

## **CHAPTER 3**

# **RAILWAY TECHNICAL STANDARD**

## **CHAPTER 3**

### **RAILWAY TECHNICAL STANDARD**

#### **3.1 Purposes of Establishing Railway Technical Standards**

Specific rules and standards are necessary for railways to carry out safe, high-speed, punctual, and efficient train operation. Therefore, it is essential for the national government to clearly indicate standards on safety conditions and so forth so that railways can satisfy a specific level of social requirements by meeting the standards.

The clarification of the technical standards by the national government will enhance the transparency of national administration. Furthermore, various railway operators with different technological power, past achievements and so forth will become able to observe the standards and secure safety conditions and so forth higher than a specific level.

The main purposes of establishing the railway technical standards are as follow.

(1) Ensuring of safety

One of the most important missions of railway enterprises is ensuring of safety. To secure railway safety, adequate education and training of personnel is necessary together with proper handling of train operation. Furthermore, it is also essential to ensure and maintain safe structure of facilities and rolling stock. In the railway technical standards, therefore, the items concerning structure of facilities and rolling stock, train operation handling and so forth are stipulated for ensuring safety.

(2) Maintaining of railway network and ensuring of railway transport characteristics

To establish a railway network which enables through operation in the entire country or within large cities and to ensure advantageous railway characteristics such as large-volume, stable, and high-speed transport, it is necessary to maintain the conditions of facilities and rolling stock at a specific level. In the railway technical standards, therefore, items for ensuring the advantageous railway characteristics (curve radius, cant, steepest gradient, construction gauge, etc.) are stipulated.

(3) Ensuring of convenience for users

The conditions of facilities and rolling stock should be maintained at a specified level, in order to ensure comfortable and convenient railway utilization by customers and also to

enable easy use of railways by movement-constrained passengers. In the railway technical standards, therefore, items concerning station facilities, transfer facilities, passenger cabin structure and so forth are stipulated for ensuring convenience for railway users.

(4) Environmental countermeasures

Although the railway is an environment-friendly means of transport, noise countermeasures for residents along its routes are necessary. In the railway technical standards, therefore, such items as the adoption of track structure and rolling stock structure for noise reduction are stipulated.

(5) Reduction of production cost

Regarding the railway facilities and rolling stock, it is effective to unify their production methods, test methods, dimensions, structure and so forth, in order to realize their quality improvement, production rationalization, production cost reduction and so forth. However, since these items should not be stipulated as compulsory standards by the national government, it is advisable for a federation of the enterprises concerned or a non-government organization to stipulate them as voluntary standards.

## **3.2 Kinds of Railway Technical Standards**

Railway technical standards are broadly classified into: compulsory standards which stipulate safety and so forth; design standards which complement the compulsory standards; and optional standards which aim at the enhancement of production efficiency, elimination of trade barriers, and so forth. The details of these standards are as follows.

### **3.2.1 Compulsory Standards**

The governments and national railways of individual countries have established compulsory technical standards on railway construction and operation, for such purposes as ensuring of railway safety and maintaining of railway networks. The titles of some of these standards centering on safety and so forth established in the countries of the world are as follows.

Japan: Regulations on Railway Structure

Germany: Regulations on Railway Construction and Operation

- France: Official Administrative Regulations on Safety and Commercial Services on Nationwide and Regional Railway Lines
- U.K.: Railway Safety Principles and Guidance
- U.S.A.: FRA (Federal Railroad Administration) Regulations (State safety participation regulations, etc.)
- EU: EU Directives  
(COUNCIL DIRECTIVE 96/48/EC on the interoperability of the trans-European high speed rail system, etc.)

The framework of the compulsory railway technical standards in Japan is as follows.

In Japan, based on the framework of railway technical standards, concrete items and contents of technical standards have been stipulated.

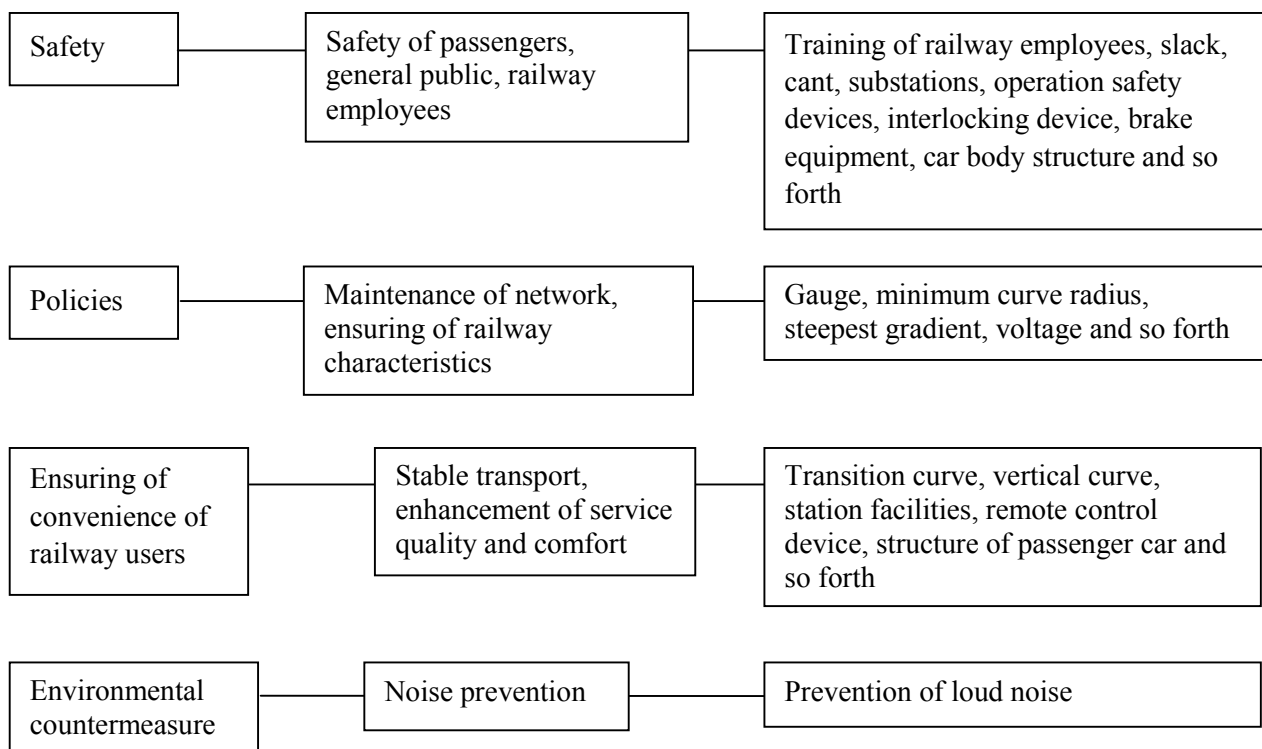


Fig. 3.2.1 Framework of Compulsory Railway Technical Standards in Japan

### **3.2.2 Design Standards Which Complement the Compulsory Standards**

To formulate the contents of the compulsory technical standards which stipulate such matters as safety, it is necessary to establish rules, from the stage of designing, concerning the strength of materials of facilities and rolling stock, safety level of structures, and so forth. If the designing and construction are carried out on the basis of these rules (design standards), uniformed and reasonable structures and so forth throughout entire lines can be completed. Furthermore, the structures and so forth constructed on the basis of the prescribed design standards can be regarded as ones which satisfy the requirements on safety stipulated in the compulsory standards.

In Japan, there are the following design standards for railway structures and so forth.

Design standards for railway structures and so forth

- Concrete structures
- Steel and composite structures
- Earth structures
- Basic structures and soil pressure-resisting structures
- Shield tunnel
- Steel-concrete composite structures
- Aseismatic design
- Earth structures for maintenance-free tracks

### **3.2.3 Voluntary Standards**

For industrial products, there are various international, regional, national, and group standards. The main purposes of these standards are to improve the quality of products, enhance production efficiency, rationalize production, reduce production costs, and eliminate trade barriers, by the unification of production methods, work methods, test methods, dimensions, structure, design methods, and so forth.

There are similar standards for railway sectors as well, and each country is making efforts to adjust its regional, national and group standards to the national standards. The voluntary standards for railway sectors are as follows.

## (1) International Standards

### 1) ISO (International Organization for Standardization)

This is a nongovernmental organization consisting of representative organizations for standardization in individual countries, and has established international standards on all industrial sectors excluding electrical engineering sectors.

As for the railway sectors, there are the following standards in the ISO Standards 45 “Railway Engineering”.

45.020 Railway engineering in general

45.040 Materials and components for railway engineering

45.060 Railway rolling stock

45.080 Rails and railway components

45.120 Equipment for railway construction and maintenance

### 2) IEC (International Electrotechnical Commission)

IEC has established international standards on electricity and electrical engineering sectors. As for the railway sectors, relevant standards are deliberated in the Technical Committee 9 (Electric railway equipment). There are the following standards related to railways.

IEC 60077 Railway applications

IEC 60349 Electric traction

IEC 60494 Rules for pantographs of electric rolling stock

IEC 60850 Supply voltages of traction systems

IEC 61375 Electric railway equipment

## (2) Regional Standards

The European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization (CENELEC) have jointly established unified standards “EN (EURO NORM)” for European countries. Some standards on railway sectors are included in the EN.

## (3) National Standards

Individual countries have respective organizations for standardization, in order to promote standardization of products and so forth in various industrial sectors. These

organizations have established national standards applicable to their countries. The national standards in main countries are as follows.

U.S.A.	ANSI
U.K.	BS
Germany	DIN
France	NF
Japan	JIS
Philippines	PS

Standards on railway sectors are included in the national standards in North America, Europe, Japan and so forth.

In Japan, the following items are stipulated in the Railway Engineering section of JIS (Japanese Industrial Standards). (see Appendix 5.3)

Track General	32 items
Electric Car Line and Substation	8 items
Signaling and Safety Appliance	44 items
Rolling Stock General	64 items
Motive Power	32 items
Power Carriage and Wagons	7 items
Industrial Vehicles	7 items

By the national standards PS of the Philippines, 57 industrial sectors are covered. However, standards on railway sectors have not yet been established. It is advisable, therefore, to introduce national standards on railway sectors to the Philippines as well.

#### (4) Group Standards

UIC (International Union of Railways)

UIC was established in 1922 as a union centering on railway enterprises in Europe. The original purpose of UIC was to standardize the railway facilities and train operation systems within Europe, so as to enable smooth international transportation. At present, 134 railway enterprises in the world (including enterprises of non-European countries) constitute UIC, and are conducting studies for effective and efficient railway operation.

UIC has established, as UIC CODE, its business and technical standards to be utilized by member railway enterprises. The entire framework of UIC CODE is as follows

- 100 Passenger and Baggage Traffic
- 200 Freight Traffic
- 300 Finance, Accountancy, Costs, Statistics
- 400 Operating (including RIV and RIC Regulations)
- 500 Transport Stock
- 600 Traction
- 700 Way and Works
- 800 Technical Specifications
- 900 Information Technology, Miscellaneous

### **3.3 Drawing Up of Railway Technical Standards in Metro Manila**

As the railways in Metro Manila, PNR lines and LRT Lines 1 and 3 are in operation at present. Furthermore, LRT Lines 2, 4 and 6 are under construction or in the stage of planning, and projects on North Rail and MCX are also in progress. In drawing up the Railway Technical Standards (draft) of this time, compulsory technical standards to be applied to Mass Rapid Transit (MRT) and Light Rail Transit (LRT) systems in Metro Manila have been studied.

In the Japanese railway technical standards, specifications are regulated by concretely stipulating numerical values concerning railway standards, such as track gauge, construction gauge, and standard voltage. However, numerical value regulations can become a factor which hampers development and introduction of new technologies, and also can nullify peculiarities of individual railway organizations or routes, eventually leading to the increase in railway operation costs. Furthermore, there is a possibility that technologies of a specific country (or countries) will become advantageous.

Therefore, in drafting the Technical Standards for the Philippines, the so-called “performance regulations” stipulating performance essential for railways have been adopted, in order to expand the scope of technological freedom of respective railways. As for the contents of the Technical Standards, detailed analysis has been made by conducting surveys on the actual situation of railway operation and construction in the Philippines, and through consultations with the Philippine counterparts as well as through the workshop on technical standards which were held five times. As for the specific difference from the Japanese standards, based on the actual situation of transfer facilities of railways in the Philippines, the two items



(smooth transfers between railway lines; and smooth transfers between railway and road-based and other modes of transport) have been added to Chapter 4 concerning station facilities. At the same time, stipulations prohibiting new crossings on the ground level have been excluded, because new construction of level crossings will be inevitable in the future. Furthermore, standards for high speed railways such as those for the Japanese Shinkansen have been excluded. In introducing the performance standards, these ways of thinking would satisfy the demand of the Philippine side that the new standards should be based not only on Japanese railway technologies but also on technologies in the world.

However, since it might be difficult to make technical judgment according to the performance standards alone, such items as “the principles and interpretation of the technical standards” and “the concrete numerical values for reference” are described in Appendix as the interpretation standards (explanation).

The Technical Standards in the main text have been drawn up, based on the assumption that official standards should be established and put in forth by the Government. The interpretation standards (explanation) have been prepared for the reference of individual railway organizations in making judgment for establishing their technical by-standards.

The composition of the Railway Technical Standards is as follows.

### **3.3.1 Railway Technical Standards for Metro Manila**

#### I. Purpose of Technical Standards

Railway traffic must be supported by an integrated system of which the priority concern is to ensure passenger safety while also aiming at ensuring reliable transportation, caring for the disabled as well as the environment and fulfilling its characteristic functions. For this purpose, Technical Standards which are applicable to railway services in general and the currently operating PNR, LRT1 and LRT3 lines as well as planned lines to be opened in the future in particular are established here.

#### II. Main Contents of Railway Technical Standards

Outline of the Contents to be stipulated for Technical Standards is as follows.

##### 1. General

- This Chapter stipulates for Definition of Terminology and Preparation of Implementation Standards

- It is stipulated that, since the technical standards established by the Government are the minimum performance standards necessary for ensuring safety and so forth, railway operators should decide, based on these standards, their own standards on the structure and maintenance of their specific railway facilities and rolling stock as well as on the handling of train operation.  
Railway operators are also obliged to submit such standards to the Government.
2. Qualification, Education and Training of Railway Employees
    - Railway operators are obliged to carry out training of their employees and to enforce train operation by employees with qualifications.
  3. Structure and Maintenance of Facilities and Rolling Stock
    - This Provisions describe Functions required for facilities and Rolling Stock in light of Ensuring of Safety, Ensuring of Planned Transportation, Consideration for Disabled Persons and Consideration for Environmental preservation.
    - (1) Tracks
      - This Chapter stipulates for Gauge and Slack, Curve Radius, Cant, Transition Curve, Grade, Vertical Curve, Construction Gauge, Width of Formation Level, Center-to-Center Distance of Adjacent Tracks, Track and Civil Engineering Structures, Building Construction, Disasters Prevention Devices, Safety Devices and Evacuation Devices.
    - (2) Station Facilities
      - This Chapter stipulates for Specifications for Station Facilities, Smooth Transfers between Railway Lines, and Smooth Transfers between Railway and Other Modes of Transport.
    - (3) Power Facilities
      - This Chapter stipulates for Contact Line, Substations and Lighting Facilities.
    - (4) Operation Safety Devices
      - This Chapter stipulates for Installation of Operation Safety Devices, Devices to Ensure Safety between Trains, Indicating Device of Railway Signals, Interlocking Device, Remote Control Device, Train Detection Device, Railway Crossing Safety Facilities, Communication system for Safety Purposes, and Installation of Communication Cables.

(5) Rolling Stock

- This Chapter stipulates for Size Limits of Rolling Stock, Constrains with respect to Tracks and Structures, Stability of Rolling Stock, Running Gear, Motive Power Apparatuses, Brake Equipment, Structure of Car Body and so forth, Coupling Device, Structure of Rolling Stock for Transport of Special Cargo, Equipment of Driver Section, Automatic Door Control Device, Air Compressor and Accessories, On-Board Devices, Marking on Rolling stock, Fire Prevention and Control Measures for Rolling Stock, and Continued Functioning of Some devices during Power Interruption.

(6) Maintenance of Facilities and Rolling Stock

- This Chapter stipulates for Maintenance of Railway Facilities and Rolling Stock, Inspection and Trial Operation of New Facilities and Rolling Stock, Patrolling for Natural Disaster, and Regular Inspection of Railway Facilities and Rolling Stock.

4. Train Operation

- In order to secure safety, train operation handling are stipulated. Specifically, such items as Boundary of station, Train Composition, Emergency Braking Distance of Trains, Train Operation, Shunting of Rolling Stock, Operation Speed, Safety between Trains, Railway Signals and Operation, Train Protection, Track Closure, and Response to Natural Disaster are stipulated.

5. Report on Railway Accidents

- In order to serve for the identification of the actual situations of railway accidents and incidents as well as for the prevention of accident recurrence, the contents of the report which railway operators should make to the Government on accidents are stipulated.

Specifically, such items as the scope application, terminology, railway operation accidents, accidents for which railways are responsible, and reporting of railway operation accidents are stipulated.

6. Environment

- This Chapter stipulates that the measures for alleviating noise pollution due to train operation should be taken.

### III. Railway Technical Standards

#### Chapter 1 General

##### 1.1 Definition of Terminology

The main technical terms are defined below.

- Main line : track constantly used for train operation
- Siding : track other than a main line
- Track gauge : shortest distance between inner side surfaces of two rail heads of a track measured
- Station : place used by passengers to get in and out of trains or for the loading and unloading of cargo
- Signalling yard : place mainly used for mutual passing or waiting for a train
- Shunting yard : place mainly used for the shunting of rolling stock or the composition of a train
- Station, etc. : inclusive term for a station, signalling yard and shunting yard
- Depot : place mainly used to accommodate and maintain rolling stock
- Train : a group of rolling stock composed for operation on track outside a station, etc.
- Rolling stock : locomotives, passenger cars, freight cars and special-purpose cars (rolling stock with special structure and equipment, including a track tester and accident relief car, etc.) used for railway business
- Train, etc. : trains and rolling stock
- Operation safety devices: signalling safety devices, level crossing safety devices and safety communication devices
- Signalling safety devices: devices to display railway signals and devices to automatically reduce the train speed or stop a train, etc. in accordance with the signal indication in order to ensure the safe operation of a train, etc.
- Signals : objects indicating the operating conditions of a train, etc. to railway staff
- Signs : physical movement and so forth to mutually indicate intentions between railway staff
- Markers : objects indicating the position, direction and conditions, etc. of specific items to railway staff
- Railway signals : signals, signs and markers
- Disabled persons: persons who find it difficult to travel by rail without help due to a physical reason(s)

## 1.2 Preparation of Implementation Standards

1.2.1 A railway proponent shall prepare “Implementation Standards” based on the Technical Standards prior to the construction of a railway line and shall submit them to the Department of Transport and Telecommunications.

1.2.2 The DOTC shall be entitled to issue an order to alter the “Implementation Standards”.

## Chapter 2 Qualification, Education and Training of Railway Employees

### 2.1 Education and Training of Railway Employees

A railway operator shall provide the necessary education and training for those railway employees directly related to train operation.

### 2.2 Qualification of Railway Employees (Obtaining of Certificate)

Motive power units (electric rolling stock; internal combustion rolling stock) shall only be operated by those who have obtained the certificate for train drivers published by DOTC or official agencies.

## Chapter 3 Tracks

### 3.1 Gauge and Slack

The gauge shall be decided to ensure the smooth running of rolling stock, taking the structure of vehicles and others into consideration. At curves, appropriate slack shall be provided in accordance with the curve passing performance of rolling stock.

### 3.2 Curve Radius

An appropriate curve radius shall be adopted based on the standard minimum curve radius to ensure the smooth running of rolling stock, taking the curve passing performance and running speed of vehicles and the cant, etc. into consideration. In the case of a curve along a platform, its radius shall be as large as possible to ensure the smooth boarding/unboarding and safety of passengers.

### 3.3 Cant

A circular curve shall be provided with cant in accordance with the gauge, radius of curve and speed of rolling stock, etc. It must be ensured that the largest value of the cant will not adversely affect the stability, etc. of rolling stock which is either travelling at a low speed or which is stationary.

### 3.4 Transition Curve

A transition curve shall be provided between a straight line and a circular curve or between two circular curves depending on the structure, degree of cant and travelling speed of rolling stock, etc.

### 3.5 Grade

The grade of the track shall be determined in consideration of the power performance, braking performance and speed of operation, etc. of rolling stock and the standard steepest grade for main lines is given below. A grade as gentle as possible shall be introduced on a main line along a platform and storage siding, etc., taking the rolling motion, etc. of rolling stock into consideration.

### 3.6 Vertical Curve

In places where the grade changes, a vertical curve shall be introduced to prevent the derauling of rolling stock and to prevent any unpleasant feeling on the part of passengers, taking the speed of train operation and rolling stock performance, etc. into consideration.

### 3.7 Construction Gauge

The construction gauge shall be determined to ensure the safety of rolling stock and passengers, etc. vis-a-vis the pitching or rolling, etc. of travelling rolling stock and no structure shall be introduced within the construction gauge.

### 3.8 Width of Formation Level

The width of the formation level shall be determined to ensure the safety of passengers and workers, etc. in consideration of the pitching motion of travelling rolling stock and the track structure, etc.

### 3.9 Center-to-Center Distance of Adjacent Tracks

The center-to-center distance of adjacent tracks shall be determined by adding a margin to the width of rolling stock in consideration of pitching motion to ensure its safety and of the passengers. This distance shall be widened at curves, etc. in response to the expected swaying, etc. of rolling stock.

### 3.10 Track and Civil Engineering Structures

Track and civil engineering structure shall be determined to ensure the safety and security of the rolling stock and railway facilities in consideration of the structure of rolling stock, train weight and sub-grade conditions, etc.

### 3.11 Building Construction

Buildings shall be constructed so as not to compromise the safety of the rolling stock and passengers.

### 3.12 Disaster Prevention Devices, Safety Devices and Evacuation Devices

Disaster prevention and safety devices shall be installed to avoid entry of unwanted persons and of falling objects onto the tracks. Similarly, measures shall be applied to prevent damage to the facilities which may be brought about by accidents or any untoward incidents happening in the perimeter area. In addition, evacuation devices designed to safely guide passengers at the time of an accident or an emergency will be set up.

## Chapter 4 Station Facilities

4.1 Specifications for station facilities such as effective track length, platform length/width, etc. shall be determined so as to ensure smooth train operation with consideration for passenger safety.

### 4.2 Smooth transfers between railway line

Railway proponents shall plan through train services by constructing or improving railway facilities in cooperation with other railway proponent, or, shall plan the stations in the same location with or adjacent to the stations of other railway lines to facilitate transfers between railway lines by proponents.

### 4.3 Smooth transfers between railway and road-based and other modes of transport

Railway proponents shall plan appropriate type of station plazas in cooperation with relevant road management agencies/operators prior to the construction or improvement of railway facilities to allow smooth transfers from road-based and other modes of transport.

## Chapter 5 Power Facilities

### 5.1 Contact Line (Overhead trolley wire and third rail)

5.1.1 The voltage of contact lines shall be maintained at a stable level sufficient to ensure smooth train operation.

5.1.2 Contact lines shall be capable of collecting power evenly and continuously in accordance with the speed of the train and the power collection method of the rolling stock.

5.1.3 Return rail shall be designed in such a way that the leakage current from rail to ground is minimized .

### 5.2 Substations

5.2.1 Substations shall be constructed in such a way that their safety and security are ensured.

5.2.2 Substation equipment shall have the capacity to meet its specified load as well as withstand specified overloading conditions.

5.2.3 Substations shall have a power control center, and shall be equipped to cope with failures.

5.2.4 Substations shall be designed such that other substations can provide the power required for train operation even when one of the substations is down.

### 5.3 Lighting Facilities

Lighting facilities shall be provided inside and under the stations and tunnels to facilitate the boarding/alighting of passengers and to guide passengers to safety in case of emergency.

## Chapter 6 Operation Safety Devices

### 6.1 Installation of Operation Safety Devices

6.1.1 Railway lines shall be equipped with operation safety devices.

6.1.2 Operation safety devices shall be installed so as not to cause any harm to the safe operation of a train, etc. even if they experience a malfunction.



## 6.2 Devices to Ensure Safety between Trains

6.2.1 A device to ensure a block section shall conform to the following criteria.

It must make the signal indication corresponding to the conditions of the block section on the route or guarantee the block section.

6.2.2 A device to control the distance between trains shall conform to the following criteria.

- a. It shall be capable of indicating the signal in accordance with the distance to a train, etc. on the route.
- b. It shall automatically reduce the train speed or stop the train at a position to prevent a collision or derailling in accordance with the distance between trains or the track conditions.

6.2.3 A device to ensure safety between trains in a single track section shall be capable of preventing the simultaneous operation of trains running in opposite directions.

## 6.3 Indicating Device of Railway Signals

6.3.1 The structure, indication method and installation method of an indicating device for railway signals shall be capable of making the correct signal indication to prevent the erroneous recognition of a signal.

6.3.2 A signal device shall be installed at the starting point of a block section, and a corresponding signal indication device shall be installed at a point in rear which enables a train to reduce its speed in accordance with the signal indication or to stop.

6.3.3 At a crossing or branching site, a signal indicating device shall be installed in a suitable position to prevent derailling or the disruption of a route by another train, etc.

6.3.4 In the case of a cab signal, the starting point of the block section shall be indicated depending upon the need.

## 6.4 Interlocking Device

6.4.1 An interlocking device shall be installed at a crossing or branching site.

6.4.2 An interlocking device shall be capable of mutually interlocking a signalled route and other signals and points which may disrupt operation on the signalled route.

## 6.5 Remote Control Device

6.5.1 A device which remotely or automatically controls an interlocking device shall not disrupt the locking function of the interlocking device.

6.5.2 When the manual control of a remote or automatically controlled interlocking device is intended, there must be a system at the control station to display the presence of a train, etc. on the track and other information.

## 6.6 Train Detection Device

A train detection device used for the operation safety system shall be capable of detecting a train, etc. without fail while preventing any disruption of its function by induction, etc.

## 6.7 Railway Crossing Safety Facilities

6.7.1 Railway crossing safety facilities shall be capable of informing the approach of a train to persons using the crossing road and of shutting down traffic on such a road with the approach of a train. They must be at least capable of informing that a train is approaching even if other operations are impossible due to the specific circumstances of the facilities.

6.7.2 Railway crossing safety facilities shall have an additional device to inform of an obstruction on a crossing road by an automobile if such an additional device is deemed to be necessary considering the train speed, traffic volume on the road and railway track and types of passing automobiles, etc.

## 6.8 Communication System for Safety Purposes

A communication system for safety shall be installed between such facilities as stations and so forth, substations, operation command centre and power command office, etc. for safety and operational purposes.

## 6.9 Installation of Communication Cables

Overhead communication cables shall be installed at a sufficient clearance/distance so as not to disrupt other means of transport and shall not contact power cables in order to avoid any physical harm to persons.

## Chapter 7 Rolling Stock

### 7.1 Size Limits of Rolling Stock

Rolling stock shall not exceed the specified size limits of rolling stock.

### 7.2 Constrains with respect to Tracks and Structures

Rolling stock shall not impose a heavier burden than that bearable by tracks and structures.

### 7.3 Stability

Rolling stock shall be capable of providing a stable running performance under the anticipated conditions.

### 7.4 Running Gear

7.4.1 Running gear shall be solid with sufficient strength, shall be capable of ensuring the safe as well as stable running of rolling stock and shall not damage the track.

7.4.2 The distribution of the axles of a car shall allow passing of the minimum radius of the running line without any problems.

7.4.3 The suspension mechanism shall have a sufficient buffer capacity and should be capable of securing stable shock absorbing movement against shock from the track.

### 7.5 Motive Power Apparatuses

7.5.1 Electric equipment of electric circuits of rolling stock shall conform to the following criteria.

- a. Electric equipment shall not cause electric shocks and/or fire accidents when the breakage of electric insulation takes place.
- b. Electrical equipment shall not cause any inductive disturbance to other electric circuits .
- c. Current collecting device shall be that which can ensure electric insulation against the car body and which can smoothly follow contact wires while running.
- d. In case of current collecting device being pantographs, they should be able to be simultaneously folded with operation from crew section depending on the purpose of use of each car.

7.5.2 A motive power apparatuses shall be installed so as to prevent the floor and walls from generating heat or causing a fire.

## 7.6 Brake Equipment

The brake equipment of rolling stock shall conform to the following criteria.

7.6.1 The brake equipment shall be capable of reducing the speed or stopping rolling stock in motion without failure in accordance with specified conditions.

7.6.2 Brake equipment shall be controlled throughout all cars in formation when operated from the crew section.

7.6.3 Brake equipment shall automatically produce braking force in case any of cars in formation is disconnected.

7.6.4 Rolling stock shall be equipped with an independent braking function depending on the type of rolling stock in case of failure of the normal brake equipment.

## 7.7 Car Body Structure

The body of rolling stock shall be solid with sufficient strength and shall be able to withstand operation under the anticipated usage.

## 7.8 Structure to Mitigate Excessive Noise

Rolling stock shall have a structure which mitigates excessive noise generated by the running train.

## 7.9 Structure of Crew Section

7.9.1 The crew section shall have a doorway for the crew and shall be so structured to protect the operation of the crew from passenger interference. Devices and equipment required for train operation shall be protected so that they cannot be touched by passengers.

7.9.2 The front and sides of the crew section shall provide the field of view required for operation by the crew in accordance with the operating conditions.

## 7.10 Structure of Passenger Doorway

7.10.1 Passenger doorway will have a structure which ensures the safe and smooth boarding and unboarding of passengers and there shall be no danger of passengers stumbling.

7.10.2 The level difference between the doorway and the platform shall be as small as possible.

## 7.11 Structure of passenger Doorway and Gangway

A passenger doorway and gangway shall have a structure which allows the safe and smooth passage of passengers and ensures the evacuation of passengers to other connected cars at the time of an abnormality.

## 7.12 Structure of a Passenger Car

The structure of passenger car shall not hamper safe use by passengers and shall conform to the following criteria.

7.12.1 When open, the windows shall not contact any ground facility nor pose any danger of passengers falling off.

7.12.2 Windows shall have sufficient strength.

7.12.3 The passenger room shall have lighting equipment required at night or when running through tunnels, and shall be maintained bright enough to ensure safety at the time of an abnormality.

7.12.4 Toilets shall be provided depending on the usage and operation distance of rolling stock.

7.12.5 At least one car of the passenger train shall be provided with a space to accommodate wheelchairs.

## 7.13 Structure of Emergency Exit

Rolling stock shall have emergency exits through which escape can be easily made in an assured manner if the structure of rolling stock makes emergency escape difficult and this emergency exit shall have a mechanism to verify its state of opening or closure.

#### 7.14 Coupling Device

The device required to connect rolling stock shall be solid with sufficient strength and shall be capable of connecting the cars securely withstanding vibrations and impacts.

#### 7.15 Structure of Rolling Stock for Transport of Special Cargo

Tankers and other freight cars for the transportation of special cargo shall have a structure to prevent disasters originating from the said cargo.

#### 7.16 Equipment of Driver Section

The driver section which is used to operate rolling stock shall be equipped with such devices and equipment as acceleration and deceleration control and others required for operation in accordance with the usage of rolling stock.

#### 7.17 Automatic Door Control Device

7.17.1 The automatic door control device installed at the doors of passenger doorway shall be capable of securing the safety of passengers while the rolling stock is running and shall allow the simultaneous opening or closing of all doors and verification of the door status of opening or closure by a crew member.

7.17.2 The doors equipped with an automatic door control device (hereinafter referred to as “automatic doors”) shall allow their manual opening at the time of an emergency.

#### 7.18 Air Compressor and Accessories

The air compressor (source of compressed air) shall be capable of preventing abnormal rise of the compression pressure and functional decline due to the water produced by air compression.

#### 7.19 On-Board Devices

On-board devices shall conform to the following criteria.

7.19.1 Rolling stock shall be equipped with device which allow verbal communication or the exchange of signs between crew members or between a crew member and ground staff, depending on the facility conditions.

7.19.2 The car at the front end of the train shall have a device capable of warning of danger by means of a whistle at its front end.

## 7.20 Marking on Rolling Stock

Rolling stock shall have a marking which allows the identification of individual cars.

## 7.21 Fire Prevention and Control Measures for Rolling Stock

7.21.1 Fire prevention and control measures for the wires and equipment onboard rolling stock shall conform to the following criteria.

- a. Onboard wires shall not cause fire or spreading of fire even in the presence of anticipated heat generating sources.
- b. On-board heat generating equipment shall not adversely affect other sections of rolling stock.

7.21.2 Fire prevention and control measures for passenger cars shall conform to the following criterion.

Fire-proof materials shall be used for the inside of rolling stock.

## 7.22 Continued Functioning of Some Devices during Power Interruption.

Devices designed to ensure the safety of train operation and passengers, and devices required for passenger evacuation shall be capable of continuing their function for a specific period of time when their main power supply is cut off.

## Chapter 8 Maintenance of Facilities and Rolling Stock

### 8.1 Maintenance of Railway Facilities and Rolling Stock

8.1.1 Railway facilities shall be regularly maintained and inspected in a condition which permits the safe operation of trains, etc.

8.1.2 Operation safety devices shall be maintained in a state which permits their accurate functioning.

8.1.3 Rolling stock shall not be used unless its condition permits safe operation.

8.1.4 These facilities and rolling stock shall be inspected in accordance with need.

## 8.2 Inspection and Trial Operation of New Facilities and Rolling Stock, etc.

8.2.1 Newly constructed/installed, improved, modified or repaired tracks and electric power equipment and newly built, procured or modified rolling stock shall only be used after satisfactory inspection and trial operation.

8.2.2 Newly installed, modified or repaired operation safety devices shall only be used after satisfactory inspection and trial operation.

8.2.3 Inspection and, if necessary, trial operation shall be conducted for tracks, electrical equipment, operation safety devices and rolling stock which have been involved in a natural disaster or other incident affecting their operation or of which operation has been suspended prior to the resumption of their use.

## 8.3 Patrolling, etc. when there is threat of disaster

When there is a prospect of a natural disaster adversely affecting train operation, the relevant tracks shall be monitored. If necessary, the operating speed of the said track shall be restricted or operation itself shall be suspended.

## 8.4 Regular Inspection, etc. of Railway Facilities and Rolling Stock

8.4.1 In regard to the regular inspection of railway facilities and rolling stock, the interval, subject sections and method of inspection shall be stipulated in correspondence with the type, structure and conditions of use, etc. of such railway facilities and rolling stock.

8.4.2 When the regular inspection of railway facilities and rolling stock is conducted, the inspection data, location and contents shall be recorded and stored.

## Chapter 9 Train Operation

### 9.1 Boundary of Station

The boundary of a station shall be the position at which the home signal or home marker is located.

### 9.2 Train Composition

9.2.1 The maximum number of connected cars of a train shall be determined based on the facility conditions and the performance, structure and strength of the cars.



9.2.2 The integrated braking force of a train shall be that which is suitable for the track conditions and operating speed.

9.2.3 The details of the brake test for a train and the method of verifying its operation status shall be stipulated separately.

### 9.3 Emergency Braking Distance, etc. of Trains

9.3.1 The emergency braking distance shall be stipulated separately.

9.3.2 The braking mechanism of a train shall be continuous braking.

9.3.3 The ratio of brake axles to the total number of axles of the train shall be stipulated separately.

### 9.4 Train Operation

9.4.1 A main line outside a station shall only be used for train operation.

9.4.2 Departure, passing and/or arrival times at a station shall be pre-determined for train operation.

9.4.3 “Keep-right” or “Keep-left” shall be stipulated separately for the double-track sections where trains are operated.

9.4.4 In principle, a train shall not engage in reverse operation, etc. However, this does not apply to trains engaged in the repair work of tracks and other facilities, relief trains and trains in trial operation.

9.4.5 When an abnormality occurs during train operation, the train shall be immediately stopped, and measures for train protection shall be taken. Measures for train protection (measures for promptly stopping other trains approaching the site) shall be stipulated separately.

9.4.6 In principle, works on track facilities and electrical equipment shall be conducted as “Work which requires closure of tracks.”

## 9.5 Shunting of Rolling Stock

That the shunting of rolling stock shall be conducted using cab signals, shunting signals, guiding signals and/or shunting markers, etc. and other requirements shall be stipulated separately.

## 9.6 Operation Speed

9.6.1 The maximum operation speed of a train shall be determined taking the tracks, electrical lines and structure of the rolling stock into consideration.

9.6.2 Should reverse operation be required, the speed of operation shall be stipulated separately.

9.6.3 Speed limit, shunting speed, etc. which are indicated by signals shall be stipulated separately.

## 9.7 Safety between Trains

9.7.1 A train shall be operated by means of employment of the block system.

9.7.2 The substitute block system shall be stipulated separately.

9.7.3 The method of operation solely relying on the driver's judgement shall be stipulated separately.

## 9.8 Railway Signals and Operation

A train or rolling stock shall be operated in accordance with the conditions indicated by the railway signals.

## 9.9 Train Protection

The types and methods of train protection shall be stipulated separately.

## 9.10 Track Closure

The procedure for the designation, commencement and ending of track closure shall be stipulated separately.

## 9.11 Response to Natural Disaster

The procedure to be taken when there is a hazard vis-a-vis train safety due to meteorological conditions (rain, wind or earthquake, etc.) shall be stipulated separately.

## Chapter 10 Reporting of Railway Accidents

### 10.1 Objective

The objective of the provisions of Chapter 10 is the prompt reporting and dealing with railway operation accidents and incidents which impede railway operation in an assured manner.

### 10.2 Scope of Application

The method to report and deal with a railway operation accident of one's own company or such an accident of another company which is related to the staff and/or rolling stock of one's own company shall be stipulated separately.

### 10.3 Terminology

Such terms as "a killed person" and "an injured person", etc. shall be stipulated separately.

### 10.4 Stipulations Regarding Railway Operation Accidents, etc.

10.4.1 Accidents shall be classified into railway operation accidents and incidents disrupting railway operation.

10.4.2 A railway operation accident shall be an accident which entails casualties and/or material damage resulting from the operation of a train, etc.

10.4.3 An incident which disrupts railway operation shall be a minor accident which involves casualties and/or material damage due to the operation of a train, etc. and which does not fall in the category of a train operation accident. The scope of such an incident shall be stipulated separately.

### 10.5 Responsible Accidents

Railway operation accidents and incidents disrupting railway operation caused by the errors of railway staff are defined as responsible accidents.

## 10.6 Reporting of Railway Operation Accidents and Other Matters

10.6.1 A railway operator shall promptly inform the DOTC of a railway operation accident, etc. and shall submit the relevant document(s) within one week of the said accident.

10.6.2 The reporting standards on railway operation accidents and so forth shall be stipulated separately.

## Chapter 11 Environment

### 11.1 Prevention of Loud Noise

Railway operators should strive to prevent loud noise due to train operation, by promoting such measures as the introduction of track and rolling stock structure which considers noise alleviation.

## **3.4 Legislation and Responsible Organization of Railway Technical Standards**

### **3.4.1 Legislation of Railway Technical Standards**

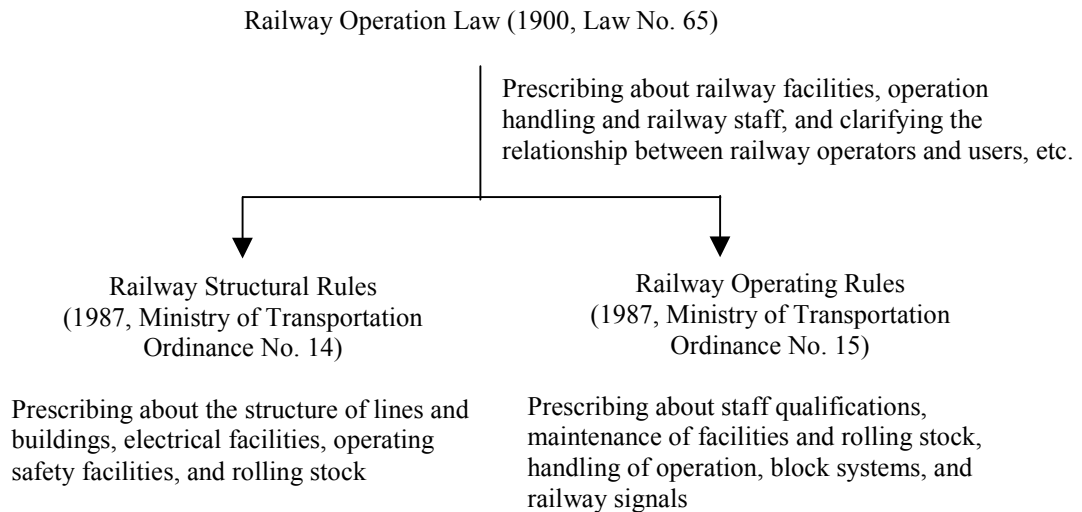
(1) Compulsory standards must be adhered to in each railway company. For this reason, it is necessary for these technical standards to be clearly prescribed in the legal system of the Philippine Government.

Confirmation of compliance with standards can either be carried out by the railway companies themselves, or by the public administration sector. As the basic philosophy, the weight applied to the self responsibility of railway companies shall be raised, the degree of freedom of companies including makers shall be expanded, and administrative involvement shall be held to a minimum.

(2) The following paragraphs describe the legal status of railway technical standards, and the system which is adopted to confirm compliance with standards in railway companies, in Japan.

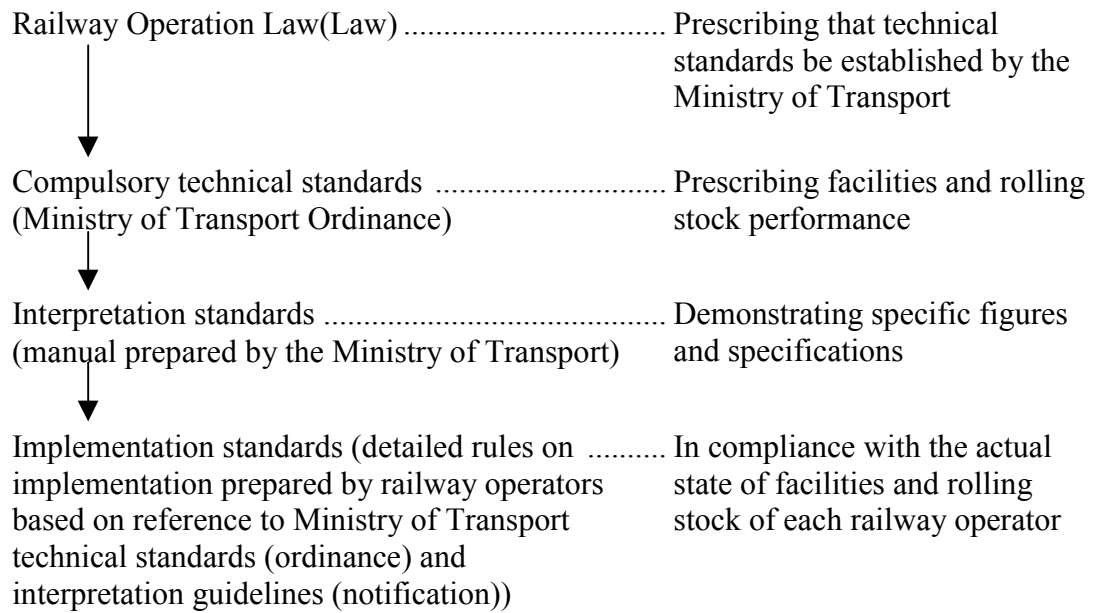
## 1) Legal Status of Railway Technical Standards

Railway technical standards are laid down in separately established regulations (Ministry of Transport Ordinance) based on the Railway Operation Law, and the system is as follows.



The Ministry of Transport in Japan is carrying out revision of technical standards with a view laying down prescriptions for facilities and rolling stock performance based on unified railway structural rules and railway operating rules.

Concerning compulsory technical standards (Ministry of Transport Ordinances), in contrast to the conventional system which prescribes in detail about materials, specific specifications, and dimensions, etc., transition is taking place to a new system (manual) whereby prescriptions are only given for minimum necessary performance and specific figures are given as interpretation guidelines with no binding force. As a result, the system of railway technical standards in Japan after revision will be as follows.



2) System for Confirming Compliance with Technical Standards in the Railway Operation

As a means of confirming that railway facilities and rolling stock satisfy technical standards, in Japan the Railway Operation Law has been established and this prescribes that the Ministry of Transport carry out checks.

In other words, the Railway Operation Law prescribes general operating rules for permission of railway operations, authorization of works execution, authorization of fares and tariffs, presentation of timetables, and so on. These rules also prescribe concerning confirmation of rolling stock particulars, facilities completion inspections, and on-the-spot inspections of facilities and rolling stock in use; and confirmation of the compliance of facilities and rolling stock with technical standards is carried out in these inspections.

The framework of the Railway Operation Law, and method for confirming compliance with technical standards in this law, are as follows.

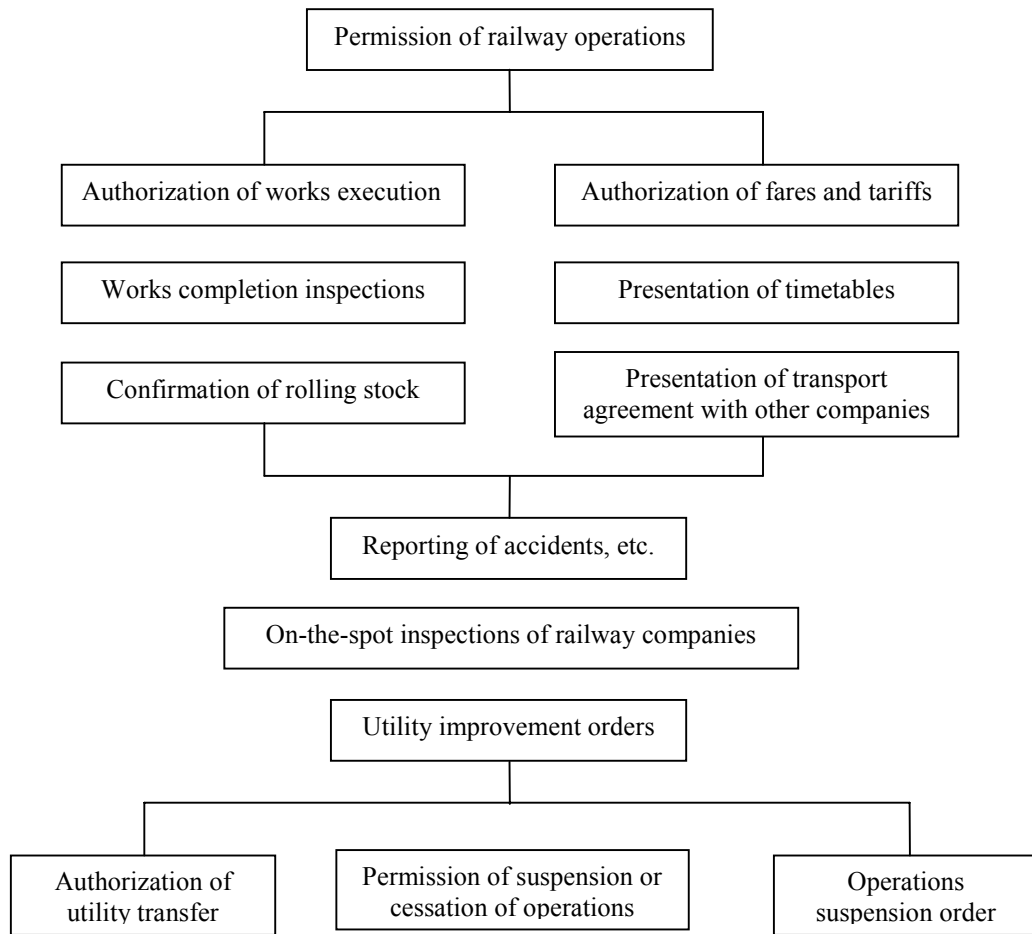


Fig. 3.4.1 Railway Business Law (1986, Law No. 92)

(3) In the Philippines, too, it is necessary for compulsory technical standards to be clearly prescribed in the legal system. Legislation relating to railways in the Philippines at the moment is as follows.

- Executive Order No. 125 January, 1987

Reorganizing the Ministry of Transportation and Communications defining its powers and functions and for other purposes

- Executive Order No. 125-A April, 1987

Amending Executive Order No. 125

- Executive Order No. 603 July, 1980

Creating a Light Rail Transit Authority, vesting the same with the Authority to construct and operate the Light Railway Transit (LRT) Project and providing funds therefore

- Presidential Decree No. 741 July, 1975

Amending an Act creating National Philippine Railways

The above legislation lays down prescriptions concerning the mandate, powers, functions, duties, organization and funds of DOTC, LRTA and PNR, but it does not directly state rules concerning railway business management, operating safety and technical standards.

However, in DOTC (E. O. No. 125) Section 5 (Powers and Functions), the following is stated: “Administer all laws, rules and regulations in the field of transportation and communications”, and since authority to establish railway-related standards is given, it is possible to establish Department Orders concerning railway technical standards.

For this reason, it is appropriate for technical standards to be established and advertised by DOTC Department Order.

In this connection, since the Interpretation Guidelines are reference standards, it is advisable to make the Guidelines sufficiently known to the personnel concerned as a notification by the Director of Transport Planning Service, Department of Transport and Communication.

Furthermore, in order to confirm that the contents of technical standards are satisfied during the construction and operation of railways, it is desirable to establish legislation concerning the business management and running of the railway utility and state prescriptions in that (for example, establishment of a rail transportation law).

Currently in the Philippines, since there is no comprehensive legislation concerning railway business management and operation (permission of railway operations, authorization of works, etc.), it is worth examining the establishment of a new law, however, this should be examined from a viewpoint that is separate from that of technical standards.



Also, from the viewpoint of minimizing administrative involvement, it is realistic to establish a system whereby railway companies themselves confirm compliance with technical standards.

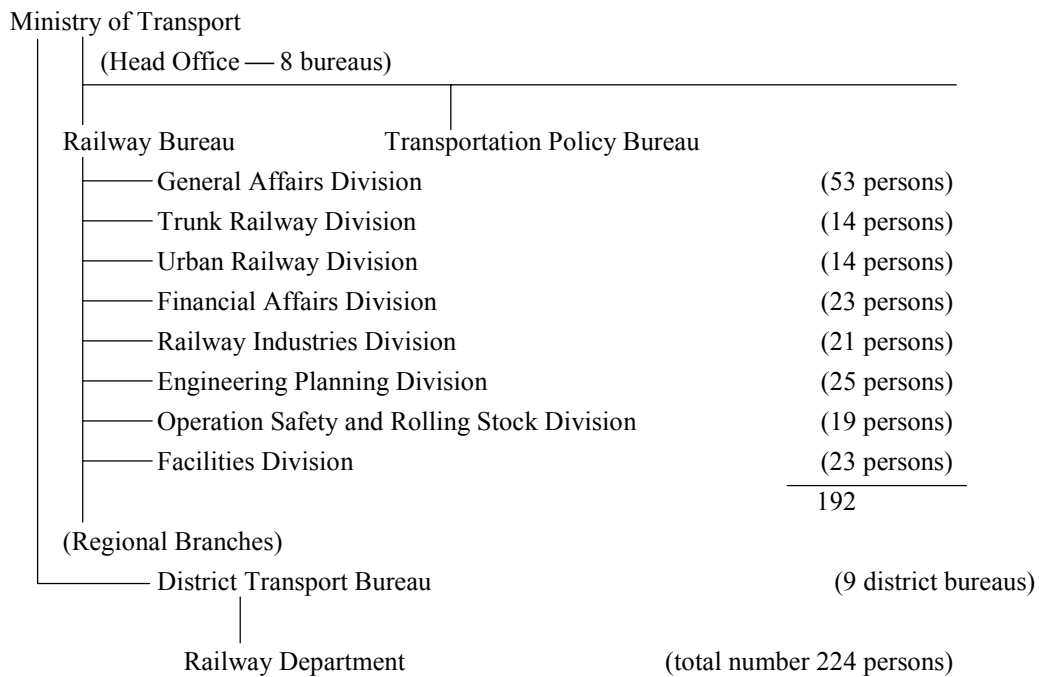
### 3.4.2 Organization in Charge of Railway Technical Standards

- (1) Railway technical standards state regulations which are necessary for securing railway safety, maintaining networks, displaying railway characteristics, securing convenience for users, and taking environmental countermeasures; however, in order to newly establish or revise standards, it is necessary to assign experts in technical standards who are well versed in railway work affairs.

Moreover, because technical standards are applied to all railway companies in the country, it is appropriate that the said experts belong to the administrative departments of national agencies or their equivalent bodies.

- (2) The departments in charge of railway technical standards in Japan are as follows.

The department in charge of establishing and revising railway technical standards is the Engineering Planning Division within the Railway Bureau (4 members of staff are responsible for technical standards).



In cases of making revisions to railway technical standards, responsible staff from the Engineering Planning Division hear views from railway companies, railway associations and learned persons and make revisions in accordance with technical progress and changes in the environment which surrounds the utility.

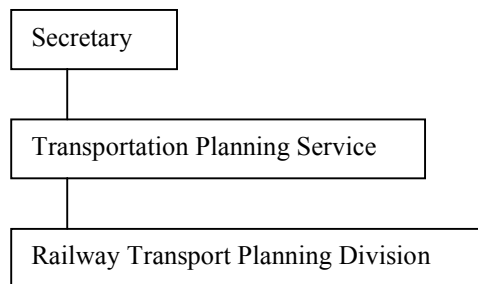
In a large-scale revision of the technical standards, the contents of the revision are deliberated in a special committee of external experts established within Railway Bureau. The committee consists of 16 members (1 person from the Ministry of Transport, 1 person from Japan Railway Construction Public Corporation, 6 persons from universities and the like, 2 persons from railway-related associations, 6 persons from railway enterprises).

The Ministry of Transport will merge with the Construction Ministry to form the Ministry of Land, Infrastructure and Transportation in January 2001, however, the Railway Bureau will still remain and there will be no change in the department in charge of railway technical standards.

- (3) In the Philippines, too, it is necessary to establish a department in charge of railway technical standards.

Government agencies currently in charge of railways in the Philippines are as follows.

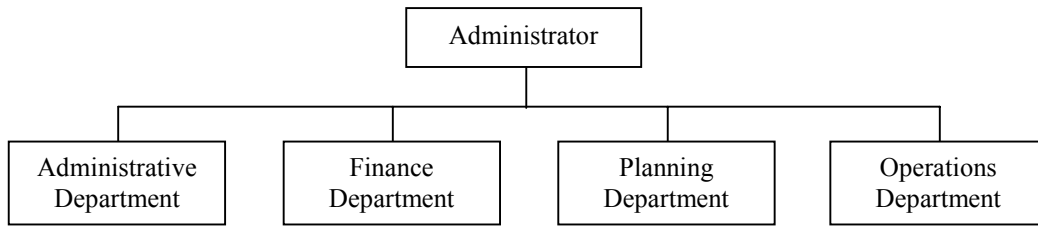
- 1) Department of Transportation and Communications (DOTC)



Within the DOTC there is a division responsible for railway transport planning, and around 10 personnel are assigned to this.

Moreover, within the ministry, EDSA MRT 3 Executive Office which is responsible for operation on Line 3 has been established.

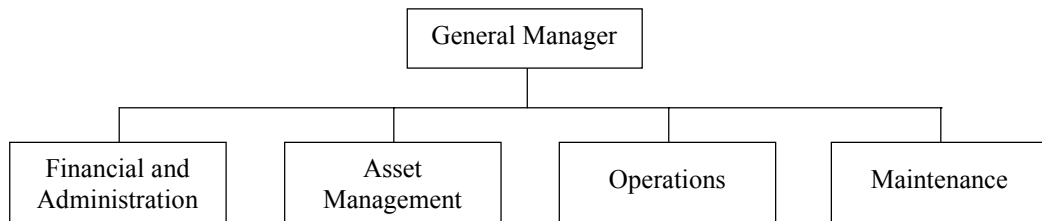
2) Light Rail Transit Authority (LRTA)



In terms of administrative machinery, LRTA is an independent authority under control of the DOTC. This authority manages and operates LRT, however, operation and maintenance of Line 1 is consigned to Metro Transit Organization, Inc. (METRO). However, the contract on the entrustment has been void since August 2000.

The number of staff is around 50 in LRTA and 1,250 in METRO.

3) Philippine National Railways (PNR)



In terms of administrative machinery, PNR is a nationalized railway company under the management of the DOTC, and it manages, operates and maintains 446 km of line. PNR has a work force of approximately 1,200 employees.

- (4) As was pointed out previously, it is appropriate for railway technical standards to be established by DOTC Department Order, so for this reason it is thought rational to establish a department within the DOTC responsible for establishing and revising technical standards. DOTC departments currently in charge of railways are the Railway Transport Planning Division (policy department) and the EDSA Line 3 Executive Office (implementing department).

The Railway Transport Planning Division belongs to the Planning Service Department and, similar to the Road Transport Division, Air Transport Division, and Water Transport Division it is jointly established with, it is responsible for planning and controlling

projects. If possible it is desirable to expand the Railway Transport Planning Division so that it can also take charge of technical standards, however, it is thought that difficulty would arise in expanding just this division (also in terms of comparison with other sections).

Meanwhile, the EDSA Line 3 Executive Office is in charge of operation on Line 3, however, it is thought that establishment of such a field department within the DOTC is temporary, and anyway this is not a department for dealing with policy matters such as establishment of standards, etc.

For the organizations in charge of the railway technical standards, it is necessary to have a good administrative sense and also to be familiar with the railway technologies. Therefore, the following organizations are considered as recommendable organizations responsible for the establishment and revision of the railway technical standards in the Philippines.

Railway Transport Planning Division is recommended as the organization in charge of the establishment and revision of the railway technical standards.

However, the number of personnel in Railway Planning Division is small, and the Division is not sufficient as the organization for studying the details of the railway technical standards. Therefore, it is advisable to establish a "Council for Railway Technical Standards" within Railway Transport Planning Division as an organization which consists of government officials, railway personnel and so forth and is responsible for substantial deliberations for the establishment and revision of the railway technical standards (including the Implementation Guidelines). The members (draft plan) of the Council for Railway Technical Standards are as follows.

- DOTC (Railway Transport Planning Division)
- DOTC (EDSA Line 3 Executive Office)
- LRTA (Planning Department)
- LRTA (Operations Department)
- LRTA (Line 2 Project Office)
- PNR (Operations Department)
- PNR (Maintenance Department)
- MRTC (Metro Railway Transit Corporation)