Public-Private ITS Initiative/Roadmaps 2017

~Toward implementation of various highly automated driving systems in society~

May 30, 2017
Strategic Conference for the Advancement of Utilizing Public and Private Sector Data, Strategic Headquarters for the Advanced Information and Telecommunications Network Society
Table of Contents

1. Introduction and Definitions ................................................................. 4
   (1) Introduction.............................................................................................. 4
   (2) Definitions of Automated Driving Systems ........................................... 6

2. Positioning and Future Direction of ITS/Automated Driving ............... 10
   (1) Positioning of ITS/Automated Driving Systems ................................... 10
   (2) Future Direction of Automated Driving Systems .................................. 11
      A. Impact on society and business models ............................................. 11
      B. Direction of the evolution of the data architecture ......................... 13
   (3) Future direction of the traffic-related data sharing platform and its use ............................................................... 18

3. ITS and Automated Driving Systems-related Society, Industrial Objectives, and Overall Strategies .............................................................. 20
   (1) Society and industrial objectives that we aim to achieve via ITS and automated driving systems ............ 20
   (2) Basic strategies related to automated driving systems and the use of traffic data ............................... 23
   (3) Popularization scenario for and expected timing of commercialization of automated driving systems ... 25

4. Efforts toward commercialization of automated driving systems ...... 30
   (1) Utilization of automated driving systems for private vehicles ..................... 30
   (2) Utilization of automated driving systems in the logistics services ............... 35
   (3) Utilization of automated driving systems in transport services ................... 38

5. Efforts toward promotion of ITS/automated driving innovation ...... 45
   (1) Development of institutions toward popularization of automated driving and enhancement of social receptivity ..................................................... 45
      A. Development of institutions concerning field operational tests on public roads and promotion of test projects ...................................................... 46
      B. Institutional challenges toward realization of highly automated driving systems (Development of the outline) .............................................. 49
      C. Securing of social receptivity and development of a society-wide collaboration system ................................................................. 54
   (2) Data strategy related to automated driving and utilization of traffic data .......................................................... 55
      (i) Data strategy toward the realization of automated driving .................... 55
      (ii) Development and utilization of traffic-related data and automobile-related data ................................................................. 63
      (iii) Response to privacy and security .................................................... 66
   (3) Promotion of R&D of automated driving systems and international criteria and standards ..................... 68
      (i) Promotion of R&D and demonstration of automated driving systems ... 68
      (ii) Development of criteria and standards, promotion of international collaboration and exercise of international leadership ..................... 69
6. Roadmaps.......................................................................................................................... 73
7. Method of and Structure for Moving Forward ......................................................... 74
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-edge 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 of the Council for Science, Technology and Innovation (hereinafter referred to as "SIP"): Automated Driving Systems 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 build and maintain the world's best ITS and thereby contribute to its people and the world.*
With this as an objective, Japan has developed and revised the Public-Private ITS Initiative/Roadmaps three times since June 2014 and will continue to pursue this objective.

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.

Especially since the Public-Private ITS Initiative/Roadmaps 2016 (hereinafter called Roadmaps 2016) was developed in May, the systems that enable field operational tests of unmanned autonomous driving transport services on the public roads in limited areas have been developed and field operational test projects have been undertaken throughout the country. In addition, toward the SIP large-scale field operational test of automated driving on expressways that will start in FY 2017, companies that develop dynamic maps that serve as a platform for such tests have been established in cooperation with the private sector.

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. In addition, domestic and foreign automakers companies and emerging IT companies have announced their efforts for the commercialization of highly automated driving and competition in development is becoming increasingly intense. Meanwhile, some countries and regions have begun considering the development of systems for the commercialization of highly automated driving.

This Public-Private ITS Initiative/Roadmaps 2017 developed as a radical revision of the Public-Private ITS Initiative/Roadmaps 2016 after discussing recent changes in the situation surrounding ITS and automated driving in the meetings of the Road Transport Working Team, New Strategies Promotion Expert Panel, IT Strategic Headquarters, including joint meetings with the SIP Automated Driving Systems Promotion Committee, which have been held since December 2016.
(2) Definitions of Automated Driving Systems

[Definitions of automated driving levels]

Ranging from the performance of driving entirely by the driver and partial performance of driving by the vehicle’s driver assistance system to performance of driving without driver’s involvement, there are various concepts of driving in terms of the driver’s level of involvement in driving.

Public-Private ITS Initiative/Roadmaps 2017 adopts the definitions described in J3016 (September 2016) by SAE\(^1\) International as definitions of automated driving\(^2\). Though J3016’s definitions should be referred to for details, its overview is shown in Table 1.

In addition, automated driving systems at SAE Level 3 and above are called “Highly Automated Driving Systems”\(^3\) and those at SAE Level 4 and 5 are called “Fully Automated Driving Systems” in the Initiative/Roadmaps 2017.

[Table 1] Overview of the definitions of automated driving levels (J3016)\(^4\)

<table>
<thead>
<tr>
<th>Level</th>
<th>Overview</th>
<th>Object and Event Detection and Response for safe driving by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drivers perform all or part of the dynamic driving task (DDT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAE Level 0</td>
<td>No automation</td>
<td></td>
</tr>
<tr>
<td>SAE Level 1</td>
<td>Driver assistance</td>
<td></td>
</tr>
<tr>
<td>SAE Level 2</td>
<td>Partial</td>
<td></td>
</tr>
</tbody>
</table>

Drivers perform all or part of the dynamic driving task (DDT)

\(\) Society of Automotive Engineers

\(\) The previous Public-Private ITS Initiative/Roadmaps adopted the definition consisting of 5 levels from level 0 to level 4 based on the Policy on Automated Vehicle announced by the U.S. NHTSA in May 2013. However, as both the U.S. and Europe fully adopted SAE J3016 since the NHTSA announced the Federal Automated Vehicle Policy in September 2016, the Public-Private ITS Initiative/Roadmaps 2017 fully adopts SAE J3016. In order to prevent confusion, the levels are described as “SAE Level XX” where necessary for the time being.

\(\) In the Federal Automated Vehicle Policy (September 2016) by the U.S. NHTSA, vehicles of SAE Level 3 and above are called “highly automated vehicles (HAV).”

In J3016, vehicles in level 3 and above are defined as automated driving systems (ADS.) However, the Public-Private ITS Initiative/Roadmaps 2017 use the term “automated driving system” as a general term for systems relating to driving automation.


The Society of Automotive Engineers of Japan, Inc. is promoting translation of J3016 into Japanese to make it JIS.
Automated driving systems perform all dynamic driving tasks

<table>
<thead>
<tr>
<th>Level</th>
<th>Condition</th>
<th>Automation</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAE Level 3</td>
<td>Conditional automation</td>
<td>The system performs the entire dynamic driving task (within operational design domains&lt;sup&gt;5&lt;/sup&gt;)</td>
<td>System (DDT fallback-ready driver)</td>
</tr>
<tr>
<td>SAE Level 4</td>
<td>High automation</td>
<td>The system performs the entire dynamic driving task (within operational design domains&lt;sup&gt;5&lt;/sup&gt;)</td>
<td>System</td>
</tr>
<tr>
<td>SAE Level 5</td>
<td>Full automation</td>
<td>The system performs the entire dynamic driving task (not within operational design domains&lt;sup&gt;5&lt;/sup&gt;)</td>
<td>System</td>
</tr>
</tbody>
</table>

(Note 1) Domains here are not limited to geographical domains but include the environmental, traffic, speed, and temporal conditions. (The definitions of the terms in J3016 (2016) are shown below. (tentative translation))

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic Driving Task (DDT)</td>
<td>All of the real-time operational and tactical functions required to operate vehicles in on-road traffic, excluding the strategic functions such as and trip scheduling and determination of destinations and routes. Specifically, it includes but is not limited to lateral motion (steering), longitudinal motion (acceleration/deceleration), monitoring of the driving environment, and maneuver planning, and enhancement of conspicuity (lighting, etc.)</td>
</tr>
<tr>
<td>Object and Event Detection and Response (OEDR)</td>
<td>The subtasks of the dynamic driving task (DDT) that include monitoring the driving environment (detecting, recognizing, and classifying of objects and events and preparing to respond as needed) and executing an appropriate response to such objects and events.</td>
</tr>
<tr>
<td>Operational Design Domain (ODD)</td>
<td>The specific conditions under which the driving automation system is designed to function, including, but not limited to, driving modes. Note 1: An ODD includes geographic, roadway, environmental, traffic, speed and temporal limitations. Note 2: An ODD includes one or more driving modes (expressway, low-speed traffic, etc.)</td>
</tr>
</tbody>
</table>

In addition, it is pointed out in J3016 that the range of operational design domains (ODD) serves as an important indicator for evaluating automated driving technology as well as automated driving levels. At each of SAE Levels 1 to 4, the wider the ODDs that are specific conditions under which the driving automation system is designed to function are, the more technically sophisticated the system is. In other words, even at SAE Level 4 (one of the fully automated driving systems), if the system enables automated driving within a narrow range of ODDs, its level of technical sophistication is relatively low.

In addition, SAE Level 5 is defined as one of the SAE Level 4 automated driving systems.

<sup>5</sup> Translation of “User” in SAE International J3016 (2016). It includes drivers.
driving systems but with unlimited ODDs and its technical level is very high.

[Figure 1]: Significance of ODD at each automated driving level (based on J3016: tentative translation)

These definitions will be reviewed as needed in accordance with SAE’s review of their definitions.

[Remote automated driving system]

Moreover, according to J3016 (2016), automated driving systems are divided into those with a user (including those who are equivalent of drivers; hereinafter the same) who is inside the vehicle and those with a user outside the vehicle who remotely monitors and operates it.

The Initiative/Roadmaps 2017 defines the latter, “driving automation system with a user outside the vehicle” 6, as “Remote Automated Driving System” and transport services that use such remote automated driving systems are called “Unmanned autonomous driving Transport Services.”

---

6 In this case, the user plays the following roles according to automated driving levels.
- At SAE Level 2, “Remote Driver” remotely performs monitoring and operation.
- At SAE Level 3, “DDT Fallback-ready User” positioned remotely performs monitoring and operation as a remote driver in case of a request to intervene by the system.
- At SAE Level 4, “Dispatcher” (tentative translation, formal translation will be discussed) positioned remotely operates the vehicle as a remote driver in case of necessity such as vehicle malfunction.
[Figure 2] “User” roles in automated driving (created based on J3016)

[Definitions of specific automated driving systems]
Based on the above-mentioned definitions of J3016, the Initiative/Roadmaps 2017 describes “semi-autopilot” and “autopilot” as specific automated driving systems that are expected to be commercialized and applied to services in the near future and defines them as follows.

Table 2 Specific Automated Driving Systems and Overview

<table>
<thead>
<tr>
<th>Name of System</th>
<th>Overview</th>
<th>Corresponding Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semi-autopilot</td>
<td>• 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.).&lt;br&gt;• Though the driver performs object and event detection and response for safe driving during automated driving mode, the system notifies the driver of traveling conditions.</td>
<td>SAE Level 2</td>
</tr>
<tr>
<td>Auto pilot</td>
<td>• It supports automated driving on expressways and under other specific conditions.&lt;br&gt;• Though the system performs all the DDT during automated driving mode, the driver takes over in response to a request by the system.</td>
<td>SAE Level 3</td>
</tr>
</tbody>
</table>
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.

In particular, interest in Automated Driving Systems has been growing rapidly throughout the world in recent years as exemplified by the fact that many automobile and emerging IT companies, in the world have been actively developing the systems. Moreover, developed countries have been making efforts to promote automated driving through industrial policy competition and coordination such as announcement of comprehensive strategy documents concerning automated driving by developed countries since the announcement of the Public-Private ITS Initiative/Roadmaps (June 2014) by Japan and holding of the G7 Transport Ministers’ Meetings where automated driving has been addressed since 2015.
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

A. 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 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, sophisticated automated driving systems 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 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 4  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, especially in highly automated driving systems, as systems drive vehicles, not drivers, the focus of added value may shift to lateral business, such as the provision of transport services to a large number of vehicles through a highly automated driving system. Moreover, particularly in fully automated driving systems, competition and collaboration may intensify between such lateral business bases and those associated with the assignment and matching of vehicles, which arise from a growing sharing economy.

In the future, the business model related to automobiles and mobility will change 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.
B. Direction of the evolution of the data architecture

**Future direction of data architecture for automated driving systems**

These changes in the business model for automated driving systems have arisen from the changes in data architecture related to automated driving systems.\(^7\)

The informatization of vehicles has advanced as an embedded architecture,\(^10\) where 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

---

\(^7\) 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.

\(^8\) 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.

\(^9\) A basic design conception that segments and allocates product components according to their functions and that designs and adjusts interfaces for those components.

\(^10\) 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.
more sophisticated and evolve toward the following directions:

- Part of the driving knowledge data, including probe data\(^{11}\) and video data collected by each vehicle, is transferred to and accumulated in the outside data and knowledge platforms such as cloud platforms via networks. Such data is used in various fields such as various big data analyses as well as dynamic maps\(^{12}\) and base data for artificial intelligence\(^{13}\).

- In addition to the data obtained from a large number of vehicles, part of the data and knowledge platforms, such as artificial intelligence (AI) generated from outside data including high-precision 3D maps and driving video data associated with 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 network structure, architecture such as edge/ fog computing is used.

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 technology. Moreover, as part of the data platforms, the roles of dynamic maps, driving video database, and cloud services to store, process, and provide them will become more important (see chapter 5).

\(^{11}\) Probe: It means originally sensors or remote monitoring devices. 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.

\(^{12}\) Dynamic maps are high accuracy 3D maps (maps for automated driving) linked with time-varying dynamic data (dynamic information, quasi-dynamic information, and quasi-static information). High-precision maps are being developed by privately-funded infrastructure developers as a cooperative area for dynamic maps (see chapter 5).

\(^{13}\) 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 high-precision 3D maps information.
Figure 6  Data architecture for automated driving systems (for illustrative purposes only)

Many of the automated driving systems currently used for field operational tests are mainly controlled by traditional software (rule-based control), excluding some functions such as image recognition in the driving environment recognition function. AI functions such as scene understanding and prediction and action planning will be introduced to automated driving systems to enable driving in more complex environments including city streets.

[Figure 7] Roles of artificial intelligence (AI) in the future automated driving systems

- Recognition
  - Driving environment recognition
    - Recognition of pedestrians, bicycles, vehicles, etc.
    - Image recognition, etc.
- Judgment
  - Scene understanding & prediction
    - Prediction of risks caused by movements of pedestrians, bicycles, vehicles, etc.
- Operation
  - Action planning
    - Judgment of the optimal route based on various information such as risk prediction results and current location

**In-vehicle system**

**Artificial intelligence (AI)**

*transition from rule-based control

- Camera
- Radar
- etc.

- Recognition of vehicle location
  - Including detailed map information of the surrounding area

**Outer vehicle systems**

(data/knowledge platforms, etc.)*

- Various external data
- Driving video data, etc.

**Remote control**

*not necessarily systems of a single company

---

Public-Private ITS Initiative/Roadmaps 2017

15
In the architecture of automated driving systems, the role of interfaces seems to become more important in vehicles. Specifically, for driver interfaces, 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.

Artificial intelligence (AI) is expected to be increasingly used in interfaces between vehicles and drivers, pedestrians and other moving objects around the vehicle.

**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 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\(^\text{15}\).

\(^{14}\) Specifically called HMIs (Human Machine Interfaces).

\(^{15}\) Information collected and provided by dynamic maps are considered as the cooperative type in a broad sense. From the perspective of automated driving, it is considered such information complements information collected by the autonomous type such as radars and cameras and improves its reliability.

As for the methods for collecting and distributing such information, generally the utilization of communications through the mobile type is considered the most likely. However, it is necessary to discuss such methods in detail in view of future advances in technology while considering the division of roles between the mobile type, road-vehicle communication type and vehicle-vehicle
Table 3  
Types of information collection technology for driving safety support systems and automated driving systems

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

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 driving safety support devices are added as modules.\(^{17}\)

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 communication type.

\(^{16}\) 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.

\(^{17}\) 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.
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.\(^{18}\)

(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 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

\(^{18}\) Safety design and measures that take risks into consideration are required for data acquired by the autonomous-type method.
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, dynamic maps that utilize such data will be maintained and managed efficiently in light of the status of acquisition of such data by private sectors and their needs.

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.

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. 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" 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 by veteran drivers will be secured by the systems, leading to the realization of a society where traffic accidents hardly occur.*

---

19 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.

20 "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. In addition, an innovatively efficient logistics system will be achieved by using automated driving systems.

A society will be achieved where people who feel uneasy about driving due to declining physical ability, such as the elderly, can enjoy going out as younger 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.

For the key objective achievement indicators toward 2030, while keeping the widespread use of automated driving systems in mind, social indicators related to “reduction in traffic accidents”, “alleviation of traffic congestion”, “streamlining of logistic traffic”, and “transportation support for the elderly”, and industrial indicators related to “diffusion of automated driving systems”,

21 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.
22 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.).
23 The Declaration of Creation specifies that indicators related to traffic congestion be set as KPIs. 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 studied and considered to set specific indicators.
24 Indicators related to streamlining of logistic traffic require further consideration.
25 For indicators related to the mobility of the elderly, specific indicators and methods to measure them, such as the rates of utilization of public transportation and automobiles by the elderly, shall be examined in the future.
“production and export of vehicles”\textsuperscript{26}, and “export of infrastructure” shall be set.\textsuperscript{27} 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.

\textsuperscript{26} 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 possibility that the surrounding business, such as car sharing, may become more important.

\textsuperscript{27} When setting specific indicators and numerical targets, discussions shall be held on statistical data required to determine them with industry and examinations shall be conducted in consideration of surveys on assessment of impact of automated driving systems on society.
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.

In Japan, while traffic accidents by the elderly account for most of the total in the aging society, transportation means for people with decreased mobility such as the elderly need to be secured. It is also urgent to secure transportation means in underpopulated areas and address the lack of drivers since Japan's populations is projected to decline. By working on the development of highly automated driving systems that are considered important to solve these urgent issues in a strategic manner with business models in mind, Japan aims to realize automated driving systems ahead of the world and strengthen its global industrial competitiveness. Specifically, highly automated driving systems with the following 3 items as objectives should be prioritized and efforts should be made for their commercialization and popularization by 2025.

1. Further sophistication of automated driving systems for private vehicles
2. Realization of innovative, efficient logistic services to address the lack of drivers
3. Realization of unmanned autonomous driving transport services for rural areas and the elderly

Though automated driving is a promising technology that may solve various issues that Japan faces, it is not the only one method to solve them. It is socially expected to solve such issues based on overall optimization by combining automated driving with various methods.
[Table 4] Society and automated driving systems to achieve

<table>
<thead>
<tr>
<th>Item</th>
<th>Society to achieve (example)</th>
<th>Automated driving systems to achieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sophistication of automated driving systems for private vehicles</td>
<td>Strengthening of industrial competitiveness</td>
<td>• Fully automated driving on expressways (SAE Level 4)</td>
</tr>
<tr>
<td></td>
<td>Reduction of traffic accidents</td>
<td>• Sophisticated driving safety support system (tentative name)²⁹</td>
</tr>
<tr>
<td></td>
<td>Alleviation of traffic congestion</td>
<td></td>
</tr>
<tr>
<td>Realization of innovative, efficient logistic services to address lack of drivers</td>
<td>Innovative streamlining of logistics responding to the era of population decrease</td>
<td>• Truck platooning on expressways (SAE Level 2 and above)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fully automated trucks on expressways (SAE Level 4)</td>
</tr>
<tr>
<td>Realization of unmanned transport services for rural areas and the elderly</td>
<td>Society that enables the elderly to freely move around the country</td>
<td>• Spread of unmanned autonomous driving transport services for limited areas throughout the country (Spread of services that utilize remote automated driving systems at SAE Level 4 in particular)</td>
</tr>
</tbody>
</table>

**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.³⁰

²⁹ The official name for the sophisticated driving safety support system (tentative name) will be discussed. It should be noted that it is not a sophisticated version of the Driving Safety Support Systems (DSSS) whose practical application have already been promoted (see 4. (1) for details.)

³⁰ Especially when promoting measures to reduce traffic accidents, it is necessary to identify measures to focus on by taking into account the results of the analysis of the current situations of traffic accident fatalities (analysis of accident situations such as locations of intersections, collisions, pedestrians, etc.) and examining the possibility of spread (expected amount of measures widely implemented as of 2020, etc.) of technical measures to deal with such situations including their feasibility and cost effectiveness.
Specifically, while promoting automobiles equipped with driving safety support functions such as automatic braking systems that have been becoming popular in recent years, in light of the fact that it will take time to popularize new vehicles equipped with such devices, introduction and popularization of driving safety support devices to be installed on existing vehicles and introduction of information systems required to provide information that will be useful in reduction of traffic accidents and alleviation of traffic congestion shall also be promoted.

(3) Popularization scenario for and expected timing of commercialization of automated driving systems

[Approach to achieving automated driving systems and their development scenario]

As a basic approach (policy) toward the implementation of automated driving systems in society, Japan aims to be the world’s best both in “technology”, one of the tangibles of automated driving, and “commercialization”, one of its intangibles. From such a standpoint, we aim to implement automated driving systems in society by utilizing the latest technologies and complementing them with institutions and infrastructures, rather than implementing them only after technologies are completely established. Since it is important that vehicle performance surpasses the complexity of the driving environments, we will consider categorizing and indexing the complexity of driving environments and tangible and intangible performance of the vehicle within this year and, based on their combinations, select areas and promote examination of required performances. Taking the results of this indexing into consideration, we will expand the Operational Design Domains (ODDs), the specific conditions under which driving automation systems are designed to function, so that they include complex driving environments.

For the evolution of automated driving technology, there are roughly two approaches to the realization of technology that enables fully automated driving in a wide variety of traffic conditions.

31 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.
i. The approach that increases the level of the automatic control type with priority given to addressing broad ODDs (ex. Various traffic situations such as the entire expressway): This approach will be the strategy mainly for automated driving systems for private vehicles (including commercial vehicles) that are generally required to drive regardless of location and time. In many cases, private vehicles with such automated driving systems have drivers inside.

ii. The approach that starts working on narrow ODDs (narrowly limited traffic situations) and then expand them gradually with priority given to realizing remote automated driving systems (fully automated driving systems) of SAE Level 4: This approach will be the strategy mainly for automated driving systems used for business vehicles (local public transportation, freight transportation, etc.) that can be serviced at limited locations within a limited time.

[Figure 10] Two approaches to the realization of automated driving systems

Taking these approaches into consideration, the Initiative/Roadmaps 2017 specifies the strategies for commercialization of automated driving systems utilized for private vehicles, those utilized for business vehicles such as transportations services, and those utilized for logistics vehicles (trucks, etc.) as application to the logistics area in light of the social objectives described above.\(^{32}\)

\(^{32}\) Though the Initiative/Roadmaps 2017 discuss automated driving systems for private vehicles, logistics services, and transport services separately, their concepts and names will be further reviewed in light of the future direction of automated driving systems and services utilizing them.
Specifically, we will make efforts to realize (1) commercialization of vehicles that can be automatically operated on expressways (semi-autopilot) and (2) provision of unmanned autonomous driving transport services (SAE Level 4) in limited areas (underpopulated areas, etc.) by 2020. Then we aim to realize commercialization of fully automated driving systems on expressways, popularization of sophisticated driving safety support systems (tentative name), introduction and popularization of automated driving systems in the logistics area, and popularization of unmanned autonomous driving transport services (SAE Level 4) for limited areas throughout Japan by 2025.

[Figure 11] Scenario for the realization of commercialization and service of fully automated driving by 2025

(Note) Based on the above schedule, the relevant ministries and agencies will cooperate with the private sector and promote necessary measures according to the specific status of their development and business models. In doing so, they will promote information sharing between the government and the private sector and provide advice and review systems and infrastructure as needed.

33 From the policy perspective of securing transportation means in rural areas, unmanned autonomous driving transport services should be realized first in underpopulated areas. However, from a business perspective, their introduction in urban areas and suburban areas may be considered.
[Expected timing of commercialization and service of automated driving systems]

Based on the objective of becoming the world's best, we have set the expected timing of commercialization\(^34\) of automated driving systems at each level (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 of other countries. However, in light of the recent progress in technological development by private companies, we have specified the expected timings for commercialization and service of automated driving systems for private vehicles and business vehicles (logistics services and transport services) separately as shown below.

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 5] Expected timing of commercialization and service of automated driving systems\(^\Star\)\(^1\)

<table>
<thead>
<tr>
<th>Level</th>
<th>Technology expected to be realized (example)</th>
<th>Expected timing of commercialization, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private vehicle</td>
<td>SAE Level 2</td>
<td>Semi-autopilot</td>
</tr>
<tr>
<td></td>
<td>SAE Level 3</td>
<td>Autopilot</td>
</tr>
<tr>
<td></td>
<td>SAE Level 4</td>
<td>Fully automated driving on expressways</td>
</tr>
<tr>
<td>Logistics service</td>
<td>SAE Level 2 or higher</td>
<td>Truck platooning on expressways</td>
</tr>
<tr>
<td></td>
<td>SAE Level 4</td>
<td>Fully automated driving of trucks on expressways</td>
</tr>
<tr>
<td>Transport service</td>
<td>SAE Level 4(^*)(^2)</td>
<td>Unmanned autonomous driving transport services in limited areas</td>
</tr>
</tbody>
</table>

\(^34\) The expected timing of commercialization is the common target timing by which the government and private sector must address various measures. It is not the timing for both to express their commitment.
The specific scenario and schedule to achieve these objectives are described in the next chapter.
4. Efforts toward commercialization of automated driving systems

(1) Utilization of automated driving systems for private vehicles

We aim to realize fully automated driving systems for expressways (SAE Level 4) and sophisticated driving safety support systems (tentative name) by 2025 to sophisticate automated driving systems developed by automakers and improve their safety. By doing so, the reduction of traffic accidents and strengthening of industrial competitiveness should be realized.

A. Previous efforts and realization of semi-autopilot driving systems

The Roadmaps 2016 stated that it was the “aim to commercialize semi-autopilot automated 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.”

In light of this, in November 2016, the Cabinet Office announced implementation of the SIP large-scale field operational test from September 2017 and we will continue making efforts to achieve our targets including those described in the Roadmaps 2016.

<table>
<thead>
<tr>
<th>Test location</th>
<th>Test contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expressway</td>
<td>• Examination of effectiveness and accuracy of dynamic maps in various track environments such as curves (including considerations on how to use dynamic information based on the lane level location referencing method)</td>
</tr>
<tr>
<td></td>
<td>• Test on driving support at merging/diverging points by vehicle-vehicle communication</td>
</tr>
<tr>
<td></td>
<td>• Examination of driver status after a 2-3 hour period of continuous driving (200-300 km) , etc.</td>
</tr>
<tr>
<td>General road</td>
<td>• Driving test using prototype vehicles developed for next-generation urban traffic systems</td>
</tr>
<tr>
<td></td>
<td>• Examination of functions using the Public Transportation Priority System (PTPS)</td>
</tr>
<tr>
<td></td>
<td>• Examination of linkage on the on-board device between dynamic information provided by infrastructure and dynamic map data delivered to the device</td>
</tr>
<tr>
<td>Test course, etc.</td>
<td>• Examination of behaviors against security threats such as cyber attacks</td>
</tr>
</tbody>
</table>

In addition, toward the realization of semi-autopilot driving systems in 2020, we will continue addressing institutional issues (examining the necessity for the HMI-related guidelines in light of the issue of overconfidence where drivers have
too much confidence in the system’s capabilities and put themselves at a higher risk of accidents), issues related to social receptivity (promotion of understanding among drivers involved in automated driving and consumers), and issues related to technologies and infrastructure (development of dynamic maps and information and communications infrastructure.)

B. Realization of fully automated driving on expressways and automated driving on general roads

[Highly/ fully automated driving on expressways]

In light of the realization of semi-autopilot driving systems by 2020, we aim to commercialize autopilot driving systems by 2020 and fully automated driving systems for expressways (SAE Level 4) by 2025.

In fully automated driving systems for expressways (SAE Level 4), fully automated driving is available from the entrance to the exit of an expressway and the driver can either override the system as needed or let the system operate. The vehicle must automatically pull over to the side of the road when it exits ODDS, the specific conditions under which the driving automation system is designed to function, or in case of abnormalities (technology for transition to a minimal risk condition. 35) For realization of automated driving systems for expressways (SAE Level 3), how to secure safety in case of a request to intervene by the system is an issue to be solved.36 In light of industrial trends in technology development and commercialization, we will reconsider the commercialization timing of systems of SAE Level 3 and 4 where necessary.

In order to achieve the above, as an institutional goal, we aim to improve driving environments for highly automated driving systems by about 2020 in light of the progress of international discussions on consistency with treaties concerning automated driving and road traffic and measures to promote such consistency. As a technological goal, we aim to establish the technologies for transition to a minimal risk condition (see “5.”). In addition, we will consider a

35 Technology that enables the vehicle to transition to a minimal risk condition automatically and safely in case of abnormalities. It is essential to develop and adopt such technology in order to realize fully automated driving (L4) and sophisticated driving safety support systems (tentative name.)

36 Technology for transition to a minimal risk condition may be added as a measure to secure safety in case of a request to intervene by the system. In this case, systems considered as SAE Level 4 in terms of technical specifications may be commercialized as systems of SAE Level 3 that require the driver inside the vehicle and send a request to intervene to the driver.
new road-vehicle cooperative type system such as the provision of information from roads in order to support automated driving in complex traffic environments such as merging/ diverging points on expressways.

[Automated driving on general roads (SAE Level 2, etc.)]

We will commercialize automated driving systems (SAE Level 2) that enable automated driving on general roads by expanding the areas where automated driving systems function based on automated driving systems of SAE Level 2 commercialized on expressways.

Specifically, we aim to realize automated driving systems (SAE Level 2) that enables straight driving on major highways (national roads and major local roads) around 2020. Then it is expected that OODs of automated driving systems of SAE Level 2 will be expanded around 2025, enabling right and left turns on major highways and straight driving on other roads.

C. Popularization of driving safety support systems and realization of sophisticated driving safety systems (tentative name)

[Popularization of driving safety support systems]

Considering it will take time to commercialize, service, and popularize the automated driving systems mentioned above, we need to address measures to popularize driving safety system with an eye on establishment of a society with the world’s safest road traffic and the world’s best ITS by 2020.

Considering the fact that prevention of traffic accidents by the elderly is an urgent issue, the government announced “the Interim Report of the Meeting of Senior Vice Ministers of Relevant Ministries on Safety Driving Support Vehicles” in April 2017. The report specifies the definitions of safety driving support vehicles (Support Car S) for the elderly, which are shown in Table 7. Based on these definitions, we will work on the promotion of popularization and public awareness of driving safety support vehicles, improvement and expansion of vehicle assessment, and development of standards for advanced safety technologies.
[Table 7] Definitions of Safety Support Car S (nickname) (abbreviated name: Support Car S)

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wide</td>
<td>Automatic braking (pedestrian detection), acceleration suppression device for pedal misapplication, Lane departure warning, advanced lights</td>
</tr>
<tr>
<td>Basic+</td>
<td>Automatic braking (vehicle detection), acceleration suppression device for pedal misapplication</td>
</tr>
<tr>
<td>Basic</td>
<td>Low-speed automatic braking (vehicle detection), acceleration suppression device for pedal misapplication</td>
</tr>
</tbody>
</table>

In addition to the efforts for popularization of Support Car S for the elderly mentioned above, the government and private sectors will jointly work on promotion of popularization and public awareness of vehicles with automatic braking and other safety features with a nickname “Safety Support Car (abbreviated name: Support Car)” to help prevent traffic accidents by all drivers.

In addition to driving safety support vehicles mentioned above, we will promote measures for popularization of various driving safety support systems and information provision systems shown in Table 8.

[Table 8] Promotion of measures related to driving safety support systems (other than driving safety support vehicles)

- Further popularization and sophistication of the Automatic Collision Notification (ACN) system and the Help System for Emergency Lifesaving and Public Safety (HELP), which enable drivers to report accidents using their on-board device or mobile phone.
- Popularization and utilization of on-board devices such as driving video recorders and event data recorders from which information can be obtained to understand and analyze accident situations.
- Preparation for the introduction of Driving Safety Support Systems (DSSS) that provide visual and audio information on surrounding traffic situations to the driver utilizing infrastructure of traffic control systems and the Traffic Signal Prediction System (TSPS) that provides prior information on which signal is on when the vehicle arrives at an intersection with traffic signals.
- Efforts to realize smooth, safe, secure road traffic utilizing ITS technologies such as popularization and promotion of ETC 2.0. Expansion of utilization of ITS technologies
including ETC at facilities other than expressways such as private parking lots is also promoted.

- Joint considerations among government, academia, and industry on more effective measures against driving the wrong way on expressways such as prompt detection of vehicles driving in the wrong direction, provision of warning on the road or inside the vehicle, and utilization of automated driving technologies
- Development of pedestrian-vehicle communication technologies useful for reduction of pedestrian accidents

[Realization of sophisticated driving safety systems (tentative name)]

In order to achieve traffic accident prevention at a higher level, it is necessary to develop vehicles with sophisticated driving safety support systems (tentative name) that cause almost no accidents not only by improving the level of automated driving but also by further sophisticating existing technologies related to vehicle safety 37 and utilizing automated driving technologies while assuming the driver operates the vehicle. Such automated vehicles are considered to contribute not only to reduction of traffic accidents but also to strengthening of competitiveness of Japan’s auto industry by providing added value to consumers as vehicles that enable drivers to enjoy driving safely.

Though specific technical specifications of sophisticated driving safety support systems will be discussed in the future, we aim to sophisticate individual technologies including “technologies for transition to a minimal risk condition” such as more advanced damage reduction braking and driver emergency support systems 38 and integrate such technologies into a system by adopting artificial intelligence (AI) and driver-friendly interfaces (HMI). In addition, we also need to consider sophisticating information gathering technologies for cooperative types (including development and sophistication of information and communications infrastructure (see 5. (2))).

In light of industrial trends in technology development, we aim to specify concrete specifications by cooperating with public and private sectors where necessary and realize vehicles with sophisticated driving safety support systems (tentative name) around the mid-2020s (by 2025.)

37 Including technologies called ADAS (Advanced Driver Assistance Systems)
38 The Ministry of Land, Infrastructure, Transport and Tourism announced the world’s first guidelines for driver emergency support systems in March 2016.
[Table 9] Specific element technologies of “sophisticated driving safety support systems (tentative name)” (image)

For example, sophistication of individual automated driving technologies will be promoted as described below and these technologies will be integrated into a system including AI and HMI technologies.

- **Sophistication of damage reduction braking (automatic braking)**
  - Drastic expansion of the distance between the vehicle and an obstacle and speed that damage reduction braking systems (automatic braking systems) can detect
  - Drastic improvement of fail-safe functions in collaboration with an acceleration suppression device for pedal misapplication

- **Sophistication of driver emergency support systems (including technologies for transition to a minimal risk condition)**
  - Promotion of development from the push-button type to the automatic detection type and from the simple/in-lane stop type to the roadside stop type

- **Others (Lane keeping assist, etc.)**

(2) Utilization of automated driving systems in the logistics services

In Japan’s trucking logistics industry, there are high expectations for utilization of automated driving systems as a measure to improve business efficiency, address lack of drivers, enhance safety, and promote energy conservation. Thus, we aim to realize truck platooning first and then fully automated driving trucks for logistics services on expressways. For local delivery, we will realize delivery services utilizing unmanned autonomous driving services in limited areas. By doing so, we will realize innovative, efficient logistics responding to the era of population decrease.

A. Realization of truck platooning on expressways

In order to realize truck platooning, we must take steady steps in cooperation with concerned parties including related ministries and agencies since there are many important issues to solve such as the impact on surrounding traffic environments and road structures as well as technical issues (safety of electronic coupling, securing of reliability, etc.) and institutional issues (positioning of electronic coupling under related laws and regulations, etc.)

---

39 The device to prevent rapid acceleration by controlling engine output if the accelerator pedal is applied when the on-board radar detects a wall or a vehicle
Specifically, we will conduct the necessary examinations on business environments such as infrastructure based on the past field operational tests of truck platooning on a test course\(^{40}\) and the progress of the test of doubles that are currently being conducted\(^{41}\). In addition, we will start field operational tests of truck platooning comprising 2 trucks with the following truck being manned by a driver utilizing existing technology called CACC\(^{42}\) on public roads in light of the results of the examinations on items related to inter-vehicle distance from FY 2017. After confirming social receptivity, we will start the field operational test of truck platooning systems with the following truck being unmanned on public roads from FY 2018.\(^{43}\) We must take sufficient safety measures when conducting these field operational tests and promote considerations on improvement of social receptivity, operational control technologies and the role of the business model of truck platooning operational control systems, as well as technology development.

Moreover, we will consider how to develop the necessary institutions and infrastructures to enable such field operational tests. Specifically, we will discuss the requirements of electronic towing\(^{44}\) and requirements for over 25-meter long platooning comprising 3 trucks or more by FY 2018. We will also examine business environments such as infrastructure by FY 2019 based on the results and operational rules of field operational tests.

Based on the above, we aim to expand the traveling distance and range after realizing truck platooning with the following vehicle being unmanned on the expressway (Shin-Tomei Expressway) in FY 2020 and realize commercialization of truck platooning with the following vehicle being unmanned on the expressways (Tokyo-Osaka) in the long-distance transportation field after FY 2022.

---

\(^{40}\) “R&D for Autonomous Driving and Platooning, Development of Energy-saving ITS Technologies” by NEDO (July 2010 - March 2015)

\(^{41}\) As the Ministry of Land, Infrastructure, Transport and Tourism has been conducting field operational tests of doubles (November 2016 - 2018), we will provide the necessary cooperation on business environments such as infrastructure.

\(^{42}\) CACC (Cooperative Adaptive Cruise Control): System that adds vehicle-vehicle communications to ACC, the technology using radar measurements to maintain a proper distance to the vehicle in front, to share information on acceleration/deceleration of another vehicle and conducts more precise inter-vehicle distance control. It is already in practical use.

\(^{43}\) Field operational tests of truck platooning on public roads will be conducted with platooning with the following vehicle being manned by a driver first. Once safety is confirmed, field operational tests of platooning with the following vehicle being unmanned will be conducted.

\(^{44}\) Vehicle standards, required driver’s license, driving lanes, etc.
[Figure 12] Schedule for realization of truck platooning on the expressways (overview)

<table>
<thead>
<tr>
<th>FY 2017</th>
<th>FY 2018</th>
<th>FY 2019</th>
<th>FY 2020</th>
<th>FY 2021</th>
<th>After FY 2022</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Field operational test of truck platooning with the following vehicle being manned by a driver (CACC)</td>
<td>Expansion of the driving distance and range</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development of institutions</td>
<td>Requirements for electronic towing</td>
<td>Development of business environments such as infrastructure as needed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;Infrastructure development&gt;</td>
<td>&lt;Examination of business environments based on technologies such as field operational test results, operational rules, etc.&gt;</td>
<td>Realization of truck platooning with the following vehicle being unmanned ((part of) Shin-Tomei Expressway)</td>
<td>Commercialization of truck platooning with the following vehicle being unmanned (Tokyo-Osaka)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Items related to inter-vehicle distance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. Utilization of fully automated /unmanned autonomous driving in logistics

[Realization of fully automated driving trucks45 on expressways]

As an effort to utilize automated driving systems, we will prioritize realization of truck platooning on expressways described in A. from the standpoint of technological easiness.

However, given the fact that, with the progress of development and field operational tests of fully automated driving systems for private vehicles, the results of such development and tests are expected to be applied to trucks in the future as described in A., also that many field operational tests are being conducted overseas by private companies including venture companies to realize fully automated driving trucks46, and finally that fully automated driving trucks are expected to be more effective than truck platooning in solving issues such as lack of drivers, it is desirable for Japan to consider their commercialization and service.

Thus, we will promote considerations on realization of fully automated driving trucks on expressways after 2025 in light of the technological progress of automated driving systems for private vehicles and results of field operational tests of truck platooning.47

---

45 In the Initiative/Roadmaps 2017, trucks with fully automated driving systems are called fully automated driving trucks.

46 Some overseas companies announced that they would commercialize such trucks in 2025. Some companies in Japan are also considering developing plans for realization of fully automated driving on expressways.

47 The timing of realization needs to be examined based on the progress of development, operational tests, and realization of automated driving systems for private vehicles and truck platooning and considerations by business operators.
When realizing innovative, effective logistics, streamlining not only transport on highways such as expressways but also logistics for small-lot delivery including delivery to users is an urgent issue. Due to this, Japan has started conducting field operational tests on utilization of automated driving for delivery services by private companies.

We aim to realize unmanned automated delivery services in limited areas after 2020 by applying the technologies of unmanned autonomous driving transport service in limited areas shown in (3). Specifically, for example, it is expected that both-way transport between a center and a settlement in underpopulated areas and door-to-door delivery services in settlements will be realized and then service recipients and areas will be expanded.

In order to promote such efforts for institutional purposes, we will, for example, simulate operational model tests of both passenger transport and freight transport utilizing automated driving vehicles and organize requirements for freight transport by passenger vehicles by FY 2018.

(3) Utilization of automated driving systems in transport services

In Japan, where the birthrate is falling and the population is aging, regional revitalization is an important issue. Due to this, it is urgent to secure transportation means for people with limited mobility such as the elderly and for those living in rural areas such as underpopulated areas. To solve this issue, we aim to realize transport services utilizing unmanned autonomous driving systems for limited areas by 2020 and implement such services throughout the country after 2025. By doing so, we will develop a society that enables the elderly to freely move around the country.

A. Previous efforts for unmanned autonomous driving transport services for limited areas

The Roadmaps 2016 stated that “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 that safety and efforts shall be made to enable the
provision of transport services at the 2020 Tokyo Olympics and Paralympics.”

Based on this, institutional efforts\textsuperscript{48} required to conduct field operational tests of unmanned autonomous driving transport services on public roads in limited areas have been steadily implemented in accordance with the Road Traffic Act and the Road Transport Vehicle Act, which enables field operational tests of remote automated driving systems on public roads that can be conducted under the current treaties concerning road traffic\textsuperscript{49}.

Field operational tests on public roads have been conducted in National Strategic Special Zones with an eye to realizing fully automated driving. In addition to such tests, in response to the announcement of the Roadmaps 2016, many government-led field operational test projects for realization of automated driving services for limited areas such as “Field Operational Test for Social Implementation of Terminal Traffic Systems” by the Ministry of Economy, Trade and Industry (METI) and the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and “Field Operational Tests of Automated Driving Services Using Roadside Stations in Hilly and Mountainous Areas as a Hub” by the MLIT are scheduled to be conducted especially after 2017. \textsuperscript{50} Some of these tests are

\textsuperscript{48} The National Police Agency (NPA) announced “the Report on Study and Research for Step-by-step Realization of Automated Driving” that describes the results of the Study and Examination Committee meeting held with experts in April 2017. At the committee meeting, “Standards for Handling Applications for Permission to Use Roads for Field Operational Tests of Remote Automated Driving Systems (draft)” was developed. The NPA sought public comment on the draft of the standards and plans to establish the standards based on these results in June 2017.

The MLIT revised related laws and regulations based on the Road Transport Vehicle Act in February 2017. Due to this revision, the standards have been relaxed on vehicles with no steering wheel or accelerator pedal on the premise that safety is secured in order to enable field operational tests of unmanned autonomous driving transport services for limited areas on public roads.

\textsuperscript{49} At the 72nd meeting (held in March 2016) of the Working Party on Road Traffic Safety (known as WP1. The name was changed to the Global Forum for Road Traffic Safety in February 2017) of the UN Economic Commission for Europe (UNECE) under the United Nations Economic and Social Council, the opinion that “testing of driverless vehicle is possible under current treaties where there is a person who is ready, and able to take control of the experimental vehicle(s); this person may or may not be inside the vehicle” formulated as a result of discussions on automated driving by the informal working group and WP1 accepted it.

\textsuperscript{50} The table below shows government-led field operational tests of automated driving on public roads conducted in local areas as of May 2017.
conducted in accordance with development of the institutions mentioned above. In addition to government-led projects, field operational tests of automated driving systems and discussions on their implementation are being conducted by municipalities, universities, etc. in regions across the country.

| Field Operational Tests in National Strategic Special Zones (Cabinet Office) | • Field operational tests where automated driving vehicles (manned by a driver) transported passengers 2.4 kilometers on the public road between their homes and a commercial establishment were conducted from February to March 2016. 51 citizens participated and got in the vehicles.  
• In March 2016, the field operational tests were conducted in the schoolyard of the elementary school in Sendai City (test of a fully automated driving system, not on public roads.)  
• In November 2016, the field operational tests where fully automated driving vehicles travel 400 meters on the public road were conducted in Semboku City (permission to use the road was obtained and traffic regulations were implemented to eliminate other means of road transportation.) 62 citizens participated and got in the vehicles. |
| Field Operational Tests of Automated Driving of Buses: Consideration on Utilization of Automated Driving Technologies for Promotion of Development and Commercialization of Next-generation Urban Traffic Systems and Improvement of Traffic Environments in Okinawa (Cabinet Office) | • In March 2017, the field operational tests of automated driving buses (manned by a driver) were conducted on public roads in Okinawa (Nanjo City.) More advanced field operational tests (of SIP automated driving systems) are planned to take place in 2017 and 2018.  
• In June 2017, field operational tests are planned to take place on a remote island in Okinawa (by the Okinawa Development and Promotion Bureau.) |
| Field Operational Test for Social Implementation of Terminal Traffic Systems (METI and MLIT) | • The National Institute of Advanced Industrial Science and Technology (AIST), the contractor entrusted with field operational test projects, selected project operators (Yamaha Motor Co., Ltd., SB Drive Corporation, etc.) in November 2016 and 4 locations to test and evaluate the systems (Wajima City, Ishikawa, Eiheiji Town, Fukui, Chatan Town, Okinawa, and Hitachi City, Ibaraki) in March 2017.  
• The AIST plans to make necessary adjustments to start field operational tests in FY 2017. |
| Field Operational Tests of Automated Driving Services Using Roadside Stations in Hilly and Mountainous Areas as a Hub (MLIT) | • In April 2017, the MLIT selected 5 roadside stations as locations to conduct technical verification. It plans to select 5 more roadside stations as locations to examine business models around this July and conduct field operational tests and summarize the results within this year. |
B. Efforts to be made for realization and popularization of unmanned autonomous driving transport services in limited areas

In consideration of the institutional development on unmanned autonomous driving transport services in limited areas mentioned above, we will start field operational tests of remote automated driving systems on public roads from FY 2017. Initially, in field operational tests on public roads, we will simulate the “1-1” situation where one remote driver monitors one vehicle. Then, after accumulating data by conducting a series of field operational tests on public roads, we will advance the tests and simulate the “1-N” situation where one remote driver monitors multiple vehicles\(^{51}\).

In addition, in order to promote field operational tests of unmanned autonomous driving transport services outside public roads in limited areas, we aim to specify requirements for dedicated spaces and driving methods within 2017. Unmanned autonomous driving transport services in dedicated spaces may be provided using fully automated driving systems with no remote driver. For unmanned autonomous driving transport services including such dedicated spaces, we aim to start confirming social receptivity through field operational tests from FY 2017 and expand the automated driving business in the private sector after 2020.

Based on these field operational tests on public roads, we will make efforts to realize unmanned autonomous driving transport services of SAE Level 4 (transport services utilizing fully automated driving) by 2020. To this end, we aim to establish technologies for transition to a minimal risk condition as a technological objective, while aiming to develop actual driving environments for highly automated driving systems by around 2020 as an institutional objective in light of the progress of international discussions on consistency with treaties concerning automated driving and road traffic and measures to secure such consistency. (See “5.”)

After that, we will work on realizing a society that enables the elderly to freely move around the country by around 2025 by expanding unmanned autonomous driving transport services across the country while improving technology levels (including expansion of ODDs) and expanding service contents.

\(^{51}\) The requirements for field operational tests of “1-N” type remote automated driving systems on public roads are already specified in the “Standards for Handling Applications for Permission to Use Roads for Field Operational Tests of Remote Automated Driving Systems (draft)” by the NPA.
Schedule for realization and popularization of unmanned autonomous driving transport services of SAE Level 4 (summary)

<table>
<thead>
<tr>
<th>FY 2017</th>
<th>FY 2018</th>
<th>FY 2019</th>
<th>FY 2020</th>
<th>FY 2021-2024</th>
<th>FY 2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field operational tests of remote-type systems on public roads (1:N)</td>
<td>Field operational tests of dedicated-space type systems</td>
<td>Preparation for commercialization</td>
<td>Expansion of the scope of national expansion and service contents of unmanned autonomous driving transport services of Level 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[Table 10] Image of unmanned autonomous driving transport services

Examples of unmanned autonomous driving transport services of SAE Level 4 in limited areas to be commercialized by 2020 are shown below (but not limited to them).

- Service areas include areas with good visibility and relatively low traffic volume such as underpopulated areas, urban areas where pedestrians and two wheeled vehicles are unlikely to run into the road suddenly, or areas in university campuses and airport facilities with relatively simple driving environments.
- The vehicles drive on specific predetermined routes at 10-30 kilometers per hour.
- The number of passengers who can get in the vehicles is small and they get in and out of the vehicles at specific locations.
- The vehicles are operated only during the daytime when weather conditions are favorable, but not during the night and not in poor weather conditions such as rain and snow.
- Operational status is monitored by private service providers and the vehicles promptly stop operation when the driving environment of the operational vehicles exits or is about to exit ODDs. Then the vehicles are limitedly operated by a remote driver, or service providers come to the vehicles and implement necessary measures.
- A person who is not a driver may be on board to provide support (help passengers get in and out) to passengers and prepare for events that cannot be handled by automated driving systems.
C. Next-generation urban transportation system and other transport support services

**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 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, ART shall be promoted under the leadership of the SIP Automated Driving 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.

**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.

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, assuming its application to rental car services in tourist areas and commercial vehicle leasing services. To this end, efforts toward formation of a consensus among concerned parties and international standardization of the automated valet parking system shall be promoted through field operational tests that have

---

52 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.

53 Automated valet parking is a system that is supposed to be utilized for private cars. However, since it is an automated driving system that utilized in highly limited areas and it will be introduced in the services that utilized business vehicles first, we included it in “(3) Utilization of automated driving systems in transport services”.

43
been conducted since FY 2016. In addition, we assume such a system will develop into an automated valet parking system in general parking lots with social implementation of fully automated driving systems.
5. Efforts toward promotion of ITS/automated driving innovation

(1) Development of institutions toward popularization of automated driving and enhancement of social receptivity

As described in the previous chapter, with the recent progress of automated driving technologies, commercialization and commencement of service of automated driving systems by 2020 have begun to come into sight. Thus, we will proceed with consideration of the institutional side with a view toward commercialization and commencement of service of highly automated driving businesses in 2020.

Based on the objective of becoming the world's best, we will work out a schedule with our eyes set on world-leading business operators. We need to work on institutional design with the aim of leading the world while collaborating with other countries as it is an issue unprecedented in the world. In addition, when designing specific institutional plans, we shall take the following approach to make sure they will promote innovation while securing safety given the fact that automated driving is highly beneficial for society.

[Table 11] Basic approach to institutional design for highly automated driving systems (3 principles)

<table>
<thead>
<tr>
<th>(i) Recognize the huge social benefits of automated driving systems and develop institutions to promote their introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Drastic improvement of traffic safety can be expected by eliminating human error as much as possible.</td>
</tr>
<tr>
<td>✓ Many social benefits can be expected, such as smooth traffic, energy conservation, smooth transportation for the elderly, reduction in drivers' burden, enhancement of industrial competitiveness, and creation of new industries.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(ii) Develop institutions that give priority to securing safety and reduce risks associated with introduction of automated driving systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Promote introduction of automated driving systems, given that they will reduce overall current traffic safety risks</td>
</tr>
<tr>
<td>✓ Develop institutional designs that promote safety-related innovation based on driving results while securing safety.</td>
</tr>
<tr>
<td>✓ Develop a mechanism that reflects new progress in technology in the existing systems</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(iii) Develop institutions that promote various types of innovation related to automated driving systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Design institutions that promote efforts toward various types of innovation while maintaining technological neutrality</td>
</tr>
<tr>
<td>✓ As for social responsibilities, design institutions that promote innovation by manufacturers and system operators including insurance systems while giving priority to social receptivity such as relief measures for victims</td>
</tr>
</tbody>
</table>
A. Development of institutions concerning field operational tests on public roads and promotion of test projects

[Institutional environments related to field operational tests and actual operation of automated driving systems (current situation)]

Environments of field operational tests on public roads and actual operation of automated driving systems in Japan are being developed based on international discussions on consistency between automated driving systems and treaties concerning automated driving and road traffic. Specifically, field operational tests on public roads can be conducted regardless of SAE Level (Level 1-5) without prior arrangement with or permission from police, if the vehicle operates in compliance with related laws and regulations including the Road Traffic Act, with a driver in the driver’s seat and ensuring emergency situations can be handled. In addition, Japan is making more advanced efforts to develop institutions than those of other countries as it plans to develop institutions that enable field operational tests on public roads of remote automated driving systems that have been confirmed to be consistent with treaties concerning road traffic in June 2017.

Since active discussions on consistency between automated driving and treaties concerning road traffic are being conducted mainly by the informal working group of the Global Forum for Road Traffic Safety (WP1) of the UN Economic Commission for Europe (UNECE), Japan aims to promote consideration of development of institutions concerning highly automated driving while actively participating in such discussions.

In addition, with an eye to promoting various types of innovation, related laws and regulations were revised based on the Road Transport Vehicle Act in February 2017 so that standards will be relaxed on vehicles with no steering wheel or accelerator pedal and field operational tests on public roads are continuously being promoted.

[Table 12] Institutional environments for field operational tests and actual operation of automated driving systems in Japan and overseas countries

| Field operational test | Every level of automation (including the unmanned type) |
### Driver inside the vehicle

<table>
<thead>
<tr>
<th>Actual operation</th>
<th>SAE Level 2 and below</th>
<th>Highly automated driving (including the unmanned type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver inside the vehicle</td>
<td>UN: Allowed</td>
<td>UN: Discussions are being held on consistency with treaties</td>
</tr>
<tr>
<td></td>
<td>Japan: Allowed under treaties</td>
<td>Japan: Not allowed (Traffic-related laws and regulations need to be reviewed)</td>
</tr>
<tr>
<td></td>
<td>Japan: Allowed under existing laws. Already commercialized.</td>
<td>Overseas: Not allowed (Considerations are being undertaken in California, US)</td>
</tr>
<tr>
<td></td>
<td>Overseas: Basically allowed under existing laws. Already commercialized.</td>
<td></td>
</tr>
<tr>
<td>No driver inside the vehicle (including remote drivers)</td>
<td>UN: Discussions are being held on consistency with treaties</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Japan: Not allowed (Task ahead)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Overseas: Not allowed (Considerations are being undertaken in California, US)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[Institutional development concerning field operational tests on public roads and promotion of test projects]

As for the development of institutions concerning field operational tests to realize unmanned autonomous driving transport services in limited areas by around the end of 2017, as described in the Roadmaps 2016, the institutional development described in the previous chapter enables field operational tests of remote-type automated driving vehicles and automated driving vehicles with no steering wheel or accelerator pedal. In addition, test courses such as simulated urban areas described in the Roadmaps 2016 were opened in April 2017. Moreover, as described in the previous chapter, many field operational tests including government-led projects are scheduled to take place. Japan shall continue promoting active implementation of such tests while utilizing these institutions and facilities.

---

54 In Japan, regarding tests to demonstrate technologies for automated driving systems of SAE Level 3-5 and the unmanned type, field operational tests on public roads can be conducted regardless of automation level (Level 1-5) without prior arrangements with or permission from police if the vehicle operates in compliance with related laws and regulations including the Road Traffic Act, with a driver in the driver’s seat and ensuring emergency situations can be handled.

The NPA developed and announced “the Guidelines for Field Operational Tests of Automated Driving Systems on Public Roads” in May 2016 as guidelines to refer to when conducting field operational tests on public roads.

55 The Japan Automobile Research Institute (JARI) established “Jtown” as an automated driving vehicle evaluation hub in Tsukuba, Ibaraki in March 2017 and opened it to the media.
The bill to amend the National Strategic Special Zone Act and so on was submitted to the Diet in March 2017 and is now under deliberation. The bill states that prior regulations and procedures should be fundamentally reviewed as “Japan’s Regulatory Sandbox” to swiftly conduct cutting-edge field operational tests of automated driving and so on while paying sufficient attention to safety and specific measures should be considered and taken within 1 year of its enactment. In addition, “Near-future Technology Demonstration One-stop Center (tentative name)” consisting of related municipalities and ministries, that is designed to provide consultations and information on procedures under related laws and legislations and perform procedures on behalf of clients as needed, will be established under the National Strategic Special Zone Council.

[Development of the public-private cooperation system and sharing of data related to field operational tests]

As mentioned above, since many government-led field operational tests on public roads are expected to be promoted, it is necessary to summarize the results of these tests and reflect them in institutional reform in the future. To this end, based on the Prime Minister’s comments at the meeting of the Growth Strategy Council – Investing for the Future, the results of various field operational tests shall be summarized and a collaboration system for public-private dialogue and cooperation shall be developed in order to intensively examine the possibility of institutional reform in light of new technologies.

In particular, data obtained from field operational tests on public roads is not only useful for securing social receptivity but also important for consideration on future R&D and institutional design. It is necessary to consider developing a framework that enables sharing of data related to field operational tests and public announcement of the results.

---

56 In this context, “Tokyo Self-Driving Technology Sandbox Committee” was established under National Strategic Special Zone Council for the Greater Tokyo Area in February 2017. The committee aims to establish a “sandbox” special zone system that fundamentally reviews the existing institutions and procedures and thoroughly implements after-the-fact check rules while working on planning and implementation of various field operational tests utilizing cutting-edge automated driving technologies in the areas around Haneda Airport.

57 Prime Minister’s comments at the 5th meeting of the Growth Strategy Council – Investing for the Future held on February 16, 2017: “We will develop a collaboration system for public-private dialogue and cooperation under the IT Strategic Headquarters in order to summarize the results of various field operational tests and intensively examine the possibility of institutional reform in light of new technologies.”
Therefore, we must consider how to share information such as accident data related to automated driving, safety-related data other than accident data (override data, near-miss data, etc.), technical data related to automated driving that requires standardization, and information on needs in field operational test areas and business models. As for sharing of safety-related data including accident data, the possibility of mandatory storage, submission, and disclosure of data by business operators, how to handle personal information, and a study framework for the safety assessment of automated driving vehicles and systems should also be included in considerations on the overall institutional design including commercialization of future automated driving systems.

B. Institutional challenges toward realization of highly automated driving systems (Development of the outline)

[Necessity of the outline of institutional development by the whole government toward realization of highly automated driving systems]

As described in the roadmaps toward commercialization of automated driving systems in the previous chapter, since the expected timing of the commercialization of highly automated driving systems, including autopilot driving systems for expressways (SAE Level 3) and unmanned autonomous driving transport services of SAE Level 4 in limited areas and fully automated driving systems, is set at 2020, it is necessary to consider the direction of institutional development including review of traffic-related laws and regulations that are required to realize their commercialization.

As for actual operation of highly automated driving systems on public roads, international discussions are being undertaken by the UN since consistency between automated driving systems and treaties concerning road traffic needs to be secured. On the other hand, some major countries are considering the role of legal systems toward domestic commercialization of highly automated driving systems.58

58 Specifically, considerations are being undertaken based on the situations of each country. Some examples are shown below.

- California, USA: California is considering rules toward comprehensive commercialization of automated driving systems including those of SAE Level 3-5 and unmanned automated driving systems based on the moves of IT companies in the state. The latest rules announced in March 2017 specify many matters that need to be certified to obtain permission. California aims to enforce the rules within 2017.
- In Germany, based on the moves of domestic and overseas auto companies, the bill to
In order to enable actual operation of highly automated driving systems, a full review of the existing traffic-related laws and regulations that are based on the assumption of “operation by the driver” is required to incorporate into them an institution that enables “operation by the system”\(^\text{59}\). The scope of consideration for the review ranges from identification of automated driving vehicles and systems and the roles of safety standards, traffic rules and so on to clarification of responsibilities such as automobile liability insurances. In addition, since they are considered to be mutually related, it is necessary to clarify the policy of the whole government on institutional development toward realization of highly automated driving systems. Therefore, the policy (outline) on institutional development by the whole government toward realization of highly automated driving systems shall be developed mainly by the IT Strategic Headquarters within FY 2017 in close cooperation with related ministries and agencies.

Though such institutional development is a matter of global concern, overseas countries are still in the trial and error stage and international discussions on consistency between automated driving and treaties on road traffic are being undertaken. In addition, since as of now there are no established technologies related especially to highly automated driving, various technologies are expected to emerge in the future and it will take time to develop international technical standards. It is necessary to take the above into account and promote consideration.

[Basic approach to institutional design for highly automated driving systems]

Japan shall consider the policy (outline) on institutional development toward realization of highly automated driving systems based on the following basic approach (strategy.)

i. Exercise international leadership in institutional design from a mid-term perspective

---

59 “Operation by the driver” and “operation by the system” mean “dynamic driving task performed by the driver” and “dynamic driving task performed by the system” of SAE J3016 (2016) respectively. The same shall apply hereinafter.
ii. Develop an institutional framework that promotes innovation while securing safety

iii. Clarify responsibilities in a way that promotes innovation while giving priority to social receptivity

i. Exercise international leadership in institutional design from a mid-term perspective

As for institutional development, as mentioned above, Japan must lead the world and develop the most advanced institutions concerning automated driving while considering the progress of deliberations by overseas countries. As for consistency between automated driving systems and treaties concerning road traffic, Japan shall promote consideration on a framework for institutional development in the country and get prepared to promptly develop domestic systems in line with the direction of international discussions on the matter while actively participating in such discussions.

Especially in Japan, compared to other countries in the world, more balanced consideration is given to commercialization of automated driving systems to be utilized for both private vehicles and business vehicles (logistics and transport services) and many field operational tests of automated driving systems for both types of vehicles are conducted on public roads. Therefore, Japan is able to identify issues in both systems swiftly. Since commercialization and service of both systems are expected to be realized in around 2020, Japan shall consider developing a consistent institutional framework toward commercialization of both systems from a mid-term perspective. It is necessary to design institutions with an eye not only on the role of manufacturers of vehicles equipped with automated driving systems but also on that of service providers that utilize automated driving systems while considering technological and business neutrality.  

ii. Develop an institutional framework that promotes innovation while securing safety

As for an institutional framework for securing safety such as permits and licenses for automated driving vehicles and systems and conditions and rules for

---

50 In order to move towards provision of full-fledged services in 2020 based on the results of field operational tests, relaxation of regulations only after securing safety must be considered. In addition, consistency between the full-fledged services and the existing business laws must be examined where necessary based on specific service contents.
actual operation on public roads, mandating uniform safety standards and measures to secure safety is not necessarily appropriate since there are no established automated driving technologies yet. Given that various technologies are expected to emerge in the future and it will take time to develop international technical standards and establish methods for assessing the safety of automated driving systems, for the time being we should develop a framework/structure where the safety of systems that are separately applied is assessed from a technical and scientific perspective while confirming the direction of specific technology development. However, we must consider operating such a framework in a way that helps promote innovation such as preannouncement of the minimum requirements where possible in light of the status of development within the industry.

In addition, when conducting safety assessment, discussions should be held with business operators from a technical perspective with the understanding that they must take responsibility in principle and appropriate conditions should be set where necessary. Assessment must be conducted by taking into consideration ODD and DDT, concepts that are being accepted globally. For example, we should consider developing a framework where operation within ODDs that are recognized as safe is permitted first and then ODDs are expanded if safety is confirmed. In light of such knowledge and experience, Japan must promote consideration on the appropriate method for assessing safety related to highly automated driving systems while actively collaborating with other countries.

iii. Clarify responsibilities in a way that promotes innovation while giving priority to social receptivity

Since there is not necessarily a uniform global system that clarifies where responsibility lies in case of accidents\(^6^1\), each country has developed institutions that clarify responsibilities based on their long history of taking measures against traffic accidents and social norms (social recognition and acceptance) related to them. In such a trend, Japan shall consider where responsibility lies in case of accidents caused by “operation by the system” based on the existing domestic legal systems such as the concept of victim relief under the Automobile Liability Security Act while looking at international developments. In addition, discussions must be held on where responsibility lies while considering social benefits that

\(^{61}\) Including response to cyber attacks.
can be brought by automated driving and promotion of innovation related to safety of automated driving.

Though responsibilities of the systems may be discussed by envisioning automated driving vehicles operated by AI capable of making autonomous decisions, they should be considered as a future issue to discuss.

[Specific considerations when developing the outline (image)]

When considering developing the “outline”, based on the approach described above, directions for the items shown below must be considered and summarized in order to promote future specific discussions by each ministry and agency while taking into account the trend in technologies of automated driving vehicles and systems in field operational tests on public roads, as well as the results of discussions by each ministry and agency.

[Table 13] Considerations in developing institutions concerning highly automated driving (image)

<table>
<thead>
<tr>
<th>[(i) Identification of automated driving vehicles/ systems]</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Definition and identification of highly automated driving systems</td>
</tr>
<tr>
<td>• Identification of administrators (system operators, etc.) of highly automated driving systems</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[(ii) Appropriate safety standards]</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Consideration toward the establishment of international standards for highly automated driving systems</td>
</tr>
<tr>
<td>• How to consider the technical requirements necessary to ensure the safety of the vehicle</td>
</tr>
<tr>
<td>• How to consider conditions under which the vehicles can operate based on their performance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[(iii) Appropriate traffic rules]</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Appropriate traffic rules concerning “operation by the system”</td>
</tr>
<tr>
<td>• Appropriate requirements and obligations for system operators</td>
</tr>
<tr>
<td>• Appropriate consumer education by and accountability of manufacturers and system operators</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[(iv) Responsibilities in case of accidents]</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Future direction under the Automobile Liability Security Act</td>
</tr>
<tr>
<td>• Other civil liabilities based on the above (including application of the concept of product liability\textsuperscript{62})</td>
</tr>
</tbody>
</table>

\textsuperscript{62} For example, law experts have pointed out the following as issues related to product liability.
C. Securing of social receptivity and development of a society-wide collaboration system

[Efforts related to social receptivity and citizen participation]

In Japan, a prerequisite for building the world’s most advanced ITS in specific regions and expanding 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 prior understanding of social costs for their introduction and their limitations as well as the benefits given by them. In particular, when introducing automated driving systems into society as a new technology, it is indispensable not only to develop institutions as mentioned above but also to secure social receptivity.

Issues related to securing of social receptivity have recently become evident since there have been problems not only in the case of highly automated driving systems of SAE Level 3 and above but also in technologies related to automated driving corresponding to SAE Level 0-2 that have already been commercialized.

In order to make efforts to improve social receptivity for ITS/automated driving under such circumstances, operators that provide such products and services must provide their consumers with appropriate knowledge by having them first understand the functions and performance of such technologies. However, considering the promotion of the popularization and standardization of such products and services, such efforts should not necessarily be made by one company alone. In addition, given that government efforts need to be made from the perspective of the whole social system, it is necessary to consider developing an industry-government-academia collaboration system that includes neutral, independent academic societies such as universities and research institutions.

Taking the matters mentioned above into account, we have started developing a review system consisting of experts from a variety of fields such as engineering and social studies and conducting surveys on social and industrial

- Should defects of on-board software and information provided from outside via a communication network be deemed product liability?
- Can users and general insurance companies prove the defects of automated driving vehicles?
- How to consider “the time of delivery of the product” for automated driving vehicles?
analyses of automated driving through SIP Automated Driving Systems since FY 2016, with the objective of assessing the social impact of automated driving objectively in order to improve social receptivity. While establishing an open review system through industry-government-academia collaboration and taking into account the results of field operational tests on public roads as well as information on safety in such tests, we aim to collaborate with citizens and secure social receptivity by showing in an easy-to-understand manner how automated driving systems will be popularized and how society will change due to the development of ITS/automated driving, as well as how automated driving systems will be positioned in society as a whole from the perspective of users and citizens.

In addition, SIP Automated Driving Systems has held media briefings, where it has explained progress in the development of automated driving. Since FY 2016, it has also been holding dialogues directly with citizens including students and such efforts will continue to be promoted.

**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.

Thus, places (such as forums) shall be developed where not only the automobile and electronic industries, but also a range of industries including IT and financial, SMEs, venture companies, universities and research institutions related to automated driving, and also regions with interests and needs, can exchange opinions on the matter across sectors.

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.

(2) Data strategy related to automated driving and utilization of traffic data

(i) Data strategy toward the realization of automated driving
Since automated driving systems are becoming more data-driven, when sophisticating and commercializing such systems, creation of a database for operation in many situations will be a key to industrial competitiveness. These situations include field operational tests on test courses and public roads, incorporation of skilled driving techniques into artificial intelligence based on the database, and development of a system that provides a massive amount of data that are required for the expansion of data to be utilized for automated driving.

From this perspective, “enhancement of capabilities of artificial intelligence (AI) for automated driving” and “efficient expansion of data utilized for automated driving” should be promoted and data strategy for “development of information and communications infrastructure” which is required to realize the former two is shown below.

(Figure 14) Direction of data strategy related to automated driving

1. Development of a driving video database for enhancement of AI for automated driving
2. Organization of information related to dynamic maps so that expansion of data related to automated driving can increase reliability
3. Development of information and communications infrastructure that enables provision of a massive amount of real-time data including dynamic maps

The relationship between capabilities of AI and software for automated driving and expansion of data to be utilized for automated driving is described below.

- In principle, automated driving is possible only with autonomous-type information (with minimum cooperative-type information) if AI/software technologies with humanlike capabilities are developed.
- On the other hand, AI/software technologies for automated driving can be complemented by providing various external information (cooperative type) related to dynamic maps to the vehicle. Note, however, that there are issues shown below.
  - Since information related to dynamic maps is cooperative-type data, reliability will be increased by provision of information. However, it is positioned just as complementary information.
  - In order to make automated driving vehicles using dynamic maps internationally available, international institutions must be developed including international standardization.
  - Dynamic information linked with high-accuracy 3D maps in dynamic maps is provided by information and communications infrastructure separately from high-accuracy 3D maps. So, it depends on the status of development of information and communications infrastructure.
Amid growing interest in artificial intelligence in recent years caused by deep learning, automated driving is generally deemed one of the most important fields for AI application.

Existing automated driving systems are mainly controlled by traditional software excluding some functions such as image recognition and not fully driven by artificial intelligence technologies. However, based on the view that utilization of AI is essential to realize operation of automated driving systems in more complex environments such as urban areas, research toward its utilization is actively pursued and considered to enhance competitiveness of automated driving in the future.

In order to enhance capabilities of AI through machine learning including deep learning, it is necessary to make sure AI learn as many driving scenes as possible. In this light, a massive amount of driving video data will play an important role. In Japan, though such data has been developed to be used for simulations of automated driving technologies (software) on test courses and public roads, the direction of strategies for utilization of such data should be discussed in light of its relationship with a learning database for AI and the status of competition related to utilization of such data in countries overseas, and basic policies for strategic collection and utilization of driving video data should be developed within this fiscal year. Based on the judgment of companies, the purposes for utilizing driving video data shall be clarified in order to develop an appropriate database for utilization of such data and sharing it properly, and then establishment of the operating structure and how to release it shall be considered.

**Table 14** Issues related to the future direction of development of a driving video database (image)

<table>
<thead>
<tr>
<th>Purposes for utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>■ Streamlining of R&amp;D of automated driving by simulation by each company (a stage</td>
</tr>
</tbody>
</table>

---

64 In Japan, technologies to establish a driving video database is designated as a cooperative area (streamlining of development by simulation) and R&D projects related to a driving video database have been implemented as SIP’s “Development and Verification of Technologies to Establish a Driving Video Database” since FY 2014. These projects aim to establish a driving video database that contains 4 million pedestrian cases and over 40,000 scenes (video). Projects are implemented by the Japan Automobile Research Institute (JARI), etc.
prior to field operational tests)

- For safety assessment/tests of automated driving systems by simulation
- For learning by AI of each company (especially in terms of securing of safety)

[Future structure]

- How to utilize and release the database developed so far and the operating structure for the database
- Alignment with efforts by universities and research institutions
- Appropriate method for sharing video data related to safety issues including near misses
- Consideration on a structure to share data held by each company while giving priority to benefits for companies

In addition, driving video is expected to be utilized for updating high-accuracy 3D maps in dynamic maps and applied to fields other than automated driving.

[Commercialization and sophistication of dynamic maps]

Dynamic maps in automated driving are high-accuracy 3D maps linked with time-varying dynamic data (dynamic information, quasi-dynamic information, and quasi-static information). The main purpose of dynamic maps in terms of realization of automated driving is to provide high-accuracy 3D map information as complementary information for self-position estimation and driving route determination.

Since it costs a great deal to establish high-accuracy 3D map information that will serve as the foundation of dynamic maps, a privately-funded infrastructure development company was established in June 2016 and will become a

---

65 Given that it is estimated that it will take tens and sometimes hundreds of years to demonstrate that automated driving systems are safer than human drivers in field operational tests, even with a fleet of 100 vehicles being test-driven 24 hours a day, 365 days a year ("Driving to Safety", Rand Corporation, 2016), safety assessment by simulation may be a way.

66 It has been pointed out that image data obtained from a vehicle camera can be used not only for updating high-accuracy 3D maps but also for visualizing road environments and sharing information with the police, fire department, and hospitals in emergencies (documents from the conference for examination of development of institutions related to IT utilization by the IT Strategic Headquarters, November 2015.)

67 Dynamic Map Platform Co., Ltd. (DMP) was established in June 2016, consisting of 6 companies from the Dynamic Map Development Consortium that have considered specifications of dynamic maps in SIP and automakers. DMP is aimed at considering development, demonstration, and operation of high-accuracy 3D maps (shared platform that is a cooperative area of dynamic maps) that are required to realize automated driving/ driving safety support systems. It sets a goal of becoming a business corporation within 2017. It aims to expand
business corporation within FY 2017 in order to promote public-private collaboration, including collaboration on development of specifications and maps between companies toward the commercialization of automated driving systems on expressways.

In alignment with such efforts by private companies and the measures of each ministry with the SIP project at the center, “development, demonstration, and standardization of dynamic maps”, “development of technologies to deliver and update high-accuracy 3D maps related to dynamic maps”, “sophistication of the method for providing traffic control information”, and “consideration on utilization of dynamic maps in other fields” are being promoted through public-private collaboration in order to promote the commercialization of dynamic maps. Specifications of dynamic maps discussed in SIP are now being internationally standardized such as ISO in order and efforts are being made to ask overseas related standardization organizations to harmonize specifications. It is necessary to strongly promote international standardization of their specifications so that dynamic maps can be used smoothly in Japan and overseas.

In addition, efforts should be made to achieve intersystem coordination and cooperation in light of the fact that the advanced map information infrastructure related to dynamic maps can be utilized not only for automated driving systems but also for pedestrian support and non-traffic related fields such as disaster prevention, tourism, and road management. Specifically, development of an information distribution structure that includes an infrastructure developer that develops high-accuracy 3D maps is being discussed. Via public-private collaboration through SIP projects, such a structure will;

- automatically produce, update, distribute high-accuracy 3D maps required for automated driving
- establish a data distribution platform that enables high-accuracy 3D maps to be used in other fields
- secure interoperability with maps of overseas countries required by promotion of international standardization

dynamic maps not only in the field of automated driving/driving safety support but also in a wide range of fields such as disaster prevention and reduction and social infrastructure maintenance and management.

※In realizing automated driving, high-accuracy 3D maps of roads and their surrounding environments are important for self-position estimation and driving route determination as well as autonomous-type information. However, since it costs a great deal for individual companies to develop such maps, they were positioned as an area that each company should work together on. To this end, DMP was established.
Development of such information distribution structure will be continued based on the results of the discussions.

In light of such circumstances, the demonstration and commercialization of the technologies related to dynamic maps that have been developed will be promoted. Institutional development and international standardization will also continue to be promoted. In addition, ways to utilize data related to automobile-related information held by the public and private sectors for dynamic maps (including development into open data) should be discussed. Specifications and structures of dynamic maps and ways to utilize probe information shall be discussed and put together within FY 2018.

[Table 15] Future direction of utilization of information related to dynamic maps through public-private collaboration (image)

- Consideration on provision of data of automobile-related information held by the public sector (including development into open data)

---

68 The figure shows the image of the structure under consideration and the details may be modified in the future.
Target data should be identified by clarifying the needs of private sectors including clarification of whether the data is required for automated driving (including high-accuracy 3D map information) and whether it is currently difficult for private sectors to obtain such data.
(The following are just examples. Specific discussions will be held.)

- Information on updating of 3D map information such as alterations to roads
- Other data that is required for automated driving and suits private sectors’ needs

Then provision of such data should be considered including clarification of future schedule in light of the current methods for collecting and holding various data in the public sector and an appropriate, efficient information provision structure.

If possible, provision of data other than the above should be promoted and it also should be made open.

- Utilization of automobile-related information held by private sectors (automakers, business operators, etc.) (Probe data, etc.)
- Specifications and structures (cooperative area) for utilization of dynamic maps should be clarified promptly to facilitate establishment of business models in private sectors.
- Then the current methods for collecting and storing various data should be sorted out and efforts should be made through public-private collaboration taking into account the past efforts.
- In addition, the possibility of utilization of driving video data in dynamic maps should be examined.

[Sophistication of information and communications infrastructure]

Connected cars (that are connected to the Internet) are expected to increase rapidly around the world. In terms of functions, many connected cars with functions related to automated driving and safety improvement are expected and various connected services including entertainment are also expected to increase.

Especially in order to realize automated driving, sophistication of information and communications infrastructure is essential since it is expected that a massive amount of real-time data including information related to dynamic maps will need to be transferred to and exchanged with external data platforms such as cloud services via a network such as a mobile network.

[Table 16] Data exchange related to automated driving and connected cars that is supposed to occur (image)

<table>
<thead>
<tr>
<th>Content (examples)</th>
<th>Remarks (Future considerations: example)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote monitoring/operation</td>
<td>・ Transfer of video data and execution of remote operation based on the data ・ Transfer of a massive amount of data and real-timeness (minimum delay) are required.</td>
</tr>
<tr>
<td>Data exchange related to dynamic</td>
<td>・ Update of dynamic maps (OTA) ・ In order to distribute dynamic data related to dynamic maps, it is essential</td>
</tr>
</tbody>
</table>
Realization of the full-fledged service of 5th generation mobile communication systems is expected to be realized in 2020 and discussions are being held to promote their commercialization not only in Japan but also in overseas countries. In the 5G era, 5G systems are expected to be utilized not only in businesses based on traditional terminals such as smart phones but also in new fields such as IoT, automobiles, industrial equipment, and smart meters. In the ITS field (automated driving, connected cars, etc.), serious discussions on the commercialization and popularization of automated driving utilizing a wireless system such as 5G are being held in Japan and abroad.

It is necessary to consider developing information and communications infrastructure including appropriate architectures such as edge computing and full-fledged utilization of 5G systems while considering the amount of data transfer and real-time requirement and the timing of realization. To this end, enhancement of reliability and accuracy of control via a network and R&D and field operational tests of technologies for real-time update of dynamic maps via a network and high-efficiency technologies to distribute information to each vehicle shall be promoted.

In addition, research and demonstration activities toward the realization of leading model systems that utilize LTE and 5G are conducted around the world and private companies are making active efforts not only for utilization of the conventional frequency for ITS but also for utilization of mobile phone networks.

| maps/probe data | • Update of in-vehicle probe data  
• Driving video data for update of high-accuracy 3D maps | to update a massive amount of information in real time.  
• As for the amount of probe data to be uploaded, since it is required in real-time, it may be necessary to collect driving video data for update from a large number of vehicles. |
|---|---|---|
| Data exchange related to AI/driving video data | • Update of AI data (OTA) | • As for OTA updates, legal and technical issues must be discussed depending on their contents.  
• Though it is considered that a massive amount of data needs to be transferred for OTA updates, it is not required in real-time. |
| Other than automated driving (entertainment purposes, etc.) | • Exchange of other data such as video data for entertainment and HMI data | • Same as cell phones. Depending on the usage (ex. video for entertainment), a massive amount of data needs to be transferred. |

(Note) The details must be discussed separately in the future.
(4G/5G) for connected cars. It is necessary to develop information and communications infrastructure including 5G to respond to the needs of automated driving and connected cars based on such international trends.

(ii) Development and utilization of traffic-related data and automobile-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, 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 utilization of data held by the public and private sectors through information linkage, standards, rules, and methods required for shared

---

69 LTE V2X: It is based on LTE, the mobile phone communication, and designed for connected cars (vehicle-vehicle communication, road-vehicle communication, etc.) It was proposed by Qualcomm, Huawei, Ericsson and Nokia at the end of 2015. Initial specifications were developed in September 2016.

5GAA: Audi, BMW, Daimler, and communications equipment and semiconductor makers established 5GAA (5G Automotive Association), the association where they collaborate with each other in developing connected car services utilizing 5G in September 2016. 5GAA and the European Automotive telecom Alliance signed a Memorandum of Understanding in March 2017.

70 Development and utilization of traffic-related data and automobile-related data that are not mentioned in "(i) Data strategy toward the realization of automated driving" above are discussed.

71 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.
use when information is distributed shall be discussed, including the promotion of information distribution by linking high-accuracy 3D maps of dynamic maps mentioned above with various dynamic data.\(^72\)

In addition, when promoting efforts related to information linkage for probe data, it is necessary to pay attention to the trend of international standardization including de facto standards and active involvement in international standardization is required.

[Efforts toward the effective use of automobile-related information]

In light of the expectation that safety and security related to the use of automobiles can be enhanced and new services can be created by leveraging automobile-related information such as information on automobile inspection and registration, checking/maintenance, and driving characteristics, we will work to achieve the four service menus set forth in “the Future Vision related to the Utilization of Automobile-related Information” developed by the Ministry of Land, Infrastructure, Transport and Tourism in January 2015. Specifically, the following will be addressed: the development of a draft of standard specifications for the external fault diagnosis devices for safety-related vehicle equipment; the popularization 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 information on checking and maintenance of the automobile and traveling distance; and the sophistication and streamlining of inspections and maintenance via correlation analysis between checking and maintenance.

**Utilization of big data, including traffic data, for policies**

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

---

\(^72\) Since methods for information linkage and issues related to them and data that should be shared vary greatly depending on purposes of use and so on, it is necessary to clarify the scope of data that needs to be shared based on due consideration of needs of the public and private sectors such as disaster prevention and tourism. By sorting out the current methods for collecting and holding various data related to such fields and taking into account the past efforts related to information linkage, efforts shall be made under cooperation between the public and private sectors including private organizations with knowledge on such information linkage.
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.
(iii) **Response to privacy and security**

[Development of a review system for personal information protection and privacy]

Since data utilization in ITS/automated driving has been expanding, it is necessary to give due consideration to protection of personal information and privacy when using data. In particular, the automobile industry has pointed out that, when utilizing a variety of data in automated driving systems, there are issues to solve, such as securing of consent from individuals on acquisition of their personal location information by the system and how information concerning surrounding vehicles and pedestrians, which is contained in camera data, should be handled.

The revised Act on the Protection of Personal Information, which was amended and promulgated in September 2015 and implemented in May 2017, allows private companies to freely use anonymized information (information that has been processed so that no individual will be identifiable from it). The examples of methods for processing probe data are shown in the report published by the Personal Information Protection Commission in February 2017.

In addition, regarding privacy protection related to camera images, a guide was published in January 2017 in order to promote utilization of camera image based on their characteristics. It summarizes the matters for business operators to consider when they try to protect citizens and their privacy and communicate with them properly.

In view of these, it will be necessary to promote utilization of probe data and driving video data. In doing so, it is crucial not only to consider legal compliance but also to make it clear that the services that utilize personal data will be useful for the individuals who provide their personal data.

**Development of a system related to security**

73. The revised Act on the Protection of Personal Information was promulgated in September 2015. The Personal Information Protection Commission was established based on the act in January 2016. (Fully implemented in May 2017)

74. “Anonymized Information: Toward the Realization of Both the Promotion of Utilization of Personal Data and the Securing of Consumer Confidence” (February 2017: report by the Personal Information Protection Commission)

With future advances in the computerization of automobile control systems, especially advances in automated driving technologies via cooperative systems including mobile-type systems, security risks will be increased and the impact of cyber attacks on road traffic society will become greater. Therefore, interest in automobile security measures including countermeasures against hacking has been growing. In light of the fact that automobile security issues may not only cause damage to owners or drivers of automobiles but also make them victimizers, security measures are an especially serious challenge to tackle.

Under such circumstances, a government agency published the revised version of the Guide for Automobile Information Security Efforts\(^\text{76}\) in March 2017. Moreover, SIP has launched industry-government-academia research and development activities on cyber security. In particular, development methods shall be standardized and minimum security standards shall be set to improve the efficiency of development for the purpose of securing safety. Then, an evaluation environment (testbed) must be developed by FY 2019 and its commercialization shall be promoted. To this end, the schedule for development of on-board security systems must be created within this fiscal year. In addition, appropriate security measures for connected cars shall be discussed from the perspective of information and communications. Consideration should be given to the fact that software updates by OTA (Over the Air) may be effective as one of the prompt security measures for the vehicles that have already been brought to market.

Moreover, it is necessary to establish a system to share information between companies for incident response to strengthen security measures. To this end, a structure for public-private cooperation must be discussed including establishment of Japan’s Auto-ISAC\(^\text{77}\).

\(^{76}\) The 2nd version of “the Guide for Automobile Information Security Efforts: Information Security for Connected Automobiles” by the Information-technology Promotion Agency (March 2017)

\(^{77}\) In the US, the automobile industry (Auto Alliance; Alliance of Automobile Manufacturers) announced the establishment of Auto-ISAC in July 2015 (ISAC: Information Sharing and Analysis Centers: the organization to reduce risks and increase resilience by collecting, analyzing, and sharing information related to security threats.) Then the U.S. Department of Transportation’s NHTSA and 18 automobile companies have agreed on “the Proactive Safety Principles 2016” that are intended to enhance automobile safety including automobile cybersecurity. Supporting and evolving Auto-ISAC is included in the automobile cybersecurity measures specified in the Principles.
(3) Promotion of R&D of automated driving systems and international criteria and standards

(i) Promotion of R&D and demonstration of automated driving systems

[Strategy for R&D and demonstration of automated driving systems toward its commercialization]

In order to realize automated driving systems, it is necessary to promote public-private joint R&D of the tangibles and intangibles related to a wide range of technologies such as sensing technologies, intelligence technologies, drive technologies, communications technologies, data utilization technologies, and security technologies with private companies playing a leading role.

In Japan, based on the Public-Private ITS Initiative/Roadmaps, public-private joint R&D and demonstrations, mainly of individual element technologies, dynamic maps, security, functional safety 78, database establishment technologies, control technologies, research related to human aspects 79, and research related to HMI, as cooperative area technologies that are not part of private companies’ competitive area such as common infrastructure technologies, have been promoted through measures of SIP and each government ministry and agency.

Toward the commercialization of various automated driving systems in 2020, focus should be on the demonstration (verification of technological aspects, institutional aspects, and social benefits) and standardization of each technology while considering the expansion of the R&D areas that are promoted cooperatively by private sectors toward the realization of more advanced automated driving systems. New ideas including demonstration projects not only by major companies but also by venture companies shall be supported 80. In addition, attention should be paid to the fact that technologies need to be

---

78 It is also necessary to consider the requirements for securing safety in case of fail-operational mode (including functional degeneration), performance limit, erroneous operation and misuse as well as functional safety.

79 When performing driver monitoring and considering the acceptable range of second tasks, it is necessary to standardize requirements based on basic and fundamental ergonomic research on drivers’ cognition, behavior, and physiological state and its findings from the perspective of streamlining and acceleration of development and securing of minimum safety.

80 When developing automated driving systems and element technologies, the introduction of a reward-type method that provides a place for competition (contest) for many entities with challenging ideas shall be considered in light of the fact that it is necessary to gather ideas and advanced teams with various capabilities.
detailed for transition from the demonstration stage to the commercialization stage.

Attention should also be paid to the necessity of integrating the efforts of many concerned parties in promoting R&D toward the development of information and communications infrastructure that will serve as a platform for automated driving systems such as 5G and cooperative systems.

[Fundamental research and human resource development for the future automated driving systems]

In the future, technologies required for automated driving systems are going beyond the boundaries of the conventional IT introduction in automobile technologies and becoming more focused on sophisticated and innovative technologies such as artificial intelligence (AI) and the utilization of interdisciplinary fields including ergonomics (HMI, etc.) and security.

In order to put these technologies into practical use, it is essential to collaborate with basic/fundamental research and develop human resources with knowledge on software and AI\(^81\). Therefore, when promoting R&D and demonstration activities for automatic driving systems, capabilities of universities, in addition to existing research institutions, shall be actively leveraged and industry-government-academia collaboration systems shall be established in Japan\(^82\).

In doing so, efforts shall be made to make these institutions the core centers that are open to the world from the perspective of promotion of the utilization of overseas human resources and the participation of overseas companies. Through these systems, efforts shall also be made to build ecosystems that will create new ventures and industries.

(ii) Development of criteria and standards, promotion of international

---

\(^{81}\)In order to secure human resources with knowledge on software required for the development of automated driving, while sorting out the abilities required for the development, a system for cultivation of human resources who are familiar with simulations and those who can develop innovative on-board software shall be established within FY 2017. Efforts to develop security human resources shall be accelerated under industry-government-academia cooperation.

\(^{82}\) A system for R&D of artificial intelligence (AI) has been developed under cooperation between the Ministry of Education, Culture, Sports, Science, and Technology (Riken), the Ministry of Economy, Trade and Industry (AIST), and the Ministry of Internal Affairs and Communications (NICT) since 2016. Discussions shall be promoted with a view to collaborating with such a system where necessary.

In addition, as for HMI, AIST established the Automotive Human Factors Research Center in April 2015 to study the attributes of humans as drivers toward the realization of safe, fun driving.
collaboration and exercise of international leadership

[Strategic efforts toward the development of international criteria and standards]

In order for Japan’s automobile industry to lead the world and actively contribute to resolving social issues including the reduction of traffic accidents, it is important to build a system that strategically responds to the efforts to develop international rules (criteria and standards) which will serve as a foundation for the promotion of efforts in the cooperative area.

For the examination of international standards for automated driving, the Subcommittee on Automated Driving was established in the UN World Forum for Harmonization of Vehicle Regulations (WP 29) in November 2014 and the Expert Council on Automatic Steering where technology standards for automatic steering are examined was established in March 2015. Japan co-chairs the subcommittee with the UK and the council with Germany. With a plan to discuss the issues including fully automated driving systems in the future, WP 29 will continue leading international discussions in the field of automated driving.

For the efforts for the establishment of international standards for automated driving, Japan is in position to lead the discussion as some of important TCs are headed by Japanese chairpersons. 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 significantly increased in recent years. In order to respond to this trend, it is necessary to continue examining measures to strengthen a mechanism to secure resources such as experts involved in the implementation of standardization activities. Important subjects for standardization include maps, communications, ergonomics, functional safety, security, and recognition technologies.

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

---

83 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, a Japanese person was elected as a convener (equivalent of a chairperson) for WG3 (ITS Database technology) where map information is handled and for WG14 (Vehicle/Roadway warning and control systems) where automobile driving control is addressed.
standards. Therefore, the Automated Driving Standardization Research Institute\textsuperscript{84} was established in May 2016 as a place for strategic discussions to bridge the gap between criteria and standards. Japan continues developing strategies that allow it to lead international activities in accordance with its future vision of automated driving.

The UN is discussing the development of international standards related to “technologies for transition to a minimal risk condition” that are not only essential for automated driving but also indispensable for “sophisticated driving safety systems (tentative name)” and Japan will continue playing a leading role in such discussions.

In addition, it is essential to utilize radio waves and secure safety of information and communication networks in order to achieve/upgrade the automated driving and connected cars. ITU\textsuperscript{85} has agreed to include “global or regional harmonization of frequency bands for ITS” as an agenda item for 2019 World Radiocommunication Conference. Japan shall play a leading role in such discussion toward global harmonization of frequency bands for ITS including automated driving.

[Promotion of international collaboration and exercise of 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.

To this 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 terms related to automated driving system, functions, component technologies, 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 an effort to display

\textsuperscript{84} The Institute was established in the Japan Automobile Standards Internationalization Center (JASIC). The director of National Traffic Safety and Environment Laboratory, National Agency for Automobile and Land Transport Technology, serves as director of the Institute.

\textsuperscript{85} ITU (International Telecommunication Union) is an international organization that determines frequency allocation and develops international standards and recommendations related to communications. ITU-R (ITU Radiocommunication Sector) has agreed to include “global or regional harmonization of frequency bands for ITS” as an agenda item for 2019 World Radiocommunication Conference (WRC-19).
international leadership, the SIP Automated Driving Systems holds an international conference on automated driving in Japan every year. Especially for the large-scale field operational tests to be conducted in 2017, Japan actively invites overseas companies to participate.

In addition, as interest in automated driving has been growing around the world in recent years and a high level of international collaboration has been promoted, Japan shall actively respond to such a trend. Specifically, in the G7 Transport Ministers’ Meeting held in Nagano (Karuizawa) in September 2016, the Ministers agreed to promote private investment and strengthen efforts for the development of safe, internationally harmonized, future-oriented regulations. Based on the results of the meeting, G7 countries will reinforce their cooperation. In addition, as part of its efforts for bilateral cooperation, Japan has issued a high-level Joint Declaration of Intent related to automated driving with Germany. Japan shall make efforts based on this statement and consider cooperating with other countries and regions from a strategic perspective on an as-needed basis.

---

86 In January 2017, the Minister of State for Science and Technology Policy Yosuke Tsuruho signed “Joint Declaration of Intent of Japanese-German Cooperation on the Promotion of Research and Development on Automated Driving Technologies” with the Federal Minister of Education and Research of Germany. The Declaration states that both countries should work together to promote R&D of automated driving technologies.

In March 2017, the Minister of Economy, Trade and Industry Hiroshige Seko and the Minister of Internal Affairs and Communications Sanae Takaichi signed “Joint Statement on Cooperation between METI and BMWi regarding the Internet of Things (IoT)/ Industrie 4.0(Hannover Declaration)” with the Federal Minister of Economic Affairs and Energy of Germany. The Statement states that both countries will discuss policies on the issues related to the automobile industry including automated driving and connected cars.
6. Roadmaps

Based on the descriptions in chapters 2 to 5, roadmaps are attached that show the issues regarding the efforts for the social implementation of highly automated driving systems (private vehicles, logistics services, and transport services) and the promotion of innovation to be addressed by both the public and private sectors and the timeline. The roadmaps were developed in tandem with the reviews made in SIP Automated Driving Systems and are consistent with the research and development plan developed in the SIP program. In addition, the timeline submitted to the 5th Growth Strategy Council-Investing for the Future held in February 16, 2017 is also reflected.

The public and private sectors shall share the roadmaps and the goals shown in them, clearly define the roles and responsibilities of each sector, and address measures and policies through discussions and mutual collaboration to promote these roadmaps.
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 2017 through the public-private collaboration, and the joint meeting between the SIP Automated Driving Systems Promotion Committee and the Road Traffic Working Team will be held twice a year as part of the public-private collaboration promotion system to promote the ITS/Automated Driving 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 addition, in order to consider developing “the outline of institutional development by the whole government toward the realization of highly automated driving systems” as written in Roadmaps, an expert conference shall be established under IT Headquarters. The conference shall hold discussions on the development of a draft of the outline and the draft shall be compiled in the end of FY 2017. The expert conference shall be composed of technical and legal experts. The conference shall not only report the previous efforts by related ministries and agencies but also have experts make presentations and conduct interviews with interested parties.

Through examination under the public-private collaboration promotion system, the details of the Public-Private ITS Initiative/Roadmaps 2017 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/Roadmap 2017 (Roadmap overview)

#### Fiscal year

<table>
<thead>
<tr>
<th>Short term</th>
<th>Medium term</th>
<th>Long term</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>2020</td>
<td>2026-2030</td>
</tr>
<tr>
<td>2018</td>
<td>2021</td>
<td>2023-2025</td>
</tr>
<tr>
<td>2019</td>
<td>2022</td>
<td>2026-2030</td>
</tr>
</tbody>
</table>

#### Initiatives pertaining to commercialization

**Private motor vehicles**
- Advanced safe driving support systems (provisionally named)
- Automated driving on general roads
  - SAE level 2
- Automated driving on expressways
  - Semi-autopilot (SAE level 2)
  - Autopilot (SAE level 3)
  - Fully automated driving (SAE level 4)

**Distribution services**
- Truck platooning (SAE level 2 and above)
- Fully automated driving trucks (SAE level 4)
- Unmanned automated driving-based delivery services in limited areas (SAE level 4)

**Mobility services**
- Level 4 unmanned automated driving-based mobility services in limited areas (SAE level 4)
- Next-generation urban traffic system (ART)
- Develop systems and increasing social receptivity
  - Outline for developing systems to achieve highly automated driving
  - Social receptivity, collaborative systems
- Data strategy and the application and utilization of traffic data
- Data strategy pertaining to automated driving
- Application and utilization of traffic-related data
- Privacy, security
- Promoting R&D, demonstration testing, and international standards and benchmarks
  - Promoting R&D and demonstration testing
  - International benchmarks, standards, and leadership

#### Initiatives pertaining to the promotion of innovation

- Develop for commercialization
  - Large-scale Field Operational Test
  - Conduct demonstration testing for each type of unmanned automatic traveling function
  - Develop for service launch
  - Study system policies
  - Promote society-wide collaborative systems and ITS on a local basis
  - Investigate social receptivity and develop systems for popularization
  - Promote on a trial basis, evaluate, and standardize dynamic maps progressively expand development areas
  - Develop data
  - Develop systems and study the promotion of collaboration among industry, academia, and the government on matters of privacy and security
  - Conduct studies on the expansion of collaborative domains and promote demonstration testing for implementation
  - International leadership pertaining to benchmarks and standards

#### Initiatives pertaining to the promotion of innovation

- Develop for commercialization
  - Commercialize advanced safe driving support systems (provisionally named)
  - Commercialize automated driving on general roads (L2)
  - Commercialize semi-autopilot functionality (L2)
  - Commercialize fully automated driving on expressways (L4)

- Develop market and further upgrade
  - Achieve platooning trucks on expressways (L2 and above)
  - Achieve L4 unmanned automated driving (L4)
  - Achieve fully automated driving on expressways (L4)
  - Achieve unmanned automated driving-based delivery services in limited areas (L4)

- World’s safest and smoothest road traffic society

*Red: Items inclusive of SIP-related R&D*
Roadmap pertaining to automated driving systems (i) : private automated driving vehicles (1)

<table>
<thead>
<tr>
<th>Fiscal year</th>
<th>Short term</th>
<th>Medium term</th>
<th>Long term</th>
</tr>
</thead>
</table>

**Private motor vehicles**
- Automated driving on expressways
  - Semi-autopilot (SAE level 2)
  - Autopilot (SAE level 3)
  - Fully automated driving (SAE level 4)
- Automated driving on general roads (SAE level 2)
- Advanced safe driving support system (provisionally named)
- Safe driving support vehicle

**Private sector**
- Promote R&D and implementation:
  - Formulate system development policy (outline)
  - Detailed study of systems, required system revisions
- Promote R&D and commercialization:
  - Promote public awareness of safe driving support vehicles (Support Car S, Support Car)

**Public-private**
- Large-scale field operational test on expressways
- System-focused investigative studies
- Detailed study of systems, required system revisions

**Public-private (incl. SIP)**
- Commercialize semi-autopilot functionality (L2)
- Commercialize autonomous driving on expressways (L3)
- Commercialize fully automated driving on expressways (L4)
- Commercialize autonomous driving on general roads (L2)
- Commercialize semi-autopilot functionality (L2)
- Commercialize advanced safe driving support systems (provisionally named)

**Relevant ministries**
- Promote public awareness of safe driving support vehicles (Support Car S, Support Car)

**Private sector**
- Develop market
- Develop market and further upgrade
- Develop market
- Develop market

**World’s most advanced ITS**
- World’s safest and smoothest road traffic society

**World’s safest and smoothest road traffic society**
- Significantly reduce traffic accidents, ease congestion, streamline traffic for distribution, support mobility for the elderly and others

**Commercialization of remote automated driving systems and commercialization corresponding to SAE level 3 or higher are premised on conformity to the Convention on Road Traffic.**

2: Set as timing for nonbinding targets to be fulfilled by the government in order to facilitate commercialization by private-sector companies.
### Roadmap pertaining to automated driving systems (ii): private automated driving vehicles (2)

<table>
<thead>
<tr>
<th>Fiscal year</th>
<th>Short term</th>
<th>Medium term</th>
<th>Long term</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fiscal year</strong></td>
<td><strong>2017</strong></td>
<td><strong>2018</strong></td>
<td><strong>2019</strong></td>
</tr>
<tr>
<td><strong>Promote the popularization of safe driving support systems</strong> (continued)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Safe driving support system (DSSS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- ETC2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Measures to prevent driving in the wrong direction on expressways</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Systems for dealing with driver incapacitation and other initiatives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>World’s safest road traffic society</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Promote the popularization of safe driving support systems</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Emergency calling system and accident data reporting system (ACN)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Drive recorder, event data recorder</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Technologies for communications between pedestrians and motor vehicles to reduce accidents involving pedestrians</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MLIT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiatives to achieve smooth, safe, secure road traffic based on the use of ITS technologies; expand the use of ETC and other ITS technologies for private-sector parking lots and other non-expressway facilities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MLIT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For measures to prevent driving in the wrong direction on expressways, more effective measures – including rapid detection of vehicles being driving in the wrong direction, road and in-vehicle warnings, and the use of automated driving technologies – shall be studied through a collaboration among industry, government, and academia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MLIT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduct studies on the expansion and fortification of security benchmarks concerning commercialized highly advanced safety technologies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MLIT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluate vehicles with onboard advanced safety technologies through motor vehicle assessments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluate collision damage reduction brakes (for collisions with other vehicles and collisions with pedestrians)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MLIT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formulate a technical policy for shoulder stoppage-type systems to deal with driver incapacitation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MLIT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ascertain accident conditions and analyze information using drive recorders and event data recorders</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NPA, MIC, MLIT/IP (IP)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop and conduct demonstration testing of systems utilizing infrastructural radar and wireless communications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NPA, MIC (IP)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop and conduct demonstration testing of systems utilizing communications between pedestrians and motor vehicles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NPA, MIC (IP)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop and conduct demonstration testing of mobility support systems for traffic-limited persons and pedestrians</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Public-private</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promote the popularization of an emergency reporting system and system for the automatic reporting of accidents (ACN)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NPA, MIC, MLIT/IP</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop and conduct demonstration testing of systems utilizing communications between pedestrians and motor vehicles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Private sector</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop sensors and terminals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Private sector</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop market</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2 Measures pertaining to safe driving support and automated driving systems.
3 Requirements for infrastructural radar to be studied under the budget for FY2014.

Significantly reduce traffic accidents, ease congestion, streamline traffic for distribution, support mobility for the elderly and others.
### Roadmap pertaining to automated driving systems (iii): distribution services

<table>
<thead>
<tr>
<th>Fiscal year</th>
<th>Short term</th>
<th>Medium term</th>
<th>Long term</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2023 ~ 25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2026 ~ 30</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Truck platooning (SAE level 2 and above)

- **Distribution services**
  - **[METI, MLIT]** Develop technologies to enable truck platooning systems (where trucks follow one another, including with respect to brakes and electronic traction)
  - **[METI, MLIT]** Conduct demonstration testing of platooning systems (where trucks follow one another) on test courses
  - **[METI, MLIT]** Study issues in real-world settings
  - **[Private sector]** Vehicle design for mass production and adoption of mass production
  - **[Public-private]** Conduct unmanned field operational test of trucks following one another on expressways (Shin-Tōmei) (L2 and above)
  - **[MLIT]** Develop project environments for infrastructure where necessary

- **Fully automated driving trucks (SAE level 4)**
  - **[Public-private]** Conduct investigative studies of systemic issues
  - **[Relevant ministries]** Detailed study of systems, necessary systemic revisions, and more

- **Unmanned automated driving-based delivery services in limited areas (SAE level 4)**
  - **[Private sector]** Develop services
  - **[Private sector]** Apply technologies relating to private automated driving vehicles (fully automated driving)
  - **[Private sector]** Achieve unmanned automated driving-based delivery services in limited areas (L4)

### World's safest and smoothest road traffic society

- **Roadmap**
  - **Significantly reduce traffic accidents, ease congestion, streamline traffic for distribution, support mobility for the elderly and others**

---

*Set as timing for nonbinding targets to be fulfilled by the government in order to facilitate commercialization by private-sector companies.*

Commercialization of remote automated driving systems and commercialization corresponding to SAE level 3 or higher are premised on conformity to the Convention on Road Traffic.
### Roadmap pertaining to automated driving systems (iv): Mobility services

<table>
<thead>
<tr>
<th>Fiscal year</th>
<th>Short term</th>
<th>Medium term</th>
<th>Long term</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2023 ~ 25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2026 ~ 30</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Mobility services

- **Unmanned automated driving-based mobility services inclusive of L4 in limited areas (SAE level 4 and more):**
  - Remote automatic travelling systems
  - Last-mile automatic travelling (dedicated space)
  - Roadside stations in intermediate and mountainous areas

- **Next-generation urban traffic system (ART):**
  - Conduct large-scale field operational test
  - Develop next-generation public road traffic systems
  - Develop support systems for traffic-limited persons and walking

- **Automated valet parking:**
  - Develop remote functions for operations and control vehicles and conduct demonstration testing on test courses
  - Develop remote operating vehicles and subject them to demonstration testing on test courses
  - Study and prepare service-provision methods
  - Define requirements for dedicated space, crystallize traveling methods, carry out demonstrations
  - Roadside stations: Conduct demonstration testing in local areas
  - Clarify requirements for freight transport by passenger vehicles, conduct trials, and undertake studies based on the results of trials
  - Make preparations to transmit signal information
  - Conduct demonstration testing in Île-de-France and elsewhere
  - Conduct investigative studies on systematic matters
  - Conduct large-scale field operational test
  - Develop next-generation public road traffic systems
  - Develop support systems for traffic-limited persons and walking

#### World’s safest and smoothest road traffic society

**Achieve unmanned automated driving-based mobility services in limited areas (inclusive of L4):**

- **Private sector**
  - Develop remote functions for operations and control vehicles and conduct demonstration testing on test courses
  - Develop remote operating vehicles and subject them to demonstration testing on test courses

**World’s most advanced ITS:**

- **Private sector**
  - Conduct demonstration testing in model areas and verify social receptivity

**Significantly reduce traffic accidents, ease congestion, streamline traffic for distribution, support mobility for the elderly and others**

---

**Notes:**

1. Studies to be undertaken from systemic and infrastructural perspectives will be separately required.

※: Set as timing for nonbinding targets to be fulfilled by the government in order to facilitate commercialization by private-sector companies. Commercialization of remote automated driving systems and commercialization corresponding to SAE level 3 or higher are premised on conformity to the Convention on Road Traffic.
### Fiscal Year Roadmap:

#### Short Term
- **2017**
  - Develop systems with a view to achieving highly automated driving systems
  - Social receptivity and developing collaborative systems
    - Analyze social and industrial aspects
    - Techniques for estimating effects in terms of reduced traffic accident fatalities
    - Visualization of volume of CO2 emissions
  - Collaborative systems for society in general and local areas

**2018**
- [NIPA, MOFA] Sort out conformity to the Convention on Road Traffic (Geneva Convention)
- [Relevant ministries and agencies] Study policy on systems
- [Cabinet Office Bureau to Promote Local Revitalization] Fundamental review of ex ante regulations in special national strategic zones (regulatory sandboxes)

**2019**
- [Public-private collaborations] Increase social receptivity
- [Cabinet Office (SIP)] Investigate with respect to analyses of social and industrial aspects with a view to upgrading, popularizing, and deploying automated driving
- [Cabinet Office, METI (SIP)] Investigate and engage in development work with respect to techniques for estimating and simulating reductions in traffic accident fatalities
- [METI (SIP)] Study techniques for evaluating effects in terms of reductions in the volume CO2 emissions

**2020**
- [Public-private collaborations] Promote collaborative systems for society in general and ITS on a local level

#### Medium Term
- **2021**
- **2022**
- **2023 ~ 25**
- **2026 ~ 30**

#### Long Term
- **World’s safest road traffic society**
- **World’s safest and smoothest road traffic society**

### Significantly reduce traffic accidents, ease congestion, streamline traffic for distribution, support mobility for the elderly and others
Roadmap pertaining to the promotion of innovation (ii) Data strategy pertaining to automated driving and applying and utilizing traffic data

<table>
<thead>
<tr>
<th>Fiscal year</th>
<th>Short term</th>
<th>Medium term</th>
<th>Long term</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td></td>
<td></td>
<td>2020</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Private sector</td>
<td>Disclose and operate (driving footage and other sensing data)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Private sector</td>
<td>Disclose and operate (accident data)</td>
</tr>
<tr>
<td>2018</td>
<td></td>
<td>Private sector</td>
<td>Disclose and operate (driving footage and other sensing data)</td>
</tr>
<tr>
<td>2019</td>
<td></td>
<td>Private sector</td>
<td>Disclose and operate (accident data)</td>
</tr>
</tbody>
</table>

**Medium term**

2020
Develop initiatives for the smart use of roads through the integrated use of a wide range of traffic data and technologies to improve safety and efficiency.

2021
Produce on a trial basis, evaluate, develop, and implement demonstrating functionality.

2022
Expand areas covered by dynamic maps and update maps.

**Long term**

2019
Data strategy pertaining to automated driving and applying and utilizing traffic data.

2021
Develop systems, engage in R&D, and conduct demonstration testing pertaining to security.

2022
Introduce new services for automated driving.

2023
Expand areas covered by dynamic maps and update maps.

2024
Further popularize and upgrade.

2025
Sequentially utilize some useable data to support safe driving and automated driving.

---

2. Measures pertaining to safe driving support and automated driving systems and the application and use of traffic-related data.
### Roadmap pertaining to the promotion of innovation (iii) Research and development concerning automated driving systems and promoting international benchmarks and standards

<table>
<thead>
<tr>
<th>Fiscal year</th>
<th>Short term</th>
<th>Medium term</th>
<th>Long term</th>
</tr>
</thead>
</table>

#### R&D and demonstration testing pertaining to automated driving systems

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>[Public-private collaborations]</strong> Establish a system of public-private collaborations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>[Public-private collaborations]</strong> Promote various types of demonstration testing on public roads</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>[METI]</strong> Establish evaluation techniques at automated driving evaluation sites</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>[Cabinet Office, relevant ministries and agencies (SIP1)]</strong> R&amp;D and demonstration testing by the SIP1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>[Cabinet Office (SIP1)]</strong> Issue guidelines based on the collection of data pertaining to human factors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>[NPA(SIP1)]</strong> Upgrade signaling systems2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>[NPA(SIP1)]</strong> Develop and conduct demonstration testing on systems based on the use of communications between the road and the car2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>[Private sector]</strong> Develop terminals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>[NPA]</strong> Sequentially introduce intersection priority passage systems for emergency vehicles and route buses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>[NPA]</strong> Deploy infrastructure at key intersections nationwide</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Initiatives concerning benchmarks and standards

<table>
<thead>
<tr>
<th>Initiatives</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023 ~ 25</th>
<th>2026 ~ 30</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>[NPA, MIC, METI, MLIT]</strong> Promote the adoption of international benchmarks and standards pertaining to automated driving</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>[Cabinet Office (SIP1)]</strong> Hold international conferences</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Demonstrate international leadership

<table>
<thead>
<tr>
<th>Initiatives</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023 ~ 25</th>
<th>2026 ~ 30</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2 Measures pertaining to safe driving support and automated driving systems.