Public-Private ITS Initiative/Roadmaps 2016

Toward the Realization of Automated Driving on Highways and Unmanned Autonomous Driving Transport Services in Limited Regions by 2020

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The Strategic Headquarters for the Promotion
of an Advanced Information and
Telecommunications Network Society

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1. Introduction and Definitions

(1) Introduction

The collective term, Intelligent Transport Systems (ITS), means new road transport systems designed to integrate people, roads, and vehicles via cutting-age information and communications technology to enhance the safety, transport efficiency, and comfort of road transport, and the systems contributed to improving the safety and convenience of road transport.

In recent years, ITS, in particular automated driving systems, has been experiencing significant innovations due to the development of information technology and progress in the use of data. In particular, since June 2013 when the Declaration on the Creation of the World's Most Advanced IT Nation (hereinafter referred to as "the Declaration of Creation") was announced by the Japanese government, many domestic and overseas manufacturers have conducted demonstrations of automated driving systems and field operational tests on public roads. As can be seen by the fact that nations around the world have also been announcing policies regarding automated driving, it seems that the era of global competition over the practical application and popularization of automated driving systems has set in. In the midst of this global context, the government of Japan has been promoting public-private partnership-based research and development under the Cross-Ministerial Strategic Innovation Promotion Program (hereinafter referred to as "SIP") Automated Driving Systems of the Council for Science, Technology and Innovation since fiscal 2014.

In the past, Japan has maintained the world's highest technology, an automobile industry that is the largest export industry in Japan, and the world's most advanced level of ITS-related infrastructure. However, in the midst of the significant global innovation in ITS, it is no longer easy for Japan to maintain its relatively high competitive edge.

The whole society of Japan aims to acutely respond to this innovation wave, continue building and maintaining the world's most advanced ITS, and develop and implement strategies through collaboration between the public and private sectors to allow its people to enjoy the fruits of the world's best road transport that society can offer.

By doing so, Japan aims to aims to build and maintain the world's best ITS and thereby contribute to its people and the world.

To continue staying focused on this objective, the Public-Private ITS

Initiative/Roadmaps and the Public-Private ITS Initiative/Roadmaps 2015 were developed in June 2014 and June 2015, respectively.

The development of the Public-Private ITS Initiative/Roadmaps has led to the sharing of the future direction among ITS-related ministries, agencies, and private companies; the promotion of specific collaboration among related ministries and agencies; and the encouragement of competition and collaboration among private companies.

On the other hand, technologies and industries related to ITS, including automated driving systems (hereinafter referred to "ITS/Automated Driving" to clearly state that it includes automated driving), have been making ongoing rapid progress. In particular, along with the change in the data distribution structure due to the development of the Internet of Things (IoT), artificial intelligence (AI) leverages such data as a knowledge base that is beginning to assume importance as a core technology of automated driving systems. Moreover, competition in development has intensified as domestic and overseas emerging automobile and IT companies have launched efforts toward the commercialization of automated driving systems. Against such a backdrop, Prime Minister Abe said in the second Public-Private Dialogue towards Investment for the Future in November 2015 stated, "We will realize transport services and automated driving on highways via unmanned autonomous driving systems for the 2020 Tokyo Olympic and Paralympic Games. To this end, we will develop the required systems and infrastructure, including the implementation of demonstrations, by 2017." Moreover, in the fifth Public-Private Dialogue in April 2016, he said, "We will put automated driving maps into practical use by 2018 at the earliest. We will gather automobile manufacturers and map companies within this fiscal year to develop integrated specifications that go beyond the boundaries of companies and propose to internationally standardize them."

This Public-Private ITS Initiative/Roadmaps 2016 developed as a radical revision of the Public-Private ITS Initiative/Roadmaps 2015 after discussing and examining specific measures in light of the aforementioned statement by the Prime Minister and recent changes in the situation surrounding ITS and automated driving in the meetings of the Road Transport Subcommittee, New Strategies Promotion Expert Panel, IT Strategic Headquarters, including joint meetings with the SIP Automated Driving System Promotion Committee, which have been held since December 2015.

(2) Definitions of Automated Driving Systems

Definitions of Driving Safety Support Systems and Automated Driving Systems

Various concepts exist for driving, which vary depending on the extent of driver involvement in driving, from situations where drivers perform all operations to those where driving support systems perform part of the operations and to unmanned autonomous driving.

From the perspectives of the extent of driver involvement in and responsibility for driving and based on the definition provided by the National Highway Traffic Safety and Administration (NHTSA), U.S. Department of Transportation,[1] the Public-Private Initiative/Roadmaps 2016 categorized driving support methods into informational and automatic control types as shown in Table 1, and the automatic control type was further broken down into four levels. The Driving Safety Support Systems and Automated Driving Systems are defined based on these types and levels.

Table 1 Definitions of Driving Safety Support Systems and Automated Driving Systems

Replacement of in-vehicle drivers' functions by systems

Categories		Outline	Note (responsibility)	Systems that Realize What is Stated in the Left	
Informational[2]		Alerting drivers, etc.	Drivers are responsible for driving.	Driving Safety Support Systems	
Automatic Control Type	Level 1: Stand - alone	Any of the acceleration, steering, or control operations is done by the system.	Drivers are responsible for driving.		
	Level 2: Compounding of systems	More than one of the acceleration, steering, and control operations is done by the system at the same time.	Drivers are responsible for driving. *Drivers need to monitor driving and be ready to resume safe driving at any time.	Semi-Automated Driving Systems	Automated Driving Systems
	Level 3: Advancement of systems	All of the acceleration, steering, and control operations are done by the system. Drivers only act on the request of the system.	The system is responsible for driving (in automated driving mode).[3] *Automated driving in certain transport settings *Drivers do not have to monitor driving (automated driving mode: the system has not requested the driver to drive.)		
	Level 4: Fully automated driving	All of the acceleration, steering, and control operations are done by everything other than drivers. Drivers have no involvement at all.	The system is responsible for driving. *All driving processes are automated.	Fully Automated Driving Systems	

(Note 1) At all levels, drivers in vehicles can intervene in system control any time.[4]

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[1] We referred to the Policy on Automated Vehicle published by the NHTSA (USA) in May 2013.

[2] Includes informational-type safe driving support devices (in-vehicle equipment) that alert a driver.

[3] Further review is required for the details and scope of responsibility of the system.

[4] For example, at Level 4, the system can be stopped on an as-needed basis via the system

(Note 2) Here, the system is a contrary concept of an in-vehicle driver and includes not only the vehicle itself, but also peripheral systems related to the control of the vehicle.

(Note 3) At Level 3, it is assumed that in-vehicle drivers do not have to monitor driving by the system. Therefore, for the realization of Level 3, its institutional and systemic aspects, including social receptivity, need to be examined.

(Note 4) At Level 4, the concept of a vehicle is different from the conventional car that assumes the presence of a driver in a vehicle; therefore, society with such vehicles or transportation services is expected to be significantly different from the current society. Therefore, when considering the introduction of Level 4, how society, where such driverless vehicles operate on the roads, should be and its institutional and systemic aspects, including social receptivity, should be examined.

These definitions are not necessarily absolute: they should rather be reviewed on an as-needed basis while actively participating in international discussions on the definitions of automated driving systems and giving due consideration to international conformity and trends in technology and forms of use.

Remote Automated Driving Systems

For systems that achieve automated driving, one form has been considered where, while in-vehicle drivers do not exist, there are persons outside vehicles (remote system) who play the same role as in-vehicle drivers, that is, an automated driving system based on monitoring by outside people. While such a system is not a fully automated driving system, it is considered Level 4 since there are no drivers inside vehicles. As will be discussed in chapter 3, it is expected that this type of system can be introduced relatively early by restricting regions and conditions. The system that includes persons who remotely operate vehicles is called the Remote Automated Driving System.[5]

For the issue of responsibility[6] in remote automated driving systems, further discussions on specific systems should be conducted in the future while giving due consideration to progress in technology development and the findings of field operational tests. Moreover, we will further examine and review the positioning and definition of remote automated driving systems based on overseas trends in the definitions of these systems.

Definition of Specific Automated Driving Systems

We define *semi-autopilot, autopilot,* and *unmanned autonomous driving transport*

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cancellation/stop button. However, if an in-vehicle driver intervenes in the system at Level 4, it is no longer Level 4 at the point.

[5] Specifically, a driving safety system where persons outside vehicles, such as in a central monitoring room, who are equivalent to drivers, remotely monitor vehicles and the surrounding conditions.

[6] Including correspondence to levels in the automatic control type in Table 1 where drivers are in vehicles.

services as specific automated driving systems that are expected to be commercialized in the near future as follows:

Table 2 Specific Automated Driving Systems and Overview

Name of System	Overview	Corresponding Level
Semi-autopilot	− It supports automated driving on expressways (from entrance ramps to exit ramps; merging, changing lanes, keeping lanes or a certain distance between cars, diverging, etc.). − The driver takes responsibility as a rule while in Automated Driving Mode, but the system can send an alert on travel and other situations.	Level 2
Auto pilot	− It supports automated driving on expressways and under other specific conditions. − The system takes responsibility as a rule while in Automated Driving Mode, but the driver may take control upon request from the system.	Level 3
Unmanned Autonomous Driving Transport Services	− With no driver inside the vehicle, these Transport Services are either remote Automated Driving Systems with someone equivalent to a remote driver (outside the vehicle) or autonomous driving systems (Level 4) in a dedicated space.	equivalent to Level 4

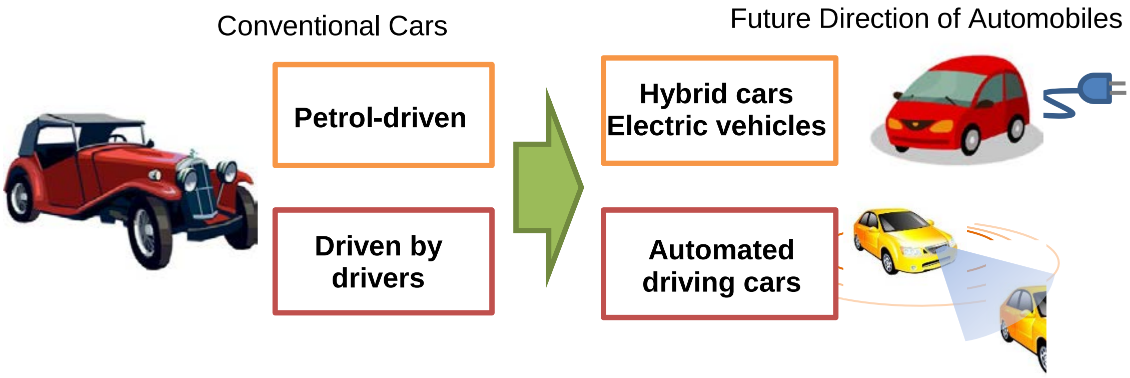
2. Positioning and Future Direction of ITS/Automated Driving

(1) Positioning of ITS/Automated Driving Systems

Since the start of mass production by Ford in 1908, the use of automobiles rapidly spread throughout the world, and today, the automobile is an indispensable part of our lives. Over the past 100 years or so, gradual ongoing innovation has taken place in automobiles, leading to the development of today's sophisticated automobiles. However, the fundamental structure of automobiles, such as petrol-driven and driving by drivers, has not changed until recently.

This fundamental structure of automobiles, however, is expected to go through discontinuous, disruptive innovation over the coming ten to twenty years. Specifically, such innovation includes a trend toward automated driving systems that have been enabled by the recent development of IT and networks, as well as trends toward hybrid cars and electric vehicles.

Figure 1 Future Changes in the Structure of Automobiles



In particular, interest in Automated Driving Systems has been growing rapidly throughout the world in recent years as exemplified by the fact that many emerging companies, such as automobile and IT companies, in the world have been actively developing the systems. Moreover, since the announcement of the Public-Private ITS Initiative/Roadmaps (in June 2014) by Japan, the issue of automated driving has given rise to not only competition, but also collaboration among other developed countries in the world in industrial policies, such as the successive announcements of comprehensive strategy documents about automated driving by developed countries, and the issue is being addressed in the G7 Transport Ministers' meetings.

The emergence and widespread use of automobiles more than 100 years ago revolutionized the mobility of people and the physical distribution means of goods, had a significant impact on society, and drastically changed the industrial structure. Along with the emergence and widespread use of automobiles, institutions and social systems related to road transport have been developed as global standards. The recent trend toward automated driving systems is expected to have a similar impact on society, and the existing institutions and social systems may be required to evolve again.

With these points in mind, we need to review road transport-related institutions and social systems to allow further evolution and to fully enjoy the positive impact of automated driving systems.

(2) Future Direction of Automated Driving Systems

i. Impact on society and business models

Social Impact of Automated Driving Systems

While automated driving systems are not expected to readily become common, they are expected to spread rapidly over the coming ten to twenty years[7] and have a significant impact on society. Specifically, driving via automated driving systems is generally safer and more efficient than that by humans; therefore, these systems can significantly contribute to solving issues faced by a society with conventional traffic systems, such as reducing traffic accidents, alleviating traffic congestion, and reducing the environmental load.

Moreover, in addition to solving those issues, automated driving systems can drastically reduce the burden of driving on drivers. In particular, automated driving systems at Levels 3 and 4 potentially provide new means to solve conventional social issues related to mobility.

The automobile-related industries, including peripheral industries, are large in size and based on highly versatile technologies that have significant ripple effects. Therefore, promoting innovation based on new automated driving technology that can solve the aforementioned issues will not only lead to the strengthening of the competitiveness of

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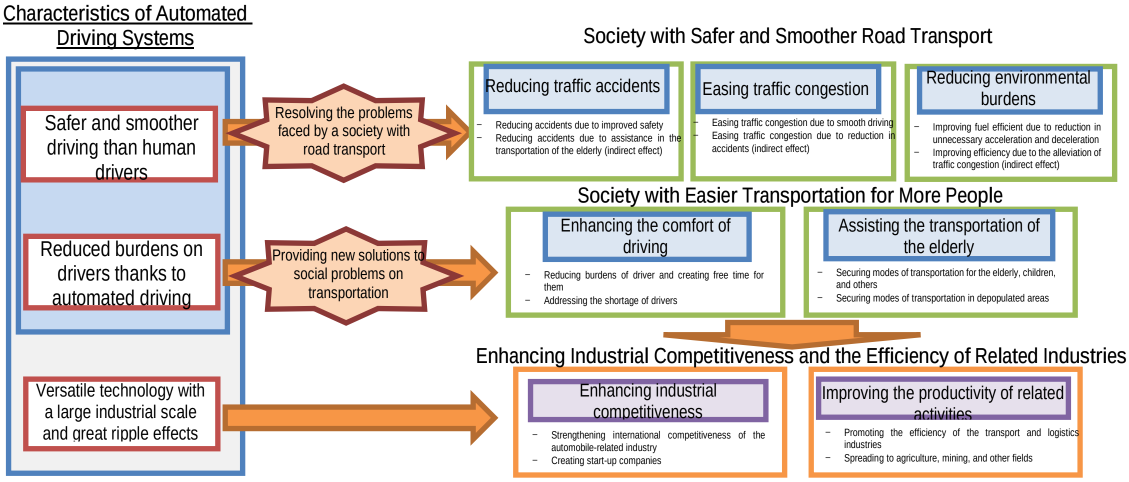
[7] For example, according to an overseas research company, the penetration rate of autonomous cars in the world will be about 13% in 2025 and about 25% in 2035, and the market size will be about 5 trillion yen (base prices of automobiles not included) in 2025 and about 9 trillion yen in 2035. It is also expected that fully autonomous cars will begin to become popular from around 2025.

the automobile industry and the creation of new industries, but also have a significant impact on various industries through improved efficiency and innovation in the mobility/logistics industry and promote the application of automated driving technology to other fields related to automated driving technology (agriculture and mining).

Figure 2 Social Expectations for Automated Driving Systems (Example)



Direction of the business models for automobile/transportation services

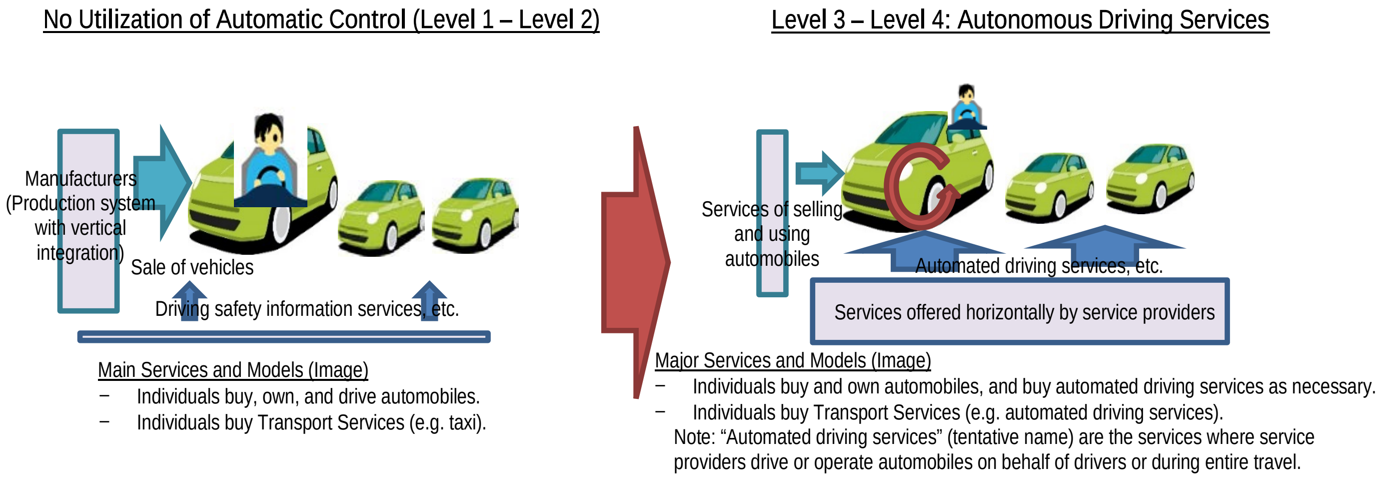
The development of automated driving systems not only has an impact on society, but can also possibly change the conventional industrial structure related to automobile/transport services by changing the focus of the business models and the added value of these services.

Specifically, since conventional automobiles presuppose driving by drivers, the focus of the added value related to the automobile/transport services was placed on the sale of automobiles, which were produced by manufacturers under vertical integration systems, to drivers. However, since in automated driving systems (particularly Level 3 and higher), not drivers, but systems drive vehicles, the focus of added value may shift to the lateral business, such as the provision of transport services to a large number of vehicles through an automated driving system. Moreover, competition and collaboration may intensify between such a lateral business base and that associated with the assignment and matching of vehicles, which arise from a sharing economy that is expanding, particularly in Level 4, the unmanned autonomous driving transport services.

In the future, the business model related to automobiles and mobility will change[8] along with the developments in automated driving systems and sharing economy, and transport services provided by a wide variety of operators, including individuals and businesses, will increase. Therefore, we need to examine matters that facilitate the smooth operation of transport services by private companies while keeping a close watch on business trends.

Figure 3 Change in Business Models Associated with the Development of Automated Driving Technology (for illustrative purposes only)[9]

Direction of a change in the business model based on the sale of vehicles (example)[10]


No Utilization of Automatic Control (Level 1 – Level 2)

Level 3 – Level 4: Autonomous Driving Services

Main Services and Models (Image)

- Individuals buy, own, and drive automobiles.
- Individuals buy Transport Services (e.g. taxi).

Major Services and Models (Image)

- Individuals buy and own automobiles, and buy automated driving services as necessary.
- Individuals buy Transport Services (e.g. automated driving services).

Note: "Automated driving services" (tentative name) are the services where service providers drive or operate automobiles on behalf of drivers or during entire travel.

ii. Direction of the evolution of the data architecture

<u>Future direction of data architecture for automated driving systems</u>

These changes in the business model for automated driving systems have arisen from the changes in data architecture related to automated driving systems.[11]

The informatization of vehicles has advanced as an embedded architecture,[12] where

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[8] As an idea that shows changes in the mobility-related business, there is a concept called MaaS (Mobility as a Service). Related to this idea, 20 industrial, academic, and government organizations in Europe established the European Mobility-as-a-Service Alliance (Europe MaaS Alliance) at the ITS World Congress held in Bordeaux, France, in October 2015.

[9] The added value of the transport service business, in addition to the added value of personal ownership-based business, may increase because of the developments in automated driving systems.

[10] Changes in business models should be examined not only from the perspective of the sale of vehicles, but also from the perspective of a sharing economy.

[11] A basic design conception that segments and allocates product components according to their functions and that designs and adjusts interfaces for those components

[12] Architecture (design conception) that incorporates hardware and software into a product to achieve certain functions. Generally, there is no architectural compatibility among vehicles or manufacturers.

along with the informatization of in-vehicle equipment and systems, various sensors have been installed in vehicles, and based on data from these sensors, in-vehicle equipment is controlled electronically.

Toward the further advance of automated driving systems, which represents the trends toward IoT, big data, and AI, the data architecture, including control judgment based on the data and knowledge platforms in each vehicle, is expected to become more sophisticated and evolve toward the following directions:

- Part of driving knowledge data,[13] including probe data[14] collected by each vehicle, is moved to and accumulated in the outside data and knowledge platforms, such as cloud platforms, via networks. Such data is used for big data analyses in various fields.
- In addition to the driving knowledge data obtained from a large number of vehicles, part of the dynamic maps generated on the basis of outside data, such as traffic-related data, and the data and knowledge platforms, which includes sophisticated AI generated from the dynamic maps, is sent back to each vehicle via networks and used as data and knowledge required to make judgments related to automated driving.

As a result, automated driving technology and the use of traffic data obtained through data platforms are expected to develop synergistically. Consequently, it is expected that automated driving systems will become more data driven and their core technology will shift from the conventional vehicle technology to software technology, including AI, and data platforms that support the software technology. Moreover, the role of dynamic maps[15] as part of the data platforms will become more important (see chapter 5).

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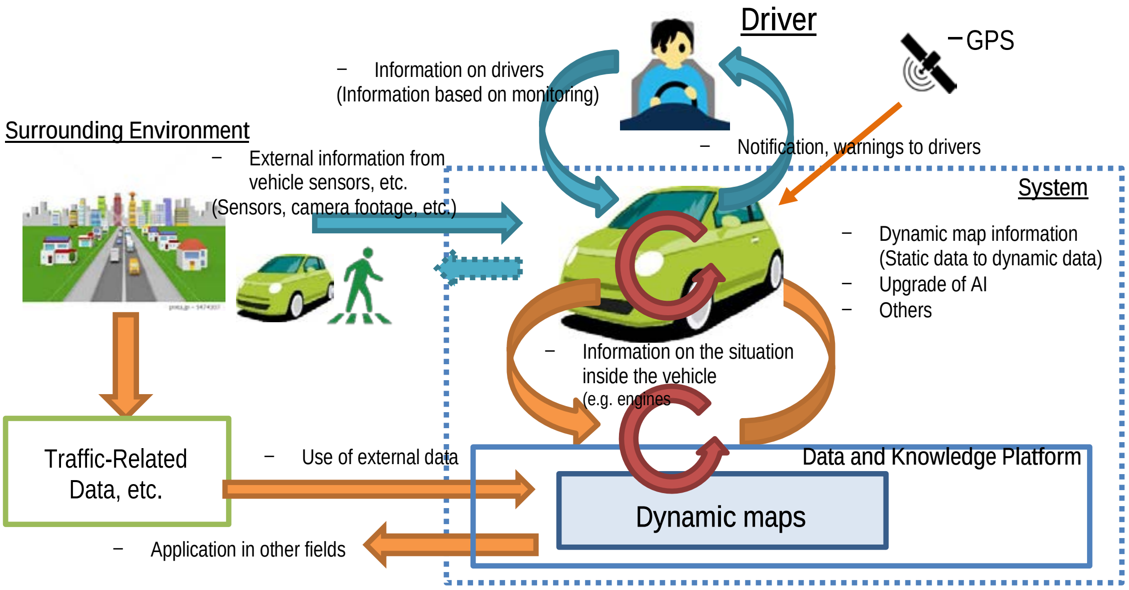
[13] Information that is collected, accumulated, and analyzed as big data includes locations where the brakes were applied and locations and time where and when the wipers were turned on. Information collected by cameras and radar equipped for automated driving systems is expected to be included in the future, which will enable the generation of sophisticated map information regarding road shapes.

[14] Probe: It originally means an instrument used for exploring a wound or part of the body, a sensor, or remote monitoring equipment.

Automobiles in recent years are mounted with sensors and measuring equipment, which measure the movement of the automobile, such as speedometer, brakes, and wipers, etc. In the ITS field, however, vehicles are viewed as sensors or remote monitoring devices, and the data remotely obtained from a large number of vehicles, that is, from sensors and measuring equipment, via mobile networks, is called probe information (data).

[15] Dynamic maps comprise high accuracy 3D geospatial information (basic map information), which enables the determination of the positions (traffic lanes) of vehicles on the road relative to the surrounding area, and additional map information required to support automated driving (for example, traffic regulation information, including static information, such as speed limits, and dynamic information, such as accident and construction information).

Figure 4 Data architecture for automated driving systems (for illustrative purposes only)[16]



In the architecture of automated driving systems, the role of interfaces seems to become more important in vehicles. Specifically, for driver interfaces,[17] interfaces that enable communication between drivers and vehicles while monitoring driver conditions will be developed (in particular Levels 2 and 3). For interfaces for the surrounding environment, interfaces for the provision of information, including that collected from the aforementioned in-vehicle equipment and sensors, to and communication with pedestrians and other moving objects around the vehicle, will be developed.

Autonomous-type architecture, cooperative-type architecture, and safety assurance

In these types of automated driving systems, plenty of data concerning information surrounding the vehicles is collected from various sources and used for driving operations.

The methods to collect information surrounding vehicles can be categorized into the following: a method to obtain information via radar installed in vehicles (autonomous type), a method to use information in the information platform on the cloud via networks (mobile phone networks, etc.) (mobile type), and a method to collect information via

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[16] For the dynamic map in the figure, collaboration among companies will be considered, and the positioning of and a system for such collaboration are subject to change depending on future reviews.

[17] In particular, they are called HMIs (Human Machine Interfaces).

communication with equipment installed on the road infrastructure or with equipment installed in other vehicles (narrow cooperative type. The former is a road-vehicle cooperative type while the latter is a vehicle-vehicle cooperative type).

These are not mutually exclusive technologies, but technologies that when combined, enable more sophisticated driving safety support systems and automated driving systems, which are based on diverse information. In fact, automated driving systems, where vehicles are controlled by bi-directionally exchanging information obtained from sensors (autonomous type) and information, such as dynamic maps, obtained from the cloud (mobile type), are being developed.

Table 3 Types of information collection technology for driving safety support systems and automated driving systems

Types of information collection technology		**Content of technology (method to input information)**
Autonomous Type		Obtains information, such as obstacles, via radar and cameras installed in the vehicles
Cooperative Type (broad sense)[18]	Mobile Type	Collects location information via GPS. Collect information (including map information) on the cloud via mobile networks.
	Road-Vehicle Communication Type	Collects road traffic information surrounding vehicles via communication with equipment installed on roadside infrastructure.
	Vehicle-Vehicle Communication Type	Collects location and speed information of the vehicle via communication with equipment installed in other vehicles.

In the future, strategies toward the integration of autonomous and cooperative types will be particularly required as driving safety support systems develop into automated driving systems. Then, the automatic control type, including automated driving systems, will be based on autonomous information-based systems, where informational-type

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[18] In this categorization, mobile type was included in the broad cooperative type from a perspective of technology types related to information collection. (While it is not clearly defined, vehicles that use road-vehicle communication-type or vehicle-vehicle communication-type technology are sometimes called connected cars.)

For the mobile type, road-vehicle communication type, and vehicle-vehicle communication type, since these types have different real-time characteristics and popularization strategies, the cooperative type in this document shall indicate, in principle, the road-vehicle communication type and the vehicle-vehicle communication type, except the mobile type.

driving safety support devices are added as modules.[19]

In light of the increased dependence on data by automated driving systems, the data architecture for automated driving systems needs to be designed while handling and leveraging massive amounts of information. When designing, the following must be considered and practiced for security purposes: the securing of redundancy, multiple safety design, such as a fail-safe mechanism, security measures (including required devices and operations management systems), and the development of technology and environment (testbed) to evaluate such measures.

In particular, in light of the possible risks, such as errors and discontinuation, the responsibility to implement the aforementioned measures for mobile-type outside data, including dynamic maps and cooperative-type road-vehicle/vehicle-vehicle data, shall be borne, in principle, by automated driving systems that use such data.[20]

Table 4 Design of data architecture from a perspective of safety assurance (for illustrative purposes only)[21]

How to handle data errors

- When data from outside sources, including dynamic maps, is at variance with data obtained from the autonomous type, such as sensors, switch to careful driving mode while giving priority to data from the autonomous type.

How to handle communication disconnects

- If communication with the outside world is disconnected, switch to minimum safe driving, including automatic evacuation, based on the autonomous-type technology.

How to handle software bugs and updates

- For a prompt response in case that there are in-vehicle software problems, enable updating via wireless communication (OTA) while ensuring security.

(3) Future direction of the traffic-related data sharing platform and its use

In light of the increased importance of data in the big data era, traffic data not only helps obtain traffic congestion information and plans traffic measures, but also plays an important role as a foundation for automated driving systems as represented by the

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[19] For detailed strategies for the integration of autonomous and cooperative (road-vehicle cooperative type, vehicle-vehicle cooperative type) technologies, please refer to the Public-Private ITS Initiative/Roadmaps 2015.

For traffic light information that is indispensable for the realization of automated driving systems, since it seems difficult for the autonomous type to accurately detect and process such information, it is important for vehicles to ensure the detection and processing of such information by adding cooperative-type functions and referring to data provided by roadside infrastructure.

[20] Risk-based safety design and measures are required also for data obtained from the autonomous-type technology.

[21] This is only an example. In reality, each company will develop a safety design while simulating various cases.

aforementioned dynamic maps. Moreover, it is also expected that the disclosure and effective use (in combination with other data) of such traffic data will contribute to the creation of new services in the tourism and insurance industries.

Conventional traffic-related data sharing platform

In Japan, the government has taken the initiative in installing a number of vehicle detectors and optical beacons on roads. Information from these devices has been used for controlling road traffic. After being centrally collected mainly by the Japan Road Traffic Information Center (JARTIC), such information has been provided to drivers through traffic information boards, traffic information providers, and the Vehicle Information and Communication System (VICS).

In recent years, however, automobile manufacturers, electric appliance manufacturers, transportation companies, smartphone and tablet operating systems manufacturing companies, and application development companies, including insurance companies, have been creating more sophisticated information services to vehicle users by collecting various probe data from vehicles, analyzing them as big data, and combining such data with the aforementioned public road traffic information.

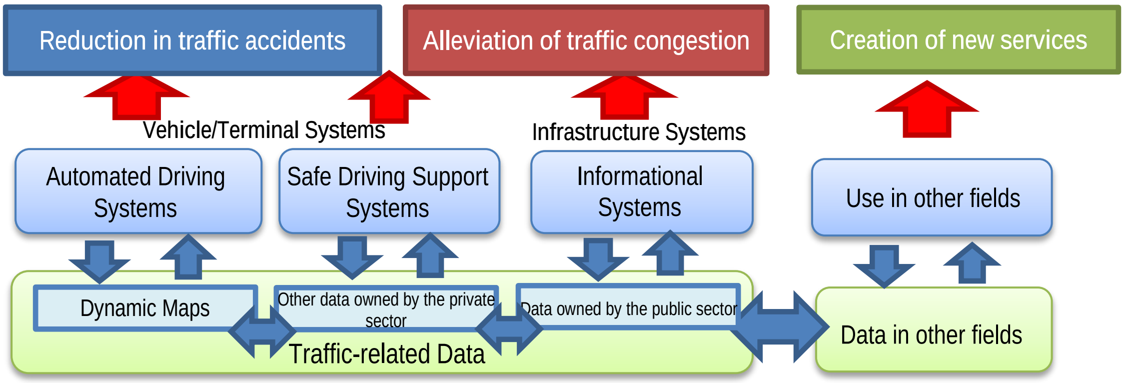
On the other hand, the public sector has been promoting programs for clever use of roads by leveraging a wide variety of detailed big data, such as data on the speed, routes, and time of ETC 2.0, in an integrated manner. In the future, the accumulation of such a wide variety of vehicle data will accelerate along with the progress in vehicle informatization and networking.

Future direction of the traffic-related data sharing platform

In the midst of such trends, particularly a trend in traffic data toward IoT, not only location and speed information, but also a wide variety of data collected by sensors and cameras installed in vehicles will be used as probe data, and along with the further evolution of automated driving systems, this data will be made available as dynamic maps.

While the systems owned by the public and private sectors have been developed separately in a vertically integrated manner to achieve the unique objectives of each system, in the big data era, the architecture will shift to horizontal specialization, and data is expected to be shared not only within each field, but also across fields, leading to the use of such data in various fields other than the traffic field.

Figure 5 Positioning of traffic-related data platforms (for illustrative purposes only)



In the midst of such a structural change, many discussions and reviews must be made regarding the development of standards and rules that enable the sharing and distribution of most-needed data, which is selected from among an enormous volume of traffic-related data, via public-private cooperation and the development of systems to examine ways to make such data available to the public.

In doing so, due consideration should be given to the following facts: data from individuals is often collected within the extent of purposes of use and the predetermined handling method; data held by private companies has been collected from a business perspective to begin with; and the data held by the public sector will require a significant amount of money to build new systems and databases for the release of the data to the public.

3. ITS and Automated Driving Systems-related Society, Industrial Objectives, and Overall Strategies

(1) Society and industrial objectives that we aim to achieve via ITS and automated driving systems

Social vision to be achieved via the public and private sectors

In the past, we have aimed to "build a society with the world's safest road transport by 2020," an ITS-related social vision specified in the Declaration of Creation.[22] We will continue our ongoing efforts to achieve this goal.

On the other hand, with an eye toward the coming ten to twenty years, significant innovation centering on automated driving systems is expected to occur in ITS as mentioned above. In light of this, we will aim to build the following two societies from the industrial and social perspectives and promote efforts to achieve them, along with efforts to attain the aforementioned goal:

- **Social perspective:** Japan aims to build "a society with the world's safest road transport" by 2020 and then aims to build and maintain "a society with the world's safest and smoothest road transport"[23] by 2030 by promoting the development and diffusion of automated driving systems and the preparation of data platforms.
- **Industrial perspective:** Japan aims to expand the export of ITS-related vehicles and infrastructure via public-private collaboration and become a global hub of innovation related to automated driving systems (including the development of data platforms) after 2020.

The following are the specifics conjured up for the society with the world's safest and smoothest road transport:

- *In a society where automated driving systems are widespread, driving much safer than that by veteran drivers will be secured by the systems, leading to the realization of a society where traffic accidents hardly occur.*

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[22] The 10th Fundamental Traffic Safety Program (established on March 11, 2016 at the Central Traffic Safety Measures Council) sets forth the following objectives:

a. Aim to reduce the number of fatalities occurring within 24 hours of accidents to 2,500 (*) or less by 2020 and thereby realize the world's safest road traffic.
(* If the number of 2,500 is multiplied by the ratio between the number of fatalities within 24 hours and that within 30 days in fiscal 2015, it will become about 3,000.)

b. Reduce the annual number of casualties to 500,000 or less by 2020.

[23] "The world's smoothest" here indicates a traffic situation with little congestion, which enables the elderly to move smoothly without any stress. Moreover, the realization of smooth road traffic by alleviating traffic congestion is expected to contribute to reducing effects on the environment.

- *Each automated driving system will select the optimal route and speed based on the road congestion data in the surrounding and wider areas. By doing so, an optimal overall traffic flow with little traffic congestion will be realized.*
- *A society will be achieved, where people who have a driver's license but are not necessarily capable of driving safely, such as the elderly, can enjoy going out as young people do by using automated driving systems and can participate in society.*

In order to realize such a society and become the center of automated driving systems innovation in the world, we shall leverage the opportunity of the 2020 Tokyo Olympics and Paralympics in a strategic manner and aim to build the most advanced ITS in the world by 2020 through ongoing efforts.

Setting social and industrial objectives

In an effort to set the vectors of the public and private sectors in the same direction toward the realization of such a society and industries and keep track of progress in such efforts, toward 2020, we will set key indicators for the achievement of objectives, mainly a reduction in traffic accidents, based on the Fundamental Traffic Safety Program and promote necessary measures based on the set indicators.[24]

For the key objective achievement indicators toward 2030, while keeping the widespread use of automated driving systems in mind, social indicators related to a reduction in traffic accidents,[25] the alleviation of traffic congestion,[26] and transportation support for the elderly,[27] and industrial indicators related to the diffusion of automated driving systems, the production and export of vehicles,[28] and the export of infrastructure shall be set. When setting specific indicators and numerical goals, discussions regarding

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[24] When examining the measures, the SIP Automated Driving Systems shall implement a survey on the methods to estimate the effects in reducing traffic accidents related to automated driving systems and examine the measures based on the results of the survey.

[25] When examining traffic accident-related indicators, a reduction in the number of persons injured from traffic accidents should be included as an indicator, as well as indicators related to the number of fatalities from traffic accidents (such as aiming to achieve zero deaths from traffic accidents, etc.).

[26] Setting indicators related to traffic congestion as KPIs has already been required under the Declaration of Creation. In the future, the existing data on traffic congestion, including surveys on the methods used overseas to obtain congestion data, shall be sorted out, and methods to obtain such data using probe data shall be investigated as specific indicators.

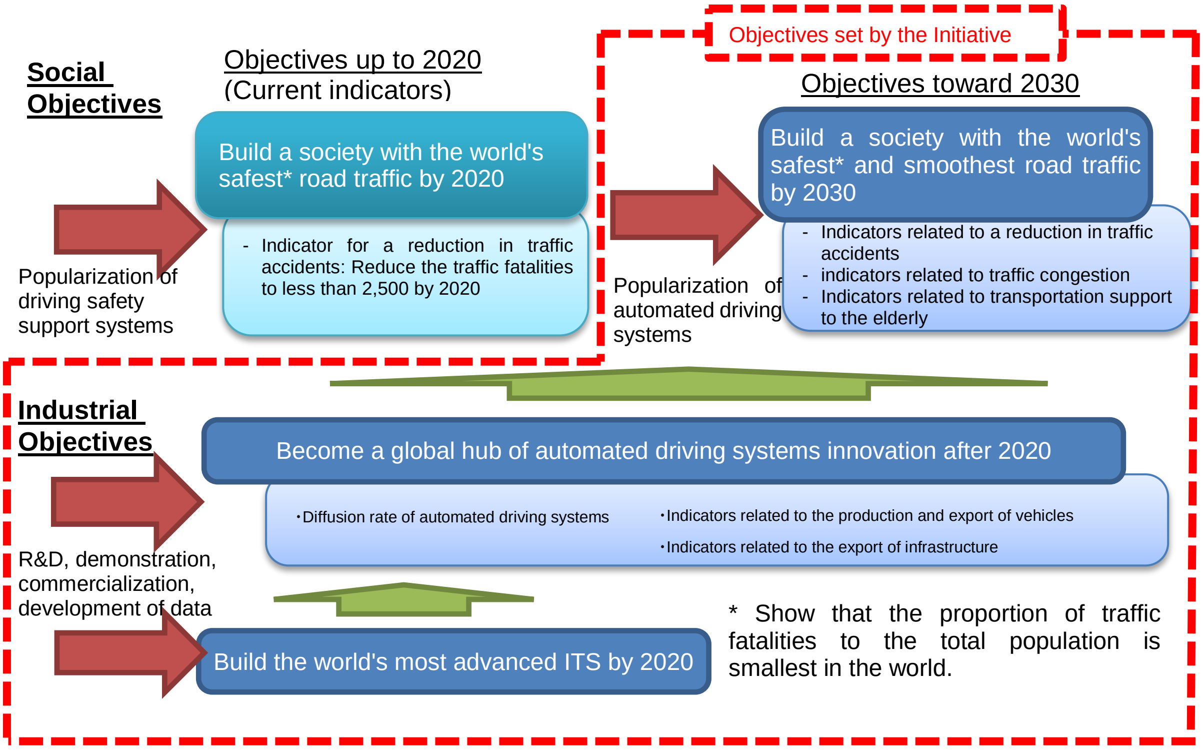
[27] For indicators related to the mobility of the elderly, specific indicators and methods to measure them, such as the rates of using public transportation and automobiles by the elderly, shall be examined in the future.

[28] For indicators related to the production and export of vehicles, they will be measured based on the number of vehicles for the time being. In the future, however, due consideration should be given to the potential that the surrounding business, such as car sharing, may become more important.

statistical data required for computation shall be made with industry and due consideration shall be given to the results of surveys on the evaluation of social impact of automated driving systems, which will be discussed in the next chapter.

When setting specific numerical targets, numerical targets of other countries shall be referred to as a benchmark since Japan aims to realize and maintain the safest road traffic in the world. The set numerical targets shall then be compared with those of other countries in an ongoing manner, and revised on an as-needed basis.

Figure 6 Society that the Initiative aims for and Key Indicators for the Achievement of Objectives



(2) Basic strategies related to automated driving systems and the use of traffic data

Basic strategies for and social impact by automated driving systems

For automated driving systems, we will build the world's most advanced ITS by 2020 by commercializing semi-autopilot systems on highways and realizing unmanned autonomous driving transport services by 2020. Then, with an eye toward further sophistication of the systems, including technology that achieves fully automated driving systems, and deployment of such systems in the world, we will aim to reduce traffic accidents, alleviate traffic congestion, and support the mobility of the elderly by introducing automated driving systems mainly for new vehicles into society and spreading them across the country and build a society with the world's safest and smoothest road traffic by 2030.

The introduction of automated driving systems into society and spreading them across the country are expected to bring substantial benefits to society: they will not only solve the problems that society under the current road traffic system faces, such as traffic accidents, traffic congestion, and environmental problems, but also provide new solutions to the current social issues related to transportation, such as transportation means for the elderly and in underpopulated areas and lack of drivers in the logistics industry. In particular, Japan has unique issues,[29] such as the falling birth rate and the aging population and the need for regional revitalization, and will be able to enhance its global industrial competitiveness by developing Levels 3 and 4 automated driving systems, which are expected to play an important role in solving the issues, in a strategic manner.

In the future, we will promote surveys on the evaluation of the social impact from automated driving systems as a foundation for the development of strategies for automated driving systems and to enhance the social receptivity of the systems via the provision of fair and unbiased information. In doing so, it should be noted that social impact from automated driving systems varies significantly with the level of automatic control applied and the social and transportation conditions of each nation or region.

Basic strategies for driving safety support systems and the use of traffic data

For driving safety support systems and the use of traffic data, while we should keep casting a careful eye toward 2020 and onward when automated driving systems are expected to have been widely used, we shall, up to 2020, work toward the realization of a society with the world's safest road traffic (traffic fatalities of 2,500) and the world's most advanced ITS.

Specifically, while promoting automobiles equipped with driving safety support functions (Level 1), such as automatic braking systems that have been becoming popular in recent years, the introduction and popularization of driving safety support devices to

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[29] In particular, while traffic accidents by the elderly account for the majority of the traffic accidents in Japan due to the ever-accelerating aging of the population. It is urgent to secure transportation means for the elderly who have difficulty in moving by themselves. Moreover, since the population is expected to shrink in the future, it is also urgent to address such issues as securing transportation means in underpopulated areas and lack of drivers.

be installed on existing vehicles in light of the fact that it will take time to popularize new vehicles equipped with such devices,[30] and the introduction of information systems required for a reduction in traffic accidents and the provision of information shall also be promoted.

When promoting measures to reduce traffic accidents, it is important to clearly articulate key measures to be addressed after examining the feasibility and the possibility of popularization (estimated amount of popularization in 2020), including cost effectiveness, of technological measures against conditions where traffic fatalities have occurred based on the analysis of such conditions (analysis of accident situations, including locations of crossroads, crashes, and pedestrians).

(3) Basic approach to the institutional design for and expected commercialization timing of automated driving systems

Basic approach to institutional design for automated driving systems

Along with the progress in automated driving technology in recent years, the commercialization of the systems and the start of providing services toward 2020 are coming into view. In the Roadmaps 2016, institutional design shall be examined toward the commercialization of the automated driving business and the start of providing services in 2020 as an immediate objective while keeping an eye toward 2020 and onward. While making a schedule with the businesses that promote the most advanced systems in mind based on the objective of building a society with the most advanced road transport, institutional design shall be addressed with the aim of leading the world in this field while collaborating with other countries in light of the fact that this is an unprecedented issue in the world. When actually developing institutional plans, the following basic approach should be taken: because automated driving is beneficial to society, actively promote innovation while securing safety.

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[30] The number of automobiles owned in Japan in recent years is about 80 million. The annual number of new automobiles sold is about 5 million. Therefore, it will take about more than 15 years to completely replace existing automobiles with new ones.

Table 5 Basic approach to the institutional design for automated driving systems (example)

a. <u>Be aware of the huge social benefits that can be generated by the introduction of automated driving systems.</u>
  - Drastic improvement in traffic safety can be expected to be achieved by removing human error as much as possible.
  - Other social benefits can be expected to be brought, such as smooth traffic, energy saving, smooth transportation for the elderly, a reduction in drivers' burden, the enhancement of industrial competitiveness, and the creation of new industries.

b. <u>Give priority to securing safety and promote risk reduction by introducing automated driving systems.</u>
  - Promote the introduction of automated driving systems, given that they will reduce overall risks associated with the current traffic system.
  - Design the institution in such a way that it facilitates a further reduction in traffic safety-related risks.

c. <u>Design the institution in such a way that it does not interfere with automated driving systems innovation, but rather promotes it.</u>
  - Design the institution in such a way that it recognizes a variety of innovation efforts while maintaining a technologically neutral position.
  - Design the institution in such a way that it facilitates innovation by manufacturers, including the insurance system.
  - Consider a mechanism that enables to reflect new technological progress in existing systems.

Two automated driving systems to be focused on

For the evolution of automated driving technology, there are two approaches to the realization of technology that achieves fully automated driving in a wide variety of traffic conditions (including vehicles that enable drivers to enjoy driving): a. An approach that gives priority to handling various traffic conditions and then gradually raises the automatic control level and, b. An approach that starts with limited traffic conditions by giving priority to the realization of Level 4 and then gradually expands the target traffic conditions.[31]

Currently, various automated driving systems are being examined as shown in Table 6. In light of the aforementioned two approaches, the specific institutional efforts related to the following two automated driving systems, which are expected to play a key role in building the world's most advanced ITS, shall be examined toward the realization of their commercialization and servicing by 2020:

a. Commercialization of vehicles for automated driving on highways (semi-autopilot)

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[31] See the report (September 2015) by the Boston Consulting Group (jointly made with the World Economic Forum).

b. Provision of unmanned autonomous driving transport services[32] in limited areas (underpopulated areas/urban cities)

Based on the examination of these points, measures for the commercialization and servicing of other automated driving systems shall be examined.

In promoting the commercialization and servicing of these systems, efforts shall be examined in light of the promotion of innovation in the automobile industry, a further reduction in traffic accidents, and systems that resolve Japan's unique issues, such as the declining birth rate, the aging population, and regional revitalization.

Table 6 Automated driving systems currently under review (example)

Advanced autonomous cars

a. Automated driving systems that can contribute to the enhancement of international competitiveness in the global market

Passenger Cars

- Commercialization of autonomous cars (semi-autopilot) on highways (by 2020)
- Commercialization of autonomous cars (equivalent to Level 2) on local roads (by 2020)
- Commercialization of automated valet parking in parking lots

Trucks

- Realization of truck platooning on highways

Regional public transportation services

b. Regional public transportation systems equipped with automated driving functions

- Realization of ART (Advanced Rapid Transit: equivalent to Level 2) (2020 Tokyo Olympics and Paralympics)

c. Regional community-type small automated driving systems

- Provision of unmanned autonomous driving transport services in limited areas (by 2020)
- Commercialization of automated valet parking in parking lots (aforementioned)

Expected timing and roadmaps for the realization of the commercialization and servicing of automated driving systems

Based on the objective of becoming the world's best, we have set the expected timing for the commercialization[33] of automated driving systems at various levels (timing comparable to that in other countries, that is, the fastest or almost fastest in the world) while referring to the commercialization objectives and roadmaps in other countries. In light of recent progress in technological development by private companies, we have set two different times for the aforementioned two automated driving systems, one for the expected time for commercialization and the other for the realization of services:

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[32] A system based on international discussions on the Geneva Convention. The same shall apply hereinafter.

[33] The expected commercialization timing is a non-binding target, toward which the public and private sectors address and implement various measures, not the time for both sectors to express their commitment.

a. Commercialize semi-autopilot systems, which are relatively high-level automated driving systems among Level 2 and which plays a role as a transitional step toward Level 3, by 2020.

b. Start providing unmanned autonomous driving transport services in limited regions by 2020 via remote automated driving systems or those in dedicated spaces.

For these systems, it is important to aim to become the world's number one in terms not only of expected commercialization timing, but also of the enhancement of industrial competitiveness and the popularization of automated driving systems.

Table 7 Expected timing for the realization of commercialization and servicing of automated driving systems

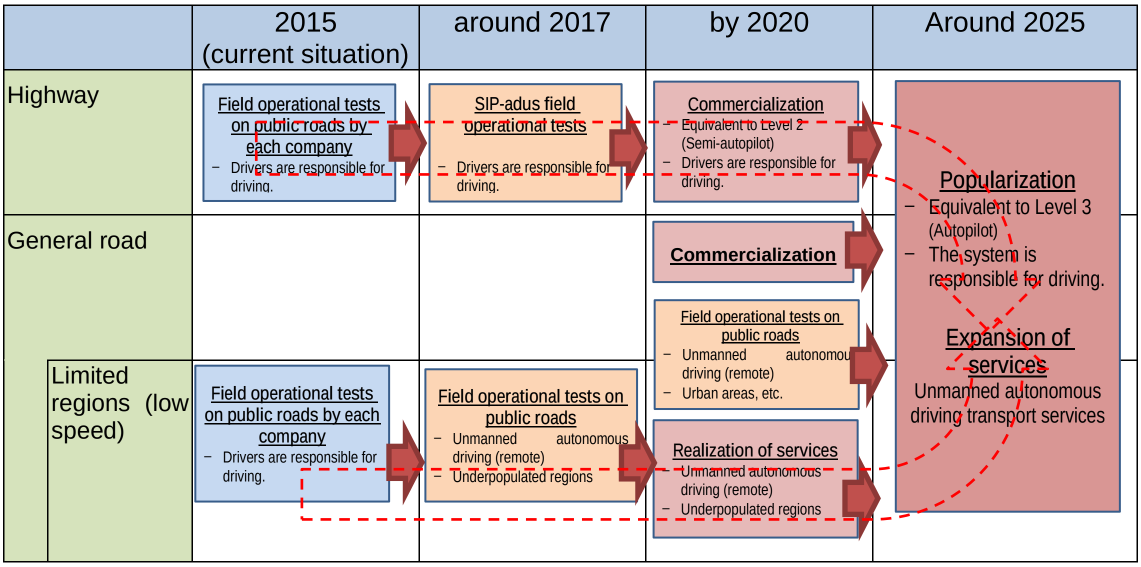
Category	Potentially feasible technology (example)	Expected timing for commercialization, etc.
Level 2	- Following and tracking systems (ACC+LKA, etc.)	Already commercialized
	- Automatic lane change	2017
	- Semi-autopilot	by 2020
Level 3	- Autopilot	targeted for 2020
Remote type, in dedicated spaces	- Unmanned autonomous driving transport services	by 2020 in limited regions
Level 4	- Fully automated driving systems (non-remote type)	targeted for 2025

(Note 1) The expected commercialization timing shall be reviewed based on the domestic and overseas industrial and technology trends, including overseas trends in the development of automated driving systems.

(Note 2) For autopilots at Level 3 and fully automated driving systems (non-remote type) at Level 4, the timing is set as a non-binding target for the government to implement measures to facilitate commercialization by private companies.

For these systems, full-fledged field operational tests shall be conducted targeted for 2017 to realize the commercialization and servicing of the systems by 2020. Then, targeted for 2025, roadmaps for the popularization and expansion of automated driving vehicles and services shall be developed. In doing so, in light of the fact that the above two automated driving systems (*a* and *b*) presuppose that fully automated vehicles (including vehicles that drivers can also enjoy driving) will be used as much as possible in the future, institutional design for those systems shall be made while ensuring consistency with the future plan.

Figure 7 Overall roadmap centering on the two automated driving systems (for illustrative purposes only)



	2015 (current situation)	around 2017	by 2020	Around 2025
Highway	Field operational tests on public roads by each company − Drivers are responsible for driving.	SIP-adus field operational tests − Drivers are responsible for driving.	Commercialization − Equivalent to Level 2 (Semi-autopilot) − Drivers are responsible for driving.	Popularization − Equivalent to Level 3 (Autopilot) − The system is responsible for driving. Expansion of services Unmanned autonomous driving transport services
General road			**Commercialization** Field operational tests on public roads − Unmanned autonomou driving (remote) − Urban areas, etc.	
Limited regions (low speed)	Field operational tests on public roads by each company − Drivers are responsible for driving.	Field operational tests on public roads − Unmanned autonomous driving (remote) − Underpopulated regions	Realization of services − Unmanned autonomous driving (remote) − Underpopulated regions	

4. Efforts toward the Commercialization of Automated Driving and Driving Safety Support Systems

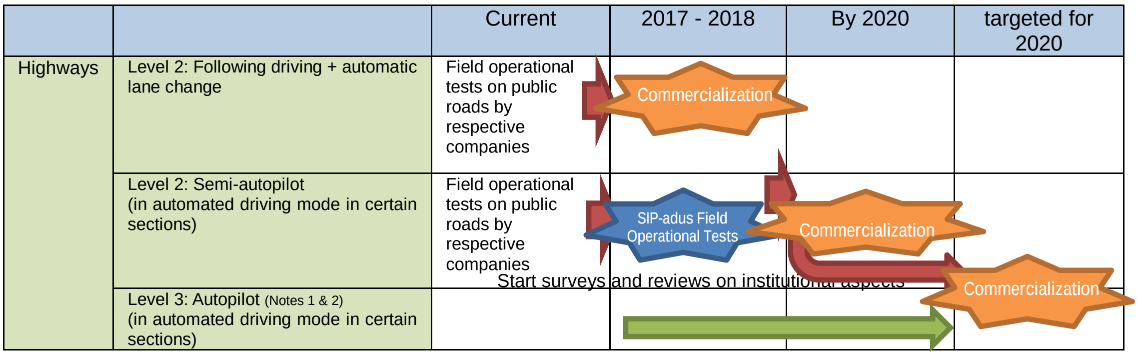
(1) Autonomous vehicles (automated driving systems) on highways

a. Overview of the Roadmap

Efforts for the development of automated driving systems for highways shall be made with an eye toward 2020 and beyond and with the roadmap shown in Figure 8 in mind:

- Aim to commercialize semi-autopilot autonomous vehicles (automated driving systems) by 2020. To this end, SIP shall implement large-scale field operational test projects in collaboration with related organizations from 2017.
- Start surveys and reviews on institutional aspects to realize the commercialization of autopilots (second task enabled), where the system is responsible for driving during the automated driving mode, targeted for 2020 for the time being.

Figure 8 Expected timing for the commercialization of automated driving systems on highways



		Current	2017 - 2018	By 2020	targeted for 2020
Highways	Level 2: Following driving + automatic lane change	Field operational tests on public roads by respective companies	Commercialization		
	Level 2: Semi-autopilot (in automated driving mode in certain sections)	Field operational tests on public roads by respective companies	SIP-adus Field Operational Tests	Commercialization	
	Level 3: Autopilot (Notes 1 & 2) (in automated driving mode in certain sections)		Start surveys and reviews on institutional aspects		Commercialization

(Note 1) Currently, there are no Japanese automobile companies that have announced the commercialization of system-responsible-type vehicles. However, some foreign companies have announced that in some of their vehicles, the system is responsible for driving in automated driving mode.

(Note 2) While a technological breakthrough may be required between semi-autopilots and autopilots, autopilot technology can be an extension of semi-autopilot technology. Therefore, for the commercialization of autopilot vehicles, the use of semi-pilot technology and its performance results for the development of autopilot should be examined, such as referring to driving safety performance data of commercialized semi-autopilot vehicles, in addition to the implementation of large-scale field operational test projects.

b. Commercialization of semi-autopilots by 2020

Image of automated driving systems that we aim to commercialize by 2020

Table 8 shows a provisional structure of automated driving systems (semi-autopilots) that we aim to commercialize by 2020 and that is envisioned, for the time being, to be operated under the driver responsibility principle.

Table 8 Semi-autopilots that should be commercialized by 2020 (provisional)

- ☐ Sale of autonomous vehicles (systems) equipped with the following functions and services to the public.
- ☐ Drivers are on board in this type of autonomous vehicles, and the driving mode can be switched to automated driving on highways.
  - ✓ Roughly from the entrance to the exit of a highway (merging, lane keeping, lane change, diverging). The driver can override the automated driving system at any time.
- ☐ In automated driving mode, the driver and the autonomous vehicle (system) can exchange information (HMI).
  - ✓ Communication between the driver and the system, such as a warning from the system to the driver that it is approaching the serviceability limit state.
  - ✓ Includes the monitoring of the driver and a system to minimize the risk and take refuge when the driver is unable to drive or when he/she does not respond to a warning.
- ☐ The driver remains responsible for driving even in automated driving mode. Therefore, the obligation of driving safety rests upon the driver all the time.

Issues to be examined and efforts to be addressed in large-scale field operational test projects

In principle, this type of semi-autopilots can be commercialized under the current system as long as it allows the driver to override the system. However, it is desirable to closely examine how to handle HMI-related issues listed in Table 9, including the securing of social receptivity and the issue of "overconfidence," toward the commercialization of the semi-autopilots.

Table 9 Issues to be examined to realize semi-autopilots (example)

	Issues to be examined (example)
Institutional aspects (securing of safety)	− In an effort to ensure safety in light of concerns over overconfidence, examine the necessity for the HMI-related industries to develop independent guidelines (including a mechanism that does not interfere with innovation by each company[34]).
Social receptivity	− Efforts to facilitate the acceptance of autonomous vehicles on highways by society as a whole (for example, provision and disclosure of data on the safety of autonomous vehicles, promotion of drivers' understanding of automated driving systems). − Clarification of issues related to the receptivity of autonomous vehicles by society as a whole, including not only consumers, but also drivers of vehicles surrounding autonomous vehicles (rules concerning which vehicle should give way to the other when ordinary and autonomous vehicles encounter, etc.).
Technology and infrastructure	− Promotion of standardization and the development of a system by stakeholders centering on private companies toward the wide use of dynamic maps on highways. − Development and preparation of new information and communications infrastructure that can handle a large amount of information, including dynamic maps.

Currently, the SIP Automated Driving Systems is considering the implementation of large-scale field operational tests from fiscal 2017 on technologies that have been developed (dynamic maps, HMI, and security solutions). In an effort to incorporate the efforts to develop institutions related to the aforementioned issues into the field operational tests, specific plans shall be created by the SIP Automated Driving Systems Promotion Committee. Moreover, private companies and related ministries and agencies shall collaborate with one another in developing specific institutions based on the results of the tests.

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[34] For example, JAMA (Japan Automobile Manufacturers Association, Inc.) has developed independent guidelines for the industry, such as Handling of Image Display Device. Examine if similar efforts should be required of other industries.

Table 10Institution-related items to be addressed in SIP large-scale field operational tests (example)[35]

Item	Overview of items and matters to be considered toward the development of institutions
Experimental study on the overconfidence generating mechanism and HMI that can handle such overconfidence	- After 2017 and beyond, implement HMI field operational tests where a large number of citizens participate. => Based on the results of these tests, consider the development of independent guidelines regarding HMI in automated driving mode by industries prior to commercialization.
Collection of basic data on automated driving to enhance social receptivity	- Accumulation of data related to automated driving during large-scale field operational tests (the number of accidents, near-miss incidents, override cases, the number of sudden stopping (braking) cases, etc.) => These data will be used for the advancement of automated driving technology and as basic materials to enhance social receptivity and confirm safety of autonomous vehicles by disclosing the data in the form of comparison with data on ordinary driving by human drivers.
Study of the impact of autonomous vehicles on ordinary vehicles in mixed traffic situations	- Implement field operational tests on the necessity of signaling that the vehicle is in automated driving mode, such as a warning light, including its relation to HMI. => Based on the experiment results, traffic rules and manners related to autonomous vehicles, such as which vehicle should give way when an ordinary vehicle and an autonomous vehicle encounter, should be examined.

c. Starting studies and review on the commercialization of autopilots (Level 3)

The commercialization of Level 3 autopilots (second task explicitly made available in automated driving mode) is currently planned for 2020 and beyond. However, since autopilots are close to semi-autopilots in terms of technology and a large number of issues are involved in the commercialization of these two systems, studies and review on social receptivity and institutional revisions required shall be launched and promoted while giving due consideration to market needs, the trends among overseas companies, and the status of international review toward the realization of their commercialization in 2020.

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[35] The contractual relationships (including insurance) between participating citizens and businesses regarding the responsibility for accidents in large-scale field operational tests shall be examined in advance by collaborating with related ministries and agencies on an as-needed basis.

Table 11 Points to consider for the commercialization of autopilots (Level 3) (example)
(Automated driving systems where the second task is explicitly made available)

- ■ a. Approval of the second task in specified autonomous vehicles
  - ✓ Review of the Road Traffic Act (Article 70: Obligation to drive safely, Article 71, item 5-5: Prohibition of the use of cell phones and looking at image display devices while driving)
  - ✓ However, it must be in compliance with the convention on road traffic (herein after referred to as "the Geneva Convention" (developed in 1949. Japan is one of the state parties to the Convention).
- ■ b. Clarification of the definition of and requirements for specified autonomous vehicles where the second task is allowed (review of related laws)
  - ✓ Examination of a new regulatory system based on the current legal system that stipulates that persons with a valid driver's license are allowed to drive
  - ✓ Development of standards that reflect to a certain degree the results of field operational tests on public roads (for example, whether or not the vehicle eliminates inevitable human errors (misidentification, incorrect operation) as much as possible and strictly complies with driving safety rules appropriate for the driving environment)
- ■ c. Institutional design that promotes manufacturers' efforts to innovate automated driving systems
  - ✓ While automated driving systems are something desirable to have in society, it has been pointed out that making the system responsible for accidents may dampen manufacturers' motivation to develop related technology.[36]
  - ✓ Development of institutional design for the insurance system (including a payment system) that can address this issue.

(2) Unmanned autonomous driving transport services in limited regions

a. Overview of the roadmap

For the field operational tests and full-fledged servicing of unmanned autonomous driving transport services in limited regions, efforts shall be made according to the roadmap toward the 2020 Tokyo Olympics and Paralympics shown in Table 9:

- By 2017, implement field operational tests on unmanned autonomous driving transport services on public roads in underpopulated areas while considering the effective use of National Strategic Special Zones.
- Based on the results of the tests, a review of regulations shall be made while ensuring safety and efforts shall be made to enable the provision of the transport services at the 2020 Tokyo Olympics and Paralympics.

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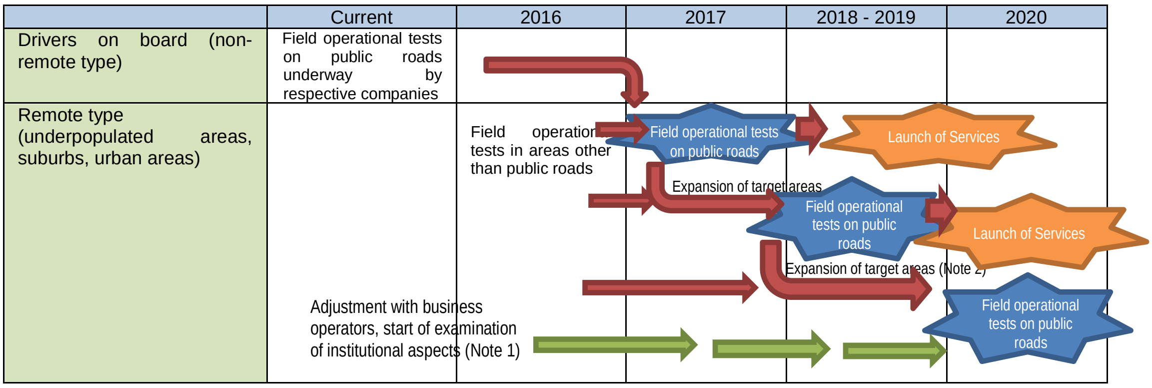
[36] While specified autonomous vehicles are desirable for society as they reduce accidents, they increase manufacturers' responsibility for their systems. It has been pointed out, therefore, that such vehicles may dampen manufacturers' motivation to promote technological development (see reports by RAND Corporation).

Figure 9 Expected timing for the realization of unmanned autonomous driving transport services in limited regions



(Note 1) Consider the integration of contact points for business operators. At the same time, in an effort to enable field operational tests for the services of business operators, which have been found to comply with the Geneva Convention, the necessity of preferential measures under the current system and measures for securing the safety of field operational tests for unmanned autonomous driving transport services on public roads shall be examined while giving due consideration to the effective use of National Strategic Special Zones.

(Note 2) After the above, based on the results of field operational tests, review regulations and expand target areas with the aim of providing transport services at the 2020 Tokyo Olympics and Paralympics.

The services cannot be introduced unless they fully comply with the Geneva Convention. Therefore, adjustments should be made between business operators and administrative organs regarding specific systems and methods to implement field operational tests on public roads while considering international trends.

b. Efforts for field operational tests on public roads to be implemented in 2017 and beyond

Provisional plan for field operational tests on public roads for unmanned autonomous driving transport services in limited regions

Table 12 shows the provisional plan for field operational tests on public roads for unmanned autonomous driving transport services in limited regions to be implemented in 2017 and beyond. Service providers shall be responsible for the implementation of these field operational tests.

Table 12 Feld operational tests on public roads for unmanned autonomous driving transport services in limited regions (provisional plan)

- ☐ Field operational tests for transport services for local residents via unmanned autonomous driving systems in limited areas
  - ✓ First, select underpopulated areas where population density and traffic volume are low.
  - ✓ Provide free-of-charge services at the demonstration stage (participation by monitors).
- ☐ When providing the services, safety measures shall be taken, such as remote monitoring by drivers of service providers (and operation of the vehicle on an as-needed basis).
  - ✓ The drivers of service providers remotely monitor the surrounding environment and the driving state of each vehicle all the time. Conversation between these drivers and in-vehicle passengers is enabled.
  - ✓ These drivers can operate vehicles remotely and, in the event of an emergency, can evacuate passengers from the vehicles. Thus, a variety of automatic safety and evacuation measures, including radio wave disruption cases, are provided.
  - ✓ Passengers can also stop the vehicles in the event of an emergency.
- ☐ Drivers of service providers (remote) are responsible for driving safety, and the service providers assume full responsibility for accidents.

Points for review and specific issues to be considered regarding the institutional design for field operational tests on public roads

Under the current system, unmanned driving transport services on public roads by drivers outside vehicles are not considered. Therefore, the necessity of preferential measures under the current system and measures to secure safety for field operational tests for unmanned autonomous driving transport services on public roads, including the effective use of the National Strategic Special Zones, must be examined immediately in tandem with the examination of schedule for business operators. The field operational tests for the services on public roads must be implemented in strict compliance with the Geneva Convention.

Specifically, details of institutions for vehicle requirements (Road Trucking Vehicle Act), such as the presence of drivers, driving safety obligation (Road Traffic Act), steering wheels, and accelerators,[37] including what preferential measures are required, shall be examined. At the same time, measures to secure safety for field operational tests on public roads for unmanned autonomous driving transport services must be examined. For the new institutional design to secure safety (example), which is summarized in Table 13, measures to secure driving safety, the vehicle and system standards, and the

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[37] In order to shift to the provision of full-fledged services in 2020 based on the results of field operational tests, the relaxation of regulations only after securing safety must be examined. In addition, the alignment of specific content of the full-fledged services with existing business laws must be examined on an as-needed basis.

standards for service providers must be examined, and agreement (conclusion of an agreement) with local governments, the local police, and road administrators must be obtained when providing services.

When designing a new institution, make it flexible in consideration of future technological development. Specifically, while setting temporary standards based on field operational tests data, equip the institution with a capability that enables to successively relax the standards, provided that security is ensured, to facilitate future commercialization.

Table 13 Issues for consideration when designing an institution for the field operational tests on public roads for unmanned autonomous driving transport services (example)

Item	Issues to consider (example)
Measures to secure safe driving	・ Work out measures based on data of field operational tests driving in places other than public roads ➢ Speed limit (for example, 30 km/h at the beginning) ➢ Add limiting conditions for the provision of services on an as-needed basis (such as not provided on rainy days or at night). ・ Requirements for drivers who remotely monitor and operate vehicles
Standards for remote unmanned autonomous driving vehicles and systems	・ Only specified remote unmanned autonomous driving vehicles and systems can be used. ・ Requirements for functions to secure safety, including emergency cases (functions for remote drivers to monitor and operate vehicles, automatic safe evacuation function in the event of an emergency, and in-vehicle emergency stop devices)
Standards for service providers	・ Development of programs and systems to secure safety ・ Clarification of emergency response procedures, rescue systems
<Items on which to make an agreement with local governments>	・ Clearly define limited regions (determination of public roads that will serve as service routes) ・ Speed limit appropriate for each route (for example, 10 km/h in a certain area in light of the population and traffic in that area) ・ Informing local residents of the field operational tests, collaboration with the local police and road administrators (including informing the residents of the fact that unmanned autonomous driving vehicles will run on public roads). ・ Other

c. Realization of unmanned autonomous driving transport services in dedicated spaces

For the realization of unmanned autonomous driving transport services in limited regions, there is more than one approach: the aforementioned approach to realize services on public roads after revising existing institutions, such as the inclusion of the use of National Strategic Special Zones, and the approach where dedicated spaces are set, in which the services are realized, and then expand the spaces on to public roads while considering the trends in technological development.

In light of controlling operating costs and addressing the issue of a driver shortage, interest in the Last One Mile Automated Driving Service[38] is mounting as a means to realize transport services in underpopulated areas. Moreover, theme park business operators are also interested in the Last One Mile Automated Driving Service as a means to reduce the burden of walking on the premises and as a topical gimmick to attract visitors. Venture companies may also enter the market.

We, therefore, aim to realize new transport services with lowered operating costs in underpopulated areas via automated driving (Level 4) in dedicated spaces. In cases where the service routes include general roads, manned driving that leverages platooning (Level 2)[39] will be adopted. In an effort to realize such services, since required transport services, dedicated spaces, and social receptivity vary with the region, places to apply the services shall first be selected and then a system that minimizes operating costs shall be established while considering the feasibility of such services as business. After determining the places for the services, the development of required element technology and the overall system shall be planned, and successful demonstration driving shall be conducted on test courses. After confirming safety through the demonstration driving, field operational tests, including those on public roads, shall be conducted, and issues, such as the establishment of traffic control technology and the business model, shall be examined.

(3) Other automated driving systems that meet the diverse socioeconomic and people's needs

In addition to the examination of institutions for the aforementioned two automated driving systems with the future development of automated driving systems in mind, the development of the following automated driving systems shall also be promoted in light of various needs, such as the 2020 Tokyo Olympics and Paralympics, solutions to social issues of Japan, and the enhancement of convenience in people's lives:

a. Next generation urban transportation system (ART: Advanced Rapid Transit)

Our challenge toward the 2020 Tokyo Olympics and Paralympics is to achieve stress-free Olympics by improving accessibility from the coastal areas with a relatively

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[38] A new transport service that connects the *last one mile*, such as between the nearest station and the final destination of a public transportation system, by leveraging automated driving (Level 4) technology

[39] Adjustment can be made by the automated driving level of the lead vehicle since the following driverless vehicles follow the manned lead vehicle.

inconvenient transportation system to downtown Tokyo, and by developing universal transportation infrastructure that facilitates the mobility of all people, including wheelchair and stroller users.

To this end, based on the operation schedule for the Practical Application of the Next Generation Urban Transportation System (ART) for the Development of Tokyo and the Aging Society,[40] ART shall be promoted under the leadership of the SIP Automated Diving Systems. Such efforts shall be promoted while regarding the 2020 Tokyo Olympics and Paralympics as a milestone and aiming at the ultimate goals of spreading the system across Japan and exporting system packages overseas after 2020.

b. Truck platooning

The trucking industry in Japan has high expectations for the use of automated driving systems, including truck platooning on highways, with a view to improving business efficiency, solving a driver shortage, and improving safety.

In the future, we will aim to achieve platooning comprising more than three following driverless trucks in long-distance transport between Tokyo and Osaka. In order to realize such truck platooning, many key issues need to be resolved: technological issues, such as safety in electronic coupling and securing of reliability; institutional issues, such as positioning of electronic coupling in related laws and regulations; surrounding traffic environment; and impact on the road structure. Therefore, solid, step-by-step efforts, such as first aiming to realize platooning comprising two following trucks, shall be made toward the realization of truck platooning in collaboration with related parties, including relevant ministries and agencies. The prospect for the development of required element technology, including control technology, and the overall system should be opened up by 2017, and field operational tests on test courses should be successfully implemented by 2018. After safety has been confirmed, further field operational tests, including those on public roads, shall be promoted. For these field operational tests, efforts to enhance social receptivity and traffic control technology and to promote discussions on the business model for platooning control services shall be made in tandem with technological development, by first starting the field operational tests with currently possible platooning (for example, platooning comprising two manned following trucks, which leverages CACC) while considering overseas trends.

The examination of truck platooning on highways shall be conducted while

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[40] It was discussed at the meeting of the Task Force on Science, Technology, and Innovation for the 2020 Tokyo Olympics and Paralympics, which was established under the Council for Science, Technology and Innovation in fiscal 2014.

comparing more than one technology, such as driving data of physically connected heavyweight full-trailers (to promote the relaxing of requirements for vehicle length) and the application of on-highway autopilot technology to trucks.

c. Automated valet parking

Currently, automated parking, where vehicles are automatically steered into parking spaces, is being put into practical use. On the other hand, there is a strong need for automated valet parking, where the driver gets out of the car, for example, in front of a store, and the car runs without the driver in the parking lot of the store, finds an empty space, and parks itself in the space, due to the parking lot owners' desire to improve parking lot management efficiency and enhance safety in parking lots and customer satisfaction.

Therefore, we aim to realize automated valet parking in dedicated parking lots (separated from general traffic, installation of a control center) for vehicles compatible with the automated valet parking system from around 2020. To this end, since it is difficult to secure safety of such automated valet parking only by vehicles, efforts to build a consensus between vehicle manufacturers and parking lot owners on role sharing, the prospect for the introduction of the system, and the standardization of the system shall be made while giving due consideration to minimizing the burden on both parties. The prospect for the development of required element technology and the system shall be opened up and a proposal for the international standardization of the automated valet parking system shall be made by 2017. After fiscal 2017, field operational tests on actual parking lots that are ready for such tests shall be implemented and the efforts to form a consensus among parties shall be further promoted. Then, efforts to equip vehicles with a scalable structure for automated valet parking shall be made to develop vehicles for automated valet parking in advance of parking lots. Finally, parking lots dedicated to automated valet parking shall be developed.

(4) Spread of driving safety support systems

In addition to the commercialization and servicing of the aforementioned individual automated driving systems, it is necessary to address measures to spread driving safety support systems to build a society with the world's safest road transport and most advanced ITS by 2020. In light of the remaining period of four years to achieve the objective, efforts to develop and spread systems and on-board devices in the following three fields shall be promoted:

Table 14 Driving safety Support Systems to be promoted

a. Promotion of the popularization of driving safety support systems and the installation of driving safety support devices[41]
  - Expansion and consolidation of safety standards, including making them obligatory for commercialized technologies, such as collision damage mitigation braking systems (automatic braking systems), and the expansion of auxiliary systems while considering international trends.
  - Continue promoting the spread of new technologies that are about to be put into practical use, such as the Driver's Abnormal Behavior Detection and Response System, by developing technology guidelines and evaluating the effect of these technologies based on accident data.[42]
  - Preparation of an environment for the further spread and sophistication of the emergency report system (HELP) and the automatic collision notification (ACN) system, which enable to report accidents via on-board device or mobile phone.
  - Examination of the measure to assess and analyze the actual conditions of accidents by using data from image-type drive recorders or event data recorders.[43]

b. Development and introduction of information delivery systems, including safety support
  - Promote the introduction of driving safety support systems (DSSS) that provide visual and audio information on traffic conditions by leveraging infrastructure of the traffic control system.
  - Implement efforts to realize smooth, safe, and secure road traffic by leveraging ITS technology, including the spread and promotion of ETC 2.0. Expand the use of ITS technology, such as ETC, to the facilities other than highways, such as private parking lots.
  - Examine effective countermeasures for wrong-way driving on highways via industry-government-academia collaboration, such as prompt detection of vehicles traveling the wrong way, warnings on roads and in vehicles, and the use of automated driving technology.

c. R&D and spread of sensors and systems, which cover pedestrians
  - Development of information delivery systems and pedestrian-vehicle communication technology to support the mobility of pedestrians.
  - Development of roadside-type high-resolution millimeter-wave radars, which are less affected by surrounding environment, such as the weather and brightness, and which can detect the presence of vehicles and pedestrians at and around intersections.

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[41] The collision damage mitigation braking system and the driver's abnormal behavior detection and response system shall be promoted while bearing in mind that they may develop into automated driving systems that can automatically avoid accidents, despite the fact that drivers drive the vehicles under normal conditions, due to the further development of technology in the future.

[42] The guidelines for the basic design of the driver's abnormal behavior detection and response system were developed in March 2016.

[43] Targeting charter bus companies, laws and regulations regarding the recording and storage of images via drive recorders and the obligations for training and supervision by using such images will be reviewed within 2016.

5. Efforts toward the Promotion of ITS/Automated Driving Innovation

(1) Development and popularization of automated driving systems

a. Promotion of R&D and demonstration, including the development of international R&D environment

Development of technology strategies and the international R&D environment for automated driving systems

In the future, the following shall be promoted based on the aforementioned roadmaps for individual automated driving systems: the research and development of hardware and software, which are related to sensing technology, intelligent technology, drive technology, communication technology, data utilization technology, and security technology, and the sophistication of automated driving technology via the private sector-driven public-private joint development efforts.

In this context, the government in particular shall promote research, development, and demonstration through measures and policies of SIP and other ministries and agencies that are determined in the Council for Science, Technology and Innovation. To this end, public-private R&D and demonstration shall be promoted in the fields that do not interfere with the competition among private companies, such as technology for common infrastructure, centering on the following specific fields:

- Development of common infrastructure technology (common element technology, for example, individual element technology, dynamic maps, security, functional safety, [44] database development technology, control technology, research on humans, [45] and research on HMI[46])
- Development of systems required for the public sector (development of cooperative systems).
- Development support to private companies (including support to universities, venture companies, and new ideas)

When setting themes for those R&D and demonstration activities, R&D management

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[44] In addition to functional safety, safety requirements for fail operational systems (including functional degeneracy) and situations, such as performance limits, and incorrect operation/mishandling, should also be examined.

[45] For the examination of driver monitoring and the acceptable level of the second task, standardization of requirements is required based on basic and scientific research in ergonomics on the driver's perception, behavior, and physiological state and on the results of such research.

[46] For the realization of more sophisticated automated driving systems, the expansion of private collaboration-based R&D fields, such as artificial intelligence, should also be examined.

shall be conducted from an integrated perspective while clearly setting the timing of launching these activities in the aforementioned roadmaps. For the R&D activities toward the commercialization of cooperative systems, the following shall be kept in mind: the integration of efforts by a variety of parties involved needs to be achieved since the effective functioning of such systems, for example vehicle-vehicle systems, will require the introduction of the systems on a massive scale. Moreover, the use of award-type methods, such as the provision of competition opportunities (contests) for challenging ideas, shall be considered in light of the fact that teams with versatile capabilities and a wide variety of innovative ideas are required for the development of automated driving systems and element technology.

In the future, technology required for automated driving systems is expected to go beyond the conventional boundaries of the informatization of automobile technology and become more focused on sophisticated and innovative technology, such as artificial intelligence (AI), and on the use of interdisciplinary fields, including ergonomics (HMI) and security. In order to put these technologies into practical use, it is essential to collaborate with basic/fundamental research and develop human resources. Therefore, when promoting R&D and demonstration activities for automatic driving systems, capabilities of universities, in addition to existing domestic research institutions, shall be actively leveraged and an industry-government-academia collaboration system shall be established.[47] In doing so, efforts shall be made to make these institutions the core international centers that also promote the use of overseas human resources and the participation of overseas companies. Through these systems, efforts shall also be made to build eco systems that will create new ventures and industries.

Development of an international environment for demonstration tests

In the efforts toward the sophistication and commercialization of automated driving systems, it is indispensable to convert skillful driving techniques to artificial intelligence (AI), prove its performance by driving tests on test courses and public roads, and compile a database of driving data in various situations (including dynamic maps in the cloud).

To that end, in addition to research and development of hardware and software, the

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[47] For artificial intelligence (AI), a R&D system is planned to be developed via collaboration among the Ministry of Education, Culture, Sports, Science and Technology (RIKEN), Ministry of Economy, Trade and Industry (AIST), and Ministry of Internal Affairs and Communications (NICT) in fiscal 2016 and beyond. Collaboration with this system shall also be considered. For HMI, AIST established the Automotive Human Factors Research Center in April 2015 to promote research on human characteristics toward the realization of safe and pleasant driving.

development of test courses, such as simulated, internationally oriented urban areas,[48] and the active field operational tests on public roads in Japan for automatic driving systems shall be promoted. Currently, compared with other countries, field operational tests on public roads are easier to implement in Japan; therefore, overseas companies also actively conduct field operational tests in Japan. In an effort to ensure traffic safety and smoothness, guidelines on field operational tests on public roads shall be developed. At the same time, an environment to actively and safely implement demonstration tests on public roads, which are required to collect data on safety (including Level 4), shall be developed while considering the use of National Strategic Special Zones on an as-needed basis.

Part of data obtained from demonstration tests on public roads not only helps secure social receptivity, but also serves as important input for the consideration of future R&D activities and institutional design. For the data related to demonstration tests on public roads, therefore, the development of a mechanism that allows the sharing of such data and the disclosure of test results as much as possible shall be examined.

b. Development of criteria and standards and international leadership in institutional efforts

Showing international leadership

In order to build the world's most advanced ITS, including the development and popularization of automated driving systems in the future, it is necessary to promote efforts from a global perspective without limiting them within the country and display international leadership in the field of ITS.

To that end, it is important for Japan to actively participate in existing international frameworks and activities in Europe and the Americas, promote the exchange of information on international standards, including automated driving systems-related terms, functions, constructing techniques, performance standards, and conformity assessment, and joint research on human factors and social receptivity from a global perspective, and play a leading role in building global consensus through these activities. As part of effort toward international leadership, the SIP Automated Driving Systems shall hold an international conference on automated driving in Japan each year.

Strategic efforts toward the development of international criteria and standards

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[48] The Ministry of Economy, Trade and Industry included the automated driving system assessment centers development project (1.5 billion yen) in the fiscal 2016 budget.

In order for the automobile industry of Japan to lead the world in and actively contribute to resolving social issues, including a reduction in traffic accidents, it is important to build a system that strategically responds to the efforts to develop international rules (criteria and standards), a foundation for the promotion of efforts in the field of cooperation and collaboration.

For the examination of international standards for automated driving, an automated driving subcommittee was established in the UN World Forum for Harmonization of Vehicle Regulations (WP 29) in November 2014 and a technical committee, where technology standards for autopilots are examined, was established in March 2015. Together with the United Kingdom and Germany, Japan holds the co-chairmanship of these committees. With a plan to discuss the issue of fully automated driving systems in the future, WP 29 will continue leading international discussion in the field of automated driving.

For the efforts of establishing international standards for automated driving, Japan is in the position to lead the discussion as it was elected chairman of important TCs.[49] Moreover, since the relationship between ISO/TC 204 (ITS) and TC22 (vehicles) has become more complicated, an automated driving standardization study panel was established in the Society of Automotive Engineers of Japan, a domestic deliberative body in this field, to promote cross-sector information sharing and examine strategies. On the other hand, along with growing interest in automated driving, the number of international standardization items has radically increased in recent years. In an effort to respond to this trend, it is necessary to continue examining measures to strengthen a mechanism to secure resources, such as experts dedicated to the implementation of standardization activities. Important themes for standardization include maps, communications, ergonomics, functional safety, security, and recognition technology.

Moreover, in order to lead the world in the field of rule-based automated driving, it is essential to have international strategies that fully cover criteria and standards. Therefore, we will set up a place to share international trends in criteria and standards based on the systems to examine each of criteria and standards and develop strategies that allow Japan to lead international activities in accordance with its future vision of automated driving.

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[49] In TC22, Japan serves as a chair and the secretariat for SC32 (Electrical & Electronic components and general system aspects) where the issues, such as information security and functional safety, are handled. In TC204, Japan serves as a convener (chair) for WG3 (ITS Database technology), where map information is addressed, and for WG14 (Vehicle/Roadway warning and control systems), where automobile driving control is addressed.

Institutional Efforts and Response to International Convention on Fully Automated Driving

Japan will continue examining responsibility in accidents and the obligation of drivers, including the Road Traffic Act, based on the data obtained from field operational tests on public roads.[50]

In order to realize fully automated driving (Level 4) on public roads, measures must be taken to achieve compliance with the Geneva Convention, which presupposes the presence of drivers.

Aiming at the realization of fully automated driving, Japan has been participating in the discussion on the Geneva Convention in the Working Party on Road Traffic Safety (WP1) of UN Economic Commission for Europe (UNECE) under the United Nations Economic and Social Council and became the official member of the WP1 in February 2016. In the future, Japan shall actively participate in international discussion and aim at the early realization of fully automated driving.

(2) Development and use of traffic data platform

a. Development of digital infrastructure, such as dynamic maps

Digital infrastructure, such as dynamic maps

In order to realize automated driving systems, it is important to establish their data infrastructure as a platform. The dynamic maps that can serve as shared infrastructure of the platform have the potential to become a source of added value in the future.

On the other hand, since the construction of dynamic maps costs significantly, it is necessary to develop maps, which serve as a foundation for specifications and dynamic maps, through public-private partnerships (including collaboration among private companies) toward the commercialization of automatic driving systems on highways. In light of a plan to launch vehicles that use maps for automated driving in several years, maps for automated driving shall be commercialized by 2018 at earliest. To this end,

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[50] The Survey Report on the Institutional Issues of Automated Driving (March 2016) by the National Police Agency has categorized and summarized the legal and operational issues regarding automated driving as follows: (1) Penal responsibility; (2) Obligations under administrative laws (obligation for vehicle inspection and maintenance, obligation regarding the security of automated driving systems, the role of the driver's license system, rescue and reporting obligation in the event of an accident, obligation related to persons other than drivers); (3) Civil responsibility; and (4) Other (electronic connection, remote piloting, second task, operation of traffic controls, infrastructure, social receptivity, information transmission to the public). In the future, related ministries and agencies will deepen discussion on these issues while confirming the direction of the development of specific automated driving systems and related technology.

while specifications and standardization of maps for automated driving are being examined mainly by SIP, we plan to gather automobile manufacturers and map companies together within fiscal 2016, create integrated specifications by going beyond the boundaries of companies, and propose them as international standards. In so doing, private companies shall collaborate with companies that use maps, such as automobile manufacturers, while giving free play to their own ingenuity, whereas the government shall provide support to efforts in the cooperation and collaboration fields, such as international standardization and the development and demonstration of common fundamental technology on an as-needed basis.

Table 15 Purposes of dynamic maps

- ■ Self-position estimation and determination of a driving route, which are prerequisites for automated driving systems:
  - ✓ Dynamic maps are used as reference to determine self-position based on GPS (including the use of quasi-zenith satellites) and sensor information.
  - ✓ Detailed 3D structure information and traffic control information are used to determine a driving route.

  * However, note that self-position is not estimated or a driving route is not determined only by information from dynamic maps (external information).
- ■ Used as intelligent traffic information database (digital infrastructure) for all vehicles
  - ✓ Can be used to support driving of all types of vehicles, not only for automated driving systems.
- ■ Planned to be used in other fields (on an as-needed basis):
  - ✓ Toward the establishment of a shared platform in an ultra-smart society, SIP promotes collaboration and cooperation with other systems (specific use cases and identification of issues through information sharing and examination related to data specifications and formats)

Inter-system collaboration and cooperation shall be addressed while giving due consideration to the following: the advanced map information infrastructure, including dynamic maps, can serve as infrastructure not only in automated driving systems, but also in other fields, such as support to pedestrians, disaster prevention, tourism, and road management.

Sophistication of Information and Communications Infrastructure

In the future, the further sophistication of information and communications infrastructure will become inevitable as a large volume of data, including dynamic maps, is expected to be exchanged with the cloud via mobile-type network.

Therefore, R&D and field operational tests regarding the following shall be promoted: highly reliable and highly accurate control via networks, highly efficient, real-time technology to update dynamic maps, etc., via networks, and technology to deliver information to vehicles in a highly efficient manner.

b. Preparation and use of traffic-related data

Efforts toward the effective use of probe data

In recent years, data collected from moving objects (automobiles) are expanding because of the progress in IoT to include probe data, such as location and speed information of automobiles, sensor and image information, and in-vehicle operation information. However, since these data are held separately by the public and private sectors,[51] and systems are developed separately by each entity, mutual connectivity has not been established.

In the private sector, these data contribute not only to providing information to automobile users, but also to creating new business and sophistication of existing business, including the sophistication of logistics systems of forwarding companies. In the public sector, these data can be used for surveys and studies on roads and road traffic management and serve as useful information in policy efforts, such as disaster prevention and tourism. Therefore, the effective use of these data by sharing between the public and private sectors is much expected.

In order to promote the use of data held by the public and private sectors through information sharing, standards, rules, and methods required for common use will be examined. Since the methods of and issues involved in information sharing and data to be shared vary significantly according to use purposes and other factors, it is necessary to first consider the needs of the public and private sectors, including disaster prevention and tourism, and then clarify the range of data to be shared. After that, the current methods to collect and hold data shall be organized, and efforts toward information sharing shall be promoted under the public-private partnership, including private organizations that have knowledge of information sharing, while referring to the past information sharing efforts.

When promoting the aforementioned efforts, it is important to pay particular attention to international standardization trends, including de facto standards, and play an active

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[51] For example, data are being collected and accumulated separately on unique systems of a variety of private companies, such as automobile manufacturers, public transportation, and forwarding companies, automobile-related equipment (car-navigation systems) manufacturers, smartphone and tablet OS manufacturers, app manufacturers, and insurance companies. Moreover, traffic administrators and road administrators also collect data on automobile traffic through sensors installed in roadside infrastructure, such as vehicle detectors, optical beacons, and ETC 2.0. The government, auto dealers, and automobile maintenance/repair companies have inspection registration information and maintenance/repair information.

role in the standardization activities.

Efforts toward the use of automobile-related information

In light of the expectation that safety and security in the use of automobiles can be enhanced and new services can be created by leveraging automobile-related information, such as inspection registration information, maintenance/repair information, and driving characteristics information, we will work to achieve the four service menus set forth in the Future Vision related to the Utilization of Automobile-related Information,[52] which was drawn up by the Ministry of Land, Infrastructure, Transport and Tourism in January 2015. Specifically, the following will be addressed: the development of standard specifications for safety-related vehicle equipment that requires external fault diagnosis equipment; the dissemination and awareness raising activities for automobile insurance programs that promote drivers' safe driving by leveraging information on driving characteristics, such as sudden acceleration and braking; the examination of a business scheme for services that summarize and provide vehicle history information, including the number of owners and maintenance and repair information of the automobile; and the streamlining and sophistication of inspections and repairs via correlation analysis between inspection and repair.

Utilization of big data, including traffic data, for policies

In parallel with the efforts to promote and sophisticate the superimposition of the

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[52] The Vision sets forth the following four services:
I. A service that in an effort to promote the safe use of automobiles and the enhancement and reactivation of the maintenance/repair industry, establishes standard specifications for universal scan tools with respect to safety-related vehicle equipment that requires scan tools (external fault diagnosis equipment) unique to each automobile manufacturer and standardizes maintenance/repair tools corresponding to advanced automobile safety equipment to enable accurate and prompt fault diagnoses by every maintenance/repair service provider.
II. A new insurance service that uses driving information, such as sudden acceleration and braking cases, in setting premiums and that provides an incentive, such as a reduction in the premium based on safe driving performance. The promotion of such a service will contribute to reducing premiums, promote safety driving by drivers, and reflect driving characteristics, which contribute to traffic safety by reducing accidents, in premium setting.
III. A service that in an effort to activate the secondary automobile market and enhance safety and security associated with automobile trading, promotes the visualization of vehicle history information by summarizing and providing vehicle history information, such as automobile inspection registration information (the number of owners, area of use) and maintenance/repair information.
IV A service that in an effort to enhance automobile safety and environmental conservation, collects and accumulates automobile inspection and repair information and analyzes such information in an integrated manner. By doing so, it enables inspections and repairs, which focus on the parts with a high trouble occurrence rate and the places with a high re-inspection rate. Thus, it improves inspection and maintenance/repair efficiency via the correlation analysis of inspection and repair.

aforementioned map data and to promote the utilization of probe data, efforts to resolve issues in the traffic and other fields by leveraging traffic-related data and other big data shall be promoted.

Specifically, efforts to use roads cleverly by leveraging a variety of detailed big data, including speed, route, and time data of ETC 2.0, in an integrated manner shall be rolled out, and efforts to apply such data to traffic policies, such as the activation of public transportation and the mobility support to pedestrians, shall be promoted. In addition, in an effort to secure efficient mobility means in rural and underpopulated areas, the popularization of on-demand vehicle dispatch systems via collaboration with vehicles operating in local communities by leveraging IT (public transportation systems) shall be examined.

For promoting these efforts, making data to be used (including data other than traffic data) in the efforts open shall be encouraged if appropriate, and the shared use of standard systems and the use of the cloud shall be considered to facilitate the efficient introduction and popularization of systems in each region.

Reference: Contribution of ITS after the 2016 Kumamoto Earthquakes

- The contribution via ITS to the relief activities for the 2016 Kumamoto earthquakes includes the provision of vehicle accessible road information on road maps (maps of roads available for traffic) for free by private organizations that collaborate with automobile manufacturers and other companies that have probe data. These information delivery systems were built based on the lessons from the Great East Japan Earthquake, and for the Kumamoto earthquakes, the vehicle accessible road information was disclosed right after the occurrence of earthquakes. Moreover, traffic control information by JARTIC (Japan Road Traffic Information Center) was also promptly disclosed after the occurrence of earthquakes and was used for the provision of information by private companies.
- We will examine the effective utilization of probe and other traffic-related data in cases of disasters and how ITS can contribute to earthquake and other disaster responses, including ways to collect and release image information gathered through automobiles and information on changes in fundamental maps in cases of large-scale disasters in parallel with the construction of dynamic maps.

(3) Response to privacy and security

Development of a system to examine personal data

In the midst of increasing use of data in ITS/automated driving, it is important to give due consideration to privacy when using data. In particular, the automobile industry has pointed out that when using a variety of data in automated driving systems, many issues must be resolved, such as agreement by individuals on providing their personal location information and how information concerning surrounding vehicles and pedestrians, which is stored in roadside cameras, should be handled.

The Personal Information Protection Law,[53] which was amended and promulgated in September 2015, allows private companies to use anonymized and processed information (information that has been processed so that no particular individuals can be identified) and stipulates that after its full-fledged enforcement, the authorization of personal information protection organizations shall be done by the Personal Information Protection Commission. In light of these changes, the handling of personal data related to ITS/automated driving, including the feasibility of a public-private examination system, shall be examined.[54] In doing so, the use of personal data shall be addressed while considering not only its legal compliance, but also that the key to success of the efforts is to make it clear that the services to be provided by using the personal data will be useful also for the individuals who provide their personal data.

Development of a system related to security

Along with future progress in the computerization of automobile control systems, in particular, progress in automated driving technology via cooperative systems, including mobile-type systems, security threats will increase, and the impact of cyberterrorism on the road traffic society will become greater. Interest in automobile security measures,

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[53] In September 2015, the revised Personal Information Protection Law was promulgated. In January 2016, the Personal Information Protection Commission was established under the revised Law (the full-fledged enforcement within two years after the promulgation).

[54] In the United States, the White House announced the Consumer Data Privacy in a Networked World in February 2012. In response to it, the US Auto Alliance announced the Consumer Privacy Protection Principles (privacy principles for vehicle technologies and services) in November 2014.

including countermeasures against hacking, therefore, has been mounting.[55] In light of the fact that owners or drivers of automobiles not only are subject to damage from security attacks, but also can become assailants, security measures become a serious issue.

In such social context, government agencies have developed and published guidelines for automobile security measures.[56] Moreover, SIP has recently launched industry-government-academia research and development activities on cyber security.

In the future, in an effort to promote the development of security measures related to automobiles, not only on the development of element technology, but also the entire architecture, including maintenance of automobiles, shall be focused on, and the development of a public-private collaboration system to ensure security, including the development of security systems in the automobile industry, shall be examined to appropriately respond to cyberattacks that are becoming increasing more sophisticated.[57]

In particular, it is necessary to develop evaluation technology and evaluation environment (testbed) for security measures. In an effort to make the technology and environment available for shared use in the automobile industry, extensive cooperation is required for the examination of communication specifications and common architecture for vehicle systems.

(4) Development of a collaboration system for society as a whole and securing of civic collaboration and social receptivity

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[55] In fact, a notorious hacker released a video in July 2015, showing an experiment to carjack and disable acceleration/braking systems. Later in the same month, Fiat Chrysler Automobiles (FCA) announced the recall of about 1.4 million vehicles in the United States to upgrade software in those vehicles equipped with an Internet connection.

The Japanese government's "Cyber security strategies," which were endorsed by the Cabinet in September 2015, mentions highly reliable ITS as an example of the development of a structure and system related to the security of IoT systems that are expected to assume greater significance in the future.

[56] "Guide for automobile information security efforts: Information security for connected automobiles" Information-technology Promotion Agency, Japan (March 2013)

[57] In the United States, the automobile industry (Auto Alliance: the Alliance of Automobile Manufacturers) announced the establishment of Auto-ISAC in July 2015 (ISAC: Information Sharing and Analysis Centers, an organization to reduce risk and enhance tenacity by collecting, analyzing, and sharing information on security threat).

Later, NHTSA of the US Department of Transportation and 18 automobile companies reached an agreement on the Proactive Safety Principles 2016 that includes automotive cyber security. The automotive cyber security measures in the Principles include the support to and the development of Auto-ISAC.

Development of collaboration systems by a variety of entities, including regions

In order to promote innovation in the midst of heightened interest in ITS/ automated driving, it is essential to build places where a variety of industries and entities exchange information and create new efforts based on the needs of the field, and raise the level of the entire society, including regions, small and medium-sized enterprises, and venture companies.

Currently, review committees are being established in industries, such as the automobile industry and the electrical appliance industry. In the future, places to exchange views (forums) shall be developed, where in addition to the aforementioned industries, a wide variety of industries, such as the IT industry, the financial industry, small and medium-sized enterprises, and venture companies, and universities, research institutions, and regions, which have interest in or needs for automated driving, can participate.

Through these systems and based on the specific mobility needs in each region, efforts shall be made to develop a mechanism that enables specific efforts toward the resolution of regional issues via ITS/automated driving, including the use of small-size mobility, through collaboration between local governments and local small, medium, and venture companies, and thereby to contribute to regional revitalization.

Efforts concerning citizen participation and social receptivity

In Japan, a prerequisite for building the world's most advanced ITS in specific regions and expand it across the nation is that citizens, who will use and live with ITS/automated driving, participate in the efforts to build such systems with a full understanding of the advantages of the systems. In particular, when introducing automated driving systems, it is indispensable to secure social receptivity for the new technology.

In an effort to secure social receptivity, SIP Automated Driving Systems has held media briefings, where it has explained progress in the development of automated driving. However, since the challenge of raising social receptivity for ITS/automated driving is not what should be addressed by the government alone or by one company, it is necessary to examine the development of an industry-government-academia collaboration system, including unbiased, independent academic societies, such as universities and research institutions.

In the future, surveys[58] on social impact of automated driving shall be promoted with

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[58] Since it has been pointed out that the popularization of automated driving systems may lead to lowering the driving skills of drivers, it may become necessary to examine the presence or absence of such impact in the future.

the aforementioned collaboration systems in mind, and civic collaboration and social receptivity shall be enhanced by showing in an easy-to-understand manner how automated driving systems will be popularized and how society will change by the development of ITS/automated driving from the perspective of users and citizens.

6. Roadmaps

Based on the description in chapters 2 to 5, roadmaps that show the issues regarding driving safety support systems, automated driving systems, and the use of traffic data to be addressed by both the public and private sectors and the timeline are attached. The roadmaps were developed in relation to the reviews made in SIP Automated Driving Systems and are consistent with the research and development plan developed in the SIP program.

The public and private sectors shall share the goals shown in the roadmaps, clearly define the roles and responsibilities of each sector, and address measures and policies through mutual collaboration.

In the roadmaps, the spread of technology, products, and systems and matters related to market deployment are designated as "led by the private sector," whereas measures based on the government budget, such as research and development activities, are designated as "led by the public sector" for convenience of reference. However, the public sector may need to support, for example, the popularization of and market deployment for technology, products, and systems through its measures and policies. Moreover, cooperation of the private sector is indispensable for the implementation of the government budget. In short, efforts will be addressed while collaborating and discussing with each other.

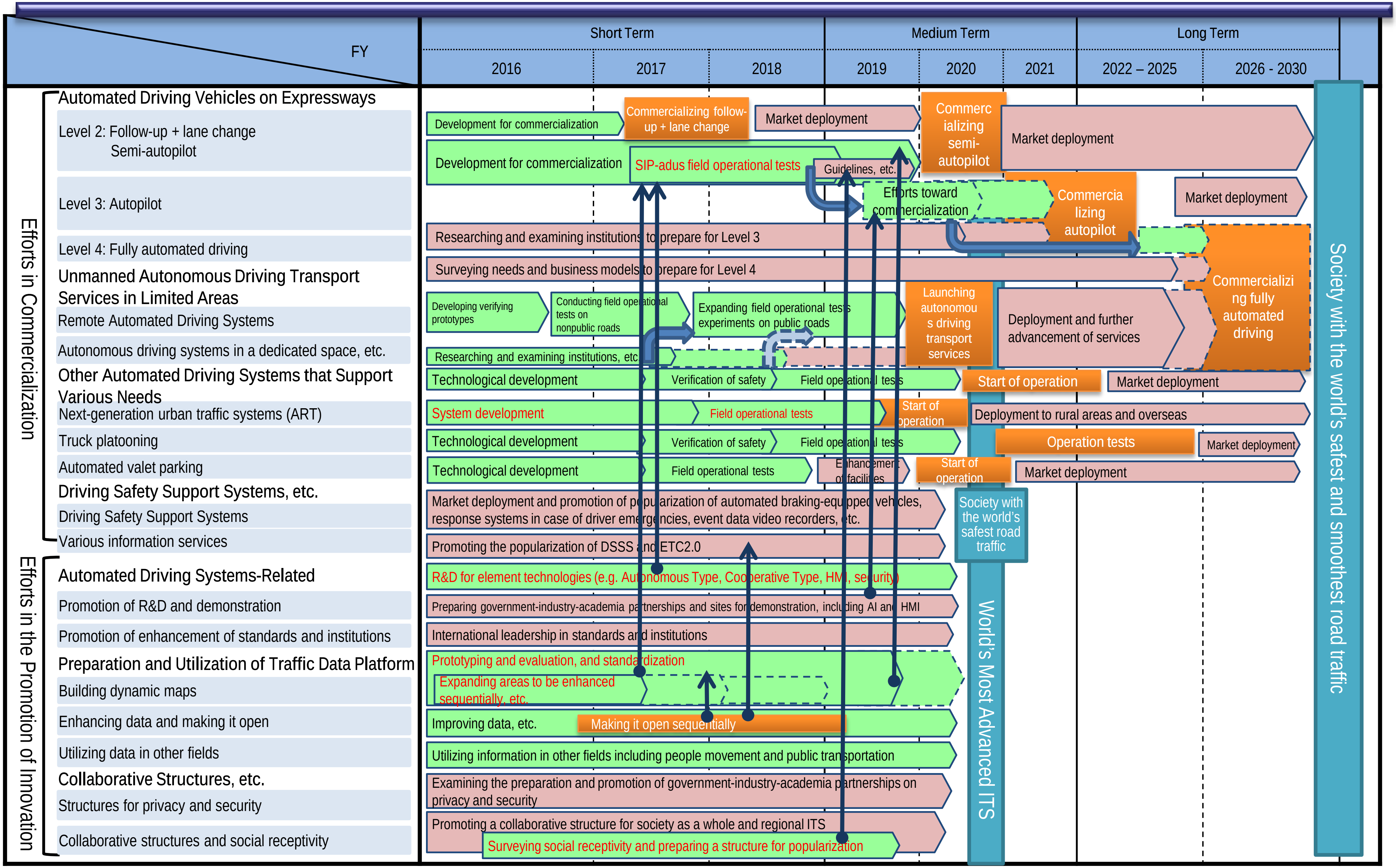
7. Method of and Structure for Moving Forward

In the future, detailed examination will be made on the issues shown in the Public-Private ITS Initiative/Roadmaps 2016 through the public-private collaboration, and the joint meeting between the SIP Automated Driving Systems Promotion Committee and the Road Traffic Subcommittee will be held twice a year as part of the public-private collaboration promotion system to promote the ITS-related measures, where the future direction will be examined and the roadmaps will be reviewed based on progress in research and development. The joint meeting shall comprise members from related ministries, agencies, and industries, and the Cabinet Secretariat and the Cabinet Office will serve as a secretariat.

In an effort to examine individual issues in a practical and intensive manner, a working group comprising a small number of working-level officials will be established to examine each of key, cross-sectional issues selected from among the issues listed in the Public-Private ITS Initiative/Roadmaps 2016. For the operation of working groups, secretariats other than the Cabinet Secretariat, including existing organizations, will be allowed to operate them to secure flexibility.

Through examination under the public-private collaboration promotion system, the details of the Public-Private ITS Initiative/Roadmaps 2016 shall be examined and the roadmaps shall be revised on an as-needed basis while considering progress and trends in new ITS-related industries and technologies in Japan and in the world and promoting the practice of the PDCA cycle in the examination.

Public-Private ITS Initiative/Roadmaps 2016 (Overall Picture of Roadmaps)



FY

Short Term: 2016, 2017, 2018
Medium Term: 2019, 2020, 2021
Long Term: 2022 – 2025, 2026 - 2030

Efforts in Commercialization

Automated Driving Vehicles on Expressways

- Level 2: Follow-up + lane change / Semi-autopilot: Development for commercialization → Commercializing follow-up + lane change → Market deployment → Commercializing semi-autopilot → Market deployment
- Level 3: Autopilot: Development for commercialization → SIP-adus field operational tests → Guidelines, etc. → Efforts toward commercialization → Commercializing autopilot → Market deployment
- Level 4: Fully automated driving: Researching and examining institutions to prepare for Level 3; Surveying needs and business models to prepare for Level 4 → Commercializing fully automated driving

Unmanned Autonomous Driving Transport Services in Limited Areas

- Remote Automated Driving Systems: Developing verifying prototypes → Conducting field operational tests on nonpublic roads → Expanding field operational tests experiments on public roads → Launching autonomous driving transport services → Deployment and further advancement of services
- Autonomous driving systems in a dedicated space, etc.: Researching and examining institutions, etc.

Other Automated Driving Systems that Support Various Needs

- Next-generation urban traffic systems (ART): Technological development → Verification of safety → Field operational tests → Start of operation → Market deployment
- Truck platooning: System development → Field operational tests → Start of operation → Deployment to rural areas and overseas
- Automated valet parking: Technological development → Verification of safety → Field operational tests → Operation tests → Market deployment

Driving Safety Support Systems, etc.

- Technological development → Field operational tests → Enhancement of facilities → Start of operation → Market deployment
- Driving Safety Support Systems: Market deployment and promotion of popularization of automated braking-equipped vehicles, response systems in case of driver emergencies, event data video recorders, etc.
- Various information services: Promoting the popularization of DSSS and ETC2.0

Society with the world's safest road traffic

Efforts in the Promotion of Innovation

Automated Driving Systems-Related

- Promotion of R&D and demonstration: R&D for element technologies (e.g. Autonomous Type, Cooperative Type, HMI, security); Preparing government-industry-academia partnerships and sites for demonstration, including AI and HMI
- Promotion of enhancement of standards and institutions: International leadership in standards and institutions

Preparation and Utilization of Traffic Data Platform

- Building dynamic maps: Prototyping and evaluation, and standardization; Expanding areas to be enhanced sequentially, etc.
- Enhancing data and making it open: Improving data, etc.; Making it open sequentially
- Utilizing data in other fields: Utilizing information in other fields including people movement and public transportation

Collaborative Structures, etc.

- Structures for privacy and security: Examining the preparation and promotion of government-industry-academia partnerships on privacy and security
- Collaborative structures and social receptivity: Promoting a collaborative structure for society as a whole and regional ITS; Surveying social receptivity and preparing a structure for popularization

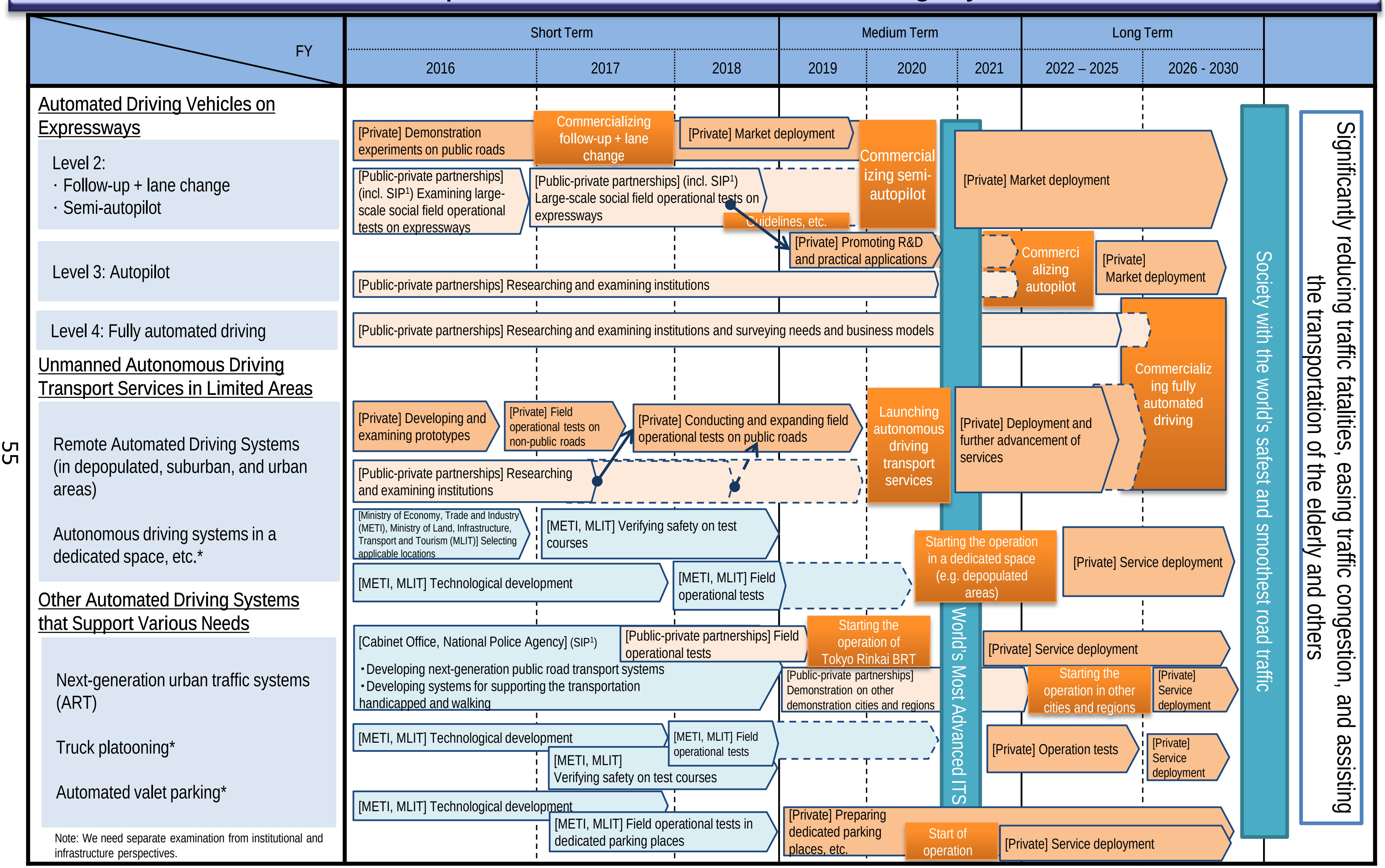
World's Most Advanced ITS

Society with the world's safest and smoothest road traffic

🟩: Measures mainly related to development 🟥: Measures mainly related to market deployment Red font: Items that include SIP^1-related R&D

[1] SIP: Cross-ministerial Strategic Innovation Promotion Program of the Strategic Innovation Creation Council (FY 2014 - FY2018)

Roadmap Related to Automated Driving Systems



FY

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Automated Driving Vehicles on Expressways

Level 2:
· Follow-up + lane change
· Semi-autopilot

[Private] Demonstration experiments on public roads

Commercializing follow-up + lane change

[Private] Market deployment

Commercializing semi-autopilot

[Private] Market deployment

[Public-private partnerships] (incl. SIP[1]) Examining large-scale social field operational tests on expressways

[Public-private partnerships] (incl. SIP[1]) Large-scale social field operational tests on expressways

Guidelines, etc.

Level 3: Autopilot

[Private] Promoting R&D and practical applications

Commercializing autopilot

[Private] Market deployment

[Public-private partnerships] Researching and examining institutions

Level 4: Fully automated driving

[Public-private partnerships] Researching and examining institutions and surveying needs and business models

Commercializing fully automated driving

Unmanned Autonomous Driving Transport Services in Limited Areas

Remote Automated Driving Systems (in depopulated, suburban, and urban areas)

[Private] Developing and examining prototypes

[Private] Field operational tests on non-public roads

[Private] Conducting and expanding field operational tests on public roads

[Public-private partnerships] Researching and examining institutions

Launching autonomous driving transport services

[Private] Deployment and further advancement of services

Autonomous driving systems in a dedicated space, etc.*

[Ministry of Economy, Trade and Industry (METI), Ministry of Land, Infrastructure, Transport and Tourism (MLIT)] Selecting applicable locations

[METI, MLIT] Verifying safety on test courses

[METI, MLIT] Technological development

[METI, MLIT] Field operational tests

Starting the operation in a dedicated space (e.g. depopulated areas)

[Private] Service deployment

Other Automated Driving Systems that Support Various Needs

Next-generation urban traffic systems (ART)

[Cabinet Office, National Police Agency] (SIP[1])
・Developing next-generation public road transport systems
・Developing systems for supporting the transportation handicapped and walking

[Public-private partnerships] Field operational tests

Starting the operation of Tokyo Rinkai BRT

[Private] Service deployment

[Public-private partnerships] Demonstration on other demonstration cities and regions

Starting the operation in other cities and regions

[Private] Service deployment

Truck platooning*

[METI, MLIT] Technological development

[METI, MLIT] Field operational tests

[METI, MLIT] Verifying safety on test courses

[Private] Operation tests

[Private] Service deployment

Automated valet parking*

[METI, MLIT] Technological development

[METI, MLIT] Field operational tests in dedicated parking places

[Private] Preparing dedicated parking places, etc.

Start of operation

[Private] Service deployment

World's Most Advanced ITS

Society with the world's safest and smoothest road traffic

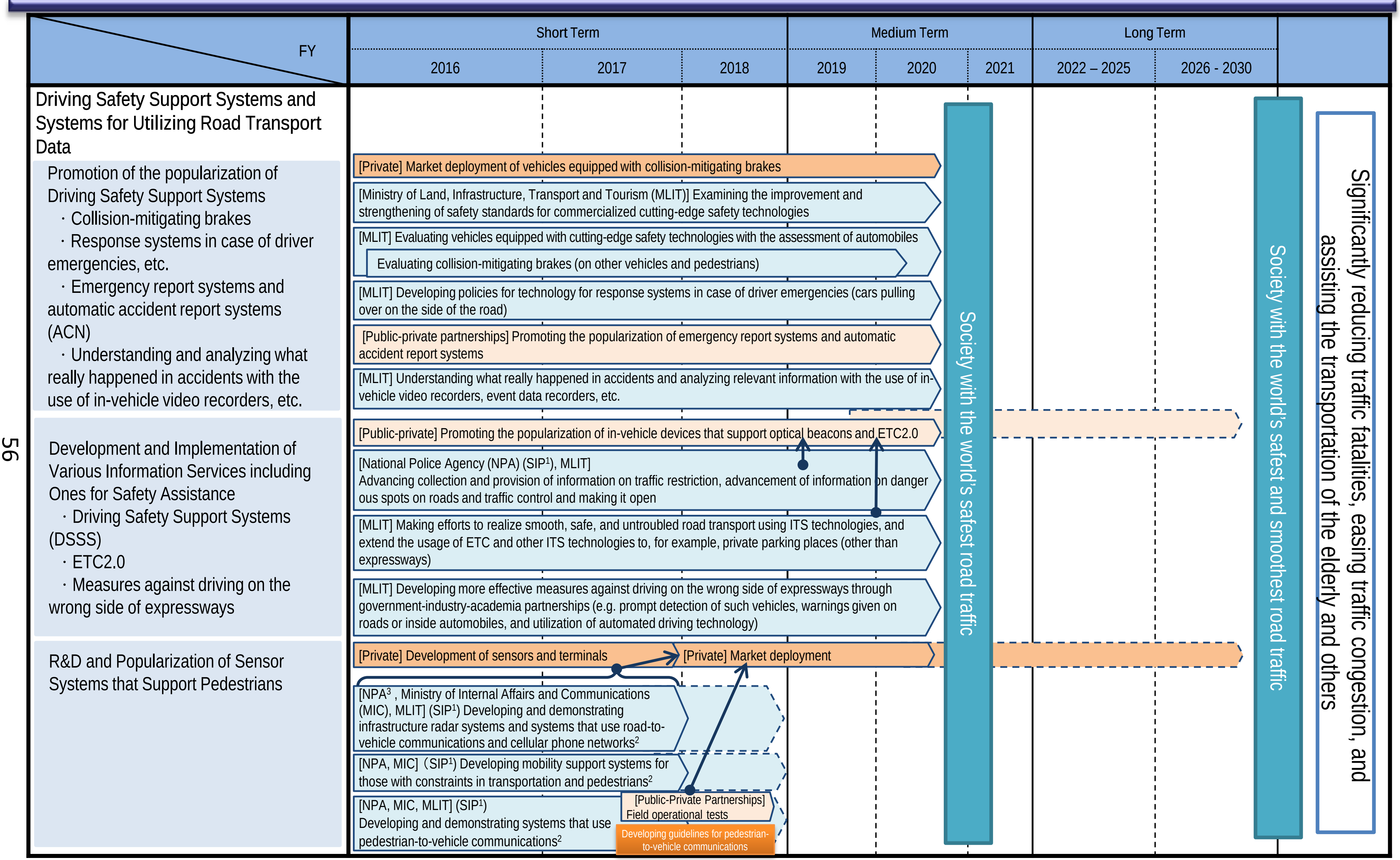
Significantly reducing traffic fatalities, easing traffic congestion, and assisting the transportation of the elderly and others

Note: We need separate examination from institutional and infrastructure perspectives.

🟧 : Measures led by the private sector ⬜ : Measures led by the government ⬜ : Measures taken through public-private partnerships

[1] SIP: Cross-ministerial Strategic Innovation Promotion Program of the Strategic Innovation Creation Council (FY 2014 - FY2018)

Roadmap for Driving Safety Support Systems



FY

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Long Term: 2022 – 2025, 2026 - 2030

Driving Safety Support Systems and Systems for Utilizing Road Transport Data

Promotion of the popularization of Driving Safety Support Systems

- Collision-mitigating brakes
- Response systems in case of driver emergencies, etc.
- Emergency report systems and automatic accident report systems (ACN)
- Understanding and analyzing what really happened in accidents with the use of in-vehicle video recorders, etc.

[Private] Market deployment of vehicles equipped with collision-mitigating brakes

[Ministry of Land, Infrastructure, Transport and Tourism (MLIT)] Examining the improvement and strengthening of safety standards for commercialized cutting-edge safety technologies

[MLIT] Evaluating vehicles equipped with cutting-edge safety technologies with the assessment of automobiles

Evaluating collision-mitigating brakes (on other vehicles and pedestrians)

[MLIT] Developing policies for technology for response systems in case of driver emergencies (cars pulling over on the side of the road)

[Public-private partnerships] Promoting the popularization of emergency report systems and automatic accident report systems

[MLIT] Understanding what really happened in accidents and analyzing relevant information with the use of in-vehicle video recorders, event data recorders, etc.

Development and Implementation of Various Information Services including Ones for Safety Assistance

- Driving Safety Support Systems (DSSS)
- ETC2.0
- Measures against driving on the wrong side of expressways

[Public-private] Promoting the popularization of in-vehicle devices that support optical beacons and ETC2.0

[National Police Agency (NPA) (SIP[1]), MLIT]
Advancing collection and provision of information on traffic restriction, advancement of information on dangerous spots on roads and traffic control and making it open

[MLIT] Making efforts to realize smooth, safe, and untroubled road transport using ITS technologies, and extend the usage of ETC and other ITS technologies to, for example, private parking places (other than expressways)

[MLIT] Developing more effective measures against driving on the wrong side of expressways through government-industry-academia partnerships (e.g. prompt detection of such vehicles, warnings given on roads or inside automobiles, and utilization of automated driving technology)

R&D and Popularization of Sensor Systems that Support Pedestrians

[Private] Development of sensors and terminals

[Private] Market deployment

[NPA[3], Ministry of Internal Affairs and Communications (MIC), MLIT] (SIP[1]) Developing and demonstrating infrastructure radar systems and systems that use road-to-vehicle communications and cellular phone networks[2]

[NPA, MIC] （SIP[1]) Developing mobility support systems for those with constraints in transportation and pedestrians[2]

[NPA, MIC, MLIT] (SIP[1])
Developing and demonstrating systems that use pedestrian-to-vehicle communications[2]

[Public-Private Partnerships]
Field operational tests

Developing guidelines for pedestrian-to-vehicle communications

Society with the world's safest road traffic

Society with the world's safest and smoothest road traffic

Significantly reducing traffic fatalities, easing traffic congestion, and assisting the transportation of the elderly and others

🟧: Measures led by the private sector ⬡: Measures led by the public sector ⬡: Measures taken through public-private partnerships

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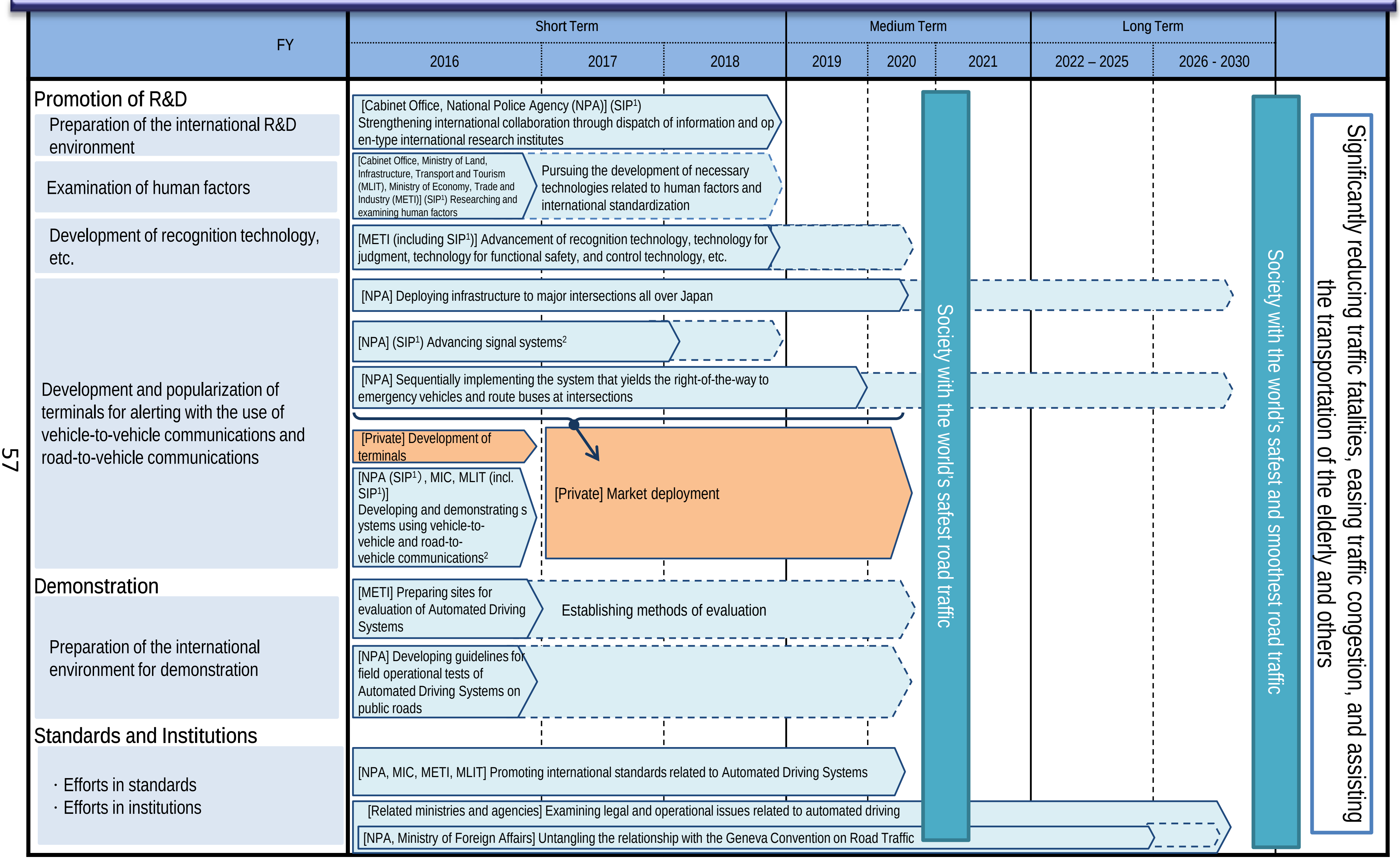
[1] SIP: Cross-ministerial Strategic Innovation Promotion Program of the Strategic Innovation Creation Council (FY 2014 - FY2018)

[2]: Measures for Driving Safety Support Systems and Automated Driving Systems

[3]: NPA plans to examine requirements for infrastructure radar systems in the FY2014 budget.

Roadmap Related to the Promotion of Innovation -1 (Automated Driving Systems)



FY

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Promotion of R&D

Preparation of the international R&D environment

[Cabinet Office, National Police Agency (NPA)] (SIP[1]) Strengthening international collaboration through dispatch of information and open-type international research institutes

Examination of human factors

[Cabinet Office, Ministry of Land, Infrastructure, Transport and Tourism (MLIT), Ministry of Economy, Trade and Industry (METI)] (SIP[1]) Researching and examining human factors

Pursuing the development of necessary technologies related to human factors and international standardization

Development of recognition technology, etc.

[METI (including SIP[1])] Advancement of recognition technology, technology for judgment, technology for functional safety, and control technology, etc.

Development and popularization of terminals for alerting with the use of vehicle-to-vehicle communications and road-to-vehicle communications

[NPA] Deploying infrastructure to major intersections all over Japan

[NPA] (SIP[1]) Advancing signal systems[2]

[NPA] Sequentially implementing the system that yields the right-of-the-way to emergency vehicles and route buses at intersections

[Private] Development of terminals

[NPA (SIP[1]), MIC, MLIT (incl. SIP[1])] Developing and demonstrating systems using vehicle-to-vehicle and road-to-vehicle communications[2]

[Private] Market deployment

Demonstration

Preparation of the international environment for demonstration

[METI] Preparing sites for evaluation of Automated Driving Systems

Establishing methods of evaluation

[NPA] Developing guidelines for field operational tests of Automated Driving Systems on public roads

Standards and Institutions

- · Efforts in standards
- · Efforts in institutions

[NPA, MIC, METI, MLIT] Promoting international standards related to Automated Driving Systems

[Related ministries and agencies] Examining legal and operational issues related to automated driving

[NPA, Ministry of Foreign Affairs] Untangling the relationship with the Geneva Convention on Road Traffic

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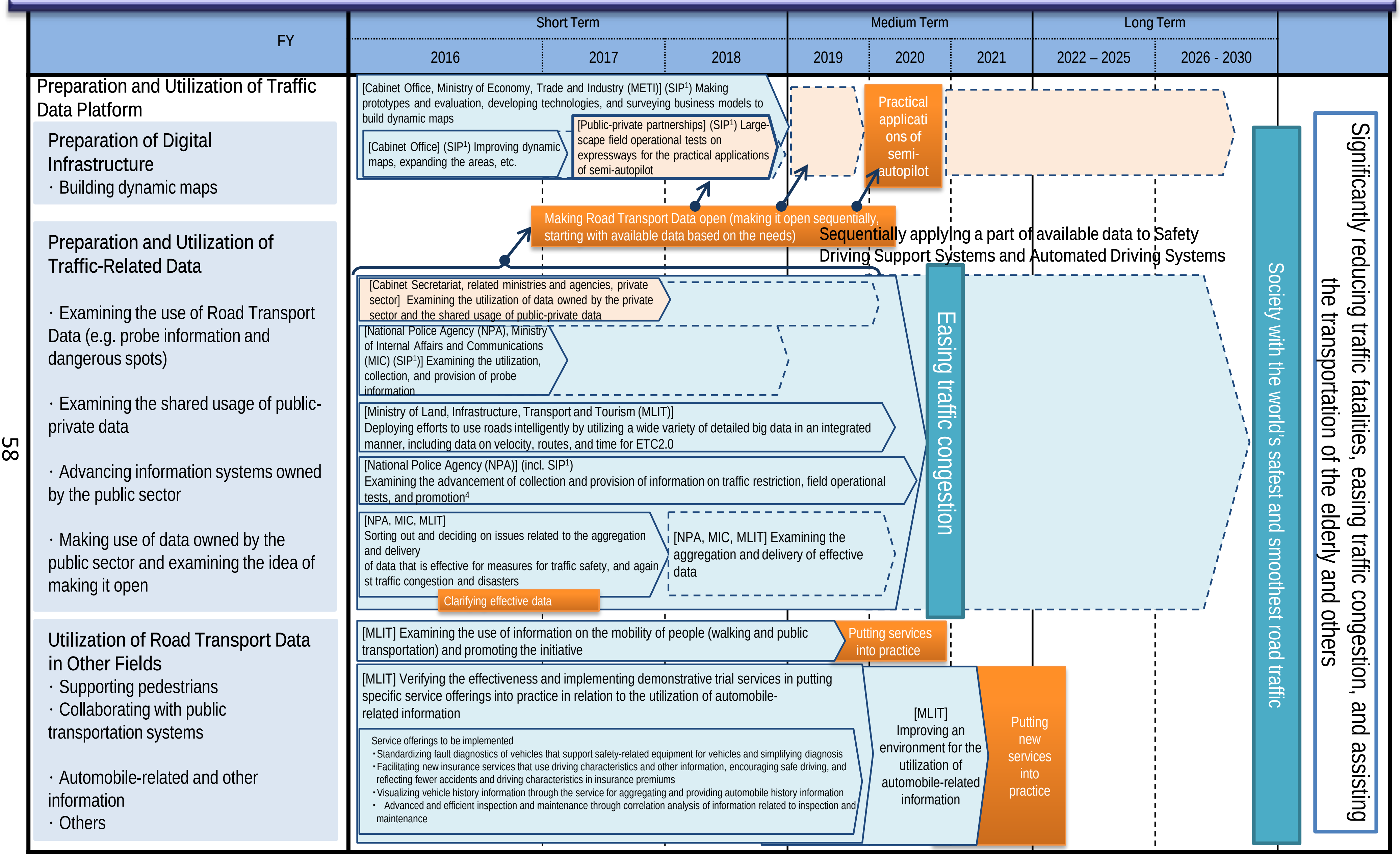
[1] SIP: Cross-ministerial Strategic Innovation Promotion Program of the Strategic Innovation Creation Council (FY 2014 - FY2018)

[2] Measures for Driving Safety Support Systems and Automated Driving Systems

Roadmap Related to the Promotion of Innovation -2 (Improving and Utilizing Traffic Data Platforms)



FY | Short Term: 2016, 2017, 2018 | Medium Term: 2019, 2020, 2021 | Long Term: 2022 – 2025, 2026 - 2030

Preparation and Utilization of Traffic Data Platform

Preparation of Digital Infrastructure

- Building dynamic maps

[Cabinet Office, Ministry of Economy, Trade and Industry (METI)] (SIP[1]) Making prototypes and evaluation, developing technologies, and surveying business models to build dynamic maps

[Cabinet Office] (SIP[1]) Improving dynamic maps, expanding the areas, etc.

[Public-private partnerships] (SIP[1]) Large-scale field operational tests on expressways for the practical applications of semi-autopilot

Practical applications of semi-autopilot

Making Road Transport Data open (making it open sequentially, starting with available data based on the needs)

Sequentially applying a part of available data to Safety Driving Support Systems and Automated Driving Systems

Preparation and Utilization of Traffic-Related Data

- Examining the use of Road Transport Data (e.g. probe information and dangerous spots)
- Examining the shared usage of public-private data
- Advancing information systems owned by the public sector
- Making use of data owned by the public sector and examining the idea of making it open

[Cabinet Secretariat, related ministries and agencies, private sector] Examining the utilization of data owned by the private sector and the shared usage of public-private data

[National Police Agency (NPA), Ministry of Internal Affairs and Communications (MIC) (SIP[1])] Examining the utilization, collection, and provision of probe information

[Ministry of Land, Infrastructure, Transport and Tourism (MLIT)]
Deploying efforts to use roads intelligently by utilizing a wide variety of detailed big data in an integrated manner, including data on velocity, routes, and time for ETC2.0

[National Police Agency (NPA)] (incl. SIP[1])
Examining the advancement of collection and provision of information on traffic restriction, field operational tests, and promotion[4]

[NPA, MIC, MLIT]
Sorting out and deciding on issues related to the aggregation and delivery
of data that is effective for measures for traffic safety, and against traffic congestion and disasters

Clarifying effective data

[NPA, MIC, MLIT] Examining the aggregation and delivery of effective data

Easing traffic congestion

Utilization of Road Transport Data in Other Fields

- Supporting pedestrians
- Collaborating with public transportation systems
- Automobile-related and other information
- Others

[MLIT] Examining the use of information on the mobility of people (walking and public transportation) and promoting the initiative

Putting services into practice

[MLIT] Verifying the effectiveness and implementing demonstrative trial services in putting specific service offerings into practice in relation to the utilization of automobile-related information

Service offerings to be implemented
- Standardizing fault diagnostics of vehicles that support safety-related equipment for vehicles and simplifying diagnosis
- Facilitating new insurance services that use driving characteristics and other information, encouraging safe driving, and reflecting fewer accidents and driving characteristics in insurance premiums
- Visualizing vehicle history information through the service for aggregating and providing automobile history information
- Advanced and efficient inspection and maintenance through correlation analysis of information related to inspection and maintenance

[MLIT] Improving an environment for the utilization of automobile-related information

Putting new services into practice

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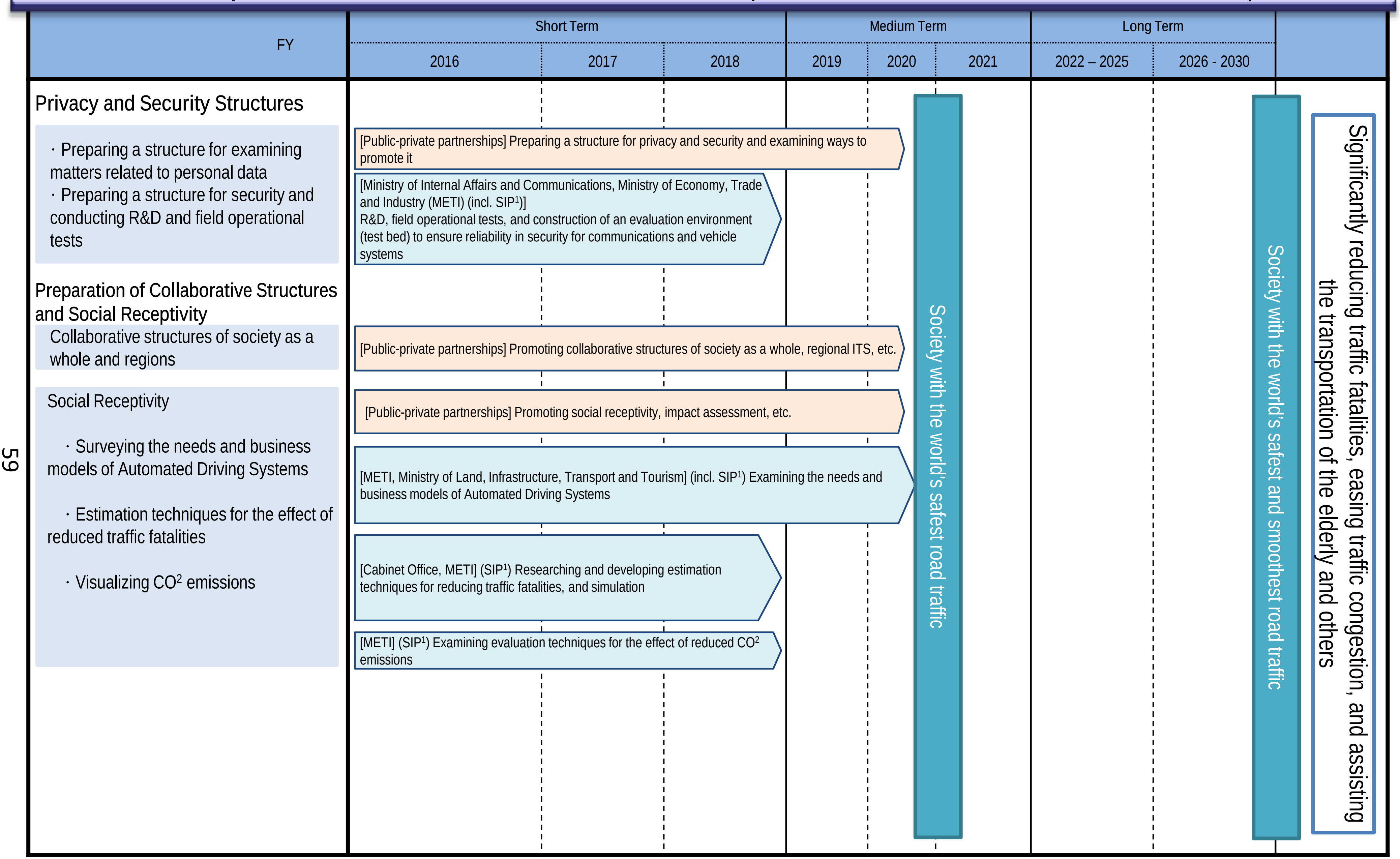
[1] SIP: Cross-ministerial Strategic Innovation Promotion Program of the Strategic Innovation Creation Council (FY 2014 - FY2018)

[4] Measures related to both Driving Safety Support/Automated Driving Systems and the utilization of Road Transport Data

Roadmap Related to the Promotion of Innovation -3 (Collaborative Structures and Other Efforts)



Privacy and Security Structures

- Preparing a structure for examining matters related to personal data
- Preparing a structure for security and conducting R&D and field operational tests

[Public-private partnerships] Preparing a structure for privacy and security and examining ways to promote it

[Ministry of Internal Affairs and Communications, Ministry of Economy, Trade and Industry (METI) (incl. SIP[1])]
R&D, field operational tests, and construction of an evaluation environment (test bed) to ensure reliability in security for communications and vehicle systems

Preparation of Collaborative Structures and Social Receptivity

Collaborative structures of society as a whole and regions

[Public-private partnerships] Promoting collaborative structures of society as a whole, regional ITS, etc.

Social Receptivity

- Surveying the needs and business models of Automated Driving Systems
- Estimation techniques for the effect of reduced traffic fatalities
- Visualizing CO^2 emissions

[Public-private partnerships] Promoting social receptivity, impact assessment, etc.

[METI, Ministry of Land, Infrastructure, Transport and Tourism] (incl. SIP[1]) Examining the needs and business models of Automated Driving Systems

[Cabinet Office, METI] (SIP[1]) Researching and developing estimation techniques for reducing traffic fatalities, and simulation

[METI] (SIP[1]) Examining evaluation techniques for the effect of reduced CO^2 emissions

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[1] SIP: Cross-ministerial Strategic Innovation Promotion Program of the Strategic Innovation Creation Council (FY 2014 - FY2018)