METRO MANILA SUBWAY

Pre-Bidding Conference

CP106

24 January 2020

The **Metro Manila Subway Project (MMSP)** is the first underground railway system in the country.

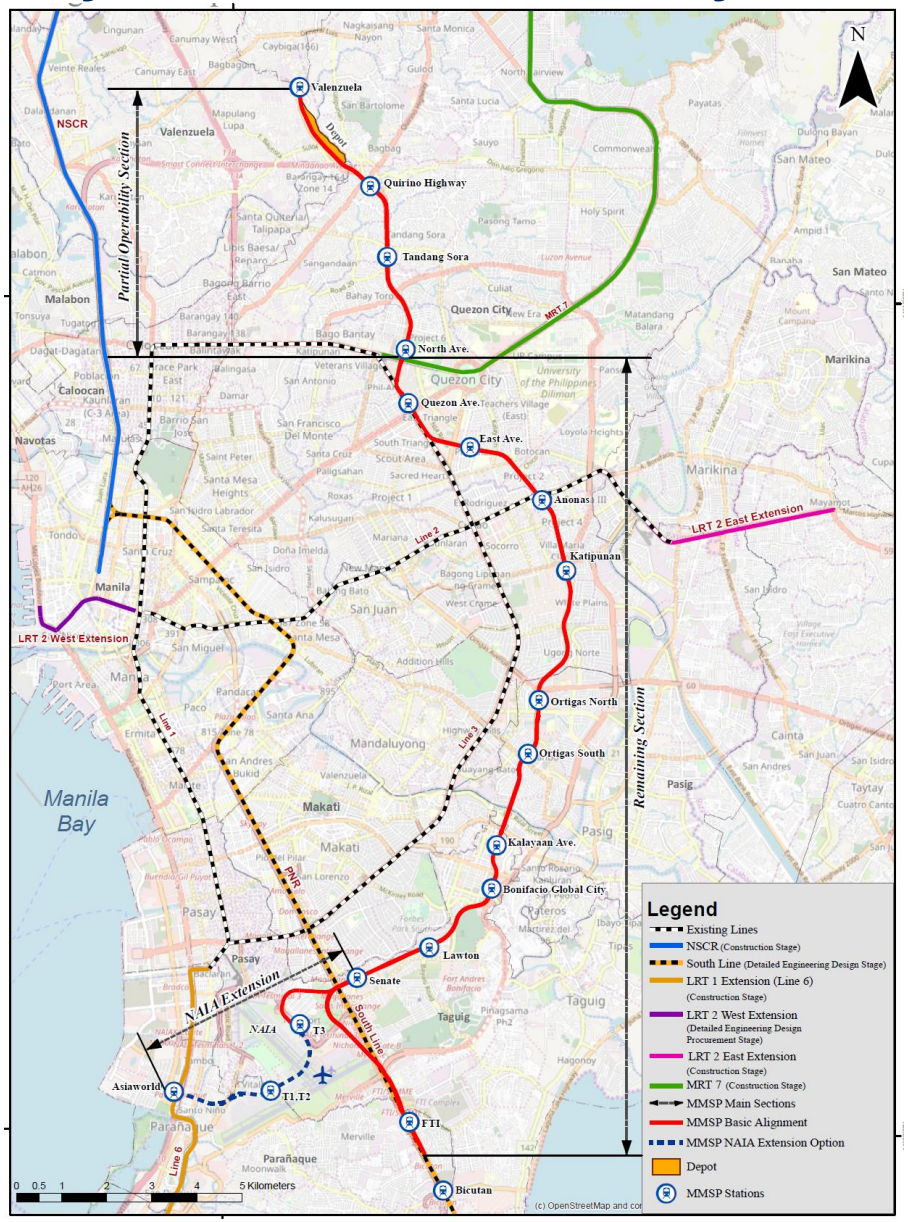
Project Proponent

Department of Transportation (**DOTr**)

Lending Agency

Japan International Cooperation Agency (**JICA**)

Loan Amount	JPY 104,530,000,000.00
Total Project Cost	Php 356,964.17M (LP – Php 265,434.23M; GOP – Php 91,529.94M)



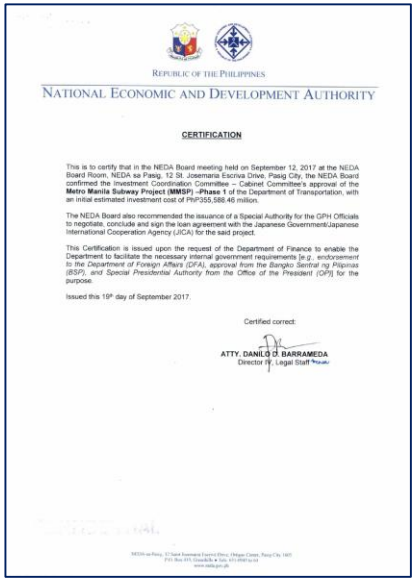
PROJECT MILESTONES

12 September 2017 – **NEDA Board Approval**

25 October 2017 – **Issuance of ECC**

16 March 2018 – **Signing of Loan Agreement** with JICA

22 November 2019 – **Issuance of ECC Amendment**



REPUBLIC OF THE PHILIPPINES
NATIONAL ECONOMIC AND DEVELOPMENT AUTHORITY

CERTIFICATION

This is to certify that in the NEDA Board meeting held on September 12, 2017 at the NEDA Board Room, NEDA sa Pasig, 12 St. Josemaria Escriva Drive, Pasig City, the NEDA Board confirmed the Investment Coordination Committee – Cabinet Committee's approval of the **Metro Manila Subway Project (MMSP) –Phase 1** of the Department of Transportation, with an initial estimated investment cost of PhP355,588.46 million.

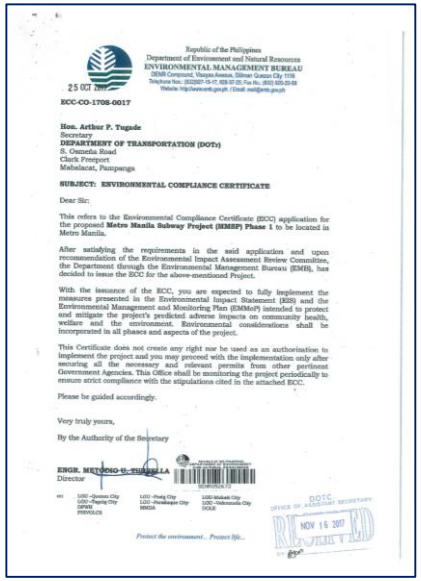
The NEDA Board also recommended the issuance of a Special Authority for the GPH Officials to negotiate, conclude and sign the loan agreement with the Japanese Government/Japanese International Cooperation Agency (JICA) for the said project.

This Certification is issued upon the request of the Department of Finance to enable the Department to facilitate the necessary internal government requirements [*e.g., endorsement to the Department of Foreign Affairs (DFA), approval from the Bangko Sentral ng Pilipinas (BSP), and Special Presidential Authority from the Office of the President (OP)*] for the purpose.

Issued this 19th day of September 2017.

Certified correct:

ATTY. DANILO D. BARRAMEDA
Director IV, Legal Staff



Republic of the Philippines
Department of Environment and Natural Resources
ENVIRONMENTAL MANAGEMENT BUREAU
DENR Compound, Visayas Avenue, Diliman Quezon City 1116
Telephone Nos.: (632)927-15-17, 928-37-25; Fax No.: (632) 920-22-58
Website: http://www.emb.gov.ph / Email: mail@emb.gov.ph

25 OCT 2017

ECC-CO-1708-0017

Hon. Arthur P. Tugade
Secretary
DEPARTMENT OF TRANSPORTATION (DOTr)
S. Osmeña Road
Clark Freeport
Mabalacat, Pampanga

SUBJECT: ENVIRONMENTAL COMPLIANCE CERTIFICATE

Dear Sir:

This refers to the Environmental Compliance Certificate (ECC) application for the proposed **Metro Manila Subway Project (MMSP) Phase 1** to be located in Metro Manila.

After satisfying the requirements in the said application and upon recommendation of the Environmental Impact Assessment Review Committee, the Department through the Environmental Management Bureau (EMB), has decided to issue the ECC for the above-mentioned Project.

With the issuance of the ECC, you are expected to fully implement the measures presented in the Environmental Impact Statement (EIS) and the Environmental Management and Monitoring Plan (EMMoP) intended to protect and mitigate the project's predicted adverse impacts on community health, welfare and the environment. Environmental considerations shall be incorporated in all phases and aspects of the project.

This Certificate does not create any right nor be used as an authorization to implement the project and you may proceed with the implementation only after securing all the necessary and relevant permits from other pertinent Government Agencies. This Office shall be monitoring the project periodically to ensure strict compliance with the stipulations cited in the attached ECC.

Please be guided accordingly.

Very truly yours,

By the Authority of the Secretary

ENGR. METODIO G. [redacted]
Director

DOTC
OFFICE OF ASSISTANT SECRETARY
RECEIVED
NOV 16 2017

Protect the environment... Protect life...

Loan Agreement No. PH-P267

LOAN AGREEMENT

For

Metro Manila Subway Project (Phase 1)(I)

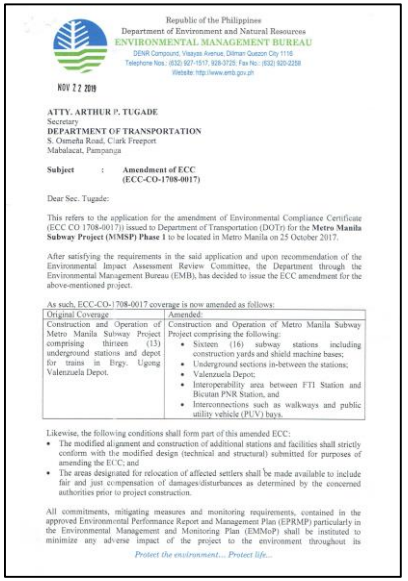
Between

JAPAN INTERNATIONAL COOPERATION AGENCY

And

THE GOVERNMENT OF
THE REPUBLIC OF THE PHILIPPINES

Dated March **16**, 2018



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Telephone Nos.: (632) 927-1517, 928-3725; Fax No.: (632) 920-2258
Website: http://www.emb.gov.ph

NOV 22 2019

ATTY. ARTHUR P. TUGADE
Secretary
DEPARTMENT OF TRANSPORTATION
S. Osmeña Road, Clark Freeport
Mabalacat, Pampanga

Subject : **Amendment of ECC (ECC-CO-1708-0017)**

Dear Sec. Tugade:

This refers to the application for the amendment of Environmental Compliance Certificate (ECC CO 1708-0017) issued to Department of Transportation (DOTr) for the **Metro Manila Subway Project (MMSP) Phase 1** to be located in Metro Manila on 25 October 2017.

After satisfying the requirements in the said application and upon recommendation of the Environmental Impact Assessment Review Committee, the Department through the Environmental Management Bureau (EMB), has decided to issue the ECC amendment for the above-mentioned project.

As such, ECC-CO-1708-0017 coverage is now amended as follows:

Original Coverage	Amended:
Construction and Operation of Metro Manila Subway Project comprising thirteen (13) underground stations and depot for trains in Brgy. Ugong Valenzuela Depot.	Construction and Operation of Metro Manila Subway Project comprising the following: • Sixteen (16) subway stations including construction yards and shield machine bases; • Underground sections in-between the stations; • Valenzuela Depot; • Interoperability area between FTI Station and Bicutan PNR Station, and • Interconnections such as walkways and public utility vehicle (PUV) bays.

Likewise, the following conditions shall form part of this amended ECC:

- The modified alignment and construction of additional stations and facilities shall strictly conform with the modified design (technical and structural) submitted for purposes of amending the ECC; and
- The areas designated for relocation of affected settlers shall be made available to include fair and just compensation of damages/disturbances as determined by the concerned authorities prior to project construction.

All commitments, mitigating measures and monitoring requirements, contained in the approved Environmental Performance Report and Management Plan (EPRMP) particularly in the Environmental Management and Monitoring Plan (EMMoP) shall be instituted to minimize any adverse impact of the project to the environment throughout its

Protect the environment... Protect life...

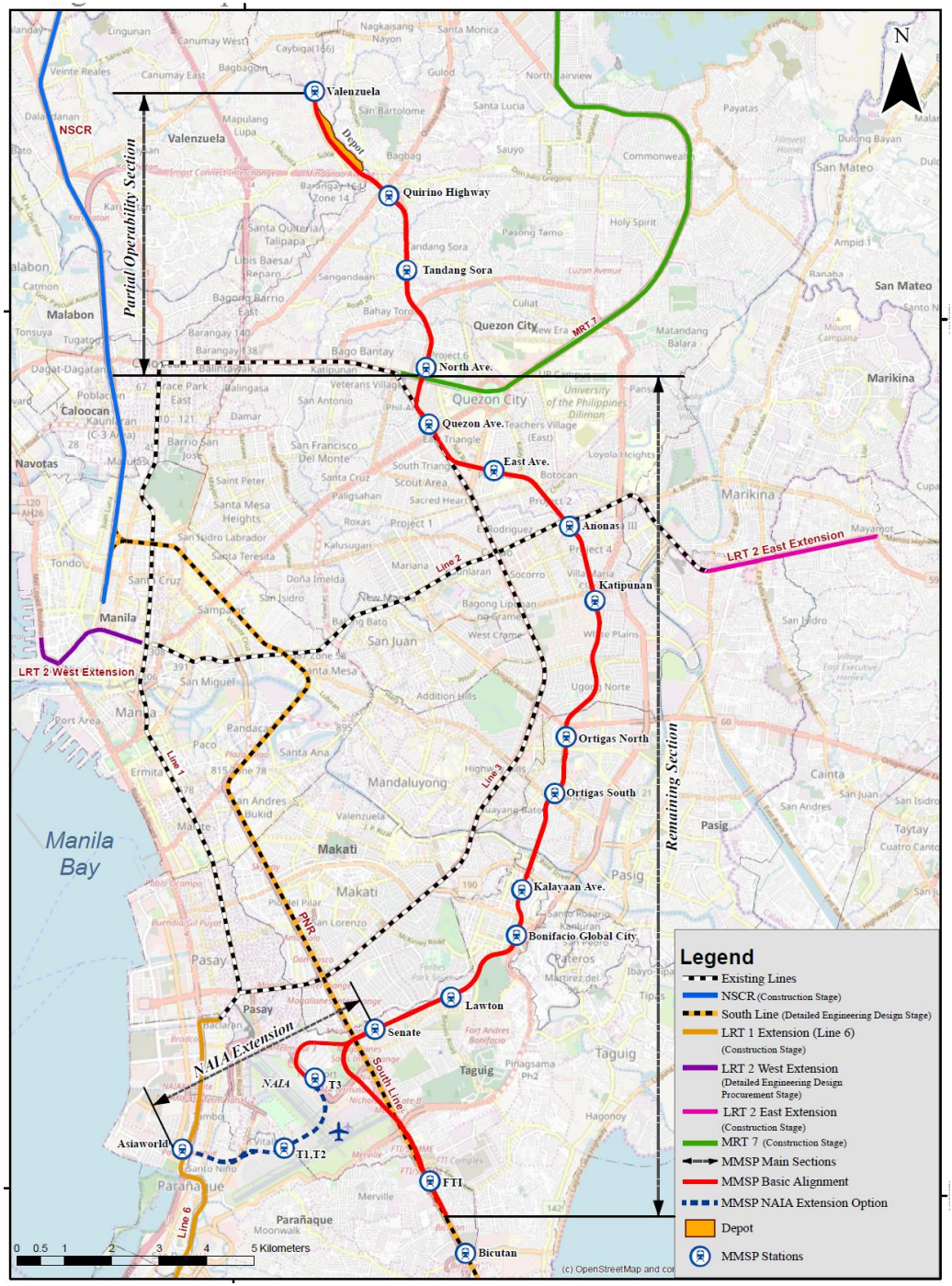
PROJECT MILESTONES

21 November 2018 – **General Consultancy *(Oriental Consultants Global-JV)* Contract Signing**

20 February 2019 – **General Contractor *(Joint Venture between Shimizu Corporation, Fujita Corporation, Takenaka Civil Engineering & Construction Co., Ltd., and EEI Corporation)* for Partial Operability Section Contract Signing**

27 February 2019 – **Groundbreaking Ceremony**

21 December 2019 – **Mobilization Ceremony**



METRO MANILA SUBWAY PROJECT (MMSP) – PHASE I

Passing through seven (7) different cities *(Valenzuela, Quezon City, Pasig, Makati, Taguig, Paranaque, and Pasay)*

GENERAL PROJECT TIMELINE

ACTIVITY	EXPECTED DATE
Partial Operability (PO) Section Construction	2020
Partial Operability (PO) Section Operation	2022
Remaining Section Construction	2021
Full Section Operation	2025

TECHNICAL PARAMETERS

Route Length: 36 km

Electric Multiple Unit (EMU)

Design Speed (max):

80 – 120 kph

Average Headway: 4 mins

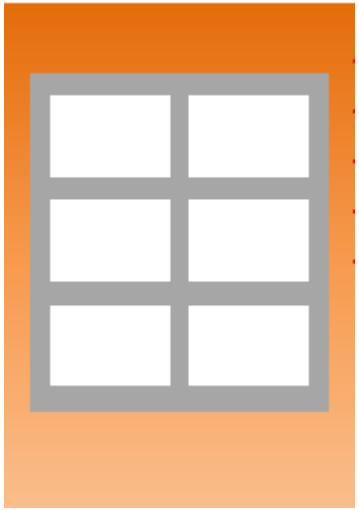
Platform Screen Doors: Full Height

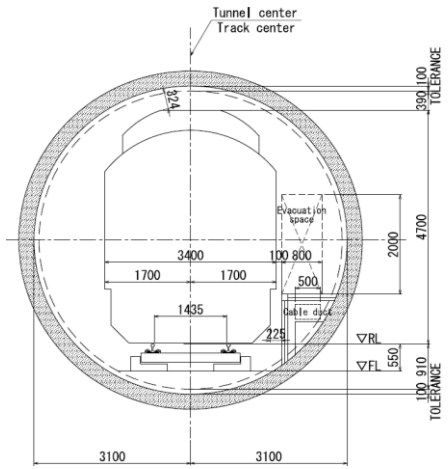
Typical Platform Width: Island (10m), Side (7m)

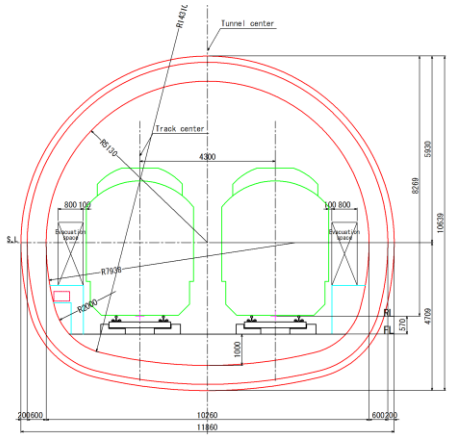
Depot: 30 ha (Brgy. Ugong, Valenzuela)

Signaling: CBTC

CONSTRUCTION METHODOLOGY







Cut and Cover Method

Tunnel Boring Machine (TBM)

New Austrian Tunneling Method (NATM)

CP106:
ELECTROMECHANICAL SYSTEMS AND TRACKWORKS


TRACKWORKS

INTRODUCTION

Tracks – known as the permanent way, the structure consisting of the rails, fasteners, railroad ties (sleepers) ballast or concrete track bed (in case of slab track) , plus the underlying subgrade.

- It enables trains to move with their wheels rolling on rails.
- Rails are laid inside the tunnel, Depot area, on ground and on viaduct preferably on concrete bed.

INTRODUCTION cont.

Main Line - Tracks commonly used for daily train operation for moving passengers. It comprising of

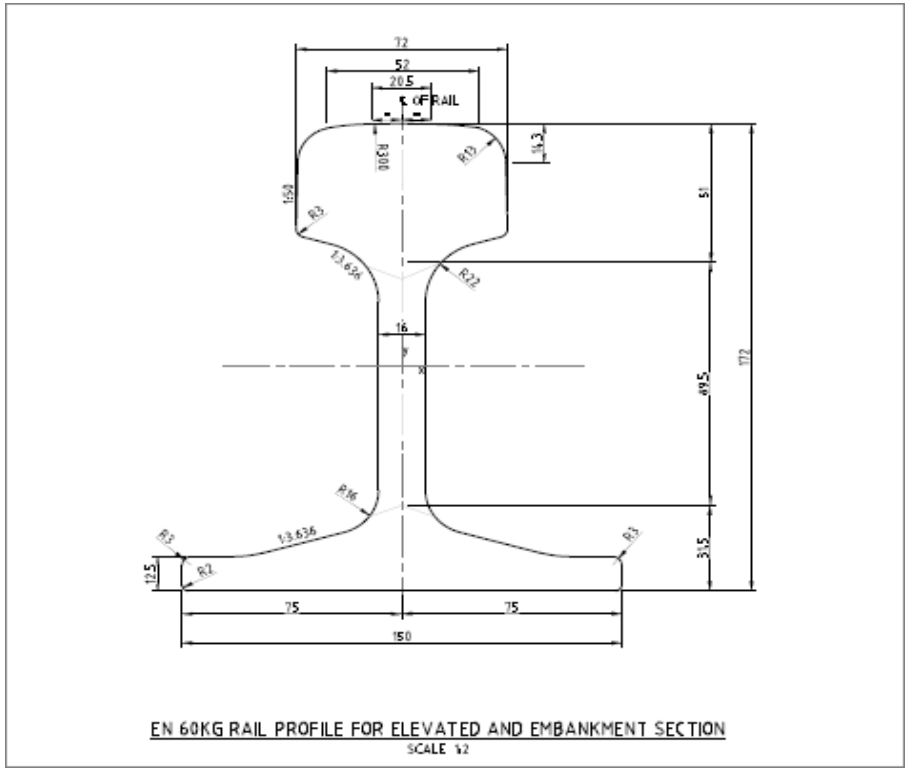
- Turnouts; Crossovers; Scissor Crossings necessary for the train to transfer from one track to another,
- Pocket Tracks for temporary storage of Trains and Maintenance Vehicles.

Depot - Secured area for stabling and maintenance of trains and other facilities for maintenance the whole railway. It comprises of

- Buildings, repair shops, stabling tracks
- P-Way Maintenance shop
- OCS Maintenance shop
- Signalling and Telecom System maintenance/repair shop

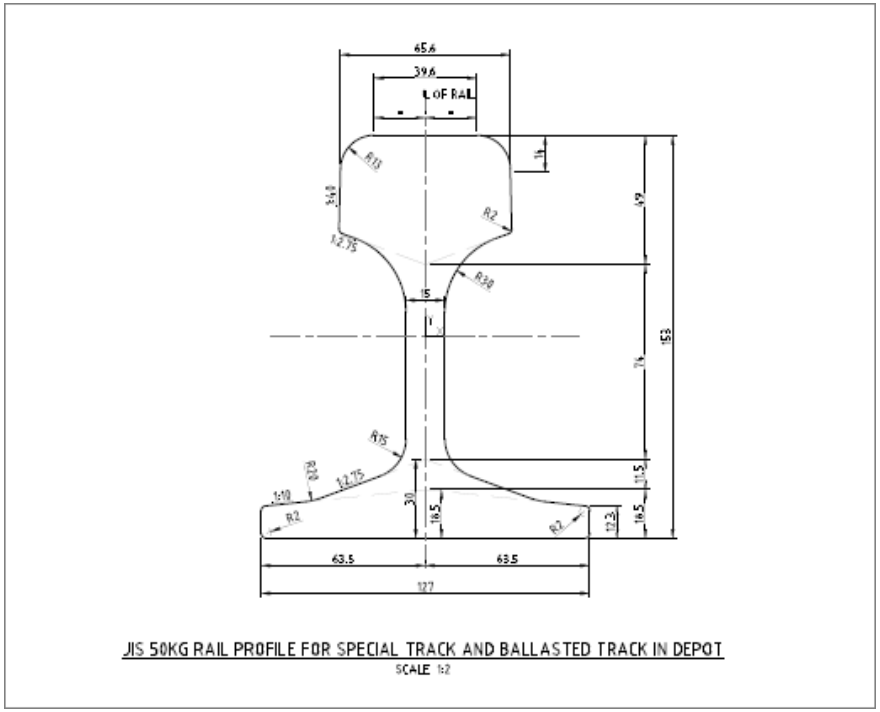
CROSS SECTION of RAIL

EN60E1 or JIS60KG (For Main Line)



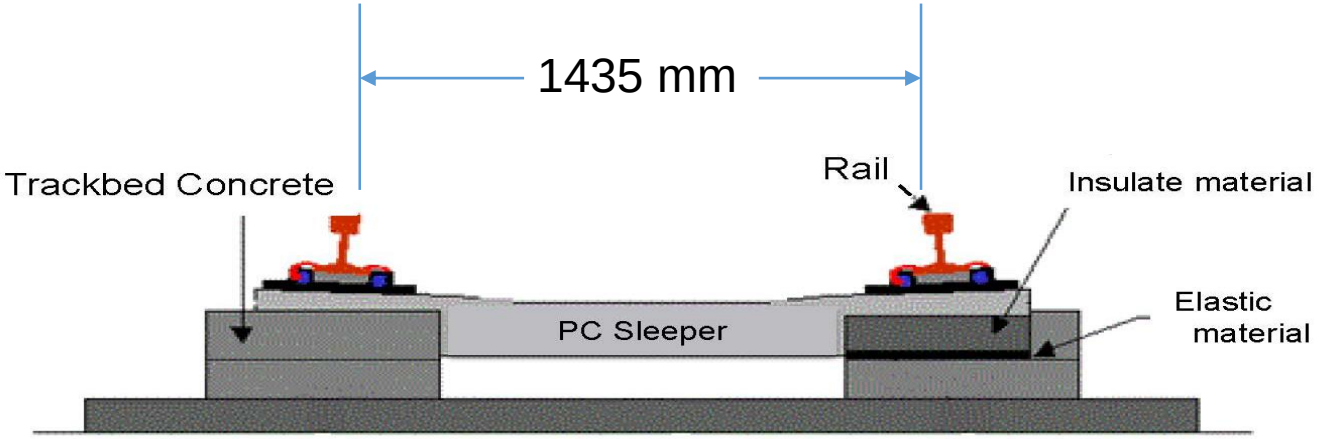
EN 60KG RAIL PROFILE FOR ELEVATED AND EMBANKMENT SECTION
SCALE ½

JIS 50KG (For Depot)



JIS 50KG RAIL PROFILE FOR SPECIAL TRACK AND BALLASTED TRACK IN DEPOT
SCALE ½

TRACK STRUCTURE & TRACK GAUGE



STABLING TRACK at DEPOT

STABLING AREA

SCHEMATIC DRAWING

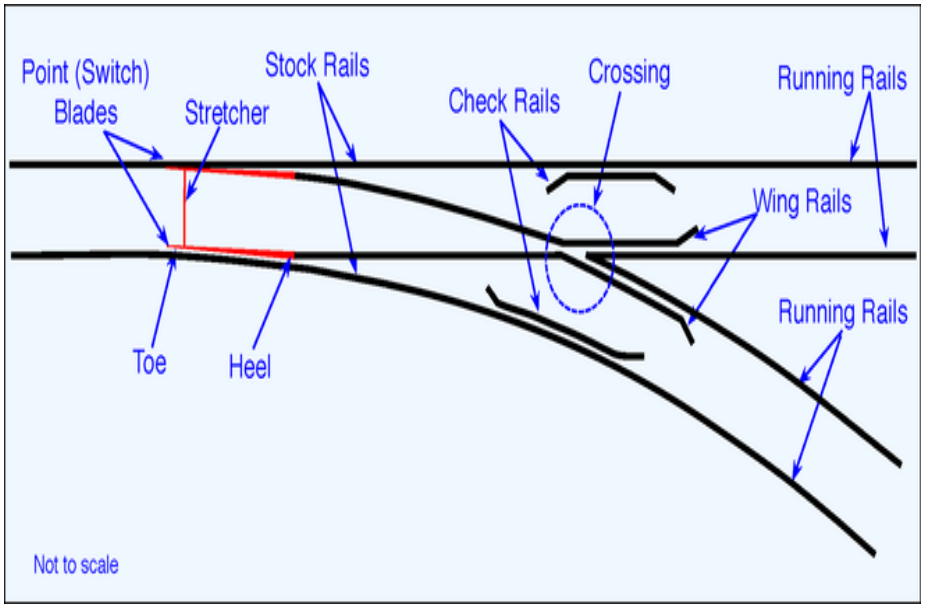
BALLAST & CONCRETE TRACK-BED

BALLASTED TRACK

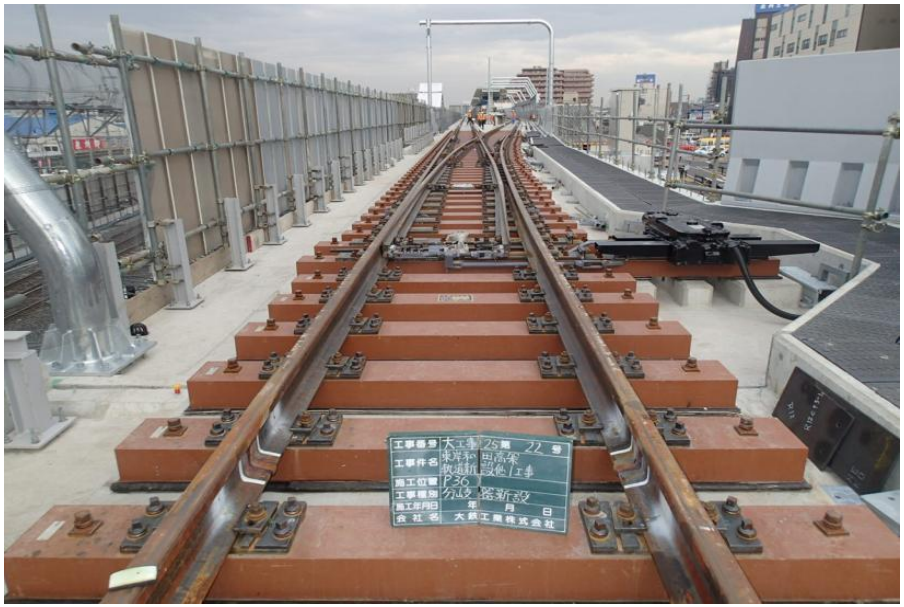
SLAB TRACK AT STATION

TURNOUT

LAYOUT DRAWING



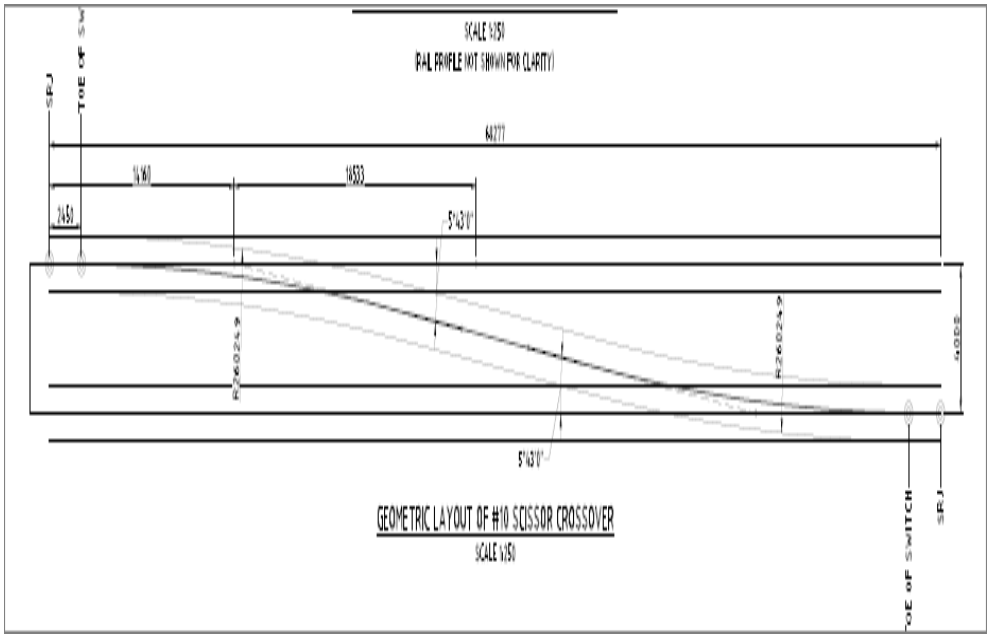
TURNOUT



CROSSOVER

CROSSOVER

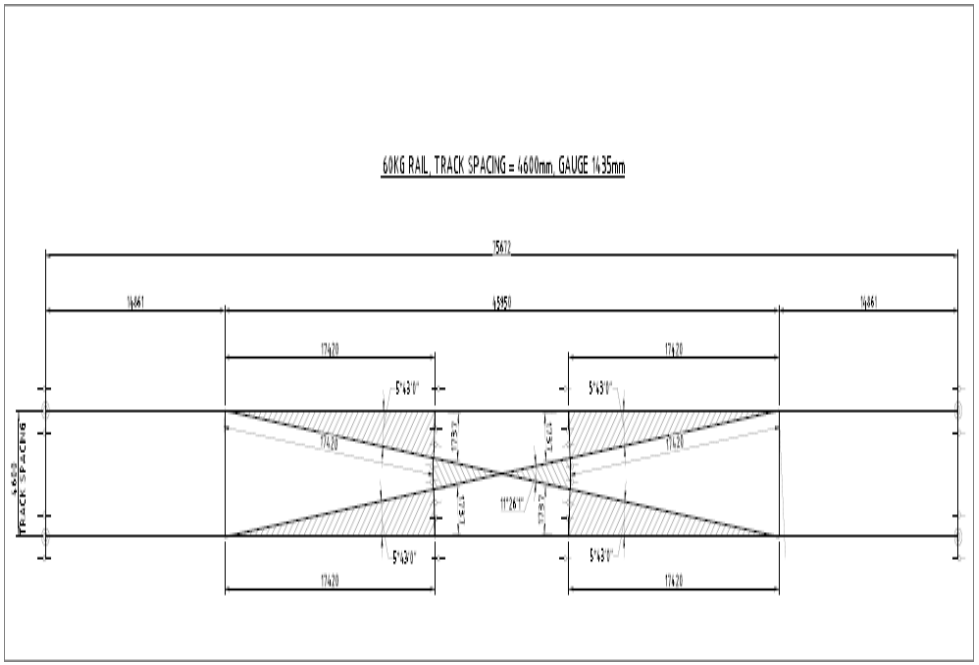
SCHEMATIC DRAWING



SCISSOR CROSSING

SCISSOR CROSSING

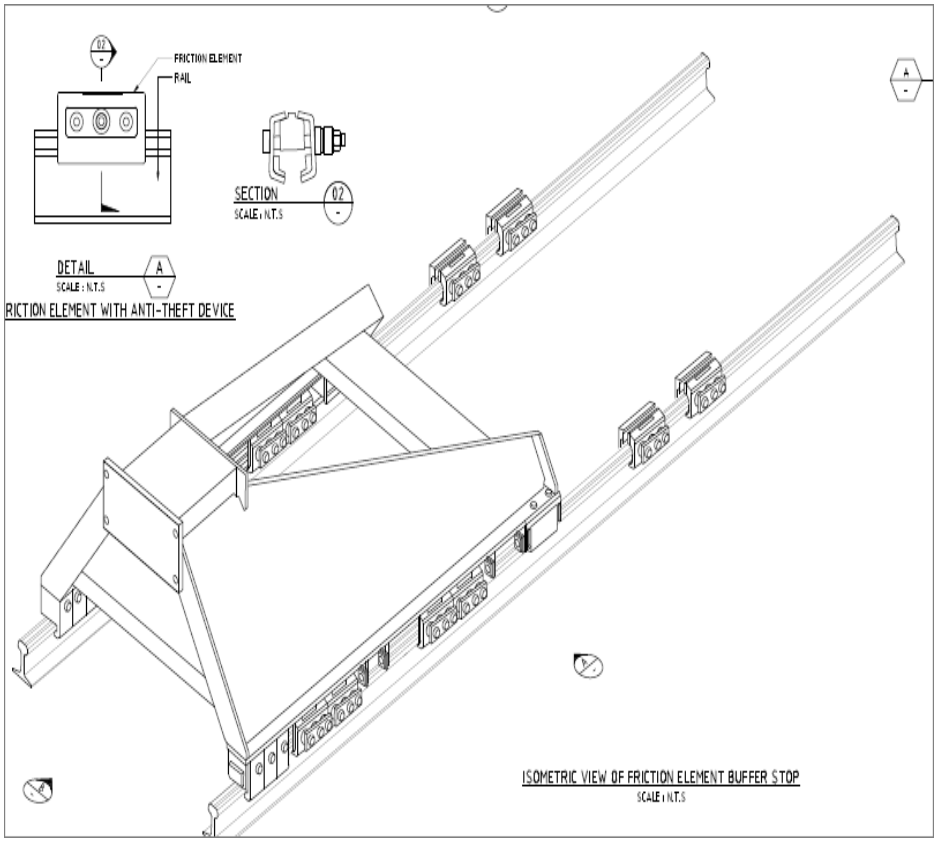
SCHEMATIC DRAWING



BUFFER STOP

RAWIE BUFFER STOP

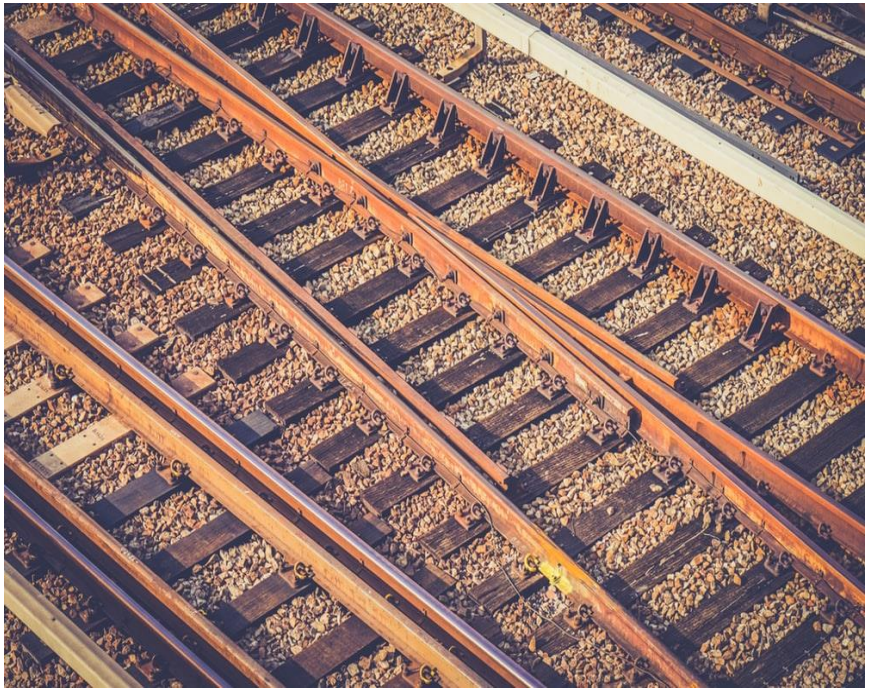
SCHEMATIC DRAWING



CHECK RAIL

Check Rail @ Level Crossing

Check Rail @ Crossover

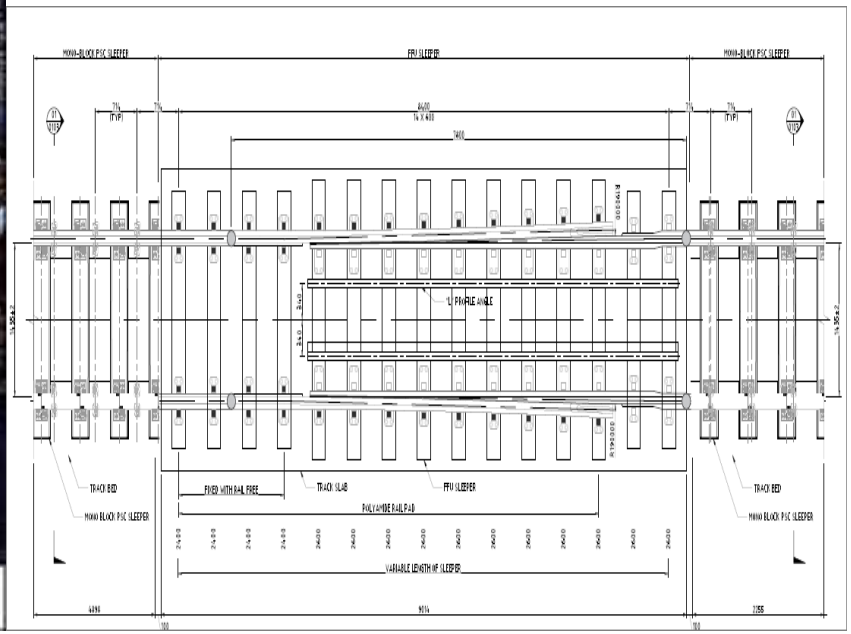


RAIL EXPANSION JOINT

RAIL EXPANSION JOINT

Expansion joints are provided in running rails to allow for temperature changes. The additional rails in the centre of the track are bolted to the sleepers to prevent the sleepers being shifted by rail expansion.

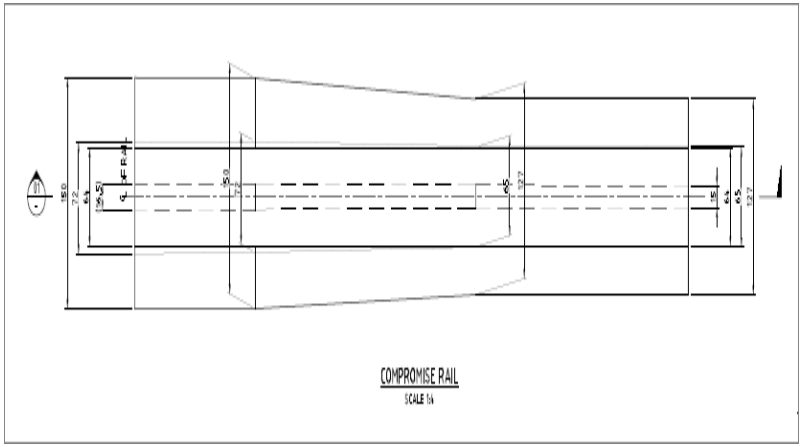
SCHEMATIC DRAWING



The Transition Rail-use to connect 2 rails of different height and sizes.

TRANSITION FISHPLATE

SCHEMATIC DRAWING



MAINLINE - TRACK CONSTRUCTION

Inside the tunnel, tracks are laid on track bed over the first stage concrete slab with embedded shear connectors (starter bars).
Passage for drainage pipe, power and telecom cables are provided on designated locations.
On ballasted section track is laid over ballast compacted section.

Track Facilities such us Turnout, Crossover, scissor crossings or double crossover are installed wherever it is deemed for the train to transfer from one track to another, i.e. from one running rails to another and/or from Main Line to Siding track,

DEPOT - TRACK CONSTRUCTION

- Track works in Depot could start by spreading and packing of ballast to design requirement.
- Track works at the location of buildings such as LRS(Light Repair Shop) and other areas like the PRI (Phil. Railway Institute),, Concrete pavement, Level Crossings, wash area, OCC (Operation Control Center) & other buildings.

- After ballast compaction is completed up to design level, Turnouts, Crossovers and Scissor, Stabling tracks, Buffer Stops shall be laid to installation.

- Rails on steel post shall be laid inside LRS. Concrete pavement shall be flash with rail level on Level Crossings.

THERMITE and FLASHBUTT WELDING

- Rails are welded to get continuous track.
- Welding method eliminates joint bars (mechanical fasteners) and greatly lessened track maintenance.
- MMSP is considering to use Thermite or Flash Butt Welding method.

- https://youtu.be/cNfVo38PGRc
- https://youtu.be/O6YyCVpnDjo


WELCOME TO MANILA METRO SUBWAY
WEATHER
Multipurpose Area
B, A

SIGNALLING

1. What is Signalling and why is it required?
2. What is CBTC?
3. What is ATC?
4. How does CBTC work?
5. Why the need for CBTC?
6. CBTC typical architecture with its sub-system

WHAT IS SIGNALLING AND WHY IS IT REQUIRED?

Signalling is required to maintain Safety of the trains by:

1. Maintaining a safe distance between following trains on the same track

2. Safeguarding the movements of trains at junctions and crossings.

3. Regulating the passage of trains according to service density and speed required

4. Ensuring safety of trains in the event of equipment failure

What is CBTC?

- CBTC means Communication Based Train Control
- CBTC is the modern version of ATC (ATC mean Automatic Train Control)
- As defined in the IEEE 1474 standard, CBTC system is a continuous, automatic train control system using:
  - High-resolution train position reports, independent of track circuits the trains send their position to wayside computer,
  - Continuous, high-capacity, bi-directional train-to-wayside data communications,
  - Trainborne and wayside processors capable of implementing Automatic Train Protection (ATP) functions, as well as optional Automatic Train Operation (ATO) and Automatic Train Supervision (ATS) functions.

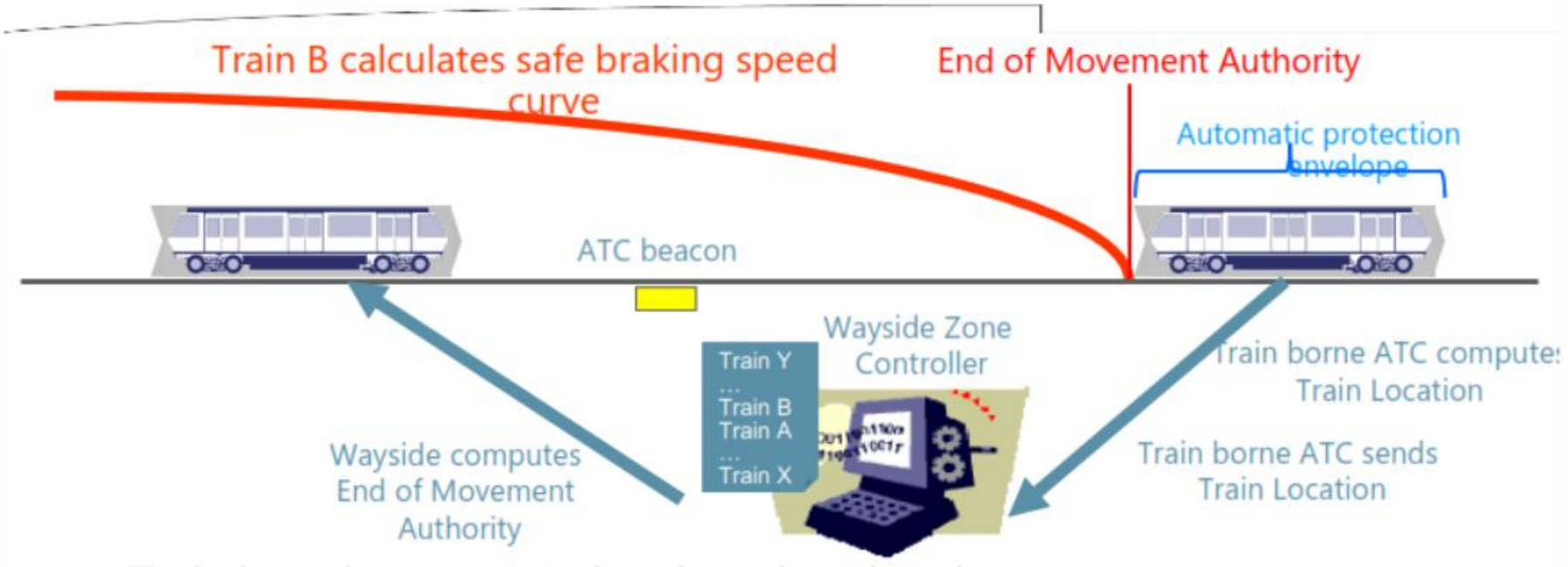
What is ATC?

- ATC or Automatic Train Control is an electronic system that protects trains against over speeding, collision and derailment when trains pass crossovers (or curved lines).

- ATC included two (2) main functions: ATP and ATO.
  - ATP or Automatic Train Protection is the fail-safe part that stops a train when any dangerous situation arrives.
  - ATO or Automatic Train Operation is the “robot” that drives the train under the close supervision of the ATP.

ATC = ATP (Safety) + ATO (Performance)

How does CBTC work?



- Train location is computed On-board each train.
- Train location is sent by radio from each train to wayside Zone Controllers.
- Wayside Zone Controller computes “End of Authority” of each train and sends it by radio to each train.
- ATP safe braking speed curve computed On-board each train.

…thanks to Moving Block, CBTC increases line capacity (more trains)

Why the need for CBTC?

Conventional Signalling

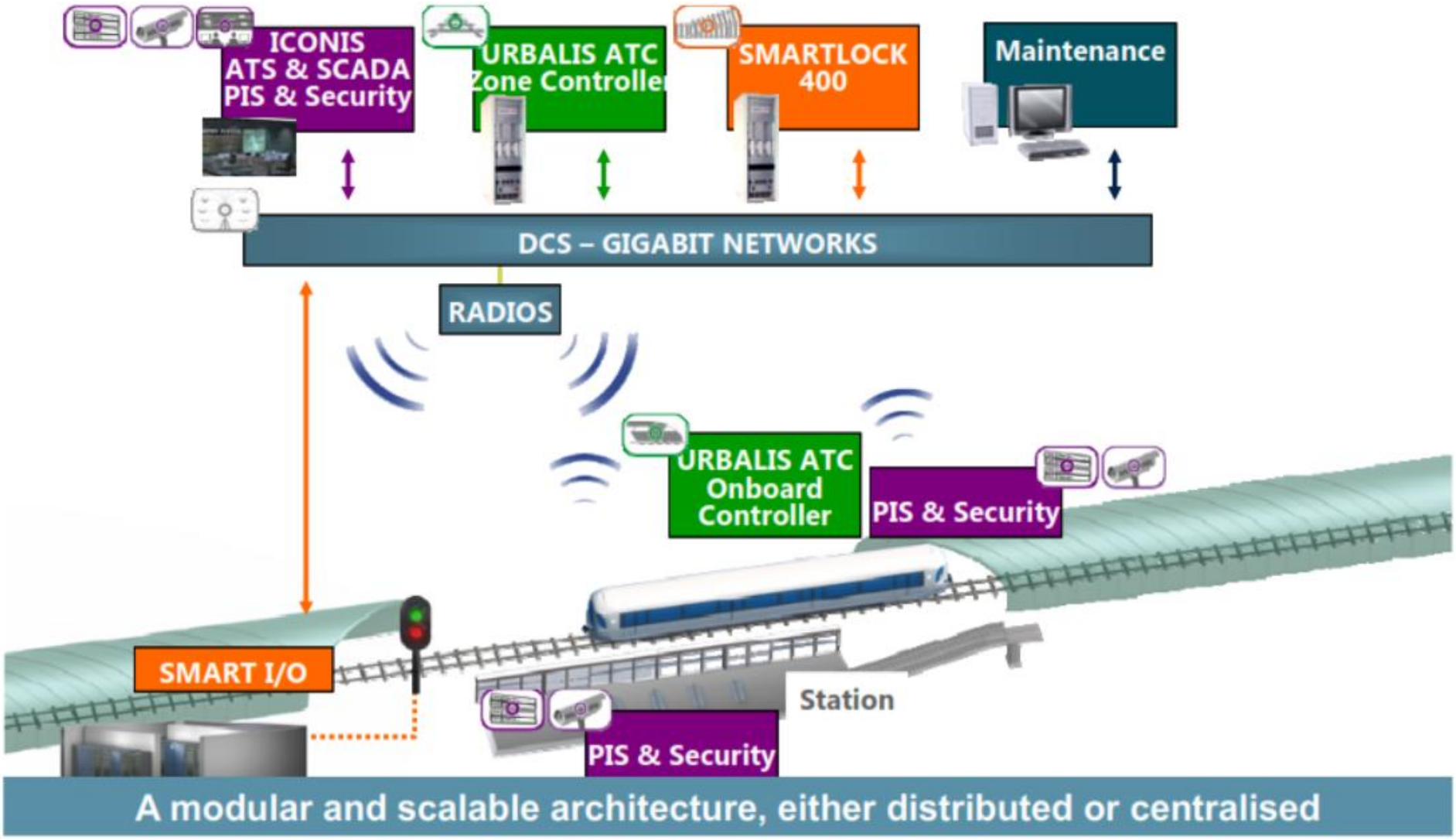
- Based on Fixed Block for protection
- Provides rough position of trains
- Protecting long space to ensure protection
- More distance needed between trains

….With less wayside equipment, CBTC increases line capacity (more trains)

CBTC solution with moving block

- Continuous communication link between trains and wayside
- Much more precise position of the train at all times
- Less space needed to ensure protection
- Distance between trains is reduced

CBTC typical architecture with its sub-system



TELECOMMUNICATION SYSTEM

INTRODUCTION

- The Telecommunication systems perform functions that are necessary for operation of trains.
- The systems provides Voice and Data services for safe and reliable train operation.
- There are 14 sub-systems installed in the stations, OCC, and Depot
- Many of the system facilities are directly related to train operation and directly affect train management for railway users.

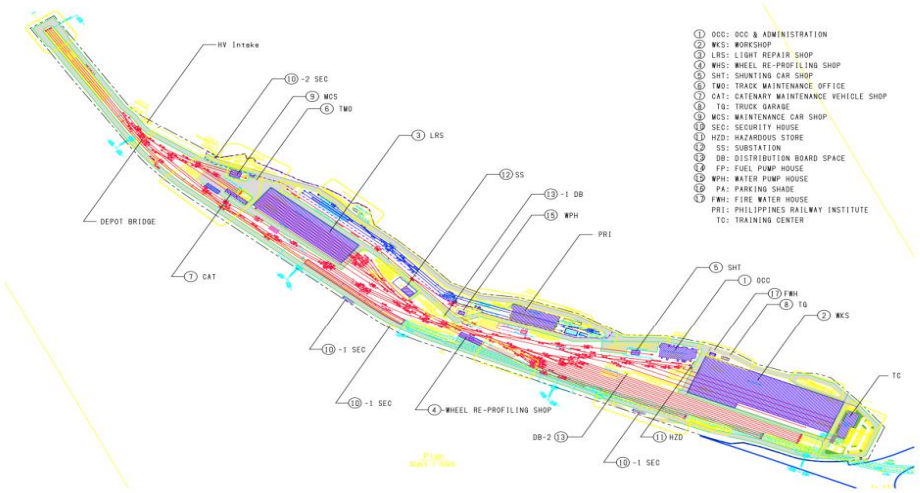
SYSTEM OF SYSTEM BREAKDOWN

- Telecommunication coverage:
  - at all station area (paid and unpaid)
  - 32 km of the track length.
- Communication and CCTV at Stations, Admin and OCC for safety and security.
- Continues and reliable communication between the 16 stations, rolling stock and tunnel sections.

SUMMARY & MMSP ROUTE MAP

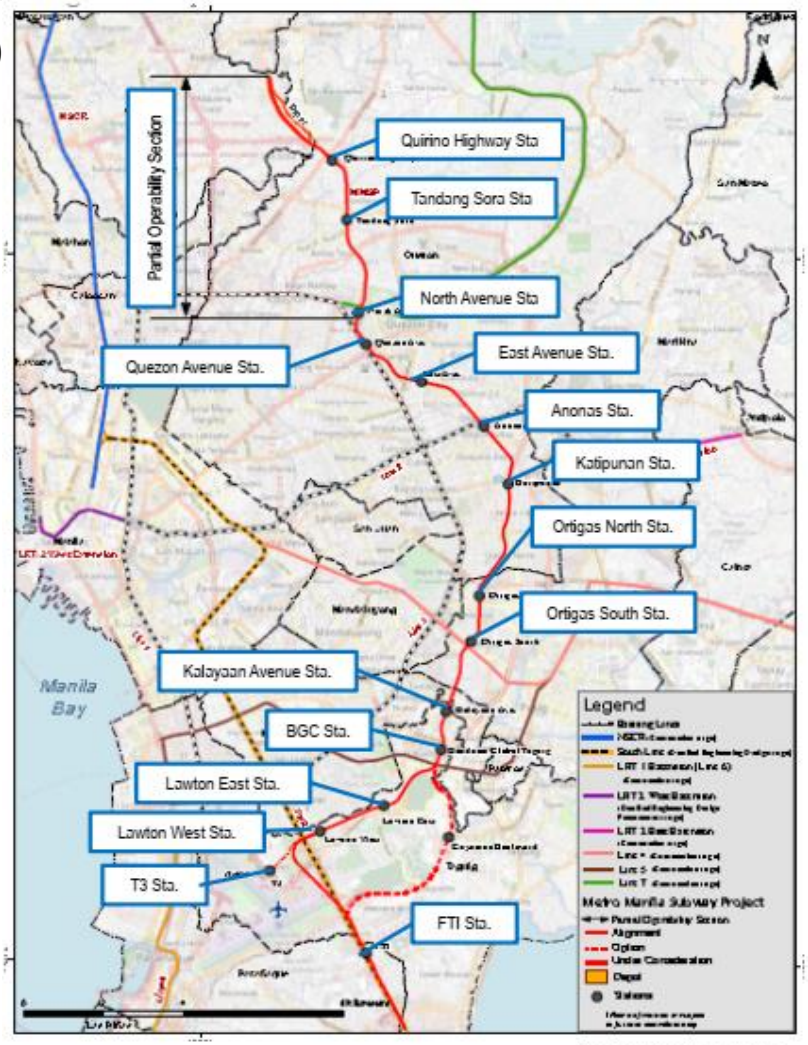
Telecommunication Systems Implementation Breakdown

- Underground Stations (Paid and unpaid area)
- Total 16 stations and 25 km track length.
- Tunnel Area.
- 17 Depot Buildings
(Admin, OCC, Maintenance,
technical and site wide infrastructure)



Source: JICA Study Team

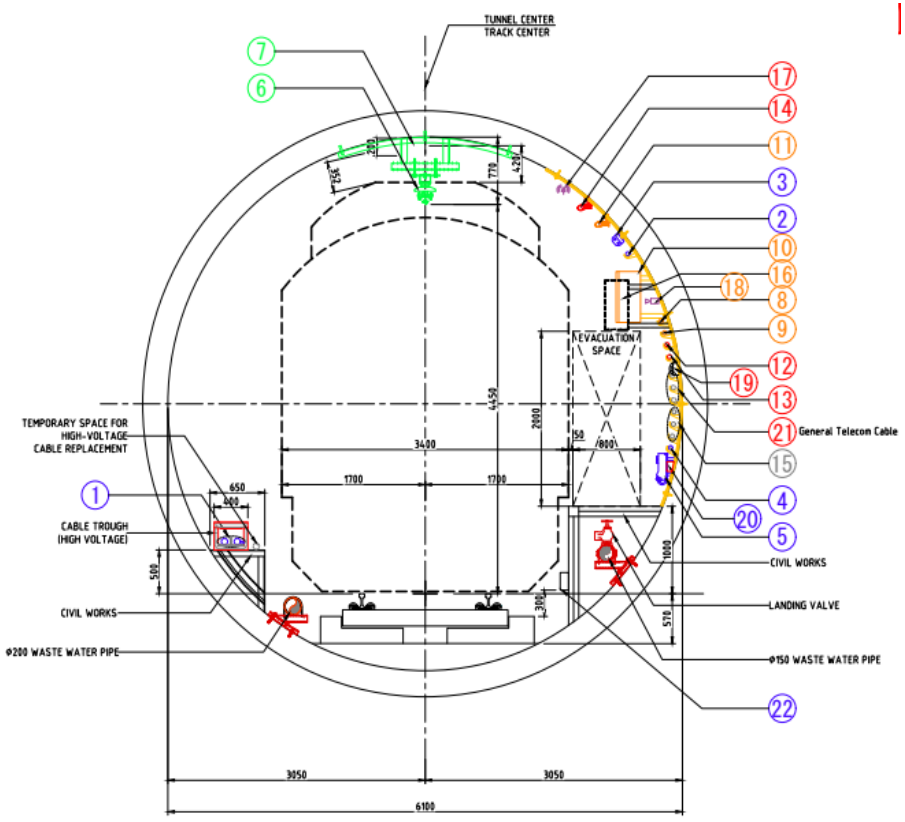
Figure 10.1.3 Layout of Depot Facility



Source: JICA Design Team

TELECOMUNICATION SYSTEM INSIDE THE TUNNEL

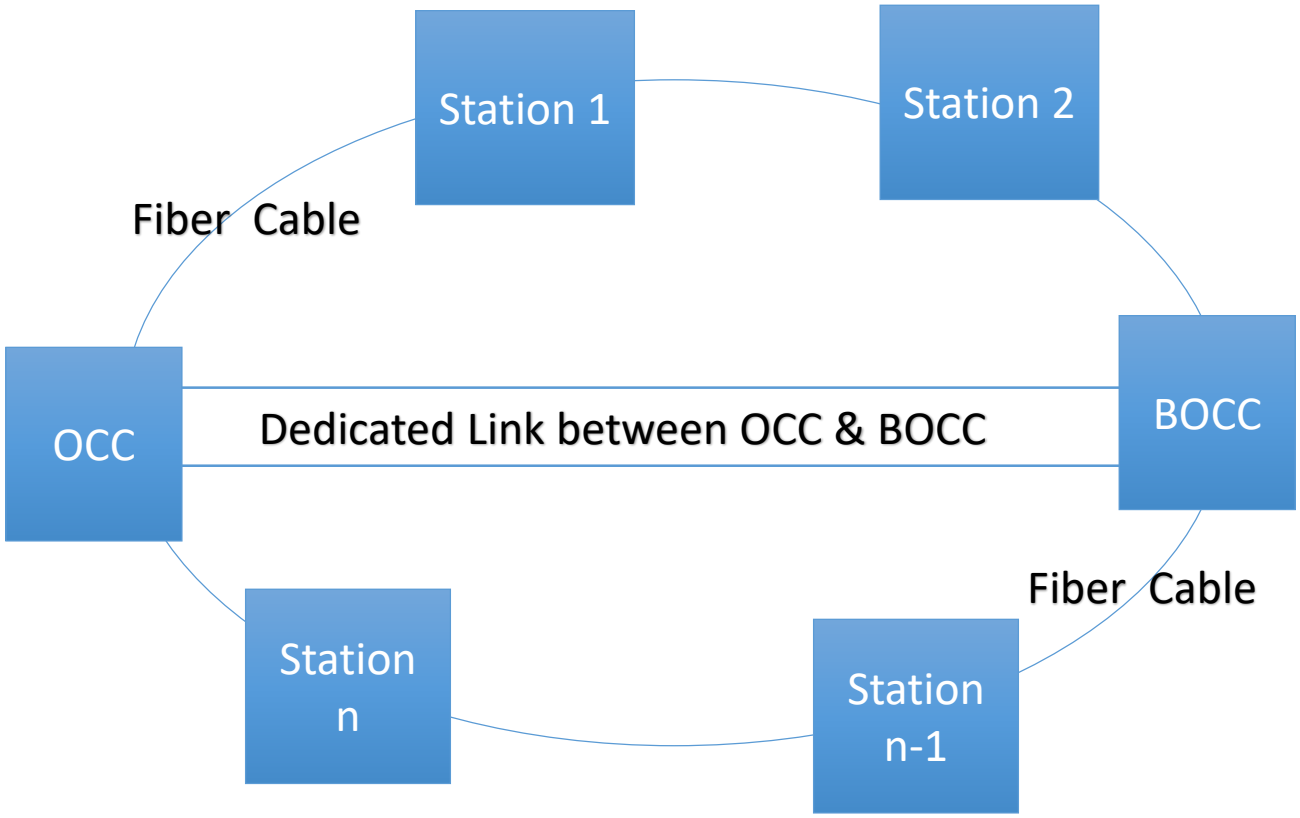
- Item 12 - Mobile LCX cable
- Item 13 - OFC Communication cable
- Item 14 - Telecommunication LCX Cable
- Item 15 - Spare space for Mobile Operators
- Item 16 - Remote cabinet
- Item 17 - Antenna
- Item 19 - Emergency Telephone
- Item 20 - Cellular Repeater
- Item 21 - Communication Power and Data Cable



SYSTEM NAMES

SL. No.	SYSTEM NAMES	Purpose / Function of System
1	Multi Service Network (MSN) System	To Provide Network Services.
2	Radio System	To Provide Voice communication for Operations & Maintenance.
3	Telephone System & wireless LAN System	To Provide Voice communication for Operations & Maintenance. To provide Wi-Fi services for Employees.
4	Recording System	To Provide Voice call Records for Radio and Telephone Systems.
5	CCTV System & Video transmitting System	To provide Monitoring at stations and Depot Area.
6	Millimeter Wave communication System	To Provide Onboard CCTV Live streaming to OCC.
7	Passenger Information Display (PID) System	To Provide Information to Passenger at station area
8	Public Address (PA) System	For public Announcement at station area
9	Clock System	To Provide Time Information to all network and Systems.
10	Intercommunication System	To Provide Emergency Voice call Services at stations.
11	Disaster Prevention System	To Provide alarm & measure for wind speed, Rainfall, earthquake seismic intensity and water level inside stations and tunnel area.
12	Telecommunication Equipment Monitoring System	To Provide Monitoring & alarm Notifications of Telecom Subsystems.
13	UPS System	To Provide Power Supply to Telecom Systems.
14	Telecommunication Cable	To Provide Physical Network between stations and Depot area.

MMSP DATA NETWORK - FIBER RING TOLOLOGY



COMMUNICATION & CONTROL SYSTEMS

- (OCC) COMMUNICATION & CONTROL SYSTEMS
  - TELECOM MONITORING SYSTEM
  - Telecoms
  - VOICE COMMUNICATION
    - Radio
    - Telephony
  - PUBLIC INFORMATION
    - PAS / PIDS

- CCTV
- Voice Recording System
- Clock
- Millimeter wave Communication System
- Intercom System
- Disaster Prevention System
- UPS

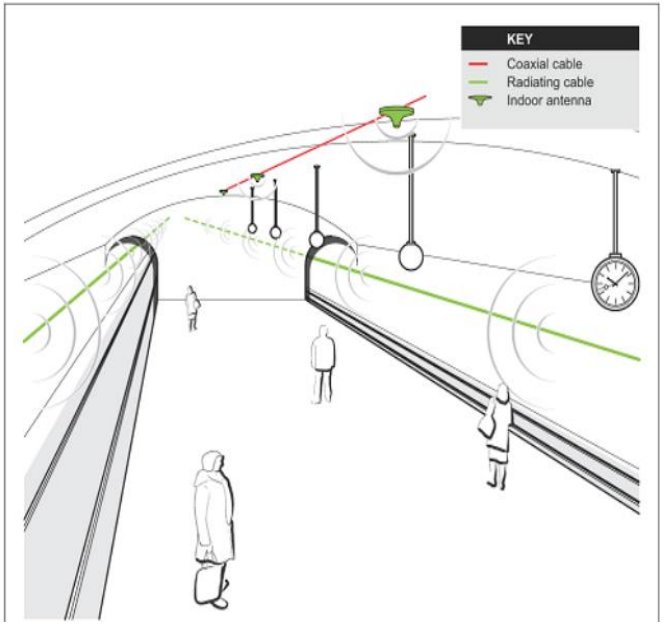
MOBILE COMMUNICATION SERVICES

CP-106

- 3G / 4G/ LTE Network inside station and Tunnel area
- Provision for 5G Network Inside Tunnel area.

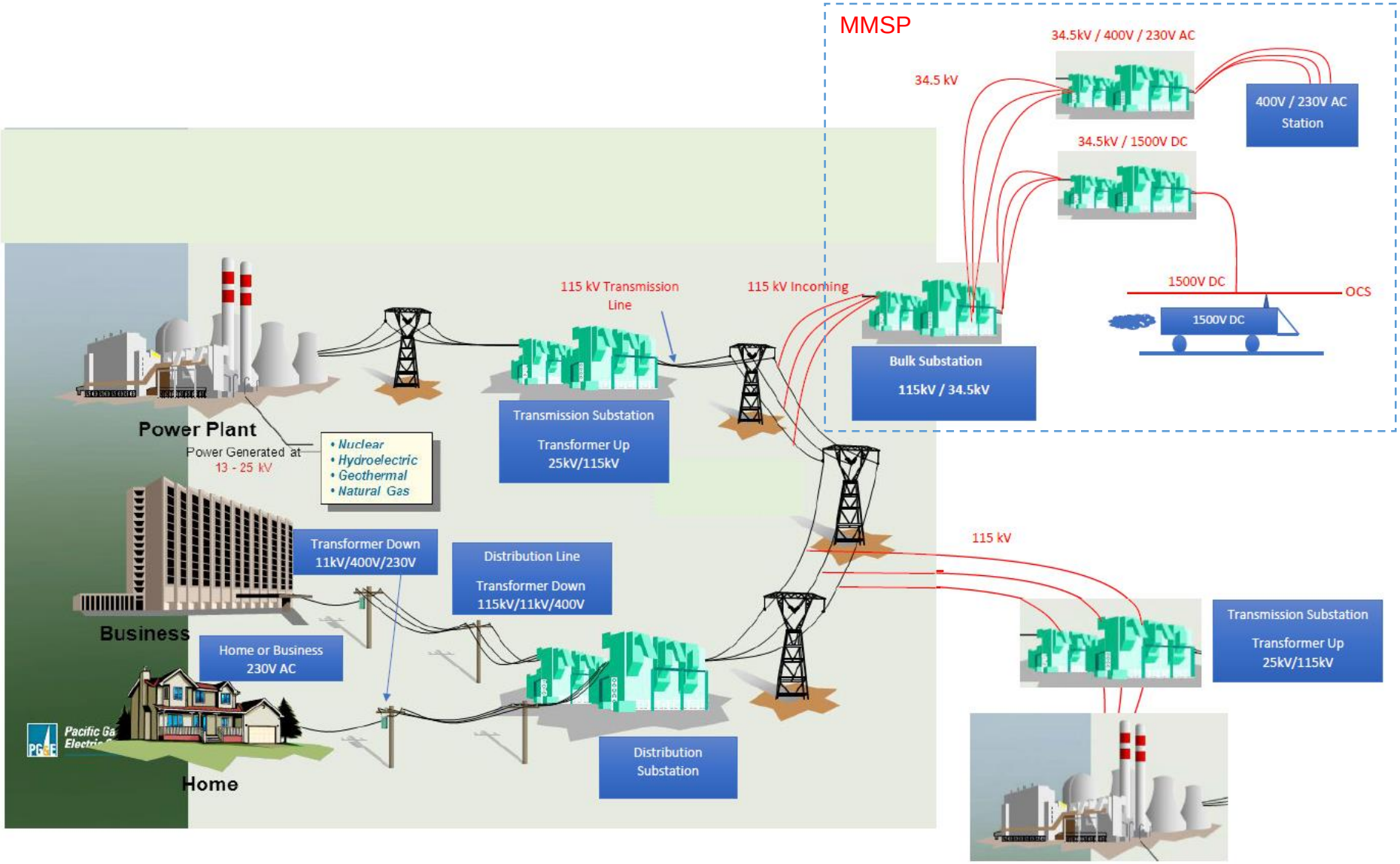
CP-101

- Wi-Fi Services for Public
- Public Telephones.



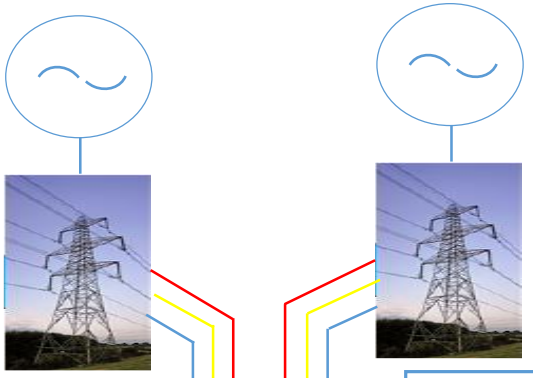
POWER SUPPLY SYSTEMS

BASIC ELECTRICITY GENERATION – TRANSMISSION & DISTRIBUTION



BULK SUBSTATION FEEDING ARRANGEMENTS

1 at Depot and 1 at Lawton West



Power Generation

115kV Transmission Line

115kV

Meter ($)

MERALCO / NGCP

New Bulk Sub. 115kV / 34.5kV

115kV GIS Switchgear

Step Down Transformer 115kV / 34.5kV

Future Supply

34.5kV

N.O.

Above Ground

Below Ground

MMSP Substations

Future Metro Supply

34.5kV S/S

MMSP POWER SUPPLY FEEDING ARRANGEMENTS

1 at Depot and 1 at Lawton West

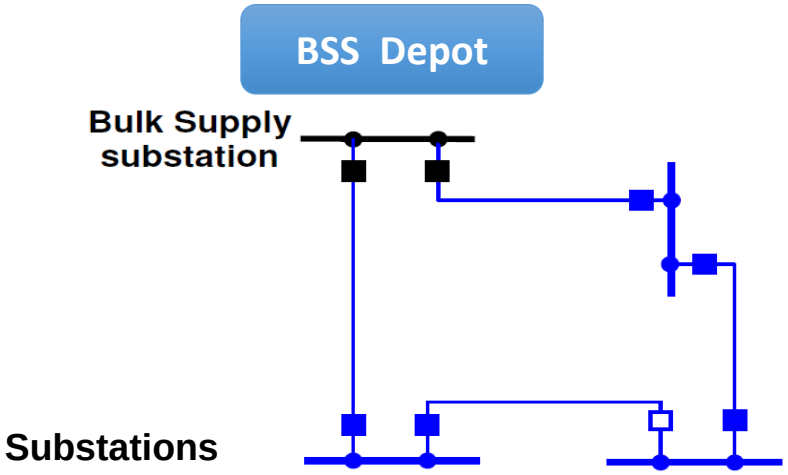


Fig. 1: P.O. Section from Single BSS

BSS shall be fed from two different Source of Supplies for security and reliability.

Fig. 1: One (1) BSS at the Depot with two GRID Feeders for the P.O. Section.

Fig. 2: Two (2) BSSs for Final Phase.
Commonly Railway Practice (i.e. Crossrail UK,
MRT Bangkok Metro, HK, Singapore, Dubai Metro etc.

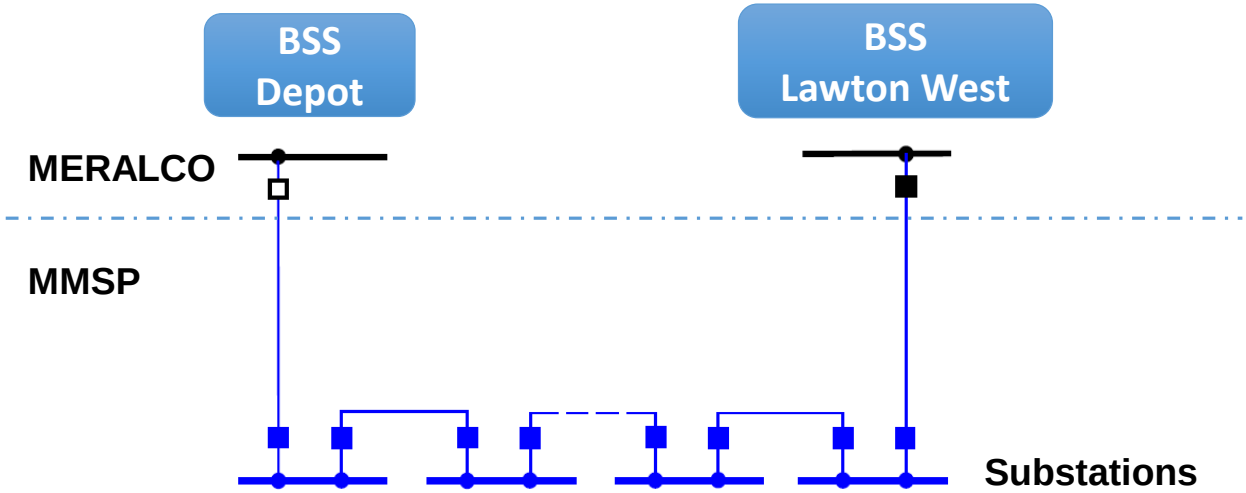


Fig. 2: Close Ring from Two BSS

BENEFITS OF USING BULK SUBSTATIONS

- Best practices internationally on Railway.
- Operational flexibility and smooth Maintenance control of Electrical system within Railway.
- Provision for future extension with minimal disruption to railway operation (Operational Flexibility).
- Faster restoration of Power Supply System.
- Less operation and maintenance costs.
- Compliance with Railway Regulatory Requirement (i.e. full responsibility of Accredited Operator).

Shangri-La MERALCO 115kV / 34.5kV Substation (Typical Compact Type)

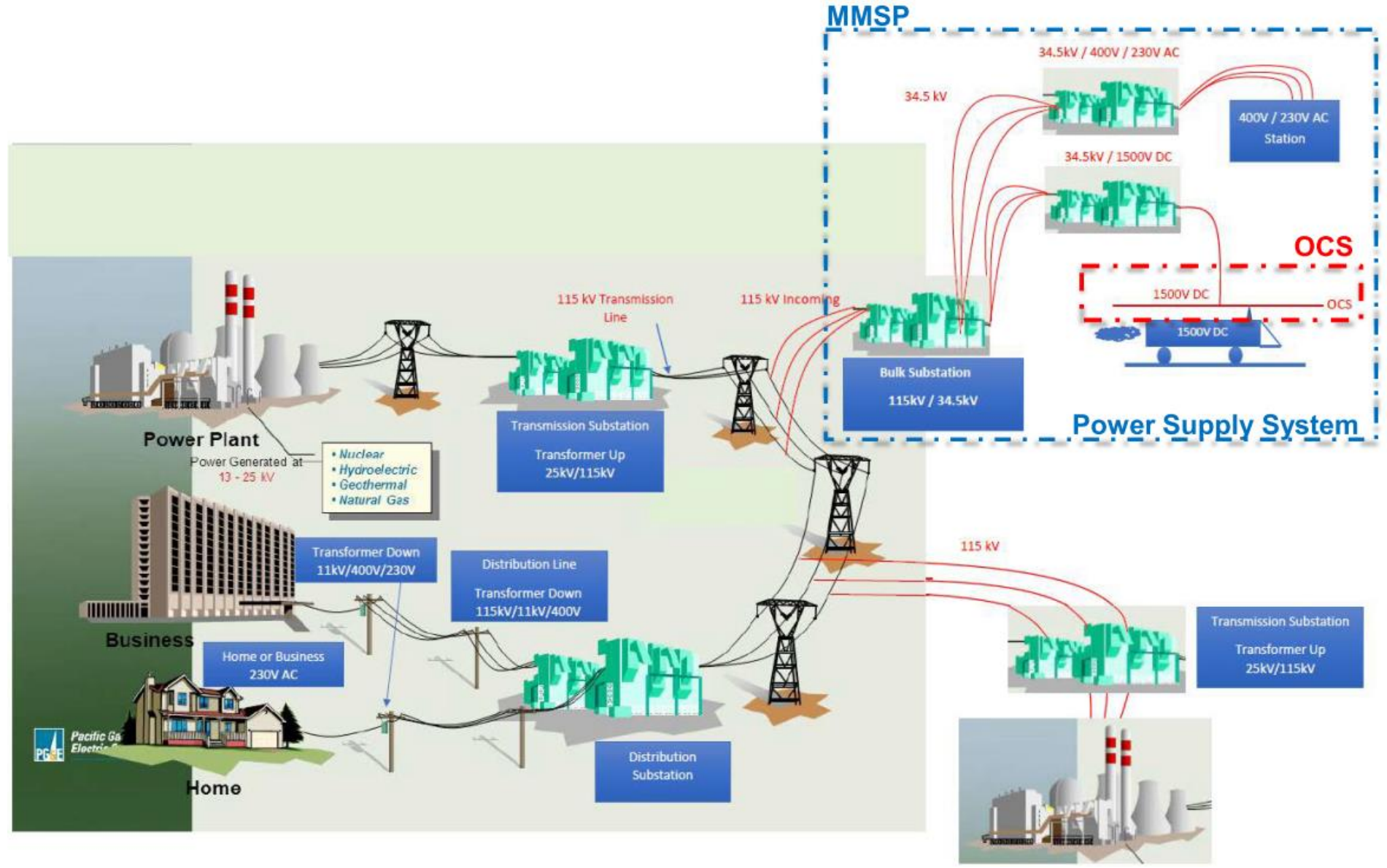
Photo taken by T. Phan from 39 Floor One Shangri-La South Tower

OVERHEAD CONTACT SYSTEM (OCS)

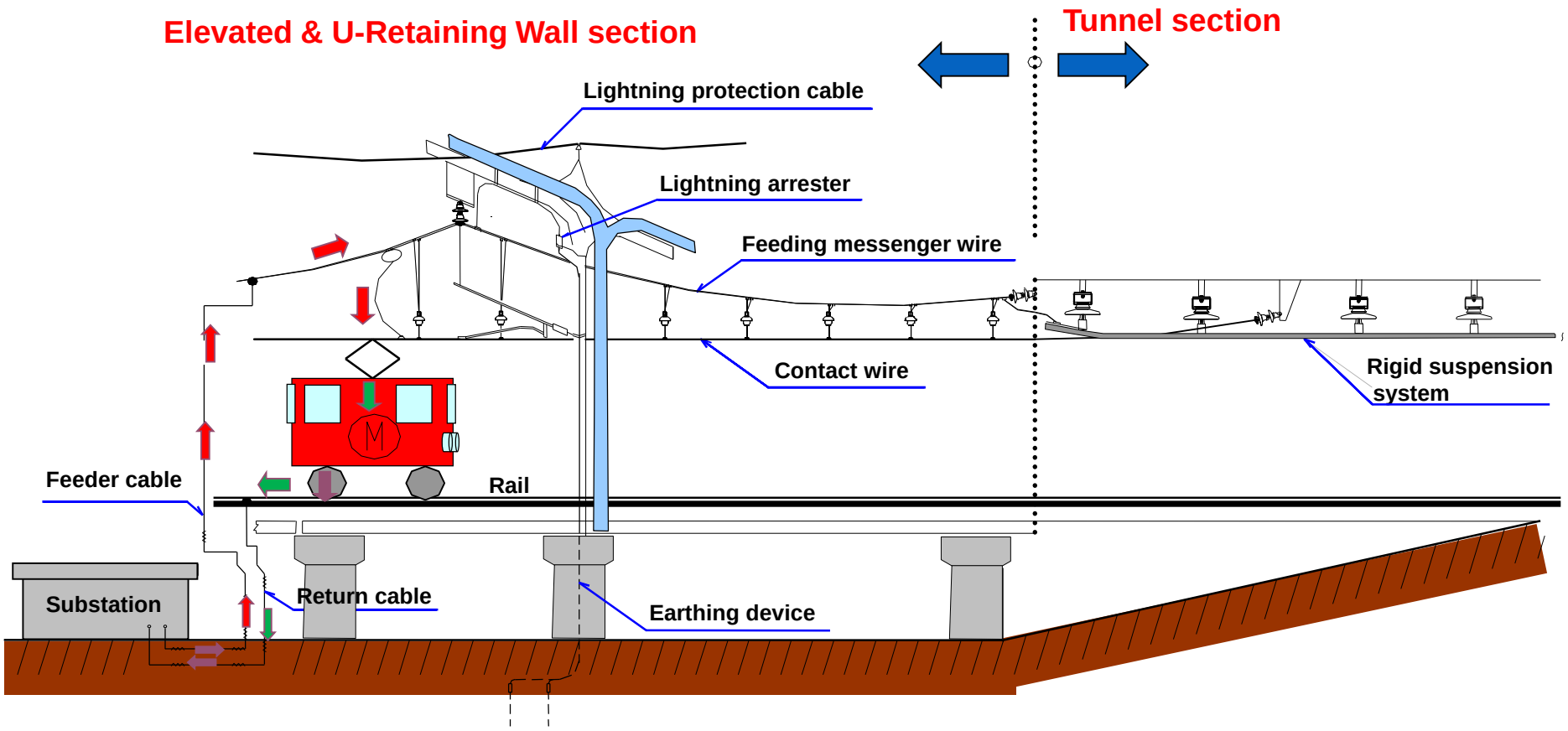
INTRODUCTION

- The main function of OCS is to supply stable electric traction power to electric Trains.
- Electricity is distributed from Traction Sub Stations (TSS) to overhead contact line.
- The overhead contact line consists of power supply lines then feed the electric power to electric Trains through pantographs.

ELECTRICITY TRANSMISSION TO MMSP

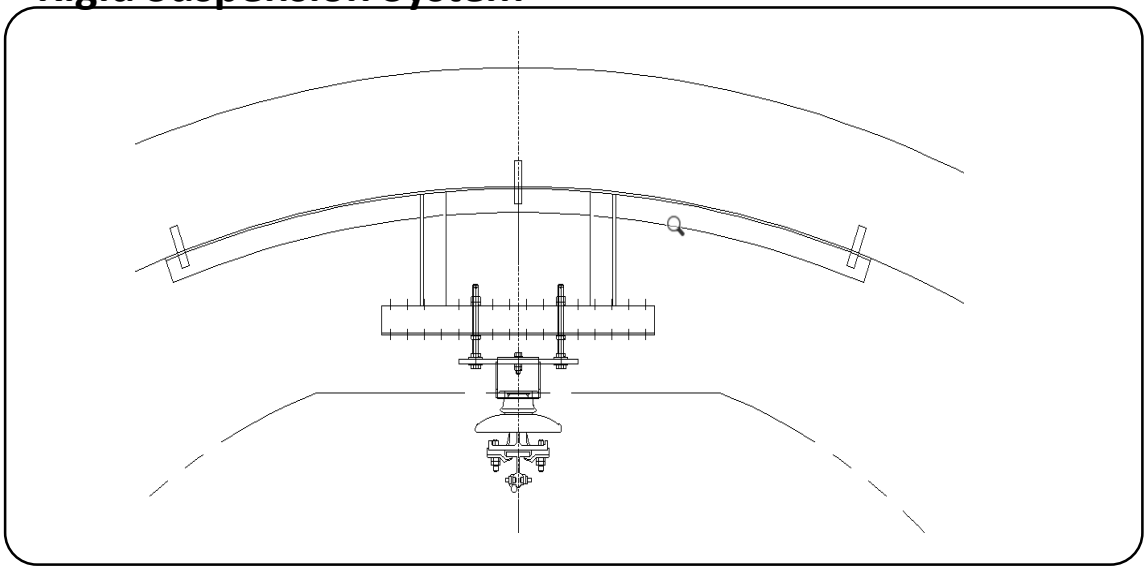


SYSTEM OVERVIEW

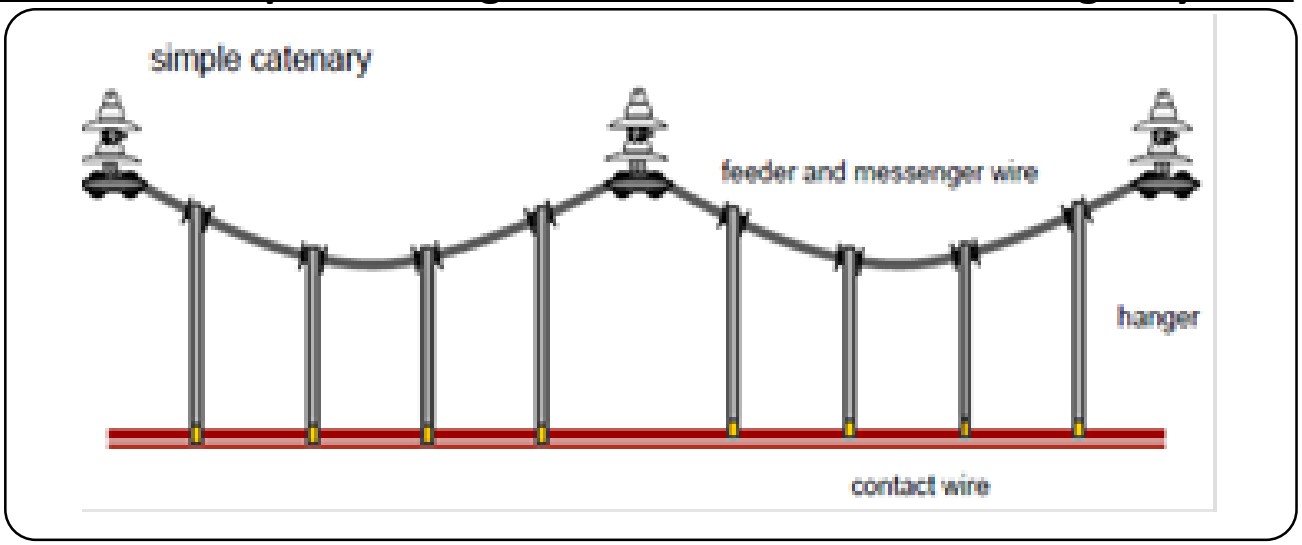


DESIGN APPLICATION

Tunnel Section - Rigid Suspension System

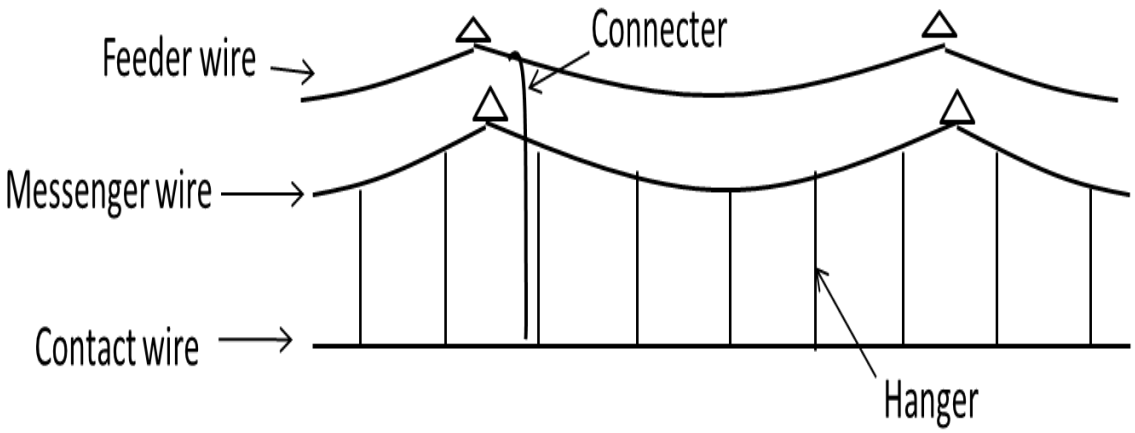


Elevated Section - U-shape retaining wall Section; Feeder Messenger System

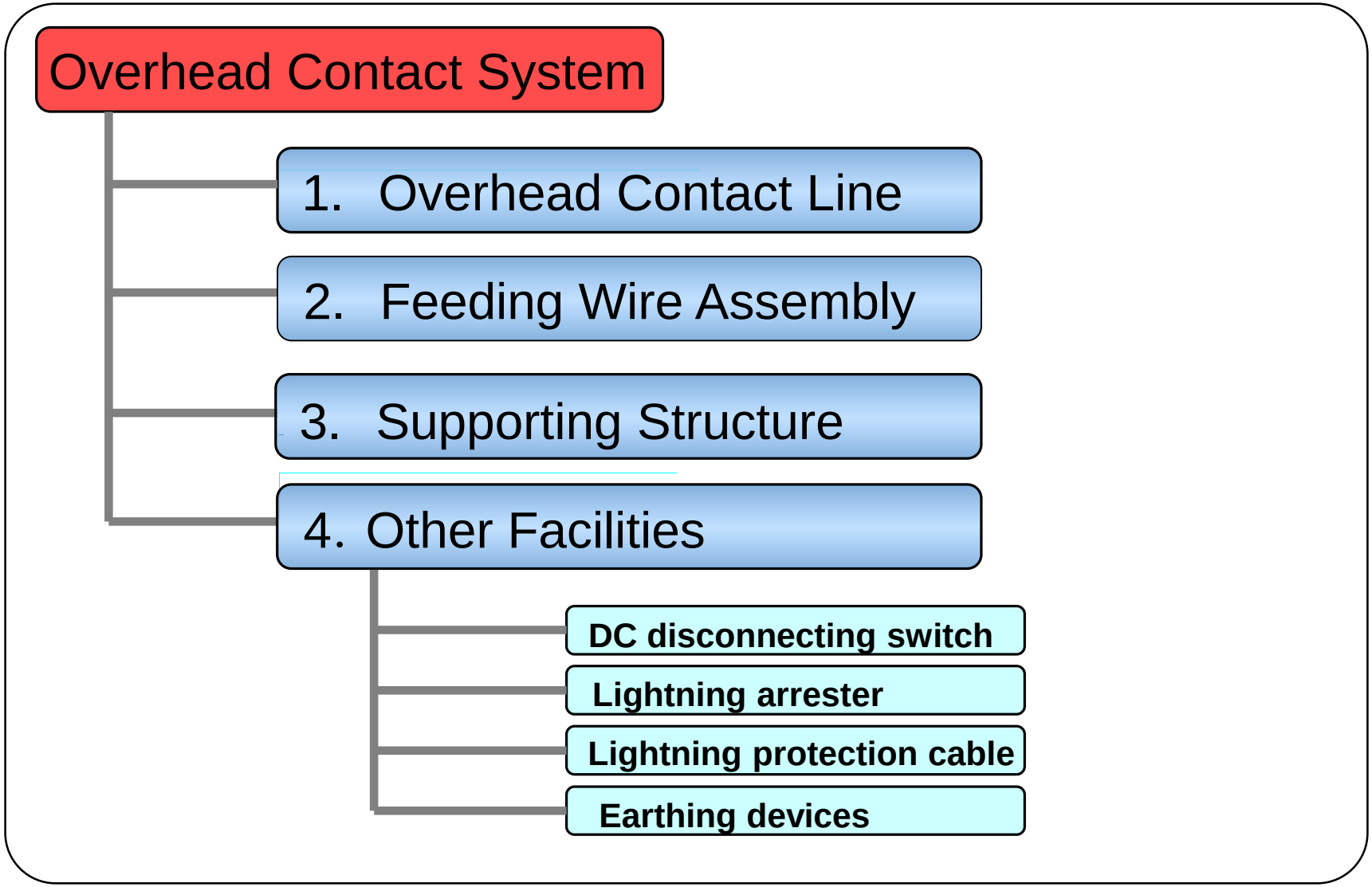


DESIGN APPLICATION cont..

Depot Yard - Simple Catenary System



COMPOSITION FOR OCS

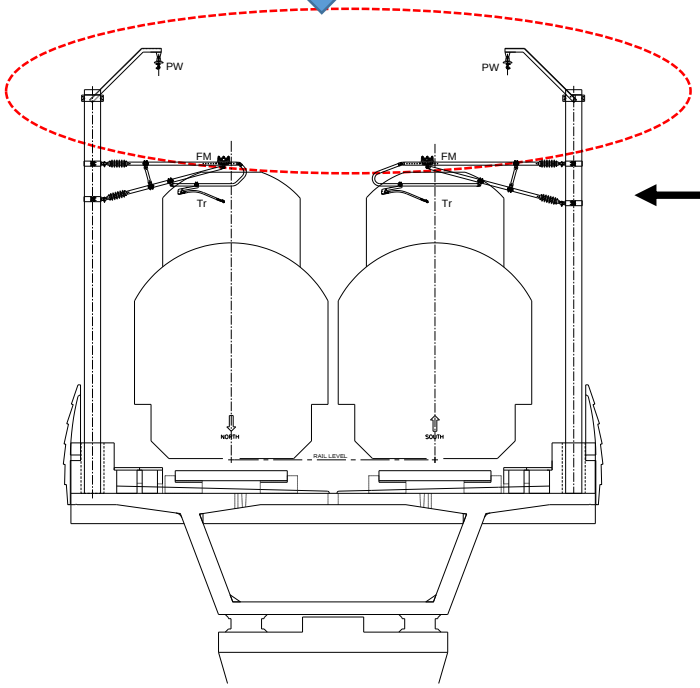


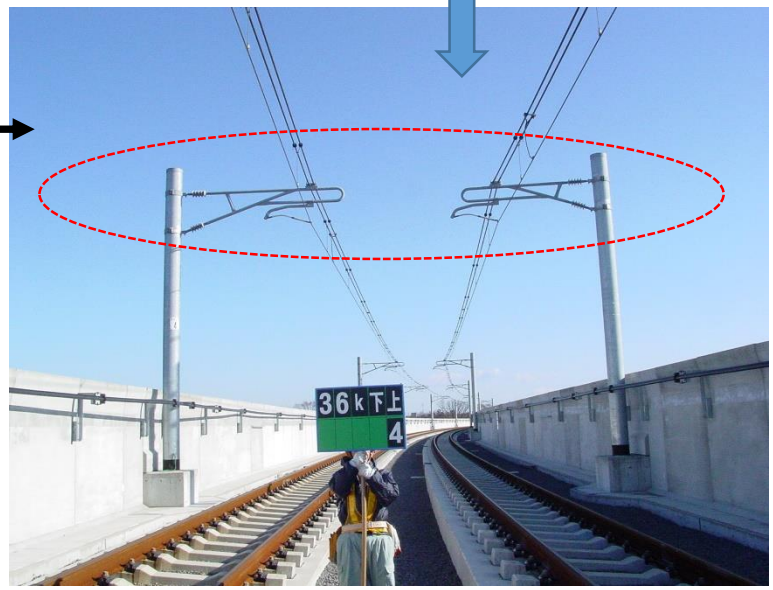
TYPICAL INSTALLATION EXAMPLE OF OCS

Overhead Contact Line and Feeder Wire Assembly

Elevated Section

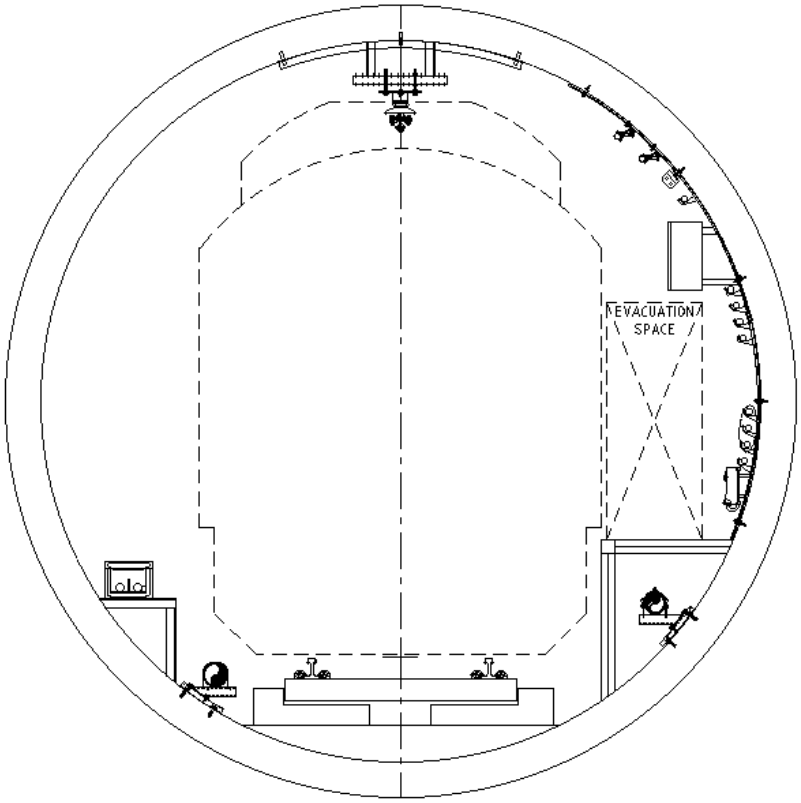
Feeder Messenger System





TYPICAL INSTALLTION EXAMPLE OF OCS cont..

Tunnel Section



Rigid Suspension System (RISS)

TYPICAL INSTALLTION EXAMPLE OF OCS cont..

Supporting Structure

Rigid Cantilever

Hinged Cantilever

V-Truss Beam

Steel Tube Mast

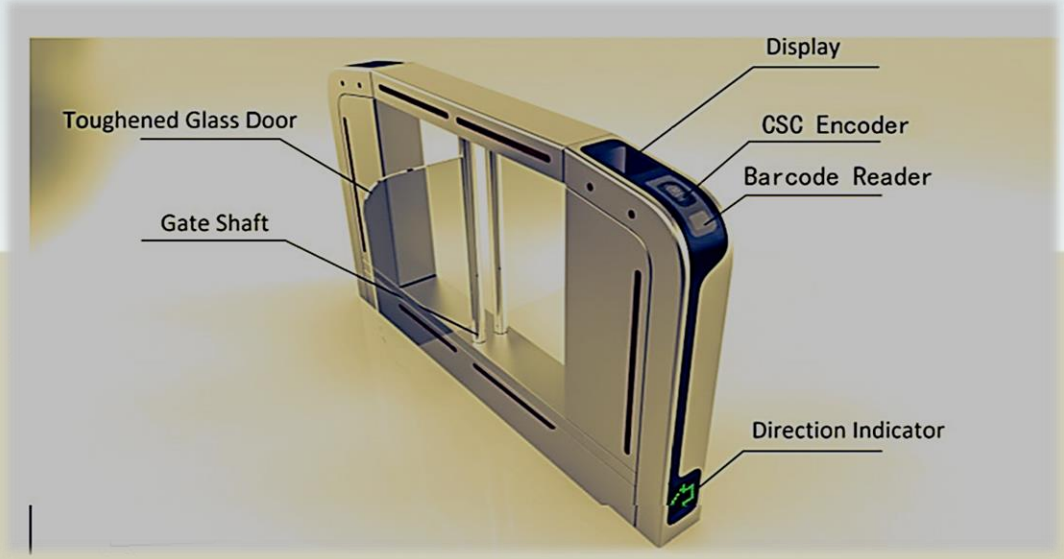
Warren Truss Beam

AUTOMATIC FARE COLLECTION SYSTEM

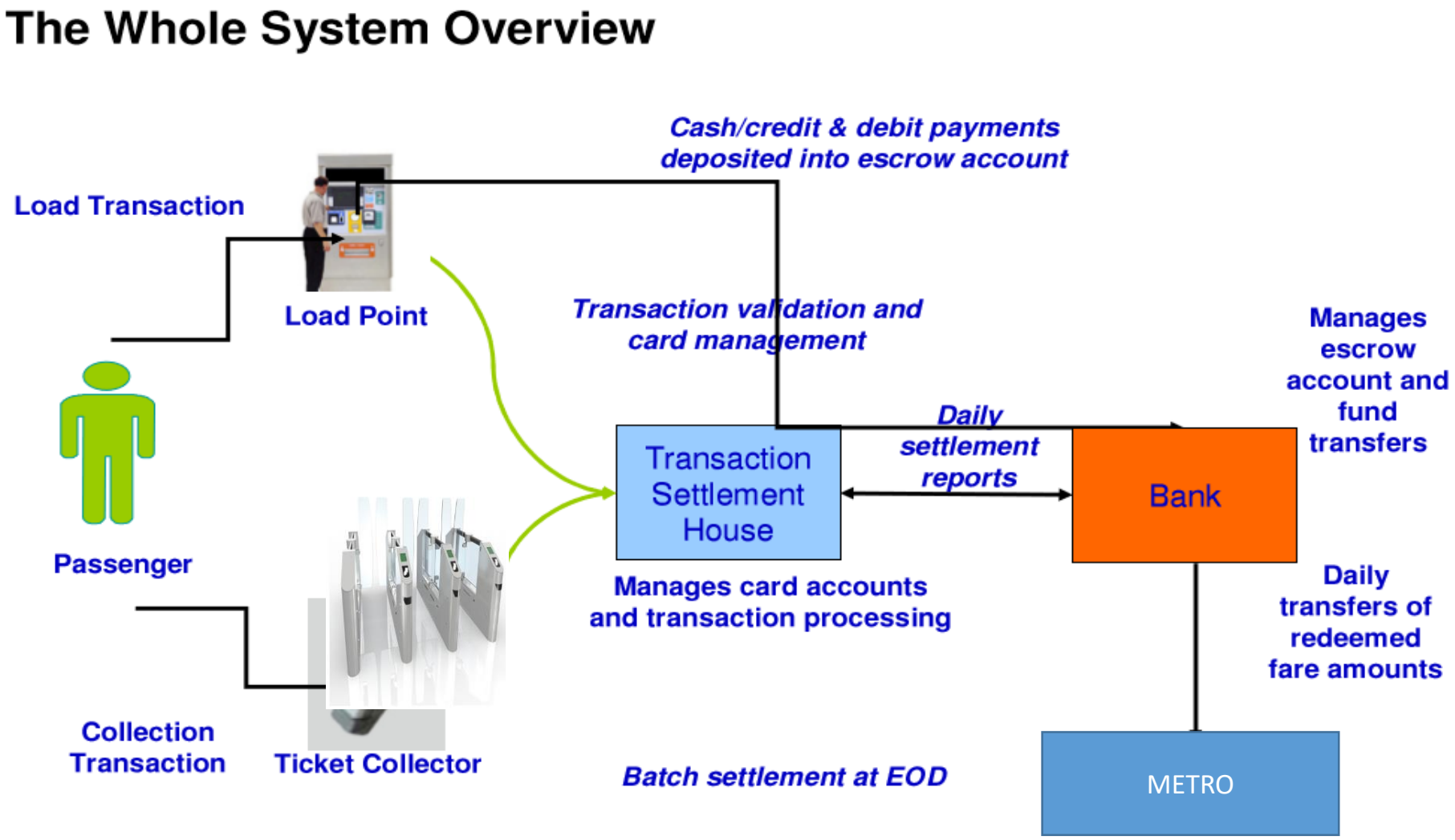
- The AFC system provides efficiency to the Operator and convenience to the passengers.
- The AFC is installed to all the sixteen (16) Stations
- It operate using industry standards and provides a highly reliable, scalable, secure and customer friendly facility.
- The system security shall include:
  - protection against fraud, theft, falsification of data,
  - false accounting, external threats, denial of service,
  - eavesdropping, loss or corruption of information,
  - masquerading (spoofing) and unauthorized

- Interoperating with existing LRT 1 & 2, MRT 3 AFC systems and Manila commuter lines (NSCR, MCRP, NSRP - South) using a contactless IC card.
- The system shall allow for the integration and operation of a mobile application-based ticketing.
- The contractor shall design, procure, manufacture, install, test, trial and integrate the AFC system. The system design shall be future proved.

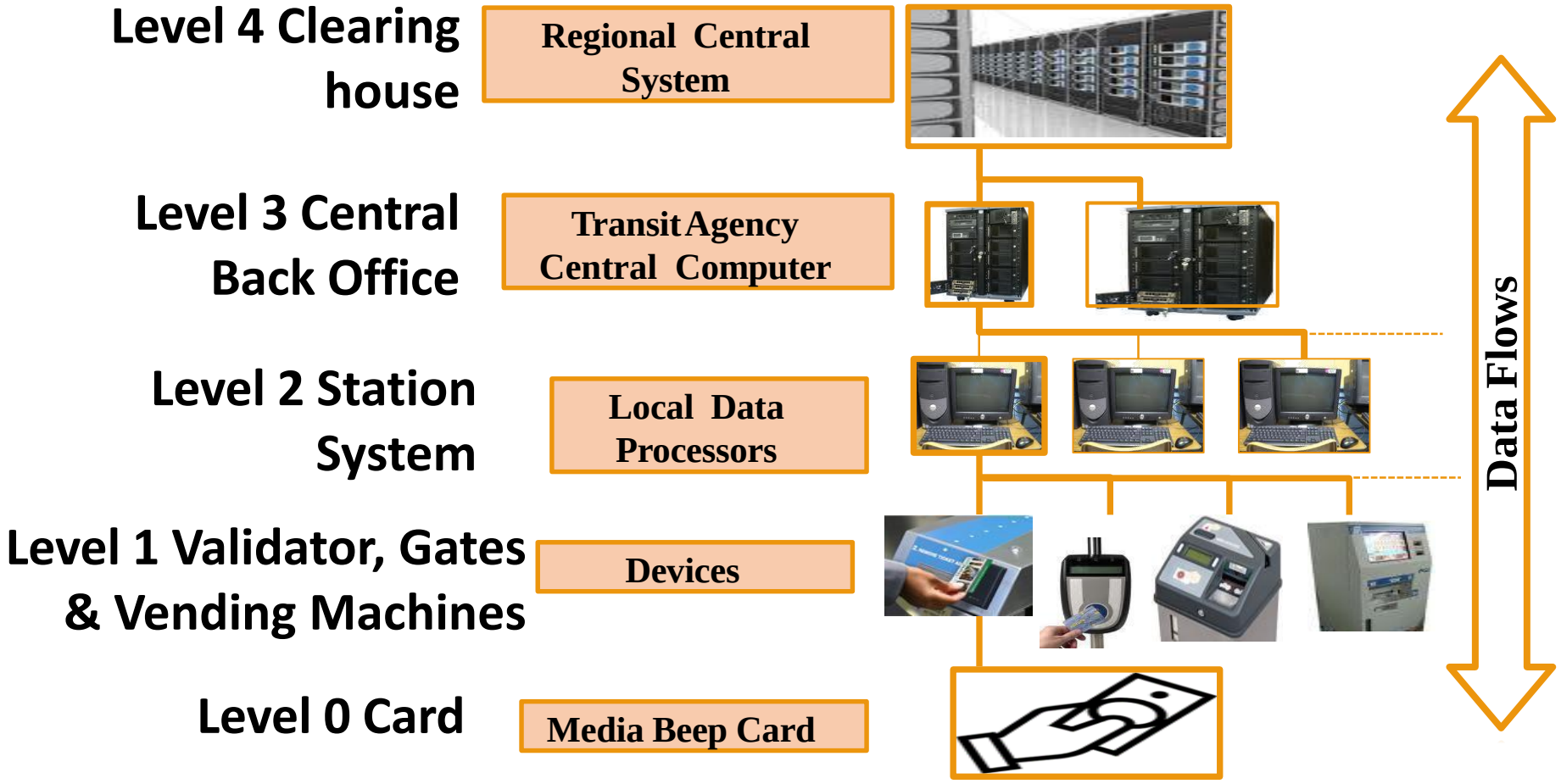
AFC SYSTEM


Display
Toughened Glass Door
CSC Encoder
Barcode Reader
Gate Shaft
Direction Indicator

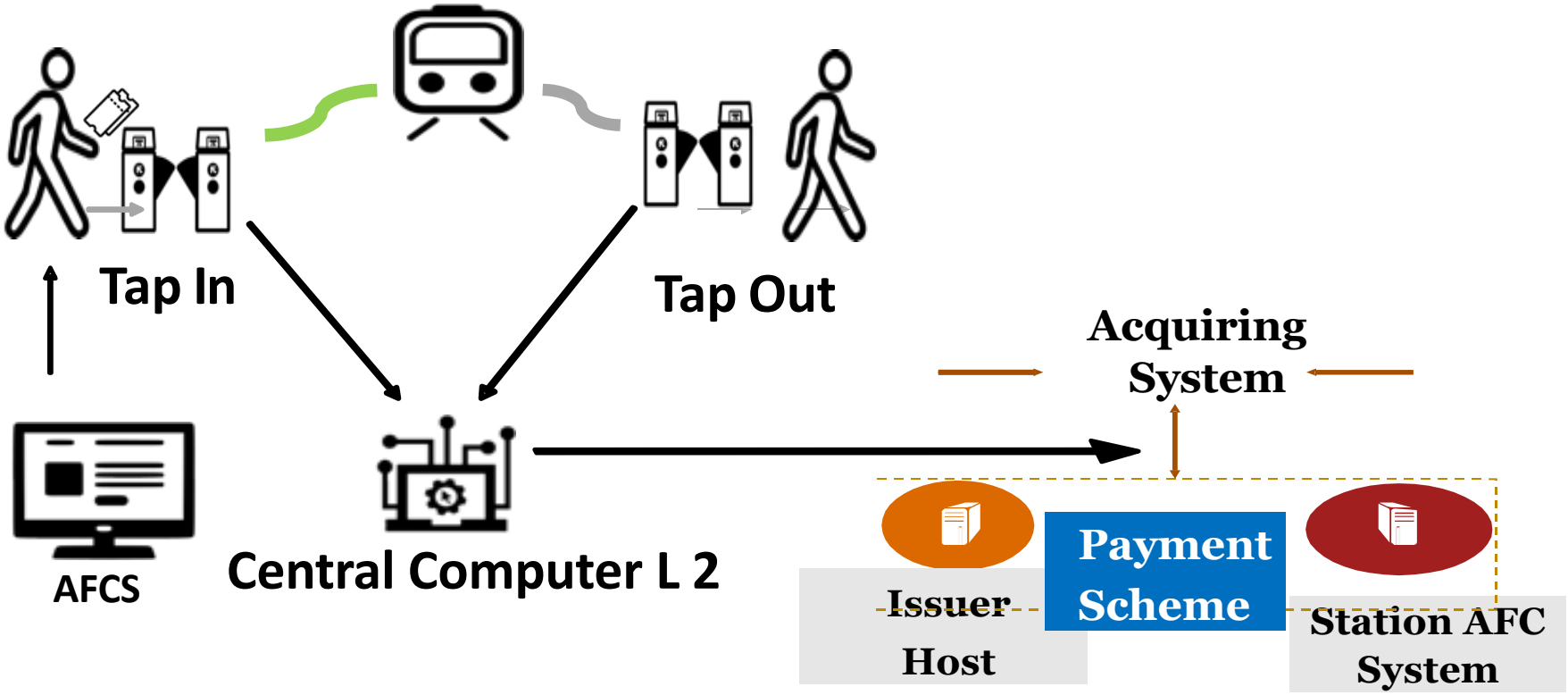
SYSTEM OVERVIEW



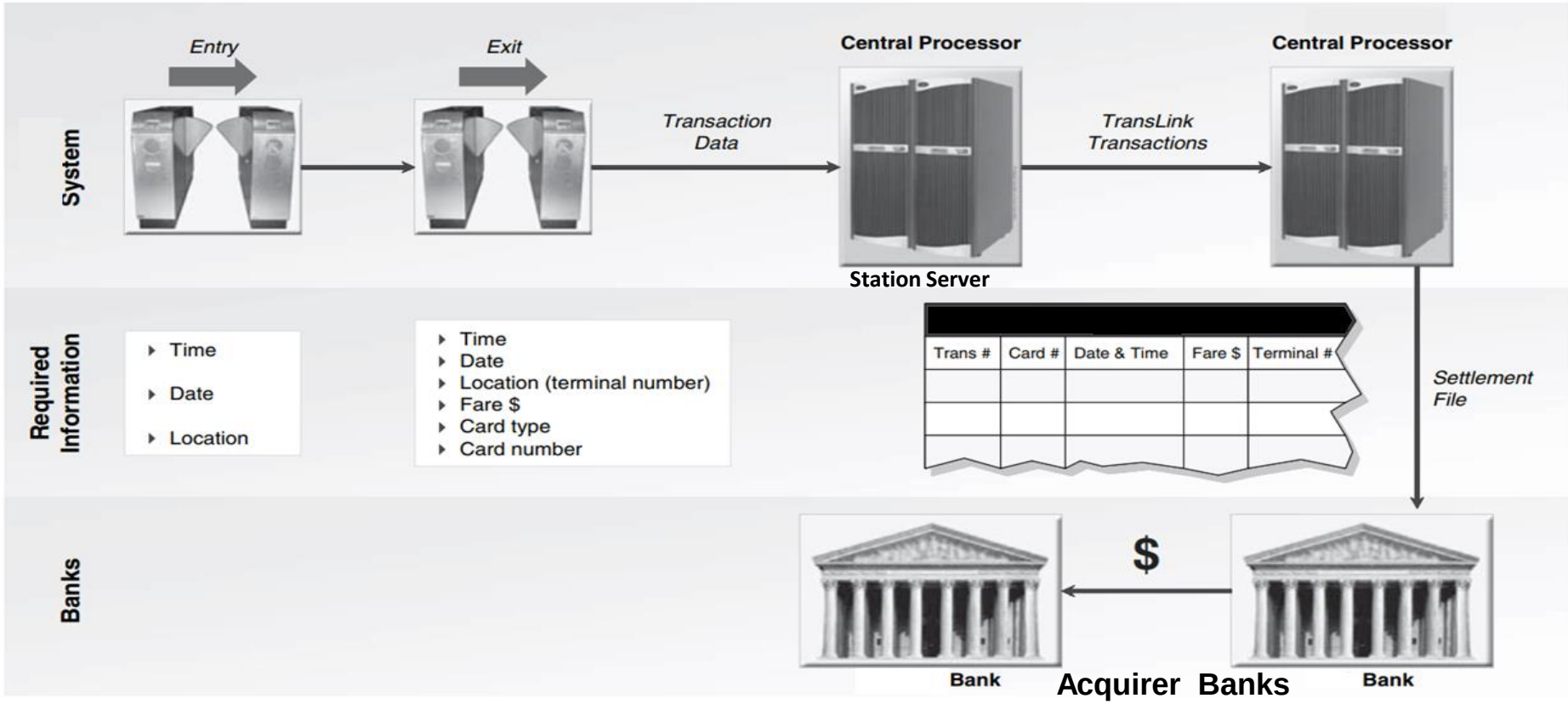
TYPICAL SYSTEM ARCHITETURE



SYSTEM FUNCTIONAL ARCHITETURE



REVENUE COLLECTION/PROCESSING



PLATFORM SCREEN DOORS (PSD)

IMPORTANTCE OF PSD

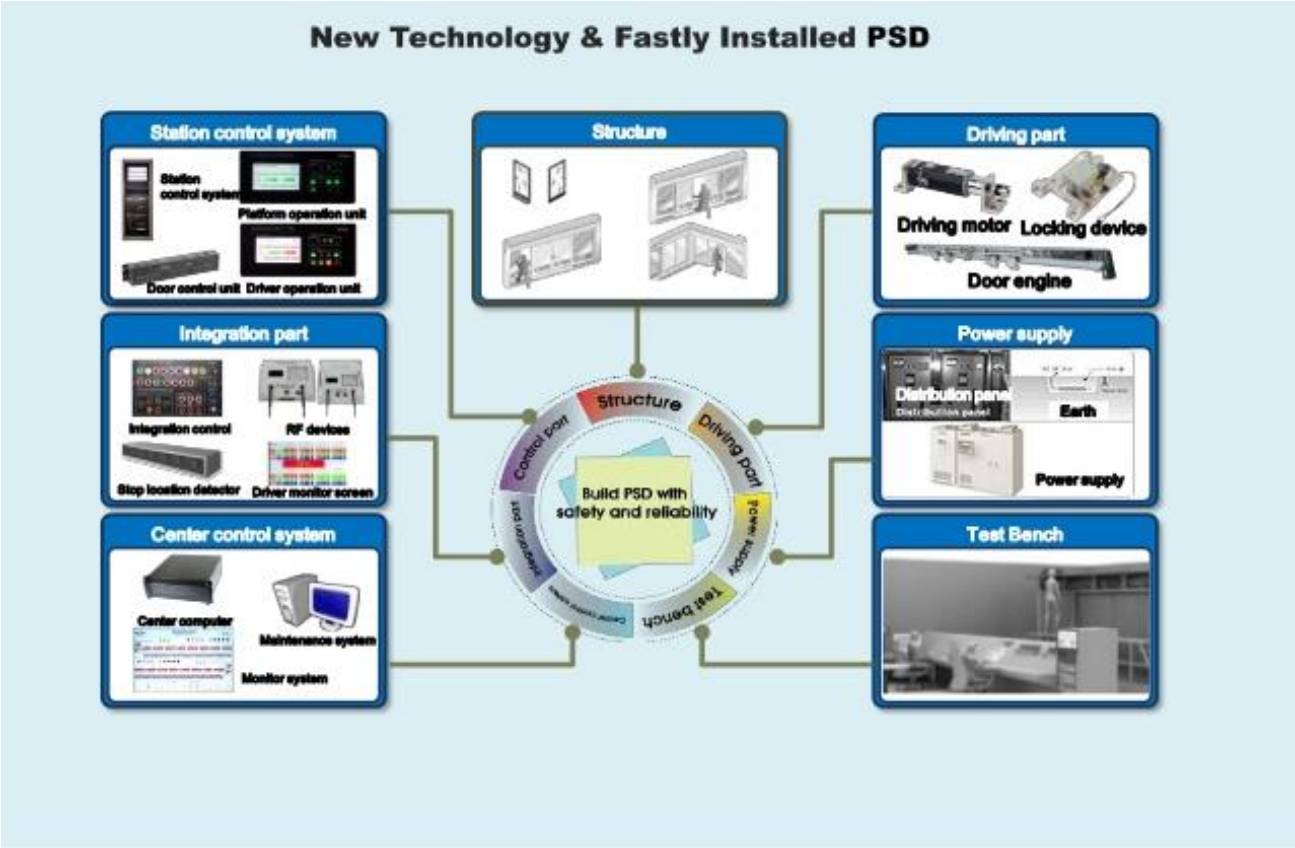
Platform screen doors fulfil a diversity of intentions namely,

- Safety – protect passengers from falling onto the railway tracks accidentally, thus increasing safety and fire retardant.
- Security - Prevent the tunnel from undesired invasions.
- Passenger flow management - Waiting zones are extended in the platform since there is no need to mark a safety line on its own border.
- Controlled Access - Travellers will be able to access the train only when it is completely stopped.
- Environmental conditions - The so-called “Piston-effect” (forced air flow inside the tunnel caused by moving trains) is avoided.
- Environment management - Heat or ventilation losses decrease, so comfort and energy conservation increase in this degree

IMPORTANTCE OF PSD cont..

- Increase efficiency - Speed of passenger flow increases since the risk of falling onto the railway tracks ceases to exist.
- Environment Management – Heat & Ventilation losses are manged, comfort and energy conservation is increased.
- Passengers flow from the platform to the train is enhanced, and so does the circulation speed of trains, improving service punctuality
- Acoustic impact in stations decreases
- Higher level of cleanliness are achieved since objects, letter or liquid substances cannot be thrown onto the tracks.

Composition of PSD

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