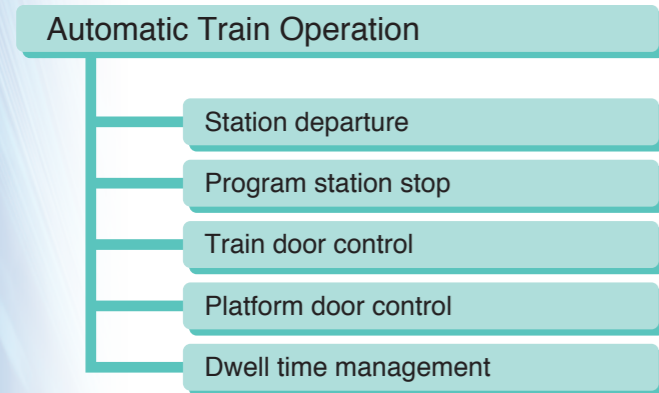


CBI Control Terminal

ATO (Automatic Train Operation System)

Overview

ATO acts as the core subsystem in unattended operation and performs required automatic train control functions, such as programmed station stop, train / platform door control, dwell time management and vehicle departing control at stations. In addition, in synchronous operation mode, ATO automatically adjusts train dispatch timing in accordance with the number and location of the train on the route ahead of the station.

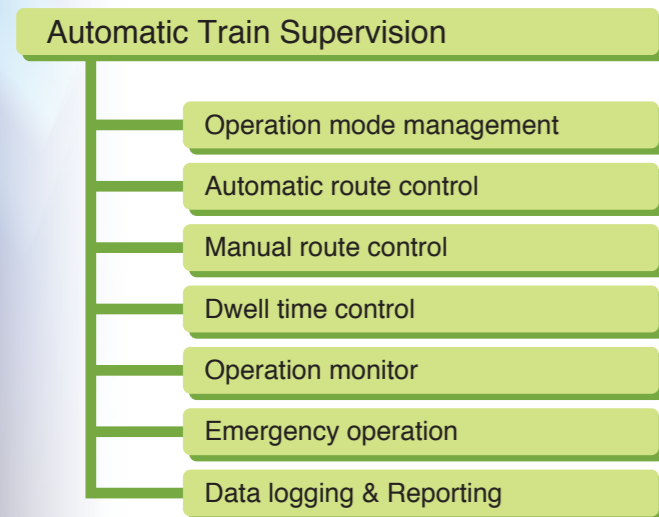


ATO Station Device Bay

ATS (Automatic Train Supervision System)

Overview

ATS system has two control facilities and manages the entire operation of the system with fully automated functions. At the control facility, a number of ATS workstations provide the operators with a wide range of comprehensive information on traffic and facilities in real time and suitably designed system operation modes.



OCC (Operation Control Center)



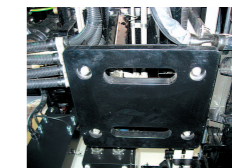
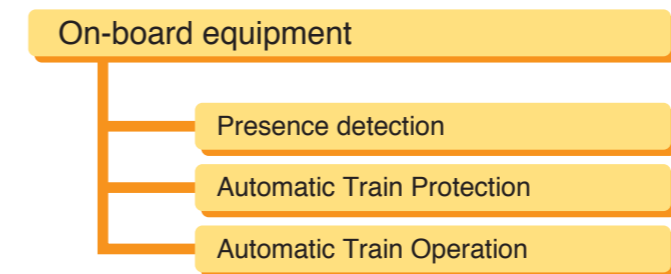
ATS Console

ON-BOARD EQUIPMENT

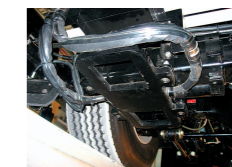
Overview

Integrated ATP & ATO Controller is the heart of the on-board equipment for automated unattended train operation. Its compact packaging allows easy installation in the limited on-board space on a train. It serves as various automatic train control functions in a fail-safe, reliable manner, such as propulsion/braking control, constant running, TASC, overrun protection, direction control, etc. ATO Transmitter & Receiver communicates with the wayside ATO while station dwelling to exchange control commands and on-board status, including train door operation. It also provides accurate position information as ATO position markers encount signal devices that transmits the Check-in and Check-out signals to ATP loop antennae for the safe presence detection.

TASC : Train Automatic station Stop Control



ATO Antenna



ATP/TD Antenna

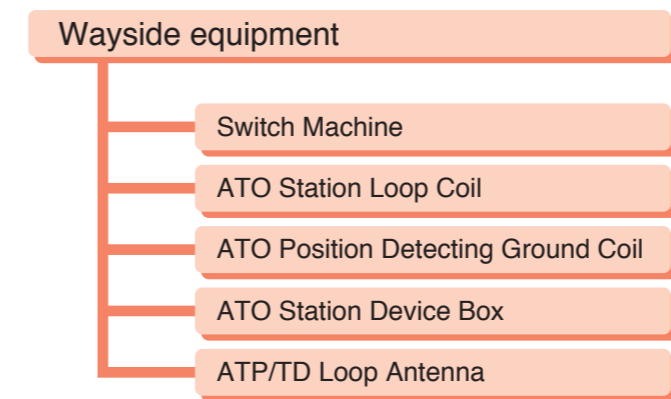


ATP/ATO Controller

WAYSIDE EQUIPMENT

Overview

The wayside equipment is designed to stand up to operation in extreme climate.



Switch Machine



ATO Station Loop Coil



PROJECT OF OVERSEAS APM



Southeast Asia

1. Hong Kong International Airport (1998)
2. Taiwan Taoyuan International Airport (2003)
3. Singapore LRT Sengkang and Punggol Lines (2003)
4. Singapore Changi International Airport (2008)
5. Korea Incheon International Airport (2008)
6. Korea Busan Rapid Transit Line 4 (2011)

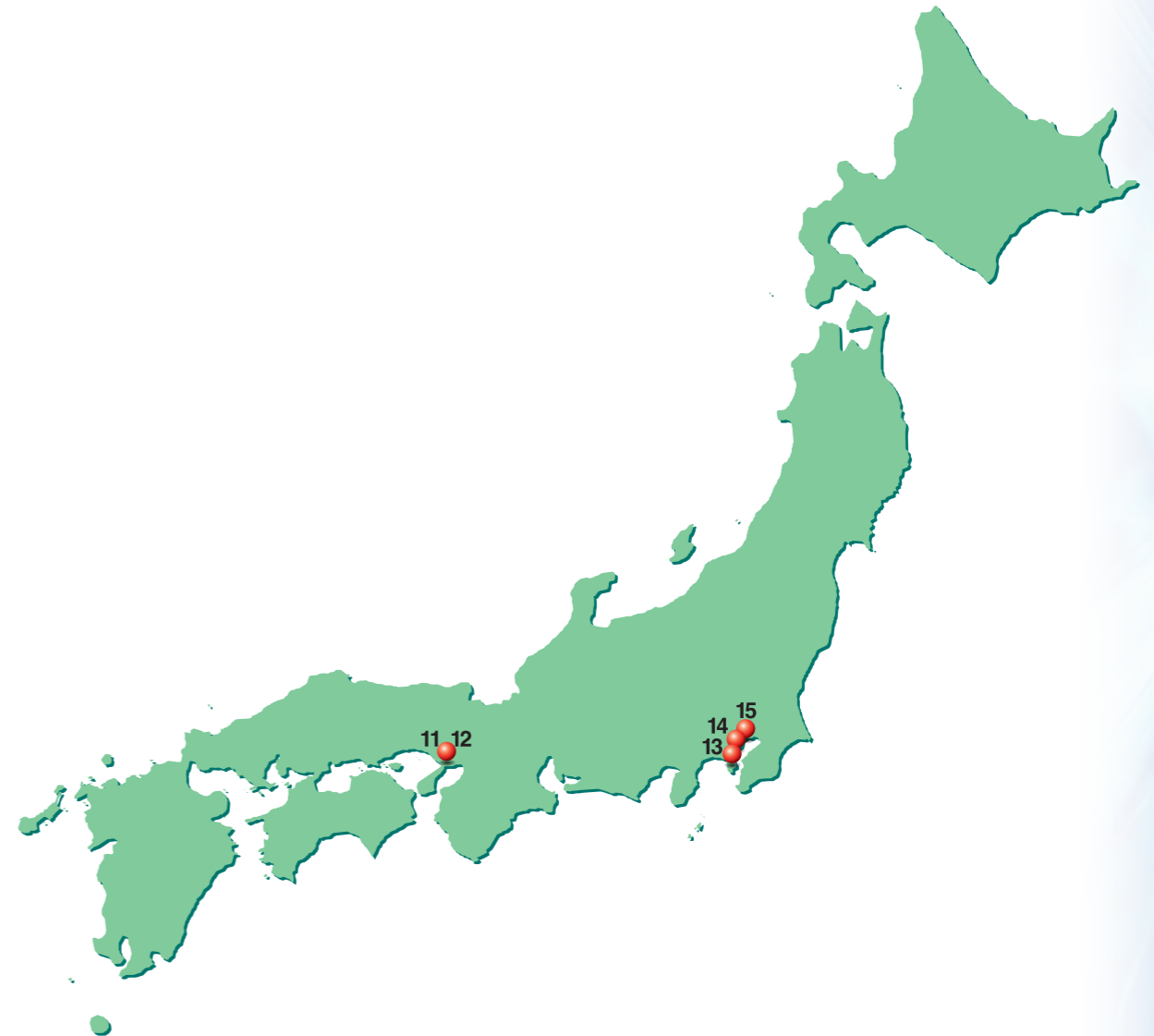
North America

7. Atlanta Airport (2009)
8. Miami International Airport - North Terminal (2010)
9. Miami International Airport - MIA-Mover (2011)

Middle East

10. Dubai International Airport (2012)

DOMESTIC RECORDS



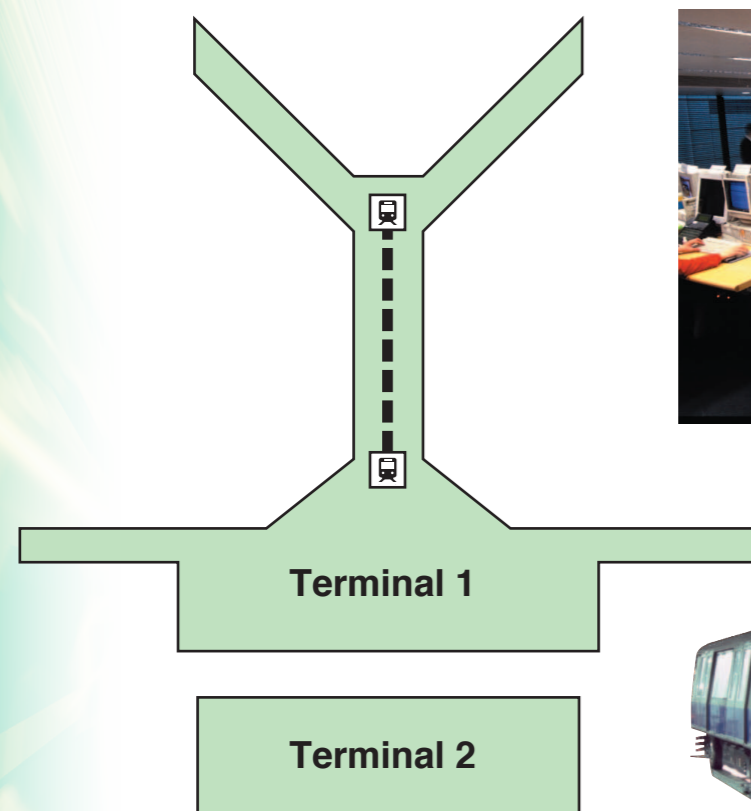
11. Kobe New Transit Port Island Line (1981)
12. Kobe New Transit Rokko Island Line (1990)
13. Kanazawa Seaside Line (1989)
14. Tokyo Waterfront New Transit Waterfront Line (Yurikamome) (1995)
15. Nippori-Toneri Liner (2008)

CASE STUDIES

1 Hong Kong International Airport APM

The Hong Kong International Airport Crystal Mover APM system, opened in 1998, provides passenger transportation service between remote gates and the Main Terminal Building via a dual trainway located at the basement of the building. Segregated arrival and departure services are provided either in shuttle or pinched loop configuration.

Location



Airport Operation Control Center



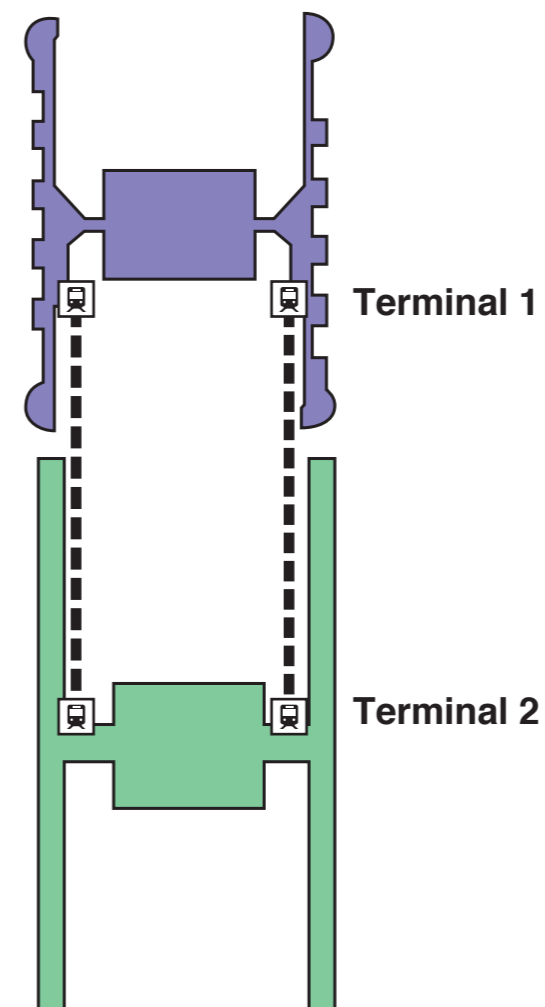
Specifications (Operations Commencement)

Length of the line	1.3 km
No. of stations	2 stations
No. of trains	4 sets / 2 cars , 4 sets / 4 cars
Max. Operation Speed	65 km/h

2 Taiwan Taoyuan International Airport PMS

Kyosan delivered a full turnkey project for a PMS (People Mover System) for Taiwan Taoyuan International Airport, the gateway to Taiwan, to link the newly constructed Terminal 2 to Terminal 1. The PMS opened in 2003. The system has two tracks, North and South. The North track is for transit passengers use only, while the South track serves all passengers and visitors to the airport.

Location



Specifications (Operations Commencement)

Length of the line	0.7 km
No. of stations	4 stations
No. of trains	2 sets / 1 car , 2 sets / 2 cars
Max. Operation Speed	60 km/h

3 Singapore LRT Sengkang and Punggol Lines

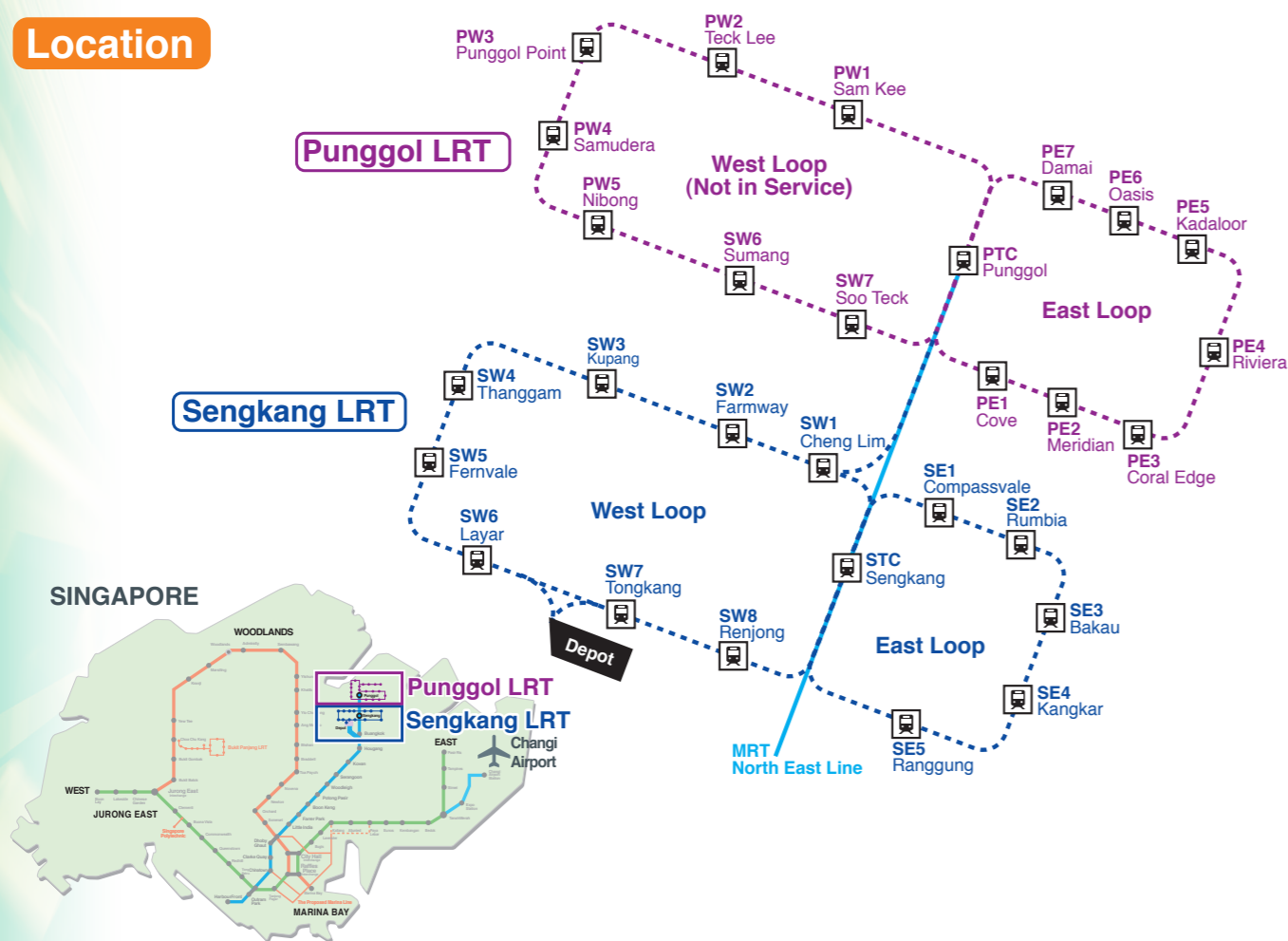
The Sengkang LRT, opened on 18th January 2003, serves a newly developed residential area in the northeast district in Singapore. Operating in fully automated driverless mode, it runs along 10.7 km-long double-circular lines in the shape of a figure 8.

The Sengkang LRT serves 14 stations on double track, all constructed on elevated guideways.

Also, the Punggol LRT, opened on 29th January 2005, serves the residents in the town and urban planning area of Punggol. Its first phase comprises a 10.3 km line with 15 stations.



Location



Specifications (Operations Commencement)

Length of the line	Sengkang : 10.7 km Punggol : 10.3 km
No. of stations	Sengkang : 14 stations + depot Punggol : 15 stations
No. of trains	Sengkang : 18 sets / 1 car Punggol : 24 sets / 1 car
Max. Operation Speed	70 km/h



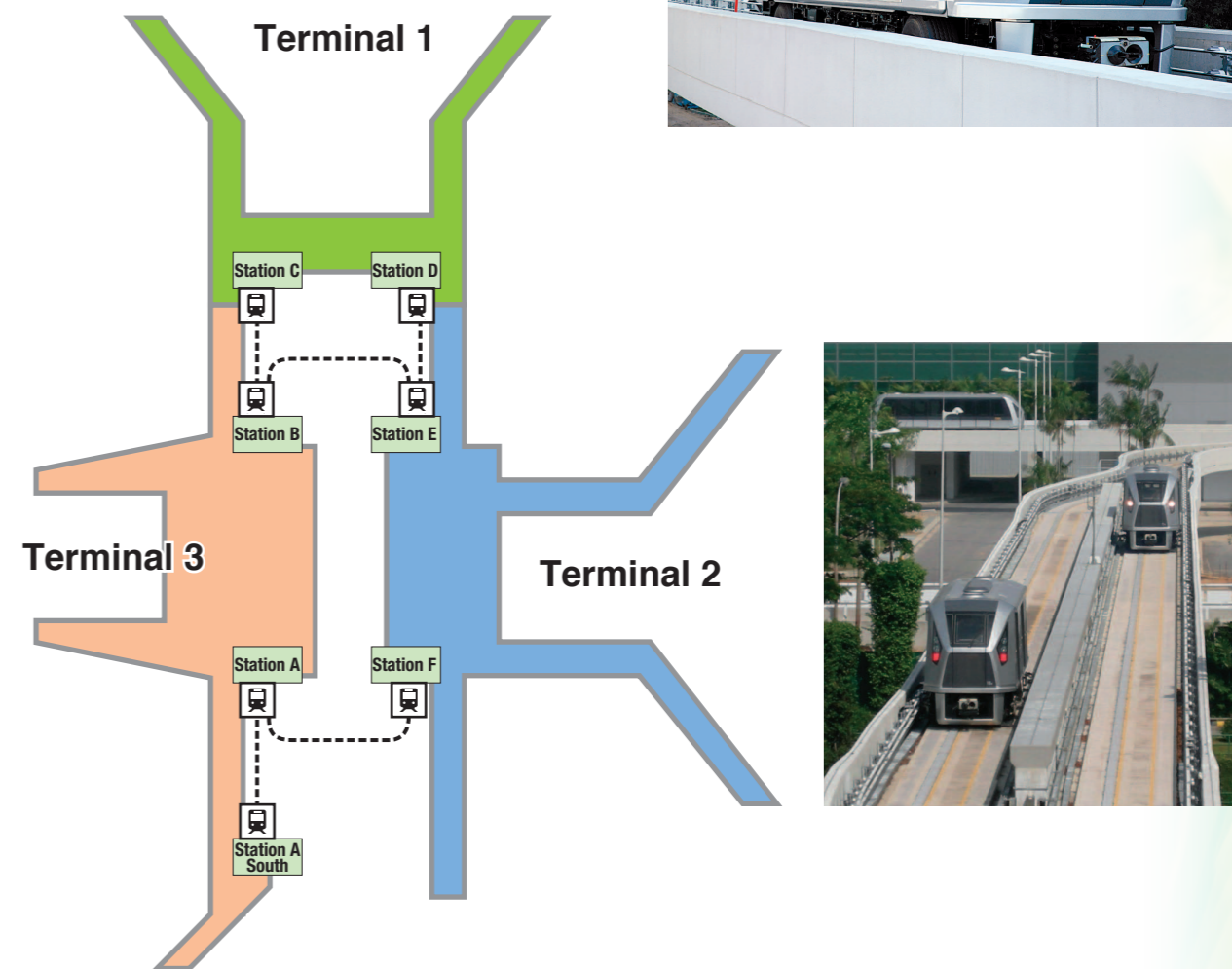
ATO / TD Loop Coil

4 Singapore Changi International Airport PMS

Singapore Changi Airport PMS, opened in January 2008, serves between existing Terminal 1, 2 and 3 each other all constructed on elevated guideways.



Location



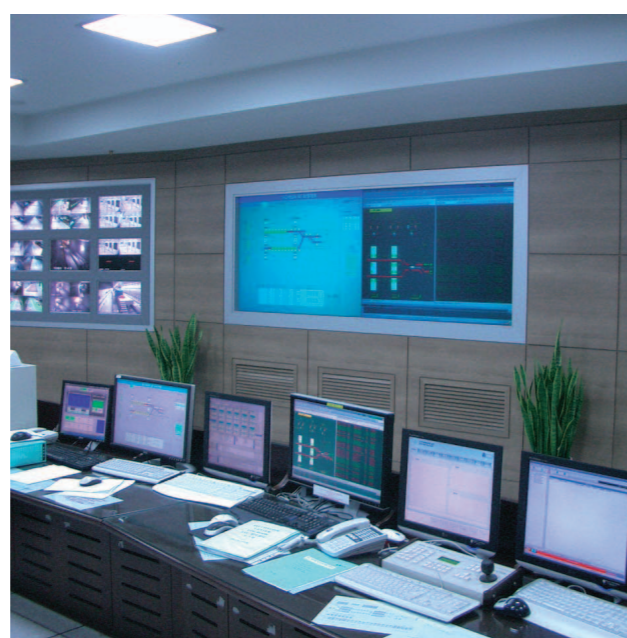
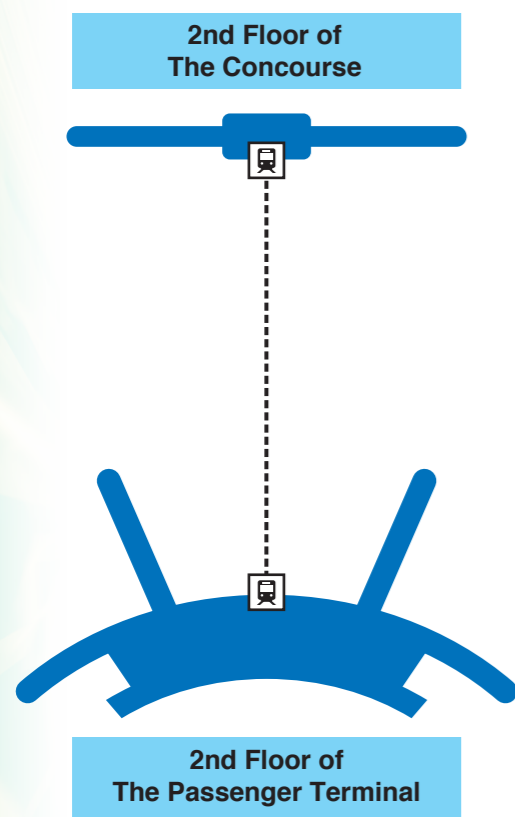
Specifications (Operations Commencement)

Length of the line	6.4 km
No. of stations	7 stations + 2 depots
No. of trains	16 sets / 1 car
Max. Operation Speed	50 km/h

5 Star Line The Incheon Intra Airport Transit

The Star Line opened in May 2008, serving the Incheon International Airport. Operating in fully automated driverless mode, it runs along 1.0 km-Double Shuttle as Incheon International Airport Intra Airport Transit system. The Star Line IAT serves 2 stations on double track, all constructed in under ground tunnel.

Location



Operation Control Center

Specifications (Operations Commencement)

Length of the line	1km
No. of stations	2 stations + depot
No. of trains	3 sets / 3 cars
Max. Operation Speed	70 km/h

6 Korea Busan Rapid Transit Line 4

The Busan Line 4 opened in March 2011. Line 4 that uses type of rubber tire is about 13 km and 14 stations from Minam Sta. to Anpyeong Sta. This line is the first adopted urban unattended train operation in Korea, and demanded high safety and quality.

Location



CBI Control Terminal



Specifications (Operations Commencement)

Length of the line	12.7 km
No. of stations	14 stations
No. of trains	17 sets / 6 cars
Max. Operation Speed	60 km/h

7 Atlanta CONRAC APM

This system opened in 2009. The Atlanta Hartsfield-Jackson Airport Crystal Mover APM system connected the existing concourse at the airport with the Consolidated Rental Car Facility (CONRAC).

The system has 3 station stops: one at the existing concourse at the airport, one at the convention center at the City of College Park, and one at CONRAC.



ATO Station Device Box

Location



Specifications (Operations Commencement)

Length of the line	2.2 km
No. of stations	3 stations + depot
No. of trains	6 sets / 2 cars
Max. Operation Speed	70 km/h

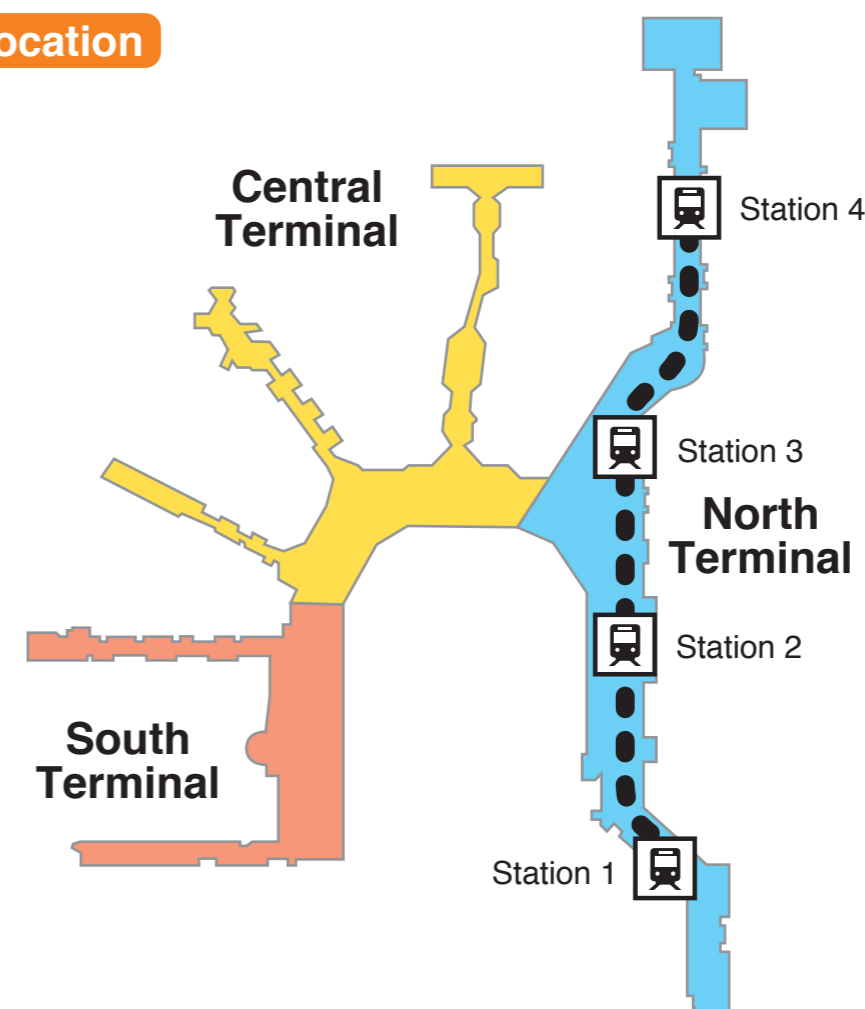
8 Miami International Airport (North Terminal) APM

This system opened in September 2010. It is based on the system of Changi International Airport, Incheon Airport and Atlanta Airport. There are 4 stations and a depot. The APM is operating by unattended train operation from 5:00 am to midnight.



CBI Bay

Location



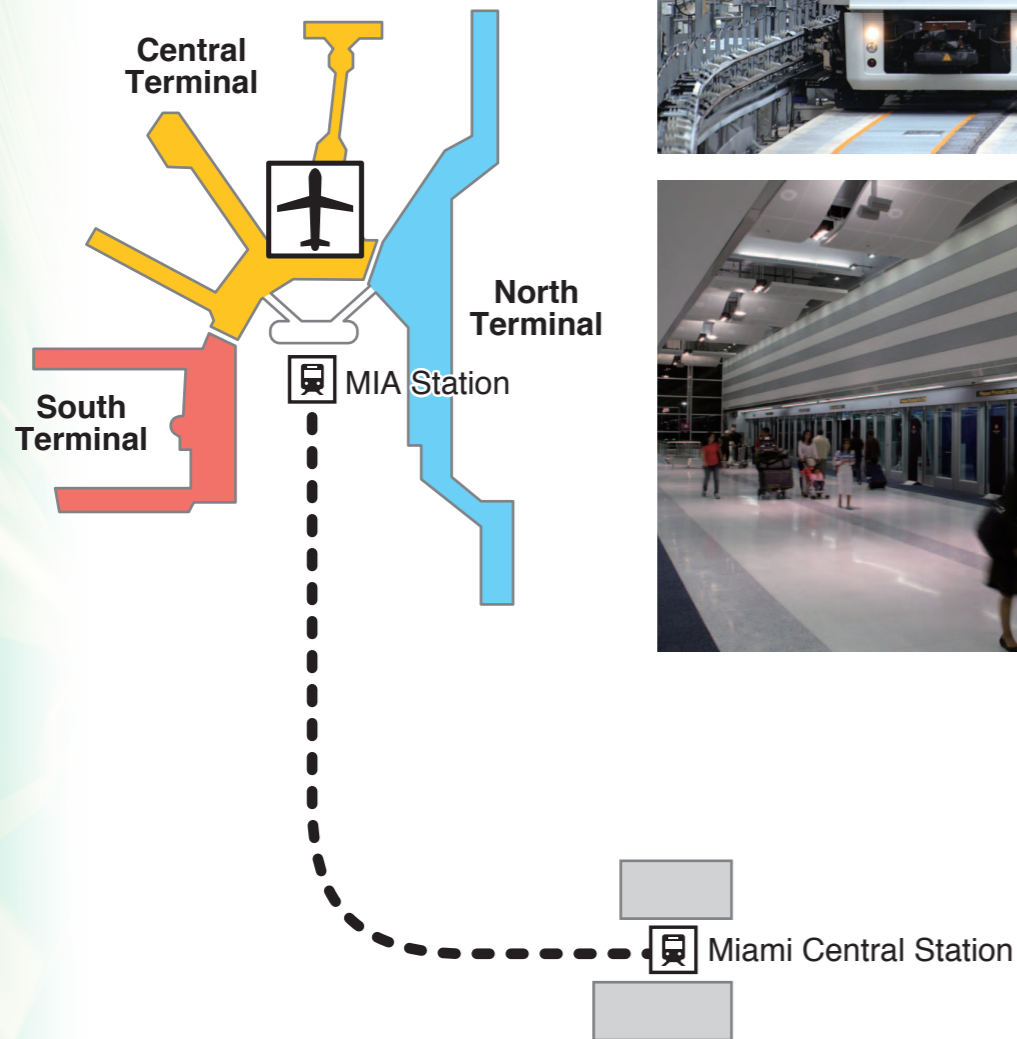
Specifications (Operations Commencement)

Length of the line	1.12 km
No. of stations	4 stations + depot
No. of trains	10 sets / 2 cars
Max. Operation Speed	55 km/h

9 Miami MIA-Mover APM

The MIA Mover APM, opened in 2011, is designed to quickly transport passengers between Miami International Airport's Main Terminal and the Miami Central Station. This system maintains high safety and reliability.

Location



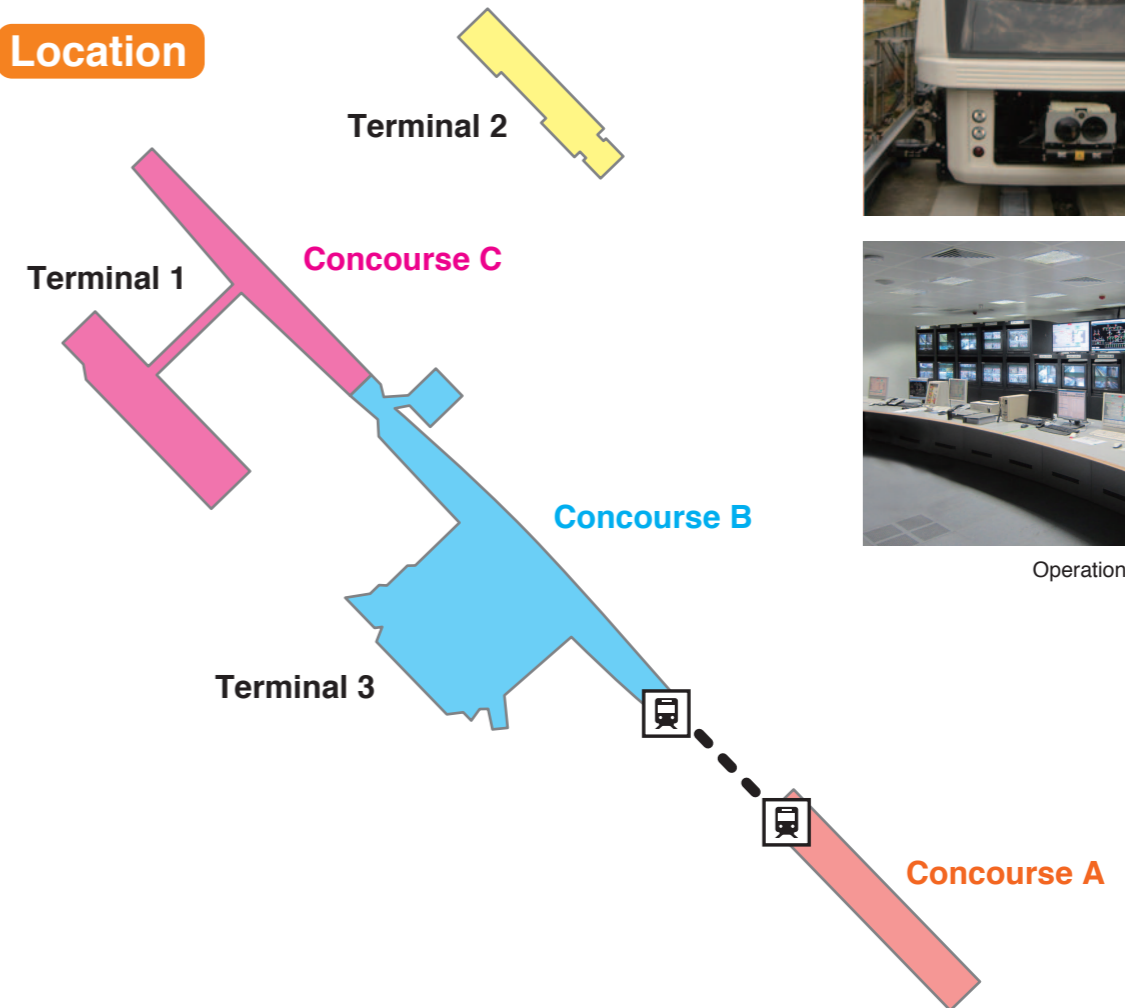
Specifications (Operations Commencement)

Length of the line	2 km
No. of stations	2 stations + depot
No. of trains	4 sets / 2 cars
Max. Operation Speed	70 km/h

10 Dubai International Airport APM

The Dubai International Airport APM Crystal Mover APM system, opened in 2012, serves the underground level of the airport terminal and connect Concourses A and B. This is the first APM system constructed in the Middle East and verb tense as part of the airport's major airport expansion program.

Location



Operation Control Center

Specifications (Operations Commencement)

Length of the line	1.3 km
No. of stations	2 stations + depot
No. of trains	2 sets / 4 cars , 2 sets / 5 cars
Max. Operation Speed	53 km/h