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Japan is a country with beautiful natural scenery, which changes from season to season, but also has steep land formations, weak geological features and is prone to earthquakes, storms, heavy snowfall and other natural disasters. Traffic accident fatalities and casualties are also rising with traffic-related deaths of about 5,000 and traffic-related casualties reaching 900,000, signifying that one out of every 140 people is injured or dies in a traffic accident. Diverse measures are being implemented to prevent disasters and accidents; mitigate damages; enable quick restoration; improve the safety and security of road traffic; and create comfortable living environments.
Reducing Traffic Accidents

The number of traffic fatalities has decreased for 12 consecutive years, fell below 4,500 in 2012, but the number of traffic fatalities and injuries still exceeds 800,000. In particular, the ratios of senior citizen and pedestrian fatalities are higher than in Europe and the United States. Therefore, effective and efficient measures are being implemented to reduce traffic accidents on both arterial roads and community roads.

Changes in the number of traffic accidents, fatalities and injuries

Accident prevention measures on arterial roads

Because traffic accidents frequently occur in specific sections of arterial roads, 3,396 sections with a particularly high incidence of death or injury accidents were designated as high accident sections. Intensive measures for these sections are being conducted through the collaboration of prefectural Public Safety Commissions and road administrators.

Method for identifying road sections requiring Accident prevention measures

Accident occurrence on arterial roads

After sorting the sections in descending order according to the incidence of death or injury accidents, those which require priority implementation of measures are selected and specified as priority action sections.

Example of measures in high accident section

Vehicle lights
A schematic diagram of a safe-to-walk area

Accident prevention measures for community roads

Meticulous traffic accident measures are being conducted for community roads by establishing a problem solving cycle from problem identification and sorting to confirmation of project implementation benefits through collaboration with regional residents and related organizations.

Arterial road measures

Zone measures

Development of walking spaces

Development of sidewalks, bicycle roads, wide sidewalks, and shared pedestrian-vehicle roads and underground installation of electric cables

Route measures

Easing traffic at railroad crossings

A survey on the road traffic situation at roughly 36,000 railroad crossings all over Japan was conducted in 2006 and revealed that about 1,800 crossings urgently need measures for easing traffic congestion. Comprehensive and focused measures are being carried out on the crossings by combining immediate measures, such as widening pedestrian paths, and drastic measures, such as the implementation of grade separation.

Continuous grade separation project

The continuous grade separation project promotes integration of divided cities and smooths urban traffic flow by eliminating many crossings through the use of elevated or underground railways at road-rail intersections.
Creating a Comfortable Living Environment

Road construction and improvement projects are being implemented so that people can truly experience the improvements, such as safe and comfortable pedestrian spaces; high-quality living environments with roadside greening; running utility cables underground, etc.

Promoting universal design in pedestrian spaces

By 2012, barrier-free pedestrian paths will be increased to represent about 75% of all road segments interconnecting railway stations, government facilities, hospitals and the like, which are designated by the Minister of Land, Infrastructure, Transport and Tourism as road sections where a large number of elderly and disabled people normally travel on foot.

Eliminating utility poles

Utility poles are being eliminated to help secure safe and comfortable pedestrian spaces; create a visually enhanced landscape and living environment; prevent disasters; improve the reliability of telecommunications networks conserve historical townscapes; promote tourism, restore local culture; and revitalize local communities.

We will continue to promote the elimination of utility poles in the future by aggressively utilizing multiple methods that suit local situations such as a combined approach of widening roads projects in conjunction with the elimination of utility poles and wiring in spaces under or behind building eaves. We will additionally look to reduce costs.

Creating a safe and pleasant environment for cyclists riding

While bicycles play an important role in the urban transportation system as a convenient transportation method, infrastructure for cyclists is not yet sufficient and is resulting in an increase of bicycle accidents relative to the total number of traffic accidents.

To stop this trend, MLIT and the National Police Agency (NPA) cooperated to launch the “Committee for Creating a Safe & Comfortable Bicycle-Use Environment” in 2011. The Committee submitted the following proposal to MLIT and the NPA: “A Bicycle Environment that is Friendly to Everybody: Proposal for a Safe & Comfortable Bicycle-Use Environment.”

In response to the proposal, in November 2012, MLIT and the NPA jointly formulated, “Guideline for Creating a Safe & Comfortable Bicycle-Use Environment.”

Changes in the number of bicycle accidents classified according to the other party (last 5 years)

<table>
<thead>
<tr>
<th>Year</th>
<th>Other party (times)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>171,018</td>
</tr>
<tr>
<td>2008</td>
<td>141,345</td>
</tr>
<tr>
<td>2009</td>
<td>11,642</td>
</tr>
<tr>
<td>2010</td>
<td>11,016</td>
</tr>
<tr>
<td>2011</td>
<td>4,159</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Other party (times)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>156,405</td>
</tr>
<tr>
<td>2008</td>
<td>130,747</td>
</tr>
<tr>
<td>2009</td>
<td>9,973</td>
</tr>
<tr>
<td>2010</td>
<td>8,841</td>
</tr>
<tr>
<td>2011</td>
<td>3,611</td>
</tr>
</tbody>
</table>

Aiming to create advanced urban settings for bicycle usage

Development of cycling route networks

Construction of bicycle parking facilities

Collaboration with public transportation

Educating of people on bicycle riding rules and etiquette

Conceptual images of the initiative

Development and promotion of community bicycle programs

Accidents involving bicycles / Accidents with motor vehicles

Accidents involving bicycles / Accidents with other vehicles

All accidents involving bicycles / Accidents with motor vehicles

Note: “Accidents involving bicycles” means the first party or the second party is a bicyclist and accidents between two or more bicyclists are calculated as one instance.
Disaster Prevention

In order to secure safe and reliable road networks, high-standard arterial highways, urban ring roads and other disaster-resistant roads are being constructed. Measures against earthquakes, storms and heavy snows are also being implemented. Roads are an important infrastructure after a disaster has occurred.

Earthquake

The land area of Japan comprises only 0.25% of the world’s total, but Japan is one of the foremost countries to experience earthquakes, with the probability of a large-scale earthquake (magnitude of 6.0 or more) occurring at about 23%.

Heavy rain

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

Heavy snow

Because the Sea of Japan lies between Japan and the Asian continent, Japan receives heavy snows brought by prevailing winds from the continent in winter, especially in areas facing the Sea. About 60% of the land is snowy and cold, where about one-fifth of the total population live, causing the population density to be as high as 105 people per km², which far exceeds the values in other snowy countries.

Earthquake protection

To ensure a highly reliable road network that allows for fast and safe emergency activities during earthquakes, bridges are being retrofitted with earthquake protection.

Disaster prevention for roadside slopes

A number of measures are implemented to protect road traffic from heavy rain and heavy snow. These include, among others, disaster prevention work on roadside slopes and construction of roads that circumvent disaster-prone sections.

Protection of road transport in winter

Road transport in snowy cold regions in the wintertime is protected by efficient snow removal as well as proactive installation of avalanche and other snow protection facilities.
**ITS (Intelligent Transport Systems)**

In Japan, ITS (Intelligent Transport Systems) are steadily expanding with the popularization of ETC (Electronic Toll Collection System) and VICS (Vehicle Information and Communication System), and have effectively opened up traffic by providing real-time information; eliminating congestion at toll gates; and mitigating environmental impacts by differential toll discounts. ITS has now entered its second stage and is promoted in order to solve social issues. Installation of systems for collecting and providing information, which are the basis of ITS, is promoted and systems are being developed whereby drivers can enjoy diverse services via a single ITS on-board unit.

**ETC (Electronic Toll Collection System)**

Since it went into service in March 2001, ETC users have been rapidly increasing in number with the quick popularization of ETC on-board units. At the end of March 2011, there were about 34.24 million ETC-equipped vehicles. ETC users now account for 86.2% of all vehicles on expressways in Japan. The system has effectively eliminated congestion at toll gates. By allowing drivers to pass through toll gates without having to stop, ETC improves the processing capability of toll gates, eliminating congestion that would otherwise occur there. ETC communication technology is also used by private operators for non-stop passage through parking gates and ferry boarding, among others.

**VICS (Vehicle Information and Communication System)**

VICS transmits road traffic data, such as congestion and traffic restrictions on a real-time basis, to onboard vehicle navigation units and displays data in the form of text, simple graphics and maps. The service started in Japan in April 1996, earlier than anywhere else in the world. VICS delivers information using three types of media: FM multiplex broadcasting, a radio wave beacon and an infrared beacon.

At the end of March 2011, over 30.13 million vehicles were equipped with VICS compatible onboard units. VICS’s best route guidance rectifies traffic flow and improves mileage, which in turn reduces CO2 emissions and environmental impacts. A target of the Kyoto Protocol Goal Achievement Plan is to reduce CO2 emissions by approximately 2.5 million tons (approximately 30% of all road related policy measures) by FY 2012, through the popularization of VICS.

**Changes in number of vehicles equipped with ETC on-board unit and percentage of ETC use**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number (Cumulative total)</th>
<th>Percentage of ETC use</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>1,000</td>
<td>6.1%</td>
</tr>
<tr>
<td>2002</td>
<td>1,400</td>
<td>19.8%</td>
</tr>
<tr>
<td>2003</td>
<td>1,800</td>
<td>36.2%</td>
</tr>
<tr>
<td>2004</td>
<td>2,200</td>
<td>54.2%</td>
</tr>
<tr>
<td>2005</td>
<td>2,600</td>
<td>72.6%</td>
</tr>
<tr>
<td>2006</td>
<td>3,000</td>
<td>81.3%</td>
</tr>
<tr>
<td>2007</td>
<td>3,400</td>
<td>88.4%</td>
</tr>
<tr>
<td>2008</td>
<td>3,800</td>
<td>93.1%</td>
</tr>
<tr>
<td>2009</td>
<td>4,200</td>
<td>95.7%</td>
</tr>
<tr>
<td>2010</td>
<td>4,600</td>
<td>98.1%</td>
</tr>
<tr>
<td>2011</td>
<td>5,000</td>
<td>98.8%</td>
</tr>
</tbody>
</table>

Source: Survey by the Organization for Road System Enhancement

**Congestion reduction effect of spreading ETC use on Metropolitan Expressway**

<table>
<thead>
<tr>
<th>Year</th>
<th>Congestion (km/h)</th>
<th>Percentage of ETC use</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>25.3</td>
<td>3.6%</td>
</tr>
<tr>
<td>2003</td>
<td>21.1</td>
<td>4.5%</td>
</tr>
<tr>
<td>2004</td>
<td>17.8</td>
<td>5.0%</td>
</tr>
<tr>
<td>2005</td>
<td>15.1</td>
<td>5.6%</td>
</tr>
<tr>
<td>2006</td>
<td>13.8</td>
<td>6.1%</td>
</tr>
<tr>
<td>2007</td>
<td>12.6</td>
<td>6.6%</td>
</tr>
<tr>
<td>2008</td>
<td>11.5</td>
<td>7.1%</td>
</tr>
<tr>
<td>2009</td>
<td>10.5</td>
<td>7.6%</td>
</tr>
<tr>
<td>2010</td>
<td>9.6</td>
<td>8.1%</td>
</tr>
<tr>
<td>2011</td>
<td>8.8</td>
<td>8.6%</td>
</tr>
</tbody>
</table>

Source: Metropolitan Expressway data

**Mechanism of VICS information**

- Prefectural police headquarters
- Japan Road Traffic Information Center
- VICS Center
- FM multiplex broadcasting
- Road administrator
- Traffic information

**Radio wave beacon located on an expressway**

- Left lane: Single lane
- Right lane: Left lane + passing lane

**Infrared beacon located on a major general road**

- Left lane: Single lane

**Text (Level 1) Simple graphics (Level 2) Map (Level 3)**

Source: Vehicle Information and Communication System Center

**Simplified ferry boarding procedure**

- Automated parking lot payment
- Simplified ferry boarding procedure
Deployment of Multiple Applications via Smartway

“Smartway” is a next-generation road traffic system incorporating ITS technologies that provide information to connect people, vehicles and roads with the primary aim of ensuring traffic safety, reducing traffic congestion, and protecting the environment. To make it a reality, industry, government and academia have been working together in research, development and demonstration testing. Services such as VICS and ETC are now provided by separate onboard units, but these services will be available using a single (ITS) onboard unit. Furthermore, aims are to build an “Open Platform” that develops wider services including account settlement, sightseeing, logistics, etc., in addition to providing a wide-range of road traffic information, safe driving support information and so on.

Characteristics of smartway

Central to the communication functions of Smartway is 5.8 GHz DSRC (Dedicated Short Range Communication), an international standard adopted by ISO (International Organization for Standardization) and ITU (International Telecommunication Union) that enables high speed, high volume, two-way communication. DSRC will make various services available by using the roadside “ITS spots” and a “compatible in-vehicle car navigation system.”

Expanding ITS spot services throughout Japan

ITS spot services are available in about 1,600 places, centered on expressways in Japan, as of August 2011. With intercity expressways, an ITS spot is installed about every 10 to 15 km, including about 90 locations before each junction, while with urban expressways, a spot is installed about every 4 km.

<table>
<thead>
<tr>
<th>Locations of ITS spots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osaka</td>
</tr>
<tr>
<td>Tokyo</td>
</tr>
</tbody>
</table>

ITS spot services consist of three basic services that are made available as an all-in-one system by high speed, high volume road-to-vehicle communications.

1. Wide-Range Road Traffic Information
   By transmitting road traffic information in real-time, car navigation systems can search a wide-area of expressways that cross prefectural borders, urban expressways and other roads, and select the fastest route based on the latest information.

2. Safe Driving Support
   ITS spots provide a wide range of road traffic information on a regular basis, including traffic safety issues for specific roads. In emergencies, they provide information that supports safe driving.

3. ETC
   ITS spot services utilize the same technologies as ETC, therefore existing ETC services can be enjoyed with a compatible car navigation system.

4. Other services
   With some car navigation systems, information on tourist sites and updated maps are provided over the internet.

Enhanced services for ITS spots

Because ITS spots are being built as an open platform where the public and private sectors can work together to provide diverse services, plans are to develop a wide variety of services, i.e., cashless bill payment for parking areas, logistics support, and so forth.

Moreover, it is possible to acquire probe information (actual travel distance and speed of the vehicle) from ITS spots, therefore plans are to use this information for road construction, road policy planning and assessing instituted measures.
Environmental Measures

Projects are being executed to improve roadside environments and roadside areas quickly. In order to prevent global warming, the transport industry must urgently deploy measures to reduce CO2 emissions from vehicles, which account for a large percentage of total emissions.

Protecting and creating roadside environments

Roadside environmental measures are being deployed to achieve environmental quality standards on noise and air pollution. Measures to control the heat-island phenomenon in cities are also being actively researched and developed.

Implementation of road measures that contribute to reduced CO2 emissions

According to Japan’s Kyoto Protocol Target Achievement Plan, reduction targets are decided for each sector. By FY2010 the transportation sector needs to reduce emissions by 14-17 million tons from the actual emission level of FY2005. Since the increased traveling speed resulting from smooth traffic flow improves effective mileage and thus reduces CO2 emissions from vehicles, traffic flow improvement measures are under way, including improvement of ring road and arterial road networks, grade separation of intersections, as well as the development of the cycling environments and the advancement of ITS.

Consistent road construction programs in post-World War II Japan have created a certain stock of roads. In a more mature society, it will be important to shift to road administration that focuses on the outcomes of road services and satisfies road users. The project management approach has been used to ensure accountability to the public, as well as effective and efficient road administration.
Administrative Management

Results-oriented road administration management has been promoted to achieve a shift toward more effective, efficient and transparent road administration from the viewpoint of citizens. Today, efforts are under way to enhance road administrative management jointly with regional public corporations, NPOs and other citizens’ groups.

Establishing a well organized evaluation system

Road administration management is currently conducted according to the PDCA cycle, whereby policy goals are set by using citizen-oriented performance (outcome) indicators (Plan); policy measures and projects are executed (Do); results are analyzed and achievements evaluated (Check); and the results are reflected in subsequent administrative activities (Action).

Target and past performance measured by Key Performance Indicators (KPIs) specified in the Priority Social Infrastructure Development Plan

<table>
<thead>
<tr>
<th>Objective</th>
<th>Measure</th>
<th>KPI</th>
<th>Actual performance</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Reduce disaster risk on a large scale in rural areas</td>
<td>Number of quake-resistant bridges on emergency routes (percentage)</td>
<td>77% (as of the end of FY2012)</td>
<td>79% (as of the end of FY2017)</td>
<td>82%</td>
</tr>
<tr>
<td></td>
<td>Number of power lines on arterial roads in urban areas that are buried in the ground (percentage)</td>
<td>15%</td>
<td>15.3%</td>
<td>18%</td>
</tr>
<tr>
<td>1-2. Protect measures in region-wide landslide-prone areas and improve the production of areas below sea level, which either have a large population or a significant number of assets, from high tide</td>
<td>Number of power lines on arterial roads in urban areas that are buried in the ground (percentage)</td>
<td>46% (as of the end of FY2012)</td>
<td>47% (as of the end of FY2017)</td>
<td>About 50%</td>
</tr>
<tr>
<td></td>
<td>Number of improved slopes and embankments that were in need of protection (percentage)</td>
<td>56% (as of the end of FY2012)</td>
<td>56% (as of the end of FY2017)</td>
<td>68%</td>
</tr>
<tr>
<td>2. Enhance traffic infrastructure across the country (formality and the importance to local communities)</td>
<td>Length of ring roads in operation in the three largest metropolitan areas (percentage)</td>
<td>59%</td>
<td>58%</td>
<td>About 75%</td>
</tr>
<tr>
<td>2-1. Expand and enhance capacity and accessibility of internationally competitive large cities, ports, and airports and promote overseas projects through public-private cooperation</td>
<td>Number of power lines on arterial roads in urban areas that are buried in the ground (percentage)</td>
<td>15%</td>
<td>15.3%</td>
<td>18%</td>
</tr>
<tr>
<td></td>
<td>Number of road links that provide a fast connection between major cities</td>
<td>77%</td>
<td>79%</td>
<td>82%</td>
</tr>
<tr>
<td>2-2. Enhance and enhance dynamism by stressing the unique strengths and charms of each area</td>
<td>Number of power lines on arterial roads in urban areas that are buried in the ground (percentage)</td>
<td>46%</td>
<td>47%</td>
<td>About 50%</td>
</tr>
<tr>
<td></td>
<td>Number of road links that provide a fast connection between major cities</td>
<td>77%</td>
<td>79%</td>
<td>82%</td>
</tr>
<tr>
<td>3. Achieve a sustainable and efficient traffic system and regional communities</td>
<td>Time lost due to railroad crossings that are closed all the time</td>
<td>1.28 million person-time/day</td>
<td>1.24 million person-time/day</td>
<td>1.21 million person-time/day</td>
</tr>
<tr>
<td>3-1. Create a model for a sustainable and energy-efficient lifestyle and encourage the diffusion of this lifestyle domestically and internationally</td>
<td>Percentage of specified roads with barrier-free elements</td>
<td>77%</td>
<td>81%</td>
<td>About 100% (as of the end of FY2012)</td>
</tr>
<tr>
<td></td>
<td>Number of power lines on arterial roads in urban areas that are buried in the ground (percentage)</td>
<td>15%</td>
<td>15.3%</td>
<td>18%</td>
</tr>
<tr>
<td>3-2. Build a stable and secure society in this era of aging population, which correlates with a declining number of children</td>
<td>Number of prevented road traffic accidents at school-prone locations (percentage)</td>
<td>-</td>
<td>-</td>
<td>About 50% of potential accidents were prevented</td>
</tr>
<tr>
<td></td>
<td>Length of sidewalks provided for school roads (percentage)</td>
<td>51% (as of the end of FY2012)</td>
<td>52% (as of the end of FY2017)</td>
<td>About 65%</td>
</tr>
<tr>
<td>4. Maintain, manage, and reconstruct social infrastructure in a proper manner</td>
<td>Number of plans for extending road bridges for cross the country (percentage)</td>
<td>70%</td>
<td>89%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Effective implementation of projects by selection and concentration

In order to effectively implement each project, data analysis is conducted for each policy issue to clearly select sites and sections especially in need of concentrated countermeasures. Road administration becomes more effective, efficient and transparent through consultation with the general public at each stage (P, D, A, C) so that, for example, regional needs and challenges can be understood and confirmation of whether selected sites are meeting the requirements of daily life can be made.

Road administration management that collaborates with general public
Road Development

This section describes how our road project is evaluated in order to achieve accountability.

Evaluation system implemented

Project evaluation is implemented for the entire process, from preparation, to execution and servicing, in order to improve efficiency and transparency. The first evaluation is conducted when planning a new project and involves cost-benefit analysis. Projects that are not completed in five years after their start are reassessed, and those that are found to be insufficiently effective are discontinued or cancelled. Projects are also assessed when they are completed.

In order to evaluate the sustainability of a project, it should be assessed in terms of economy, environment and social effects. Economic and environmental impacts are already being assessed through cost-benefit analyses and environmental assessments, respectively.

Procedure of road development project

- Measurement of road traffic volume
- Understanding road traffic condition
- Road development plan
- Identify comparison route
- Comparative review
- Decision of sketch plan
- Establishment of city plan
- Commencement of development
- In-situ survey
- Detail design
- Pile installation for right of way
- Purchase of land
- Construction
- Open to public
- Management

Policy goals assessments for road projects

To enhance the transparency and efficiency of road projects, reviews have been introduced into the planning stage of bypass, road widening and other projects, and "results-oriented management" practices that are based on data have been introduced for local projects.

Flow of planning review and results-oriented management

Project that seriously impacts traffic flow (Bypass, road widening, etc.)

- Identification of urban/regional issues
  - Analysis of causes
  - Defining of policy goals
  - Comparison and assessment of proposed measures
  - Selection of measures to implement

Environmental impact assessment, urban planning

- Bypass, road widening, etc.
- Other projects, measures (Intersection improvement, etc.)

Local projects (Traffic safety, disaster preparedness, etc.)

- Identification of local issues
  - Analysis of causes
  - Defining of policy goals
  - Comparison and assessment of proposed measures
  - Selection of measures to implement

Results-oriented management (New)

- Identification and announcement of areas requiring attention (List)
- Analysis of causes, measures proposal
- Selection of measures to implement

Chapter 2 Improving Performance and Service
Planning of road development

Measurement of road traffic volume
- Covers vehicles, bicycles and pedestrians for the purposes of:
  1. Traffic volume
  2. Origin and destination
  3. Condition of road development

Assessment of road and traffic condition
- Assess the current condition such as traffic volume and traffic safety of the existing roads.

Road development plan
- Determine the road type and plan the fundamental structure (lane number and cross-section)

Identify comparison route
- Identify multiple routes for comparison in the light of the plan.

Comparative review
- Make a comparison with other routes with respect to nature, structure, care for control-points* and economy before deciding the optimal route.

Decision of sketch plan
- Identify multiple routes for comparison in the light of the plan.

*Control point: a spot where a route should avoid because of its societal condition such as shrines and temples or landslide-prone areas.

Implementation of road project

Decision of City Plan
- Explain measurement to the parties involved

Comencement of development
- Install plan for center mark (red) during the land survey

Explanatory meeting
- Designed based on the survey data (S=1/1,000)

In-situ survey
- Explanation of details to the parties involved using the design together with indemnity for land loss

Detail design
- Installed piles to mark right of way (in yellow)

Consultation with the local
- Measurement of properties of lands and buildings (owners are asked for their presence for confirmation)

Pile installation for right of way
- Negotiation with the parties involved on the indemnity for land loss

Measurement of lands
- Payment of indemnity for land loss following conclusion of agreement

Land acquisition negotiation
- Further survey of buried cultural properties is to be conducted as necessary

Explanation of construction plan
- Roads are constructed with utmost caution not to disturb the surrounding areas

Construction
- Roads are open to pedestrians and vehicles after completion of construction

Completion/open to public
- Roads are open to pedestrians and vehicles after completion of construction

Maintenance/management
Environmental Impact Assessment (EIA)

An assessment system in which a project proponent itself identifies/predicts/evaluates the potential impacts of the project on the environment prior to decision being made on the details. This collected information is open to the public and municipalities for their inputs to create an improved project.

- Class 1: A large-sized project with potentially significant environmental impacts
- Class 2: A large-sized project that requires an assessment to determine whether it has significant environmental impacts.

<table>
<thead>
<tr>
<th>Road projects to be assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Expressway</td>
</tr>
<tr>
<td>All</td>
</tr>
<tr>
<td>Tokyo Metropolitan Expressway</td>
</tr>
<tr>
<td>4 lanes or more</td>
</tr>
<tr>
<td>National Highway</td>
</tr>
<tr>
<td>4 lanes or more, 10km or longer Length between 7.5km and 10km</td>
</tr>
<tr>
<td>National Highway</td>
</tr>
<tr>
<td>2 lanes or more, 20km or longer Length between 15km and 20km</td>
</tr>
</tbody>
</table>

Road Projects to be assessed

Document on primary environmental impact consideration

Planning

Class-2 project

Class-1 project

No assessment required

Outline of the project

Screening

Screening process to decide whether the project qualifies for a more detailed EIA.

Periodic assessment during project

Within 5 years after completion

Start of Construction

Project Selection

Pre-project assessment for project approval

Post-project evaluation

Pre-project assessment for project approval

Project assessment including a cost-benefit analysis is conducted when approving a new project. This procedure was introduced in FY 1998.

Total: 1,458 projects

(No pertinent project in FY2009)

Periodic assessment during project

When a project has not started for 3 years after approval or when a project is still in progress for 5 years, another assessment will be conducted and any necessary improvements will be made. If the continuation of the project is found to be inappropriate, it will be abandoned. This procedure was introduced in FY 1998.

Total: 3,397 projects

Of which reviewed projects:

- FY2009: 102 projects
- Of which reviewed projects: 4
terminated projects: 0

Post-project evaluation

Post-Project evaluation is carried out in order to confirm its effectiveness and environmental impacts. As necessary, improvements and appropriate planning and researching for similar projects are examined. This procedure was introduced in FY 2003.

Total: 217 projects

(FY2009: 29 projects)

Oversight of an outsider

Independent Committee on Oversight of Project Evaluation is formed by each local office and public body for Periodic Assessment during Project and Postproject Evaluation

Chapter 2: Improving Performance and Service
Two-way Communication

Road users present increasingly complicated and diversified needs for the road administration. Interactive communication between users and road administrators is promoted to provide appropriate services. Strategies are being implemented to better understand the needs of users and to provide substantial services that respond to their needs.

Substantial systems for responding to the diverse needs of users

Road counseling and road telephone services are used to collect information about roads from users, which then serve as a reference when revising road policies. In addition, efforts are being made to constructively introduce various monitors and incorporate opinions from users before implementing road policies.

Substantial road services by collaborating with NPOs and local communities

Groups involved in volunteer support programs, under agreements with road administrators and municipal governments, are steadily increasing and there are 2,258 groups working in many parts of Japan since the end of March 2011. Main activities include cleaning road sides; weeding, planting and growing flowers; as well as snow removal and information provision. Road administrators provide groups with cleaning tools and garbage bags to support their volunteer activities.

Roadside rest areas (Michi-no-eki)

Roadside rest areas, called Michi-no-eki, are being constructed on national highways to provide users with three amenities, i.e., parking areas, restrooms, as well as road and regional information outlets and serve as community centers for residents. Currently, 970 rest areas have been constructed in all parts of Japan (as of March 2011). Michi-no-eki are being built with emergency facilities so that the rest areas can serve as a staging ground for disaster-relief activities and evacuation centers. Information provision at rest areas is being enhanced to improve and increase services. Michi-no-eki are also expected to revitalize regional economies by serving as a base for tourists visiting nearby natural, historic and cultural sites.
Asset Management

A great deal of Japan’s infrastructure was constructed during the postwar rehabilitation period and the subsequent period of rapid economic growth in the 1950s to 1970s. As the Japanese society and its economy have matured, today’s concern is to extend the use of accumulated capital stocks in order to cope with a decreasing birthrate, aging population and 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 damage and deterioration of structures; to extend their life by extending the time until renovations are needed and reducing the total costs of maintenance and renovation.

Efficient management of road assets

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

Number of newly constructed bridges

<table>
<thead>
<tr>
<th>(bridges)</th>
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<tbody>
<tr>
<td>14,000</td>
</tr>
<tr>
<td>12,000</td>
</tr>
<tr>
<td>10,000</td>
</tr>
<tr>
<td>8,000</td>
</tr>
<tr>
<td>6,000</td>
</tr>
<tr>
<td>4,000</td>
</tr>
<tr>
<td>2,000</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

Source: Survey of current road infrastructure conditions (data as of April 2013)

Percentage of bridges older than 50 years

The number of bridges aged 50 years or above, which is a yardstick of aging, will account for 43% of all bridges in ten years and 67% in 20 years.

Schematic diagram of the effects of preventive repairing (comparison of total unit cost)

- Reduction in cost per year
- Extending life
- The bridge is appropriately maintained and repaired
- Advanced corrosion of bars means that the bridge needs to be rebuilt
- Conventional management method
- Appropriate management (estimated value)
- Delay in implementing measures
- Total unit cost
- Conventional
- Appropriate

Bridge inspection example

Collapsed slab due to fatigue

Deterioration due to salt damage

Deterioration due to an alkali aggregate reaction

Flow of the system

Current soundness

Future soundness

Time of repairing

Amount of repairs

Cost of repairs

Medium to long-term management plan

Flow of the system

Database

Deterioration curve
- Salt damage
- Fatigue in reinforced concrete slab
- Deterioration of coating

Cycle of renovation (Supports and expansion joints)

Standard unit cost of repairs

Long-term repair plan

Drawing up a long-term (20 years) repair plan

Short-term repair plan

Drawing up a short-term repair plan

Conventional management method

Appropriate management (estimated value)
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 road’s structure or disrupt traffic. However, road administrators are empowered to give permission to the vehicles that exceed the size or weight regulations to use the road, but only if the road administrator acknowledges that there are no alternatives after examining the vehicle’s structure and the cargo. In these cases, the road administrator will put certain conditions in place to protect the road structure and prevent potential dangers to road users.

**Roads in Japan**

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

- **On general roads**
  - Length: 26.5m
  - Height: 3.8m (4.1m for designated roads)
  - Width: 2.5m
  - Minimum turning radius of 12m

- **On expressways**
  - Length: 26.5m
  - Height: 3.8m
  - Width: 2.5m

- **Specified vehicles**
  - Length: 8m, 9m, 10m or more
  - Gross weight: 25t, 26t, 27t, 28t, 29t, 30t, 31t, 32t, 33t, 34t, 35t, 36t, 37t

- **Typical special vehicles**
  - Van type
  - Tank type
  - Carrier car type
  - Heavy cargo carrying type
  - Truck crane type

- **Wheel weight**
  - 5t

- **Axle weight**
  - 10t

- **Greatest axle distance**
  - 8m or more
  - 9m or more
  - 10m or more
  - 11m or more
  - 12m or more

- **Gross weight**
  - 25t
  - 26t
  - 27t
  - 28t
  - 29t
  - 30t
  - 31t
  - 32t
  - 33t
  - 34t
  - 35t
  - 36t

Approval system for the use of special vehicles on roads

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

**Controlling illegal 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 regulation, 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 as the vehicle drive over a measurement site. If the vehicle is over the weight regulations, it 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.
Efficient Operation of the Road Network

Traffic is controlled 24 hours a day to ensure efficient operation and to provide safe, smooth and comfortable traffic flow. Diverse kinds of road information are collected, accumulated, analyzed and provided to road users.

Collecting information

Vehicle detectors, TV cameras, meteorological observation apparatuses and other sensors are installed along roads to quickly collect correct information on traffic congestion, stationary vehicles, and accidents. During disaster events, patrol cars and vehicles equipped with satellite communication systems rush to the site and collect information. Today, efficient methods are used to identify congestion-prone points, such as the use of GPS equipped probe cars, VICS data and other ITS technologies, in cooperation with police departments, instead of the conventional method of conducting field surveys at major intersections.

**Collecting data using probe cars; processing, accumulation and utilization of data collected**

- **Collecting data**
  - Buses, taxis, trucks, general vehicles, etc.
  - Location, speed, etc.
- **Processing and accumulating data**
  - Calculating sectional traveling time from positional data
  - Combining with traffic volume data
- **Performance monitoring center**
  - Utilization for advanced road management
  - Before the project
  - After the project

Information collected by on-road sensors is transmitted to traffic control centers and analyzed. Information on traffic congestion, accidents and traffic regulations is quickly and properly transmitted for use via roadside light information boards, VICS and the Internet.

**Traffic control center**

**Providing road information**

- Displaying congested road sections on an information board
- Warning of tunnel congestion, using an information board
- Displaying congested sections and the time required to traverse these
- Car radio
- Providing information to VICS-compatible car navigation units
- Displaying traffic congestion information on large displays at Service Areas and Parking Areas
- Providing information via the Internet

**Accumulating, analyzing and providing information**

Utilization for advanced road management

- Policy assessment
- Project assessment
- Traffic census
- Work plan support
- Advanced road management, etc.

Losses caused by traffic congestion are calculated and published every year.

**Losses caused by traffic congestion in each prefecture (2001)**

- Before the project
- After the project
Chapter 3

Advanced Road Technologies

The islands of Japan stretch out long and thin from north to south with a backbone of steep mountains rising to elevations of 2,000 to 3,000 m. As about 70% of the land is mountainous, roads must be constructed on the narrow strips of land between steep slopes and the sea, along rivers winding between mountains, and through tunnels. Tunnels are increasingly used when constructing roads in highly populated areas of cities due to the shortage of land and to protect the environment.

Kan-etsu Tunnel (Kan-etsu Expressway)

The Kan-etsu Tunnel passes through steep mountains with a maximum depth of 1,100 m from a mountain top. The 11 km long tunnel is the longest highway tunnel in Japan and the fifth-longest in the world. Of its four lanes, the outbound lanes were opened in 1985 and the inbound lanes were completed in 1991.

Yamate Tunnel

The Central Circular Shinjuku Route of the Metropolitan Expressway connects Shibuya, Shinjuku and Ikebukuro, which are major sub-centers of Tokyo. Two tunnels account for most of its 11 km length, one for the inbound lanes and the other for the outbound lanes. The tunnels were completed in 2010.

Shield machine

The shield machine cuts the ground with the cutter face in the front, assembles segments inside the machine, and advances through the ground by constructing the tunnel behind. Advanced robotic technologies are used, with a computer controlling the series of tunneling work.
Bridges

Japan consists of four major islands of Hokkaido, Honshu, Kyushu and Shikoku and a number of small islands. Straits and inland seas hinder the traffic between islands. For well-balanced development of the nation, new transportation axes are needed, and bridges connecting islands have been constructed. Japan is also highly prone to earthquakes, typhoons and strong winds, so cutting-edge technologies are used for constructing and maintaining long-span bridges that can withstand such severe natural conditions.

Honshu-Shikoku Expressway

The Honshu-Shikoku Expressway, which was completed in 1999 and connects the main island of Honshu with the island of Shikoku, has three routes; the Kobe-Naruto route (the Kobe Naruto Expressway), the Kojima-Sakaide route (the Seto-Chuo Expressway and the JR Seto-Ohashi line), the Onomichi-Imabari route (the Nishi-Seto Expressway). Control length of these roads is approximately 173 km. The center span of the Akashi Kaikyo Bridge is 1,991m; the longest in the world, and the height of the main tower is approximately 300m above sea level.

Tokyo Bay Aqua-line Expressway

Of the 15.1 km of the Tokyo Bay Aqua-line Expressway across Tokyo Bay, which was completed in 1997, about 10 km is a tunnel under the ocean and the remaining 5 km is a bridge (Aqua Bridge). A ventilation tower (“Kaze-no-to”) is the longest in the world, and the height of the main tower is approximately 300m above sea level.

A manmade island “Umihotaru” and the Aqua-line Bridge

Pavement

In 1955, the paved road ratio of national highways in Japan was less than 14%. The ratio increased sharply thereafter as motorization progressed rapidly, reaching 57% in 1965, 79% in 1975, and over 90% today. Various paving technologies have been researched and developed since roads in Japan are subjected to large seasonal temperature differences and heavy rainfall. Technologies are also being developed to address an aging society and environmental issues.

Drainage and low-noise pavement

The surface is more porous than ordinary pavement, allowing water to seep down through it. The water passes through the pavement and flows along an inclined impermeable course, and is then discharged to side gutters. The pavement drains well, remains non-slippery on the surface even on rainy days, controls spray, and ensures good visibility. The porosity also suppresses the noise generated by tires and traffic.

Water-retaining pavement

Water is retained in the pavement and the road temperature is lowered by the heat of water evaporation. Diverse technologies have been proposed, such as injecting water-retaining materials like polymers into the voids of asphalt mixtures, from which rain water and underground water slowly evaporate.

Heat-insulating pavement

Special paint is applied on the pavement surface to reflect infrared rays from the sun and thus reduce the heat which accumulates in the pavement. The paint controls the rise in surface temperature of pavement and improves the thermal environment for pedestrians and road-side areas, helping to mitigate the heat-island phenomenon.
Road Administration in Japan

Chapter 4

Type of Road

This chapter describes road types which are administrated differently by national government, prefectural government, municipal government and expressway companies. It also explains how their development/improvement and maintenance/repair costs are secured along with their governing acts.

What is a “Road” from a Legal Perspective?

"Road" in Road Act

Road Act

Article 2 In this Act, “Road” is defined as a thoroughfare that is open to public use and is classified according to the following types.

Article 3 Road Types

1) National Expressways*1
2) National Highways*2
3) Prefectural Roads*3
4) Municipal Roads*4

Definition:

*1: National Expressways form the strategic traffic network for automobiles across the country and connects the areas of political/economical/cultural importance or with a critical influence on national interest. (Article 4 of the National Expressway Act)

*2: Together with National Expressways, National Highways form the strategic road network and meet legal requirements (Article 5 of the Road Act)

*3: Prefectural Roads form the regional arterial road network and meet legal requirements (Article 7 of the Road Act)

*4: Municipal Roads serve within a municipal jurisdiction. (Article 8 of the Road Act)
### Burden sharing of road development projects

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Road Administrator</th>
<th>Burden is carried by</th>
<th>Burden Sharing</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Expressway</td>
<td>Toll</td>
<td>Expressway Companies (NEXCOs)</td>
<td>Development/improvement</td>
</tr>
<tr>
<td>National Expressway</td>
<td>Under jurisdiction of MLIT</td>
<td>National Gov.</td>
<td>Maintenance/repair</td>
</tr>
<tr>
<td>National Highway</td>
<td>Under jurisdiction of Pref.*</td>
<td>National Gov.</td>
<td>Maintenance, Repair and other management</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>National Gov.</td>
<td>Designated section : Minister*1</td>
</tr>
<tr>
<td>Prefectural Road</td>
<td></td>
<td>National Gov.</td>
<td>Maintenance*4</td>
</tr>
<tr>
<td>Municipal Road</td>
<td></td>
<td>Municipalities</td>
<td>Maintenance*5</td>
</tr>
</tbody>
</table>

*1 "Minister" refers to Minister of Land, Infrastructure and Transport
*2 "Prefecture" includes ordinance-designated city
*3 "Maintenance" includes repair

Note: Some national highways, prefectural roads and municipal roads are maintained by Expressway Companies or Road Public Corporations.

### Classification under article 3 of the Road Act

1. **National Expressway**
   - Length: 8,050.3km (0.7%)
   - Under jurisdiction of MLIT

2. **National Highway**
   - Length: 55,222.3km (4.5%)
   - Under jurisdiction of Pref.*

3. **Prefectural Road**
   - Length: 129,396.8km (10.7%)
   - Under jurisdiction of Pref.*

4. **Municipal Road**
   - Length: 1,022,247.8km (84.1%)
   - Under jurisdiction of Pref.*

Total Length = 1,214,917.1km**

**includes very narrow roads. Total length of roads with enough width to pass a car coming the other way (i.e. 5.5m wide) is only 340,000km. As of 2011 April 1.

### Length and travel by road type

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>5.7</td>
<td>8.050.3km (0.7%)</td>
<td>84.1</td>
<td>18.5, 12.7, 32.6, 27.2</td>
</tr>
<tr>
<td>19.5</td>
<td>10.7</td>
<td>9.0</td>
<td>13.3, 22.1, 13.1, 31.9</td>
</tr>
<tr>
<td>70.0</td>
<td>84.1</td>
<td>31.9</td>
<td>19.5</td>
</tr>
</tbody>
</table>

Classification of arterial high-standard highway system

[System]

- Arterial High-standard Highway* (Total length: about 14,000km)
- National Expressway (Total length: about 11,520km)
- National Highway with access control (Total length: about 2,480km)

[Procedure]

- Contemplated route
  - Legally determined in the National Development Arterial Express Construction Act [11,520 km]
- Basic Plan
  - Decided by the Minister of Land, Infrastructure, Transport and Tourism after discussion in the National Development Arterial Automobile roads panel
- Development Plan
  - Decided by the Minister of Land, Infrastructure, Transport and Tourism after discussion in the Panel on Infrastructure Development (Road division) (Mar 2009)
- Section that is under direct jurisdiction of national government
- Toll section
  - Toll rate based on the individual highway profitability
  - Developed in a mixed way of public work project and toll road project

* Planned as a high-speed surface traffic network in "the Forth Comprehensive national Development Plan" (decided by the Cabinet on June 30, 1987) and "Grand Design of Japan for the 21st century" (decided by the Cabinet on Mar 31, 1998).
Introduction of toll road system in Japan

In response to rapidly increasing traffic demand after World War II, immediate road development required additional financial resource to supplement general revenue; namely, the following 2 systems.

1. Toll Road System

2. Toll Road System

1952 Act on Special Measures concerning Road Construction and Improvement was enacted.
→ Toll road system was introduced to the public roads across the country.
(Policy proponent: National, prefectural or municipal government as a road administrator)

1958 Full-fledged revision of Act on Special Measures concerning Road Construction and Improvement was enacted.
Act on Japan Highway Public Corporation was enacted.
1959 Act on the Metropolitan Expressway Public Corporation was enacted.
1962 Act on the Hanshin Expressway Public Corporation was enacted.
1970 Act on the Honshu-Shikoku Bridge Authority was enacted.

Pool system

After the partial opening of Meshin Expressway in 1963, about total of 3,400km of development plan was formulated by Mar 1972 based on individual profitability. About 710km of 8 expressways including Tomei Expressway and Chuou Expressway was developed.

To expand current toll road system as a measure of immediate development of roads across the country, an organization such as the Japan Highway Public Corporation (JHPC) provisional name) needs to be established as the has the capability to construct, manage, and operate roads smoothly and efficiently. (Road Council’s recommendation 1959)

1972 Road Council Recommendation

1) Expressways should be an arterial traffic network, connected to each other across the country. Each link is not necessarily considered independent, therefore, the toll rates should remain consistent and integrated.

2) Under the circumstance where development costs are affected largely by changing land cost and construction costs depending on the construction period, cost differentiation due to project start timing should be avoided. In addition, debt repayment should be carried out smoothly.

Organizational chart after privatization

Privatization objectives
- Maintain the repayment of 4 trillion JPY
- Construct essential roads promptly with the least national burden, while supporting expressway companies individual initiatives.
- Provide various and flexible toll rate settings and services while taking advantage of being a private company.

Pool system

Toll road system was introduced to the public roads across the country.

Japan Highway Public Corporation (JHPC)
Metropolitan Expressway Public Corporation
Hanshin Expressway Public Corporation
Honshu-Shikoku Bridge Authority

[Private Company] Construction, Operation and Toll-collection
NEXCO* East
NEXCO Central
NEXCO West

[Agency] Holding of expressways and repayment of debt
Japan Expressway Holding and Debt Repayment Agency

4 Laws Related to Privatization of Former Highway Public Corporations
- Expressway Company Law
- Japan Expressway Holding and Debt Repayment Agency Law
- Law regarding the Development of Highway-related Laws in connection with the Privatization of the Japan Highway Public Corporation.
- Act for Enforcement of Acts Related to Privatization of the Japan Highway Public Corporation, etc.

*NEXCO: Nippon Expressway Company

Business Scheme

Expressway Companies are responsible for constructing new roads funded by debt and loans before transferring expressway assets to the Agency.
The Agency is responsible for completing the repayment of debts with the revenue of lease fees in 45 years.

Funds raised

- NEXCO: Nippon Expressway Company

(NEXCO* East NEXCO Central NEXCO West Metropolitan Expressway
Hanshin Expressway
Honshu-Shikoku Bridge

New construction

Agency

Debts

Lease fees

Expressway Companies

Agency

Debts

New construction

Expressway asset

Transfer of lease fees

Leasing of expressway assets

Payment of lease fees

Toll collection

Agency

Holding of expressways

Repayment of debts

Reduced national burden
To support expressway companies in carrying out smooth business

<Responsibilities of the Agency>
- Holding and Lease of expressway assets (property tax is exempted based on the premise of free service in the future)
- To ensure early repayment of the debts

Approved by the Minister of MLIT

New construction

Borrowing

Depends on both national and local governments for construction (and this money is loaned to the companies at no interest)

Toll collection

Agency

Debts

Lease fees

Expressway Companies

Agency

Debts

New construction

Expressway asset

Transfer of lease fees

Leasing of expressway assets

Payment of lease fees

Toll collection

Agency

Holding of expressways

Repayment of debts

Reduced national burden
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- Holding and Lease of expressway assets (property tax is exempted based on the premise of free service in the future)
- To ensure early repayment of the debts

Approved by the Minister of MLIT

New construction

Borrowing

Depends on both national and local governments for construction (and this money is loaned to the companies at no interest)
History of Roads in Japan

There is a country comprised of four major islands and numerous minor islands in a crescent shape situated to the east of the Asian continent in the northwestern Pacific Ocean. Of the 378,000 square km of land, a substantial 70% is mountainous terrain. That is Japan. It is a country with a wonderful harmony between traditional culture from ancient eras and a modern society with advanced technology. Japan’s fascinating natural environment changes from season to season and is home to more than 120 million people.

The history of land transport in Japan over the last two thousand years can be roughly categorized into the following three ages: 1) Age of People and Nature (ancient times until the Meiji Restoration in 1867), 2) Age of Modernization (from the Meiji Restoration until the 1950s), 3) Age of High Efficiency Networks (from the 1950s to the present day), and 4) Age of Good Maintenance and Management for Maximum Utilization of Existing Roads.

I. Age of People and Nature (Ancient times until the Meiji Restoration in 1867)

1) The Ancient Foundations of Modern Japan

The oldest written record of roads in Japan appeared in a Chinese history book in the 3rd Century called Gishi-wajin-den. At that time, Japan was in the process of unifying the country under the Yamato Dynasty. People travelled on foot or horseback for hundreds of years until the Meiji Restoration when Japan opened its doors to the modern nations of the West, late in the 19th century.

Unlike in China and the European countries, horse-drawn carriages never fully evolved in this country. The lack of use of horse-drawn carriages in Japanese history may be attributed to the country’s terrain, which is mostly mountainous with numerous creeks and is surrounded by the sea. After the Reformation of the Taika Era (645), when an elaborate central government system with administrative and judicial institutions was established and a new road network was developed that connected Honshu (the main island) to Shikoku (the smallest of the four main islands) and all the way to Kyushu (the southernmost and third largest island). This nationwide public road network system was called "Seven Roads", composed of Tokaido, Tosando, Hokurikudo, San-in, San-yodo, Nankaido, and Saikaido ("do" in Japanese means ‘road’). Once the Seven Roads were opened, after bitter struggles with the rough terrain of the country, they became a prototype for highways and roads in much later years. Almost all routes of the Seven Roads were used for the arterial railways in the Meiji Era (1868-1912) and the expressways opened from 1964 onward. In short, the Seven Roads established during this age have served as the backbone of transport routes in Japan.

2) User-friendly Roads Can Be Traced Back to Early Times

With the establishment of the Seven Roads came another system called "Ekiba, Tenma" (Post Horse System), which eventually became the modern international word "Ekiden" (a relay road race). In this Chinese-originated system, an "Eki" (meaning station) was located at intervals of 16km and would provide necessary services for the officials and people of high rank on their journeys. About 400 "Eki" were developed across the country. In the mid-8th century, a number of fruit trees were systematically planted along the Seven Roads, which would eventually evolve into today’s tree-lined roads.

In more recent years (later in the 16th century), a road signage system called “ichiri-zuka” was established by referencing the practice in ancient China. This system can be interpreted as the Asian version of the Roman milestone system. After the Edo Shogunate was established in 1603, the Ichiri-zuka system was transformed into ample facilities and the 5 Major Highway System radiating from Edo (old name for the current Tokyo). The Shogunate specified that the five major highways should be about 11m wide and secondary roads 5.5m wide. The road was filled with gravel and cobbles to a depth of 3cm and finished with sand after treading them down.

Sir Rutherford Alcock, who came to Japan as the first British minister in Japan, at the end of the Shogunate era, wrote, “Their highways, the Tokaido, the imperial roads throughout the kingdom, may challenge comparison with the finest in Europe. Broad, level, carefully kept and well macadamized, with magnificent avenues of timber to give shade from the scorching heat of the sun, it is difficult to exaggerate their merit.”

3) Road Construction with a Consideration for People and Scenery

Japanese people frequently travelled, to a degree that foreigners found incredible. They would not hesitate to travel because there were excellent road facilities and services even then.

In the middle of the Edo Era (1860), Engelbert Kaempfert, a German doctor who came to Japan to work for a Dutch trading house, wrote in his book: “An unbelievable number of people travel the highways of this country every day. The reason for this is the high population of this country, but another reason is that, unlike other nations, the Japanese travel extremely often.”

The Hakone Road was already paved in 1680. Sir Ernest Satow, a British diplomat who came to Japan at the end of the Edo Shogunate (mid-19th century), wrote in his book, “A Diplomat in Japan”, about his astonishment at the pavement: “Next morning we started at half-past six to ascend the pass.” The road which climbs the range of mountains by an excellent road paved with huge stones after the manner of the Via Appia where it leaves Rome at the Forum, and lined with huge pine trees and cryptomerias.”

Unlike Via Appia, however, Japanese surface transport routes were developed primarily for people and horses, because horse-drawn carriages were not common prior to the Meiji Era (1868-1912). For this reason, roads in those days were usually kept in good condition: damages from traffic were not severe and the maintenance was relatively easy. Road cleaning and other regular maintenance was not performed by the Shogunate or the government of feudal clans, but by residents alongside the roads. Back then, roads were taken care of by roadside residents on a voluntary basis, not by the governments.

This implies that there was general understanding that roads were not the exclusive property of the overlords, but were “public property”.

- "Geschichte und Beschreibung von Japan"

2. Age of Modernization (from Meiji Restoration to the 1950’s)

After ending two hundred years of national seclusion in the Edo Era, the revolutionary government of the Meiji Era (1868-1912) quickly started modernization of the surface transport system by importing new technologies from Europe. Unlike China and Europe, however, Japan did not have a history of horse-drawn carriages as transport during the Middle Ages. It was thus impossible to transform the ancient roads designed strictly for the passage of people and horses into modern roads in a single step.

The beautifully maintained pre-modern roads of the Edo Era began to deteriorate under the burdens of modern horse-drawn and human-powered vehicles (or “rickshaws”). Arthur Crow, who visited Japan in 1881, recorded this observation in “Highways and Byeways in Japan”: “The Tokaido is in a dreadful bad state, with nuts and holes large enough almost to swallow a cart, and yet traffic is very heavy, both for horse and man-power vehicles”. The slow improvement of roads can be partially attributed to the decision by the Meiji Government to give rail and sea transport a higher priority over roads. This decision was intended to allow Japan to catch up with the advanced nations of the West as quickly as possible. The backwardness of the road system in Japan continued until 1945 when Japan was defeated in World War II and the entire national landscape was devastated by bombings and other influences of the war. During the process of reconstruction, the modernization of roads in Japan was fully accelerated along with the development of railways.
3. Age of High Efficiency Networks (from the 1950’s ~ today)

1) Arrival of the Motorization Age

Automobiles proliferated quickly as the Japanese economy recovered from defeat and the standard of living improved. Only 130,000 vehicles were registered at the end of World War II, but the number increased rapidly, reaching 500,000 vehicles by 1951, then doubling to one million in 1953, and doubling again to two million in 1957. The Age of Motorization had arrived in Japan. However, the road system remained insufficient to support the rapid motorization. Ralph J. Watkins, an economist invited by the Japanese government to conduct research on the Meishin Expressway wrote in his 1956 report, “The roads of Japan are incredibly bad. No other industrial nation has so completely neglected its highway system”.

Japan’s road system in those days was indeed terrible. Only 23% of the first-class arterial national highway system was paved. Only two-thirds of the total national Highway Route 1, supposedly the major arterial highway connecting Tokyo with Osaka, was paved. The Japanese Government at that time accepted Mr. Watkins’ proposals and immediately put them into practice. Thus, road improvement in Japan moved into high gear, propelling the nation into the high economic growth era of later years.

2) The Five-Year Road Development Program, Toll Road System, and Tax Revenue System with Earmarks for Roads

Without a history of horse-drawn carriages, Japan had only poor roads in those days. What is worse, road development was inevitably slow, because the development of the railway system was given priority over the development of roads. Under these circumstances, the Five-Year Road Development Program was launched so that road development would be fully accelerated. Because the public works budget under the general revenue scheme was not sufficient to meet ever-increasing road traffic demand, two financing systems were introduced so that a significant number of road projects could be undertaken in a short period: the toll road system and the tax revenue system with earmarks for roads.

The former “Act on Special Measures concerning Road Construction and Improvement”, enacted in 1952, enabled the introduction of the toll road system where the national and municipal governments could borrow sufficient money to develop roads and the borrowed money would be repaid with toll revenue from the new roads. The toll road system was applied primarily for national expressway projects. In 1956, the Japan Highway Public Corporation (JH) was founded, so that expressways would be operated efficiently and financial resources from the private sector could be widely utilized. With the founding of JH, toll road development was led by JH instead of by the National Government. Although the mechanism of the toll road system was similar to that of current PPP projects, the former included an ingenious system that enabled them to carry out unprofitable road projects if the road was recognized as necessary from an economic vantage point. The National Government reduced the business risk, of unprofitable road projects, by guaranteeing the loan and by paying a fixed rate of interest. In addition, the Government utilized the pool system, in which revenues and expenditures were balanced for the integral road network as opposed to a collection of individual roads. This system enabled them to develop not only profitable urban roads but also unprofitable regional roads across the country.

In 1953, the “Act on State’s Tentative Financial Measures for Road Construction Projects” was enacted, which introduced a new tax revenue system with earmarks for roads. This system earmarked the revenues from gasoline tax and other automobile-related taxes for road projects based on the beneficiary payment principle. This measure secured stable financial resources for long-term development of roads, including the 1st to 12th Five-Year Road Development Programs. The toll road system and the tax revenue system with earmarks for roads supported the development of the nationwide road network for more than 50 years. During those years, all major roads were paved and more than 10,000 km of expressways were developed all across the country. However, there were increasing calls for a change in both of the financial revenue systems, since the road networks were developed to a certain level. There were various criticisms and opinions arguing that the roads were developed one after another by spending a large amount of both borrowed money and the national budget with a unilateral approach. At the same time, the repayment and management costs were not sufficiently saved due to the high-cost structure of JH’s toll road system. As a result, JH was privatized and reorganized into the Japan Expressway and Debt Repayment Agency (JEDRA) and 6 other Expressway Companies. The main purpose of this change was to ensure the full repayment of the massive debt reaching 40 trillion yen, to streamline the administrative authority, and to provide various services for road users by utilizing experience in the private sector.

There was also increasing criticism of the tax revenue system with earmarks for roads. Critics argued that fixed expenditures from the abundant financial resources resulted in a number of unnecessary road developments. In 2009, the tax revenue system with earmarks for roads was abandoned and the Government decided to cover road expenditures with general revenue.

The state of roads in the mid 1950s was “incredibly bad” as Watkins wrote in his report.

April 1968 Vehicles running from Okayama IC to Komaki IC after the opening ceremony of Tomei Expressway (Photo: Mainichi Shinbun)
Moving into the 21st century, with the total length of expressways coming to more than 10,000 km, there was a tide of public opinion claiming that Japan had sufficient road networks, especially in urban areas. At the same time, Japan entered the age of declining birthrates and aging population (the national population has been declining since it peaked in 2008).

In addition to these changes in social conditions, ever-increasing social security costs and the fragile national financial condition galvanized public opinion to a view that public investments should be economized. This brought about the abolition of the tax system with earmarks for roads and the reorganization and privatization of JH. While road development is slowing down, utilization of existing road networks or improvement of asset management is beginning to become the focus of current programs.

The first task of asset management is to map out strategies for the aging road infrastructure that was largely developed during the high-growth period of the Japanese economy (from the later 1950s to the 1990s).

The second task is to continually provide road transport services and to support the lives and economies of the people who live in a country that is prone to natural disasters, such as earthquakes and typhoons.

The third task is to provide road services that are safe, accessible, and environmentally friendly by utilizing evolving ITS technologies and by improving the quality of roads.

### 1) Strategies for Aging Road Infrastructure

The majority of roads and bridges that were constructed in the high-growth period of the Japanese economy will be 50 years old in the next 10 years. To maintain the safety of this aging infrastructure, periodic investigation and database management, as well as systematic repair work, are required. It is a new technical challenge to efficiently investigate and repair 5.2 million bridges and 10,000 tunnels. At the same time, this is a significant challenge in terms of financial and human resources as well.

### 2) Preparing for Natural Disasters

The Great East Japan Earthquake in March 2011 brought about the rediscovery of the importance of road networks in the event of a large-scale disaster. As an earthquake-prone country, in which 20% of the world-wide earthquakes having a magnitude 6 or higher occur, disaster prevention measures, including improvement of bridges’ quake resistance, are carried out after the repeated experience of large earthquakes. In addition, it is necessary to enhance road networks for redundancy in the event of road closure after a large-scale disaster and in order to add disaster prevention functions to existing roadside service facilities.

As climate change is increasingly occurring on a global scale, Japan has been experiencing more frequent heavy rains and snows at the local level. Landslides on slopes and snowbound traffic are always significant challenges in a country with precipitous terrain. Japanese road administration has been implementing countermeasures such as constructing slope protection, establishing a snow removal system, installing road monitoring systems, and improving operations for swift responses.

### 3) Improvement of Road Service Provision using Intelligent Transport System (ITS)

Ring roads are being developed in the Tokyo Metropolitan Areas, where traffic congestion is a serious problem. Once completed, ring roads are expected to provide multiple route options and smoother vehicular flow.

Since they were introduced in 1990s, ITS technologies have provided various new services including car navigation systems and Electronic Toll Collection (ETC). Even now, the technologies are evolving in the road infrastructure and automobile sectors. Newly introduced automobiles with crash-avoidance systems offer a good prospect for fully automatic driving systems in the near future. In the road infrastructure sector, dynamic traffic guidance, warning messaging, and vehicular controlling technologies are under study as road-to-vehicle and/or vehicle-to-vehicle communication systems.

The advancement of technology is going to integrate road infrastructure with automobiles into a new synthetic transport system and will provide a break-through solution for “traffic congestion”, “traffic accidents” and “environmental protection”, issues that have been major challenges since the modernization of the road system began.
Organization Chart

The Ministry of Land, Infrastructure, Transport, and Tourism (MLIT) is in charge of the comprehensive and systematical use of national land, development and conservation, consistent infrastructure development, implementation of traffic policies, development of meteorological service, and maritime safety and security. Below is the chart showing the organization of the MLIT.

Organization Chart of MLT

The Organization of the Ministry of Land, Infrastructure, Transport and Tourism (As of July 1, 2011)
Road Structure Ordinance
(Government Ordinance No.320 of 29th October, 1970)
[Provisional translation]

Structure of Road Technique Standards

Road Act
[Act No. 108 of 1952]

Road Structure Ordinance
[Cabinet Order No. 320 of 1970]

- Geometric design
- Earthworks
- Pavement
- Bridges
- Tunnels
- Traffic safety device
- Road environment
- Road disaster prevention
- Maintenance and repair
- Parking space
- Toll facilities

Ordinance on Road Signage and Marking
[Ordinance issued by Prime Minister’s Office and Construction Ministry in 1960]

- Shoulder: A strip of road section connected with carriageway
- Service road: A strip of carriageway provided to applicable structures
- Center strip: A strip road section provided to separate a lane from other structures
- Climbing lane: A lane for slower vehicles to be separated from other vehicles on uphill roads
- Additional overtaking lane: An additional lane (except for climbing, other vehicles on uphill roads or turns) to overtake other vehicles
- Cyclist/pedestrian track: A road section provided for dedicated bicycle/pedestrian traffic, which is separated by curb lines or fences or other similar structures
- Bicycle path: A road section provided for dedicated bicycle traffic, which is separated by curb lines or fences or other similar structures
- Carriageway: A road section used by dedicated vehicle traffic, except for bicycles
- Lane: A strip section of the carriageway (except for the service road) provided for safe and smooth traffic by directional separation of vehicles traveling in a single direction
- Additional overtaking lane: An additional lane (except for climbing, turning and speed change lanes) provided specifically for vehicles to overtake other vehicles
- Climbing lane: A lane for slower vehicles to be separated from other vehicles in uphill roads
- Turning lane: A lane for vehicles to turn right or left
- Speed change lane: A lane for vehicles to accelerate or decelerate
- Center strip: A strip road section provided to separate a lane from the traffic in the opposite direction and ensure lateral clearances
- Service road: A strip of carriageway provided to applicable sections, parallel to the carriageway, to ensure access of vehicles to roadsides where access is prevented by reason of embankment and/or cut, or other means
- Shoulder: A strip of road section connected with carriageway sidewalks, bicycle tracks or bicycle/pedestrian tracks to protect major road structure sections and to maintain carriageway functions

(Purpose of This Ordinance)

This Ordinance specifies general technical standards (limited to the provisions of the Road Act (hereinafter “Act”)) Article 30.1.1, 30.1.3 and 30.1.12 for general technical standards of the structure of prefectural roads and municipal roads for the structure of national expressways and national highways when these roads will be newly constructed or reconstructed and also specifies general technical standards that should be taken into account when technical standards (except for the provisions in Article 30.1.1, 30.1.3 and 30.1.12) for the construction of prefectural roads and municipal roads are required under the ordinances of prefectural or municipal governments, who also serve as a road administrator.

(Definition)

Article 1

The following terminology definitions shall apply to the corresponding terms in this Ordinance:

1. Sidewalk: A road section provided for dedicated pedestrian traffic, which is separated by curb lines or fences or other similar structures
2. Bicycle track: A road section provided for dedicated bicycle traffic, which is separated by curb lines or fences or other similar structures
3. Bicycle/pedestrian track: A road section provided for dedicated bicycle/pedestrian traffic, which is separated by curb lines or fences or other similar structures
4. Carriageway: A road section used by dedicated vehicle traffic, except for bicycles
5. Lane: A strip section of the carriageway (except for the service road) provided for safe and smooth traffic by directional separation of vehicles traveling in a single direction
6. Additional overtaking lane: An additional lane (except for climbing, turning and speed change lanes) provided specifically for vehicles to overtake other vehicles
7. Climbing lane: A lane for slower vehicles to be separated from other vehicles in uphill roads
8. Turning lane: A lane for vehicles to turn right or left
9. Speed change lane: A lane for vehicles to accelerate or decelerate
10. Center strip: A strip road section provided to separate a lane from the traffic in the opposite direction and ensure lateral clearances
11. Service road: A strip of carriageway provided to applicable sections, parallel to the carriageway, to ensure access of vehicles to roadsides where access is prevented by reason of embankment and/or cut, or other means
12. Shoulder: A strip of road section connected with carriageway sidewalks, bicycle tracks or bicycle/pedestrian tracks to protect major road structure sections and to maintain carriageway functions
13. Marginal strip: A strip section of the center strip or shoulder connected with the carriageway to provide optical guidance for drivers and ensure lateral clearances
14. Stopping lane: A strip of carriageway section principally used to park vehicles
15. Track bed: A road section dedicated for use by streetcar traffic (streetcars as specified in Article 2.1.13 of the Road Traffic Act [Act No.105 of 1960]; this definition of streetcars shall apply hereinafter)
16. Island: An area facility provided at intersections, carriageway separation points, bus bays, streetcar stops, or other areas to ensure safe and smooth vehicle traffic or the safety of pedestrians crossing streets or bus and streetcar passengers boarding or alighting
17. Planting strip: A strip of road section provided for tree planting in order to improve road traffic environment and ensure a better living environment along roadsides, which is separated by using curb lines or fences or other similar structures
18. On-street facility: A road accessory facility on sidewalks, bicycle tracks, bicycle/pedestrian tracks, center strips, shoulders, bicycle paths and bicycle/pedestrian paths, except for common ducts and common cable ducts
19. Urban area: An area forming or expected to form a city or town
20. Rural area: Other areas than urban areas
21. Designated daily volume: Daily vehicle traffic volume determined by planners for road construction or reconstruction planners designated by the Land, Infrastructure and Transport Ministry’s ordinance according to requirements in the same ordinance for the basis of road design, in consideration of trends of development in the area and vehicle traffic conditions in the future
22. Design speed: Vehicle speed that is used as a basis for road design
23. Sight distance: The distance measured along the lane (or carriageway in the case of a road without a lane and the same is applied hereinafter) centerline at which an apex of a 10cm high object on the lane centerline is visible from 1.2m on the lane centerline.
1. Roads shall be classified into Types 1 through 4 as listed in the following table.

<table>
<thead>
<tr>
<th>National expressways and access-controlled highways</th>
<th>Area where road is located</th>
<th>Rural Area</th>
<th>Urban Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>National expressways and access-controlled highways</td>
<td>Type1</td>
<td>Type2</td>
<td></td>
</tr>
<tr>
<td>Other Roads</td>
<td>Type3</td>
<td>Type4</td>
<td></td>
</tr>
</tbody>
</table>

2. Type 1 roads shall be classified into classes 1 through 4 as listed in Table 1, Type 2 roads shall be classified into Class 1 or 2 as listed in Table 2, Type 3 roads shall be classified into classes 1 through 4 as listed in Table 3, and Type 4 roads shall be classified into classes 1 through 4 except where topographic conditions or other circumstances do not permit such provision. Roads can be classified into one class lower than the original class unless roads are otherwise applicable to Type 1 Class 4, Type 2 Class 3, Type 3 Class 5, or Type 4 Class 4.

### Table 1 Type 1 Roads

<table>
<thead>
<tr>
<th>Road type</th>
<th>Topography area where road is located</th>
<th>Designed daily volume (vehicles/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Expressway</td>
<td>Level Area</td>
<td>Class 1</td>
</tr>
<tr>
<td>National Expressway</td>
<td>Mountainous Area</td>
<td>Class 2</td>
</tr>
<tr>
<td>Roads other than National Expressway</td>
<td>Level Area</td>
<td>Class 2</td>
</tr>
<tr>
<td>Roads other than National Expressway</td>
<td>Mountainous Area</td>
<td>Class 3</td>
</tr>
</tbody>
</table>

### Table 2 Type 2 Roads

<table>
<thead>
<tr>
<th>Road type</th>
<th>Area where road is located</th>
<th>Area other than Central Business District</th>
<th>Central Business District</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Expressway</td>
<td>Class 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roads other than National Expressway</td>
<td>Class 1</td>
<td>Class 2</td>
<td></td>
</tr>
</tbody>
</table>

### Table 3 Type 3 Roads

<table>
<thead>
<tr>
<th>Road type</th>
<th>Area where road is located</th>
<th>Designed daily volume (vehicles/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Highway</td>
<td>Level Area</td>
<td>Class 1</td>
</tr>
<tr>
<td>National Highway</td>
<td>Mountainous Area</td>
<td>Class 2</td>
</tr>
<tr>
<td>Prefectural Roads</td>
<td>Level Area</td>
<td>Class 2</td>
</tr>
<tr>
<td>Municipal Roads</td>
<td>Level Area</td>
<td>Class 2</td>
</tr>
<tr>
<td>Municipal Roads</td>
<td>Mountainous Area</td>
<td>Class 3</td>
</tr>
</tbody>
</table>

### Table 4 Type 4 Roads

<table>
<thead>
<tr>
<th>Road type</th>
<th>Designed daily volume (vehicles/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Highway</td>
<td>More than 10,000</td>
</tr>
<tr>
<td>Prefectural Roads</td>
<td>Class 1</td>
</tr>
<tr>
<td>Municipal Roads</td>
<td>Class 1</td>
</tr>
</tbody>
</table>

3. Roads shall be classified as specified in the previous paragraph based on traffic conditions.

4. Type 1, 2 and 3 Class 1 through 4 roads or Type 4 Class 1 through 3 roads (limited to elevated roads and other structures from which vehicles cannot access roadways for Type 3 Class 1 through 4 roads and Type 4 Class 1 through 3 roads) can be specified as the roads provided exclusively for the traffic of smaller motor vehicles (hereinafter indicating small-sized vehicles and other similar small vehicles, and pedestrians and bicycles in the case of Type 3 Class 1 through 4 and Type 4 Class 1 through 3 roads), in an unavoidable case such as for a topographical reason and due to conditions of urbanization, there shall be a neighboring detour road for other types of vehicles, other than smaller motor vehicles. A lane specifically for the traffic of smaller motor vehicles can be provided, by separating other lanes on Type 1, 2 and 3 through 4 roads or Type 4 Class 1 through 3 roads, the lane specifically for the traffic of smaller motor vehicles shall be limited to elevated roads or other structures from which vehicles cannot access roadways.

6. Roads shall be classified into smaller motor vehicle roads (hereinafter indicating the roads provided specifically for the traffic of smaller motor vehicles specified in the paragraph 4 and smaller motor vehicles and pedestrians and bicycles in Type 3 Class 1 through 4 and Type 4 Class 1 through 3 roads and vehicles specified in the previous paragraph) and regular motor vehicle roads (hereinafter indicating roads and road sections other than smaller motor vehicle roads). The next Article through Article 40 specify general technical standards for the construction of national expressways and national highways structures, when these roads will be newly constructed or reconstructed.

### (Design Vehicles)

**Article 4**

1. Roads shall be so designed for the smooth and safe passage of small-sized motor vehicles and semitrailers (hereinafter indicating combined body consisting of trailing motor vehicle and trailed vehicle without front axle, in which a part of the trailed vehicle rests on the motor vehicle and substantial weight of the trailed vehicle and its load are supported by the motor vehicle) on Type 1, Type 2, Type 3 Class 1 or Type 4 Class 1 regular motor vehicle roads, small-sized motor vehicles and regular-sized motor vehicles on other regular motor vehicle roads and smaller motor vehicles on smaller motor vehicle roads.

2. Specifications for the vehicle that is a basis of road design (hereinafter referred to as “design vehicle”) by Type shall be listed below.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Length</th>
<th>Width</th>
<th>Height</th>
<th>Front-edge overhang</th>
<th>Wheelbase</th>
<th>Rear-edge overhang</th>
<th>Minimum turning radius</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small-sized motor vehicle</td>
<td>4.7</td>
<td>1.7</td>
<td>2.0</td>
<td>0.8</td>
<td>2.7</td>
<td>1.2</td>
<td>6.0</td>
</tr>
<tr>
<td>Smaller motor vehicles</td>
<td>6.0</td>
<td>2.0</td>
<td>2.8</td>
<td>1.0</td>
<td>3.7</td>
<td>1.3</td>
<td>7.0</td>
</tr>
<tr>
<td>Regular-sized motor vehicle</td>
<td>12.0</td>
<td>2.5</td>
<td>3.8</td>
<td>1.5</td>
<td>6.5</td>
<td>4.0</td>
<td>12.0</td>
</tr>
<tr>
<td>Semi-trailer</td>
<td>16.5</td>
<td>2.5</td>
<td>3.8</td>
<td>1.3</td>
<td>Front section wheelbase: 4.0 Rear section wheelbase: 9.0</td>
<td>2.2</td>
<td>12.0</td>
</tr>
</tbody>
</table>

For this table, the following terminology definitions shall apply to the corresponding terms.

1. Front-edge overhang: Distance from the front face of the vehicle body to the center of the front-wheel axle of a vehicle.
2. Wheelbase: Distance from the center of front-wheel axle of a vehicle to the center of the rear-wheel axle.
3. Rear-edge overhang: Distance from the rear face of the vehicle body to the center of the rear-wheel axle of a vehicle.

### (Lane)

**Article 5**

1. The carriageway (except for the service road, stopping lane and other sections specified by the ordinances of Ministry of Land, Infrastructure, Transport and Tourism) shall consist of the below-specified lanes, except for those classified as Type 3 Class 5.

2. The number of lanes shall be 2 (except for additional overtaking, climbing, turning and speed change lanes and the same is applied in the following paragraph) in accordance with the road classification and on rural roads where designed daily traffic volume is no more than values of standard design volume (hereinafter indicating maximum allowable traffic volume) as listed in the following table, while taking into account topographic conditions.
3. The number of lanes on roads, other than those specified in the design traffic volume herein by 0.8.

As for Type 4 roads with many intersections, standard design traffic volume shall be calculated by multiplying standard design traffic volume per lane herein by 0.6.

In the case of Type 4 roads with many intersections, standard design traffic volume per lane shall be calculated by multiplying

3. A center strip shall be provided, when required, for directional lane division.

4. Lane width (except for climbing, turning, and speed change lanes) shall be as listed in the columns for lane width, in the following table, in accordance with road classification. However, the lane width on Type 1 Class 1 and 2 or Type 3 Class 2 or Type 4 Class 1 regular motor vehicle roads may add 0.25m to the values as listed in the columns depending on the traffic situation. Lane width on Type 1 Class 2 or 3 smaller motor vehicle roads or Type 2 Class 1 roads may be reduced 0.25m from the values as listed in the columns in unavoidable cases, such as for topographical and other reasons.

5. Carriageway width on Type 3 Class 5 regular motor vehicle roads shall be 4m. However, the width could be reduced to 3m where designed daily traffic volume is extremely low and topographic conditions or special reasons do not permit such provisions or where a narrow pass is created on regular motor vehicle roads pursuant to the provisions of Article 31.2.

(Lane Division)

Article 6

1. The lanes (hereinafter this applies for all except one-way roads) on Type 1, Type 2 or Type 3 Class 1 roads shall be directionally divided. It is also applied to other roads with four or more lanes if necessary for safe and smooth traffic.

2. Notwithstanding the provisions of the first sentence of the preceding paragraph, Type 1 roads with three or less lanes (hereinafter, this applies for all except for climbing, turning and speed change lanes) may be left directionally undivided in unavoidable cases, such as for topographical conditions or any other reasons.

3. A center strip shall be provided, when required, for directional lane division.

4. Center strip width shall be no less than the values indicated in the left columns in the following table. However, the center strip width can be reduced to the values listed in the right columns of the same table when the center strip width of the road or road section is reduced in accordance with paragraph 4.

5. A marginal strip shall be provided to the center strip.

6. The width of the marginal strips shall be the values listed in the left column of the following table in accordance with road classification. However, the center strip width can be reduced to the values listed in the right columns of the same table when the center strip width of the road or road section is reduced in accordance with the provisions of paragraph 4.

7. Fences, or other similar structures, or curb lines connected to the marginal strip shall be provided to sections other than the marginal strip of the center strip (hereinafter referred to as the "median").

8. When on-street facilities are provided on the median, the center strip width shall be determined considering clearances as specified in Article 12.

9. If necessary, additional overtaking lanes shall be provided to the carriageway of Type 1 roads with single lanes in each direction.
(Service Roads)

Article 7
1. The service roads shall be provided to Type 3 or 4 roads with more than four lanes (except for climbing, turning and speed change lanes) if necessary.
2. Service road width shall be a standard 4m.

(Shoulers)

Article 8
1. Shoulders shall be provided to roads connected to carriageways, except where a center strip or stopping lane is provided.
2. Shoulder width on the left side of the carriageway shall be, in accordance with road classification, no less than the values listed in the left column of the following table. However, road width may be reduced to the values listed in the right columns in the same table where additional overtaking lanes, climbing lanes or speed change lanes are provided, or on road sections of bridges 90m or longer or elevated roads or other road sections in unavoidable cases such as for a topographical or other special reasons.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Width of Shoulder Provided on Left of Carriageway(m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td></td>
</tr>
<tr>
<td>Class 1 and 2</td>
<td>Regular motor vehicle roads 2.5 1.75</td>
</tr>
<tr>
<td>Class 3 and 4</td>
<td>Regular motor vehicle roads 1.75 1.25</td>
</tr>
<tr>
<td></td>
<td>Smaller motor vehicle roads 1.0 1.25</td>
</tr>
<tr>
<td>Type 2</td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>Regular motor vehicle roads 1.25 0.75</td>
</tr>
<tr>
<td>Class 2 through 4</td>
<td>Smaller motor vehicle roads 0.75 0.5</td>
</tr>
<tr>
<td>Class 5</td>
<td>0.5</td>
</tr>
<tr>
<td>Type 3</td>
<td></td>
</tr>
<tr>
<td>Class 2 through 4</td>
<td>Smaller motor vehicle roads 0.5 0.5</td>
</tr>
<tr>
<td>Type 4</td>
<td></td>
</tr>
</tbody>
</table>

3. Notwithstanding the provisions of the preceding paragraph, shoulder width on the left side of carriageways on Type 1 roads with directionally divided lanes shall be, in accordance with road classification, no less than the values listed in the left column of the following table. However, shoulder width on the left side of the carriageway may be reduced to the values listed in the right columns in the same table where the road section is in a tunnel of no shorter than 100m, on bridges of no shorter than 50m, on elevated roads with low traffic volume of larger vehicles, or in unavoidable conditions such as for topographical or other reasons.

4. Shoulder widths of the regular motor vehicle roads in tunnels (except for shoulders specified in the paragraph 3) or shoulder widths on the left side of smaller motor vehicle roads (except for shoulders specified in the paragraph 3) may be reduced to 1m on Type 1 Class 1 or 2 roads, 0.75m on Type 1 Class 3 or 4 roads and 0.5m on Type 3 (except for Class 5) regular motor vehicle roads or Type 3 Class 1 smaller motor vehicle roads.

6. As for the shoulder connecting to the service road, values of "1.25" and "0.75" in the left column of Type 3 carriageway as tabulated in Section 2 shall be regarded as "0.5" and provisioy requirements in Section 2 shall not be applied.
7. On roads where sidewalks, bicycle tracks or bicycle/pedestrian tracks are provided, major road structures shall be protected. If smooth carriageway traffic can be maintained, the shoulder connecting width can be omitted or the width can be reduced.
8. A marginal strip shall be provided to the shoulder connecting with the carriageway on Type 1 or 2 roads.
9. The width of the marginal strips for regular motor vehicle roads shall be the values listed in the left column of the following table in accordance with road classification. The width of the marginal strips on smaller motor vehicle roads shall be 0.25m. However, shoulder widths for the regular motor vehicle roads in tunnels may be the values listed in the right columns in the same table.
10. Where it is necessary to protect major road structures, the shoulder shall be provided on road ends as so to be connected to the sidewalk, bicycle track or bicycle/pedestrian track.
11. Where on-street facilities are provided on the shoulder connected to the carriageway, shoulder width shall be the values of shoulder width provided for the left side of the carriageway listed in paragraph 2 or the values of shoulder width provided for the right side of the carriageway listed in paragraph 4, plus the values required for the on-street facilities.

(Stopping Lane)

Article 9
1. A stopping lane shall be provided on the left carriageway end on Type 4 roads to prevent stopping vehicles from impeding safe and smooth traffic.
2. The stopping lane width shall be 2.5m. However, the width may be reduced to 1.5m where the traffic volume of larger vehicles is low.

Track Bed

Article 9.2
The track bed width shall be, in accordance with single or double track, wider than the values listed in the bottom columns of the following table.

<table>
<thead>
<tr>
<th>Single or Double Track</th>
<th>Track Bed Width(m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Track</td>
<td>3</td>
</tr>
<tr>
<td>Double Track</td>
<td>6</td>
</tr>
</tbody>
</table>

Bicycle Track

Article 10
1. Bicycle tracks shall be provided on both sides of roads on Type 3 or 4 roads with higher vehicle and bicycle traffic volume, except where topographic conditions or other special reasons do not permit such provision.
2. Bicycle tracks shall be provided on both sides of the roads to ensure safe and smooth traffic on Type 3 or 4 roads with higher bicycle traffic volume or on Type 3 or 4 roads with higher vehicle and pedestrian traffic volume (except for roads specified in the preceding paragraph), if separation of bicycle traffic is considered necessary, except where topographic conditions or other special reasons do not permit such provisions.

Bicycle/Pedestrian Track

Article 10.2
1. Bicycle/pedestrian tracks shall be provided on both sides of Type 3 or 4 roads with large traffic volume (except for roads where the bicycle tracks would already be provided) except where topographic conditions or other special reasons do not permit such provisions.
2. Bicycle/pedestrian track width shall be wider than 4m for roads with higher pedestrian traffic volume and wider than 3m for other roads.
3. Where a sidewalk is crossing a bridge or underpass (hereinafter referred to as "pedestrian crossing bridge") or on-street facilities
are provided, the bicycle/pedestrian track width shall be increased by 3m where a pedestrian crossing bridge is to be constructed, 2m where a rooded bench is to be installed, 1m where a row of trees is to be planted, 1m where a bench is installed or 0.5m in other cases, respectively to the values given in the preceding paragraph. The requirements as specified above shall be applied except for Type 3 Class 5 roads where topographic conditions or other special reasons do not permit such provisions.

4. The bicycle/pedestrian track width shall be determined in consideration of bicycle and pedestrian traffic conditions on the road.

(Sidewalk)

Article 11

1. A sidewalk shall be provided on both sides of Type 4 roads (excluding those roads provided with bicycle/pedestrian tracks), Type 3 roads (except for Class 5 and excluding those roads provided with bicycle/pedestrian tracks) with higher pedestrian traffic volume or Type 3 roads already provided with bicycle tracks, except where topographical conditions or any other reasons prevent such provision.

2. Sidewalks shall be provided on Type 3 roads (excluding those roads already provided with bicycle/pedestrian tracks and those roads stipulated in the preceding paragraph) where it is required for safe and smooth traffic, except where topographical conditions or any other reasons do not permit such provision.

3. The sidewalk width shall be wider than 3.5m for roads with higher pedestrian traffic volume and wider than 2m for other roads.

(Waiting Area for Pedestrians)

Article 11.2

Waiting space for pedestrians shall be provided on sidewalks, bicycle-and pedestrian tracks, bicycle-and pedestrian paths or exclusive pedestrian roads, in the case that it is necessary to ensure that the safe and smooth passage of pedestrians or bicycle riders will not be impeded due to the accumulation of pedestrians at the pedestrian crossings or at bus stops.

(Center Strip Width in Snowy Areas)

Article 11.3

Center strip, shoulder, bicycle/pedestrian track and side walk width in snowy areas shall be determined in consideration of snow removal.

(Planting Strip)

Article 11.4

1. The planting strip shall be provided to Type 4 Class 1 and Class 2 roads and if necessary to other roads, except where topographical conditions or other special reasons do not permit such provisions.

2. The planting strip width standard shall be 1.5m.

3. The planting strips provided between road sections as described below shall have proper width values, exceeding values specified in the section above when required for conditions in comprehensive consideration of road structure, traffic condition, and land use of adjoining areas and other measures taken to improve road traffic environment or to ensure a better living environments along adjoining areas irrespective of the requirements above:

a) Sections of arterial roads and central business districts in large cities running through scenic spots.

b) Sections of arterial roads running through residential areas or areas that are expected to become residential.

4. For planting strips, the selection of plant species and arrangement of trees shall take into account with the ecological characteristics of the area.

(Clearances)

Article 12

Clearances on roads shall be shown in Fig. 1 for carriageways and in Fig. 2 for sidewalks and bicycle tracks or bicycle/pedestrian tracks (hereinafter referred to as “bicycle tracks”).

(Design Speed)

Article 13

1. Design speed on roads, except for service roads, shall be the values listed in the left column of the following table, in accordance with road classification, except where topographical conditions or any other reasons do not permit such provisions.

Design speed on roads may be the values listed in the right column of the same table when dealing with these exceptions, however this does not apply to Type 1 Class 4 roads that are national expressways.

2. Design speed on the service roads shall be 40km, 30km, or 20km per hour.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Design Speed (km/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>120</td>
</tr>
<tr>
<td>Class 2</td>
<td>100</td>
</tr>
<tr>
<td>Class 3</td>
<td>90</td>
</tr>
<tr>
<td>Class 4</td>
<td>60</td>
</tr>
<tr>
<td>Type 2</td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>90</td>
</tr>
<tr>
<td>Class 2</td>
<td>60</td>
</tr>
<tr>
<td>Class 3</td>
<td>50</td>
</tr>
<tr>
<td>Type 3</td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>90</td>
</tr>
<tr>
<td>Class 2</td>
<td>90 or 60</td>
</tr>
<tr>
<td>Class 3</td>
<td>60 or 30</td>
</tr>
<tr>
<td>Class 4</td>
<td>50 or 20</td>
</tr>
<tr>
<td>Type 4</td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>90 or 40</td>
</tr>
<tr>
<td>Class 2</td>
<td>60 or 30</td>
</tr>
<tr>
<td>Class 3</td>
<td>50 or 20</td>
</tr>
</tbody>
</table>

(Reasons)

In this figure, H: A, B, C, D: the indicated values.

H: 4.5m for regular motor vehicle roads and 3m for smaller motor vehicle roads except for Type 3 Class 1 regular motor vehicle roads where the value is reduced to 3m in unavoidable cases such as for a topographical reason (or 3m when traffic volume of large-sized motor vehicle is extremely small and these may excess neighboring bypass roads).

a) The width of the shoulder connected with the carriageway on regular motor vehicle roads (for shoulders where on-street facilities are provided, shoulder width minus value required for on-street facilities), provided that the value exceeds 1m shall be 1m.

b) The width of the shoulder connected with the carriageway on smaller motor vehicle roads shall be 0.5m.

c) Concerning the separator, values listed in columns c and d in accordance with road classification and concerning the island, the value of c shall be 0.25m and the value of d shall be 0.5m.

![Fig. 1](omitted)

**Carriageway of roads where the shoulder is provided by connecting with the carriageway except for the road sections specified in (3)**

- Carriageway of roads where the shoulder is not provided by connecting with the carriageway except for the road sections specified in (3).

<table>
<thead>
<tr>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carriageway of roads other than tunnels without sidewalk or bicycle track, bridge longer than 50m or viaduct</td>
<td>Carriageway in tunnels without sidewalk or bicycle track, on bridge longer than 50m or viaduct</td>
<td>Carriageway of road's sections related to Separator or Island</td>
</tr>
</tbody>
</table>

**Fig. 2 (omitted)**

<table>
<thead>
<tr>
<th>Classification</th>
<th>c (Unit: m)</th>
<th>d (Unit: m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>Regular motor vehicles</td>
<td>0.5</td>
</tr>
<tr>
<td>Class 2</td>
<td>Regular motor vehicles</td>
<td>0.25</td>
</tr>
<tr>
<td>Class 3 and 4</td>
<td>Smaller motor vehicles</td>
<td>0.25</td>
</tr>
<tr>
<td>Type 2</td>
<td>Smaller motor vehicles</td>
<td>0.25</td>
</tr>
<tr>
<td>Type 3</td>
<td>Smaller motor vehicles</td>
<td>0.25</td>
</tr>
<tr>
<td>Type 4</td>
<td>Smaller motor vehicles</td>
<td>0.25</td>
</tr>
</tbody>
</table>

- **c** and **d**: Concerning the separator, values listed in columns c and d in accordance with road classification and concerning the island, the value of c shall be 0.25m and the value of d shall be 0.5m.

![Table](omitted)

<table>
<thead>
<tr>
<th>Carriageway of roads where the shoulder is provided by connecting with the carriageway</th>
<th>Carriageway of roads where the shoulder is not provided by connecting with the carriageway</th>
<th>Of carriageway, sections related to Separator or Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warriageway of roads other than tunnels without sidewalk or bicycle track, bridge longer than 50m or viaduct</td>
<td>Carriageway in tunnels without sidewalk or bicycle track, on bridge longer than 50m or viaduct</td>
<td>Carriageway of road's sections related to Separator or Island</td>
</tr>
</tbody>
</table>

![Table](omitted)
Article 14
Carriageway bend sections shall be curved in shape, except for transition sections, (hereinafter indicating certain sections, provided at the carriageway bend sections, that allow for smooth vehicle traffic) or bend sections provided pursuant to the provision of Article 31.2.

Article 15
Radii of curve at the centerline of the carriageway (hereinafter referred to as “radius of curve”), except for transition sections, (hereinafter referred to as “carriageway curve section”) shall not be less than the values as listed in the left column of the following table according to design speed, except when unavoidable due to, for example, topographical reasons, in which case the radii of curve may be reduced to the values as listed in the right column of the same table.

### Design Speed (km/h) vs. Radius of Curve (m)

<table>
<thead>
<tr>
<th>Design Speed (km/h)</th>
<th>Radius of Curve (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>710</td>
</tr>
<tr>
<td>100</td>
<td>460</td>
</tr>
<tr>
<td>80</td>
<td>280</td>
</tr>
<tr>
<td>60</td>
<td>150</td>
</tr>
<tr>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>20</td>
<td>15</td>
</tr>
</tbody>
</table>

Article 16
Appropriate super-elevation with no more than the values as listed in the right column of the following table (6% for Type 3 roads without bicycle track) shall be provided on curves of the carriageway, the center strip (except for median), and shoulder connected with the carriageway, according to road classification and design speed, except where topographical or any other reasons do not permit such provisions. In such cases the values of the grade may be reduced to the values as listed in the right column of the same table.

### Classification vs. Super-elevation (%)

<table>
<thead>
<tr>
<th>Classification</th>
<th>Area Where Road is Located</th>
<th>Maximum Super-elevation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1, 2, and 3</td>
<td>Snowy or Snowy or Cold Area</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Other Areas</td>
<td>8</td>
</tr>
<tr>
<td>Type 4</td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

Article 17
The lane width on carriageway curve sections (or carriageway width in the case of roads without lanes) shall be appropriately widened except for Type 2 and 4 roads, where topographical conditions or any other reasons do not permit such provisions.

Article 18
1. Transition sections shall be provided on carriageway bend sections for Type 4 roads where topographical conditions or any other reasons do not permit such provisions.
2. When a curved section is widened and/or provided with super-elevation, a runoff for this widening and/or super-elevation shall be completed in the transition section.
3. The transition curve length shall not be less than the right side value as listed in the following table according to design speed (or length required for runoff when length required for runoff as specified in Section above exceeds values as listed in the same column).

### Design Speed (km/h) vs. Transition Section Length (m)

<table>
<thead>
<tr>
<th>Design Speed (km/h)</th>
<th>Transition Section Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>100</td>
</tr>
<tr>
<td>100</td>
<td>85</td>
</tr>
<tr>
<td>80</td>
<td>70</td>
</tr>
<tr>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>40</td>
<td>35</td>
</tr>
<tr>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

Article 19
1. Sight distance shall not be less than the values below, as listed in the following table according to design speed.
2. For roads with two lanes (except for one-way roads), sufficient sections of oncoming highway visible to the driver shall be provided for overtaking.

### Design Speed (km/h) vs. Transition Section Length (m)

<table>
<thead>
<tr>
<th>Design Speed (km/h)</th>
<th>Transition Section Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>210</td>
</tr>
<tr>
<td>100</td>
<td>160</td>
</tr>
<tr>
<td>80</td>
<td>110</td>
</tr>
<tr>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td>50</td>
<td>55</td>
</tr>
<tr>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

Article 20
Carriageway grades shall be no more than the values listed in the left grade column of the following table according to road classification and design speed, except where topographical conditions or any other reasons do not permit such provisions; in such cases the values of the grade may be reduced to the values listed in the right grade column of the same table.

### Classification vs. Grade (%)

<table>
<thead>
<tr>
<th>Classification</th>
<th>Design Speed (km/h)</th>
<th>Grade (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular motor vehicle roads</td>
<td>120</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>80</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>5</td>
</tr>
<tr>
<td>Smaller motor vehicle roads</td>
<td>80</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>Regular motor vehicle roads</td>
<td>60</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>9</td>
</tr>
<tr>
<td>Smaller motor vehicle roads</td>
<td>60</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>10</td>
</tr>
</tbody>
</table>

Article 21
1. A climbing lane, if necessary, shall be provided to the carriageway of the regular motor vehicle roads where grades exceed 5% (or 3% when the design speed is no less than 100 km per hour on other regular motor vehicle roads than national expressways and national highways).
2. The climbing lane width shall be 3m.


**Carriageways, Center Strips (except for Median), Shoulders**

1. Vertical curves shall be provided where grades change on the carriageway.
2. Radii of vertical curves shall be more than the values listed in the radius of vertical curve column of the following table according to design speed and Types of vertical curves, except when the radii of crest vertical curves on Type 4 Class 1 roads, when design speed is 80km per hour, the radii shall be reduced to 1,000m, where topographical conditions or any other reasons do not permit such provisions.
3. Vertical curve lengths shall be more than the values listed in the following table according to design speed.

**Cross Slopes**

1. Cross slopes shall be provided to the carriageway, center strip (except for median), shoulders connected with carriageways, bicycle tracks and sidewalks shall be paved except in unavoidable cases, such as extremely small vehicle traffic volume. 2. The pavement of carriageways and marginal strips shall be constructed so that safe and smooth vehicle traffic can be ensured on the basis of the design wheel load of 49 kN, in consideration of designed daily volume, vehicle weight, subgrade conditions, and meteorological conditions and that shall meet the standards laid down in the Ordinance of Ministry of Land, Infrastructure, Transport and Tourism, except in the case of small vehicle traffic volume or any other unavoidable conditions.
3. Type 4 roads (except for tunnels) shall be constructed so that it shall be capable of causing storm water to permeate smoothly under the road surfaces and reducing the traffic noise level, in consideration of the land uses and vehicle traffic conditions in the area where the roads are located or along them; except where road structure, meteorological conditions or other special reasons do not permit such provisions.

**Road Structure Ordinance**

**Article 22**

1. Design Speed (km/h) Type of Vertical Curve Radius of Vertical Curve (m) 2. Design Speed (km/h) Vertical Curve Length (m)

<table>
<thead>
<tr>
<th>Design Speed (km/h)</th>
<th>Type of Vertical Curve</th>
<th>Radius of Vertical Curve (m)</th>
<th>Design Speed (km/h)</th>
<th>Vertical Curve Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>Crest</td>
<td>11,000</td>
<td>120</td>
<td>100</td>
</tr>
<tr>
<td>100</td>
<td>Crest</td>
<td>9,000</td>
<td>100</td>
<td>85</td>
</tr>
<tr>
<td>80</td>
<td>Crest</td>
<td>6,500</td>
<td>80</td>
<td>70</td>
</tr>
<tr>
<td>60</td>
<td>Crest</td>
<td>4,000</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>50</td>
<td>Crest</td>
<td>3,000</td>
<td>50</td>
<td>40</td>
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<tr>
<td>40</td>
<td>Crest</td>
<td>2,000</td>
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<td>35</td>
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<td>30</td>
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<td>1,000</td>
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<td>20</td>
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<td>800</td>
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<td>30</td>
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<td>450</td>
<td>20</td>
<td>30</td>
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<td>20</td>
<td>Sag</td>
<td>250</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>10</td>
<td>Sag</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Article 23**

1. Carriageways, center strips (except for median), shoulders connected with carriageways, bicycle tracks and sidewalks shall be paved except in unavoidable cases, such as extremely small vehicle traffic volume.
2. The pavement of carriageways and marginal strips shall be constructed so that safe and smooth vehicle traffic can be ensured on the basis of the design wheel load of 49 kN, in consideration of designed daily volume, vehicle weight, subgrade conditions, and meteorological conditions and that shall meet the standards laid down in the Ordinance of Ministry of Land, Infrastructure, Transport and Tourism, except in the case of small vehicle traffic volume or any other unavoidable conditions.
3. Type 4 roads (except for tunnels) shall be constructed so that it shall be capable of causing storm water to permeate smoothly under the road surfaces and reducing the traffic noise level, in consideration of the land uses and vehicle traffic conditions in the area where the roads are located or along them; except where road structure, meteorological conditions or other special reasons do not permit such provisions.

**Article 24**

1. Cross slopes shall be provided to the carriageway, center strip (except for median) and shoulder connected with the carriageway according to road surface Type and the right side values as listed in the following table unless super-elevation is provided.
2. 2% of cross slope as a standard shall be provided to sidewalks and bicycle tracks.
3. The paved road of the structure specified in paragraph 3 of the previous Article may dispense with or reduce cross slope, if proper road surface drainage can be ensured in consideration of meteorological conditions.

**Compound Grade**

**Article 25**

1. Compound Grades (hereinafter indicating combination of vertical grade and super-elevation or cross slope) shall be no more than the right side values as listed in the following table according to design speed, except for roads with design speed of 30km/h or 20km/h where compound grades may be 12.5% in unavoidable cases, such as topographical conditions or any other reasons.
2. Compound grades shall be not more than 8% on those roads located in severely snowy or cold areas.

**Road Structure Ordinance**

**Article 26**

Gutter, guilty, or other drainage facilities shall be provided to roads if necessary.

**At-grade Intersection or Connection**

**Article 27**

1. An intersection shall be designed so as to contain no more than five intersecting legs, except when it is located in a special place such as in front of a station.
2. At an intersection where two or more roads join or intersect at grade, if necessary, a turning lane, speed change lane, or island shall be provided, and corners of intersection shall be cut, and unobstructed sight shall be ensured.
3. Where the turning lane or speed change lane is provided, lane width (except for the turning lane or speed change lane) of the related section may be reduced to 3m for Type 4 Class 1 regular motor vehicle roads or to 2.75m for Type 4 Class 2 or 3 regular motor vehicle roads or to 2.5m for Type 4 smaller motor vehicle roads.
4. The standard width of turning and speed change lanes shall be 3m for regular motor vehicle roads and 2.5m for smaller motor vehicle roads.
5. Where a turning or speed change lane is provided, proper runoff shall be provided according to design speed.

**Grade Separation**

**Article 28**

1. When two regular motor vehicle roads having four or more lanes intersecting mutually, excluding climbing lanes, turning lanes and speed change lanes, the intersection shall be separated by grades as a rule, except when the grade separation is unsuitable due to traffic conditions or in an unavoidable case such as a topographical reason.
2. When a smaller motor vehicle road with four or more lanes (except for turning lanes and speed change lanes) crosses another smaller motor or a regular motor vehicle road, the intersection shall be separated by grades.
3. Where the grade separation is provided, a road linking intersecting roads mutually (hereinafter referred to as a “ramp”) shall be provided if necessary.
4. Provisions of Articles 5 through 8, Article 12, Article 13, Article 15, Article 16, Articles 18 through 20, Articles 22 and 25 shall not be applied to the ramp.

**At-grade Intersection with Railroad**

**Article 29**

When a road intersects at a grade with a railway or street railway newly constructed in accordance with the Street Railway Act (Act No.76 1921) (hereinafter referred to as a “railway”), the road shall be so constructed as specified below:
1. Intersection angles shall be not less than 45 degrees.
2. Sections 30m from both ends of railroad crossing and the railroad crossing section shall be straight and vertical carriageways, grades for these sections shall be less than 2.5%, except where there is extremely small vehicle traffic volume or topographical conditions or any other reasons do not permit such provisions.
3. A visible distance, distance from the intersection point of the railway end track centerline and the carriageway centerline to the point on the track centerline visible at the height of 1.2m at point 5m on the carriageway centerline from the track, shall not be less than the values listed in the following table, except for where a crossing gate or other security facilities are provided or with smaller vehicle traffic volume and fewer passing trains.
1. Where an avalanche, blizzard, snowfall or other meteorological events could prevent smooth traffic, snow shed, drain for snow removal, snow melting facilities or other facilities shall be provided as specified by the Land, Infrastructure and Transport Ministry’s Ordinances.  
2. Unless specified above, a fence, retaining wall, and other proper protections shall be installed where falling stone, slope failure, billow, etc. could prevent traffic or damage road structure.

### Turnout

**Article 30**

Turnout shall be provided on Type 3 Class 5 roads as specified below, except for on roads where smooth traffic can be ensured.  
1. Distance between two turnouts shall be within 300m.  
2. Roads between two turnouts shall be visible from one of these turnouts.  
3. The length shall be more than 20m and the total width of the carriageway or on the shoulders connecting to the carriageway, or narrow passes or bend sections shall be provided on the carriageway, on Type 3 Class 5 roads intended primarily for use by nearby residents.

### Traffic Safety Device

**Article 31**

When it is necessary for traffic accident prevention, the pedestrian crossing bridge, fence, lighting, safety post, emergency notification facility, and other similar facilities, as specified by the Land, Infrastructure and Transport Ministry’s Ordinances, shall be provided.

### Protrusions, Narrow Passes, etc.

**Article 31.2**

When it is necessary for slowing down vehicles, to ensure safe pedestrian or bicycle traffic, protrusions shall be provided on the surface of the carriageway or on the shoulders connecting to the carriageway, or narrow passes or bend sections shall be provided.

### Islands Provided at Bus Bays

**Article 31.3**

Islands shall be provided as necessary at bus bays or streetcar stops that do not connect to bicycle tracks, bicycle/pedestrian tracks or sidewalks.

### Automobile Parking Lot

**Article 32**

Automobile parking lots, bicycle parking lots, bus bays, emergency parking basis or other similar facilities specified by the Land, Infrastructure and Transport Ministry’s Ordinances shall be provided, if necessary, to ensure safe and smooth traffic or to contribute to public convenience.

### Snow Protection Facility and Other Protector

**Article 33**

1. Where an avalanche, blizzard, snowfall or other meteorological events could prevent smooth traffic, snow shed, drain for snow removal, snow melting facilities or other facilities shall be provided as specified by the Land, Infrastructure and Transport Ministry’s Ordinances.  
2. Unless specified above, a fence, retaining wall, and other proper protections shall be installed where falling stone, slope failure, billow, etc. could prevent traffic or damage road structure.

### Tunnel

**Article 34**

1. To ensure safe and smooth traffic, proper ventilation facilities shall be provided in the tunnel when required in consideration of designed daily volume and tunnel length on the road.  
2. When required for safe and smooth traffic, proper lighting shall be provided in the tunnel in consideration of design speed.  
3. When a vehicle fire or other accidents in the tunnel could cause risks to traffic, the communication facilities, warning facilities, firefighting facilities and other emergency facilities shall be provided in the tunnel if necessary.

### Bridge and Viaduct

**Article 35**

1. Bridges, viaducts, or other similar roads shall be steel or concrete structure or the equivalent.  
2. Design vehicle load for bridges, viaducts, and other similar regular motor vehicle roads shall be 245kN. The structures of said bridges, viaducts, and other similar regular motor vehicle roads shall secure safe traffic in view of large-sized vehicle traffic conditions for these roads.  
3. Design vehicle load for bridges, viaducts, and other similar smaller motor vehicle roads shall be 30kN. The structures of said bridges, viaducts, and other similar smaller motor vehicle roads shall secure safe traffic in view of smaller vehicle traffic conditions for these roads.  
4. In addition to the requirements in the three previous paragraphs, necessary matters regarding construction standards for bridges, viaducts, or other similar roads shall be specified by the Ordinances of the Ministry of Land, Infrastructure, Transport and Tourism.

### Exception to Accessory Work

**Article 36**

After a case is identified in which road work executed on others roads or work other than road work is executed and determined to be influencing roads, provisions from Articles 4 to 35 (except for Article 8, Article 13, Article 14, Article 24, Article 26, Article 31 and Article 33) may be exempted from application after it is approved that the case is not subject to these requirements.

### Exception to Change of Road Classification

**Article 37**

When classification, as specified in Article 3.2, is changed by plans as to change a part of national highways to prefectural or municipal roads, classification following the change shall result in applying requirements of Article 3.4, Article 3.5, Article 4, Article 5, Article 6.1, Article 6.4, Article 6.6, Article 8.2 through 8.6, Article 8.9, Article 8.11, Article 9.1, Article 10.2.3, Article 11.1, Article 11.2, Article 11.4, Article 11.4.1, Article 12, Article 13.1, Article 15, Article 17, Article 18.1, Article 20, Article 22.2, Article 23.3, Article 27.3, Article 30 and Article 31.2; In this case, “Type 3 Class 5 roads” in proviso of Article 5.1, Article 5.5, proviso of Article 10.2.3, proviso of Article 11.4 and Article 12 shall be read as “Type 3 Class 5 or Type 4 Class 4 roads”. “Type 3 Class 5 roads” in Article 5.3 shall be read as “Type 3 Class 5 and Type 4 Class 4 roads”. “Type 4 roads” in Article 8.1 and Article 11.1 shall be read as “Type 4 (except for Class 4)”. “Type 3” in these paragraphs shall be read as “Type 3 or Type 4 Class 4”. “Type 3” in Article 11.2 shall be read as “Type 3 or Type 4 Class 4”. “Values listed in the top column” in Article 13.1 shall be read as “Values listed in the top column (for Type 4 Class 4 roads, 40km/h, 30km/h or 20km/h)”. “Mainly” in Article 31.2 shall be read as “Type 4 Class 4 roads or mainly”.

### Exception to Reconstruction of Short Section

**Article 38**

1. When a short section on roads that severely prevents traffic is reconstructed as an emergency measure, except for reconstruction as listed in the following requirements, this section may be exempted from application of Article 5. Article 6.4 through Article 6.6, Article 7, Article 9.2, Article 10.3, Article 10.2.2, Article 10.2.3, Article 11.3, Article 11.4, Article 11.4.2, Article 11.4.3, Article 15 through Article 22, Article 23.3, and Article 25, if it is approved that the road structure of sections adjacent to this section do not satisfy these requirements.

2. When a short section of roads that severely impact safety is reconstructed as an emergency measure, this section shall be exempt from application of Article 5, Article 6.4 through Article 6.6, Article 7, Article 8.2, Article 9.2, Article 9.3, Article 10.3, Article 10.2.2, Article 10.2.3, Article 11.3, Article 11.4, Article 11.4.3, Article 19.1, Article 21.2, Article 23.3, Article 39.1, Article 39.2, and Article 40.1, if it is determined in consideration of road conditions that it is not proper to apply these requirements.
(Bicycle Path and Bicycle/Pedestrian Path)

Article 39
1. Bicycle path width shall be not less than 3m, while bicycle/pedestrian path width shall be no less than 4m. However, where topographical conditions or any other reasons do not permit such provisions, bicycle path width can be reduced to 2.5m.
2. Lateral clearances wider than 0.5m shall be provided to both sides of bicycle paths or bicycle/pedestrian paths as a part of the roads.
3. Where on-street facilities are provided on bicycle tracks or bicycle/pedestrian tracks, width of these tracks shall be determined in consideration of clearances as specified in the following provision.
4. Bicycle path and bicycle/pedestrian path clearances shall be in accordance with the following figure.
5. Alignment, grade, and other features of bicycle paths and bicycle/pedestrian paths shall be determined so as to ensure safe and smooth bicycle and pedestrian traffic.
6. Requirements of Article 3 through 37 and Section 1 of the preceding Article (excluding Article 1 1.2 for bicycle/pedestrian path) shall not be applied to bicycle paths and bicycle/pedestrian paths.

(Pedestrian Path)

Article 40
1. Pedestrian path width shall be not less than 2m in consideration of pedestrian traffic conditions and areas where the track is located, except where topographical conditions or other reasons do not permit such provisions, in which case the width can be reduced to 1m.
2. Where on-street facilities are provided on pedestrian paths, width shall be determined in consideration of clearances as specified in the following provision.
3. Pedestrian path clearances shall be in accordance with the following figure.
4. Alignment, grade and other features of pedestrian paths shall be determined so as to ensure safe and smooth pedestrian traffic.
5. Requirements of Articles 3 through 11, Article 11.3 through 37 and Section 1 of Article 38 shall not be applied to pedestrian paths.

(General technical standards for structure of prefectural and municipal roads)

Article 41
1. The provisions of Article 4, 12, 35.2, 35.3, 35.4 (limited to the matters listed in Article 30.1.12), 39.4, and 40.3 shall apply mutatis mutandis to general technical standards for the structure of prefectural or municipal roads when these roads are newly constructed or reconstructed. In this case, “Type 3 Class 5 roads” in Article 12 shall be read as “Type 3 Class 5 or Type 4 Class 4”.
2. The provisions of Article 5 through Article 11.4, Article 13 through 34, Article 35.1 and 35.4 (except for the provisions listed in Article 30.1.12), Article 36 through 38, Article 39.1 through 39.3, Article 39.5 and 39.6, Article 40.1, 40.2, 40.4, and 40.5 shall apply mutatis mutandis to the standard specified in Article 30.3. In this case, “Type 3 Class 5 roads” in proviso of Article 5.1, Article 5.5, proviso of Article 10.2.3, and proviso of Article 11.4 shall be read as “Type 3 Class 5 or Type 4 Class 4 roads”. "Type 3 Class 5 roads" in Article 5.3 shall be read as "Type 3 Class 5 and Type 4 Class 4 roads". "Type 4 roads" in Article 9.1 and Article 11.1 shall be read as "Type 4 (except for Class 4)", "Type 3 in these paragraphs shall be read as "Type 3 or Type 4 Class 4".
"Type 3 in Article 11.2 shall be read as "Type 3 or Type 4 Class 4". "Values listed in the left column" in Article 13.1 shall be read as "Values listed in the left column (for Type 4 Class 4 roads 40km/h, 30km/h or 20km/h)", "Primarily for use" in Article 31.2 shall be read as "Primarily for Type 4 Class 4 roads or use". In Article 37 "National highways" shall be read as "prefectural roads", "prefectural roads or municipal roads" and "other roads" shall be read as "municipal roads", "subject part" shall be read as "subject prefectural roads".
Statistics

Road Statistics of Japan

Road Length by Category (April 1, 2012)

<table>
<thead>
<tr>
<th>Category</th>
<th>Unit: km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motorways</td>
<td>8,050</td>
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<tr>
<td>Highways, Main or National Roads</td>
<td>51,237</td>
</tr>
<tr>
<td>Secondary or Regional Roads</td>
<td>91,440</td>
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<tr>
<td>Other Roads</td>
<td>190,782</td>
</tr>
<tr>
<td>Total</td>
<td>341,928</td>
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Vehicles in Use (Mar. 31, 2012)

<table>
<thead>
<tr>
<th>Vehicle type</th>
<th>Unit: vehicles</th>
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<tbody>
<tr>
<td>Passenger cars</td>
<td>59,357,223</td>
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<tr>
<td>Buses &amp; Motor coaches</td>
<td>226,047</td>
</tr>
<tr>
<td>Vans, pick-ups, lorries, road tractors</td>
<td>16,506,405</td>
</tr>
<tr>
<td>Total</td>
<td>76,089,675</td>
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</tbody>
</table>

Reference: Motorcycles & Mopeds 3,535,528

Vehicle Traffic Volume (2011)

<table>
<thead>
<tr>
<th>Vehicle type</th>
<th>Million vehicle km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger cars</td>
<td>499,037</td>
</tr>
<tr>
<td>Buses &amp; Motor coaches</td>
<td>6,124</td>
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<tr>
<td>Vans, pick-ups, lorries, road tractors</td>
<td>196,821</td>
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<td>Total</td>
<td>701,982</td>
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</table>

Road Accidents (2012)

<table>
<thead>
<tr>
<th>Unit: accidents, or persons</th>
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</thead>
<tbody>
<tr>
<td>Number of Injury Accidents</td>
</tr>
<tr>
<td>Number of Persons Injured</td>
</tr>
<tr>
<td>Number of Persons Killed</td>
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</tbody>
</table>

Road Expenditure (2011)

<table>
<thead>
<tr>
<th>Unit: million yen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross investment</td>
</tr>
<tr>
<td>Maintenance expenditures</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Freight Transport (2011)

<table>
<thead>
<tr>
<th>Modes</th>
<th>Unit: million ton-km/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road</td>
<td>231,061</td>
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<tr>
<td>Rail</td>
<td>19,998</td>
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<tr>
<td>Inland Waterway</td>
<td>174,900</td>
</tr>
<tr>
<td>Total</td>
<td>425,959</td>
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</table>

Passengers Transport (2009)

<table>
<thead>
<tr>
<th>Modes</th>
<th>Unit: million passenger-km/year</th>
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</thead>
<tbody>
<tr>
<td>Road, public transport</td>
<td>81,360</td>
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<tr>
<td>Road, private transport</td>
<td>817,361</td>
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<tr>
<td>Rail</td>
<td>393,765</td>
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<tr>
<td>Total</td>
<td>1,292,486</td>
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</table>

- Since 2010, survey and calculation methods for road traffic have been changed, so the data do not match the previous data.
- Due to Great East Japan Earthquake, traffic for March of FY2010 (2010.4-2011.3) in Hokkaido and Tohoku Regions are not included in 2010 figures.
- Roads less than 5.5m in width have been excluded from the statistics.
- Expenditures for toll roads are excluded.

(Source: Road Statistics Annual Report [Douro Toukei Nenpo] 2012, Road Bureau, MLIT)
## Change in Investment in the Five-Year Road Development Program

<table>
<thead>
<tr>
<th>The Five-Year Road Development Plans</th>
<th>General Road Projects</th>
<th>Toll Road Projects</th>
<th>Unsubsidized Local Road Projects</th>
<th>Total Billions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Investment (¥ billions)</td>
<td>Ratio (%)</td>
<td>Investment (¥ billions)</td>
<td>Ratio (%)</td>
</tr>
<tr>
<td>1st Plan (A) FY1954-57 (a) e/A (%)</td>
<td>260.0</td>
<td>100.0</td>
<td>-</td>
<td>-</td>
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<tr>
<td>2nd Plan (B) FY1958-60 (b) b/B (%)</td>
<td>610.0</td>
<td>61.0</td>
<td>200.0</td>
<td>20.0</td>
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<td>3rd Plan (C) FY1960-63 (c) c/C (%)</td>
<td>1,300.0</td>
<td>61.9</td>
<td>1,250.0</td>
<td>18.1</td>
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<tr>
<td>4th Plan (D) FY1964-66 (d) d/D (%)</td>
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<td>51.0</td>
<td>1,100.0</td>
<td>50.1</td>
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<tr>
<td>5th Plan (E) FY1967-69 (e) e/E (%)</td>
<td>5,500.0</td>
<td>53.8</td>
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<td>27.3</td>
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<tr>
<td>6th Plan (F) FY1970-72 (f) f/F (%)</td>
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<td>7th Plan (G) FY1973-77 (g) g/G (%)</td>
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<td>49.9</td>
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<td>8th Plan (H) FY1978-82 (h) h/H (%)</td>
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<td>9th Plan (I) FY1983-87 (i) i/I (%)</td>
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<td>10th Plan (J) FY1988-92 (j) j/J (%)</td>
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<td>11th Plan (K) FY1993-97 (k) k/K (%)</td>
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<td>12th Plan (L) FY1998-02 (l) l/L (%)</td>
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<td>108.7</td>
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<td>79.0</td>
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</table>

### 2nd Plan (B)

- **B/B (%)**
- **2nd Plan (B) FY1958-60 (b)**
- **b/B (%)**
- **Third Plan (C) FY1960-63 (c)**
- **c/C (%)**
- **Fourth Plan (D) FY1964-66 (d)**
- **d/D (%)**
- **Fifth Plan (E) FY1967-69 (e)**
- **e/E (%)**
- **6th Plan (F) FY1970-72 (f)**
- **f/F (%)**
- **7th Plan (G) FY1973-77 (g)**
- **g/G (%)**
- **8th Plan (H) FY1978-82 (h)**
- **h/H (%)**
- **9th Plan (I) FY1983-87 (i)**
- **i/I (%)**
- **10th Plan (J) FY1988-92 (j)**
- **j/J (%)**
- **11th Plan (K) FY1993-97 (k)**
- **k/K (%)**
- **12th Plan (L) FY1998-02 (l)**
- **l/L (%)**