Public-Private ITS Initiative/Roadmaps 2015

- Strategies on Automated Driving Systems and the Utilization of Road Transport Data to Build a Society with the World's Safest and Smoothest Road Transport -

June 30, 2015
The Strategic Headquarters for the Promotion of an Advanced Information and Telecommunications Network Society
(IT Strategic Headquarters)

Outline of Public-Private ITS Initiative/Roadmaps 2015

Data from the 68th Session of IT Strategic Headquarters Dated June 30, 2015

- **ITS including automated driving is in the midst of a large shift in innovation; the competitive environment is changing by the minute.**
- **In order to promote our national ITS strategies in light of the most recent status, we will revise the Public-Private ITS Initiative/Roadmaps* developed last year, and continuously aim to build the world's most advanced ITS and to become the major player in innovation related to Automated Driving Systems.**

*: The Roadmaps are revised based on the specific description found in the June 30, 2015, document: "we will review (once a year as a rule) what needs to be addressed from the next fiscal year onward through the PDCA cycle, and modify the roadmaps as necessary."

<Changes in the Environment Surrounding ITS>

Intensifying Competition in the Development of Automated Driving Systems>

- ✓ One global company after another (including IT and venture businesses) have announced ambitious plans for developing Automated Driving Systems.
- ✓ Their action is in line with the global systemic revision (e.g. the Geneva Convention).

=>Need to clarify what kind of Automated Driving Systems Japan should aim at
=>Need to work on, for example, promoting the implementation inside Japan in response to international trends

Advances in Technology (e.g. application of IoT and AI)

- ✓ Changes in the structure of data distribution with increased application of IoT
- ✓ Heightened importance in IT and data in terms of Automated Driving Systems (e.g. application of AI and map information infrastructure)
- ✓ Response to cyber security

=>Need of strategies related to the Utilization of Road Transport Data
=>Need of technological strategies in light of advances in technology

<Key Points in Public-Private ITS Initiative/Roadmaps 2015 (Major Revisions and Additions)>

<Strategies for Automated Driving Systems>

✓ Clarifying concrete images with the aim of development and popularization in the immediate future

・We will develop separate strategies for popularization and technology. (Shown below are examples.)

(1) Automated Driving Systems that contribute to increased competitiveness in the global market
(2) Regional public transportation systems with Automated driving capabilities
(3) Small-sized Automated Driving Systems for regional communities

Note: Expected time of commercialization to be considered for review in the future

✓ Technological strategies in light of advances in technology

・Promoting and managing national R&D programs (e.g. SIP)
・Cooperating among government, industry, and academia, and securing human resources with the application of AI in mind, examining award-type methodologies, etc.
・Responding to cyber security

✓ Additional Efforts in Terms of Institutions and Social Receptivity

・Responding to international conventions, studying HMI, and strengthening social receptivity

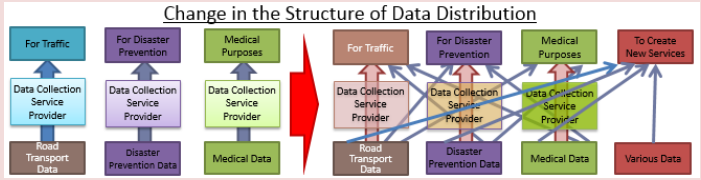
<Strategies for the Utilization of Road Transport Data>

Note: To be Completely Rewritten

✓ Changes in the structure of data distribution and basic policies

・Preparing for standards and rules and examining the possibility of making them open

Change in the Structure of Data Distribution



✓ Specific efforts made in the immediate future

(1) Overlaying data on maps and making it more advanced
- R&D for map information infrastructure (dynamic maps)

(2) Enabling the sharing and utilization of automobile-related and other data
- Promoting public-private collaboration in information related to, for example, probe data
- Using automobile-related information

(3) Use of big data in various policies
- Solving various problems including the vitalization of local economy

<Cross-Sectional Efforts to Prepare for the World's Most Advanced ITS>

International Collaboration and Leadership

- ✓ Examining international core sites and social demonstration projects
- ✓ Disseminating information to the world

Toward the Tokyo Olympic and Paralympic Games

- ✓ Developing and implementing the next-generation urban traffic system (ART: Advanced Rapid Transit)
- ✓ Other efforts based on Reform 2020

Regional Efforts and Civic Participation

- ✓ Promoting efforts related to near-future technological demonstration experiments in National Strategic Special Zones
- ✓ Preparing an environment for active and safe demonstration experiments on public roads

Table of Contents

1. Introduction and Definitions

(1) Introduction

(2) Definitions of Safety Driving Support Systems and Automated Driving Systems

(1) Introduction

- "The Public/Private ITS Initiative and Roadmaps 2015" have been created by revising the Public-Private ITS Initiative/Roadmaps (decided by the IT Strategic Headquarters in June 2014) in light of the recently changing situation surrounding ITS.
- Intelligent Transport Systems (ITS) have contributed to the improved safety and convenience of road transport.
- In recent years, we have gone through striking innovation in ITS, particularly Automated Driving Systems. We are entering the competitive age for practical application and popularization of Automated Driving Systems on a global scale.
- Since 2014, the Japanese government has facilitated R&D efforts made through public-private partnerships under the Cross-ministerial Strategic Innovation Promotion Program (SIP) for Automated Driving Systems.
- We also expect that new next-generation services will be provided, operations become more efficient, and new industries created through the use of a large variety of data (big data).
- The initiative is intended to ride a wave of striking innovation with the aim of building and maintaining the world's best ITS and contributing to Japan and the rest of the world.
- Last year, we offered the direction to which the private sector and related ministries and agencies should go together as well as specific roadmaps focusing on two areas: (1) Safety Driving Support Systems and Automated Driving Systems and (2) the utilization of Road Transport Data.
- The Public-Private ITS Initiative/Roadmaps 2015 were created in light of the rapid changes in technology and industry surrounding ITS including Automated Driving Systems.
- Based on the Initiative/Roadmaps 2015, both the public and private sectors are expected to work closely to achieve the goals of cutting down on traffic fatalities to 2,500 or lower by around 2018 and realizing a society with the world's safest road transport by 2020.

(2) Definitions of Safety Driving Support Systems and Automated Driving Systems

- Methods of driving support are classified into Informational and Automated. Automated systems are then grouped into four levels.
- As a rule, drivers take ultimate responsibility* under the systems up to semi-Automated Driving Systems. The system (anything but the driver) has final responsibility under fully Automated Driving Systems.
- Fully Automated Driving Systems are different from the conventional concept of automobiles. We need to examine how society should be if cars drive down a road with no one inside, and discuss the institutional aspect as necessary.

Note: Depending on specific circumstances, the system (anything but the driver) will be responsible even under semi-Automated Driving Systems unless it requests driver intervention and if it is deemed unnecessary for drivers to watch out for surrounding traffic situations or to operate the automobile.

[Definitions of Safety Driving Support Systems and Automated Driving Systems]

Categories		Outline	Systems that Realize What is Stated in the Left	
Informational		Alerting drivers	Driving Safety Support Systems	
Automated	Level 1: Stand-alone	Any of the acceleration, steering, or control operations is done by the system.		
	Level 2: Compounding of systems	More than one of the acceleration, steering, and control operations is done by the system at the same time.	Semi-Automated Driving Systems	Automated Driving Systems
	Level 3: Advancement of systems	All of the acceleration, steering, and control operations are done by the system. Drivers only act on the request of the system.		
	Level 4: Fully automated driving	All of the acceleration, steering, and control operations are done by everything other than drivers. Drivers have no involvement at all.	Fully Automated Driving Systems	

Note 1: At any level, drivers can intervene the control by the system.
Note 2: The term “system(s)” herein is defined in contraposition to the term “driver(s).” It means not only the automobile as a stand-alone but also any peripheral system(s) involved in the control of the automobile. At Level 4, for example, drivers may suspend the operation of the system with the System Suspend or other buttons.

2. Future Direction of the Progress of ITS

- The basic structure of driving automobiles (e.g. petrol-driven, human drivers) has remained the same since they were invented.
- Along with the advancement of IT and networking as well as motorization in the future, we expect that there will be discontinuous and disruptive change and innovation.
- We will see a rapidly growing interest in Automated Driving Systems both inside and outside Japan.
- The utilization of big data raises expectation for the creation of new services and industries.

[Future Changes in the Structure of Automobiles]

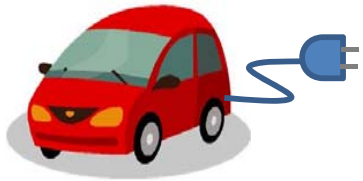
Conventional Cars

Petrol-driven

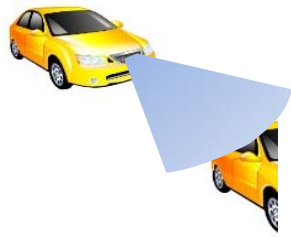
Driven by drivers

Future Direction of Automobiles

Hybrid cars
Electric vehicles



Automated driving cars



3. Relationship Between Safety Driving Support Systems/Automated Driving Systems and the Structure for the Use of Road Transport Data

3. Relationship Between Safety Driving Support Systems /Automated Driving Systems and the Structure for the Utilization of Road Transport Data

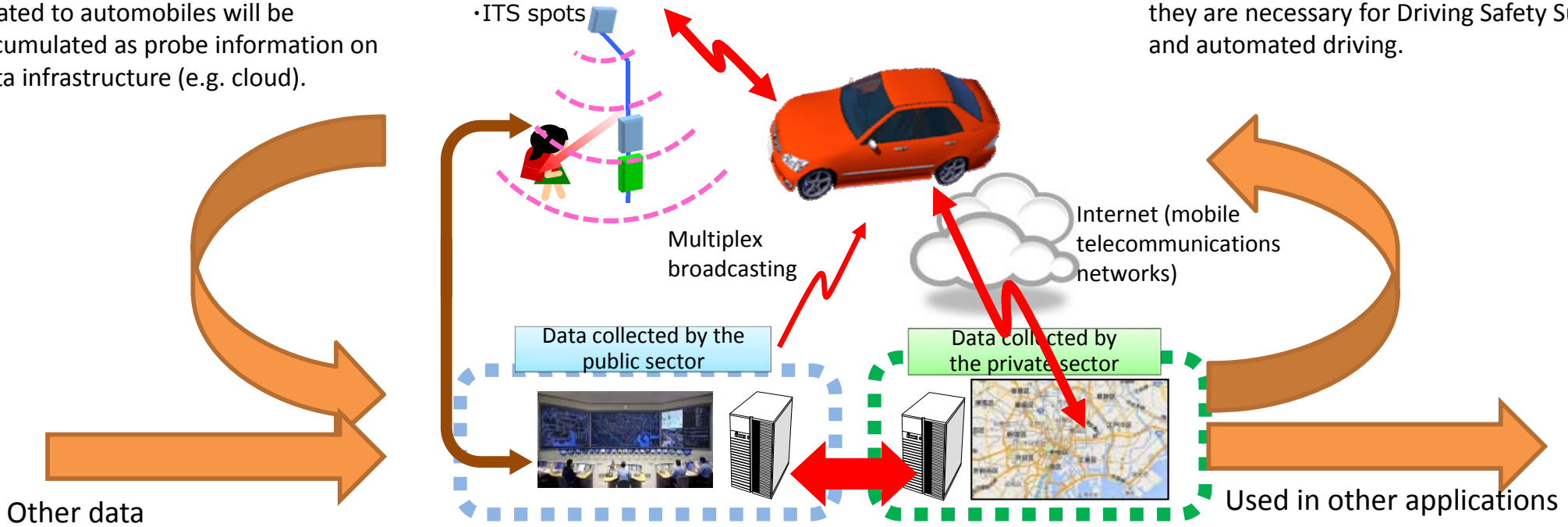
- Safety Driving Support Systems and Road Transport Data contribute to both the safety and facilitation of traffic.
- Use of Road Transport Data is projected to increase as Automated driving cars gain popularity.
- The data infrastructure is assumed to become the core of the knowledge base (AI) of Automated Driving Systems.

Focusing on (1) Driving Safety Support and Automated Driving Systems and (2) the Uitlization of Road Transport Data

[Relationship between Automobiles and the Structure for the Use of Road Transport Data]

As IT and networking progress in the area of automobiles, various information related to automobiles will be accumulated as probe information on data infrastructure (e.g. cloud).

Information accumulated on data infrastructure (e.g. cloud) will be utilized as they are necessary for Driving Safety Support and automated driving.



4. Society and Industry Goal by Japan Through ITS

Image of Society that the Public and Private Sectors should Attain

- Looking further into the coming 10 to 20 years, we have added the following goals in terms of both industry and society, given the prospect of a major change in innovation in ITS, mainly in Automated Driving Systems:
  - Social aspect: Building a society with the world's safest road transport by 2020; building and maintaining a society with the world's safest and smoothest road transport by 2030 by developing and popularizing Automated Driving Systems and preparing data infrastructure subsequently.
  - Industrial aspect: Becoming the major player in innovation related to Automated Mobility Systems (including the preparation of data infrastructure) from 2020 onward.
- To attain a society as stated above, we will strategically exploit opportunities offered by the 2020 Tokyo Olympic and Paralympic Games.

Concrete Images of a Society with the World's Safest and Smoothest Road Transport

- Automated Driving Systems to be popularized will ensure driving safety that exceeds the level of experienced drivers. If such Automated Driving Systems with this level of capability become popular, the society we live in would be almost free from traffic accidents.
- Individual Automated Driving Systems would decide on the most suitable route and set speed patterns and other parameters with the understanding of the status of traffic congestion in the surrounding and broader areas. As a whole, there would be a flow of optimum road transport where traffic congestion has been significantly reduced.
- Although they have a driver's license, some people, including the elderly, are unable to drive safely. Such people would take advantage of Automated Driving Systems so that they can go out easily with younger people and be part of society.

4. Society and Industry Goal by Japan through ITS Part 2

Setting Social and Industrial Goals

- Setting indicators and implement various measures to become the nation with the world's best ITS.

[Society and Indicators for Achieving Important Goals Targeted for the Initiative]

New Goals to be Set in the Public-Private ITS Initiative/Roadmaps

[Social Aspect]

The goal up until 2020 (Current indicator)

Building a society with the world's safest* road transport by 2020

・Indicator related to reduction in traffic accidents: Cutting down on traffic fatalities to 2,500 or lower by around 2018

Popularization of Driving Safety Support Systems

The goal up until 2030

Building a society with the world's safest* and smoothest road transport by 2030

・Indicator in relation to reducing traffic accidents
・Indicator in relation to easing traffic congestion
・Indicator in relation to supporting the mobility of the elderly

Popularization of Automated Driving Systems

Social Indicators

[Industrial Aspect]

Becoming the major player in innovation related to Automated Driving Systems from 2020 onward

・Penetration rate of Automated Driving Systems
・Indicator in relation to the production and export of vehicles
・Indicator in relation to the export of infrastructure

R&D, demonstration, practical applications, preparation of data

Industrial Indicators

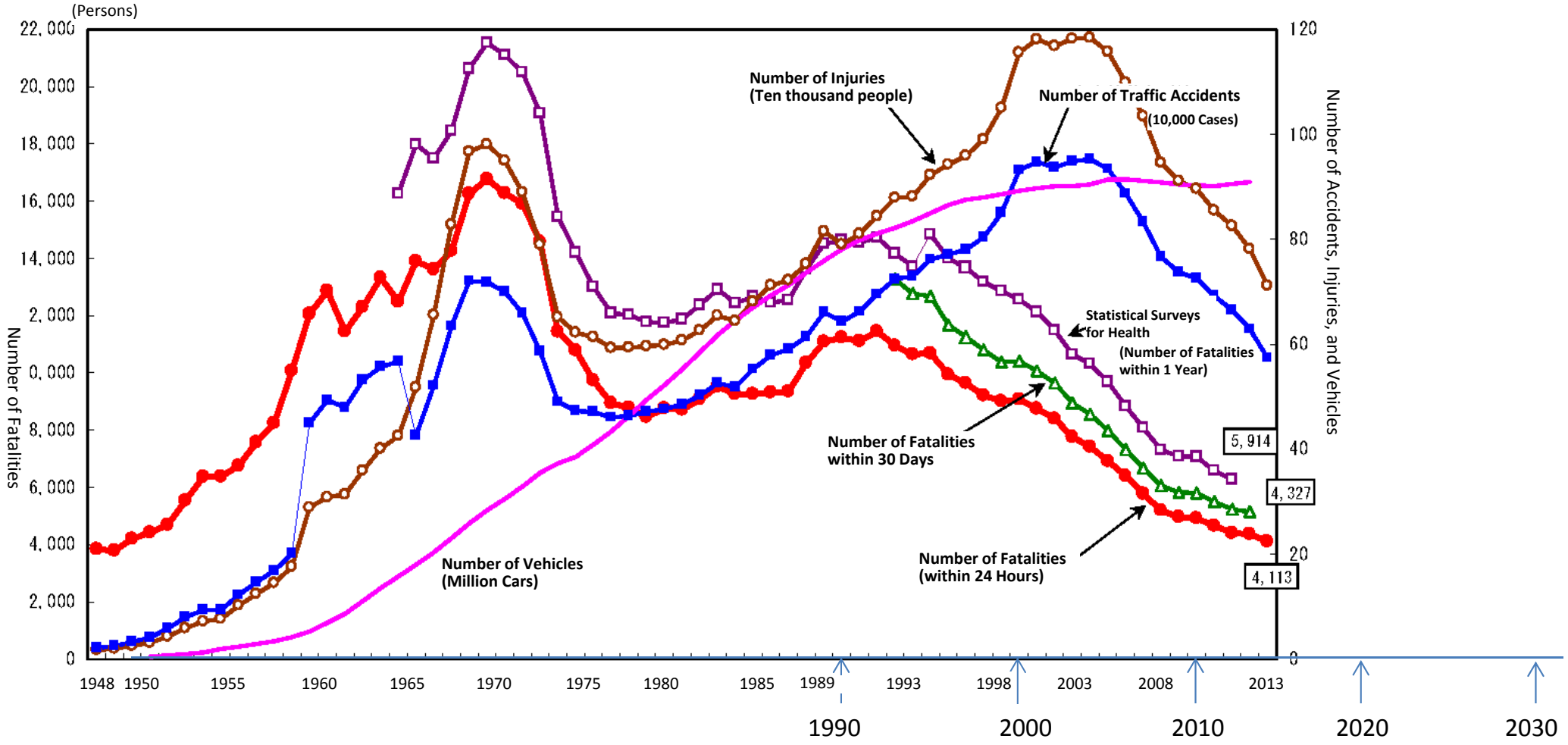
Building the world's most advanced ITS by 2020

Showcasing and demonstration

*: It means that traffic fatalities in Japan are the lowest in the world in proportion to the total population.

■ Shift in Traffic Fatalities and Other Indicators in Recent Years

- Traffic fatalities in 2014 were 4,113 and the number of injuries was 710,000.
- While traffic fatalities and injuries are on a declining trend in the medium and long term, traffic fatalities are not easily reduced.



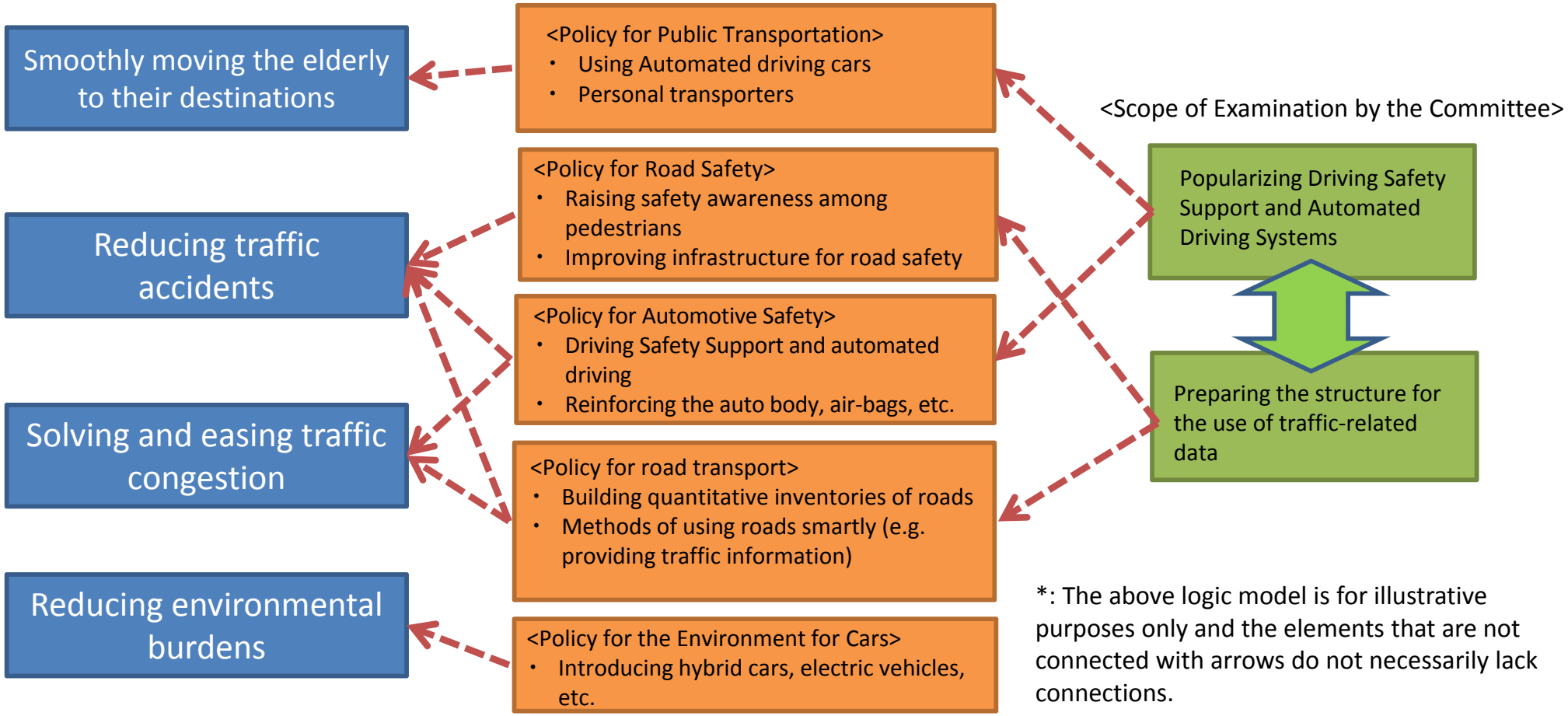
(Source: Characteristics of Fatal Traffic Accidents and Status of Crackdown on Violations of the road transport Act in 2014)

5. Direction of ITS-Related Measures to Achieve the Goals

■ Strategic Priority Measures to Achieve the Goals and Targeted Indicator Levels

- Strategically focusing on the technologies and measures related to the development and popularization of Safety Driving Support Systems and Automated Driving Systems and the preparation of the structure for the Utilization of Road Transport Data, which are effective in achieving the targeted indicator levels
- Clarifying a logic model for achieving the targeted indicator levels and ensuring alignment with various related policies

[Logic Model for Achieving the Targeted Indicator Levels (Examples)]*

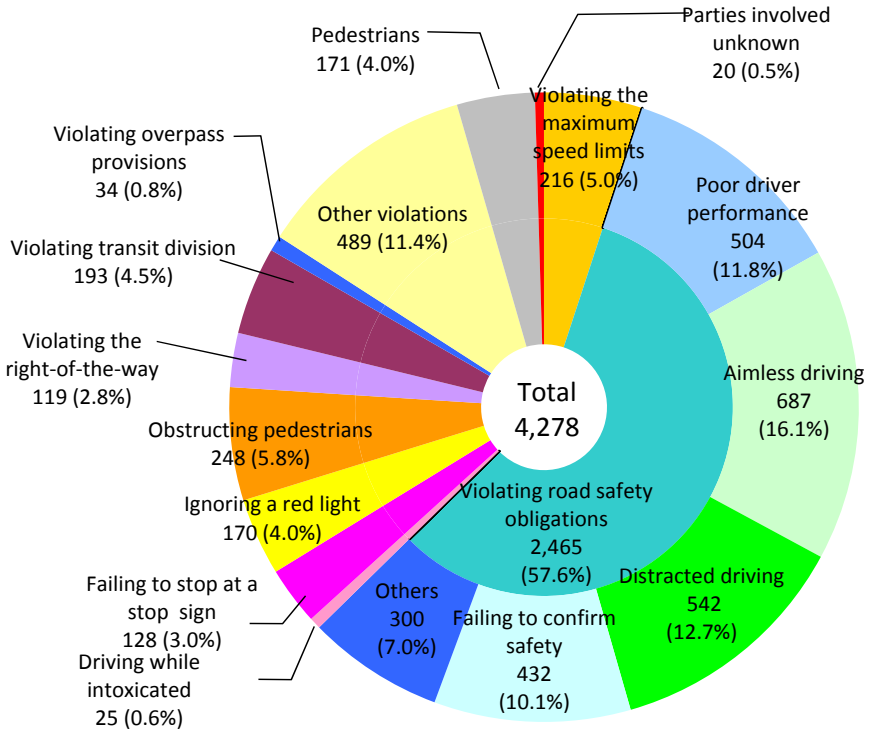


*: The above logic model is for illustrative purposes only and the elements that are not connected with arrows do not necessarily lack connections.

■ Roles of ITS in Efforts to Reduce Traffic Fatalities

- Most traffic fatalities are attributable to violating road safety obligations (including poor driver performance, aimless driving, distracted driving, and failed safety confirmation), failing to stop at stop signs, ignoring a red light, etc.
- Cautionary information provided to drivers once Safety Driving Support Systems have been implemented could help reduce traffic accidents.

Number of Traffic Fatalities by Specific Legal Violation (2013)



(Source: White Paper on Traffic Safety in Japan 2014)

Categories of Measures Related to Road Safety

<Preventive Measures against Traffic Accidents>

Measures Related to Road Infrastructure

Improving the safety of pedestrians
Improving infrastructure for road safety

Measures Related to Vehicle Safety

Safety standards
Tests, inspection and maintenance
Popularization and development of advance safety vehicles (ASVs)

ITS

Measures Related to People

Ensuring safe driving (driver's licenses, management and guidance for safe driving)
Ideas of road safety (education on road safety, publicity and education campaigns)
Order of road safety (guidance and crackdown, investigation on accidents and incidents, etc.)

<Measures Taken after Traffic Accidents>

Enhancing rescue and first-aid activities
Victims support (helping victims properly making a claim for damages)

■ Approach to KPIs Related to the Promotion of ITS Measures

- KPIs will be set with the measures contributing to achieve the goals in mind. In the process, the existing KPIs in the Japan Revitalization Strategy and other plans will be taken into account, and indicators related to the popularization (e.g. the number of units in use, a penetration rate) and indicators related to industrial competitiveness (e.g. the global market share, export) will be set separately.
- Methods of measuring the new KPIs are to be examined in the future.

[KPIs Related to (1) Safety Driving Support Systems and Automated Driving Systems and (2) the utilization of Road Transport Data (Examples)]

Categories for ITS	Key Performance Indicators (KPIs) in Relation to the Popularization and Competitiveness of ITS
Development and promotion of (1) Safety Driving Support Systems and (2) Automated Driving Systems	**<Popularization and Industrial Competitiveness of Driving Safety Support Devices/Systems>** Note: The following two KPIs are from the Japan Revitalization Strategy. • Mounting Driving Safety Support Devices/Systems on 20% of vehicles in Japan (on the inventory basis) and achieving 30% of the global market share in 2020. • Installing Driving Safety Support Devices/Systems as standard equipment in new cars sold in Japan and on almost all inventories in 2030. **<Popularization of Automated Driving Systems>** • Penetration rate of Automated Driving Systems installed on vehicles in Japan • Global market share of Automated Driving Systems (e.g. taking or maintaining the No. 1 position by 2030)
Preparation of the structure for the Utilization of Road Transport Data	• Number of categories for traffic-related data made available to the Japanese people • Number of exports of infrastructure and technologies that include Road Transport Data

5. Direction of ITS-Related Measures to Achieve the Goals Part 3

[Relationship Between Overall Goals/Indicators for Achieving Important Goals and ITS-Related KPIs (Overall Picture)]

・Value will be set from the viewpoint of becoming the world's best.

	Goals	Indicators for Achieving Important Goals
Social goals	・Society with the world's safest road transport (2020) ↓ ・Society with the world's safest and smoothest road transport (2030)	• Indicator related to reduction in traffic accidents • Indicator related to the status of traffic congestion • Indicator related to the support of the mobility of the elderly
Industrial goals	・Becoming the major player in global ITS-related innovation (2020–2030)	• Indicator related to the production and export of vehicles • Indicator related to the export of infrastructure

<Logic Model>
- Policy for public transportation
- Policy for road safety
- Policy for automotive safety
- Policy for road transport

Tokyo Olympic and Paralympic Games 2020

Tokyo will be showcased.

・Value will be set from the viewpoint of becoming the world's best.

ITS Elements Targeted	KPIs
Development and promotion of Safety Driving Support Systems and Automated Driving Systems	<Driving Safety Support Devices/Systems> • Goal for popularizing Driving Safety Support Devices/Systems • Goal for capturing the market for Driving Safety Support Devices/Systems <Popularization of Automated Driving Systems> • Penetration rate in vehicles in Japan • Goal for capturing the market for autonomous cars
Preparation of the structure for the utilization of Road Transport Data	e.g. • Number of categories for Road Transport Data made available to the Japanese people • Number of exports of infrastructure and technologies that include Road Transport Data

Building the world's most advanced ITS by 2020

・Taking advantage of the Tokyo Olympic and Paralympic Games

6. Strategy Related to Safety Driving Support Systems and Automated Driving Systems

(1) Overall Strategy Related to Safety Driving Support Systems and Automated Driving Systems

(2) Method of Proceeding with Driving Safety Support Systems

(3) Method of Proceeding with Automated Driving Systems

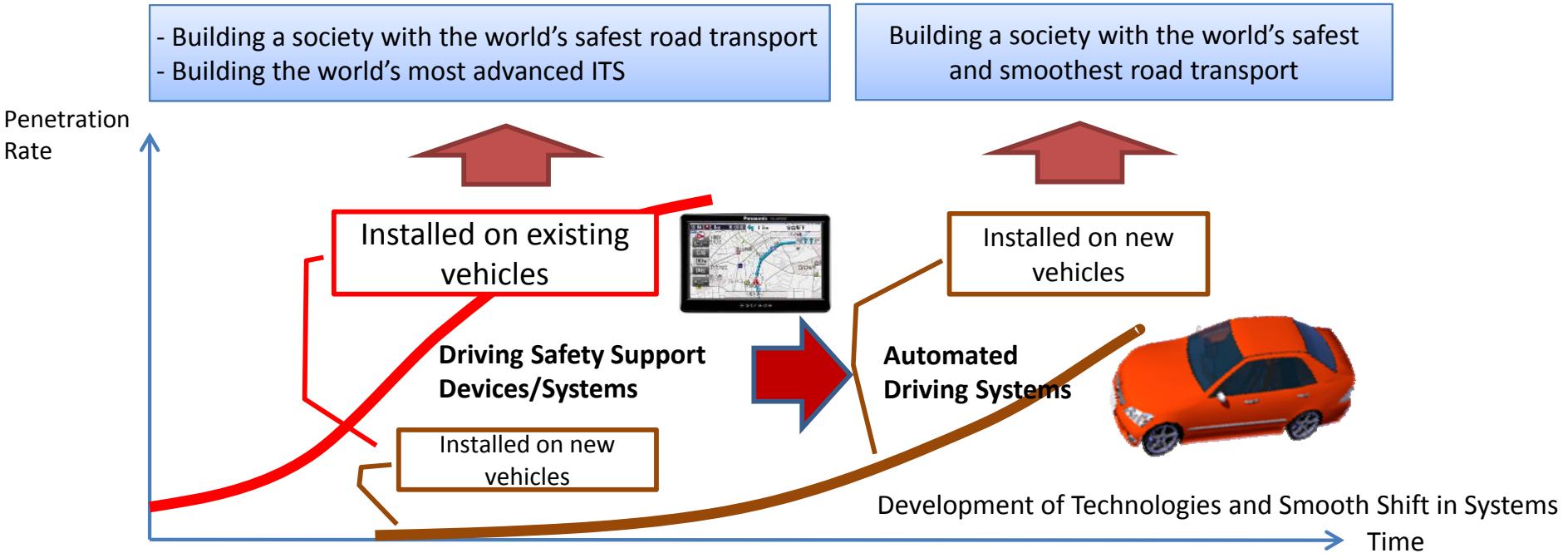
(1) Overall Strategy Related to Safety Driving Support Systems and Automated Driving Systems Part 1

■ Overall Strategy Related to Safety Driving Support Systems and Automated Driving Systems

- Advancement from Safety Driving Support Systems to Automated Driving Systems along with development in technology
  - Driving Safety Support Systems: Promoting the popularization of the systems mounted on existing vehicles
    =>Aiming to build a society with the world's safest road transport by 2020
  - Automated Driving Systems: Promoting the popularization of the systems mounted on new vehicles with future deployment to overseas in mind

    =>Aiming to build a society with the world's safest and smoothest road transport by 2030

[Strategy Related to the Popularization of Safety Driving Support Systems and Automated Driving Systems (Image)]



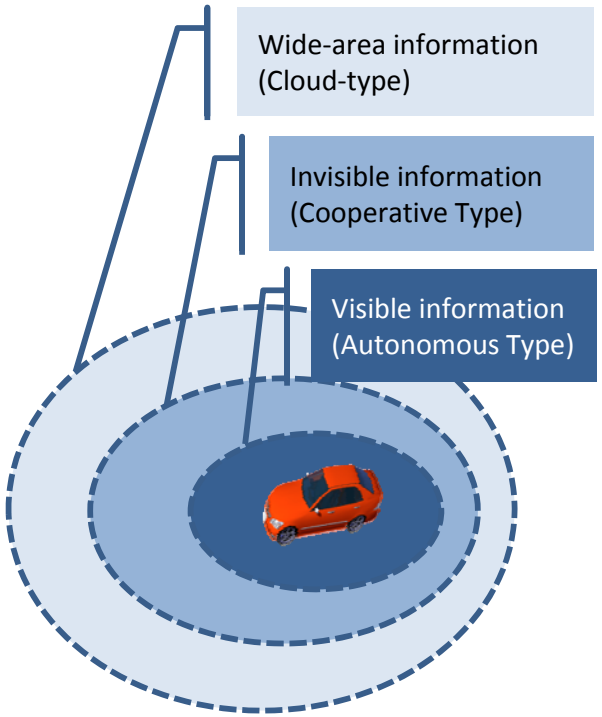
(1) Overall Strategy Related to Safety Driving Support Systems and Automated Driving Systems Part 2

Strategy for Autonomous and Cooperative Architecture to Expand Safety Driving Support Systems (1)

- Flow of how information is provided:
  Collecting information on the surroundings of the vehicle -> Analyzing and making decisions on the intelligence element -> Operating the vehicle/providing information to the driver
- Methods of collecting information on the surroundings: Roughly grouped into Autonomous Type and Cooperative Type
- These technologies are not contradictory to each other; introducing more than one technology makes the systems more advanced.

[Categories of Technologies for Information Collection for Driving Safety Support/Automated Driving Systems]

Categories of Technologies for Information Collection		Description of Technology (Method of Obtaining Information)	Characteristics
Autonomous Type		Recognizing information on obstacles and other items via radars and cameras installed on vehicles	・It works in almost all locations. ・It works only when things are visible. Depending on methodology, it is influenced by the weather and other elements in the surrounding environment. ・It is high in immediacy.
Cooperative Type (in a broad sense)	Mobile	Recognizing the positional information via GPS and various information on a cloud-based map	・It works in almost all locations. ・It can collect wide-area information. ・It lacks immediacy.
	Road-to-vehicle communications	Collecting information on the surrounding relating to the road transport from the devices installed on the road infrastructure	・It works at the place where infrastructure has been installed. ・Information on the surroundings and the wide area is also available. ・It is high in immediacy.
	Vehicle-to-vehicle communications	Collecting information on the position and speed of the vehicle from the devices installed on other vehicles	・Other vehicles also need to have them installed. ・Information is available in invisible locations as well. ・It is high in immediacy.

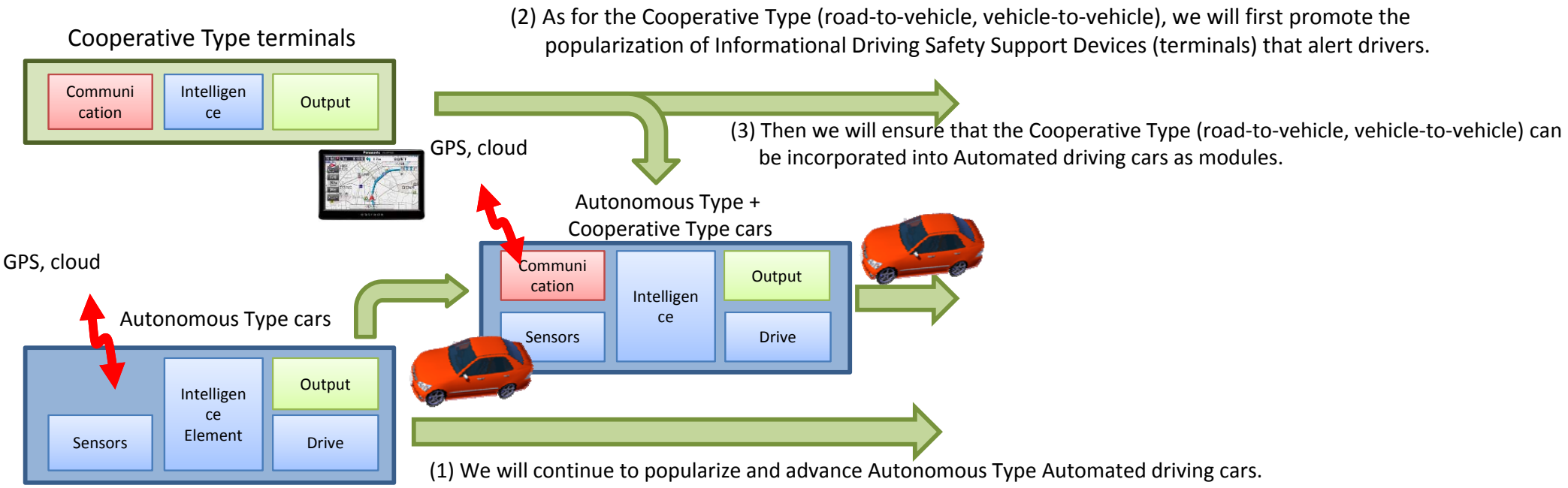


(1) Overall Strategy Related to Safety Driving Support Systems and Automated Driving Systems Part 3

■ Strategy for Autonomous and Cooperative Architecture to Expand Safety Driving Support Systems (2)

- Mainly, private businesses have taken the lead in developing the Autonomous Type, while the public and private sectors have worked together to develop the Cooperative Type. The government has taken the initiative in preparing an environment for infrastructure.
- As a rule, the integrated strategy for the Autonomous and Cooperative Types will take the following steps:
  (1) Promoting the further popularization and advancement of Autonomous Type automobiles (Level 1 or higher)
  (2) (As for the Cooperative Type) Popularizing Informational Type Safety Driving Support Devices along with the preparation of infrastructure
  (3) Making the use of the advantage of the Cooperative Type by adding/integrating Cooperative Type functions to/with Autonomous Type vehicles as necessary

[Strategy for Integrating Autonomous Type with Cooperative Type (Image)]



(2) Method of Proceeding with Driving Safety Support Systems

■ Priority Measures Related to Driving Safety Support Systems

- Clarifying the priority measures to be taken to achieve the goal of reducing traffic fatalities to 2,500 or lower (by 2018)

We need to take into account the situation analysis of traffic accidents, needs, feasibility, and possibility of widespread use, cost-effectiveness, and other factors.

[Measures Related to the Roadmaps to Popularize Driving Safety Support Systems]

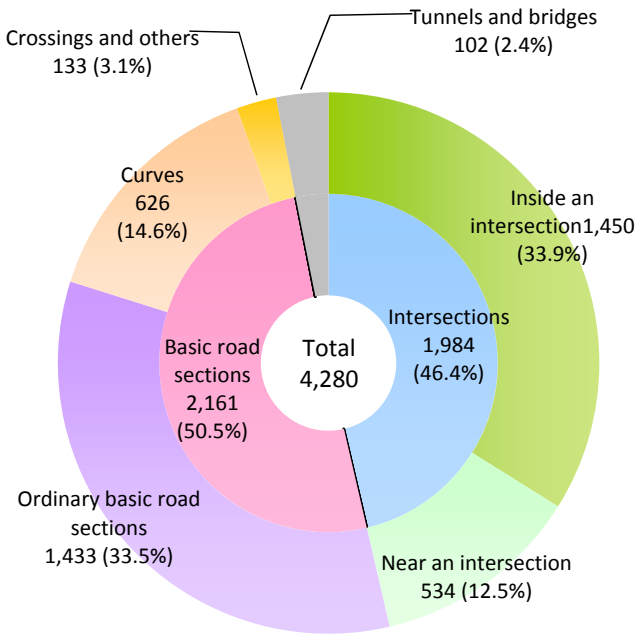
Categories	Outline	
(1) Popularization of automobiles with Safety Driving Support Devices	・We will popularize automobiles with an automatic brake. ・We need to continue to promote the popularization of these devices through a public-private collaboration.	
(2) Practical application and popularization of Informational Safety Driving Support terminals	Popularizing the Informational Type Safety Driving Support Devices installed on existing automobiles	
	・Specifically, the terminals can be classified into (a) map information-type terminals, (b) vehicle-to-vehicle terminals, and (c) road-to-vehicle terminals. We need a strategy for popularization that we should prioritize.	(a) Map-type terminals: Development and popularization of Informational terminals using GPS, map, and other information => It is necessary to prepare and deliver map-related data.
		(b) Vehicle-to-vehicle terminals: Development and popularization of Informational terminals that allow vehicles to communicate on roads with poor visibility => We need a strategy for such popularization.
		(c) Road-to-vehicle terminals: Popularization of Informational terminals including car navigation systems that support optical beacons and ETC2.0 => We need to improve infrastructure in parallel.
(3) R&D and popularization of sensors and systems that support the mobility of pedestrians	We need to alert pedestrians, bicyclists, and motorcyclists, who account for the majority of the parties involved in traffic accidents.	
	・We need R&D and popularization of the systems looking ahead to 2018 and beyond.	(a) Sensing technologies for pedestrians, including the 79 GHz band and image processing
		(b) Development of systems that inform vehicles of pedestrian information
		(c) Infrastructure and systems that warn pedestrians if they ignore crossing signals, etc.

(For Reference) Analysis of Traffic Fatalities Part 3

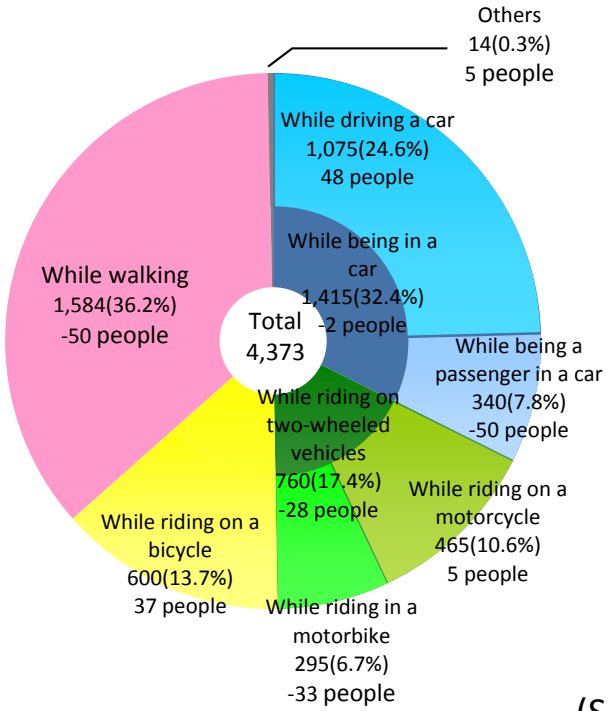
■ Need of Measures for Pedestrians, Bicycles, and Motorcycles in road transport Safety

- About half of traffic accidents take place inside or near intersections. Pedestrians, bicyclists, and motorcyclists account for about two thirds of traffic fatalities.
- For this reason, measures for intersections and other risky locations, and pedestrians, bicyclists, and motorcyclists are also important, in addition to the measures against collisions between vehicles and with objects.

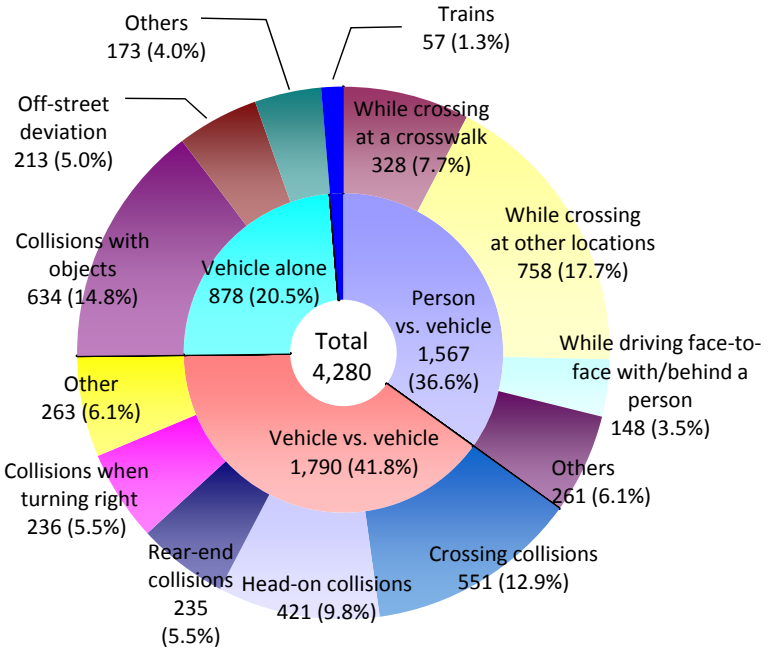
Number of Fatal Traffic Accidents by Shape of Roads (2013)



Number of Traffic Fatalities by Situation (2013)



Number of Traffic Accidents by Type of Accident (2013)



(Source: White Paper on Traffic Safety in Japan 2014)

Note: Traffic fatalities and injuries on expressways were 227 (5.2%) and 19,920 (2.5%), respectively.

■ Expected Time of Commercialization of Automated Driving Systems

- Promoting the advancement of Automated Driving Systems from the viewpoint of achieving long-term goals
  [Long-Term Goals]
  - Building a society with the world's safest and smoothest road transport
  - Becoming the major player in innovation related to Automated Driving Systems
- Japan will set the expected time of commercialization in a way that is in no way inferior to the rest of the world.
- It is also important for us to strengthen an industrial competitive edge and popularize Automated driving systems.

Levels	Technologies Expected to be Realized	Expected Time of Commercialization	(For Reference) Targeted Time in Europe and Other Regions **
Level 2	・Follow-up and tracking systems	**Mid 2010s**	2013 - 2015
	・Steering for collision avoidance		2017 - 2018
	・Automated driving on multiple lanes, etc.	**In 2017**	2016
Level 3	・Automated merging, etc.	**First half of 2020s**	2020
Level 4	・Fully automated driving	**Second half of 2020s***	2025 – 2028 (expressways) 2027 – 2030 (urban areas)

*: Level 4 (fully Automated Driving Systems) is expected to have a trial period. The expected time will be reviewed as necessary due to many uncertainties, based on the examination of commercialization in Japan and abroad as well as the status of various efforts.

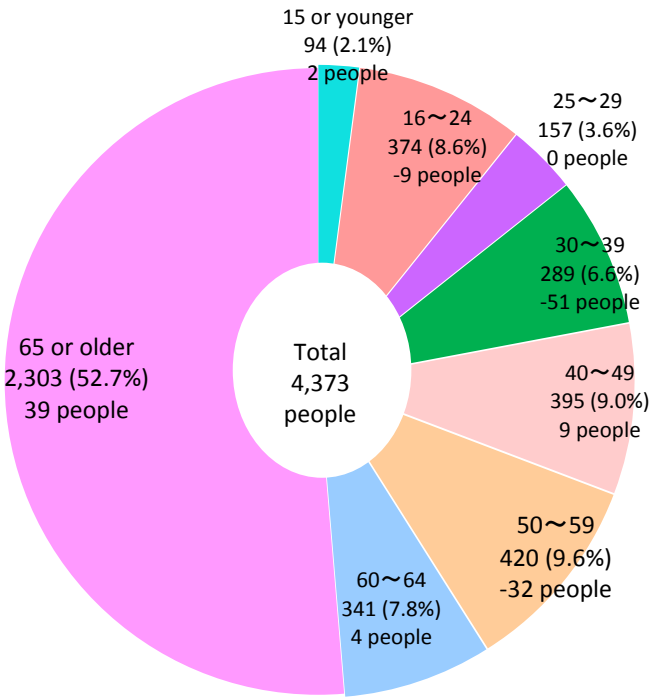
**: The targeted time of commercialization in Europe and other regions was investigated by the Cabinet Secretariat through such channels as the iMobility Forum.

(For Reference) Analysis of Traffic Fatalities Part 4

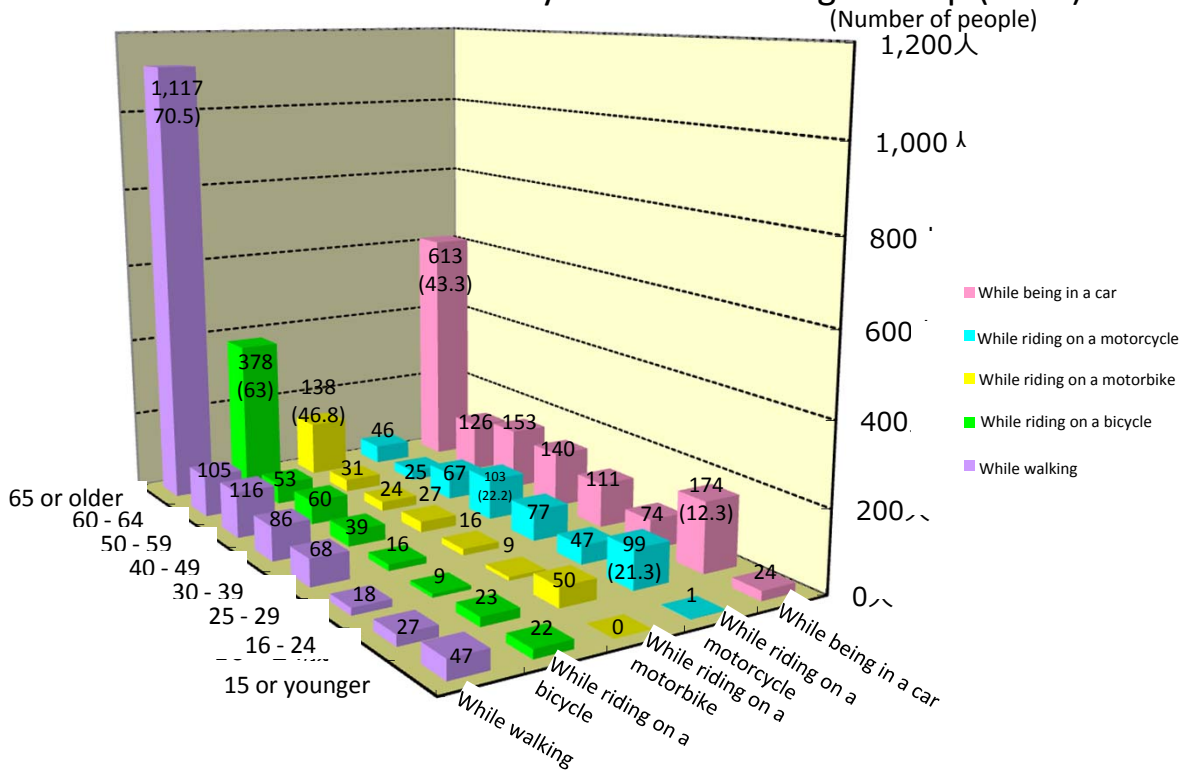
■ Positioning of the Elderly in Efforts to Reduce Traffic Fatalities

- The majority of traffic fatalities are old people when walking or driving cars. For this reason, it is necessary to develop vehicles that they can drive free from anxiety and to take safety measures for older pedestrians.
- On the other hand, injuries from traffic accidents increasingly span all age groups; separate measures are necessary.

Number of Traffic Fatalities by Age Group (2013)



Number of Traffic Fatalities by Situation and Age Group (2013)



Note: Elderly people (aged 65 or older) account for only 14% of all traffic fatalities.

(Source: White Paper on Traffic Safety in Japan 2014)

(3) Method of Proceeding with Automated Driving Systems Part 2

■ Specific Images of Automated Driving Systems We Aim to Go Ahead and Develop and Popularize in the Immediate Future

- It is necessary to clarify specific images of Automated Driving Systems that contribute to the resolution of problems faced by Japan.
- A particularly urgent issue is to secure means of transportation for the elderly and in the depopulated area.
- We will clearly state specific examples of Automated Driving Systems we aim to go ahead and develop and popularize.

[Specific Images of Automated Driving Systems We Aim to Go Ahead and Develop and Popularize in the Immediate Future (Examples)]

Outline	Expected Social Effects and Mainly Relevant Indicators
(1) Automated Driving Systems that contribute to increased competitiveness in the global market	
Automated Driving Systems that ensure the same level of safety as that of experienced drivers; we will go ahead and support Automated driving on expressways in the immediate future. They include the capability of responding to abnormal situations of drivers.	・ Reducing burdens on drivers and ensuring comfort. ・ Ensuring safety and providing reassurance under abnormal situations of drivers. ・ Strengthening the competitiveness of the auto industry through the above-mentioned effects. **Relevant Targeted Indicators:** Popularizing Automated Driving Systems and producing and exporting automobiles.
(2) Regional public transportation systems with Automated driving capabilities	
Bus systems (ART) that offer the same level of on-time operation and comfort as that of trains through the Automated driving technology; we will go ahead, develop, and popularize them in urban areas in the immediate future.	・ Expanding the use of public transportation facilities in urban areas through increased express delivery, on-time operation, eco-friendliness, safety, comfort, and accessibility. ・ Securing the means of transportation for the elderly and others through the above-mentioned advantages. **Relevant Targeted Indicators:** Supporting the mobility of the elderly and exporting infrastructure.
(3) Small-sized Automated Driving Systems for regional communities	
Small and low-velocity systems in which the elderly can move around easily within the community; we will go ahead and develop and popularize them in depopulated areas in the immediate future.	・ Ensuring the mobility for those with constraints in mobility, such as the elderly, in depopulated and other limited areas, and vitalizing rural areas. ・ Reducing traffic accidents by securing the means of transportation for the elderly. **Relevant Targeted Indicators:** Supporting the mobility of the elderly and reducing traffic accidents.

(3) Method of Proceeding with Automated Driving Systems Part 3

■ Scenarios for Popularization and Technological Strategies Related to the Specific Images (Leading Examples)-1

- With examples of specific images in mind, development efforts will be through public-private partnership. We will also clarify scenarios for popularization and technical specifications necessary to achieve the goals.

(1) Automated driving cars that contribute to increased competitiveness in the global market

Scenario for popularization	• <u>Popularization to start from Automated Driving Systems that support automated driving on expressways</u> ➢ Long-distance trucks, buses, etc. ➢ General passenger cars targeting global deployment ◆ Level 2 in late 2010s => Level 3 in early 2020s ⇒ • <u>Popularization to be expanded to vehicles that support automated driving on general roads</u> ◆ Level 3 in early 2020s
Points to remember: Technological specifications and strategies	• As a rule, automobiles are intended to be the Autonomous Type. Private businesses take a central role in developing them. • We will consider the use of both the Autonomous and Cooperative Types for truck platooning. • We will promote R&D with automated driving on general roads as before

Source: Website of Prime Minister of Japan and His Cabinet

Source: Website of New Energy and Industrial Technology Development Organization

(3) Method of Proceeding with Automated Driving Systems Part 4

■ Scenarios for Popularization and Technological Strategies Related to the Specific Images (Leading Examples)-2

(2) Regional Public Transportation Systems with Automated Driving Capabilities

Scenario for popularization	• Starting from introducing them at the 2020 Tokyo Olympic and Paralympic Games. ◆ Close to Level 2 in 2020 → • Deploying them to regional urban centers • Promoting the export of infrastructure. ◆ Early 2020s → • <u>Aiming at Level 4.</u> ◆ Late 2020s and onward
Points to remember: Technological specifications and strategies	• Automated Driving Systems are intended to use the Autonomous Type with the Cooperative Type (particularly road-to-vehicle communications with signals). They will be developed through public-private partnership involving such parties as local governments and bus operating companies. • We will also examine control management with data and hydrogen and electric automobiles. • Specifications will be developed with deployment to rural areas and export in mind.

Source: Cabinet Office SIP Website

(3) Small-Sized Automated Driving Systems for Regional Communities

Scenario for popularization	• Examining the application of the systems to serve the elderly in depopulated areas ◆ We will examine the possibility of demonstrations in Levels 3 to 4 in limited areas, which presupposes safety. • Including boarding-type mobility support systems primarily for old people who have difficulty driving → • Expanding them to regional communities in suburban areas. ◆ 2020 and onward
Points to remember: Technological specifications and strategies	• As a rule, systems are intended to be the Autonomous Type and used with the control management type. We assume small-sized, electric-driven moving objects. • They will be developed in a competitive environment involving companies from other industries such as venture businesses and players in the robot industry. • They will be implemented through collaboration with local governments. We will examine not only the sales of auto bodies but also different types of service models such as sharing and on-demand.

Source: Google Website

Source: Cabinet Office Website

(3) Method of Proceeding with Automated Driving Systems Part 5

■ Technological Strategy for R&D and Demonstration Related to Automated Driving Systems

- Private businesses take the lead in developing technologies related to the advancement of Automated Driving Systems.
- The government will promote R&D and demonstration of the technology as the common basis (through SIP and measures taken by related ministries and agencies).
- Themes for R&D and demonstration will be linked clearly with specific images (scenarios and timing of implementation).
- It is also necessary to improve a structure for security measures as security risks increase.

R&D and Demonstration Promoted Jointly by the Public and Private Sectors

<R&D for a Structure for the Technology as the Common Basis>
- Research on technologies for distinct elements, dynamic maps, cybersecurity, functional safety, HMI, etc.

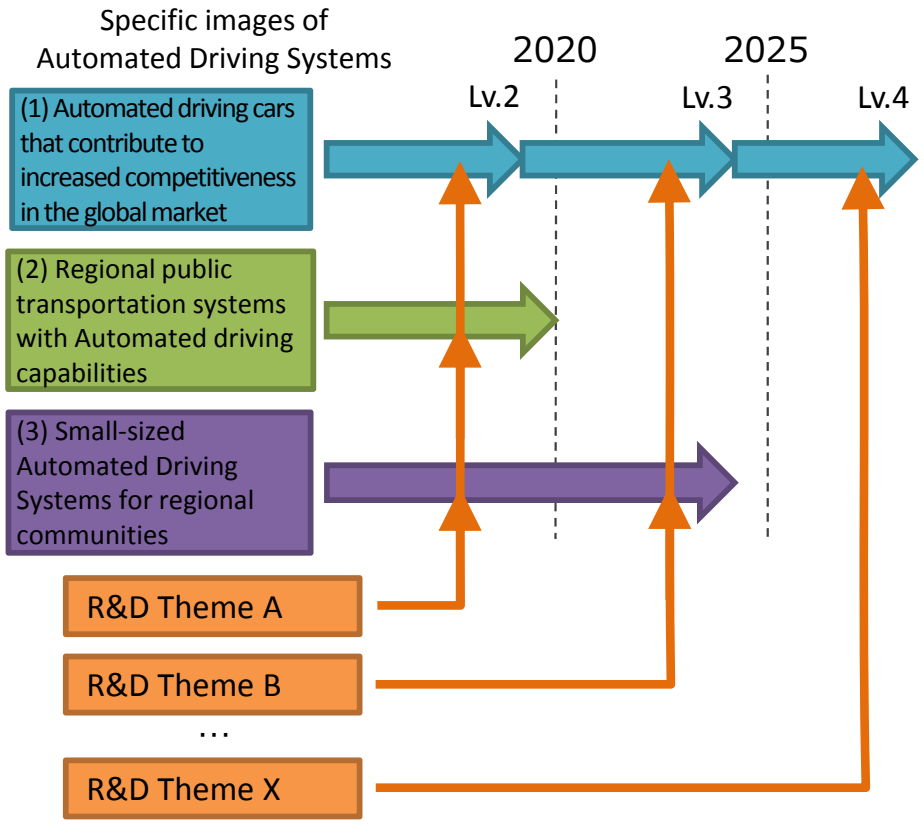
<R&D Needed for Public-Sector Systems>
- Development of Cooperative Type systems

<Support of Development for Private Businesses and Other Entities>
- Support for universities, venture businesses, new ideas, etc.

Points to Consider when Promoting R&D and Demonstration

(1) Collaborating among industry, academia, and government, and promoting knowledge of universities and other entities and use of human resources
(2) Examining the implementation of award-type methodologies
(3) Improving an environment for actively and safely conducting demonstration experiments on public roads in Special Zones with Level 4 in mind

Relationship with Specific Images (Examples):
(Images of the Way Out)



■ Efforts to Popularize Automated Driving Systems in Terms of Social Receptivity and Institutions-1

- Need not only to develop R&D and technological strategies but also to improve an environment in terms of social receptivity and institutions
- Semi-Automated Driving Systems (up to Level 3) can be implemented under existing laws and regulations in Japan if they assume that emergencies are responded by drivers.
- Technologies that assume fully Automated Driving Systems can go through a test run without infringing on existing laws and regulations if the driver goes on aboard and responds to emergency situations.

[Issues that Need to be Addressed for the Implementation of Semi-Automated Driving Systems (Examples)]

Content	Agenda to be Examined (Examples)
Examination of needs, and user and social receptivity	• Needs related to the use of semi-Automated Driving Systems and how to divide responsibilities in case of accidents • Receptivity of users to Automated Driving Systems as well as ordinary vehicles running in the vicinity, pedestrians, and other elements in the surroundings Impact of semi-Automated Driving Systems on the entire traffic system (an issue of mixed traffic)
Examination of human factors	• Research and study on safe Automated Driving Systems and methods of driver-centered handing over (HMI) in light of human factors such as driver behavior • (Specific examples) Overconfidence and dependence as well as the maintenance of the driving skills of drivers who have got used to automated driving

Efforts to Popularize Automated Driving Systems in Terms of Social Receptivity and Institutions-2

- Fully Automated Driving Systems on the other hand completely differ from the conventional concept of automobiles.
- We need to examine the aspects of social receptivity and institutions in implementing them.
- Japan serves as one of the co-chairs of the automated driving subcommittee (established in November 2014) and the expert panel on technical standards for self-steering (established in March 2015) of the UN's World Forum for Harmonization of Vehicle Regulations (WP29) with UK and Germany. It continues to take initiative in international discussions.

[Issues that Need to be Addressed for the Implementation of Fully Automated Driving Systems (Examples)]

Content	Agenda to be Examined (Examples)
Examination of how society should be (needs and business models, and user and social receptivity)	• How society should be if it accepts fully Automated Driving Systems • Needs and business models of fully Automated Driving Systems, and creation of new industries • Receptivity of users to fully Automated Driving Systems, in which the relationship of responsibility is completely different from conventional automobiles, as well as receptivity of ordinary automobiles running in the vicinity, pedestrians, and other elements in the surroundings • Impact of fully Automated Driving Systems on the entire traffic system (an issue of mixed traffic) • Formation of an international consensus on these areas
Examination of the relationship of responsibility in case of accidents and the legal aspect	• Fundamental review of the relationship of responsibility in light of global trends • Review of the legislative aspect in light of how an international consensus is formed as mentioned above, active participation in forums of international consideration, and understanding of global trends

7. Strategy Related to the utilization of Road Transport Data

(1) Positioning of Traffic-Related Data and Future Direction

(2) Basic Direction Related to the Improvement and Use of Traffic-Related Data

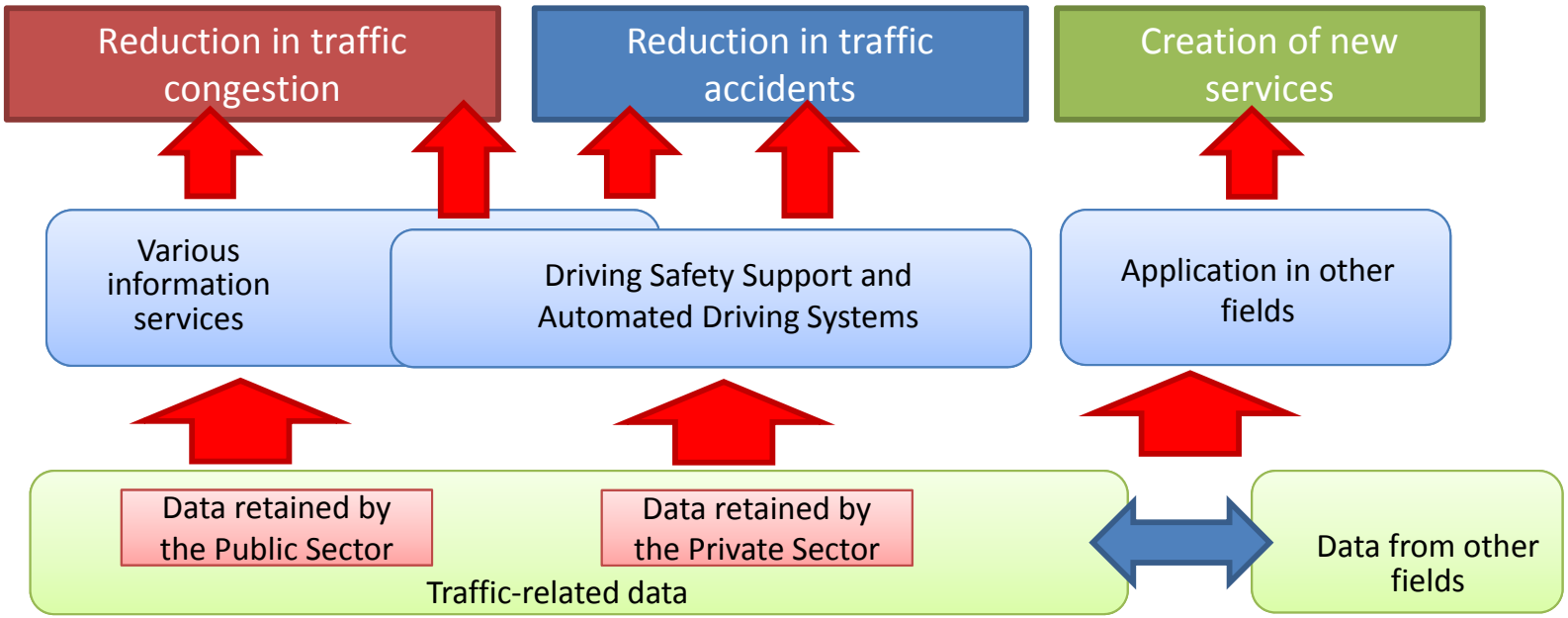
(3) Specific Efforts that Need to be Made in the Immediate Future

(1) Positioning of Traffic-Related Data and Future Direction Part 1

■ Positioning of Road Transport Data

- The government has played a central part in building a structure for an advanced information service as Road Transport Data infrastructure.
- In recent years, private businesses have been building a more advanced information service by collecting various kinds of probe data from automobiles, smartphones, and other sources and analyzing big data.
- Along with the advancement of IT and networking in the area of automobiles, a wide variety of data will be accumulated in the future.
- Road Transport Data collected by the public and private sectors will become the foundation necessary for Safety Driving Support Systems and Automated Driving Systems; we expect that new services will be created through the linkage with other information.

[Relationship between Traffic-Related Data, Various Information Services, and Driving Safety Support and Automated Driving Systems (Image)]



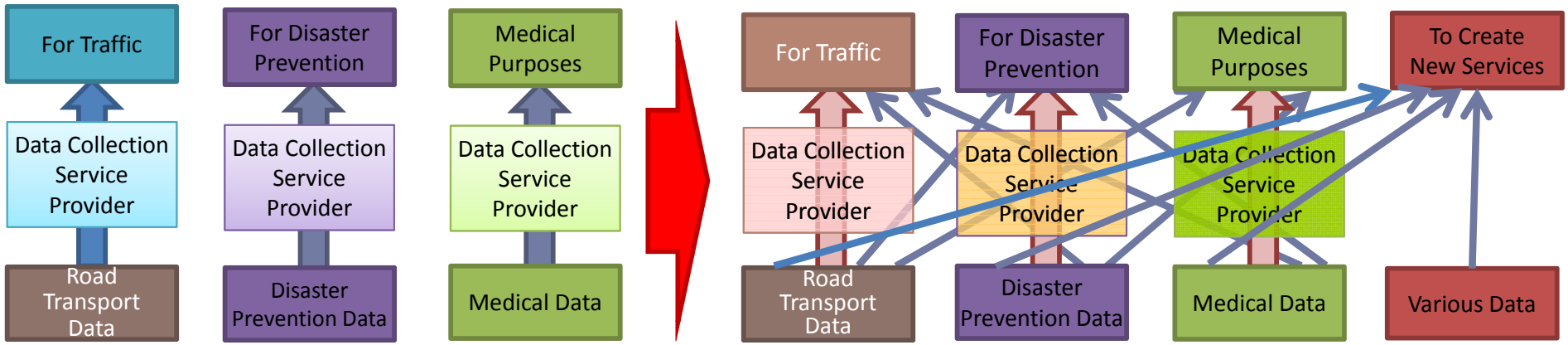
Future Direction Related to the utilization of Road Transport Data

- Structural change to be expected for Road Transport Data in the future
  (1) Advancement of IoT: Using a wide variety of data such as positioning and velocity information and other data collected from different automobile sensors, cameras, and other sources
  (2) Shift to horizontal division of labor: We expect that there will be a shift from the conventional structure of vertical integration to distribution of data within one field and across different fields and the usage extended outside the field of traffic.
- We need to prepare a structure for examining the enhancement of data standards and rules for much-needed data for each of the public and private sectors and ways to make them open.

Points to Consider:

- ✓ (As for most of the data) Clarifying the purpose of use and ways to handle data, and collecting them within the said scope
- ✓ **Data owned by private businesses:** Being collected from a business perspective
- ✓ **Data owned by the public sector:** Requiring a cost for building systems and databases for public disclosure

Change in the Structure of Data Distribution



(2) Basic Direction Related to the Improvement and Use of Traffic-Related Data

Basic Approach

(1) The public sector will prepare digitization of data that is important from a perspective of policies and promote the process of making such data open as long as it is necessary and done at a manageable level.

- Giving attention to the possibility of interconnection such as linkage with data in other fields in light of existing standards
- Giving consideration to a cost required for building new systems and databases as well as needs in the private sector

(2) As for probe data owned by the public and private sectors, we will promote the preparation of formats and rules necessary for data distribution in light of the trends of the existing standards.

- Giving attention to the protection and handling of personal information
- Giving sufficient attention to the handling of costs associated with information service

(3) Promotion of policies for the efficient utilization of public-private data.

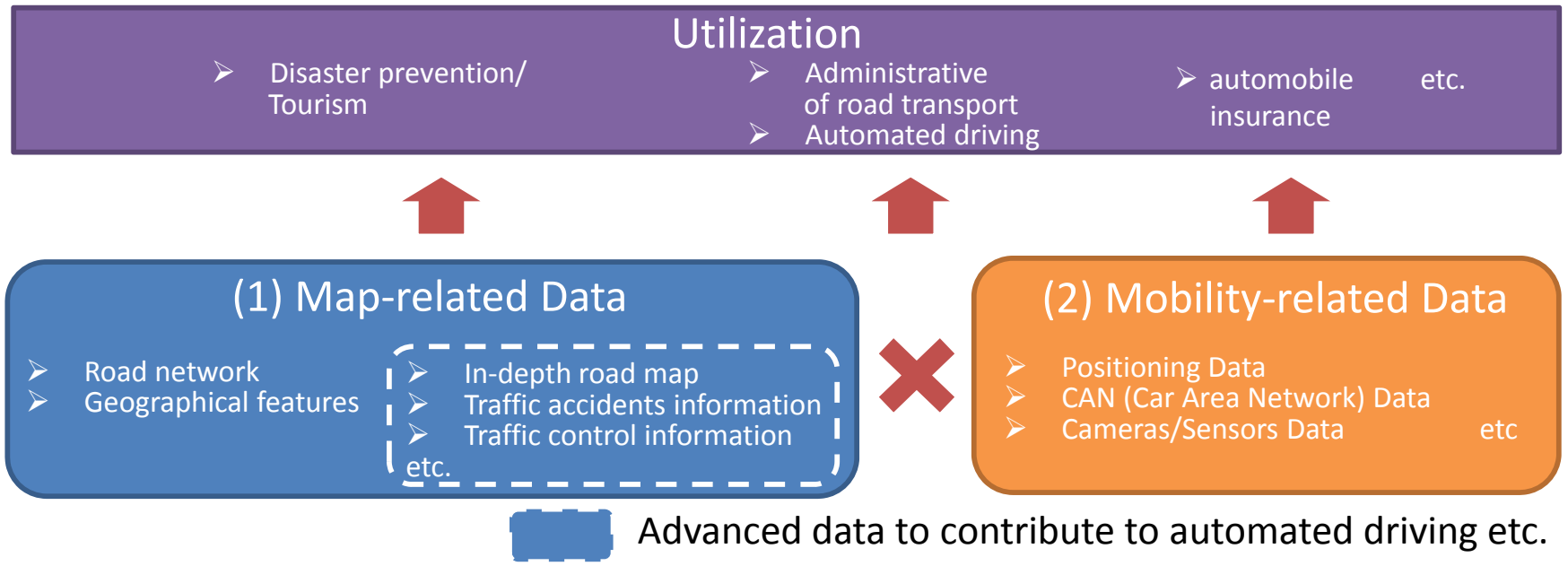
Services Expected with the utilization of Road Transport Data (Examples) (by Around 2020)

- Private business will prepare dynamic maps in regions where the demonstration and practical application of Automated driving cars are expected, and preparations be made for Automated driving toward Level 3.
- When we search possible routes between the point of departure and destination, comparative information will be provided on the time needed and costs for various means of transportation (e.g. private cars, buses, trains, taxis), making more efficient transportation possible.
- By using information such as probe data that can be collected from automobiles as well as various other information on accidents, we can improve maps that indicate locations throughout Japan with risks of accidents and manage road transport properly.
- Various kinds of sensors and video devices (including smartphones and tablet computers) will be installed on virtually all automobiles. A mechanism will be in place for setting different insurance premiums based on the content of such data; in time of accidents, necessary information will be transferred to emergency centers and other related organizations instantly and accidents will be video-taped.
- The use of probe data from automobiles, smartphones, and other devices and various kinds of big data such as weather information allows us to predict the status of traffic congestion in a more refined manner and estimate travel time more accurately.

(3) Specific Efforts that Need to be Made in the Immediate Future #1

- Traffic-related data can be roughly grouped into:
  (a) Data related to maps such as links between roads
  (b) Data related to mobility (mobile objects) such as automobiles
- We assume that each of the said data will further advance and increase in quantity as they are distributed.
- The following three tasks will be carried out in the immediate future for the future utilization of data:
  A) Making map-related data more advanced and overlaying various data
  B) Distributing data related to mobility
  C) Resolving social challenges through the utilization of these data

Utilization of Traffic-Related Data



(3) Specific Efforts that Need to be Made in the Immediate Future #2

■ Specific Task: A. Overlaying Various Data on Maps and Making Map Information More Advanced

- It is useful to overlay information on various maps on top of the infrastructure for map information. It is important to improve this data and promote the overlaying task from the perspective of the utilization of Road Transport Data.
- There are needs of advanced infrastructure for map information (dynamic maps) to realize Automated Driving Systems. A future challenge is to develop and improve it through public-private partnership with business models and secondary use in mind.

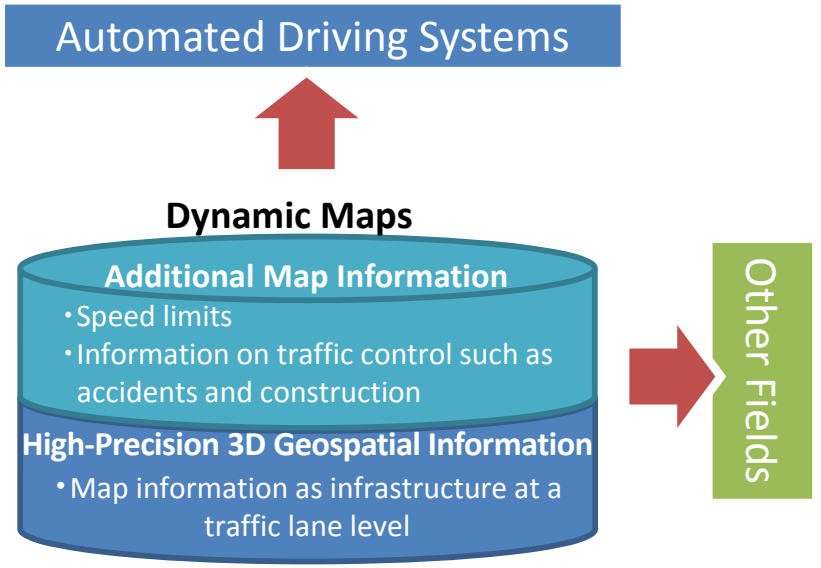
<Current Status of Examination of Dynamic Maps>

- As part of SIP activities, we are in the process of creating map information as infrastructure, and researching and examining feasibility and other aspects for the Odaiba District, Tokyo.
- We will continue to make trial models and evaluation for practical application and promote R&D through public-private collaboration.

<Future Direction and Points to Remember for the Improvement of Dynamic Maps>

- As a rule, it will be led by private businesses. We will work with the users of the systems such as automakers to ensure tasks are coordinated and aligned with the rest of the world.
- The public sector provides assistance as necessary.
- Consideration is given not only to the application to Automated driving but also the use to support pedestrians and for disaster prevention and tourism.

Image of Advanced Infrastructure for Map Information (Dynamic Maps) and Usage



(3) Specific Efforts that Need to be Made in the Immediate Future #3

■ Specific Task: B. Efforts Made for the Use of Probe Data, Automobile-Related, and Other Information-1

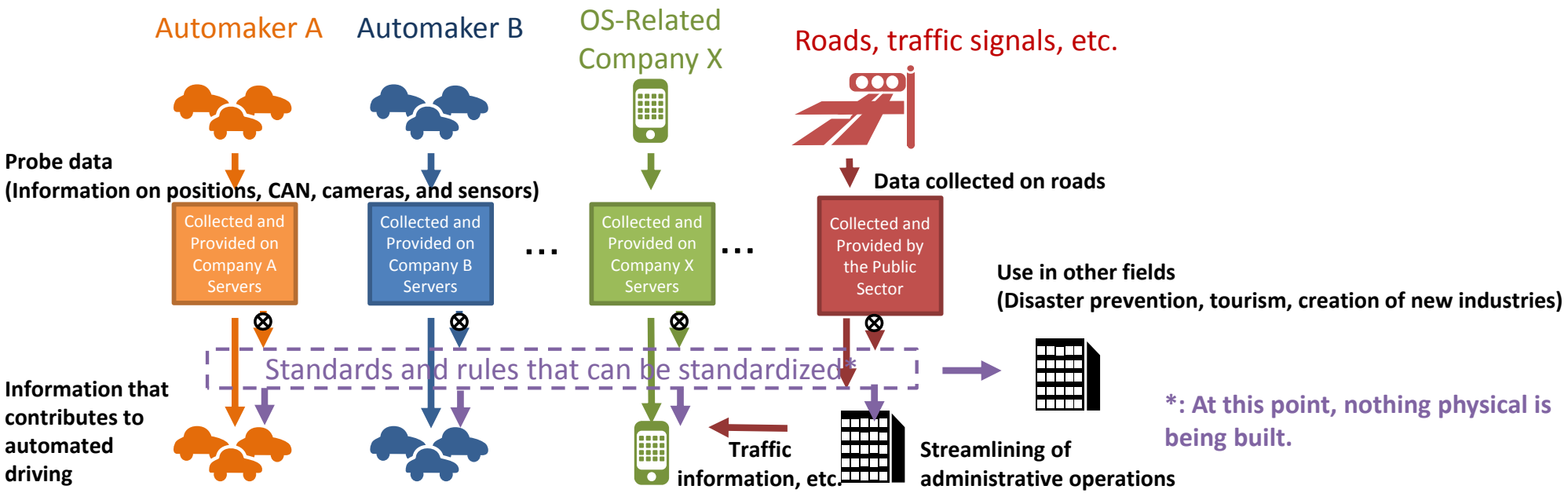
[Data Related to Mobile Objects (Automobiles) on Maps]

- Examining standards and rules that enable shared usage in probe data distribution

<Points to Consider when Distributing Probe and Other Data>

- ✓ Trends of standards including international de-facto standards
- ✓ Difference in data formats and other aspects which need to be standardized depending on the intended purpose
- ✓ Protection of personal information
- ✓ Use of data in disaster prevention, tourism, and other fields

Image of Collection and Provision of Probe Data (Future Vision)



(3) Specific Efforts that Need to be Made in the Immediate Future #4

■ Specific Task: B. Efforts Made for the Use of Probe Data and Other Automobile-Related Information-2

[Enormous and Various Automobile-Related Information Originating from Cars*]

- We will work on standardizing them and deploying new services to facilitate the use of such information.

*: Automobile-related information: Information on inspections and registration, history (e.g. accidents, repair and maintenance, mileage, water damage), and driving (e.g. abrupt acceleration, sudden braking), etc.

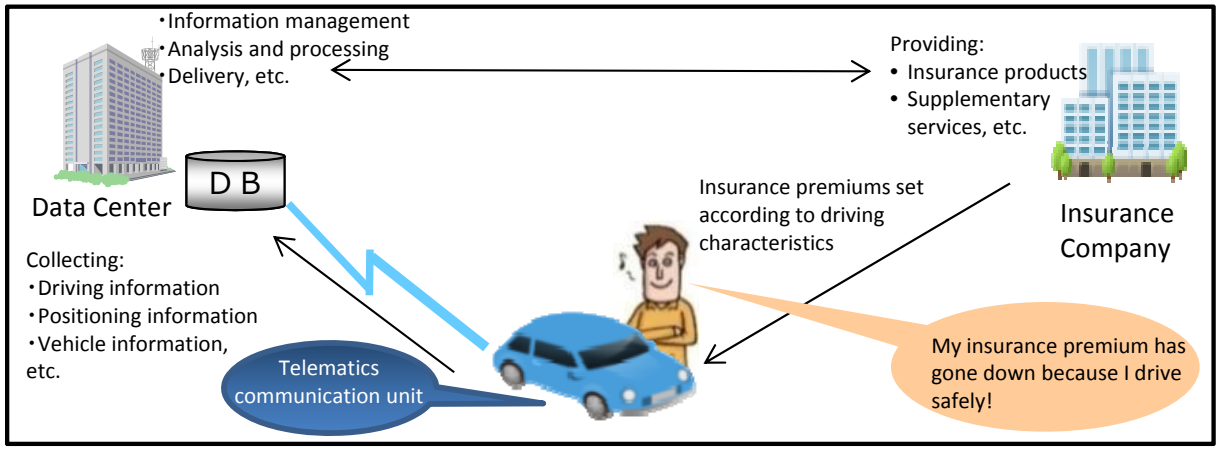
<Efforts Made for the Use of Automobile-Related Information>

We will work on various standardization tasks and the deployment of new services based on the Future Vision on the Use of Automobile-Related Information (developed by MLIT on January 23, 2015).

Specific Efforts

(1) Standardizing scan tools that support on-board diagnostics (OBD) for safety
(2) Starting new insurance servicing using telematics
(3) Expanding into traceability services that collect and use automobile history information
(4) Making inspection and maintenance more advanced and efficient through the correlation analysis of inspection and maintenance

New Insurance Service Using Telematics (Conceptual Diagram)



(3) Specific Efforts that Need to be Made in the Immediate Future Part 5

■ Specific Task: C. Use of Traffic and Other Big Data in Various Policies

- In parallel with the above-mentioned tasks A and B, traffic-related and other big data will be used to solve various problems that include those in the field of traffic.

Specifically:

- ✓ Providing information on traffic congestion, supporting Safety Driving Support Systems and Automated Driving Systems, managing road transport and doing research and study on roads, using data for road management, etc.
- ✓ Vitalizing public transportation systems, supporting the mobility of pedestrians, etc.
- ✓ Securing efficient means of transportation in rural and depopulated areas (e.g. on-demand system for car dispatch)

<Points to Consider As Necessary when Driving Forward>

- ✓ Encouraging the process of making various data used open
- ✓ Sharing the usage of the standard system and using cloud computing as we try to popularize the systems in rural areas efficiently

8. Cross-Sectional Efforts to Prepare for the World's Most Advanced ITS

8. Cross-Sectional Efforts to Prepare for the World's Most Advanced ITS

International Collaboration and Leadership

- Need to promote efforts from a global perspective and exercise leadership
- Taking the lead in developing international standards at the UN WP29
- Need to prepare internationally-open core sites that use more than one existing research institution
- Examining the promotion of social demonstration projects that use the core sites
- Holding international conferences on Automated driving annually in Japan

Response to the Tokyo Olympic and Paralympic Games

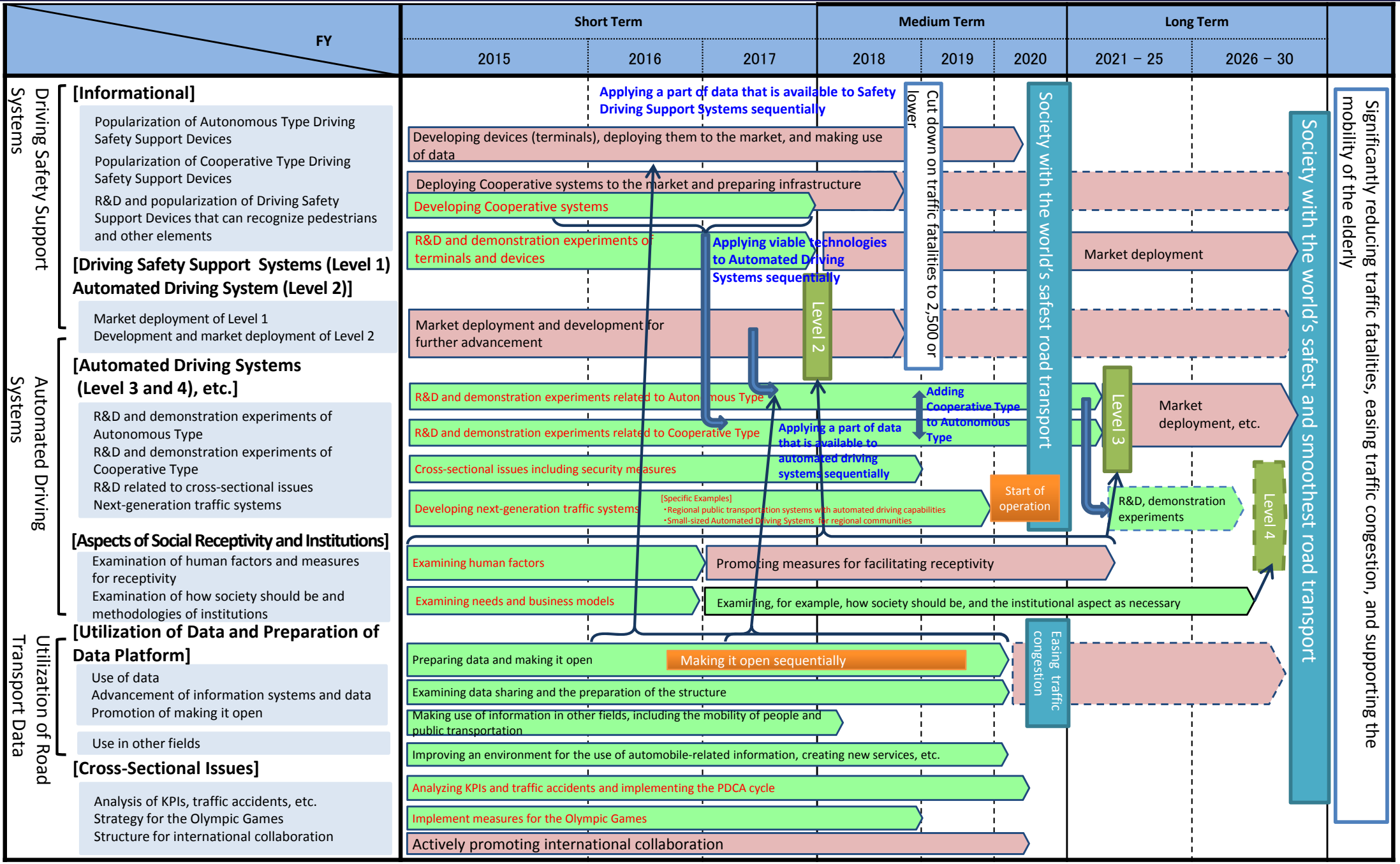
- Aiming to build the world's most advanced ITS in Japan and stress the strengths to the rest of the world
- Encouraging efforts in deploying the systems to other areas in Japan and exporting them as a package in light of the progress schedule of Practical application of ART
- Pursuing the use of the next-generation traffic system and Automated driving technologies in light of the Japan Revitalization Strategy revised in 2015 titled Reform 2020

Aligned Efforts in Rural Areas and Civic Participation

- Essential to demonstrate and implement the systems in specific cities and regions
- Preparing an environment where we can actively and safely conduct demonstration experiments on public roads through efforts related to near-future technological demonstration in National Strategic Special Zones
- Conducting demonstration experiments that include testing in places other than public roads in disaster hazard areas in the affected area of the Great East Japan Earthquake

9. Roadmaps

Public-Private ITS Initiative/Roadmaps 2015 (Overall Picture of Roadmaps)

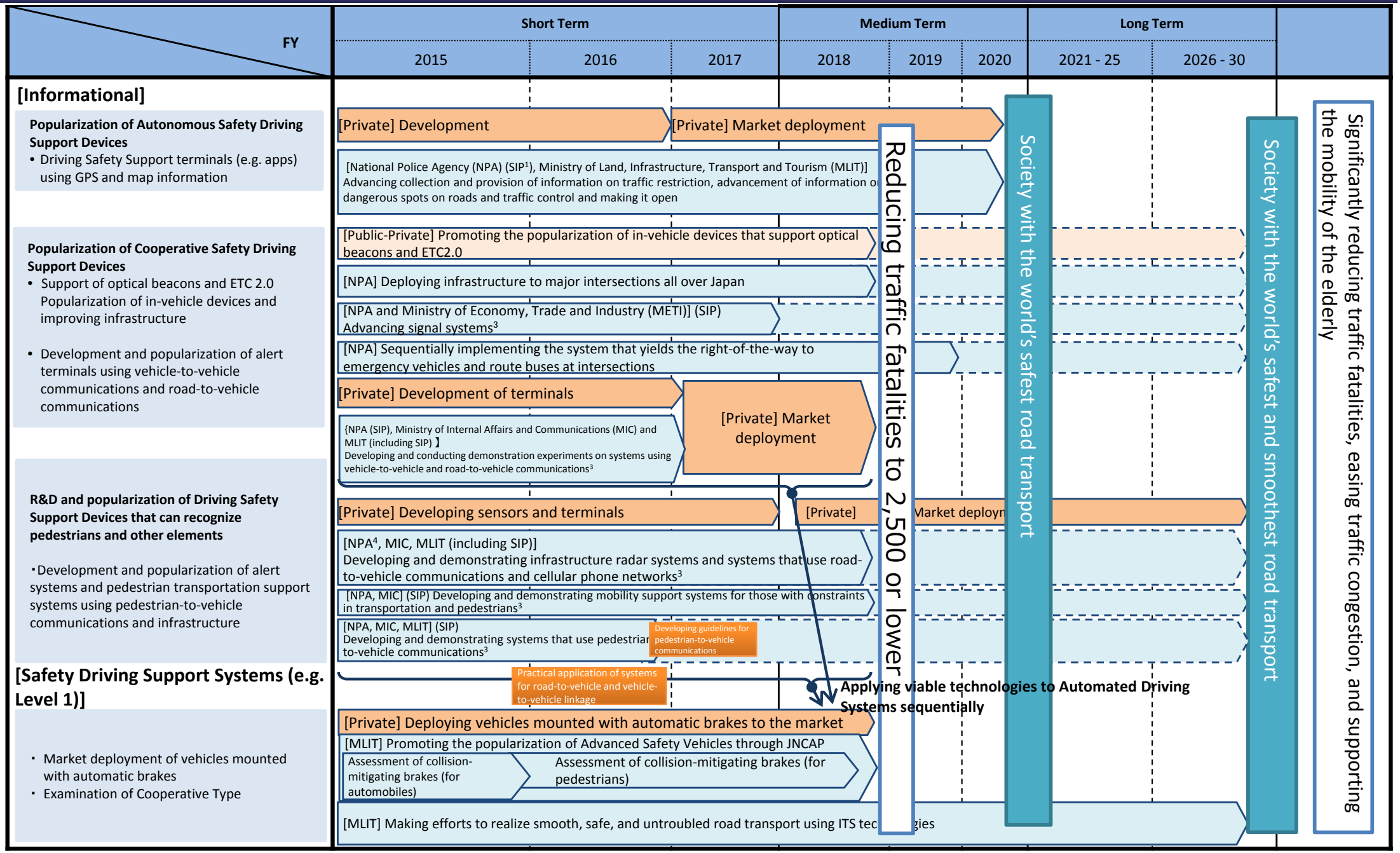


: Measures mainly related to development

: Measures mainly related to market deployment

Red font: Items that include SIP

Roadmap Related to Safety Driving Support Systems



:Measures led by the private sector

:Measures led by the public sector

: Measures taken through public-private collaboration

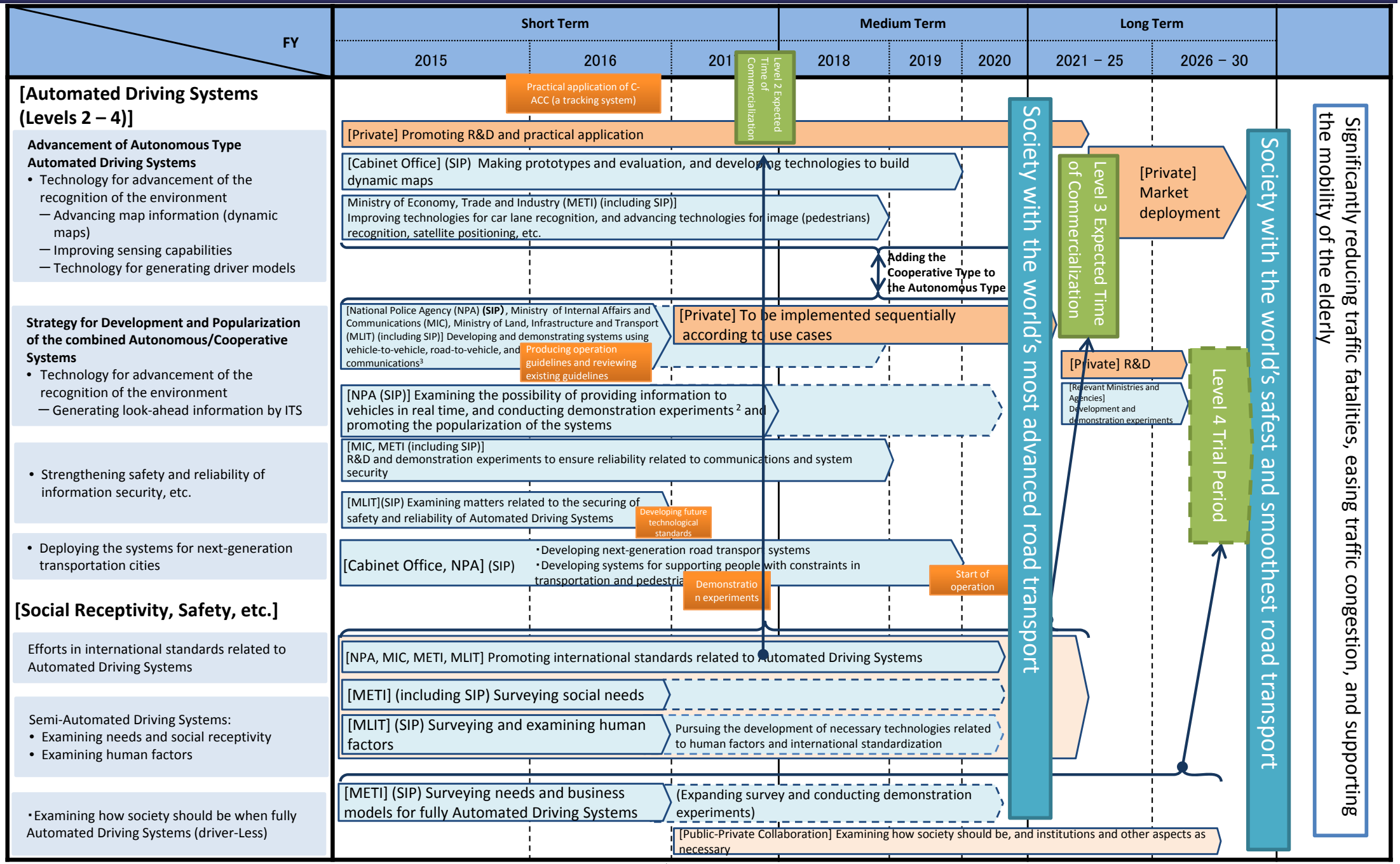
[1]SIP: Cross-ministerial Strategic Innovation Promotion Program of the Strategic Innovation Creation Council

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

[3] Measures related to Safety Driving Support Systems and Automated Driving Systems

[4] Requirements of infrastructure radar systems were examined under the FY 2014 budget.

Roadmap Related to Automated Driving Systems



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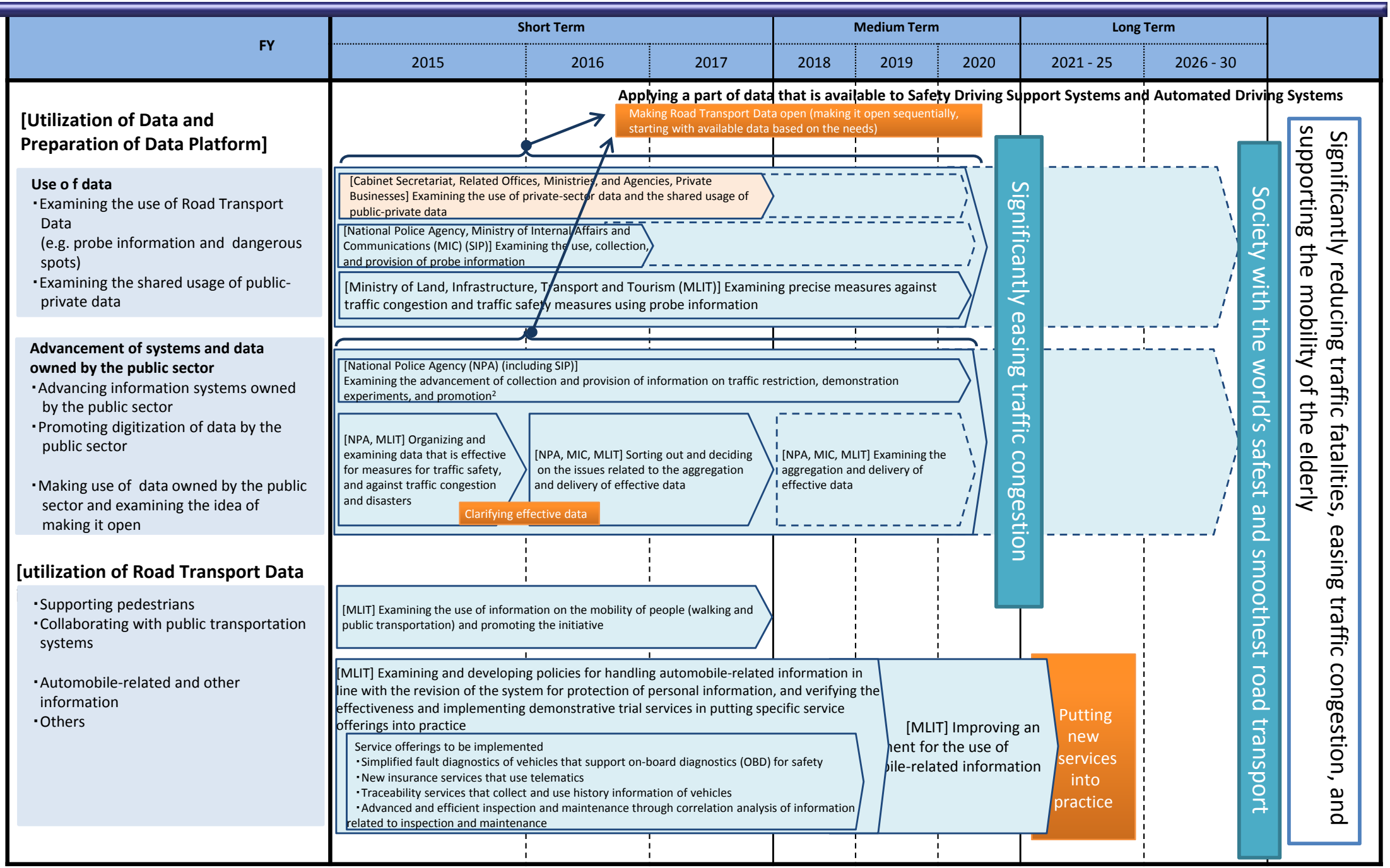
[3] Measures related to Safety Driving Support Systems and Automated Driving Systems

Roadmap Related to the utilization of Road Transport Data



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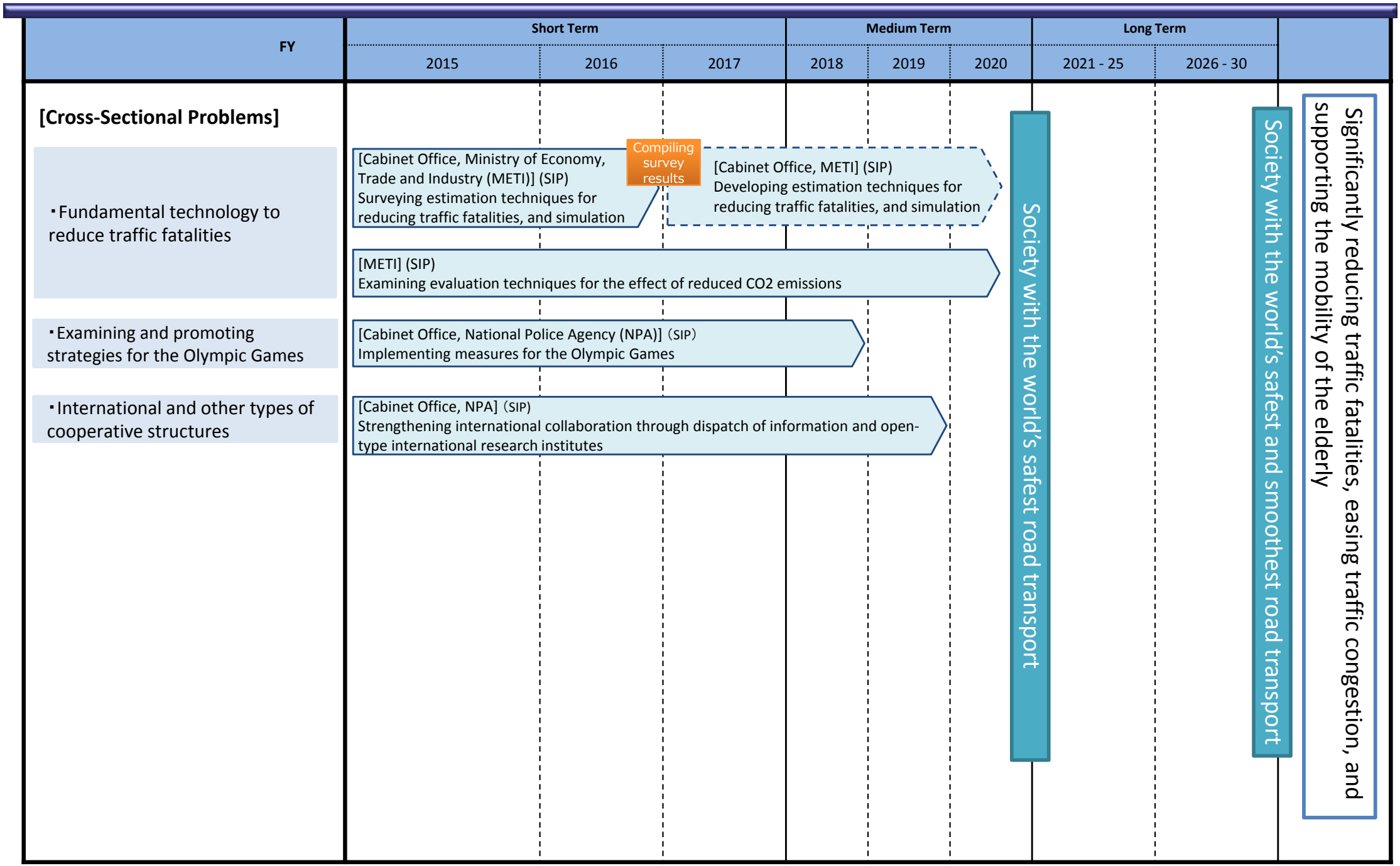
[3] Measures related to Safety Driving Support Systems and Automated Driving Systems

Roadmap Related to Cross-Sectional Problems



:Measures led by the private sector

:Measures led by the public sector

:Measures taken through public-private collaboration

[1]SIP: Cross-ministerial Strategic Innovation Promotion Program of the Strategic Innovation Creation Council

10. Method of and Structure for Moving Forward

- A joint conference between the SIP Automated Driving Systems Promotion Committee and the road transport Subcommittee will be held about twice a year as a structure for public-private collaboration to promote ITS-related measures
- This joint conference consists of members of related offices, ministries, and agencies as well as the business circle. Cabinet Secretariat and Cabinet Office serve as a secretariat.
- We will implement the PDCA cycle related to these roadmaps every year in light of new industries and technologies surrounding ITS that emerge both inside and outside Japan, and revise the roadmaps as necessary.