

Technical Standards of Railways

November 7, 2019

Engineering Planning Division of Railway Bureau,
MLIT

○ Railways in Japan are operated by private companies, except for some of the subways and LRTs etc., which are operated by public corporations such as municipalities

Number of railway companies: Approx. 200 companies

Operating kilometers: Approx. 27,800km



Shinkansen



Commuter lines



Subway



LRT

○ The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) is the director of railway business operators. To ensure the safety of transportation, profit of users, sound development of railway business, as well as appropriate and rational operation of railway businesses, it supervises and provide guidance to railway business operators.

Railway Bureau of MLIT (Tokyo)

[Technical Staff of Railway : Approx. 50 persons]

Railway Division of District Transport Bureau (9 bureaus in total: Hokkaido, Tohoku, Kanto, Hokuriku-Shinetsu, Chubu, Kinki, Chugoku, Shikoku, and Kyushu)
[Technical Staff of Railway : Approx. 150 persons]

Supervision,
Guidance

Accident Investigation

Entrustment of survey, etc.

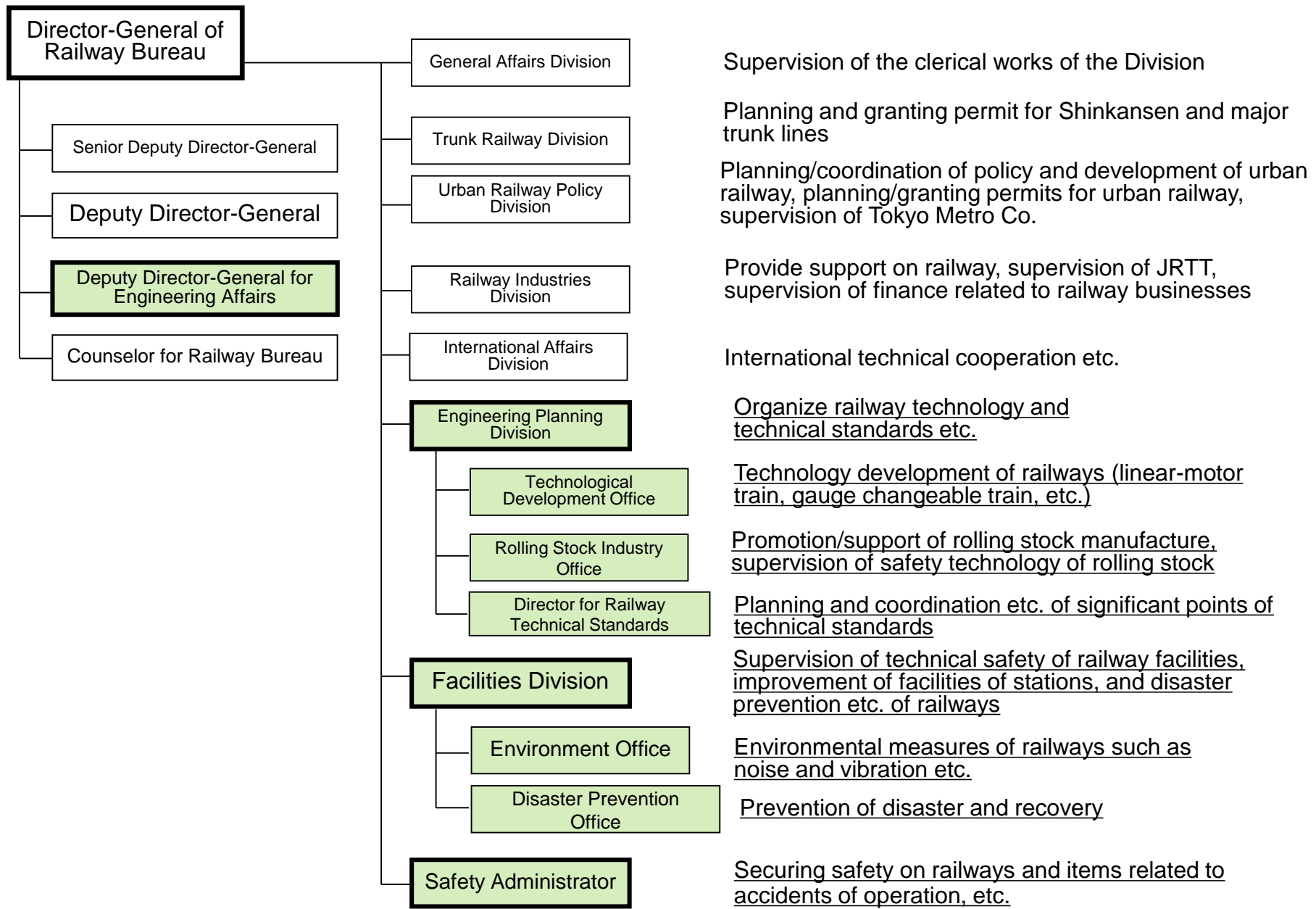
(MLIT)
Transport
Safety Board

Railway Business Operator
Head office, branch office, or site
office, etc.

National Traffic Safety and Environment Laboratory (NTSEL)

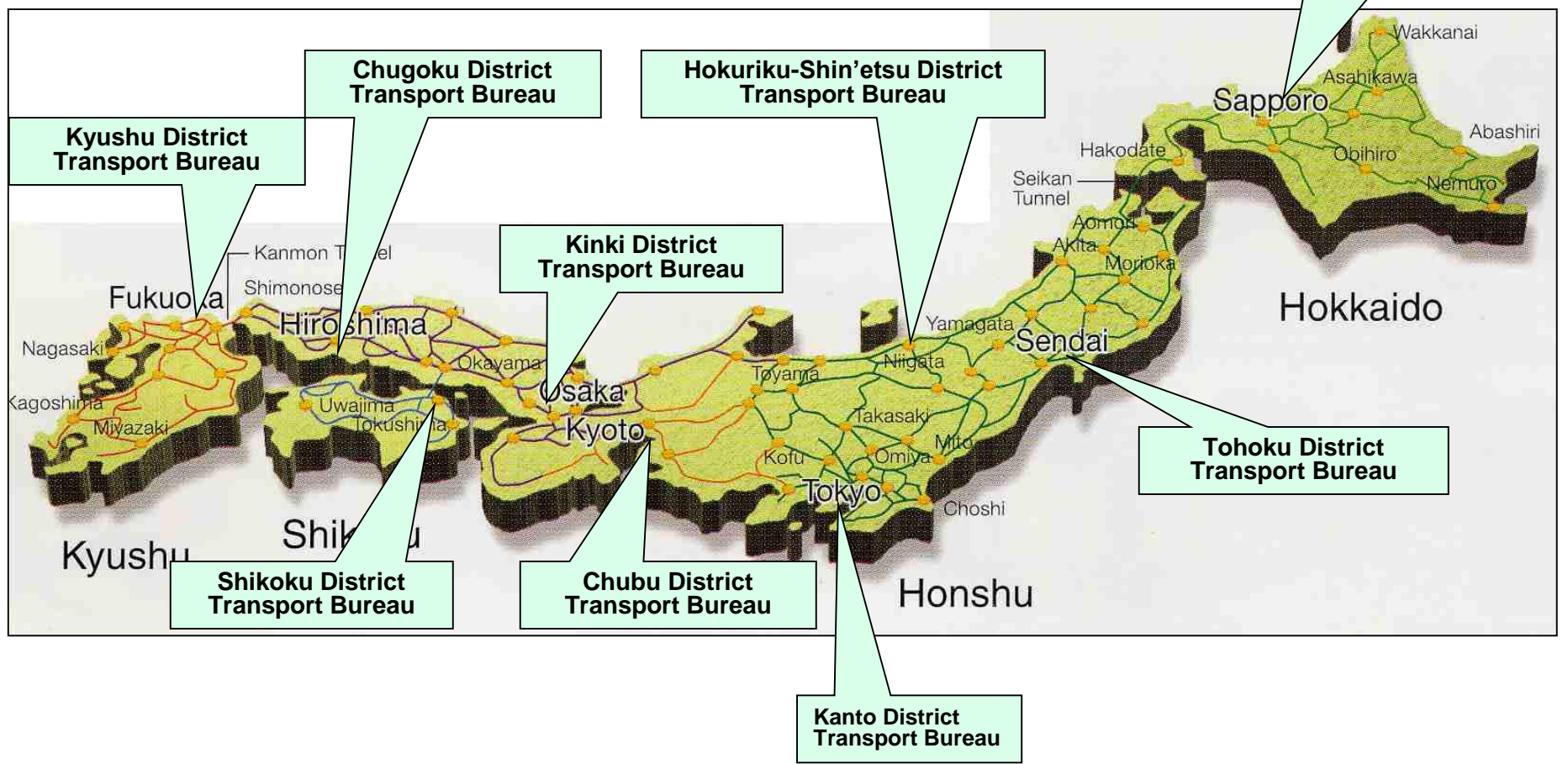
Railway Technical Research Institute (RTRI)

Japan Railway Construction, Transport and Technology Agency (JRRT)



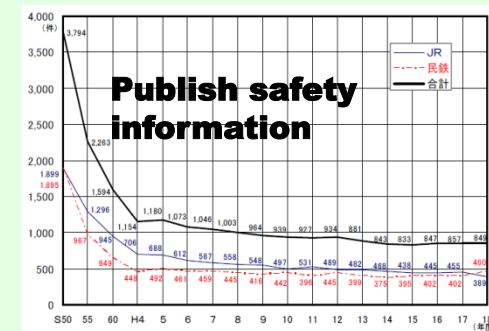
Structure of District Transport Bureau of MLIT

- **Technical Staff of Railway Bureau:**
Approx. 50 persons
- **Technical Staff of Railway Division of District Transport Bureau :**
Approx. 150 persons



MLIT

- **Standardization of structure and functions of facilities and rolling stocks, and operation, etc. (technical standards)**
- Grant authorization for projects, permits for construction, verification of rolling stock design and final inspection of constructions
- Power car operator examinations, issuance of licenses
- Carry out periodical safety audit, issue order for improvement in case of law violation etc.
- In case of an accident; execute on-site investigation, investigate cause, and publish safety information



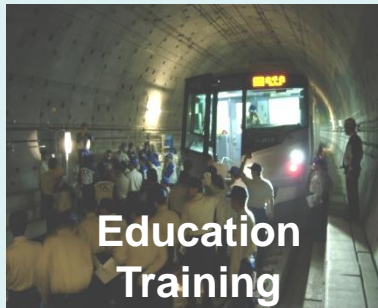
Railway Business Operator

Passengers and Residents

MLIT

Railway business operator

- **Establish and comply with concrete manual (implementation standards) based on technical standards**
- Select Chief Safety Management Officer, educate and train railway staff
- Appropriately maintain/control facilities and rolling stocks, as well as upgrade equipment
- Report to the national government in case of an accident, take measures for preventing recurrence, publish safety report, etc.



Passengers and residents

- Compliance with the rules upon transport based on the transport agreement
- Forbidden to disturb the train; e.g. entering a track, throwing stones, damage stop signals etc.
- Forbidden and given penalty for creating disorder in the train car, etc.

Railway Business Act:

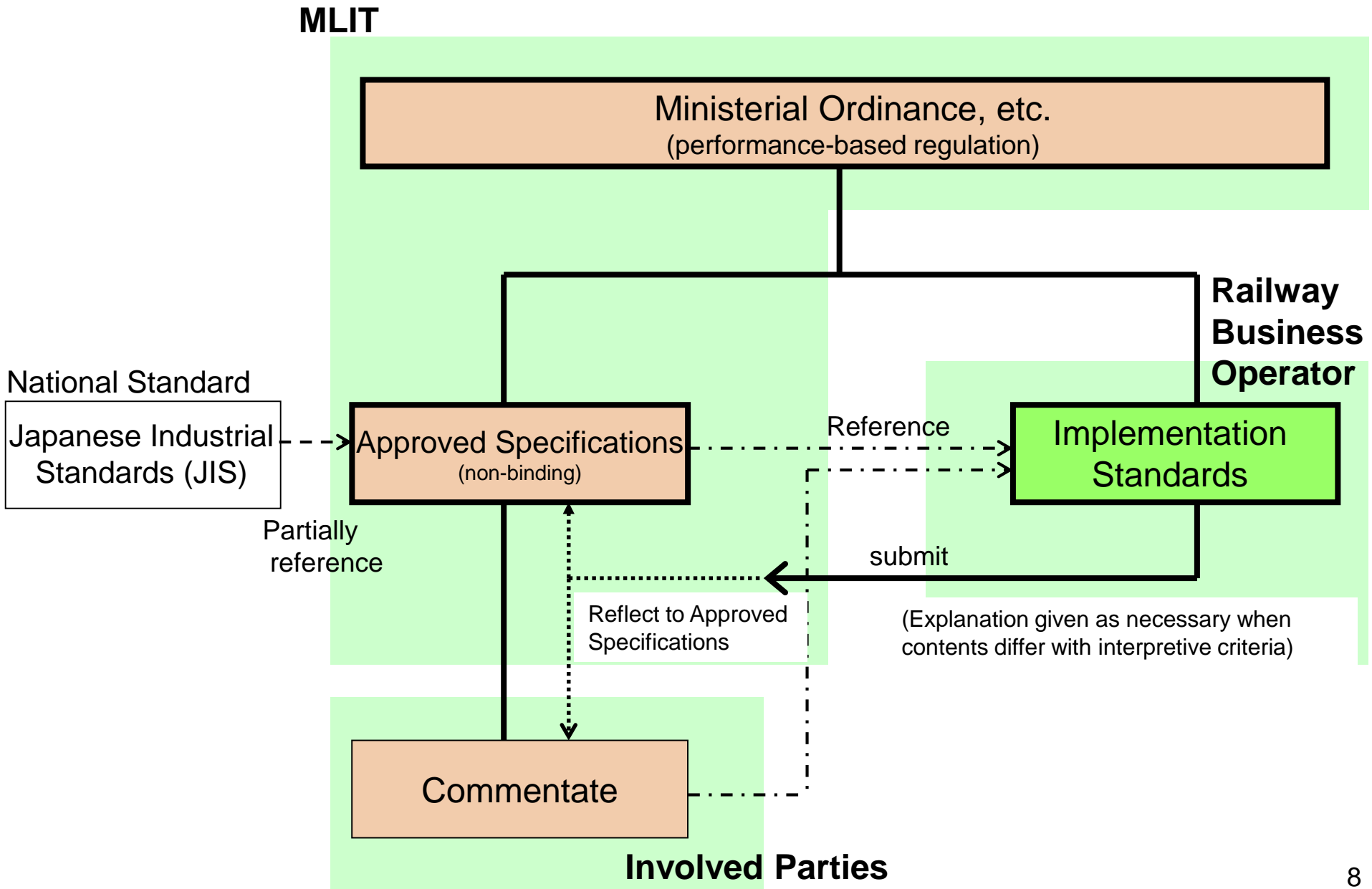
Specifies the requirement of business operation, procedures for construction of facilities and operation plans

- the Enforcement Ordinance of Railway Business Act: Details of procedures stipulated in the Railway Business Act
- the Ordinance for Inspection of Railway Facilities: Procedures of final inspection of the construction of facilities
- the Ordinance for Reporting of Operation Accident: Procedures for reporting to the national government in an occurrence of operation accident
- the Ordinance for Reporting of Railway Business: Periodical reports related to Railway Business Act
- the Ordinance for Audit of Railway Business: Method of audit related to Railway Business Act

Railway Operation Act:

Specifies the items related to duties and rights of railway business operators, staff, and passengers

- **Ministerial Ordinance to Provide the Technical Standards on Railways:**
Technical standard related to structure of facilities and rolling stocks, or handling upon operation, etc.
- Ministerial ordinance related to ensuring safety of operation:
Rules enforced to personnel involved in operation
- Ministerial ordinance related to operation license of power cars
Procedures for types, examinations, and acquisition of operating license



Government – Railway Business Operator Relationship

- Government shall establish ministerial ordinance etc. related to technical standards of railway to ensure the safety and stability of transportation
- The railway business operator shall formulate detailed implementation standards that reflect the actual state of affairs at individual railway business operators within the scope applicable to the Ministerial Ordinance and referred to the Approved Specifications, and shall submit them to the government
- The government may order alterations if the implementation standards do not satisfy the regulations of the ministerial ordinance
- Railway business operator must comply with the implementation standards to ensure the safety and stability of transportation

- Chapter 1. General rule (Article 1 ~ Article 8)
- Chapter 2. Staff (Article 9 ~ Article 11)
- Chapter 3. Guide way
 - Section 1. Gauge (Article 12)
 - Section 2. Guide Way Alignment (Article 13 ~ Article 19)
 - Section 3. Structure Gauge (Article 20)
 - Section 4. Width of Formation Level and Distance between Track Centers (Article 21/22)
 - Section 5. Structure of Guide Way (Article 23 ~ Article 25)
 - Section 6. Buildings (Article 26)
 - Section 7. Safety Facilities (Article 27~ Article 32)
 - Section 8. Wayside Posts (Article 33)
- Chapter 4. Station and Halt
 - Section 1. Station and Halt (Article 34 ~ Article 37)
 - Section 2. Train depot, etc. (Article 38)
- Chapter 5. Intersection with Road (Article 39/40)
- Chapter 6. Electrical Facilities
 - Section 1. Electric line facilities (Article 41 ~ Article 48)
 - Section 2. Substation and Other Facilities (Article 49)
 - Section 3. Electrical Equipment and Other Facilities (Article 50/51)
 - Section 4. Miscellaneous Provision (Article 51-2 ~ 53)

Chapter 7. Operation Safety Facilities

Section 1. Railway Signaling Facilities (Article 54~ 59)

Section 2. Safety Communication Facilities (Article 60~ 61)

Section 3. Level Crossing Protection Facilities (Article 62)

Section 4. Miscellaneous Provision (Article 63)

Chapter 8. Rolling Stock

Section 1. Rolling Stock Gauge (Article 64)

Section 2. Weight of Rolling Stock etc. (Article 65-66)

Section 3. Running Gear of Rolling Stock, etc. (Article 67~ 69)

Section 4. Carbody Structure and Rolling Stock Devices, etc. (Article 70~82)

Section 5. Countermeasures against Rolling Stock Fire etc. (Article 83~ 85)

Section 6. Rolling Stock Facilities for Trains, etc., Stationed by a Single Staff Member Who Drives the Motive Power Car (Article 86)

Chapter 8-2. Other Facilities (Article 86-2)

Chapter 9. Maintenance of Facility and Rolling Stock (Article 87~ 90)

Chapter 10. Train Operation

Section 1. Loading Limitation, etc. (Article 92/93)

Section 2. Train operation (Article 94~ 108)

Section 3. Operation of Rolling Stock (Article 109~ 111)

Section 4. Railway Signals (Article 112~ 119)

Chapter 11. Special Railways (Article 120)

Supplementary provision

◆ Implementation Standard

◎ Ministerial Ordinance (Article 3)

A railway operator shall set a standard (implementation standard) to implement this Ministerial ordinance and abide by that standard.

○ Approved Specification

Railway business operators shall formulate detailed implementation standards that reflect the actual state of affairs at individual railway business operators within the Ministerial Ordinance in carrying out design, maintenance and operation of facilities and rolling stock.

Items in the implementation standards shall correspond to items in the Ministerial Ordinance etc., and the contents shall be described in specific terms through quantification or the like, conforming to the examples, design methods, verification methods etc., indicated in the Approved Model Specifications.

◆ Prevention of Extreme Noise

◎ Ministerial Ordinance (Article 6)

A railway enterprise shall strive to prevent extreme noise to be generated with the movement of a train.

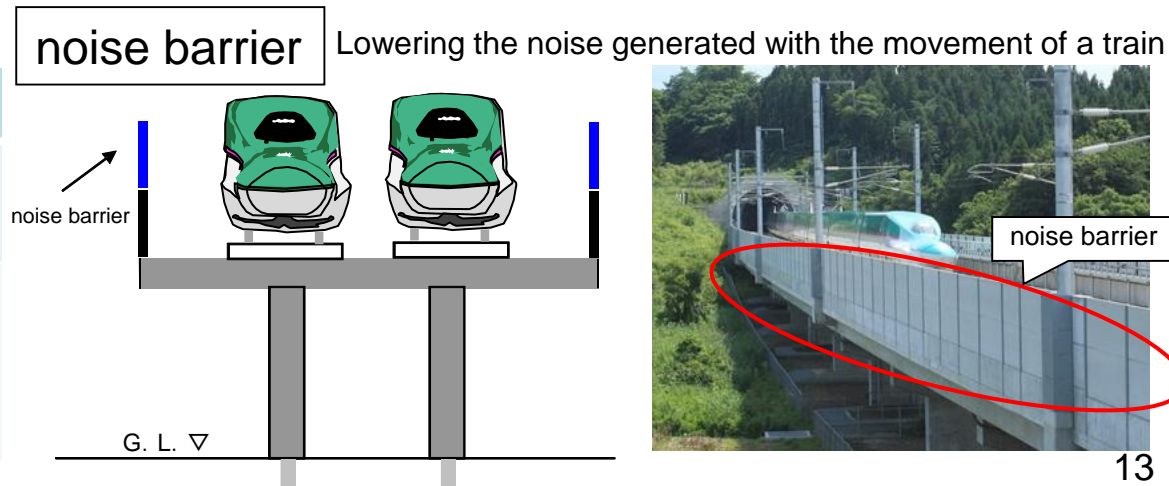
○ Approved Specification

1 The noise from Shinkansen shall be in accordance with the Environment Standard (Public notice given by the Ministry of the Environment (former Environment Agent)).

A power mean of the peak noise level shall be measured at 1.2m above the ground in the open air along the railway line and the location representing the noise in the area shall be, in principle, at a position 25m away from the center line of the near side of the track.

Environment Standard

Type	Value
Region for residence(type1)	70dB or less
Other region which shall be preserved(type 2)	75dB or less



◆ Gauge

◎ Ministerial Ordinance (Article 12)

Gauge shall be able to maintain the safe and stable car operation, given the structure of rolling stock, the maximum design speed and other relevant factors into consideration.

○ Approved Specification

Gauge of ordinary railways (excluding Shinkansen railways)

0.762m

1.067m

1.372m

1.435m

Gauge of Shinkansen railways 1.435m

◆ Radius of Curvature

◎ Ministerial Ordinance (Article 14)

Radius of curvature shall be set in order not to impair safe car operations, taking the performance capability of negotiating a curve, the operation speed, and other relevant factors into consideration.

○ Approved Specification

Curve radius of ordinary railways (excluding Shinkansen and railways with a gauge of 0.762m)	not less than 160m
Curve radius of Shinkansen	not less than 400m

◆ Gradient

◎ Ministerial Ordinance (Article 18)

Gradient shall be set in the manner that a car can be started, operated continuously at a designated speed and brought to a stop within a designated braking distance, taking situations into consideration such as the car performance of motive device and braking device and operation speed.

○ Approved Specification

The maximum gradient of Shinkansen

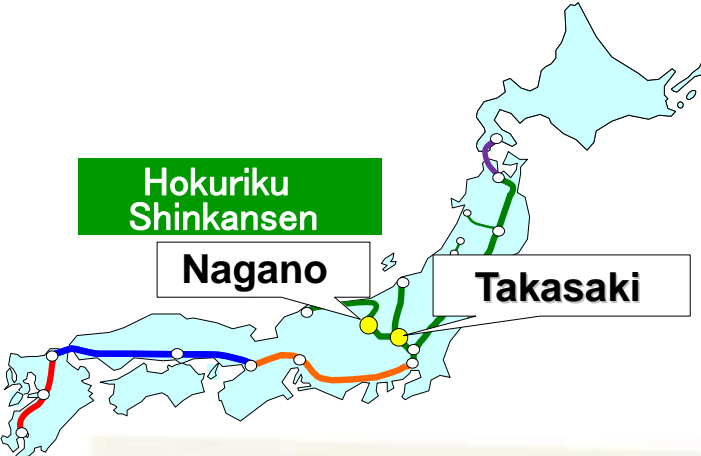
1) In the traveling areas : 25/1000

(Where the above standard cannot be applied for topographic or other reason, it may be 35/1000)

(2) In the stopping areas : 3/1000

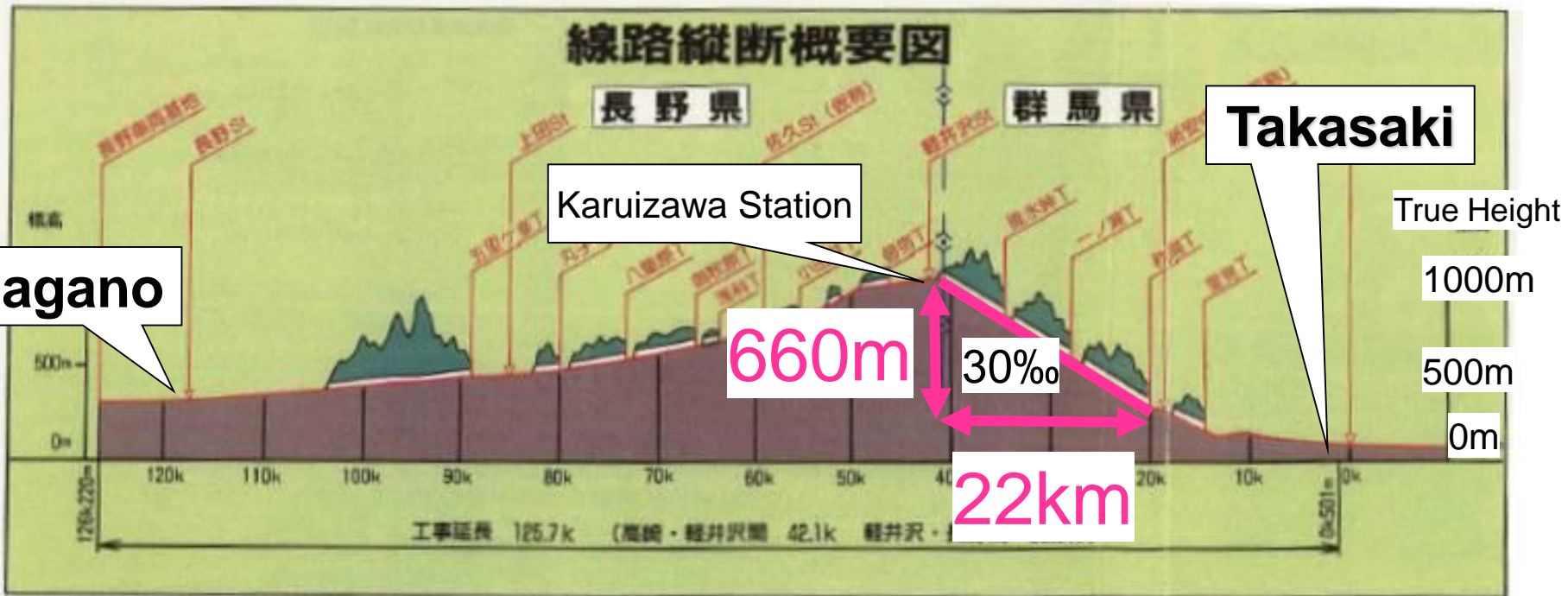
Example of gradient

Steepest gradients of Shinkansen



Steepest gradients of Shinkansen network

	Tokaido	Sanyo	Tohoku	Joetsu	Hokuriku	Hokkaido	Kyushu
steepest gradient (‰)	20	15	20	20	30	20.8	<u>35</u>



◆ Structures

◎ Ministerial Ordinance (Article 24)

Structures such as earthwork, bridge, and tunnel shall be able to withstand the anticipated load.

They shall also be free from any impediment for the safe car operation like the deviation of structures caused by the load and impact of the train.

○ Approved Specification

The design of earthworks, bridges, tunnels and other structures shall conform to the notifications in the following “Technical Standards for Railway Structures.”

Design Standards for Railway Structures and Commentary

- Earth Structures
- Concrete Structures
- Steel and Composite Structures
- Tunnel
- Seismic Design ,etc.

◆ Facilities of Underground Stations, etc.(Fire-prevention)

◎ Ministerial Ordinance (Article 29)

2. Underground stations, etc., shall be equipped with fire extinguishers, evacuation facilities and other necessary fire-prevention equipment, depending upon the structure and facility.

○ Approved Specification

- Fireproofing of structures
- Provision of a disaster prevention control center
- Provision of alarm facilities, notification facilities, evacuation guidance facilities, smoke exhaust facilities
- Provision of fire extinguishing facilities ,etc.



extinguishing facilities



◆ Apparatus to Automatically Decelerate or Stop Trains

◎ Ministerial Ordinance (Article 57)

In the case when trains are operated by the block system, apparatus to automatically decelerate or stop trains depending upon signal aspects and line conditions shall be installed. This does not apply, however, to those cases where safe train operation will not be jeopardized from the standpoint of operational and route conditions.

○ Approved Specification

In cases where a main signal indicates a stop signal, the device automatically stops trains outward of this signal if braking operation for such trains is not conducted at a predetermined point.

In the cases listed below, automatic train stop apparatuses shall be a type that can automatically decelerate trains to a safe speed or stop them before the near side of a speed restriction point, a stop limit point, etc., when the train runs at a speed exceeding a certain level at a predetermined position.

- There is a risk of overturn to the outside of curves when a train intending to enter a curve comes into the section at the permitted operation speed.

◆ Running gear

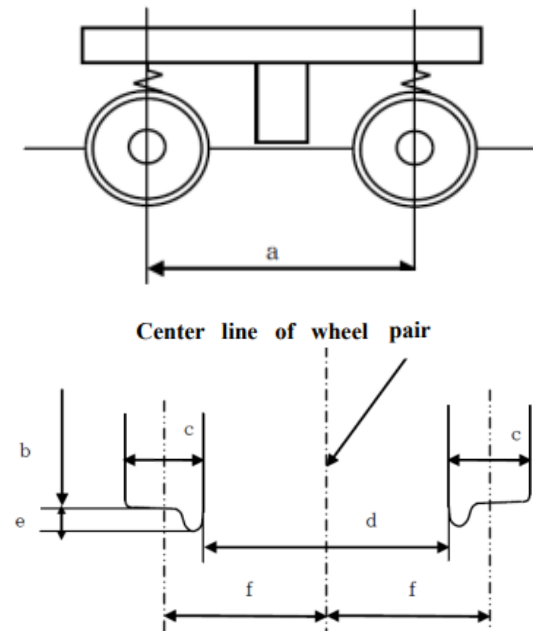
◎ Ministerial Ordinance (Article 67)

The axles shall be arranged appropriately without imposing any problem for a train to negotiate the curve of the minimum radius of the line on which it is supposed to run.

○ Approved Specification

The dimensions of the wheelbase of the rolling stock, wheels, etc., shall be as shown in the following table and shall meet these numerical values even when the wheels are worn.

	Regular Railways	Shinkansen
Type of Gauge	1067mm	1435mm
a: Wheel base	4570mm or less	3500mm or less
b: Wheel diameter	680mm or more	730mm or more
c: Wheel rim width	120mm or more and 150mm or less	120mm or more and 135mm or less
e: Tire Flange height	25mm or more and 35mm or less	25mm or more and 35mm or less



◆ Maintenance of Facilities and Rolling Stock

◎ Ministerial Ordinance (Chapter 9)

Article 87. Rail track and electric facilities to operate trains, etc. shall be maintained in an appropriate condition to provide a safe train operation at the designated speed.

3. Train protection facilities shall be maintained so as to operate accurately.

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

Article 90. Periodic Inspection of Facilities and Rolling Stock

Public Notice on Periodic Inspection of Facilities and Rolling stock

- 1) Purport
- 2) Periodic Inspection of Railway Track
- 3) Periodic Inspection of Electric Equipment
- 4) Periodic Inspection of Train Protection System and Equipment
- 5) Periodic Inspection of Rolling Stock
- 6) Exceptions

Article 91. Records

◆ Maintenance of Facilities

■ Public Notice on Periodic Inspection of Facilities and Rolling stock (Periodic Inspection of Railway Track)

Article 2 Inspection of railway tracks shall be carried out periodically within the month in which the day, passed the respective basis period specified in the third column reckoned from the basis date of inspection, is involved, or within the tolerable deviation period, specified in the right column of the table below, from the day passed the respective basis period, for each facility and equipment listed in the second column, for the kind they are installed as described in the left column of the table below.

Kind of Railway	Kind of Facility	Basis Period	Tolerable Deviation Period
Railway other than Shinkansen	Track	1 year	1 month
	Bridge, tunnel and other structures	2 year	1 month

When it is found that the facilities performed the said inspection, etc. have sufficient durability, periodic inspection may be carried out within the range of period to be found that there is in no danger of durability loss by stipulating appropriate period exceeding the basis period.

◆ Maintenance of Facilities

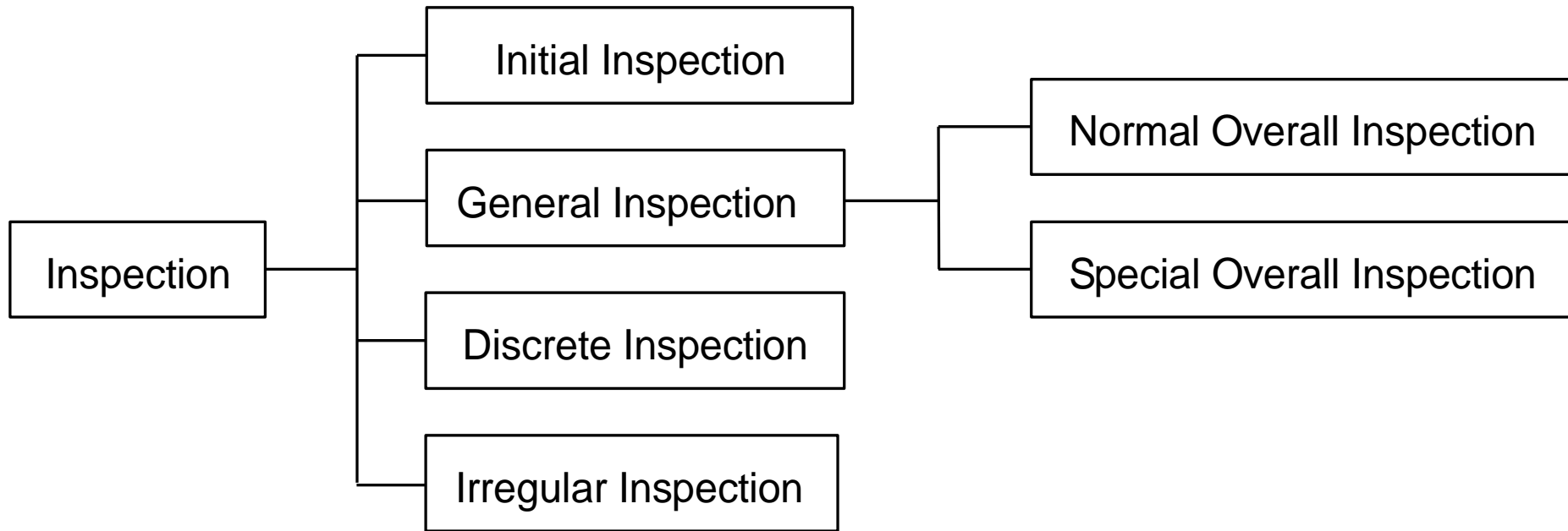
○ Approved Specification

The notification “Enactment of Maintenance Standards for Railway Structures” shall define the Maintenance of the facilities and the rolling stock.

Maintenance Standards for Railway Structures and Commentary(Track)

Maintenance Standards for Railway Structures and Commentary(Structures)

- Concrete Structures
- Steel and Composite Structures
- Foundation Structures and Retaining Structures
- Tunnel
- Earth Structures



Initial Inspection : The inspection to check the initial condition of the structures

Overall Inspection : The general inspection of the structures as a whole

Normal overall inspection : The periodic inspection to detect the lowering of structure performance

Special overall inspection : The general inspection to increase the accuracy of performance evaluation

Discrete Inspection : The inspection carried out according to the result of overall inspection and irregular inspection

Irregular Inspection : The inspection carried out in abnormal case

◆ Maintenance of Rolling Stock

■ Public Notice on Periodic Inspection of Facilities and Rolling stock

Article 5 Inspection of the rolling stock shall be carried out periodically within the respective period specified in the right columns for the type of rolling stock listed in the left column of the appended table. However, this does not apply to the parts of rolling stock having characteristics of anti-wear and durability, and the functions of such parts are assured to be maintained for a longer period than the period specified in the right columns of the Appendix.

Kind of Rolling Stock	Period		
	Inspection of Condition and Function	Inspection of important and Critical Part <small>* power generation system, running gear, braking device, and other equipment</small>	Overall Inspection
Electric Car	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

◆ Safety Assurance between Trains

◎ Ministerial Ordinance (Article 101)

A train shall be operated by one of the following methods in order to secure safety between trains.


- (1) Method using blocks;
- (2) Method using device to secure the distance between trains;
- (3) Method in which the person in charge of driving the locomotive performs operation in consideration of forward sighting and other conditions necessary for safe train operation.

○ Approved Specification

Types of block method regularly used for train operation shall be as follows:

- [A] Automatic block system
- [B] Cab signal block system ,etc.

In the case of train operation by “the method using a device to secure the distance between trains” , an Automatic Train Control(ATC) shall be used.



Thank you for your kind attention

※ Download data of Technical Standard for Japanese Railway

http://www.mlit.go.jp/english/2006/h_railway_bureau/Laws_concerning/14.pdf