

Appendix 4

Workshop Text

1. Outline

1

Japan International Cooperation Agency

Workshop on Rules and Technical Standards for Dhaka Metrorail System

May 8th, 2014

**Japan International Consultants for Transportation Co., Ltd.
Oriental Consultants Co., Ltd.
Metro Development Co., Ltd.**

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Dhaka Urban Transport Network Plan



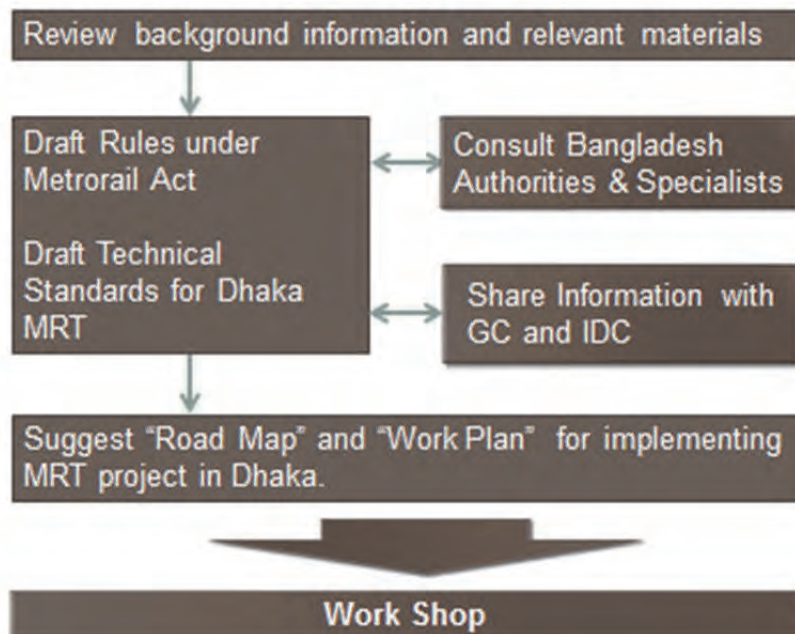
JICA's Cooperation for Dhaka MRT Project

- 2009-2011; Execution of Dhaka Urban Transport Network Development Study (DHUTS) with the aim of constructing an urban transport system centered on MRT.
- 2011-2012; Delegation of Institutional Building Assistance Staff for Dhaka Urban Transport Network Development (Dhaka IBA; loan assistance specialists) as advisors to the government
- FY2012; Commencement of the **Dhaka Mass Rapid Transit Development Project 1** (FY2012; loan-assisted MRT Line 6).
- September 2013~; Preparation of Rules and Regulations under Urban Mass Rapid Transit Act (Dhaka, Bangladesh): Technical Assistance Related to ODA Loan

Work Objectives

1	To make rules for the development of MRT Line 6 and the lines subsequently built
2	To prepare the Technical Standards and other regulations for working out technical plans
3	To make the roadmap and work plans for preparing the legal system and building a license/approval system
4	To assist in obtaining the Cabinet approval of Metrorail Act on which the Bangladesh urban transport projects are based

Work Flowchart



Work Schedule

Period	FY2013							FY2014									
	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
Phase	Phase1		Phase2-1		Phase3			Phase5					Phase6		Phase7		
Work Items	Review of the background and existing information Arrangement of Legal System Preparation of the Roadmap and Work Plan Preparation of Technical Standards Assistance for Cabinet Approval of Metrorail Act Follow up																
Reports	 ICP							 PR	 DF/R							 F/R	

Task 1

Review the background and existing information

- Review such upper level plans as Vision 2021, Strategic Transport Plan and relevant legislations
- Review the legal framework proposed in Dhaka IBA study
- Analyze and compare the institutional systems of the preceding countries like Japan, Singapore, India, Thailand, Vietnam, etc.
- Collect information on the BRT (Bus Rapid Transit) project
- Confirm the scopes and schedules of the general consultant (GC) and the organization development consultant (IDC) for Metrorail Line 6

Task 2

Make draft rules under Metrorail Act with Japanese legal system as the basis

The current draft of the Metrorail Act has been simplified as compared with the original draft, putting down to the subordinate rules such fundamental items as

- details of licensing procedures,
- fixation of fares
- authorization of works,
- functional inspection of facilities, etc. .

Remark:

Those items shall be provided additionally in the rules under the Metrorail Act.

Major Rules to be established

Rules applied before opening

- License Rule
- Fare Rule
- Authorization Rule

Rules applied after opening

- Inspection Rule
- Audit (Safety, Accounting, Business Operation) Rule
- Accident Reporting Rule
- Accident Investigation Rule
- On-the-spot Inspection (Regular & Accidental) Rule

Task 3

Prepare Technical Standards for Dhaka Metrorail System

**Use of Japanese Railway Technical Standards
as bases**

Japanese Railway Technical Standards

Regulator's Technical Standards

Government Ordinances - - - Compulsory

Explanatory Standards - - - Noncompulsory
(specific and numerical indications)

Operator's Implementation Standards

prepared in compliance with Ordinances and by reference to
Explanatory Standards

Remark:

Deviation from the Regulator's Non-compulsory Standards is
strictly checked by the regulator.

Dhaka Metrorail Technical Standards

Regulator's Technical Standards

Compulsory Standards supplemented by Additional
Explanations

Operator's Implementation Standards

established in compliance with the Regulator's Compulsory
Standards

Remarks:

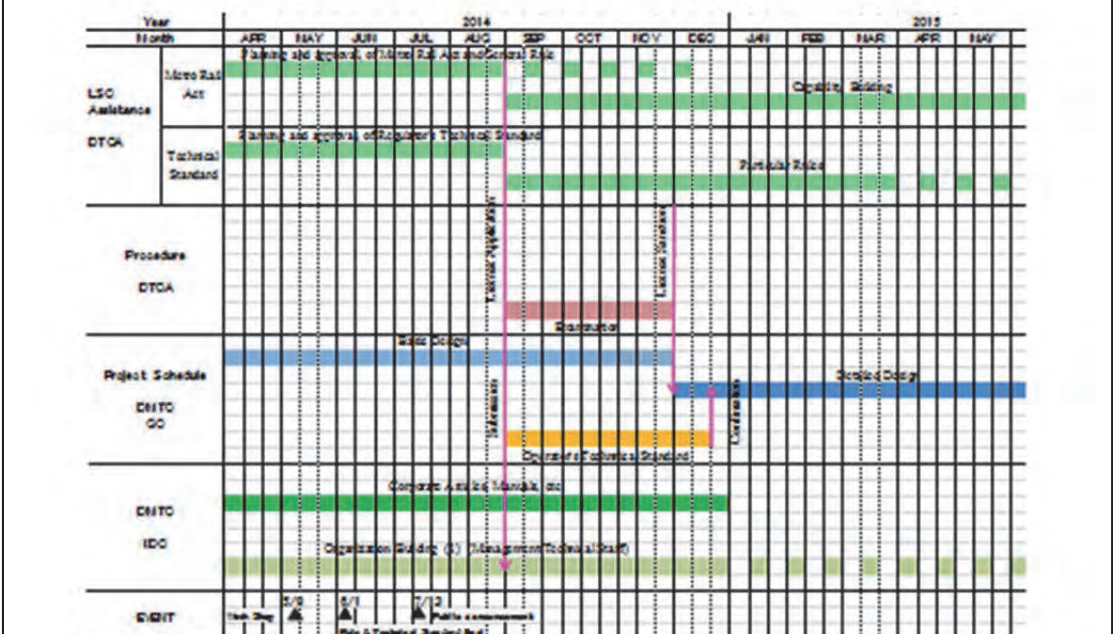
- Initiatives of railway operators are respected especilly in the areas technical innovations are progressing.
- Any deviation from the Regulator's Standards is deliberately checked before the approval by the regulator.

Task 4

Prepare the Roadmap for Dhaka MRT project

The Roadmap shows the Project Schedule and necessary Legal Procedures correlatively in time sequence .

Roadmap for the First 2 Years of the Project



Present State of the MRT Project

- DTCA drafted out the Metrorail Act. The draft has already been approved by the Cabinet and put on the procedure of legislation.
- DMTC has been conducting the Basic Design since February this year and is going to commence the Detailed Design this fall (October).
- JICA study team has prepared the drafts of Rules and Technical Standards and will present them at the Work Shop in May to hear the opinions of the stakeholders.

Request:

After the Work Shop, the stakeholders are requested to give their opinions within two weeks to the JICA Study Team.

Way Forward

Before the Commencement of Detailed Design

- The DMTC (operator) should obtain Project License from the Government and approval of the Implementation Standards from DTCA (regulator).
- The Metrorail Act and Rules should be in force prior to the project license application by DMTC (operator) for starting the Detailed Design. Technical Standards are also required to be in effect concurrently.

Remark:

Enforcement of the above legal factors shall preferably be in July allowing for the time necessary for DMTC(operator)'s application and DTCA(regulator)'s examination.

Toward the Opening of Line 6

- The organization building and the operation staff training have particular importance to the detailed design and operation and management of MRT system.
- In this regard, coordination with DMTC and IDC (Institutional Development Consultant) is required to secure a successful opening.
- The following rules applied during operation and maintenance shall be established 2 to 3 years before opening. Namely, Rules on:
 - business audit,
 - report of accidents,
 - report of railway management, etc.

METRORAIL RULES & REGULATIONS

May 2014

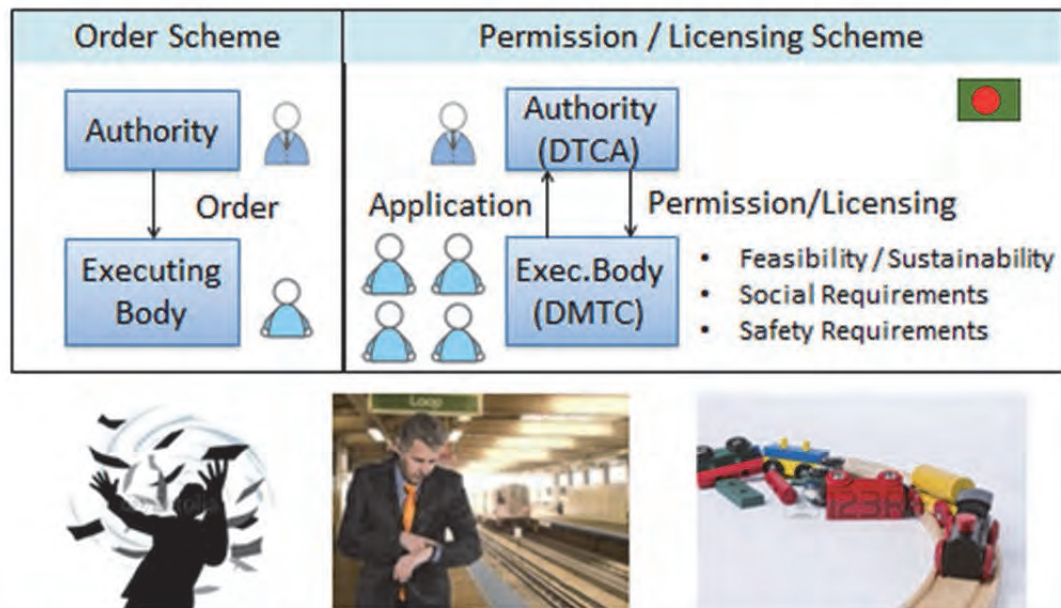
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Objectives

1. To explain the **need** for Rules & Regulations
2. To understand the **process** regulated by Rules
3. To comprehend the **3 regulatory tools**, namely:
(1) licensing, (2) inspection (3) fare assessment
4. To review **a set of rules** framed under the Act
5. To discuss actions to be taken / way forward

Why Metrorail Regulation?



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Need for Rules & Regulations

Need for Metrorail Regulation

- Metrorail must ensure good **safety performance**.
- Metrorail industry must be **economically sustainable**.
- Metrorail **market entry & exit** must be controlled.

Who is the Regulator?

- **DTCA** = safety & economic (& licensing) regulator

How to institute?

- Powers & obligations: under **Metrorail Act**
- Regulatory procedures: under **Metrorail Rules**
- Technical standards: under **Metrorail Regulations**

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Our Missions

Bangladesh Side

- To timely enact **Metrorail Act**
- To institute **Metrorail Rules** by the completion of Basic Design
- To authorize **technical standards** developed by JST
- To enforce regulatory control incl. technical standards

Japan Side

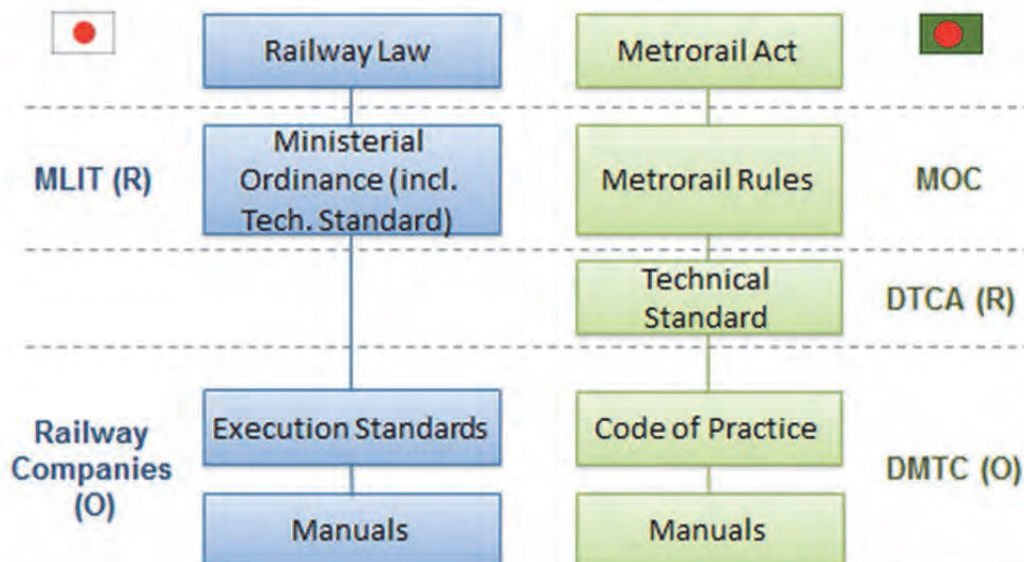
- To assist **drafting and enhancing** the rules & regulations
- To provide **capacity building trainings** for DTCA (next phase)
- To continue support till **full functioning of DTCA** as the Regulator

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Regulatory Framework

(R) – Regulator
(O) – Operator

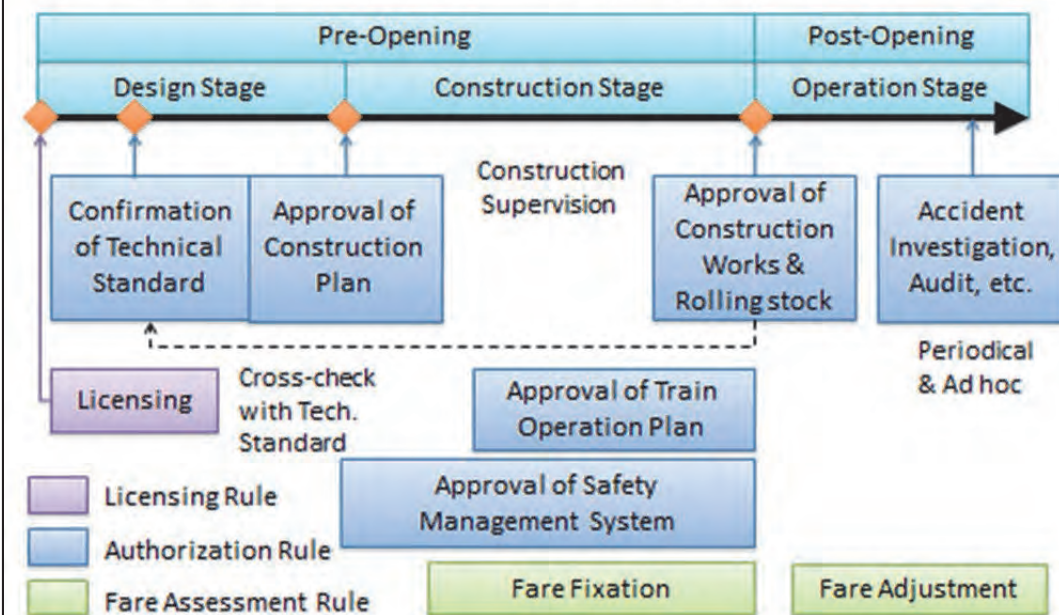


Rules – For various metrorail systems
Tech. Standard – exclusively for Line 6

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Regulatory Regime & Control by Stage



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Rules Framed under Act

Metrorail Rules - 2014 (Pre-Opening Procedures)	Metrorail Rules - 2014 (Outstanding Procedures)
1. Licensing Rule	1. Staffing Organization & Certification System (incl. driving licence system)
2. Fare Assessment Rule	2. Reporting (Safety, Business)
3. Authorization Rule	3. On-site Inspection
A. Conformity to the Authority's Technical Standards	4. Accident Investigation
B. Approval of Construction Plan	5. Audit (Safety, Accounting, Service)
C. Approval of Works, Plants, & Equip.	
D. Approval of Rolling Stock	
E. Approval of Safety Mgmt. System	
F. Approval of Train Operation Plan	

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In the Event of Failure to Pass

D: Design Stage
C: Construction Stage
O: Operation Stage

- Failure to satisfy licensing requirements (Disqualification)
 - *Licence not issued as per Act & Rule*
- Non-conformity to Authority's technical standards (D)
- Failure to obtain approval for technical design and construction plan (D)
- Failure to obtain approval for completion of works (C)
- Failure to take corrective actions to ensure safety operation (O)
 - *Instruction / order for improvement as per Rule*
 - *Not permitted to proceed to next stage or continue service*
 - *Licence to be suspended as per Act & Rule*



Pre-Opening Procedures

1. Licensing Rule

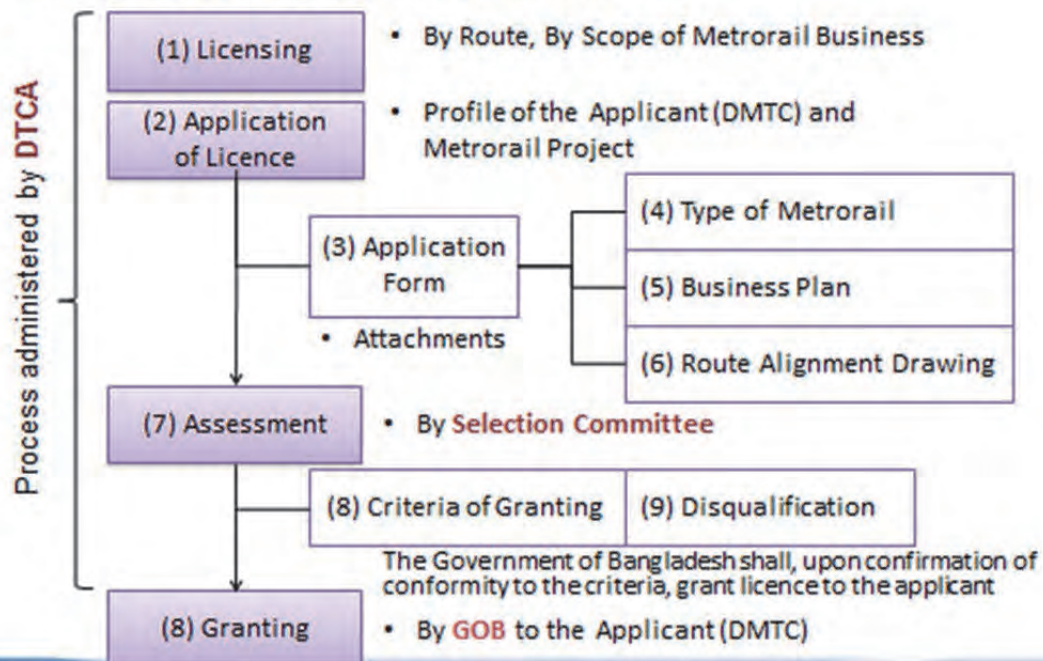
Licensing Procedures



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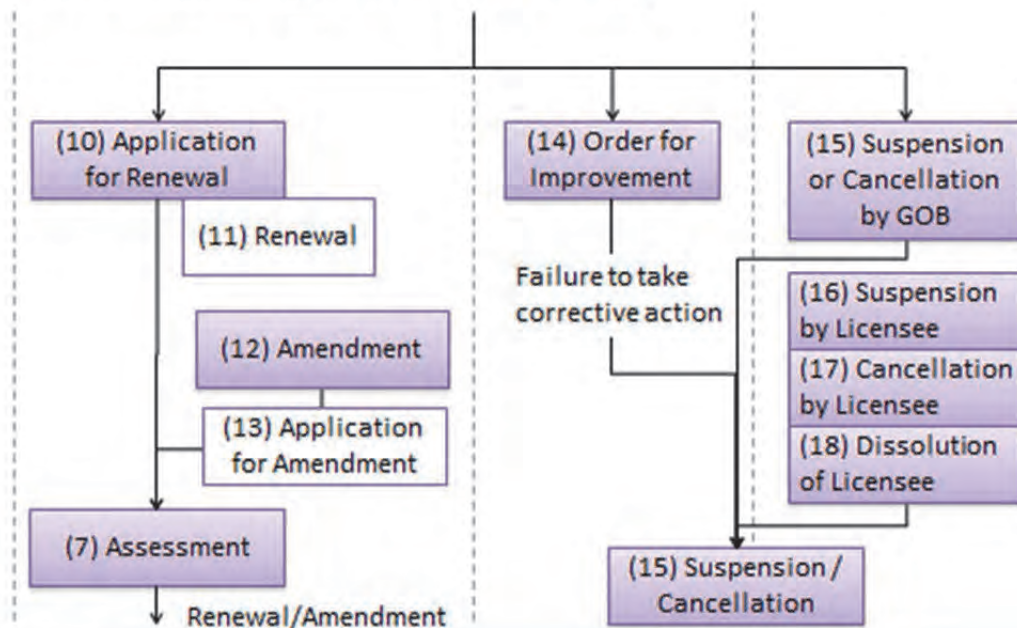
Licensing Rule (till First Granting)



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Licensing Rule (after First Granting)



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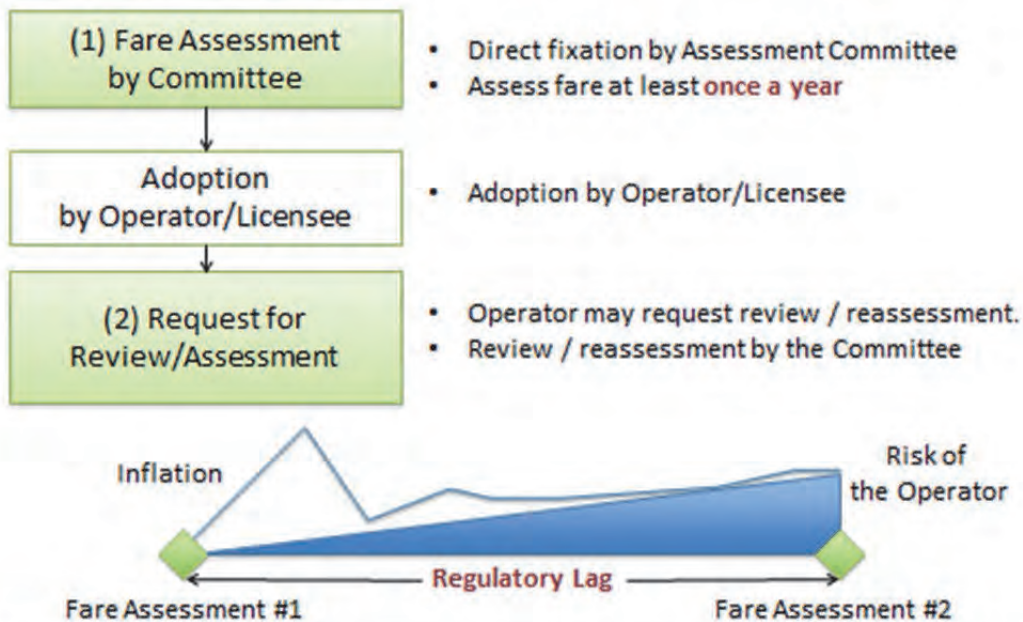
Pre-Opening Procedures

2. Fare Assessment Rule

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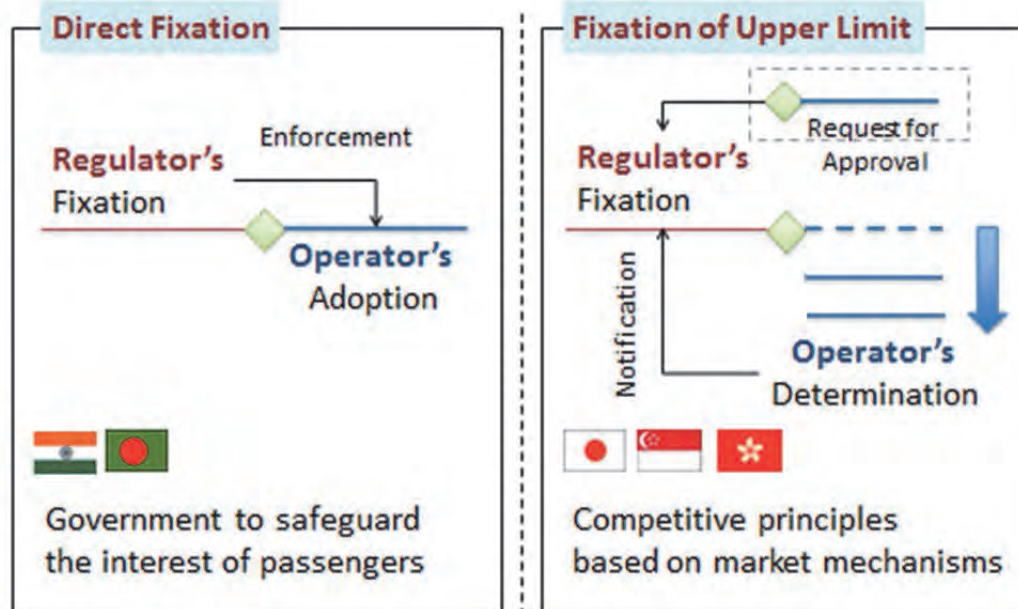
Fare Assessment Rule



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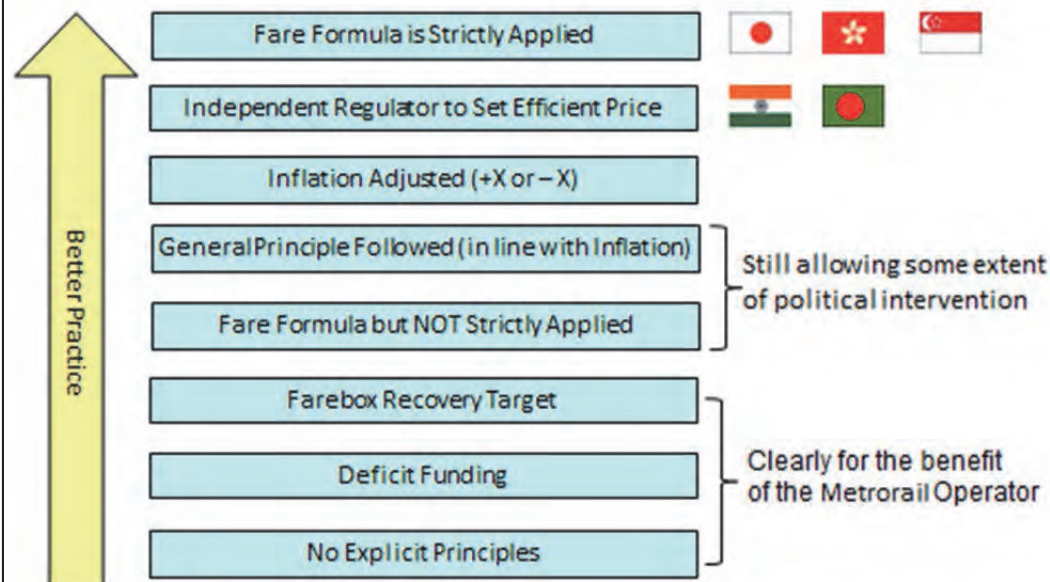
Fare Fixation



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Practices of Fare Regulation and Adjustments



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Fare Adjustment Criteria

Philosophy of Fare Adjustment

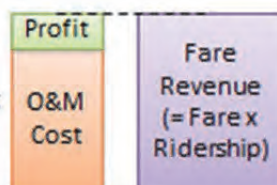
1. Cost of Service (or Rate of Return)
2. Socio-Economic Indicators Adjusted

Indicators often Used for Adjustment

- Inflation + X (for innovation & reinvestment)
- Inflation - X (for the benefit of general public)
- CPI (Customer Price Index) linked
- WI (Wage Index) linked
- Productivity Factor linked

1. Cost of Service (Rate of Return)

- Innovation
- Service Improvement



2. Socio-Economic Indicators Adjusted



e.g. (Rate of Fare Adjustment) = $0.5 \times \Delta \text{CPI} + 0.5 \times \Delta \text{WI}$

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Pre-Opening Procedures

3. Authorization Rule

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Contents of Authorization Rules

- A. Conformity to Authority's Technical Standard
- B. Approval of Construction Plan
- C. Approval of Works, Plants and Equipment
- D. Approval of Rolling Stock
- E. Approval of Train Operation Plan
- F. Approval of Safety Management System

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Metrorail Facility

Metrorail Facility	
Metrorail civil structures & tracks	Train control facilities
Stations	Substations and auxiliary facilities
Depots and maintenance facilities	Electrical facilities

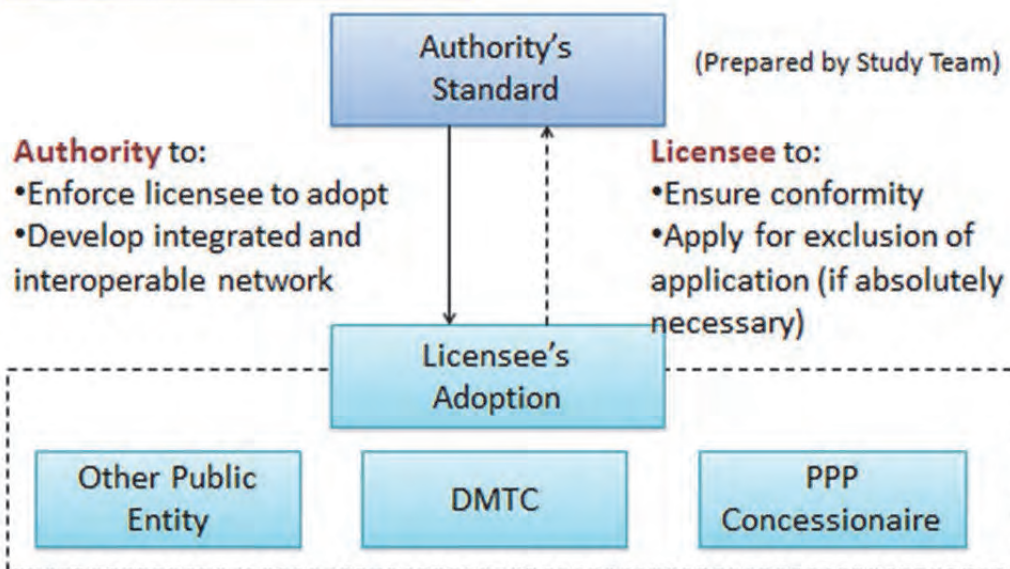


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A. Conformity to Authority's Technical Standard

Period Early Period of Design Stage

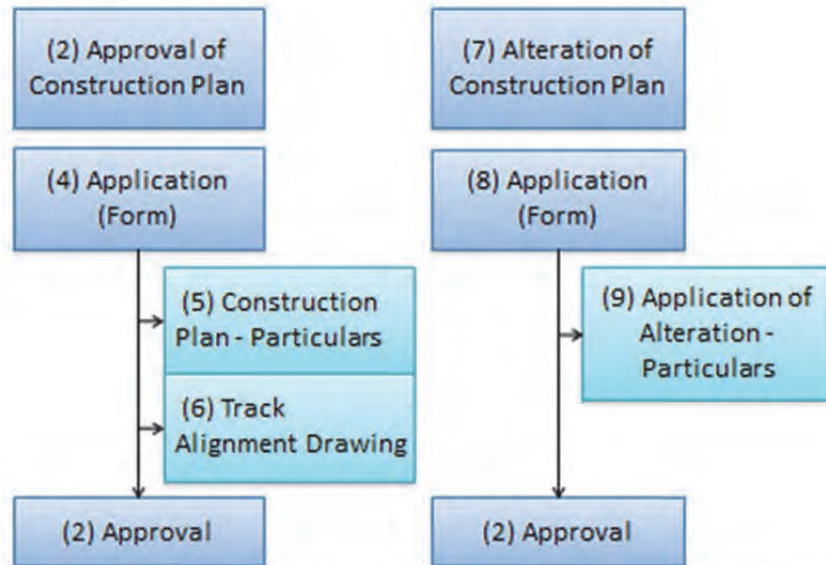


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B. Approval of Construction Plan

Period End of Design Stage

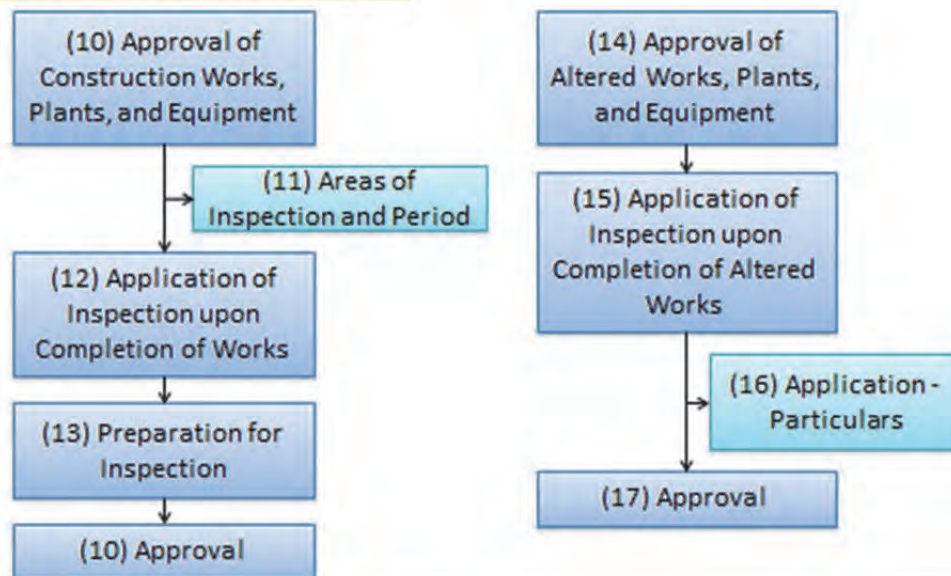


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C. Approval of Works, Plants, and Equipment

Period End of Construction Stage

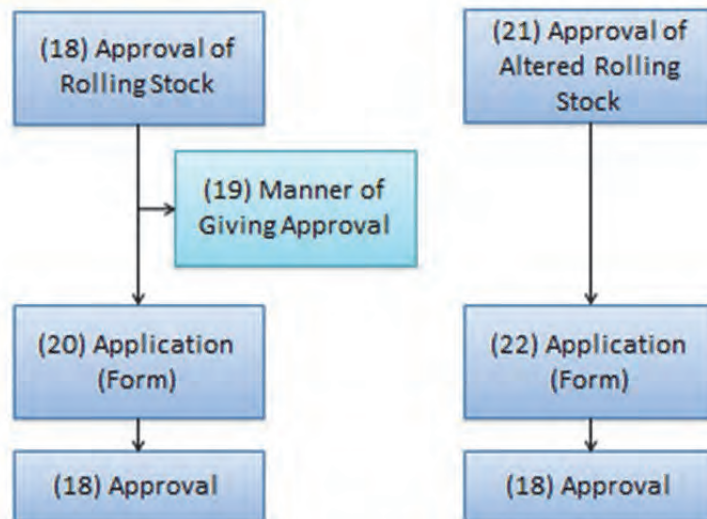


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D. Approval of Rolling Stock

Period End of Construction Stage

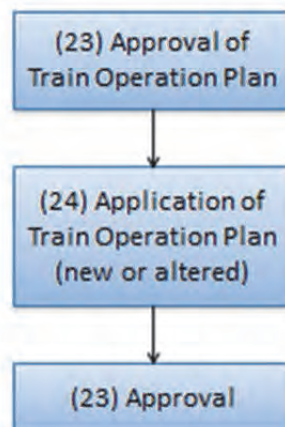


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E. Approval of Train Operation Plan

Period Before Commencement of Commercial Service

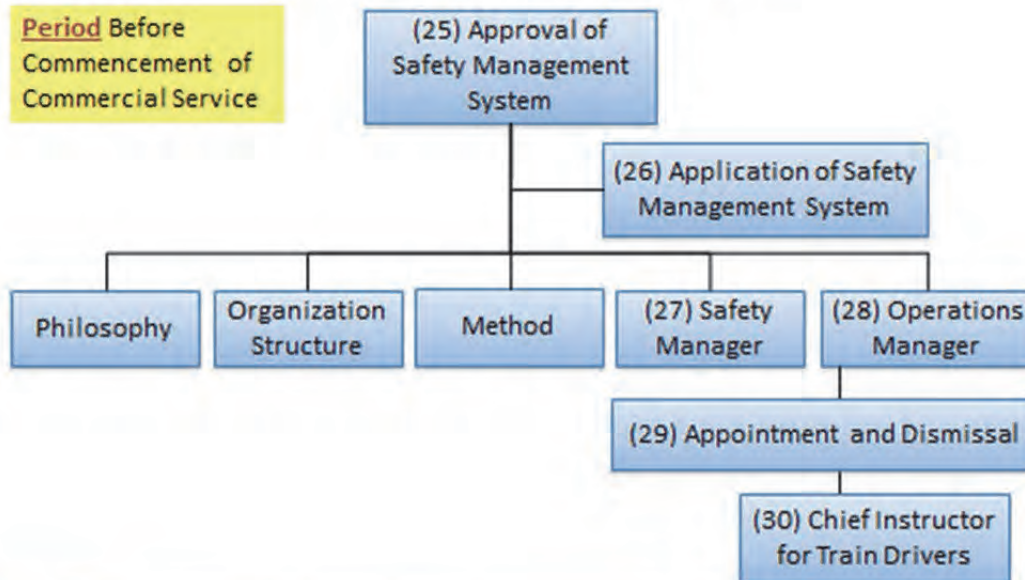


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F. Approval of Safety Management System

Period Before
Commencement of
Commercial Service



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Conclusions & Way Forward (1)

- Metrorail Rules (Pre-Opening Procedures)
 - drafted in English & Bengali
- Metrorail Rules (Post-Opening Procedures)
 - to be drafted in the next phase
- Deadline for institution of necessary rules
 - before completion of Basic Design by GC
 - say by the end of September, 2014
- Further assistance & capacity building trainings
 - currently under consideration

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Conclusions & Way Forward (2)

Suggested Schedule for Institution of Rules	In Charge	Date
1. Submission of the draft Rule to DTCA	Study Team	15 Jun.
2. Review and no objection by DTCA (10D)	DTCA	25 Jun.
3. Finalization of Rule by MOC (12D)	MOC	7 Jul.
4. (Inter-Ministerial Meeting &) Vetting by MOL (2W)	MOL	20 Jul.
5. Incorporating the Opinions of MOL (1W)	MOC/DTCA	27 Jul.
6. Sending 3 Copies of Rule to MOL for Rule No. (11D)	MOL	7 Aug.
7. Notification in Official Gazette	MOL	7 Aug.
Absolute late completion / Time spared	30 Sep. / 1M 3W	

Thank You

**Partnering with you for
Successful Development of
Metrorail Rules & Regulations**

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Prescriptions in Metrorail Rules

- Regulatory procedures
(e.g. application by licensee & approval by Authority)
- Application forms and contents
- Attachments to application forms (e.g. drawing)
- Assessment criteria
- Cause of disqualification
- Areas of order for improvement
- Cause of suspension and cancellation of licence



Inspection of Metrorail Facility



Periodical Safety Audit



3. Outline of Technical standards

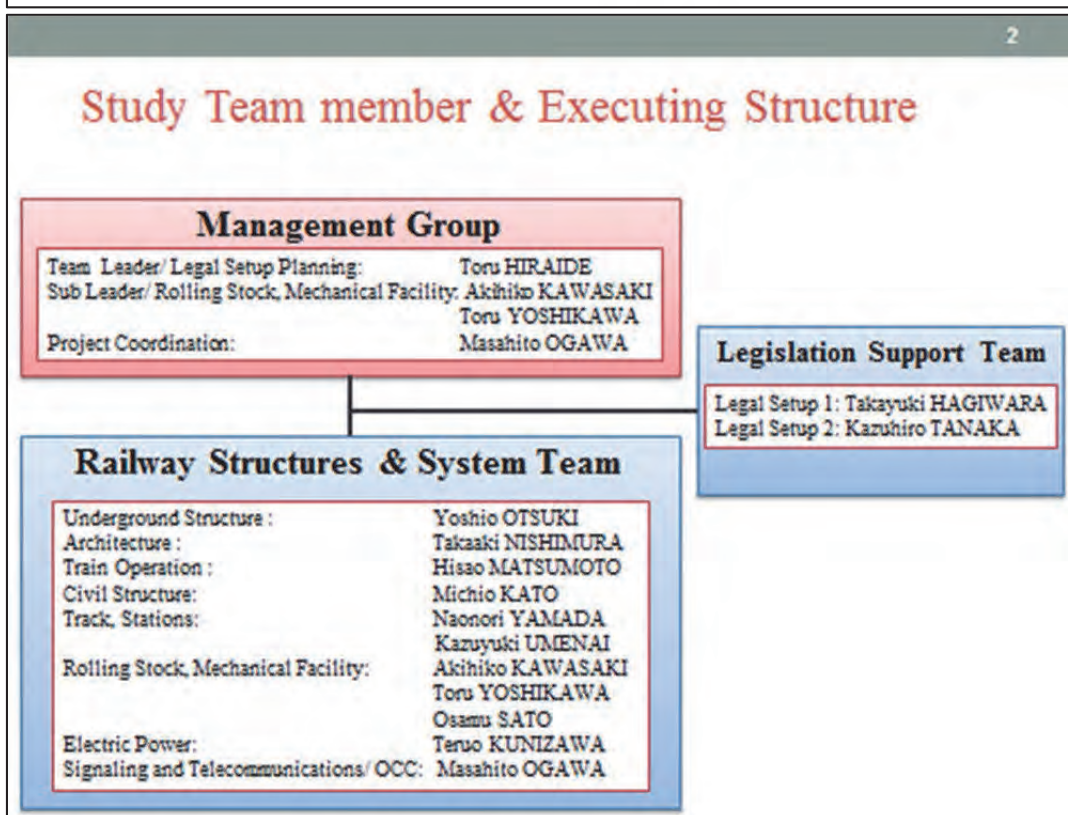
THE PEOPLE'S REPUBLIC OF BANGLADESH
PREPARATION OF RULES AND REGULATIONS UNDER URBAN MASS RAPID
TRANSIT ACT PROJECT
[TECHNICAL ASSISTANCE RELATED TO ODA LOAN]

Outline of technical standards in this study

8 may 2014

Japan International Cooperation Agency (JICA)

Japan International Consultants for Transportation Co., Ltd
Oriental Consultants Co., Ltd.
Metro Development Co., Ltd.



Objectives of Work

1	To prepare the Technical Standards and other regulations required at least for working out technical plans
2	To rearrange legal system of rules and regulations required for Dhaka Urban Transport applied to MRT Line 6 and the lines subsequently built
3	To work out the roadmap and work plans for preparing the legal system and building a license/ approval system
4	To expedite the Cabinet approval of the Urban MRT Act on which the Bangladesh urban transport is based

Work Schedule

Period	FY2013							FY2014								
	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Local Work	Phase1		Phase2-1		Phase3			Phase5		Phase6			Phase7			
								★ Workshop								
Work Items	Analysis of the background and existing information and form a policy															
	Rearrangement of Legal System for Dhaka MRT															
	Preparation of the Roadmap and Work Plan															
	Preparation of Technical Standards															
	Assistance in Obtaining Cabinet Approval of Urban MRT Act															
	Follow up															
Reports	ICP							PR	DF/R							F/R

Development policy of the technical standard necessary for MRT Line 6

1. General Policy

the MRT Technical Standards/Structural Codes are prepared as the regulator's examination standards for DTCA.

Development policy of the technical standard necessary for MRT Line 6

2. Character of the Technical Standards

In order to smooth the regulatory procedures, the span of choice is narrowed to the maximum possible extent in consideration of the specific characters of Line 6.

Development policy of the technical standard necessary for MRT Line 6

3. Relations with Japanese Railway Technical Standards

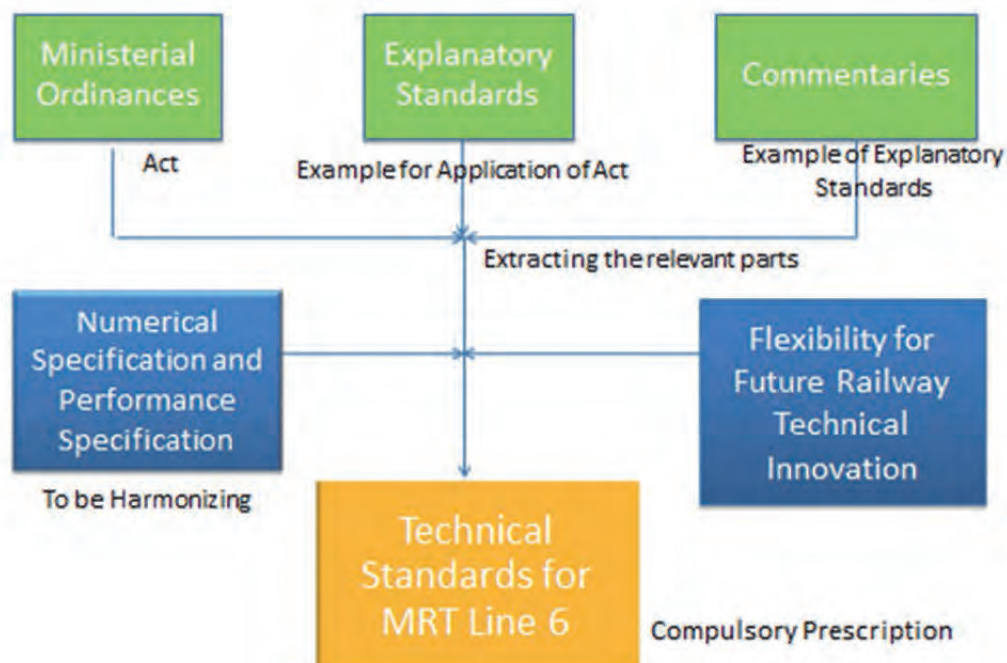
The Japanese Railway Technical Standards comprise the three ranks which are “Ministerial ordinances”, “Explanatory standards”, “Commentaries”.

The standards that railway operators shall absolutely comply with are “Ministerial ordinances”.

As the Dhaka MRT Technical Standards are specialized for MRT Line 6, they are constituted by extracting the relevant parts for the Line 6 construction from Japanese Ordinances, Explanatory Standards and Commentaries. In this context, the proportion of the compulsory prescriptions including specific figures will become higher.

- 1) To what extent specific figures and methods can be included in compulsory prescriptions.
- 2) What are the parts requiring the flexibility and discretion in view of the global innovations in the railway technologies.

3. Relations with Japanese Railway Technical Standard

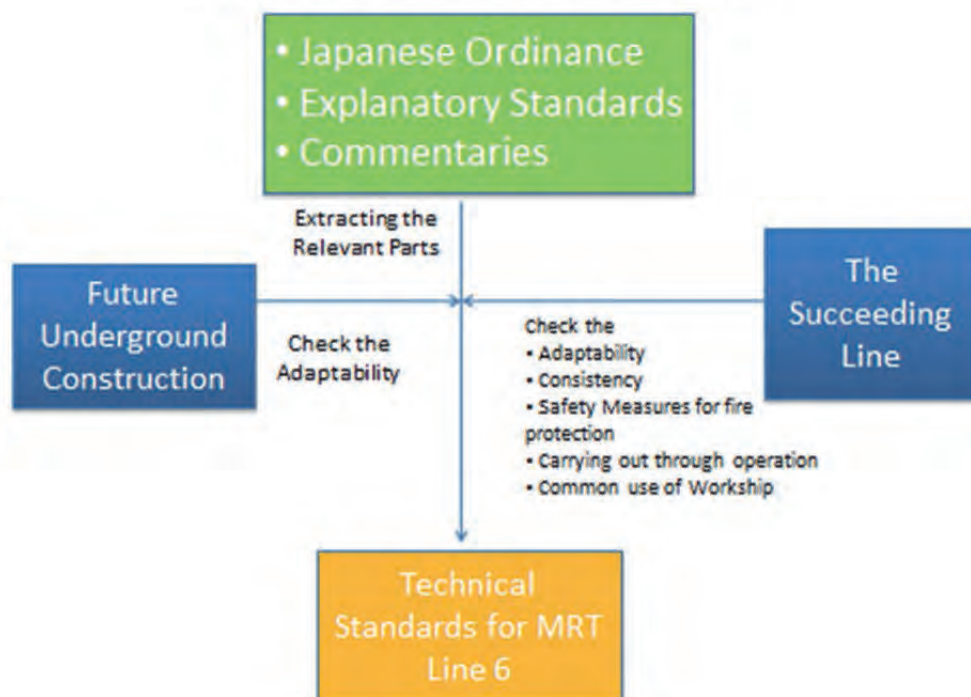


Development policy of the technical standard necessary for MRT Line 6

4. Relation with other future lines

Though the Technical Standards are specialized for Line 6 undertaken shortly, due considerations should be paid to their adaptability to the succeeding lines regarding, at least, the items requiring consistency in terms of the future MRT network. (for example, commonly applied safety measures for fire protection, possibility of carrying out through operation, efficient common use of workshops, etc.). Besides, preparatory considerations are required for the future underground construction works carried out at the intersections with other lines.

4. Relation with other Future Lines

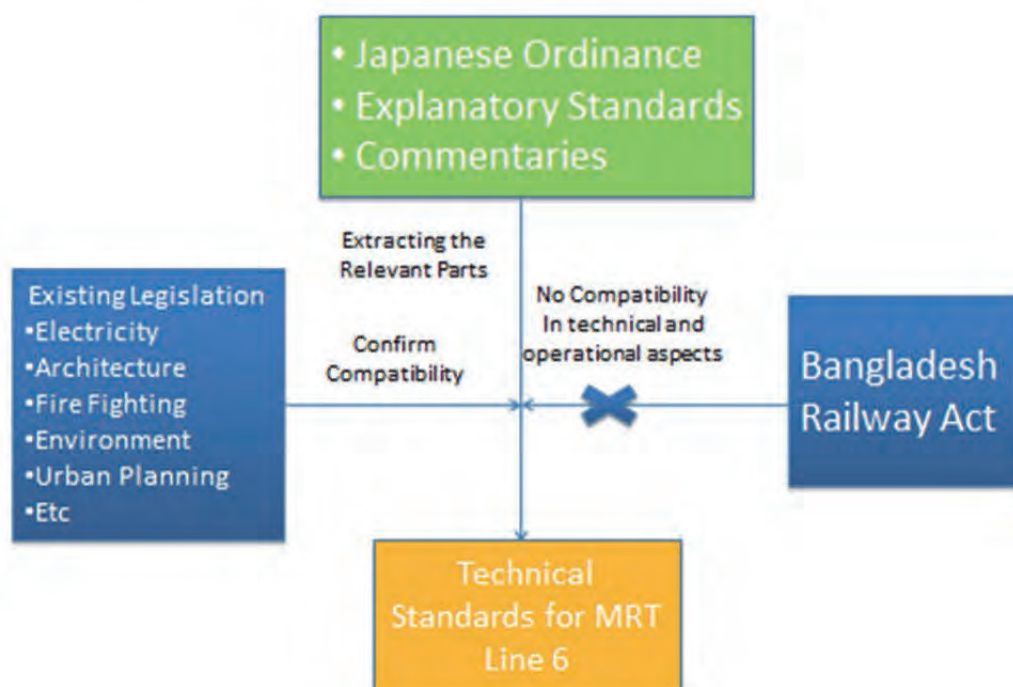


Development policy of the technical standard necessary for MRT Line 6

5. Compatibility with the existing legislations

The compatibility of the Technical Standards with the existing legislations should be confirmed in such areas as electricity, architecture, fire fighting, environment, urban planning, etc. On the other hand, it is considered unnecessary to ensure compatibility with Bangladesh Railway Act in technical and operational aspects on the ground that MRT is a transportation system drastically different from Bangladesh national railway as seen in electrification and Centralized Train Control.

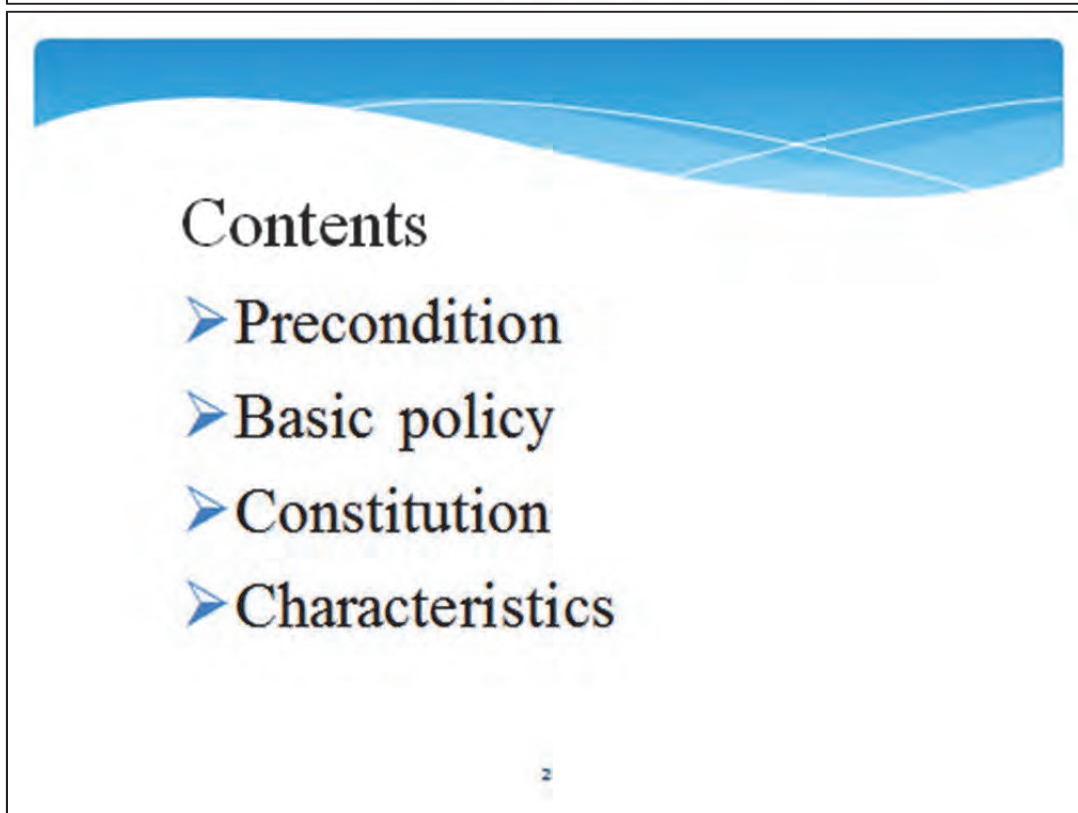
5. Compatibility with the Existing Legislation



Formulation of Technical Standards

1. Civil
2. Track
3. Architecture
4. Station
5. Electric Facilities
6. Operation Safety Facilities
7. Rolling stock
8. Automatic Fair Collection (AFC)
9. Train operation
10. Railway Signals
11. Fall Prevention Facility
12. Underground Structures and Facilities
13. Measures Against Accidents, etc.

4. Technical standards for Rolling stock



Precondition

- The technical standards should be applied to the rolling stock used for MRT.
- The technical standards should be taken the specification for light-weight rolling stock into consideration.
- The technical standards should be taken the social situation in Bangladesh, such as natural environment, electric power situation, and so on, into consideration.

3

Basic policy of the technical standards

The technical standards for rolling stock should be required to fulfill the following items.

- To ensure safe transportation
- To ensure stable transportation
- To realize appropriate maintenance of rolling stock

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Constitution of the technical standards

The constitution can be roughly divided into two regulations.

1. Rolling Stock Structure

Stipulate the technical standards related to rolling stock structure which is required to ensure passenger's safety and realize stable transportation.

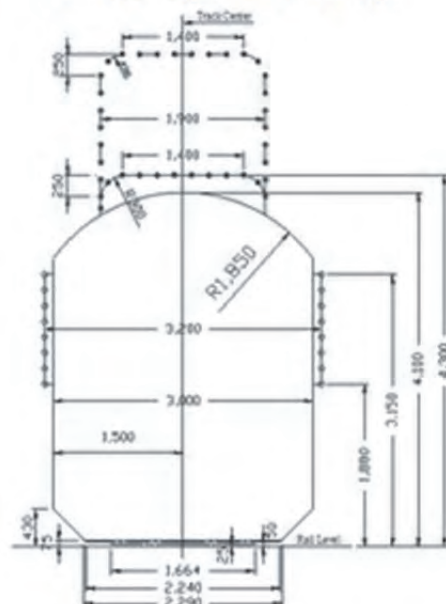
2. Maintenance of Rolling Stock

Stipulate the technical standards related to maintenance of rolling stock. Appropriate maintenance of rolling stock is essential to ensure stable transportation.

5

Characteristics of the technical standards

➤ Rolling Stock Gauge



- Basic
 - - - Gauge in relation to parts that do not move vertically due to action of
 - Gauge in relation to sanding pipe, obstacle deflector, brake shoe and other parts that do not exceed the rim
 - +—+—+ Gauge when current collector
 - +—+—+ Gauge in relation to top of roof when current collector is operated.
 - +—+—+ Gauge in relation to signs, marker lamps, car side lamps.
- Unit : mm

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Characteristics of the technical standards

➤ Rolling stock in Japan



Item	Series E233
Car body width	2950mm
Passenger capacity of a car	160 (54)
Passenger capacity of a train (10 cars)	1564(510)

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Characteristics of the technical standards

➤ Weight of Rolling Stock and car-body material

- The axle load of rolling stock shall be maximum 16t in the stopped and loaded state.
- The aluminum alloy or stainless steel shall be used as a main material of rolling stock car-body structure.



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Characteristics of the technical standards

➤ Brake Devices

• Type of Brake Device

① Service brake device (incl. emergency brake)

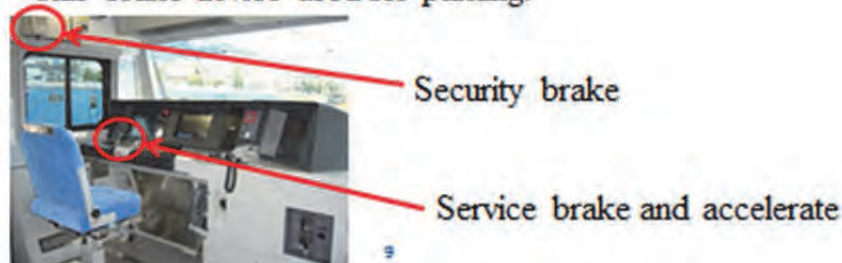
This brake device usually used for braking during operation.

② Security brake device

This brake device used for braking when the service brake device has failed.

③ Parking brake device

This brake device used for parking.



Characteristics of the technical standards

➤ Structure of Car Body

- Rolling stock car body shall be made sturdy with enough strength and be capable of withstanding train operation.

Load condition in Japan

Name	Definition	Load standard
Longitudinal force of rolling stock end	Tensile force	Electric railcar : 343 kN
	Compressive force	Electric railcar : 490 kN

Characteristics of the technical standards

➤ Structure of Passenger Car

- One or more wheelchair spaces shall be provided in each train.



Wheelchair space



Priority seat

The Japanese rolling stock has a "priority seat" which is available for the elderly, handicapped passengers, expectant mothers, etc.

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Characteristics of the technical standards

➤ Structure of Passenger Entrance and Exit

- The door for passenger shall be provided on both sides of rolling stock.
- The effective width of the door for passenger shall be 1300 mm or more and the effective height shall be 1800 mm or more.



The Japanese rolling stock has the width of aisle and door which enables a wheelchair to pass through enough.

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Characteristics of the technical standards

➤ Structure of Gangway Entrance and Gangways

Type of rolling stock	Number of gangway entrances	Number of gangways	Width	Height
Passenger car (incl. EMU)	2	2	550 mm or more	1800 mm or more
Front or rear part of the train.	1	1		



The Japanese rolling stock has the gangway entrance and gangways which meets the technical standards sufficiently.

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Characteristics of the technical standards

➤ Equipment of a Driver's Cabin

- A driver's cabin shall be provided with the facilities shown in the following:
Operating devices for control facilities, Operating devices for service brake devices, Communication devices, Speedometer, Emergency stop device, etc.

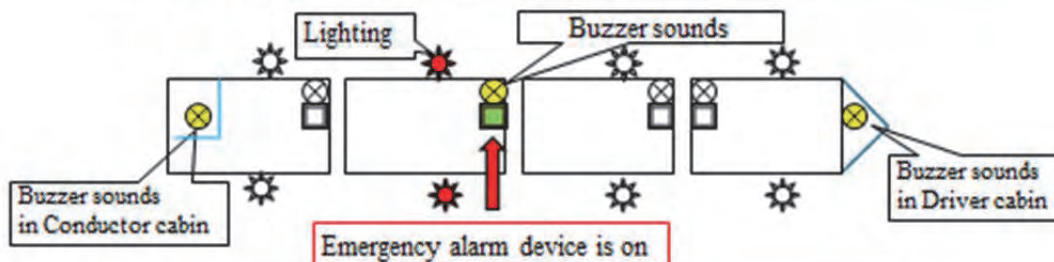


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Characteristics of the technical standards

➤ Rolling stock accessory

- The emergency alarm device shall be provided on rolling stock.



Emergency alarm device

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Characteristics of the technical standards

➤ Rolling stock accessory

- In the rolling stock, Equipment for displaying by characters, etc., and equipment for audibly providing the name of the next station the train is going to stop at and other information relating to the operation of the train must be provided.



Using those two LCDs various information is provided for the passengers.

Left hand side display:

- Commercial messages
- News
- Tourism information etc.

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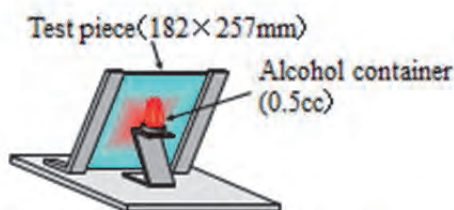
Right hand side display:

- Information for next station
- Information of stop pattern
- Real-time train operation information for other lines

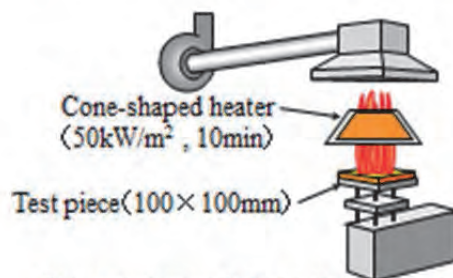
Characteristics of the technical standards

➤ Countermeasures against Rolling Stock Fire

- Carbody shell
Metal or equal to or better than the Non-combustibility of metal
- Interior
Non-combustible, Flame retardant, Extremely flame retardant, melt-dripping resistance and flame resistance are required by the part.



Non-combustible, Flame retardant and Extremely flame retardant are judged by the state of the test piece under combustion and after combustion. ¹⁷



Flame resistance is judged by Overall heat value(MJ/m²), Ignition time(Sec) and Maximum heating speed (kW/m²).

Characteristics of the technical standards

➤ Maintenance of Rolling Stock

The rolling stock shall not be used unless they are maintained to function accurately and to be safely operated.

【Inspection of train】

- Main component of a rolling stock shall be inspected according to the type and traffic condition of trains.

【Periodic inspection of Rolling Stock】

- Inspection of the rolling stock shall be carried out periodically within the respective period specified in the table pursuant to the pre-determined items and methods according to their type, structure and usage.

Kind of Rolling Stock	Period		
	Inspection of Condition and Function	Inspection of important and Critical Part	Overall Inspection
EMU	3 months	4 years, or the period of traveled mileage of the rolling stock being not exceeding 600 thousand kilometers, of which shorter period is selected.	8 years

Characteristics of the technical standards

➤ Maintenance of Rolling Stock

Inspection of train

Inspection of train, which includes inspections, tests, and quick replacement of parts, etc.

Periodic inspection of Rolling Stock

Inspection of Condition and Function

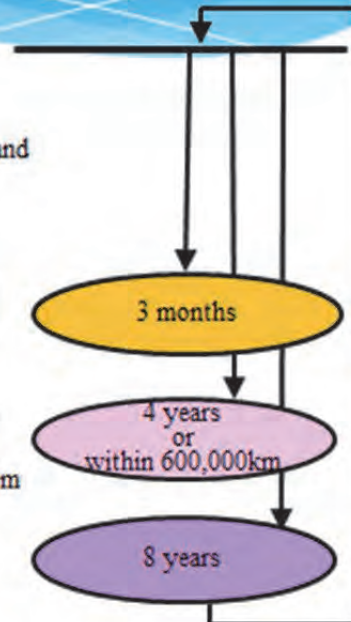
Periodic inspections, which is a part of preventive maintenance program.

Inspection of important and Critical Part

Main parts of car and bogies shall be disassembled from car and inspected.

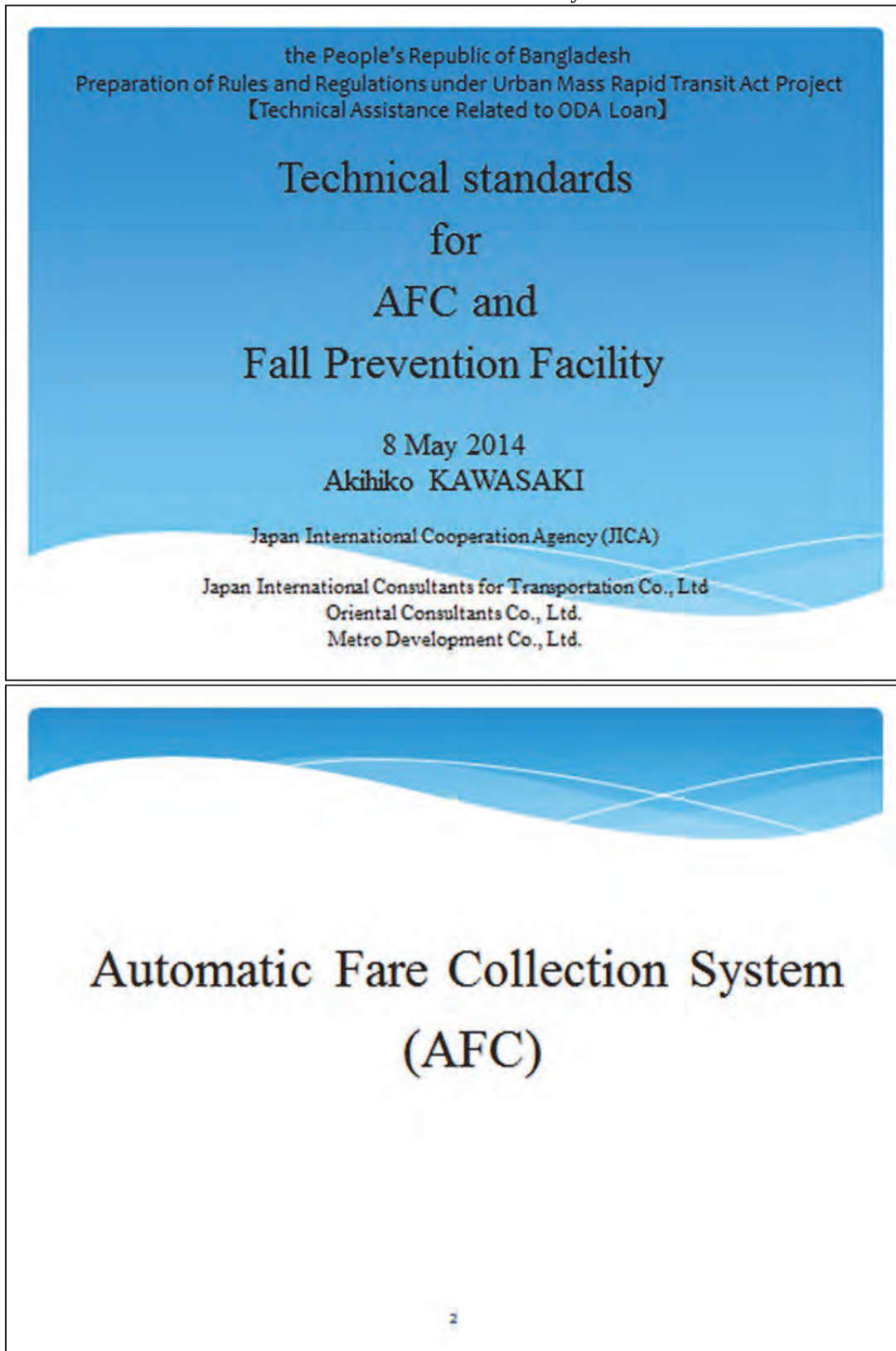
Overall Inspection

Detailed inspection shall be carried out on the main equipment disassembled from cars.



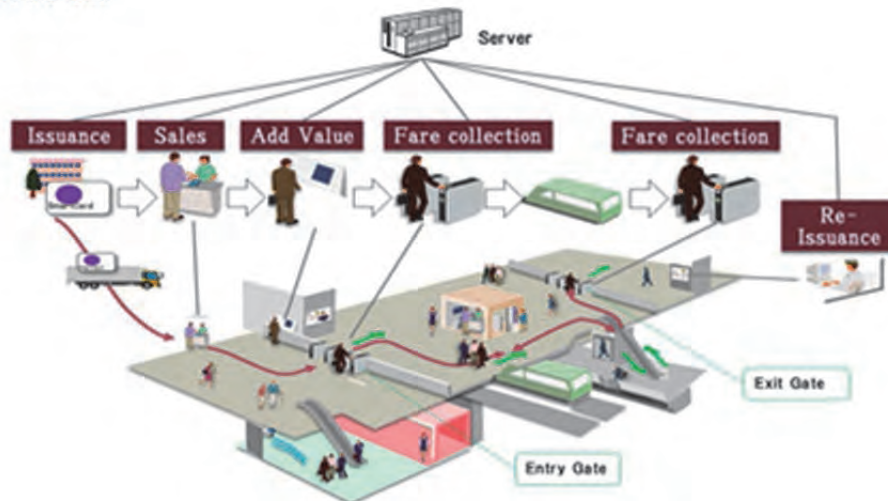
Thank you for your kind attention.

5. Technical standards for AFC and Fall Prevention Facility



Introduction of AFC

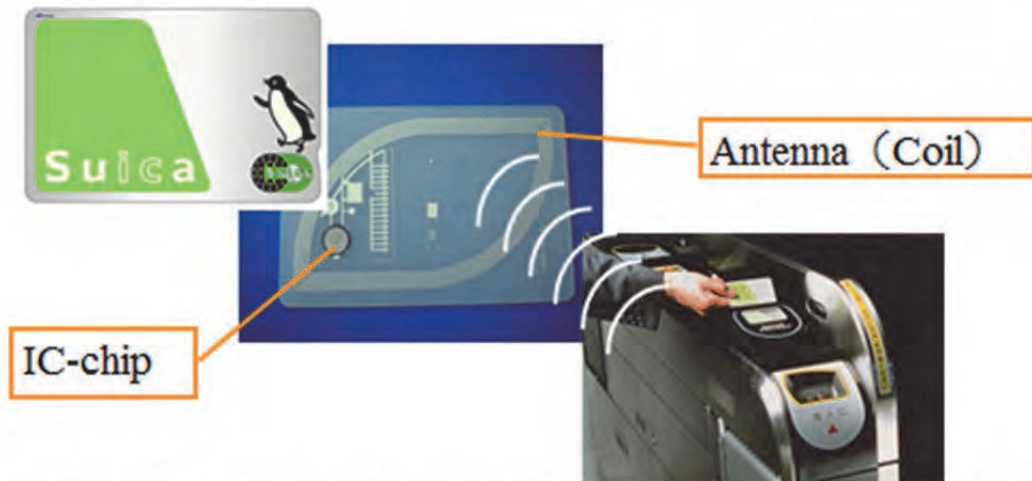
The AFC system automatically collects the fare from passenger with the machine for Public transportation such as railways, buses and so on.



Main Components of the AFC System

- Contact-less IC cards
- Ticket vending machine
- Passenger gate
- Network facilities
- Central server, etc

Contact-less IC cards



IC card communicates by radio wave with the Read/Write device of passenger gate

Ticket vending machine



Ticket vending machine for conventional line



Ticket vending machine in station

Passenger gate



Flap type



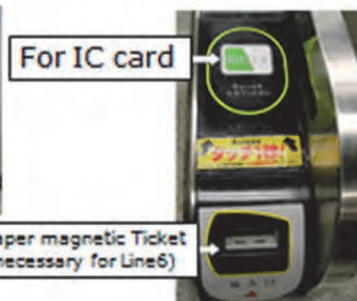
Retractable type



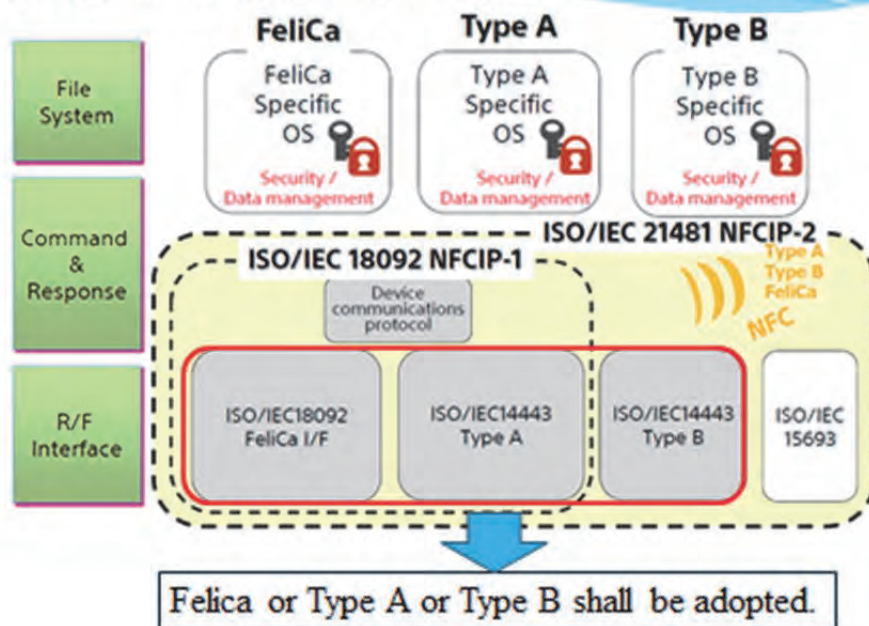
Turn style type



The flap type is most suitable for dealing with many passengers.



International Standards for Contact-less IC cards



Basic requirements for AFC

- High Security and Safety
- High Speed
- High Reliability and Durability
- High Interoperability and Expansivity

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Security

- ISO/IEC 15408 EAL4+ or more
(for High Security Card)
- Data transmission related to revenue data shall employ high-security encryption

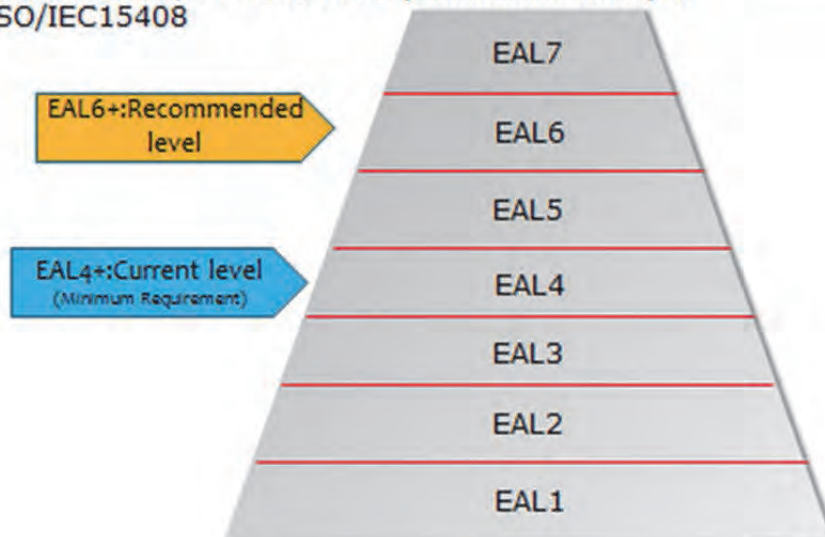
Safety

- Emergency mode of passenger gate for emergency evacuation.

10

Security Level

About Security Evaluation CC (Common Criteria) or ISO/IEC15408

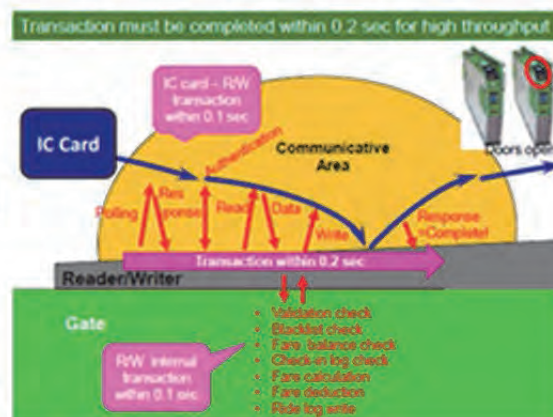


11

High Speed

High speed is very important for dealing with large number of passengers in limited space.

- Passenger gate shall pass at least 60 passengers per minute.
- Transaction time between card and read/write unit shall be 100ms or less.
- Initial data transfer rate shall be at least 212kbps



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Reliability and Durability

- The AFC system shall retain backup data for 7 days or more.
- The Central server shall retain backup data for 1 year or more.
- Data shall be assured even when power supply to the card is interrupted while writing.
- Rewriting durability shall be at least 100 thousand times.

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Interoperability and Expansivity

- Mutual availability with other public transport system (BRT, Bus, BR etc.) shall be secured.
- Future potential services such as E-cash and Park and Ride service, etc shall be considered.

14



Fall Prevention Facility

15



Fall Prevention Facility

- Safety facility, such as Platform Screen Door, which prevents that a passenger falls from the platform or a passenger contacts with the running train.
- This facility is a option for Line 6 but this shall be obligated if one-man or no-man driving operation will be adopted.

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Conventional Platform Screen Door



Full Height Type



Half Height Type

Merits: Proven System

Demerits: Heavy, High Cost,

Narrow acceptable range of train stopping position

New Developing Facility



Rope Screen Type



Bar Type

Merits: Light weight, Low Cost,

Wide acceptable range of train stopping position

Demerits: Under proving test ¹⁸

Items to be considered for FPF

- Enough strength against passenger's leaning force or strong wind
- Correspondence to the case when a train stops at inappropriate position
- Correspondence to the electric power failure
- Measures against difference of electrical potential

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Items to be considered for FPF

- Counter measures for envisaged risks
 - (1) Contact to the train by putting long things, such as a bamboo pole, against Fall Prevention Facility
 - (2) Contact to the train by a passenger leaning out from Fall Prevention Facility
 - (3) Contact to the Fall Prevention Facility by a passenger leaning out from the window of the train
 - (4) Falling a foreign substance by a passenger placing a can etc. on Fall Prevention Facility
 - (5) The dangerous foreign substance (thin string etc.) stuck to the door in Fall Prevention Facility
 - (6) Leaving a passenger between Fall Prevention Facility and the train

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Contents

1. Scheme of railway transport
2. System for securing railway safety
3. Basic concept for technical standards of operation
4. Main contents of technical standard
 - 4.1 Officials in charge
 - 4.2 Train operation
 - 4.3 Railway signals
 - 4.4 Measures against accidents. etc.

1. Scheme of railway transport

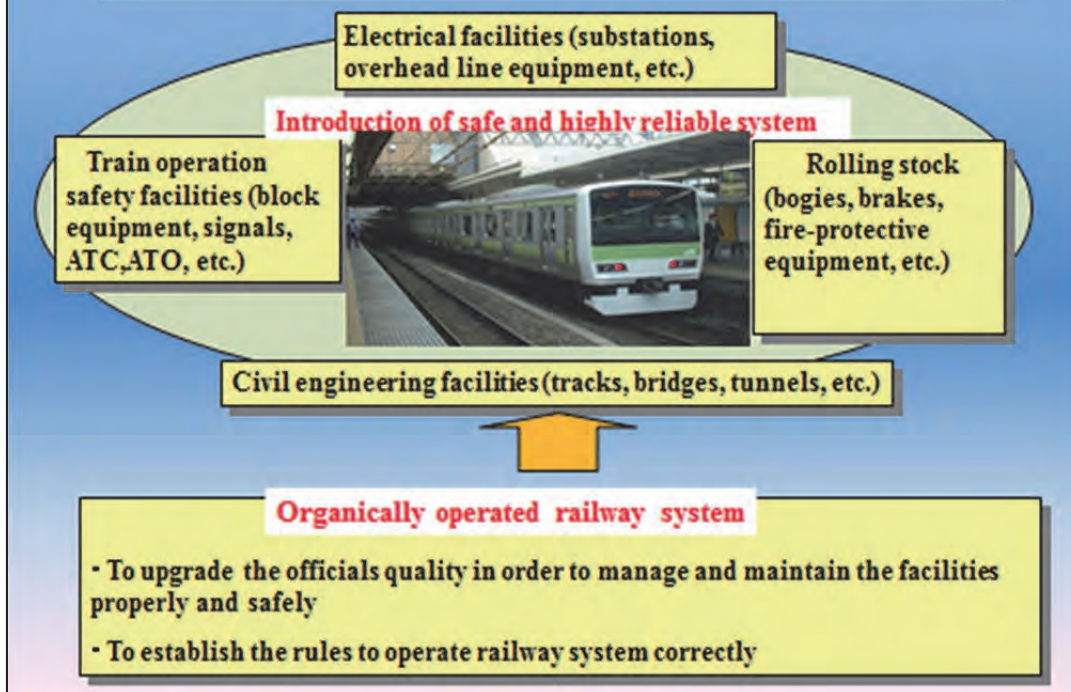
- Operation of many trains on a rail for exclusive use.
 - Mass rapid means of transportation ---
- The damage at the time of the occurrence of an accident (derailment, collision) is serious.
- A high level of safety, stability, and comfort are expected.



- The railway system is composed of “persons” and “things” such as “officials in charge” for the former, and track, safety facilities or rolling stock for the latter.
- Railway transport is managed based on the organic combination of these two, “persons” and “things.”
- There are rules for "persons" to deal with "things" correctly. Good practice of these rules enables to achieve safety and stability of railway transport.



2. System for securing railway safety



3. Basic concept for technical standards of operation

- Safety and stability of railway transport must be ensured under the total management of a railway operator.
- The government, in a position to supervise and advise the railway operator needs to show a certain standard focused on safety.



4. Main contents of technical standard

4.1 Officials in charge

1. 5 items were prescribed in total
2. The features of items for officials in charge
 - ① Regarding education and training of the officials, those officials engaged in maintenance of facilities and rolling stock have been included in addition to those engaged directly in train operation to be able to receive the education and training given regularly by railway operator.
 - ② Qualification requirements and standards of theoretical and practical training in the training center for MRT driver's license
It is necessary to establish it separately as the government.

Education and training (For officials of operation related)



Training for driver
using simulator

Training of derailment recovery
in electric car depot



Education and training (For Officials of maintenance related)



Training of contact wire recovery at the
electric power maintenance depot

Replace training of electric point machine
at the signaling maintenance depot



4.2 Train operation

1. 30 items were prescribed in total
2. The features of items for the train operation

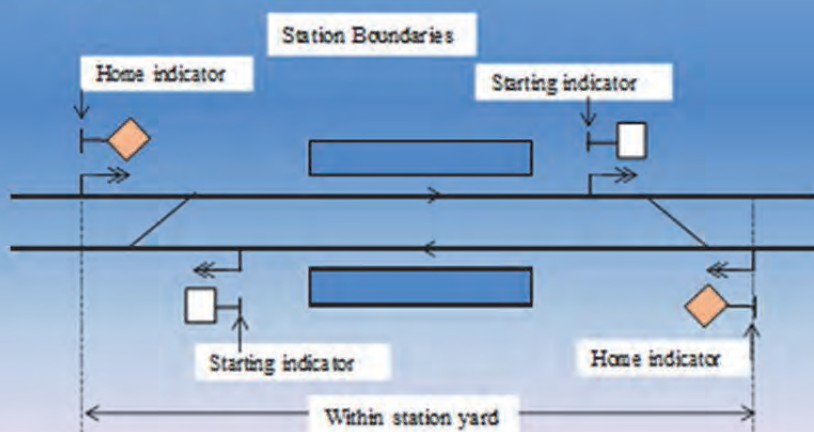
① Basic of train operation plan

Metrorail Operators shall design the train operation plan which considered convenience, comfort enough in consideration for assumed passenger transportation demand, devise the suitable train working time that there is not of the problem in safety track condition, operating performance of rolling stock

② Station Boundaries

Station Boundaries shall be indicated as follows

- 1) As for the approaching direction of train ; outmost home indicator
- 2) As for the departing direction of a train; outmost home indicator on the opposite track



③ Safety assurance between trains

➤ ATC system

ATC system is a method to secure the safety between trains by using ATC to control train speed in accordance with the interval with the preceding train and the route conditions

➤ Substitute block system

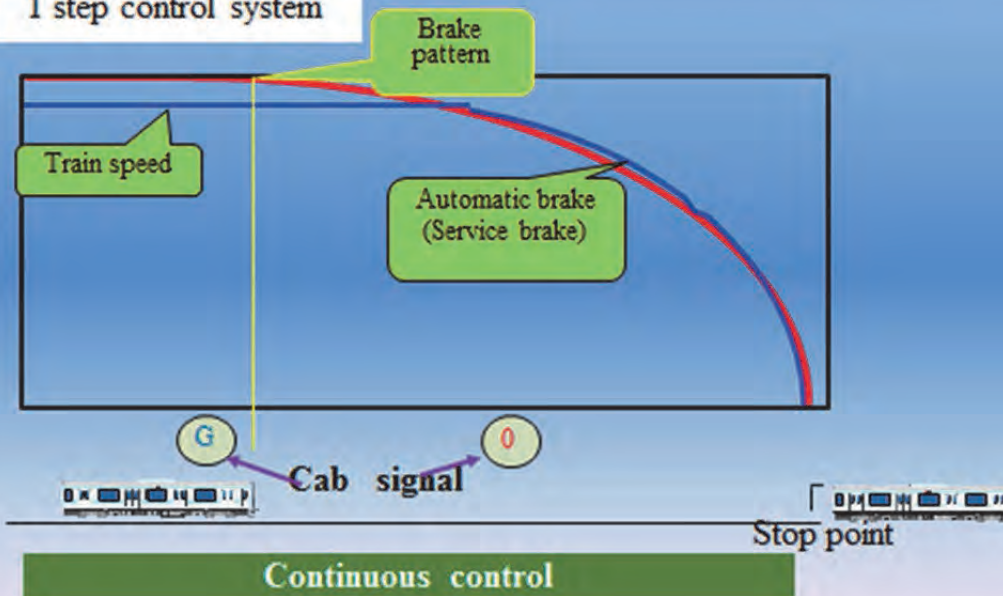
The substitute block system is a method to secure the safety between trains by using blocks as a substitute for the ATC system when it is unable to implement

➤ Driver's attentiveness operation

Driver's attentiveness operation is a method to be applied based on the instruction of the traffic dispatcher to secure the safety between trains by operating trains at a speed in which the driver can stop the train within the visible distance forward when it is unable to implement the ATC system or a substitute block system

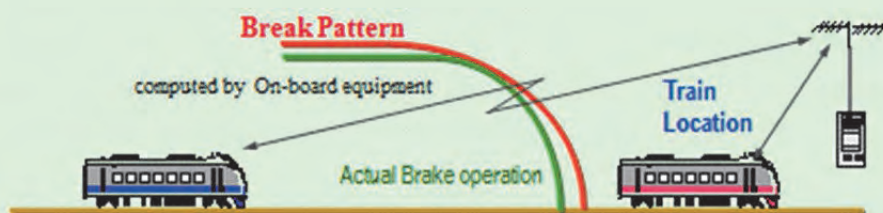
ATC (Automatic Train Control)

1 step control system



New type Radio Based Train Control System

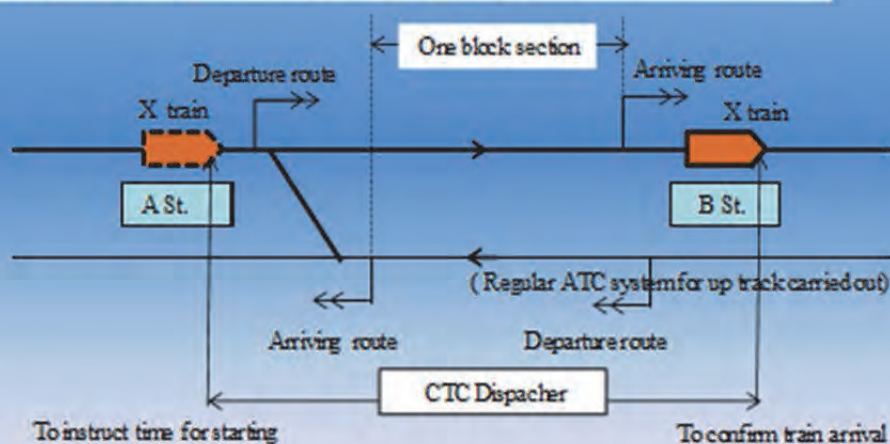
Train Interval Control (Moving Blok System)



Substitute Block System

【Example of command type system】

The train X leaves the station A when the departure route for down track does not work as well as ATC system for down tracks between stations A and B.



4.3 Railway signals

1. 22 items were prescribed in total
2. The features of items for the railway signals

① Introduction of Cab signal with ATC



② Special signals

Type of special signal	Indication method
Fusee signal	Red flame from a fusee
Flash signal	Flashing red light
Audible signal	Warning sound via radio communication

The diagram shows a driver's cab on the left with a label 'Warning sound via radio communication'. On the right, a speedometer is shown with a needle pointing to 120 km/h. Above the speedometer is a green triangle with the text '(Proceed)'. Below the speedometer is a red triangle with the text '(Stop)'. To the right of the speedometer is a red 'X' with the text '(Stop)'.

③ On-board a conductor for the commercial train

- The conductor shall indicate a departing sign when the train departs from the station



4.4 Measure against accidents, etc.

Following 3 items were prescribed

- Caution in abnormal meteorological conditions
- Stop arrangement for train protection
- Measure for fire outbreaks on trains, underground stations, etc.

Reference: Flow of Acquisition of Driver License

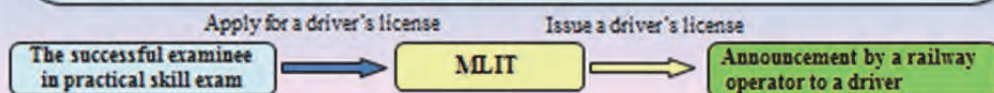
Ministerial ordinance relevant to driver license

- No crew drive any power car without driver's license
- Driver's license is given to those who passed driver's license examination
- Those who are 20 years old or more are eligible for the exam
- Examinees need to pass the exam of four items ; 1. Medical aptitude, 2. Driving aptitude, 3. Paper test, 4. Skill test



Railway operator (JR east etc.)

- Obtain authorization of driver's license training center from the Minister of Land, Infrastructure and Transport
- Qualification of examinee- Experience as a station staff for one year and as a conductor for two years or more
- Examination to enroll training center: Only those who passed the tests 1 and 2 of the ministerial ordinance can take the exam
- 568 hours (four months) of academic subjects followed by 515 hours (four months) of the practical skills for those who passed the subject exam



ELECTRICAL TECHNICAL REGULATORY STANDARDS FOR DHAKA MRT

MAIN CONTENTS

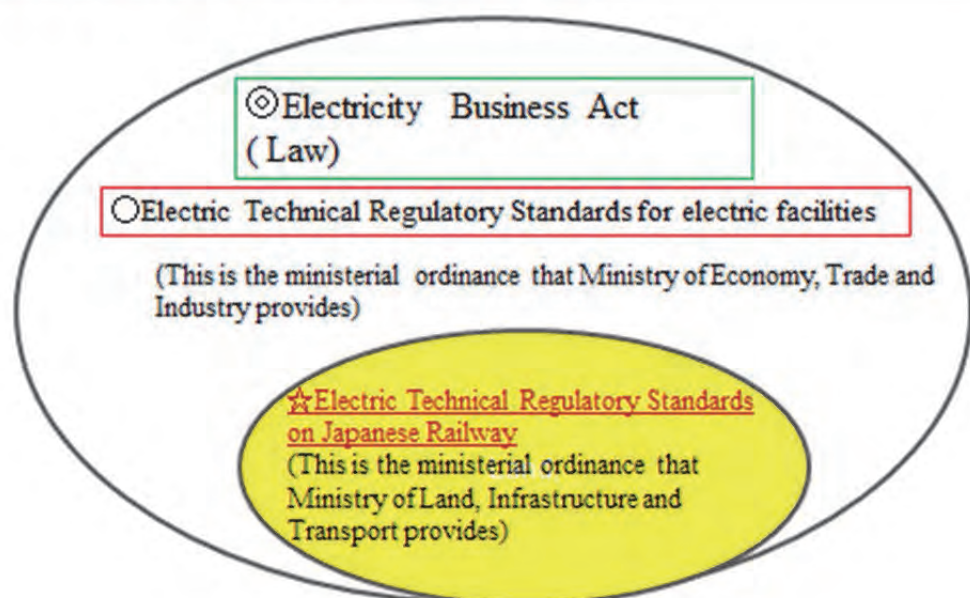
- 1 The Fundamental View of Electric Technical Regulatory Standards (ETRS) for MRT**
- 2 Structure of Electric Technical Regulatory Standards**
- 3 What is the base of the ETRS**
- 4 Composition of ETRS**
 - ✧ **DC Electrification System**
 - ✧ **DC Feeding System**
 - ✧ **Power Distribution System**
 - ✧ **Signaling system**
 - ✧ **Telecommunication System**
 - ✧ **Operation Control Center (OCC) System**

FUNDAMENTAL VIEW OF ETRS

1. This ETRS shall be applying to MRT .
2. Supposing IT (Information Technology), new technology and system will be installed into MRT .
3. High quality and high performance material are appeared one after another in future. Therefore, the performance standard of material shall be provided.

A high level of safety should be maintained in the railway system.

STRUCTURE OF ELECTRIC TECHNICAL REGULATORY STANDARDS



WHAT IS THE BASIS OF THIS ETRS

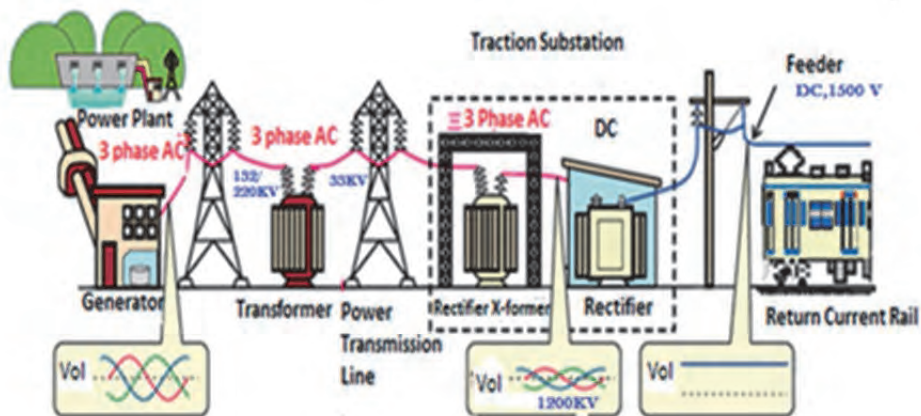
- ❖ This ETRS is based on ministerial Ordinance and interpretational Standards of Japan and Standards of the world.
- ❖ We created the ETRS suitable for MRT in Bangladesh.
- ❖ The ETRS is making it not to become the hindrance of introduction of IT and new technology and system on the railway in future.

COMPOSITION OF ETRS

Main Electric facilities are consist of as follows-

- ❖ Substation
- ❖ Contact lines - **Feeding System** (The overhead contact line voltage is DC **1,500V** as standard.)
 - **Catenary System** (MRT shall adopt Overhead Simple Catenary system.)
- ❖ Power distribution equipment
- ❖ Railway signaling
- ❖ Telecommunication Facilities
- ❖ Other Facilities- **Operation Control Center(OCC)**

DC Electrification System

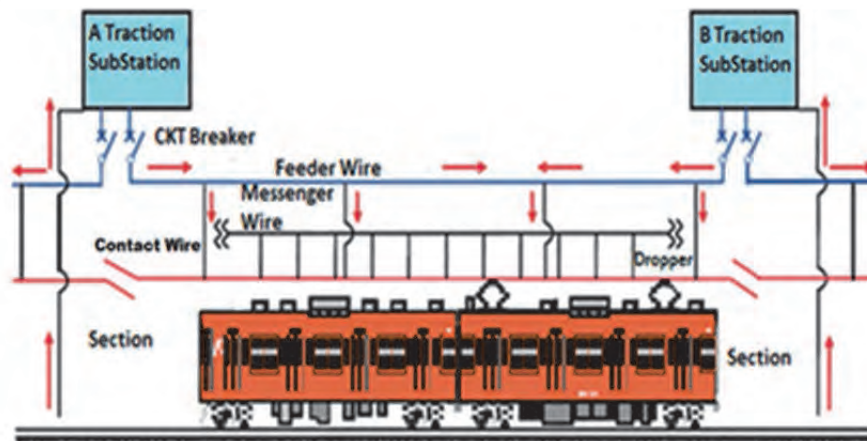


DC Substation

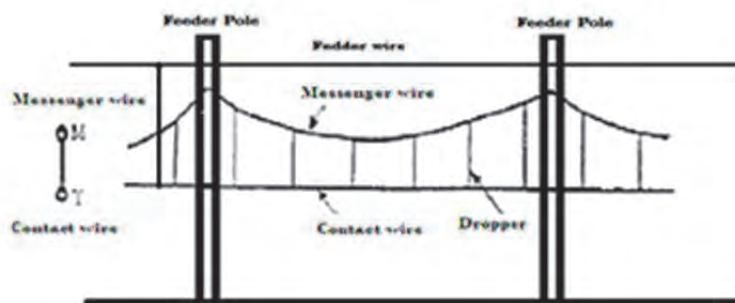


Substation shall be constructed in the manner to exclude unauthorized person.

DC Feeding System

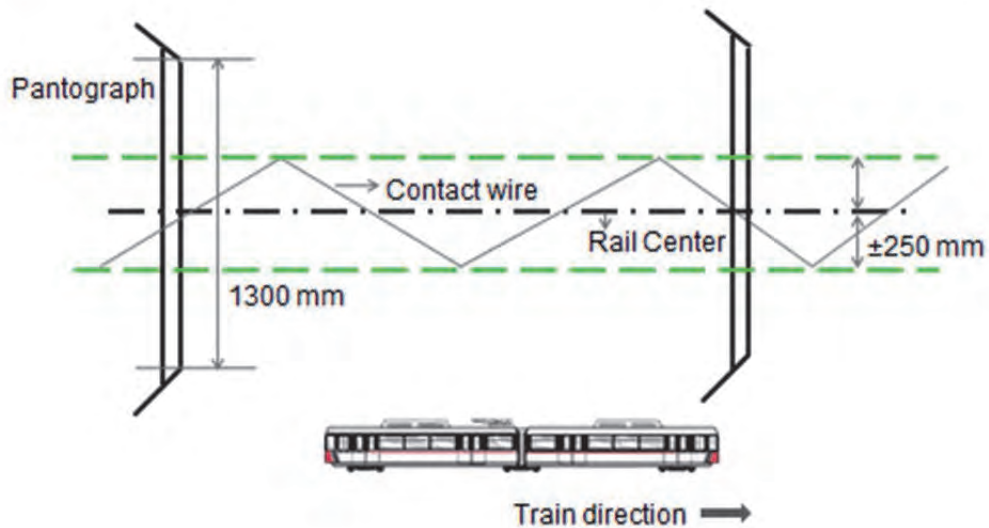


Simple Catenary System

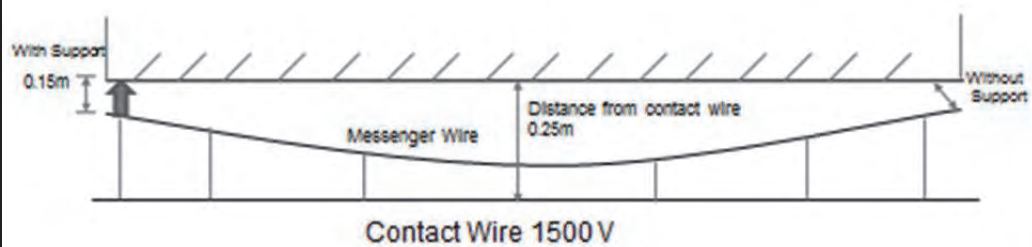


- ❖ The distance between Feeder poles shall not be more than 60m
Japanese standard is 50m
- ❖ The distance between droppers shall be 5m as standard

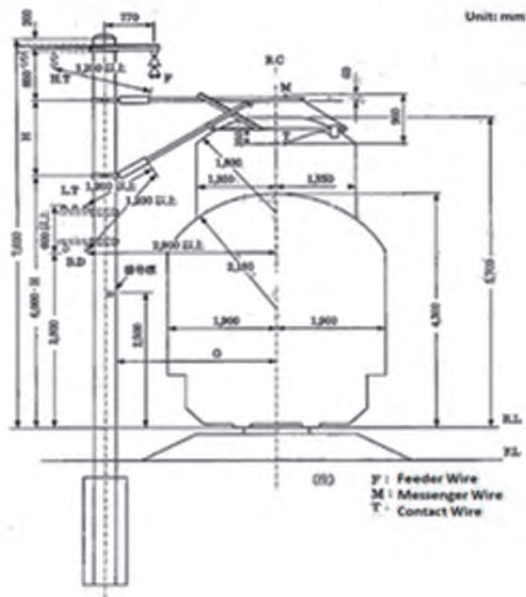
Deflection Range of Overhead Contact Line



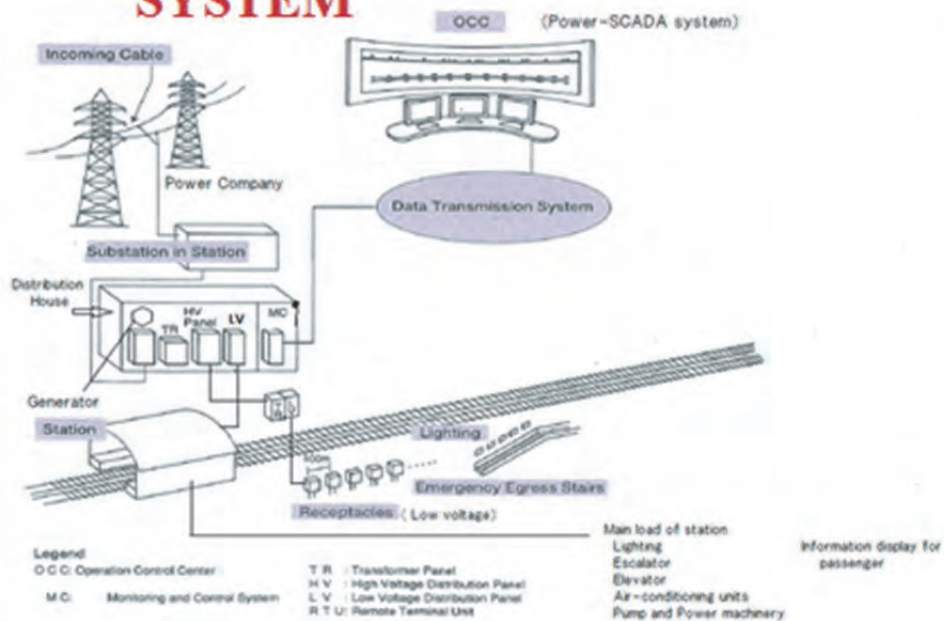
Distance Regulation between Contact wire and Structure



Cross-Section of Contact Wire System of DC (Open Section)



POWER DISTRIBUTION SYSTEM



CONSIDERING ISSUE FOR SIGNALING SYSTEM

- ❖ It is assumed that Cab signal block system and ATC(Automatic Train Control system) are introduced into MRT .
- ❖ It is also assumed that the signal system which take in new technology will be introduced into MRT .

SIGNALING DEVICE TO ENSURE BLOCK

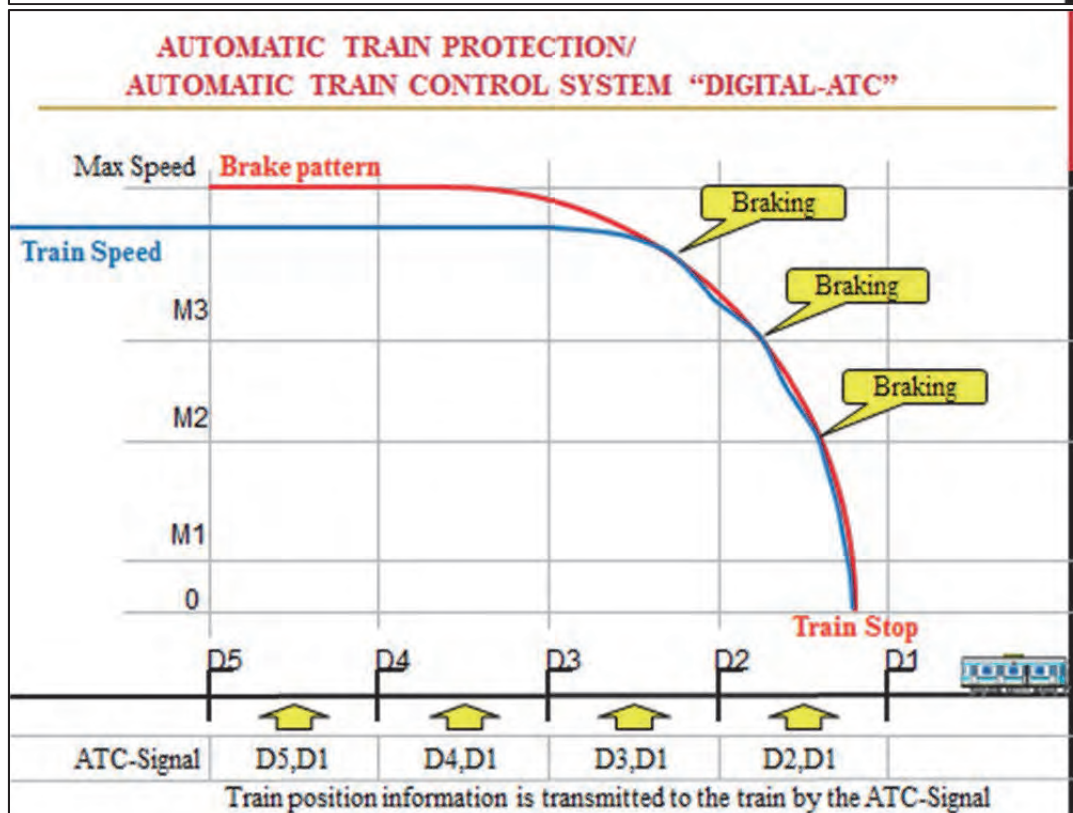
The Device to ensure the interval between trains shall be capable of retarding or stopping the speed of the relevant train, by continuously controlling it according to the intervals with other trains/cars and track conditions on the route.

AUTOMATIC TRAIN CONTROL SYSTEM(ATC)/ AUTOMATIC TRAIN PROTECTION SYSTEM

- In order to carry out high-density train operation, it is necessary to introduce an ATC system from a view point of safety

>>> Cab signal system

Operating speed is displayed in numbers .The brake is controlled automatically to stop the train safety if the train speed exceeds the operating speed.

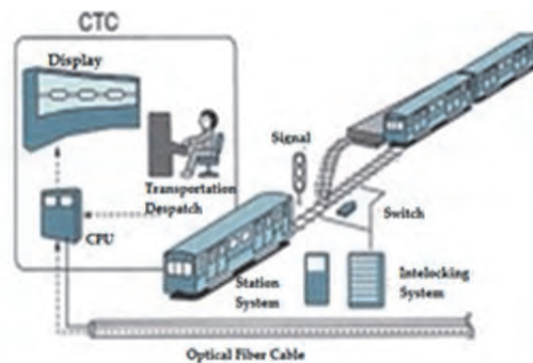


TELECOMMUNICATION FACILITIES

This provision stipulates that safety communication facilities to be located and shall have dedicated line between following systems-

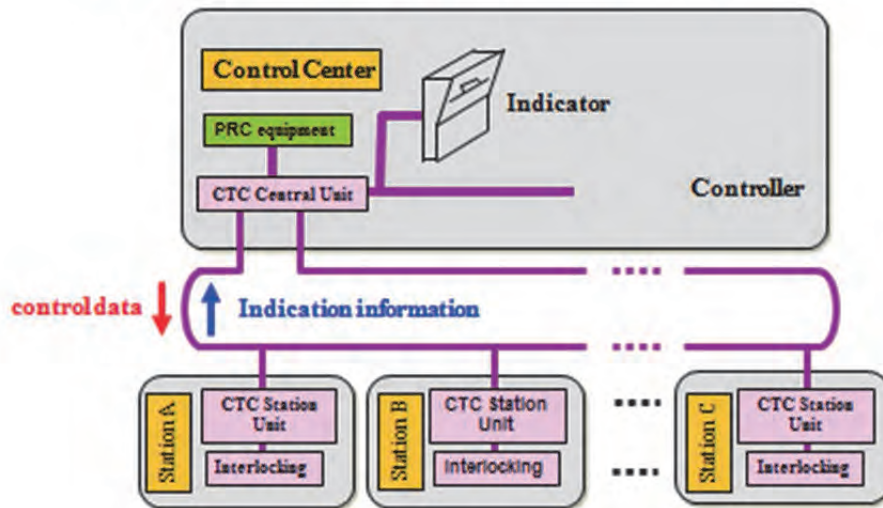
- **Operation Control Center and Train**
- **Operation Control Center and Depot**
- **Power Dispatch and Substation**
- **Operation Control Center and Stations**

OPERATION CONTROL CENTER (OCC)



Centralized traffic Control system

CENTRALIZED TRAFFIC CONTROL SYSTEM (CTC)



**THANK YOU
FOR YOUR
ATTENTION**

8. Technical standard for Civil Structures



Contents

- 1 General
- 2 Civil Structures
 - 3. 1 **Design requirement**
 - 3. 2 **Design life**
 - 3. 3 **Codes and standards**
 - 3. 4 **Seismic design**
 - 3. 5 **Design loading**
 - 3. 6 Bearings
 - 3. 7 **Environmental consideration**
 - 3. 8 Cable duct
 - 3. 9 Drainage arrangement
 - 3.10 **Precautions against flooding**
 - 3.11 Facilities to prevent disasters and other incident
 - 3.12 **Protection of below bridges**
 - 3.13 Evacuation Facilities
 - 3.14~18
maintenance

Design Requirement

【Object】

- for Safety Train Operation

【Design Requirements】

- Reliability for Safety
- Facility for Construction Works
- Facility for Maintenance
- Compatibility for Environment
- Design Durability Period

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Design Life

【Considerations】

- Use Period
- Environmental Condition

【Case Example】

〈Padma Bridge〉

- Structure : 100 years
 - Bearings : >40 years
 - Movement joints : >25 years
 - Corrosion protections : >20 years

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Codes / Standards 1

【for Railway Structures】

- no independent national design code for railway structure in Bangladesh exist
 - Internationally recognized codes

〈Padma Bridge〉

- American Association of States Highway and Transportation Officials (AASHTO) Specifications

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Codes / Standards 2

【for MRT Line 6】

shall be applied

- Internationally recognized codes

“AASHTO” USA

“British Standard (BS)” UK

“Indian Railway Code (IRC)” India

“Design Standards for Railway Structures” Japan
et cetera

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Seismic Design

【in Bangladesh exist】

“Road Design Standards” (RHD, LGED)



- Seismic Load ➤ followed with BNBC
BNBC : Bangladesh National Building Code
- Analysis ➤ followed with AASHTO

【for MRT Line 6】

- Seismic Load ➤ followed with BNBC
- Analysis ➤ Internationally
recognized codes

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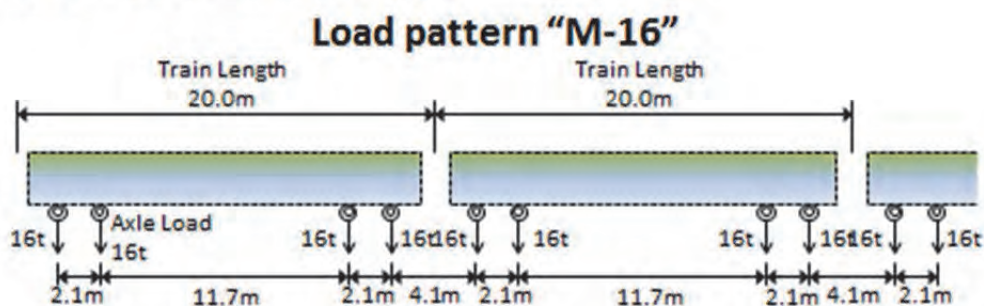
7

Design Loading

【Loads and Consequential Effects】

- Dead load, Live load, Seismic load
et cetera ➤ 16 items

【Train Loading】



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Environmental Consideration

Environmental Protection Requirements

➤ Noise, Sewage Discharge and others

【Bangladesh environmental regulations】

The Bangladesh Environment Conservation Act

The Environment Conservation Rules

Noise Insulating wall

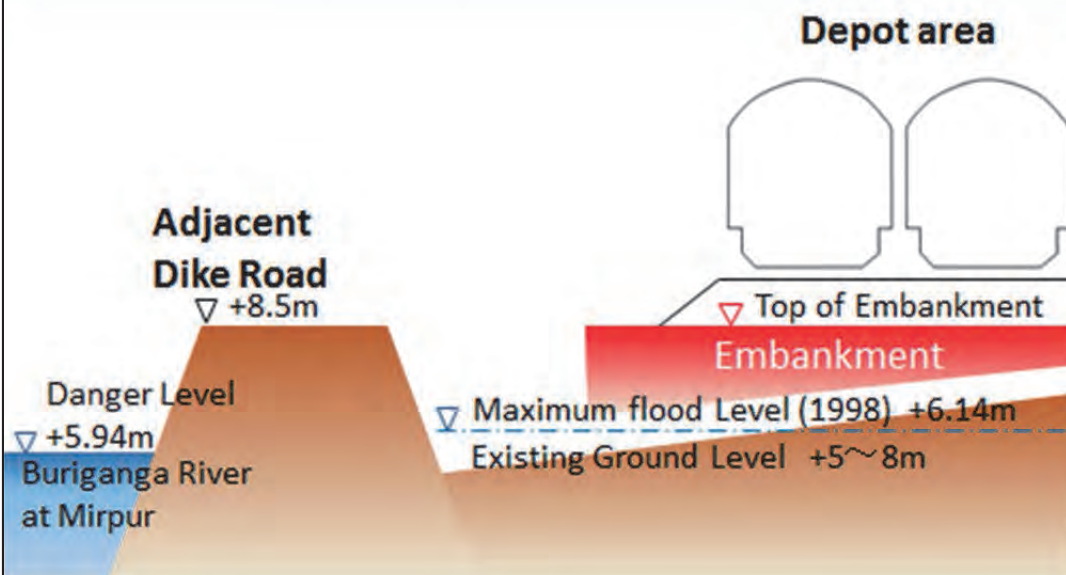


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Precautions against flooding



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Vertical Clearance (above road)

【in Bangladesh exist】

“Bridge Design Standards for RHD”

➤ minimum 5.1m



allowance for
headroom being lost

【for MRT Line 6】

minimum 5.5m

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9. Technical standards for Track and Station Facilities



Contents	
◆ Track	
1. Alignment	
(1) Gauge	
(2) Design Maximum Speed	
(3) Minimum Radius of Curvature	
(4) Length of Straight Line and Circular Curve	
(5) Cant (Super-elevation)	
(6) Gauge Widening (Slack)	
(7) Transition Curve	
(8) Gradient and Vertical Curve	
(9) Structure Gauge	
(10) Formation Width and Distance between Track Centers	
2. Structure of Track	
3. Safety Equipment	
4. Sign Post	
5. Maintenance	
◆ Stations	
Track Layout, Platform	
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(1) Gauge

Standard Gauge (1,435mm)

Gauge of Various Countries

Gauge			Coverage %	Name of Countries
mm	feet, inch	name		
1,676~1,668	5'6"	Broad Gauge	6	Argentina, India, Spain, Ceylon, Chile, Portugal, Pakistan
1,600	5'3"			Australia, Brazil, Ireland
1,524~1,520	5'0"		9	Russia, Finland, Panama, Mongolia
1,500	4'11"			Part of France
1,435	4'8 ¹ / ₂ "	Standard Gauge	62	North America, Most of the European Countries, Canada, China, Part of Japan, South Korea
1,372	4'6"			Part of Japan
1,067	3'6"	Narrow Gauge	8	Japan, Indonesia, Philippine, India, South Africa
1,050	3'5 ² / ₃ "			Colonies of France
1,000		Meter Gauge	9	Malay, Myanmar, Thailand, Vietnam, Laos, Cambodia, India, Part of France, Switzerland, Portugal, Brazil
950	3'3 ² / ₃ "			Italy (Sicily)
914	3'0"			Colombia, Cuba, Mexico, Peru
900				Germany, Portugal, Rumania
762	2'6"			India, Bulgaria, Chile, Cuba, Czechoslovakia, Hungary, Japan
610	2'0"			India, Australia, South Africa

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(2) Design Maximum Speed

Main tracks shall be able to attain
the design maximum train speed.

Design maximum train speed = 110km/h

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(3) Minimum Radius of Curvature

Result of the examined maximum cant and cant deficiency

$$R = \frac{GV^2}{g \times C}$$

R : Radius of Curvature (m)

G : Gauge (m) 1,435mm = 1.435m

V : Train speed (m/s) 80% of Design maximum speed

110km/h × 80% = 88km/h = 24.4m/s

g : Gravitational Acceleration (9.8m/s²)

C : Cm + Cd

Cm : Actual Cant (m) 160mm = 0.16m

Cd : Cant Deficiency (m) 100mm = 0.1m

Minimum Radius of Curvature

$$R = \frac{1.435 \times 24.4^2}{9.8(0.16 + 0.1)} = 335 \approx \underline{400m}$$

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(3.1) Radius of Curvature along the Platform

$$R \geq 400m$$

$$R = \frac{L^2}{8d}$$

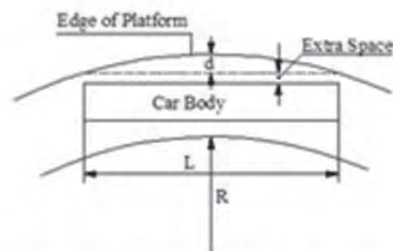
R : Curve Radius (m)

L : Length of Car (m) 20m

d : Distance between platform and Car (m)

d = 20 - 5 (Space) = 15cm
= 0.15m

$$R = \frac{20^2}{8 \times 0.15} = 333 \approx \underline{400m}$$



Length of Car and Curve Radius (d = 15cm)

L (m)	d (m)	R (m)	L (m)	d (m)	R (m)
12	0.15	120	19	0.15	301
13	0.15	141	20	0.15	333
14	0.15	163	21	0.15	368
15	0.15	188	22	0.15	403
16	0.15	213	23	0.15	441
17	0.15	241	24	0.15	480
18	0.15	270	25	0.15	521

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(4) Length of Straight Line and Circular Curve

Length of Straight Line between Curves More than Maximum Rolling Stock Length

Length of Circular Curve More than Maximum Rolling Stock Length

Because, the length should be steadied
the vibration and swing of rolling stock

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(5) Cant (Super-elevation)

- Equilibrium Cant

$$C = \frac{GV^2}{127R} = \frac{1,435V^2}{127R} = 11.3 \frac{V^2}{R}$$

C : Cant Value (mm)

G : Gauge (mm)

V : Train Speed (km/h)

R : Curve Radius (m)

- Maximum Actual Cant Value

$$C_{m_{\max}} = \frac{G^2}{6H} = \frac{1,435^2}{6 \times 1,700} = 201\text{mm} \times 80\% = \underline{160\text{mm}}$$

- Maximum Cant Deficiency Value

$$C_{d_{\max}} = \frac{G^2}{8H} = \frac{1,435^2}{6 \times 1,700} = 151\text{mm} \times 70\% = \underline{100\text{mm}}$$

G : Gauge (mm)

H : Gravity of Rolling Stock (mm)

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(6) Gauge Widening (Slack)

$$S_{\max} = 1000 \left(\frac{B^2}{2R} \right) - \eta$$

$S_{\max}$: Maximum Slacking Value (mm)

B : Wheel Base (m)

R : Curve Radius (m)

η : Value of Movable Wheel Space (mm)

However, maximum slack value should be 25mm.

Example :

$B = 2.1\text{m}$

$R = 100 \sim 300\text{m}$

$\eta = 7\text{mm}$

Therefore it is not necessary to
slack curve radius 300m or more.

R (m)	B (m)	η (mm)	S (mm)
100	2.1	7	15
120	2.1	7	11
140	2.1	7	9
160	2.1	7	7
180	2.1	7	5
200	2.1	7	4
220	2.1	7	3
240	2.1	7	2
260	2.1	7	1
280	2.1	7	1
300	2.1	7	0

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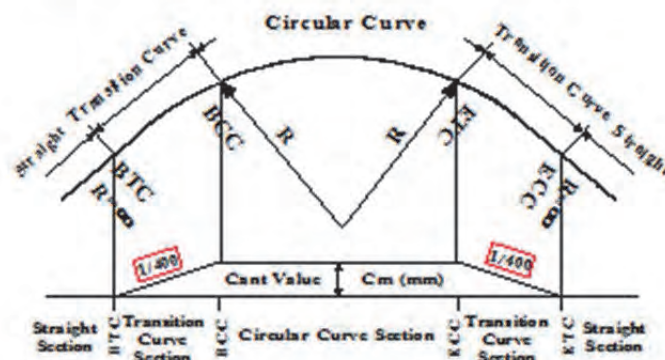
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(7) Transition Curve

$$L = 0.4 \text{ Cm}$$

L : Transition Curve Length (m)

Cm : Actual Cant (mm)



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(8) Gradient and Vertical Curve

Gradient

Maximum Gradient - - - less than 35/1,000

Rolling stock stop Area - - less than 5/1,000

Vertical Curve

Curve Radius - - - more than 2,000m

(When the horizontal curve radius is 600m or less - - - more than 3,000m)

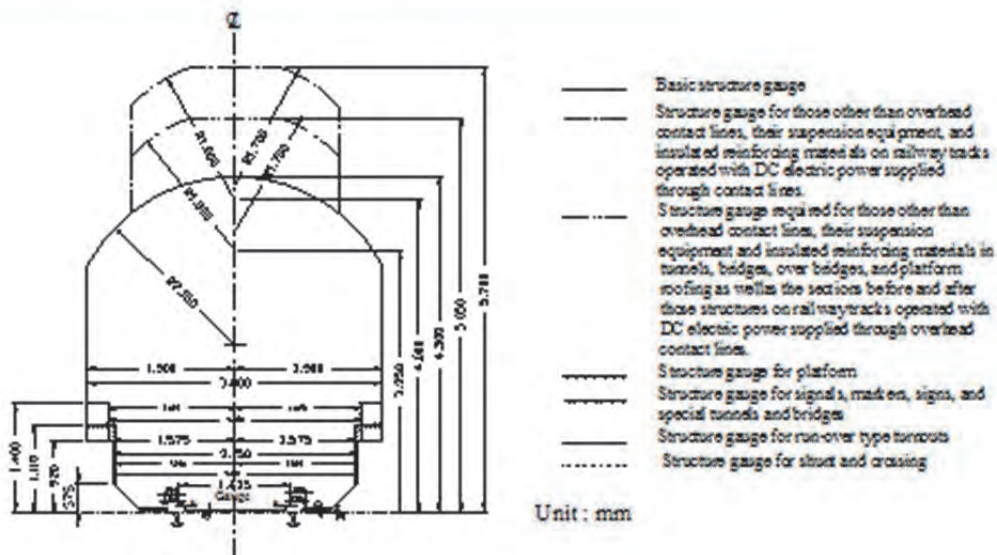
Conflict between vertical curves and transition curves should be avoided.

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(9) Structure Gauge

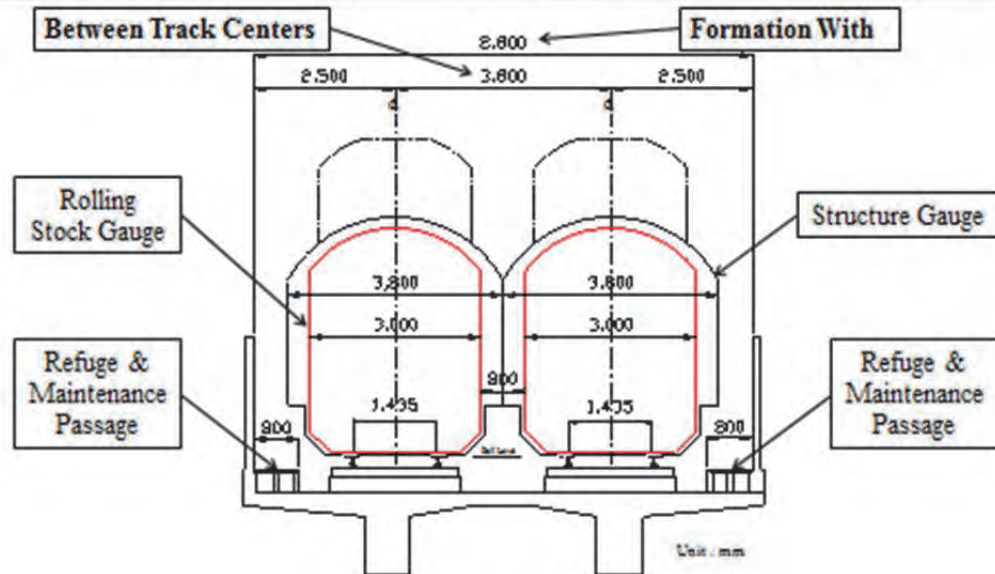


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(10) Formation Width and Distance between Track Centers



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2. Structure of Track

Track

- Comply with the structure of the Rolling Stock
- Guide the Rolling Stock in a predetermined direction
- Withstand the Rolling Stock Loads
- No fear of deformation to the Gauge, Cross-level, Longitudinal level and Horizontal alignment



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3. Safety Equipment (1)

- Guardrail --- Prevent Derailment
- Prevention of Rolling Stock Overrun
--- Car Stop Device
- Car stop device must be installed at end of track.



Car Stop Device

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Guardrail



Car Stop Device

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3. Safety Equipment (2)

- No Trespassing to Railway and Protection of Railway
--- Fence, Keep out Indicator
- Evacuation Facilities --- Secure Passage on Formation
- Level Crossing

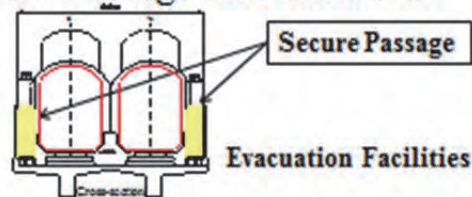


Fence



Indicator

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Level Crossing

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4. Sign Post

**Required to maintain tracks or
to assure the safe operation of trains**



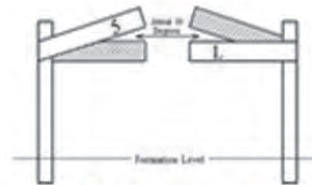
Clearance post



Kilometer post



Curve post



Gradient post

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5. Maintenance of the Railway Facilities

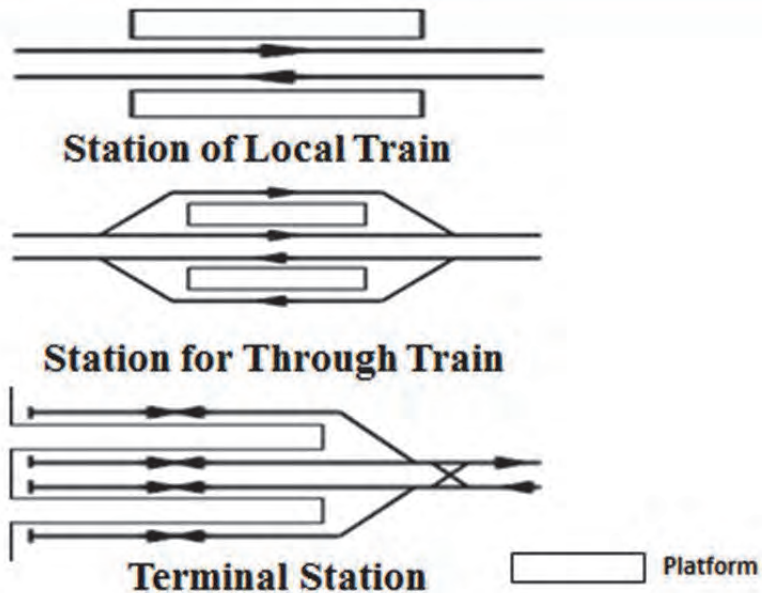
- Should be maintained in a state capable of train and to drive safely at a predetermined speed.
- Inspection and test operation for newly-built, driving accident occurs and suffered disaster facilities
- Track patrol and watched for Mainline
- Regular Inspection of the Facilities
 - Interval not exceeding 1 year

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▪ Track Layout in Stations



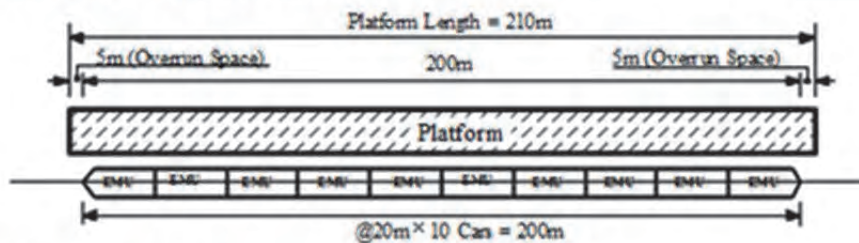
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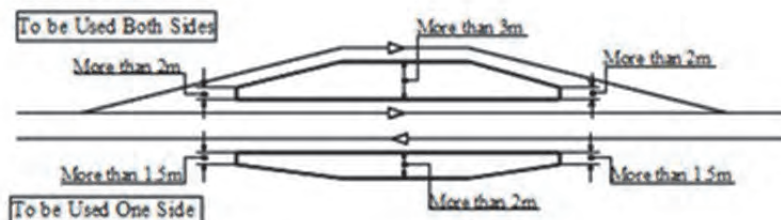
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▪ Platform

Effective Length of the Platform



Width of the Platform



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Thank you for your kind attention.

11. Technical standards for Architecture

The People's Republic of Bangladesh
Preparation of Rules and Regulations under Urban Mass Rapid Transit Act Project

Technical Standards for Architecture

Japan International Cooperation Agency (JICA)
Japan International Consultants for Transportation Co., Ltd.
Oriental Consultants Co., Ltd.
Metro Development Co., Ltd.

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Basic idea

- Withstanding the anticipated load
- No impairing the safe car operation and safe utilization by passengers

1. Buildings

- Station Office, Station Rooms(signaling, track point, communication, etc), Commercial Shops, Warehouses, etc
- Overbridge
- Stairs
- Platform sheds

Stairs (Tokyo Metro)



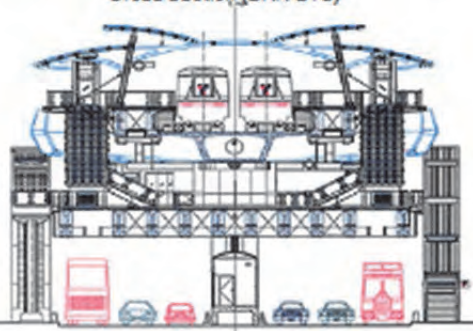
Platform shed (BKK BTS)



Commercial Shops (Tokyo Metro)

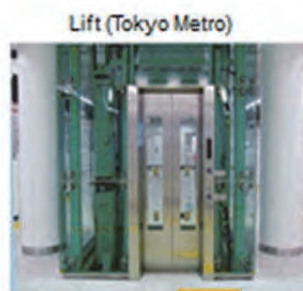


Cross section (BKK BTS)



2. Station Facilities

- Platform
- Passage
- Concourse
- Lift
- Escalator
- Ticket gate
- Lavatory
- Lighting fixtures
- Office
- Information instructions
- Platform screen doors, etc



Platform screen doors (Tokyo Metro)



3. Platform Facilities

Platform requires as follows,

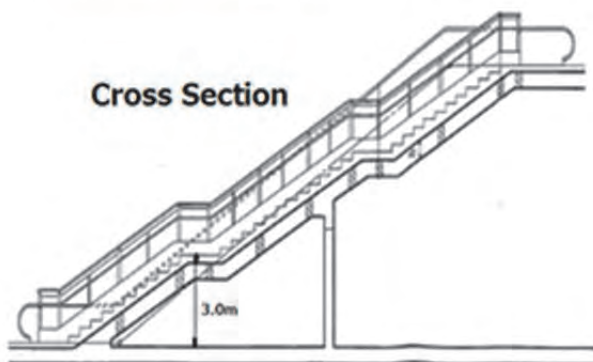
- Surface of platform and rolling stock floor : as Flat as possible
- Material on the surface of platform : No slipping
- Warning display and audible facilities for approach of a train



4. Access for Passengers

Necessary walkways and stairways for passengers at stations as follows,

- Width of accesses and stairs : at least 1.5 m
- One landing every 3 m height for stairs
- Handrails for stairs



Escalator & Stairs (Tokyo Metro)



Escalator & Stairs (BKK ARL)



5. Barrier – Free Facilities

Aim : To promote aged and disabled persons make easily accessible mobility

- Minimum 1 route from ST entrance to Platform : Lifts or Ramps
- Warning blocks : Platform / Beginning of Steps, Slopes & Escalators
- Guidance blocks : ST entrance ~ Platform
- Space for turn of wheelchair, Audio guidance : Lift

Ramp & Guidance blocks (Tokyo Metro)



Braille Map (Tokyo Metro)



Ticket machine (Tokyo Metro)



6. Station in a Building

Design Standards

- Building : Bangladesh National building code
- Station Facilities : Railway Structures and Commentary or others

Ginza Line (Tokyo Metro) & Tokyu Department



Shibuya Station Platform of Ginza Line (Tokyo Metro)



11. Technical standards for Underground Structures and Facilities



1. Introduction for Underground Railway Structures

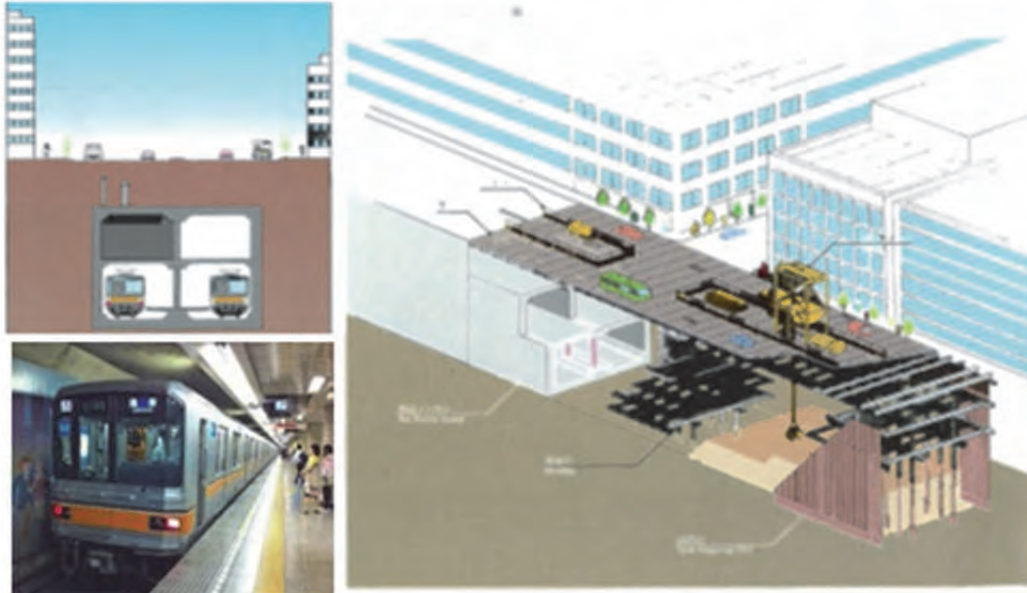
Underground Station



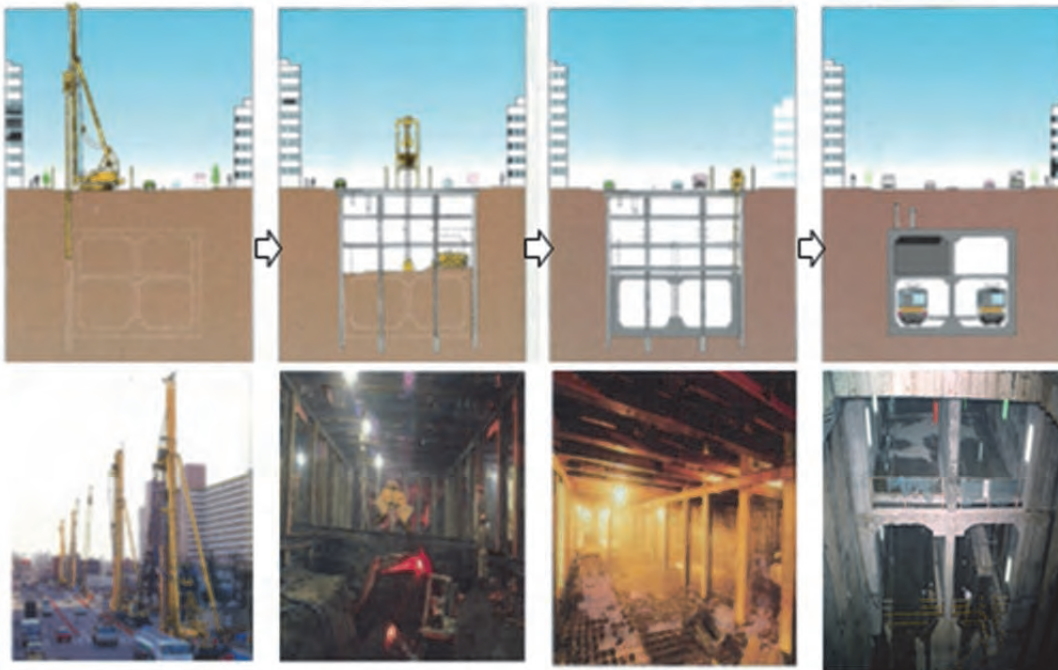
Shield Tunnel between Stations



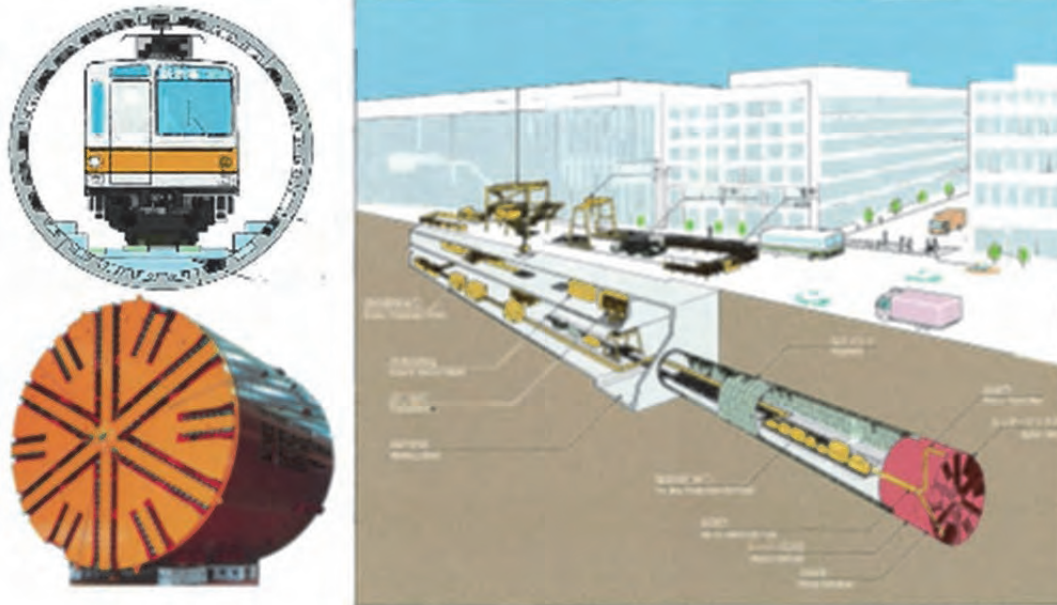
2. Underground Station (Cut-cover method)



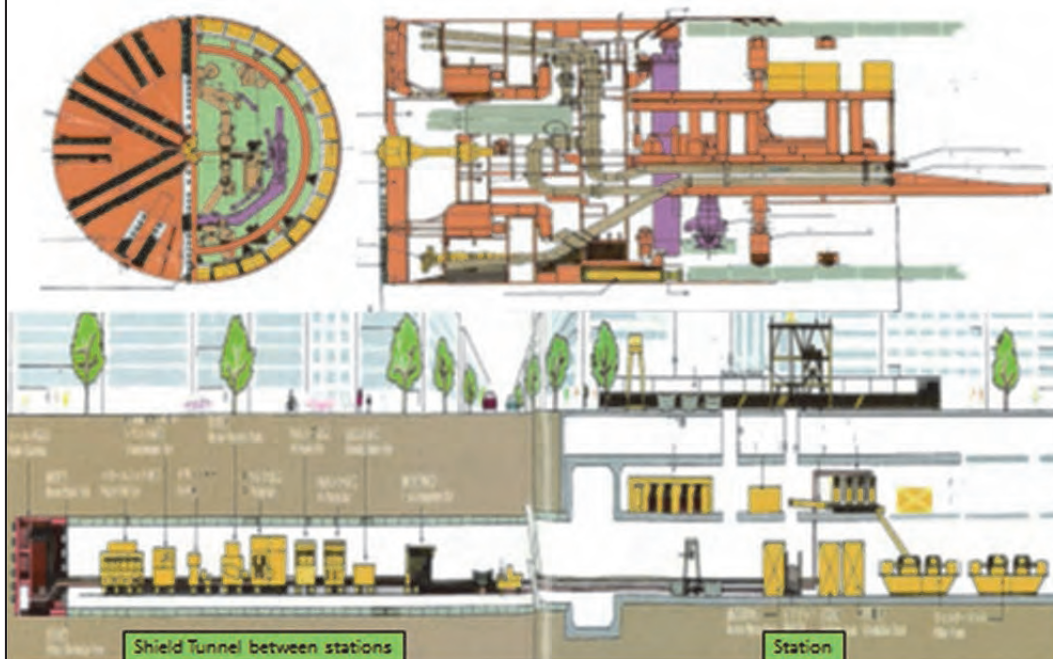
Cut-cover construction method for Underground Station



3. Underground Shield Tunnel (TBM method)



TBM : Tunnel Boring Machine



4. Firefighting Equipment

Fire Extinguisher



Indoor fire hydrant



Sprinkler



Sprinkler pump



Water spray with connected water pipes



Fireproofing materials
Fire prevention doors

5. Smoke exhaust equipment (including Ventilation)

Ventilation shaft



Smoke exhaust machine



Hanging down Shutter



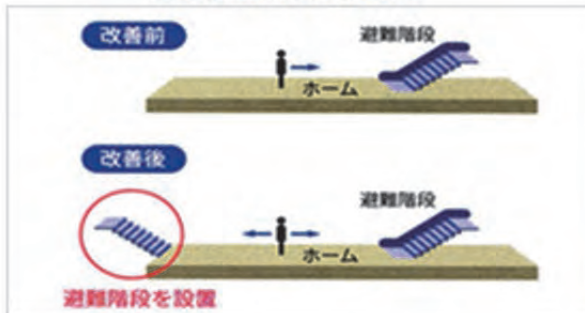
First step down



Second step down

6. Evacuation Equipment

More than 2 distinct routes



Generator



Instruction Display



Lighting fixtures

7. Control Room for Disaster Prevention

Control room for disaster prevention
at station



Control room for disaster prevention
at operation control building



8. Alarm & Monitoring Equipment

Smoke sensor



Heat sensor



Security camera



Emergency train stop button



9. Flooding Prevention Equipment

