Priority objectives in Road sector

Every five years, the Government establishes the Priority Plan for Infrastructure Development. This plan contains priority objectives for the road sector and indices to measure the achievement of these objectives.

■ Key Performance Indicators (KPI) used in the Priority Plan for Infrastructure Development 2021-2025

Road Data Book 2021

Priority Objectives	Policy Packages	Index	Initial Value	Target Value for FY2025
1. Achieving a society where disaster prevention and mitigation is are mainstream issues	1-1 Promotion of river basin management where effects of climate changes are considered	Required measures to protect bridges and buildings facing rivers along the emergency transport roads	0% (FY2019)	Approx. 28%
		Development rate of locations for which measures are required on slopes and banks along emergency transport roads	Approx. 55% (FY2019)	Approx. 73%
	1-2. Mitigating risks of disasters that can occur at any time, including earthquakes, tsunami, etc.	Rate of reinforcement work for bridges located on emergency transportation roads	79%(FY2019)	84%
	1-3. Securing transport function when a disaster occurs	Start rate of four-lane conversion projects on high-standard (toll) roads in priority development sections	Approx. 13% (FY2019)	Approx. 47%
		Rate of improvement for missing links on high-standard roads (*)	0% (FY2019)	Approx. 30%
		Rate of reinforcement work for bridges on emergency transportation roads	79%(FY2019)	84%
		Start rate of utility pole removal on emergency transportation roads in urban areas, etc. where the risk of utility pole collapse exists	Approx. 38% (FY2019)	Approx. 52%
		Development rate for locations where measures are required on slopes and banks along emergency transport roads	Approx. 55% (FY2019)	Approx. 73%
	1-4. Promoting crisis management measures based on the risk of disasters	Improvement rate of evacuation facilities which require the use of elevated sections of directly-controlled national highways as emergency evacuation sites	Approx. 27% (FY2019)	100%
		BCP formulation rate at Roadside Rest Areas positioned in the regional disaster prevention plan.	3% (FY2019)	100%
2. Sustainable maintenance of infrastructure	2-1. Promoting planned maintenance of infrastructure	Roads (bridges, pavement): The rate of repair measures for bridges on roads managed by local governments that require urgent or early maintenance and the rate of pavement repair on roads important for disaster prevention	(Bridges) approx. 34% (Pavement) 0% (FY2019)	(Bridges) approx. 34% (Pavement) 0%
		Number of people trained in maintenance and management in local governments, etc. (roads)	6,459 (FY2019)	10,000
	2-2. Sophistication and efficiency improvement of infrastructure maintenance by using new technologies	Percentage of local governments that used new technologies in bridge and tunnel inspections from local governments that considered using new technologies in bridge and tunnel inspections.	Bridges) approx. 39% (Tunnels) 31% (FY2019)	(Bridges) approx. 50% (Tunnels) 50%
		Number of technologies published in the performance catalogue of inspection support technologies.(roads)	80 technologies (FY2020)	240 technologies
		Road: Data implementation rate of infrastructure ledger and maintenance/administration data	0% FY2020	100%
	2-3. Appropriation of infrastructure stock by consolidation and reorganization, etc.	Roads: Percentage of local governments considering consolidation, removal, or functional reductions of facilities	14% (FY2019)	100%
3. Achieving a local society that is sustainable and comfortable to for daily life	3-1. Creating attractive compact cities	Number of municipalities that have prepared Bicycle Utilization Promotion Plans that include plans for bicycle networks.	89 (FY2020)	400
	3-2. Infrastructure development for promoting a new flow of population and interregional exchange	Percentage of inter-city expressways secured by road (*2)	57% (FY2019)	63%
		Improvement rate of ring roads in the three major cities	83%(FY2020)	89%
	3-3. Developing safe traffic and living space	Improvement rate of sidewalks on school routes	53% (FY2019)	57%
		Start rate of utility pole removal on specific roads	31% (FY2019)	38%
		Reduction rate of fatal and injurious accidents on community roads through measures combining a 30km/h speed limit in Zone 30, etc., and maintenance of speed bumps and narrow strips	-	Reduced by approx. 30% (vs. FY2019)
		Reduction rate of fatal and injurious accidents at dangerous locations on arterial roads	-	Reduced by approx. 30% (vs. FY2019)
		Start rate of four-lane conversion projects on high-standard (toll) roads in priority development sections [Repeat]	Approx. 13% (FY2019)	Approx. 47%
		Number of municipalities that have prepared Bicycle Utilization Promotion Plans that include plans for bicycle networks.	89 (FY2019)	400
		Number of accidents at railroad crossings	-	Reduced by approx. 10% (vs. FY2020)
	3-4. Promoting barrier-free / universal designs	Barrier-free rate for specific roads	Approx. 63% (FY2018)	Approx. 70%
4. to support a favorable economic cycle	4-1. Enhancement and optimization of the whole supply chain	Improvement rate of ring roads in the three major cities	83% (FY2020)	89%
		Percentage of intercity expressways secured by road	57% (FY2019)	63%
	4-3. Enhancing cities' global competitiveness by encouraging private sector investment	Improvement rate of ring roads in the three major cities	83% (FY2020)	89%
5. Digital Transformation (DX) in the area of infrastructure	5-1. Reform of working practices and increase in productivity by digitalization and "smartification" of social capital development	Installation rate of CCTV cameras on sections of emergency transport roads where continuous observation is required	0% (FY2019)	Approx. 50%
6. Decarbonization in the area of infrastructure / improving the quality of life by utilizing i nfrastructure spaces in various ways	6-1. Achieving a green society	Time lost due to railroad crossing blockage	103 mil persons x time/day (FY2018)	98 mil persons x time/day
	6-2. Reviewing people-oriented infrastructure space	BCP formulation rate at Roadside Rest Areas positioned in the regional disaster prevention plan.	3% (FY2019)	100%

*1. Rate of sections that are fully or partly in service out of the total sections that are missing links on high-standard roads
*2. Rate of sections on inter-city links where inter-city transport speed** is ensured at least 60km/h.
** Minimal road distance between cities /minimal travel time required

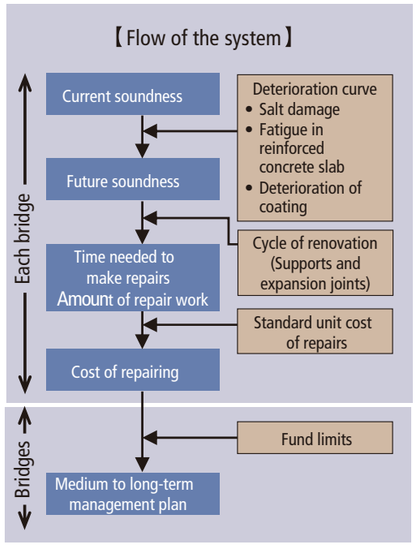
Asset Management

A great deal of Japan's infrastructure was constructed during the postwar reconstruction period, which was also a rapid economic growth period from the 1950s to the 1970s. As the Japanese society and its economy have matured, concerns have shifted to extending the use of accumulated capital stock in order to cope with a decreasing birthrate, aging population and the need to protect the global environment. Infrastructure management in Japan is in the process of switching its focus from construction to maintenance.

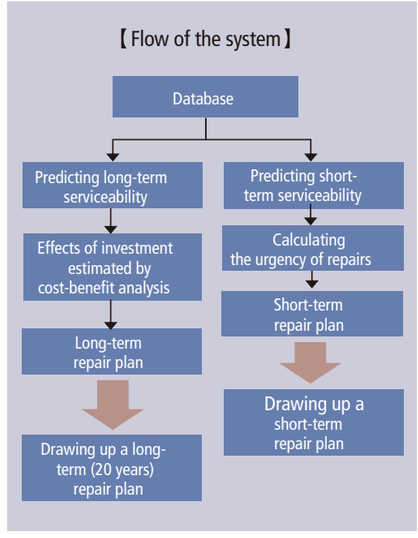
Development of road asset management

The Bridge Management System (BMS) and the Pavement Management System (PMS) are being developed to predict future deterioration of structures and to ultimately extend their lifetime by extending the time until renovations are needed and reducing the total costs of maintenance and renovation.

■ Overview of a Bridge Management System

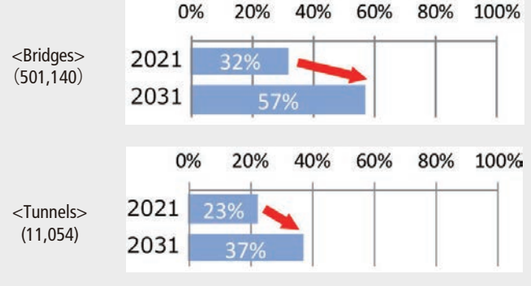


■ Overview of Pavement Management System



■ Percentage of bridges olderthan 50 years

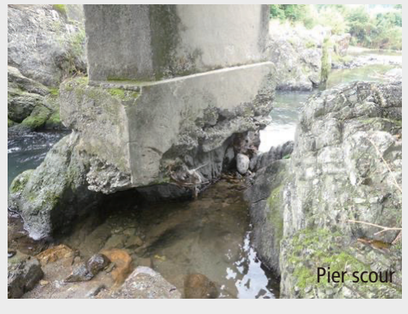
The percentage of infrastructure facilities that are more than 50 years old is increasing at an accelerating rate.



Facilities that are more than 50 years old

* ( ) is the number of bridges and tunnels covered, excluding bridges and tunnels where year of construction is unknown.

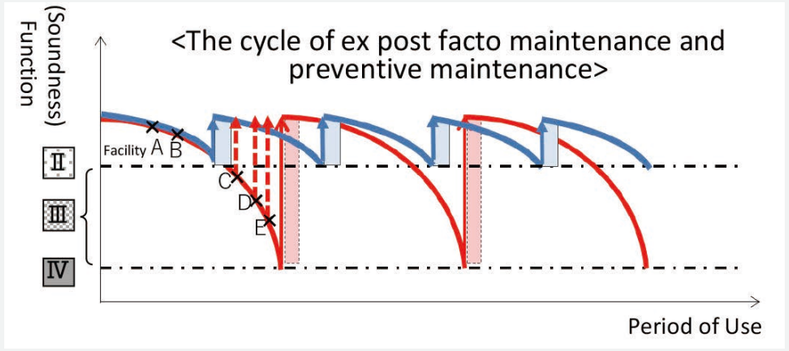
Judgment category IV (urgent measures should be taken)

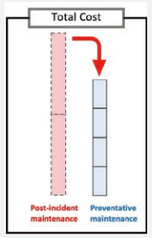


Efficient management of road assets

Preventive maintenance involves taking appropriate measures before roads are seriously damaged. This is vitally important for ensuring the safety of roads and minimizing the overall cost of repairs and renovation.
Efforts will be made to ensure long-term safety and security of road traffic by extending the service life of bridges that connect expressways with municipal roads. This will be completed, based on the periodic inspection of the bridges, using the planned implementation of “preventive maintenance, or early detection and early maintenance”.
Cost-saving and other measures will be carried out through efficient maintenance and through responsive management based on regional characteristics.

Medium- to long-term cost reduction through preventive maintenance





In order to shift to maintenance management based on preventive measures, and to reduce and equalize total costs over the medium to long term, it is urgent to take early countermeasures for facilities that require early or urgent action (evaluation categories III and IV).

Bridge inspection example

Collapsed slab due to fatigue

Deterioration due to salt damage

Deterioration due to an alkali aggregate reaction

History of maintenance activities for aging road

In the wake of Sanyo Shinkansen Tunnel Lining Concrete Collapse in 1999, the National Government established an inspection guideline along with various activities by road administrators. After Sasago Tunnel Ceiling Collapse in December 2012, the government amended the Road Act in 2013, prompting the 2014 Ministerial Ordinance which obligates road administrators to conduct close visual inspection once every 5 years.

History of the road asset management

2003: Recommendations for management and renewal of road structures
“Early preventive maintenance can reduce total cost”

2004: Notice of National Guideline for Periodic Bridge Inspection (for national road bridges)
Prescribes specific inspection procedures

2013: Called “The First Year of Infrastructure Maintenance Era”

2013: Amendment of the Road Act
Inspection standards were legislated with clear perspectives of preventive maintenance

2007: Break of diagonal truss of Kisogawa Ohashi Bridge over National Highway Not 23

Note: embeddedpart of diagonal truss in concrete

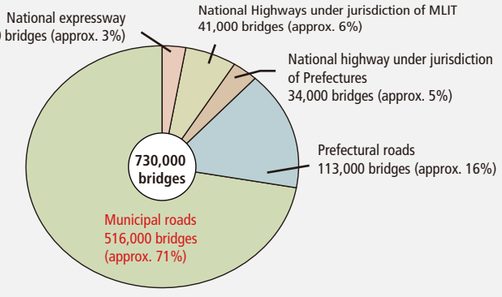
December 2, 2012:
Sasago Tunnel Ceiling Collapse

December 7, 2012:
Order of urgent inspection of road tunnel facilities
Jet fans, lighting and other

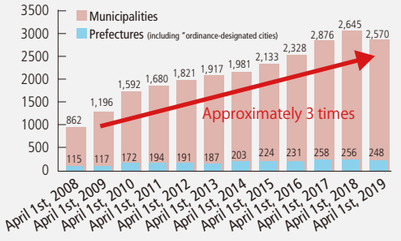
Current maintenance activities for aging roads activities

Of the 730,000 road bridges across Japan, 520,000 bridges, which account for 70% of all bridges, are situated on municipal roads. 10 years later, 57 % of all bridges are expected to be 50 years or older.
Deterioration is evident, especially in an infrastructure that was constructed in the short term, and other infrastructure that is in severe environments, such as under-water. Municipalities have increased traffic restrictions on their bridges in recent years.

Number of bridges by road type

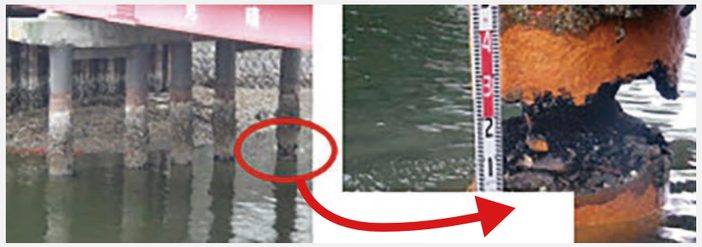


Increasing number of traffic restrictions on local roads



Source: Road Bureau (as of April 2019)
Note: the figure does not include some damaged areas from the Great East Japan Earthquake.

Serious damages on a bridge

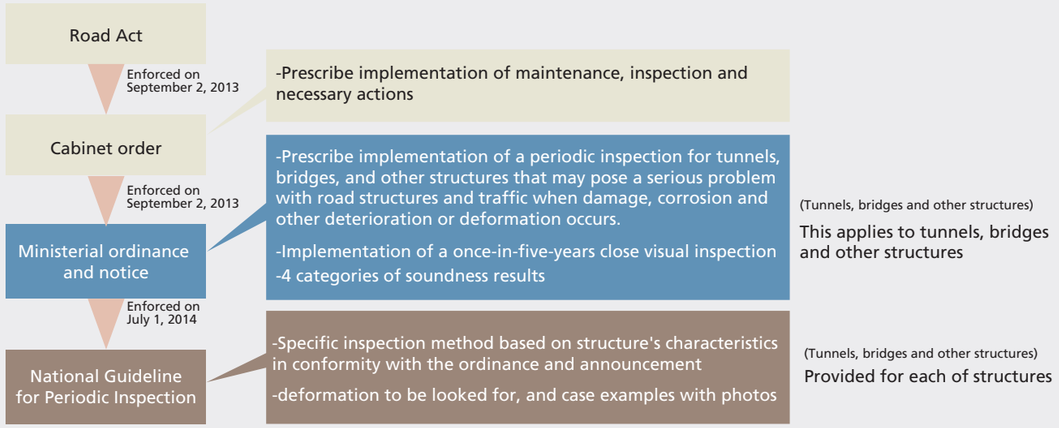


37-year old Miharashi Bridge (on Shinyamashita 8th municipal road) was found damaged.

Standards for statutory inspection

1. The ministerial ordinance and notice prescribes once-a-five-year close visual inspection and defines 4 categories of the soundness results (applied to tunnel, bridge and other structures).
2. Periodic Inspection Standard is established to provide specific procedures (by structure (e.g. tunnel, bridge))
3. The MLIT has developed a periodic inspection guideline containing bridge deformation to be looked for and case examples to technically assist municipalities to implement their inspections (by structure (e.g. tunnel, bridge)).

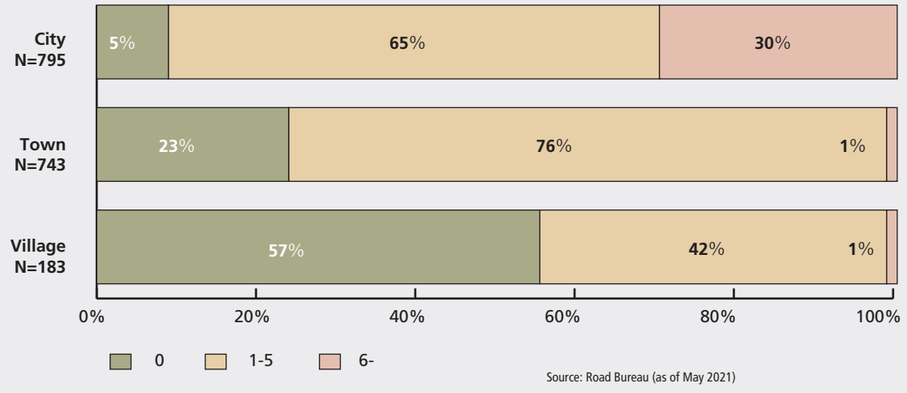
Legal system of the inspections



Maintenance by Municipalities (Technician and Inspection Method)

30% of towns and 60% of villages in the country have no civil engineering technicians for bridge maintenance in their workforce.

Number of bridge maintenance engineers in the workforce by types of municipal governments



Source: Road Bureau (as of May 2021)

Road Maintenance Panel

Through the Road Maintenance Panels, the National Government provides various technical supports to complement a shortage of human/technology resources of municipal governments. Road Maintenance Panels were launched in all prefectures in 2014 to facilitate cooperation with interested parties, to grasp and share the current issues, and to assist with promoting effective measures for aging roads.

Through "Road Maintenance Panel" the following activities are supported:

-Introduce an efficient procurement including area-wide lump sum ordering and multi-year contract for maintenance projects.

-Establish technical assistance system such as sending a "road maintenance specialist team", comprised of national government officials, to evaluate bridges of social importance or with complicated structure and record the results. This includes financial support from the national government.

-Utilize a new system that allows national government to immediately carry out technically-difficult maintenance work on behalf of a municipality.

-Combine or remove unnecessary bridges according to changing demands. For important bridges (e.g. bridges on expressways and other arterial road network and overpass of bullet train and other arterial railway network) or bridges in need of immediate repair, national government and expressway companies should carry out periodical inspections and repairs on behalf of municipalities.

-Provide a series of extensive training courses for municipal government officials and private business employees for better maintenance framework.

Composition of the Panel

Institutional framework

-Regional Development Bureau (under MLIT)

-Municipalities (prefectures, cities, towns and villages)

-Expressway Companies (NEXCOs, Tokyo Metropolitan Expressway, Hanshin Expressway, Honshu-Shikoku Bridge Road, designated urban expressways)

-Road Public Corporation

Roles

1. Facilitate training and presentation meetings for standards.
2. Facilitate training and presentation meetings for standards.
3. Organization, evaluation and publication of current inspection and repair work.
4. Assistance for area-wide lump sum ordering of inspection work
5. Technical assistance and other

Photo of the Panel (Nara Road Maintenance Panel on February 3, 2016)

New technologies and "InfraDoctor" (Infrastructure Doctor) Shutoko Engineering Company's Activities

*InfraDoctor, our service is provided in the cloud, in other words, in comfortable environment, accessible anytime, anywhere.

InfraDoctor is an innovative system, providing support to road structure maintenance through GIS (Geographical Information System) and 3D point cloud data. This can help achieve labor savings and advancing/streamlining inspection, repair and design work in the infrastructure maintenance. InfraDoctor has 3 main features:

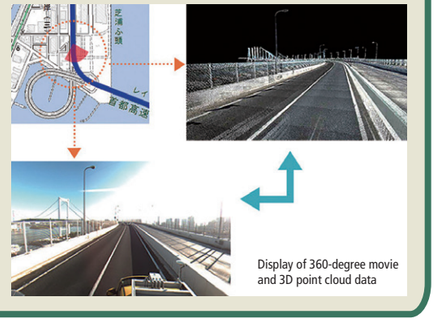
I. Basic features for GIS and 3D point cloud data

Advancing of road space examination feature and labor savings through use of 3D point cloud data

InfraDoctor provides an integrated management of 3D point cloud data and movies from laser scanner. With a replaying feature 360-degree movie and 3D dimension measurement feature, this allows operators to quickly understand the situation on site, realizing labor savings in infrastructure management.

Upgrading of road space examination feature and labor savings through use of 3D point cloud data

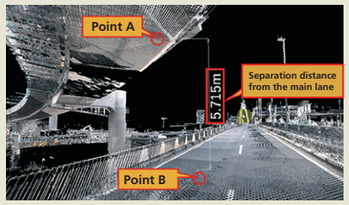
InfraDoctor displays 3D point cloud data and 360-degree movie in synchronization. Easy switching between these data enables to quickly understand the situation on site.



Display of 360-degree movie and 3D point cloud data

3D measurement

3D point cloud data has accurate 3D coordinate (X, Y, Z) for all points, allowing a distance measurement between any 2 points at your fingertips. This eliminates the need for traffic restriction at intersection which was previously necessary for measurement, a separation distance from railway facility and track closure which was necessary for checking clearance.



Dimension measurement between 2 points by point cloud data

Measurement of 3D point cloud data

3D point cloud data is obtained by Mobile Mapping System (MMS) equipped with laser scanner and cameras. For underneath the elevated road/track and side strips where MMS is not accessible, a fixed-type laser scanner is used for measurement.


Measurement by MMS

II. Management and search features for GIS records

Easy-to-use search system for management/inspection result records that meets needs of administrator]

InfraDoctor provides a customizable search system for management/inspection result records depending on the need of infrastructure administrator. This solution helps realize rational and efficient management.

Search system for various records for management

Maintenance and management work involves record data for structures, accessories, and underground utilities. InfraDoctor provides efficient management by associating record data with 3D point cloud data.

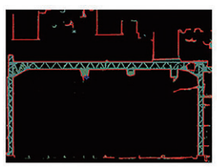
III. Further sophisticated management and advanced features

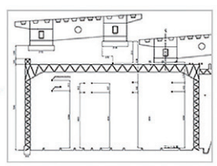
Further sophisticated infrastructure management through expanded features using GIS and 3D point cloud data

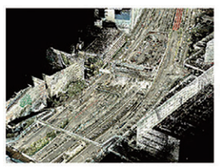
InfraDoctor provides various features, including drawing, deformation detection on pavement and walls, creation of traffic control plan drawing and 3D simulation, streamlining maintenance work through a good use of GIS and 3D point cloud data.

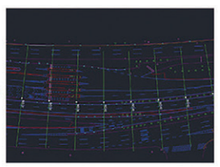
2D CAD drawing feature

InfraDoctor provides a semi-automatic feature of drawing floor plan/cross section from 3D point cloud data. InfraDoctor also provides a high measurement resolution with mm for cross section and sufficient resolution for a 500:1 scale floor plan.


Automatic contour extraction of 3D point cloud data

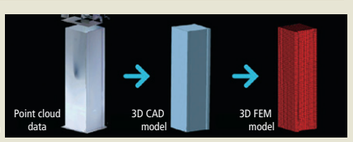

2D CAD drawing (cross section)


3D point cloud data


2D CAD drawing (floor plan)

3D CAD model drawing feature

InfraDoctor provides a semi-automatic feature of creating a 3D CAD model from 3D point cloud data that reflects the current condition of structure.

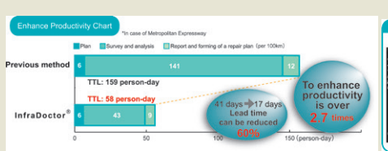


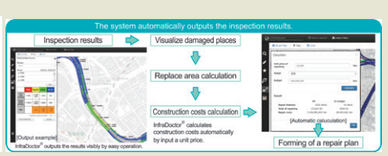
Creation of an FEM model from 3D point cloud data

Analysis of road surface deformation system

InfraDoctor provides a new road surface analysis from 3D point cloud data, displaying the inspection results automatically on the InfraDoctor system.

This feature enables us to make a repair plan easily by automatic cost estimation process and to enhance the efficiency of road maintenance work as a whole.





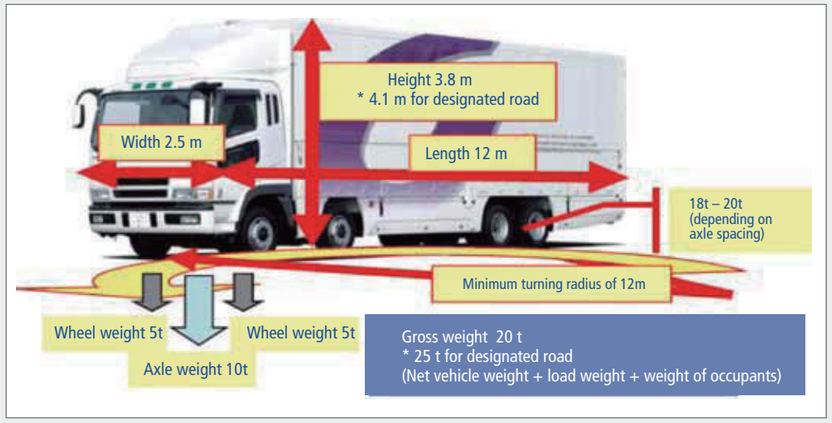
Road-related systems in Japan

Roads are designed to ensure safe and smooth traffic for vehicles with certain specifications. In principle, vehicles that do not meet size and weight requirements are not allowed to be on the road because they can potentially damage the roads and disrupt traffic.

However, road administrators are empowered to give permission to vehicles that exceed the size or weight regulation to use the road, only if the road administrator acknowledges that there are no alternatives after examining the vehicle's structural characteristics and the cargo. In these cases, the road administrator will require that the vehicle meets certain conditions in order to protect the road structure and prevent potential danger to other road users.

On general roads

General limit (upper limit) of vehicles according to Article 3.1, Vehicle Size and Weight Restrictions



Typical overweight or oversize vehicle types

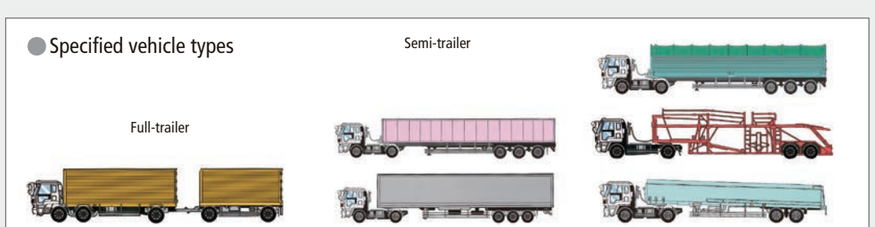
On expressways

Dimension and weight limits for specified vehicles on expressways are more lenient than the limits on general roads

combination vehicles	Length
Semi-trailer	16.5m
Full-trailer	18.0m

Distance from the foremost axle to the rearmost axle	8m or more	9m or more	10m or more	11m or more	12m or more	13m or more	14m or more	15m or more	15.5m or more
Gross weight	25t	26t	27t	29t	30t	32t	33t	35t	36t

Specified vehicle types



Approval system for transporting abnormal loads

Road administrators are authorized to permit the drivers of vehicles that exceed the size or weight limits to use the road, but only after the road administrator examines the vehicle's structure and cargo and determines that there are no alternatives. In these cases, the road administrator will put certain conditions in place to protect the roads and to prevent any potential danger to other road users. Road fatigue, which is caused by oversize or overweight vehicles, can have a significant impact on roads and pavement. In order to utilize our road stock effectively in the future, it is important to ensure the road structures are properly maintained.

Stopping unauthorized vehicles

1.Instructive enforcement
Drivers are told to pull over at "instruction stations", where vehicle weights and sizes are measured. If the vehicle exceeds the size or weight limits, the drivers are ordered or warned to reduce the weight and size of the vehicle by splitting the cargo.

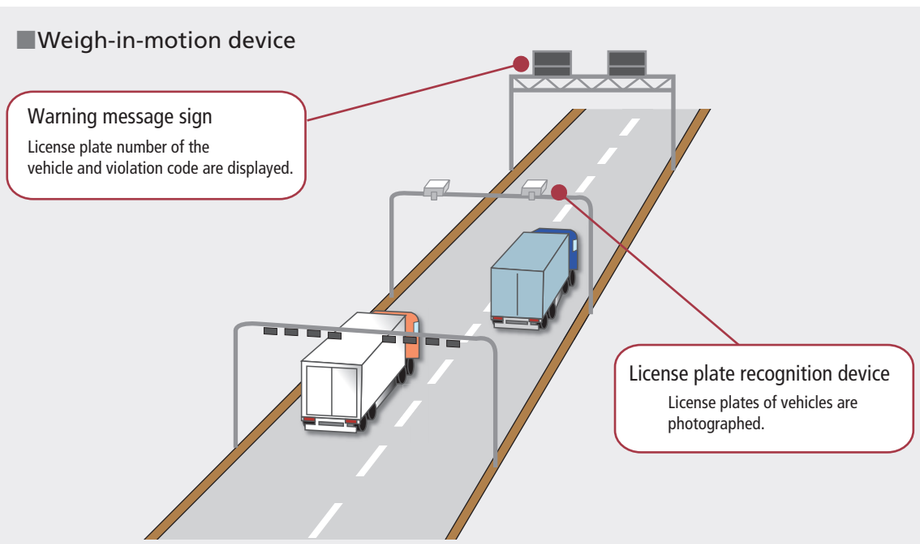
2. Weigh-in-motion (WIM)
A WIM device automatically measures a vehicle's gross weight. If the vehicle is over the weight limits, the WIM system then determines if the overweight vehicle has a permit by accessing the database. Based on the results, repeated violators will be given an instructive warning.

■Enforcing regulations

Instructive enforcement

License plate recognition device

■Weigh-in-motion device



Disaster Prevention

In order to secure safe and reliable road networks, construction of arterial high-standard highways, urban ring roads and other disaster-resistant roads has begun. Since roads are an important part of disaster relief, measures to respond to and reduce the damages of earthquakes, storms and heavy snows on roads are also being implemented.

Earthquake

The land area of Japan comprises only 0.25% of the world's total, but Japan experiences a large percentage of earthquakes. The probability of a large-scale earthquake, with a magnitude of 6.0 or more, is about 23%.

On March 11, 2011 a massive earthquake and the following giant tsunami caused an enormous amount of damage to the roads in Japan
(National Highway 6, Hirono-machi, Fukushima Prefecture)
(Photo: Tohoku Regional Development Bureau)

Heavy rain

Japan receives twice as much precipitation as the mean amount of precipitation in the rest of the world, especially during the heavy rain and typhoon seasons. Throughout the last decade, heavy rains have increased sharply, thereby increasing the risk of floods. The soft soil easily collapses during storms and is prone to sediment run-off, landslides and other sediment-related disasters.

Massive collapse from the top of the slope
Heavy rain in July 2020
(National highway 3, Ashikitamachi Kumamoto Prefecture)

Heavy snow

Since the Sea of Japan lies between Japan and the Asian continent, Japan receives heavy snows brought by prevailing winds from the continent in the winter, especially in areas closest to the sea. About 60% of the land is snowy and cold in the winter season, and approximately one-fifth of the population of Japan lives in this area. The population density in these snowy and cold areas is as high as 105 people per km^2, which far exceeds the density in other snowy countries.

In February 2014 there was a record-breaking heavy snow in the Kanto region.
(Japan Self-Defense Force clearing the snow on Route 20)
(Photo: Mainichi Shimbun)