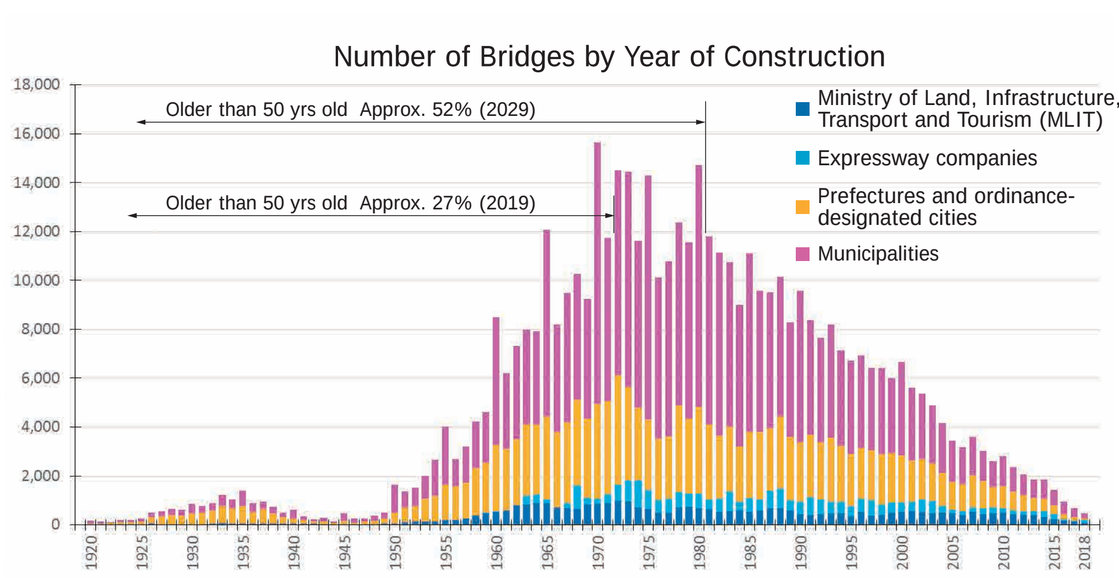
Full Implementation of Deterioration Prevention Measures

التنفيذ الكامل لتدابير منع التدهور

- In Japan, there are 720,000 road bridges nationwide, 90% of which are under the jurisdiction of local governments. Over the next 10 years, the ratio of bridges more than 50 years old will rise from 27% in 2019 to 52% in 2029.
- Since 2014, bridge inspections once every five years by road administrators have been required, and we are conducting with two pillars of full measures.
- Completion of the first round of inspections in 2018 revealed the need for urgent maintenance measures for about 10% of bridges.
- New technologies have been implemented since 2019 for more efficient inspections.

Current Situation / Issues for Bridge Deterioration

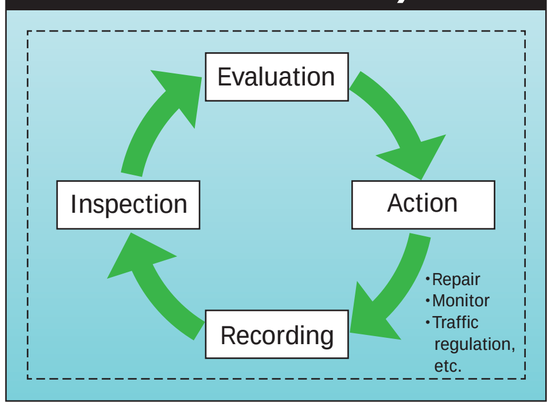
The ratio of bridges older than 50 years old will rise from 27% in 2019 to 52% in 2029.



Measures for Dealing with Road Deterioration

Since 2014, bridge inspections once every five years by road administrators have been obliged, and two pillars of full implementation of measures were begun to address deterioration.

Set up maintenance cycle (Clarify duties of road administrators)



Set up structure for the maintenance cycle

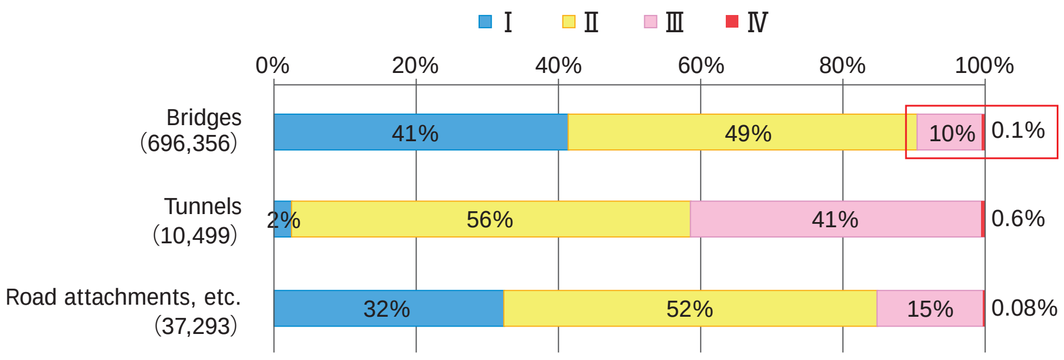
System Support
- Hold road maintenance meetings

Technical Support
- Formulate periodic inspection procedures
- Provide training

Budgeting
- Set up a national subsidy system

Current Situation of Road Structure Inspections

Inspections revealed the need for urgent measures for about 10% of bridges.



Classification		Situation
Ⅰ	Sound	Function of the structure is not impeded.
Ⅱ	Preventive maintenance	Function of the structure is not impeded, but measures for preventive maintenance are desirable.
Ⅲ	Prompt repair	An impediment to the structure's function may arise, requiring early-stage measures.
Ⅳ	Emergency response	An impediment to the structure's function has occurred or is highly likely to occur, requiring urgent measures.

Inspection (close visual)

Recording of inspection results / measures

Example
Scouring has caused the collapse of a pile-bent bridge pier and the inclination of another pier with the deformation of the superstructure.

Example
Scouring has caused the sinking of the bridge pier, making the receiving part of the girder for the superstructure unstable.

Example
Scouring has caused the sinking of the bridge pier, resulting in cracking in the superstructure.

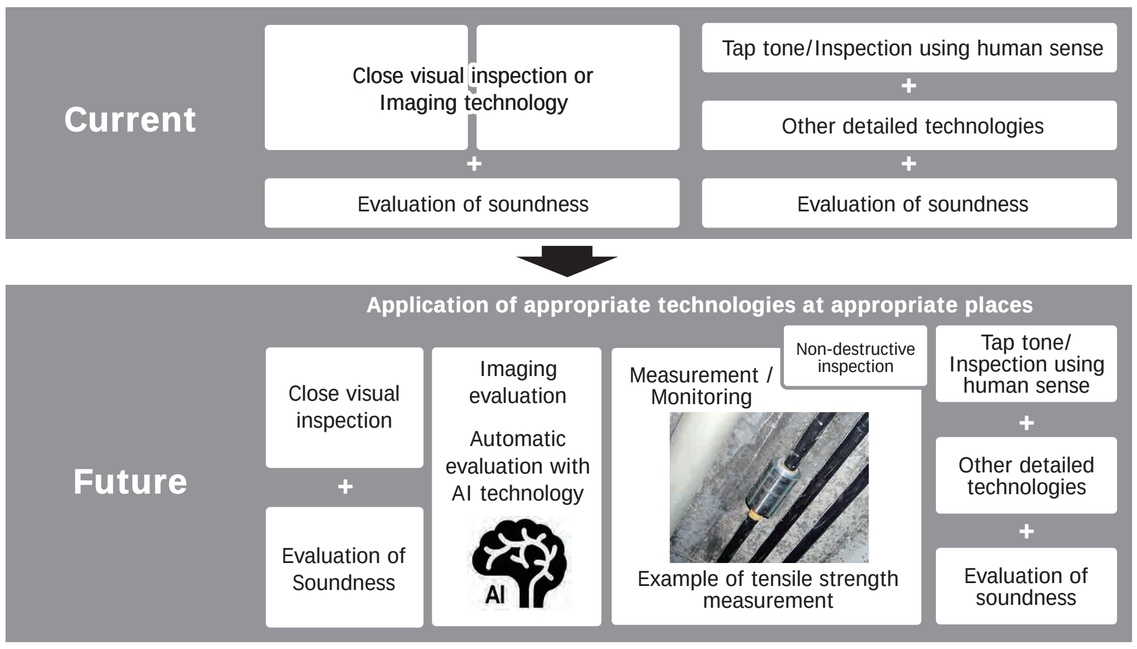
Example
Scouring has caused the inclination of the pier of "sinking bridge", a bridge designed to be underwater during a flood. Water pressure during a flood may develop further inclination.

Note
Scouring may cause an inclination or a sinking of a substructure.

Introduction of New Inspection Technology

Introduce more efficient inspections through the use of imaging systems as periodic inspections from FY 2019.

From now, we will proceed with the development of AI-based inspection and evaluation technologies, advance the verification of measurement and monitoring technologies, and develop technology for carrying out inspections that do not depend on close visual inspection.



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Smart Use of Road Networks

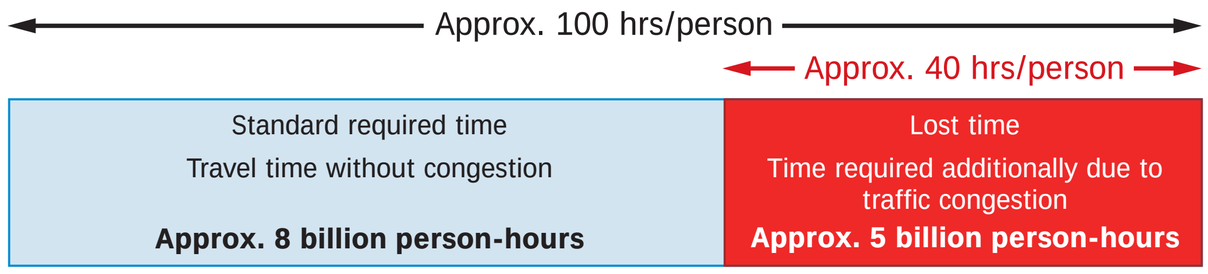
الاستخدام الرشيد للشبكات

- Location-specific congestion-mitigating measures to enable the entire road network to function at maximum efficiency by making improvements in existing road operations and implementing small-scale enhancements.
- Optimizing traffic flow by implementing 3 smart principles in fee structures: (1) making them fair by linking them to degree of use; (2) making them simple, seamless and independent of the management entity, and (3) making them strategically structured to optimize traffic flow.

Location-specific Congestion Mitigation Measures

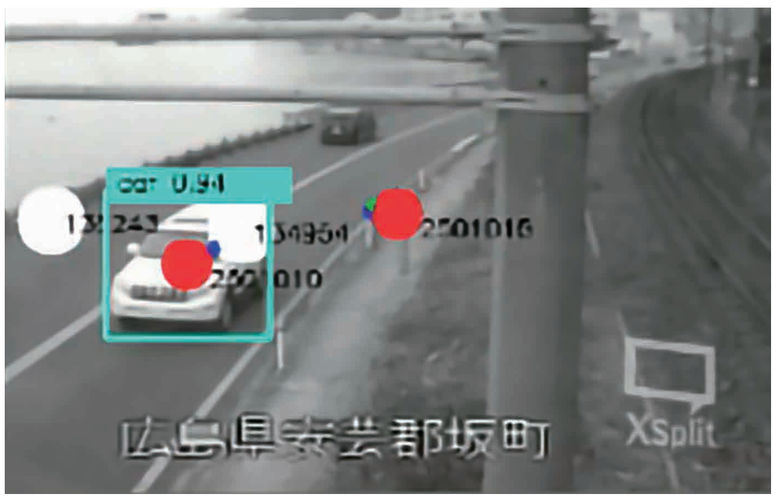
Background

In Japan average time loss per year due to traffic congestion is approx. 40 hours per person, equal to approx. 40% of total driving time (approximately 100 hours).

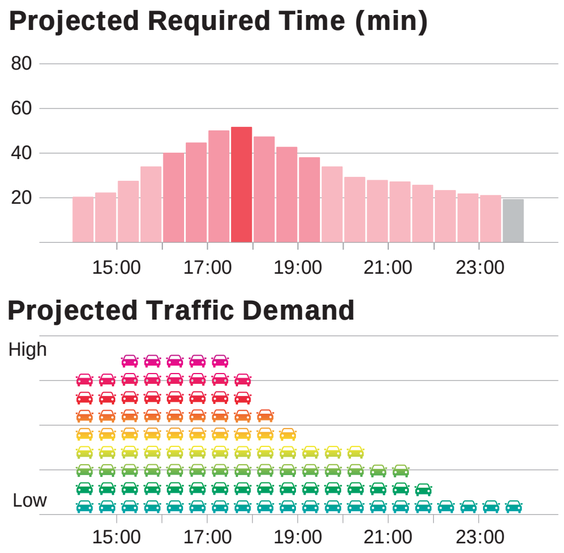


Example cases

Location-specific measures on expressways
(e.g., Ken-Ō Expressway, Ebina Jct.)



Measuring traffic volume by AI analysis of CCTV feed
(e.g., During heavy rain in July 2018)



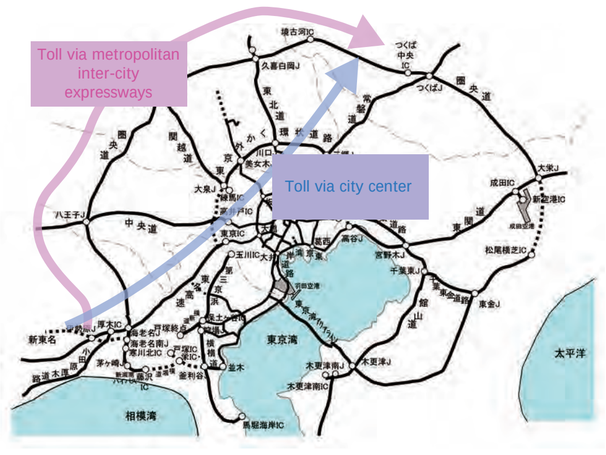
Distribution of projected driving time and traffic demand by “AI traffic congestion forecast” system.
(e.g., Tokyo Bay Aqua Line)

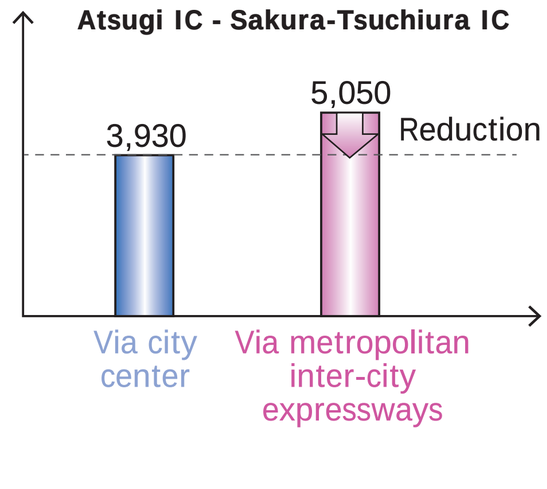
Optimizing Traffic Flow by Fee Structure

Background

With through traffic in the city center on one hand, we are making progress in the development of ring roads for metropolitan inter-city expressways (Ken-Ō Expressways) etc.
The challenge is to make effective use of these alternative road networks.

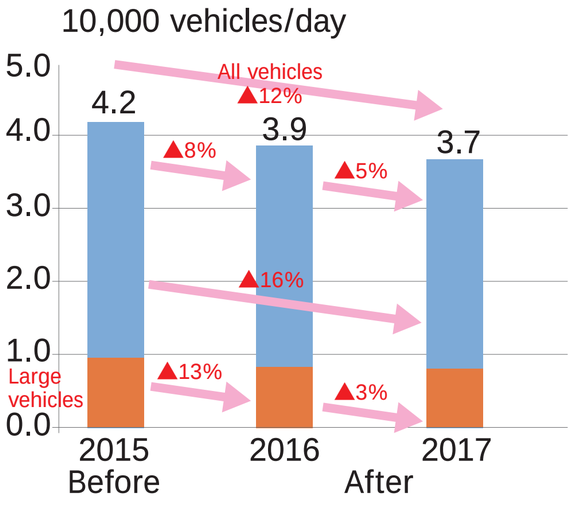
We have been working towards the adoption of uniform tariff standards and the realization of seamless tolls based on the journey's starting and ending points, with the aim of eliminating through traffic within the city center and promote a shift to the use of metropolitan inter-city expressways, etc. (from April 2016).

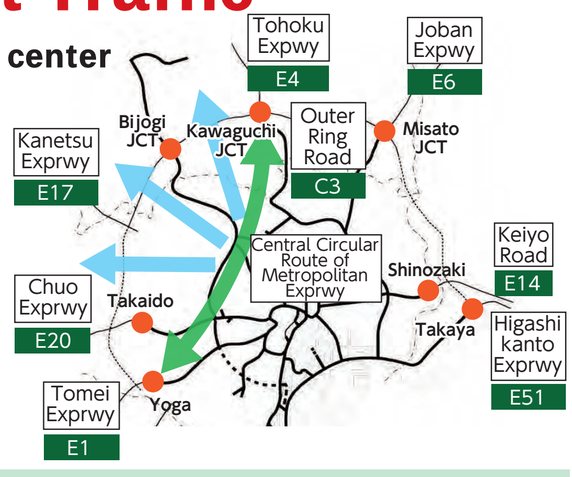




City Center Transit Traffic

Traffic volume passing through city center



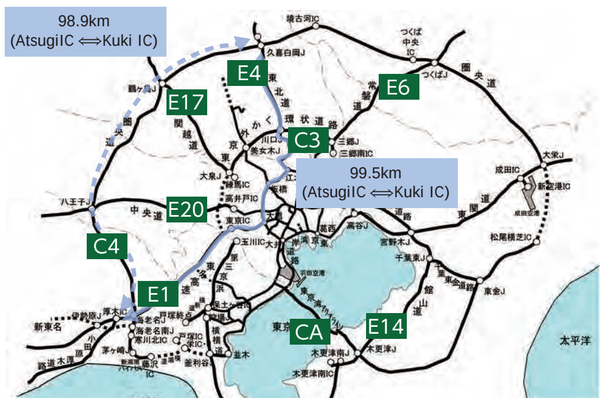


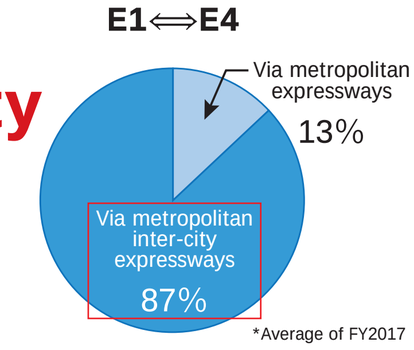
<Tomei⇔Tohoku>

	2015	2016	2017
All vehicles	4,620 ⇒	2,740 <▲41%>	⇒ 2,650 <▲43%>
Large vehicles	1,490 ⇒	590 <▲60%>	⇒ 550 <▲63%>

- Approx. 10% reduction in traffic passing through city center.

Conditions of Metropolitan Inter-city Expressways





*Average of FY2017

e.g., Atsugi IC⟺Kuki IC

	Via metropolitan expressways		Via metropolitan inter-city expressways
Distance	99.5km	=	98.9km
Time	112.8min	>	90.6min
Toll	3,180yen ↓ 3,550yen	< ↓ >	3,770yen ↓ 3,260yen

*For standard vehicle with ETC (daytime)

Set new toll system

- More than 80% of drivers choose metropolitan inter-city expressways between the E1 and E4.

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Advancing Measures for Logistics System

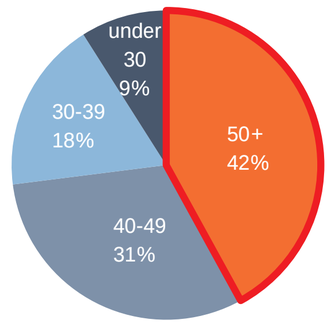
تدابير متطورة للنظام اللوجستي

- To address an increasingly serious shortage of truck drivers, we are emphasizing the introduction of labor-saving “double trailers” that can transport twice the amount of regular HGV cargo.
- With the introduction of truck platooning on expressways in view, we are studying the use of highway infrastructure, primarily on the Shin-Tomei Expressway. This includes the introduction of six lanes on the Shin-Tomei and Shin-Meishin Expressways, which will increase the stability and efficiency of the double network connecting the three major metropolitan areas, as well as provide rest spaces and coupling/decoupling bases.

Background

- Approx. 90% of domestic freight is transported by trucks.
- A serious shortage of truck drivers is worsening (approx. 40% are 50 years old or more)
- Approx. 50% of domestic freight transport uses the Tomei and Meishin Expressways (including Shin-Tomei and Shin-Meishin Expressways)

Age structure of truck drivers



Source: "Labor Force Survey," Ministry of Internal Affairs and Communications

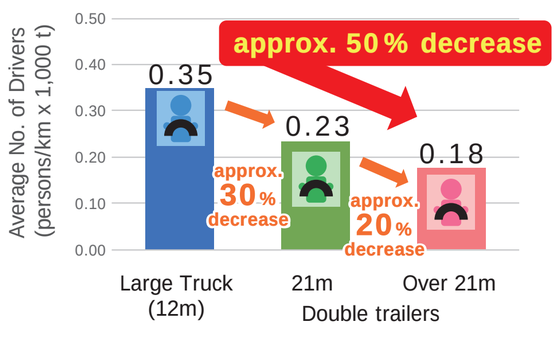
Introduction of Double Trailers

- Confirmation of the labor-saving effects and driving safety through the conduct of demonstration experiments.
- Full introduction of double trailers primarily on the Shin-Tomei Expressway by allowing relaxation of licensing standards for passage of special vehicles and, as of January 2019, relaxation of licensing standards regarding maximum length for special vehicles.

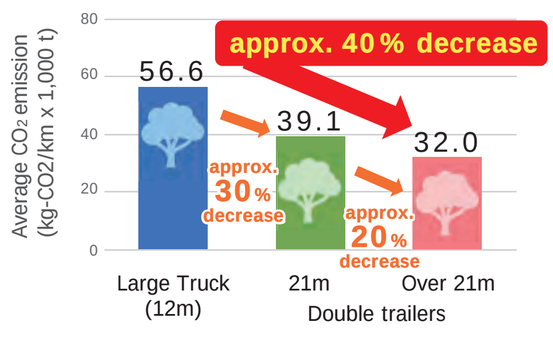
Experiment result

In transporting the same weight in cargo, use of vehicles over 21m long compared to regular HGV, achieved a labor saving with a reduction of the number of drivers by about 50%, as well as a drop in fuel consumption and CO_2 emissions of about 40%.

● Labor Saving
(Number of drivers required per 1,000 ton-km)



● CO_2 Reduction
(emission per 1,000 ton-km)



Realization of Truck Platooning

- We have been conducting demonstration experiments on public roads, on the Shin-Tomei Expressway, etc. since January 2018, aiming to establisih truck platooning.
- While embarking on demonstration experiments for truck platooning, we are making a concrete study of expressway infrastructure that will support new logistics systems, primarily on the Shin-Tomei Expressway.

Government targets

- To establish a technically viable platooning system with unmanned following vehicles on an expressway (Shin-Tomei) in FY2020.
- To implement a commercial platooning system with unmanned following vehicles on an expressway (between Tokyo and Osaka) from FY2022.

Image of Expressway Use with Platooning

Driven by a driver **Assisted or automated driving system**

Platooning by electronically linking vehicles in front with those in back

Labor Saving Double Trailers

Before Regular HGVs

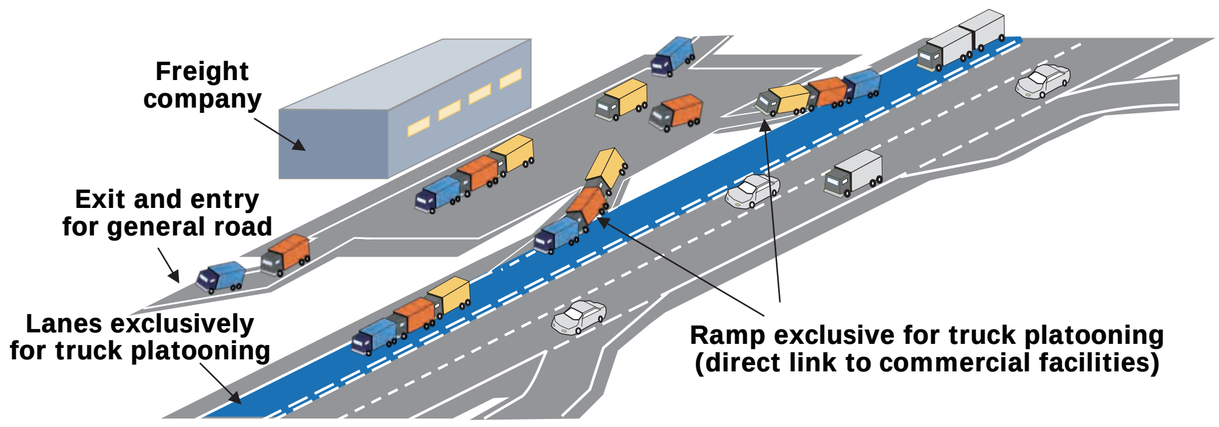
approx. 12m

After Double trailers: carries twice as much cargo as a regular HGV.

Relaxing the maximum permissible length of oversized trucks from the current 21 m to 25 m.

Concept of Platooning on Expressways

(When platooning with unmanned rear vehicles becomes established)



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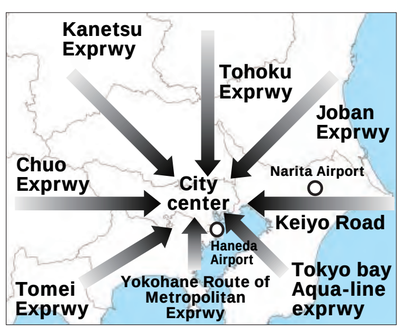
Road Disaster Prevention and Road Safety Improvement

منع كوارث الطرق وتحسين السلامة

- In the event of a major earthquake or other disasters, we provide support for rescue activities through the rapid removal of road obstacles. In order to provide safe and highly reliable road networks, we are working on disaster countermeasures including slope collapse pevention and antiseismic reinforcement.
- Given that half of road traffic deaths occur among pedestrians and cyclists and half of them are killed on residential streets in the vicinity of their homes, we are committed to enhancing traffic safety effectivity by utilizing Big Data.

Road Disaster Prevention

- When a large earthquake occurs, debris and abandoned vehicles in the city center may hinder the movement of emergency vehicles. In order to provide secure relief routes, we have formulated plans in Tokyo to remove road obstacles from eight directions.
- The law has been revised to allow road administrators to remove abandoned vehicles that hinder the clearing away of road obstacles in the event of a disaster.
- The law has been revised to allow the national government to engage in road obstacle removal and disaster recovery measures on behalf of road administrators in order to support relief activities in the event of a disaster.

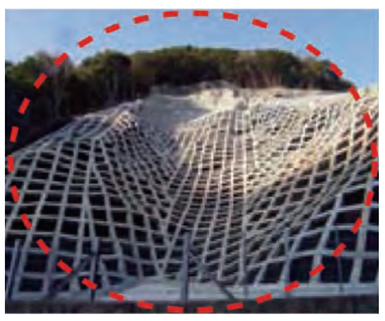


<Eight-way strategy for securing relief routes in Tokyo>


<Training in the removal of vehicles in accordance with the Disaster Countermeasure Basic Act>


<Elimination of road obstacles during a disaster>

- To mitigate the effect of heavy rains on road traffic, we have taken various preventive measures, including slope collapse prevention and the installation of facilities to prevent falling rock at sections that are subject to disasters.


<Measures to protect against slope collapse>


<Facility to ptrotect against falling rock>

- We have been implementing seismic retrofitting based on insights from bridge damage caused by the Great Hanshin-Awaji Earthquake in 1995. No bridges that had undergone reinforcement measures suffered collapse during the Great East Japan Earthquake in 2011.

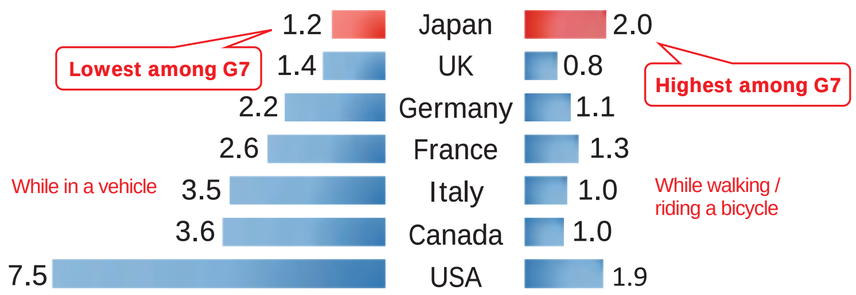

<Damage caused by the Great Hanshin, Awaji Earthquake in 1995>

<Bridge with antiseismic reinforcement after the Great East Japan Earthquake in 2011>

Road Safety Improvement

- The number of traffic fatalities in Japan (per 100,000 persons) involving pedestrians and cyclists is the largest among those in the G7 countries.

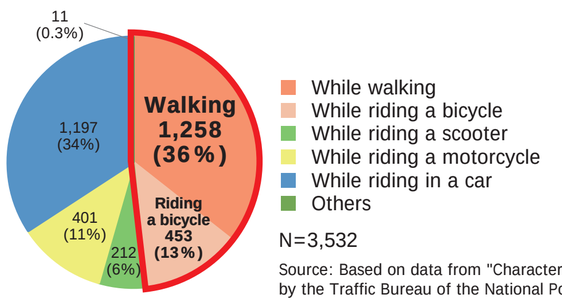
<Comparison of traffic fatalities per 10,000 persons>



Source: IRTAD (2017), World Bank

- About half of the fatalities in traffic accidents happen to people walking or riding a bicycle, and about half of those cases occur within 500 m of their home.

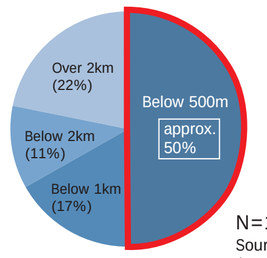
<Number of traffic deaths by condition>



N=3,532

Source: Based on data from "Characteristics of traffic fatalities in 2018" by the Traffic Bureau of the National Police Agency.

<Deaths by distance from home (pedestrians/bicycles)>

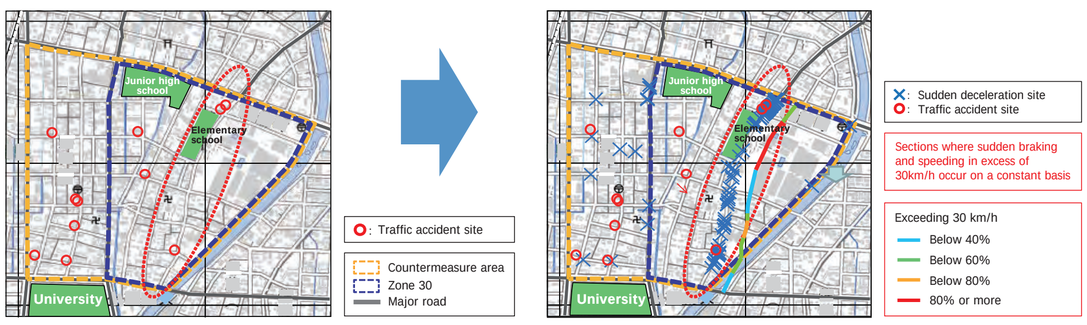


N=1,810

Source: Traffic accident data (ITARDA: 2017 data)

- By applying big data to traffic safety measures, we are identifying potential places where speeding, sudden braking and other dangerous actions may occur and are promoting initiatives to implement more effective and efficient countermeasures.

<Using Big Data>



[Before]
Countermeasures addressing symptoms at accident sites

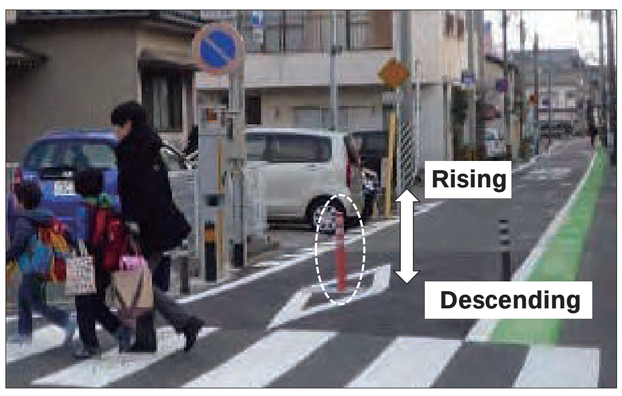
[After]
Effective measures based on the **identification of potential sites** where dangerous actions occur, such as speeding, sudden braking and the use of rat runs.

- We are advancing efforts based on the implementation and verification of physical devices such as speed bumps and rising bollards.

<Countermeasure (speed control)>


Speed bumps

<Countermeasure (restricting the entry of traffic)>



Rising bollards

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Strengthening the Function of “Michi-no-Eki”

"Michi-no-Eki" تعزيز دور

- 1,160 “Michi-no-Eki” stations have been installed and are being used by more than 200 million people annually as areas for road-users to rest, to provide information, and to serve as centers for community cooperation. We will continue to use these stations as bases of regional revitalization to meet growing expectations and to win the trust of users and local communities.

- We construct and deploy facilities with the aim of making Service Areas (SAs) and Parking Areas (PAs) on expressways into places that people want to actively use.

Disaster Prevention Function

Michi-no-Eki "Mukakawa Shiki no Yakata"

- In response to the occurrence of disasters of greater frequency and intensity, Michi-no-Ekis have been enhanced with disaster-prevention functions and used in recent years as evacuation centers, etc. at times of disaster.

Inbound Support

Michi-no-Eki "Aso"

- In order to encourage more foreign tourists to visit rural areas, we are promoting the establishment of more receptive inbound environments through certification of information centers for overseas visitors.

Automated Driving

- By introducing automated driving services that connect Michi-no-Ekis with surrounding facilities and villages, etc., we strengthen their function as traffic nodes.

Branding of Service Areas and Parking Areas

By incorporating the region's features, we develop Service Areas and Parking Areas as attractive destinations to visit rather than places to merely pass by.

Pasar Hasuda on the Tohoku Expressway (East Nippon Expressway)

- Branding SAs and PAs and offering various services such as multi-functional commercial complexes with specialty shops etc., tourist information centers and dog runs according to diversifying needs.

EXPASA Fujikawa on the Tomei Expressway (Central Nippon Expressway)

- Creating unique areas with a variety of local color, for instance with inclusion of a large ferris wheel from which visitors can enjoy a magnificent view of Mt. Fuji.

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Contribution to the growth of developing countries by “Quality Infrastructure” Investment

المساهمة في نهضة الدول النامية عن طريق الاستثمار في "البنية التحتية عالية الجودة"

- Japan has experience in the solution for various problems, including those related to severe topography and construction conditions, disasters such as earthquakes and typhoons, congestion due to population concentration in urban areas, accidents, environmental problems, and the prevention of deterioration in structures.

- By taking advantage of such "achievements" and the underlying technological capabilities and systems that support these achievements that are Japan's strengths, we hope to contribute to the growth of emerging countries and to help them in realizing their productive future through the development of “quality infrastructure”.

Technological Capabilities related to Bridges and Tunnels

Possessing rich experience and advanced technical capabilities to overcome severe construction conditions in the field of bridges and tunnels.

Steel Superstructures

- The use of high-performance steel SBHS enables the building of long-span bridges.

PC Superstructures

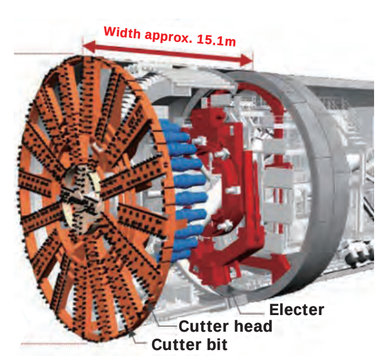
- Using corrugated steel web bridges, the replacement of concrete parts with steel plate results in shorter construction periods and economic advantages.

Mountain Tunnels

- The adoption of methods such as multiple-layer and high-standard steel support, hybrid rapid-spray construction and full-face excavation with auxiliary benches makes it possible to cope with stratal changes during construction.

Shield Tunnels

- The use of a double cutter method increases excavation speed and shortens the construction period.

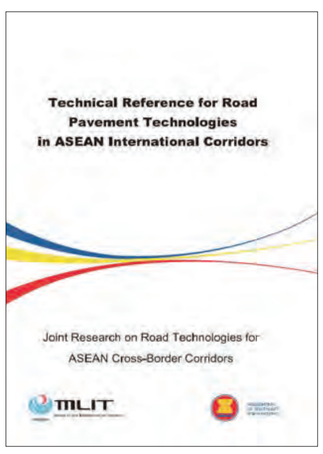


Technical Support through Joint Research

Making use of the framework of Japan-ASEAN transportation cooperation, we have conducted joint research on pavement technology and overload management technology that can support international road networks.

The final report, “Technical Reference for Road Pavement Technologies in ASEAN International Corridors”, was officially approved at The Sixteenth ASEAN and Japan Transport Ministers Meeting in November 2018.
More joint research on bridge maintenance is planned for the future.

Examples of Damaged Road Pavement



Technical Reference for Road Pavement Technologies in ASEAN International Corridors

Achievements in the Field of Roads and Bridges

We are advancing inter-field collaboration in international port and airport development projects involving Japan, and promoting projects with highly-collaborative effects such as access roads.

Access Roads in Conjunction with Port Development

Lucken International Port Access Road
(Completed in 2017)

- In conjunction with the development of container terminals, etc., at Lach Huyen International Port, an access road was developed to connect the expressway from Hanoi.

Access Roads in Conjunction with Airport Development

Nhat Tan Bridge (Completed in 2015)

- In conjunction with the development of an international passenger terminal at Hanoi's Noi Bai International Airport, an access road and bridge to the center of Hanoi was developed.

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