The Second Phase of SIP-Automated Driving for Universal Services (Overview)

Kotaro Sugiyama, Hiroaki Kimura (Cabinet Office)

1 Background and Policy Position

Interest in automated driving is increasing day by day, and automobile manufacturers and parts manufacturers are actively investing in research and development, and at the national level, active efforts are underway to attract research and development projects and Field Operational Tests (FOTs). In addition, steady progress is being made in developing legislation and improving the environment for practical use, mainly in Japan, the United States, and Europe.

Driving these developments, in addition to solving social issues such as reducing traffic accidents, reducing traffic congestion, and ensuring mobility for the elderly and vulnerable road users, there are great expectations for the social changes to be brought about by automated driving, such as the creation of new services and businesses related to logistics and transportation.

Currently, the automobile industry is facing a wave of innovation including automated driving, electrification, connected vehicles, and vehicle sharing, so much so that it is said that we are in a once-in-a-century era of major change. Winning this competition for development will not only maintain and strengthen the competitiveness of the automobile industry, which is currently a core industry in Japan and has a broad base, but it will also have ripple effects on related industries such as the digital infrastructure, sensors, and communications required for automated driving. We can also expect the creation of new industries and services, and there is a strong possibility that it will contribute to the future economic development of Japan.

Under these circumstances, at the Council on Investments for the Future (March 2018), the then Prime Minister Abe said, "We will realize automated driving at the Tokyo 2020 Olympic and Paralympic Games. We will transmit traffic signal information to vehicles and develop a testing site in the Tokyo waterfront area where vehicles can operate more safely, thereby further accelerating our efforts with a view to developing a variety of businesses." With this suggestion in mind, Public-Private ITS Initiative/Roadmaps 2021 (June 2021)[(1)] stated that by 2030, "We will lead the world in realizing a safe and highly convenient digital transportation society that supports the prosperous lives of the people." Furthermore, the Integrated Innovation Strategy 2022 (June 2022), as part of the development of data coordination foundations for Society 5.0, calls for the development of inter-field data coordination foundations, the development of a data coordination platform for each field, and the construction of an architecture.

SIP is an effort to realize "Society 5.0" set forth in the Fifth Science and Technology Basic Plan (January 2016). The Sixth Science, Technology, and Innovation Basic Plan (March 2021) calls for research, development and social implementation to solve various social issues and for the utilization of the convergence of knowledge to create a sustainable and resilient society that ensures the safety and security of the people, one in which the diverse well-being of each and every person can be realized.

2 Overseas Trends

When we look at the world, we see that many have awakened from the overly ambitious dream of fully automated driving as defined by the Society of Engineers (SAE), or SAE Level 5™, and have shifted to more practical

efforts. Meanwhile, discussions on safety, reliability, and ethical issues are deepening. Pilot test project of automated driving are being conducted all over the world, and discussions are progressing on the formulation of common evaluation methods for sharing knowledge and common formats for collected data. Due to the spread of infections of the novel coronavirus, which has spread rapidly around the world since the beginning of 2020, the flow of people and things has been greatly affected both globally and locally. Even in this circumstance, research and development on automated driving has been actively pursued, although there have been delays.

In the United States, in January 2020, the White House and the Department of Transportation jointly issued Automated Vehicle 4.0 (AV4.0) with the stated purpose of ensuring the United States' leadership in automated driving technology. AV4.0 establishes federal guidance for the development and integration of autonomous vehicles in three core areas: prioritizing safety and cybersecurity, promoting innovation, and ensuring a consistent regulatory approach. Although it was before the transition to the new government inaugurated in January 2021, based on the principles of AV4.0, the Automated Vehicles Comprehensive Plan was released. The plan defines three goals to achieve the U.S. Department of Transportation's vision for automated driving systems: promote cooperation and transparency, modernize the regulatory system, and prepare transportation systems.

In Europe as well, research projects related to automated driving are being pushed forward in various countries, such as Germany's PEGASUS and VIVALDI, and the UK's DRIVEN and Human Drive. Furthermore, in the EU, many research projects related to connected and automated driving are underway under the European Commission's Horizon 2020. Regarding the implementation of Horizon Europe, the successor program to Horizon 2020, an agreement was reached in December 2020, positioning climate, energy and mobility as one of the six clusters under the pillar of solving social issues.

3 Initiatives in the First Phase of SIP-adus and Major Achievements to Date

In Japan, the first phase of SIP-adus, which started in 2014, has played the central role, with the Tokyo 2020 Olympic and Paralympic Games etc. being set as a milestone. Research and development in the cooperative area of automated driving have progressed through industry-academia-government collaboration and collaboration among ministries and government agencies.

In FY2017, large-scale FOTs were begun, progress was made on verifying the effectiveness of dynamic maps and formulating unified specifications, and results such as the establishment of map platform creation systems were achieved. Based on these results, from the end of 2018, Dynamic Map Platform Co., Ltd. started the commercial distribution of high precision 3D maps covering about 30,000 kilometers of motorways nationwide.

Meanwhile, on the institutional side, the "Outline on improvement of legal system and environment for automated driving system" (April 2018, IT Comprehensive Strategy Headquarters) was formulated, and studies have taken place in each relevant ministry. In May 2019, revisions to the Road Transport Vehicle Act and Road Traffic Act were passed, and both revisions came into force in April 2020, making it institutionally possible to drive automated vehicles corresponding to SAE Level 3 on public roads. In November 2020, in accordance with the Road Transport Vehicle Act, the world's first type designation was carried out for an automated vehicles (SAE Level 3) equipped with an automated driving system. In March 2021, commercial sales of that automated vehicle, which was a first in the world. In addition, the high precision 3D maps from Dynamic Map Platform Co., Ltd. have been adopted for multiple vehicles, including that automated vehicle.

In addition, in May 2020, a partial revision of the Road Act was passed concerning the development of facilities on roads to assist in automated driving operations, and went into force in November of the same year. This is an example of the steady progress that has been made in institutional reforms toward the social implementation of mobility services using automated driving technology.

4 Launch of the Second Phase of SIP-adus and Details of Research and Development

In March 2018, the Council for Science, Technology and Innovation decided on an implementation policy for the second phase of SIP-adus. In response to this, in July of the same year, the Cabinet Office formulated the "Cross-ministerial Strategic Innovation Promotion Program (SIP) Automated Driving for Universal Services R&D Plan". For the social implementation of automated driving, it is necessary to overcome three barriers: technology, the legal system, and public acceptance. In response to these issues, the SIP-adus has sought to promote cooperation with the Digital Agency (formerly the Cabinet Secretariat's IT Comprehensive Strategy Office), the National Police Agency, the Ministry of Internal Affairs and Communications, the Ministry of Economy, Trade and Industry, and the Ministry of Land, Infrastructure and Transport, and to gain participation from industry and universities. It advances research, development, and FOTs through inter-ministry collaboration and collaboration among industry, academia, and government.

The following four pillars, namely

I) Development and verification of automated driving systems (FOTs)

II) Development of platform technologies for the practical application of automated driving
III) Fostering public acceptance of automated driving
IV) Enhancement of international cooperation
make up research and development.

The main content of research and development is organized as follows.

I) FOTs (Field Operational Tests)
 (1) The FOTs in the Tokyo waterfront area
 (2) Social implementation of mobility and logistics services in regional areas, etc.
II) Development of platform technologies
 (1) Utilization technology for road traffic environment data
 (2) Technologies for safety assurance
 (3) Cybersecurity
 (4) Construction of architecture related to geographic data
III) Fostering public acceptance
 (1) Disseminate information to citizens and promote understanding
 (2) Investigative research for solving social issues (clarification of socioeconomic impact)
IV) Enhancement of international cooperation
 (1) Disseminating information internationally by holding international workshops, etc.
 (2) Joint research and such with overseas research institutes
 Among those, the following are key themes:
(1) Building and distribution of a road traffic environment data framework
(2) Building of safety assurance environments in virtual environments
(3) Establishment of cybersecurity evaluation methods
(4) Building of distribution portal for geographic data

These four themes were positioned as important themes in the second phase of SIP-adus, we made active efforts toward practical application and commercialization. In addition, we cooperated with the Digital Agency so that technological development and the development of legal and other systems could proceed together, and coordinated efforts related to system development pursued by each ministry.

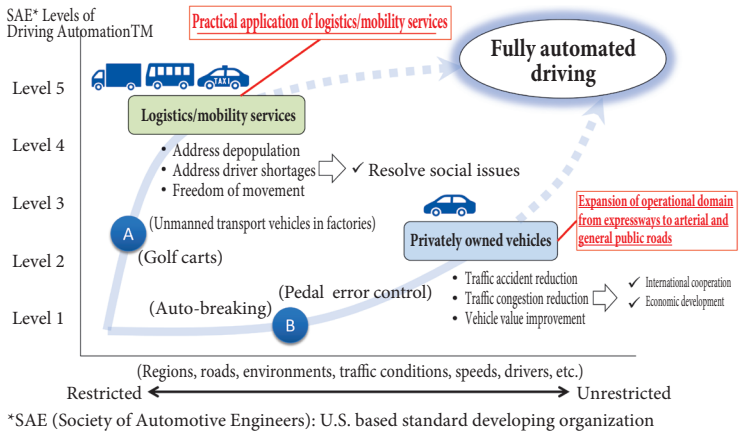
As shown in Fig.1, there are currently two approaches to automated driving development: one that pursues automated driving in a limited space and time (A), and one that pursues application in more diverse environments (B). In the SIP-adus, we believe that both approaches are necessary in order to contribute to achieving these goals more quickly by utilizing the technology of automated driving.

5 Main Initiatives and Results of the Second Phase of SIP-adus

5.1. The FOTs in the Tokyo waterfront area

On prefectural and municipal roads where the traffic environment is complex, vehicles intersect and pedestrians and bicycles come and go. Given these circumstances, it is difficult to realize advanced automated driving with only the information available from the sensors installed on the vehicle. As one of the solutions to this problem, we studied the utilization of traffic signal information with automobile manufacturers and installed ITS roadside units (RSU) that provide signal information through short-range wireless communication (V2I) in the Tokyo waterfront area. In addition, the development of road traffic infrastructure was advanced with such measures as installing ETC 2.0 roadside wireless devices used to provide information on vehicles traveling on the main line and information on opening and closing of ETC gates, with the aim of supporting safe and smooth merging from prefectural and municipal roads to expressways and the passing through of ETC gates by automated vehicles.

With the participation of domestic and foreign automobile manufacturers, in the Tokyo Waterfront City area of the Tokyo waterfront area, in the Haneda Airport area, and along the Metropolitan Expressway that connects Haneda Airport and Waterfront City area, etc., in October 2019, we began FOTs of vehicle-infrastructure cooperative driving automation system under the real traffic



*SAE (Society of Automotive Engineers): U.S. based standard developing organization

Fig.1: Overall initiatives of automated driving (Research and Development Plan) [2]

environment of public roads, and conducted technical verification as well as verification of the effectiveness of providing traffic signal information to automated vehicles. Although it was temporarily suspended due to the impact of the novel coronavirus, it was completed by the end of FY2020. In response to requests from experiment participants to continue, it was decided to add a new road traffic environment data and extend for one year until March 2022.

Beginning in November 2021, in addition to V2I traffic signal information distribution, with a public long range network (V2N) we built an experimental environment that could distribute broader and diverse road traffic environment data to vehicles. We conducted FOTs on the effectiveness of that data and on issues for social implementation.

In addition to the distribution of traffic signal information, emergency vehicle information, and rainfall information by V2N, we used real-time collection and statistical processing of private-sector probe information possessed by car/navigation system manufacturers, which enabled us to generate and distribute more detailed and accurate congestion tail information at the lane level than conventional lane level information. We conducted verification of the effectiveness of that information and necessary requirements.

5.2. Development of Platform Technologies

As described in Section 5.1, in the second phase of SIP-adus, we worked on building and distributing dynamic road traffic environment data frameworks linked to the high precision 3D maps that served as the platform for the dynamic maps that we worked on in the first phase. We verified these in the FOTs in the Tokyo waterfront area.

In order to realize automated driving, ensuring safety is the most important issue. It is necessary to verify safety not only by FOTs on public roads, but also by combining reproduction tests with actual vehicles on test courses and evaluations by simulations. It is particularly important to evaluate the sensors that serve as the "eyes" of automated vehicles, but there are no simulations that can simultaneously evaluate cameras, radar, and LiDAR. We therefore have no choice but to rely on evaluations based on FOTs on public roads, which is time-consuming. For this reason, in the second phase of SIP-adus, we worked on the development of a simulation platform that is highly consistent with actual phenomena that can be evaluated under critical conditions in various traffic environments.

In addition, the risk of cyberattacks will increase if we drive while using communications to obtain road traffic environment data in the future. In the second phase of SIP-adus, we worked on building guidelines for evaluating the performance of IDS (intrusion detection systems), which are expected to spread in the future, and building methods for collecting and analyzing threat information on cyberattacks.

To achieve Society 5.0, in addition to applying traffic environment data and other data for automated driving to other fields, it is necessary to utilize data collected in other fields, and thereby the build road traffic environment data frameworks. In the SIP-adus, we worked on the construction of the portal site "MD communet®" on the web network with the aim of promoting data coordination and distribution through the organization and structuring of information held by businesses in various fields. This portal site catalogs government data related to disaster prevention and geographical spaces, as well as mobility data from multiple private companies, and has been open to the public since April 2021. Since going public, we have increased the value of the portal site by recruiting many companies and organizations.

5.3. Fostering Public Acceptance

In addition to trying to quantify the benefits and utility obtained from automated driving, we have promoted the implementation of citizen-participatory events that ensured interactivity, and the creation and dissemination of information content that promotes a correct understanding of automated driving. In March 2021, which has been a milestone since the beginning, we held an midterm results presentation event on the SIP-adus, where we exhibited the latest research results for the practical application of automated driving in an easy-to-understand manner. We are planning to hold a final results presentation event in March 2023.

Also, in April and October 2021, we held test-ride events for the mass media in the Tokyo Waterfront City area. Because they were able to test-ride multiple automated vehicles at the same time, the media praised us for deepening their understanding of the technology and concepts. A similar test-ride event was held in September 2022, the final year of the second phase of SIP-adus.

5.4. Promotion of International Cooperation

In order to continue to maintain the international competitiveness of automobiles and related industries in Japan, it is necessary for Japan to take the initiative in standardization and scaling activities for automated driving, which is an important future technology, and to strive for international accord in the field.

As for international standardization activities, we strengthened cooperation with standardization bodies at the start of the second phase of SIP-adus. In addition to the Japan Automobile Manufacturers Association (JAMA) and the Society of Automotive Engineers of Japan (JSAE), we are cooperating with the Japan Auto Parts Industries Association, the Japan Electronics and Information Technology Industries Association (JEITA), the UTMS Society of Japan, the Association of Radio Industries and Businesses (ARIB), the ITS Info-communications Forum

(ITS Forum), and others. In doing so, we have gone forward with standardization with both de jure standards such as ISO, IEC, and ITU, and de facto standards via cooperation with internationally influential industry standardization organizations.

In addition, with the aim of cultivating human resources who can serve as leaders in research topics on an international stage, we held an international conference called the "SIP-adus Workshop" every year to share information and issues related to automated driving and discuss efforts to solve them. In addition to being a forum for disseminating information, it was also used as a forum for discussion through the exchanges among experts from Japan and overseas. International recognition increased after the first event was held in 2014. The SIP-adus Workshop 2021 was held online in November 2021 due to COVID-19, and saw more than 1,000 participants from Japan and overseas.

6 Goals and Project Achievement Milestones

In the SIP-adus, we proceeded our initiatives according to the stated achievement years of Public-Private ITS Initiative/Roadmaps 2021 described below as specific timings for the realization of the practical application and spread of automated driving.

- Mobility services: Realization of unmanned automated driving transportation services with remote monitoring only (SAE Level 4) in limited areas around FY2022
- Logistics services: Realize fully automated truck driving (SAE Level 4) on expressways after 2025
- Privately owned vehicles: Realize fully automated driving (SAE Level 4) on expressways by around 2025
- Privately owned vehicles: Further advancement of driving support technology on prefectural and municipal roads (SAE Level 2 or higher)

In addition to trying to establish the technologies in the cooperative areas necessary to achieve the goals, we worked to confirm the effectiveness of the technologies and services through FOTs involving various local business operators, local governments, and others. By creating multiple examples of practical application, we aimed to have prospects for social implementation by the end of the second phase of SIP-adus.

For the social implementation of research and development, it is necessary to integrate the efforts of various stakeholders, which encompasses not only technological development in cooperative areas but also technological development in competitive areas such as vehicle development. As a result, the Tokyo 2020 Olympic and Paralympic Games were set as milestones. Due to the impact of the novel coronavirus, the joint test ride event with the Japan Automobile Manufacturers Association, which was part of efforts to foster public acceptance, was postponed, but with regard to technological development, advancements were completed on schedule.

7 System of Initiatives

With program director (hereinafter referred to as "PD") Seigo Kuzumaki as chairman, representatives from the Digital Agency, the National Police Agency, the Ministry of Internal Affairs and Communications, the Ministry of Economy, Trade and Industry, the Road Bureau and the Road Transport Bureau of the Ministry of Land, Infrastructure, Transport and Tourism, experts, related industries, industry groups, etc. formed the SIP-adus Steering Committee, which conducted discussions of basic research and development policy and project achievement milestones via industry-academia-government collaboration. Under the Steering Committee, the System Implementation Working Group, Business Promotion Working Group, and International Cooperation Working Group were established. In addition, respective task forces were set up to build road traffic environment data frameworks, conduct FOTs in the Tokyo waterfront area, and study communication methods for cooperative automated driving, and discussions were facilitated. The New Energy and Industrial Technology Development Organization (NEDO), which is the management agency, was made responsible for the promotion of the SIP-adus. NEDO flexibly implemented measures when necessary and performed appropriate management and related duties.

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1 The Second Phase of SIP-Automated Driving for Universal Services

Overview of Activities of the National Police Agency

Hisaaki Ikeuchi (National Police Agency)

1 Main Initiatives of the second phase of SIP-adus

During the second phase of SIP-adus (Cross-ministerial Strategic Innnovation Promotion Program (SIP) Automated Driving for Universal Services), the National Police Agency worked on "Research and Development on Advanced Traffic Signal Information Provision Technology for Automated Driving," "Research and Development on Provision of Traffic Signal Information using Cloud Technology," "Research and Development on Traffic Signal Control using GNSS (location information)," and "Research and Studies on Improvement of Data Accuracy of Traffic Regulation Information."

1.1. Research and Development on Advanced Traffic Signal Information Provision Technology for Automated Driving

To achieve the practical use of automated driving systems, it is required for vehicles to recognize traffic signals in real time and controls themselves appropriately. Therefore, it is meaningful to improve the recognition reliability of traffic signals by using traffic signal information as a complement to the on-board camera that recognizes signal light colors.

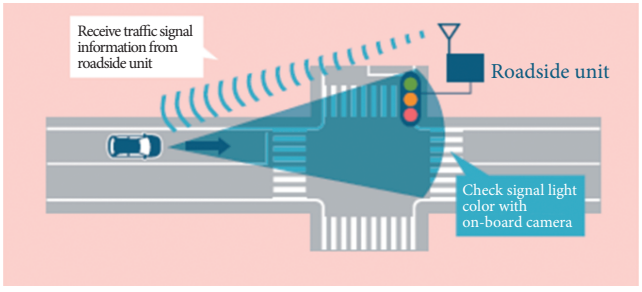

Fig.1: Provision of traffic signal information by ITS Roadside unit (RSU)

We therefore conducted research and development on an ITS roadside unit that provides traffic signal information to vehicles using the 700 MHz band. (Fig.1)

The primary results of this project are as follows: the domestic and international survey on the provision of traffic signal information from roadside infrastructure conducted in FY2018, the study of detailed functional and technical requirements, and the development of a prototype ITS roadside unit in FY2019. In addition to these, in FY2020, we prepared the specifications for ITS roadside units based on the results of the prototype test, and we made some alternations in the prototype considering the study on providing traffic signal information specifically to automated vehicles and the reexamination of the details of the functional and technical requirements for it.

1.2. Research and Development on Provision of Traffic Signal Information using Cloud Technology

This project is aimed at realizing the provision of SPaT information to automated vehicles by means other than vehicle-to-infrastructure (V2I) communication using ITS roadside units.

To realize this, we studied a method to provide SPaT information from traffic signal controllers to vehicles via the Traffic Control Center of each Prefectural Police Headquarters, the SPaT Information Aggregation System of the National Police Agency, the SPaT Information Center, and the Distribution Centers of businesses or other entities. (Fig.2)

In FY2018, we conducted domestic and overseas case studies on methods that enable the provision of SPaT information

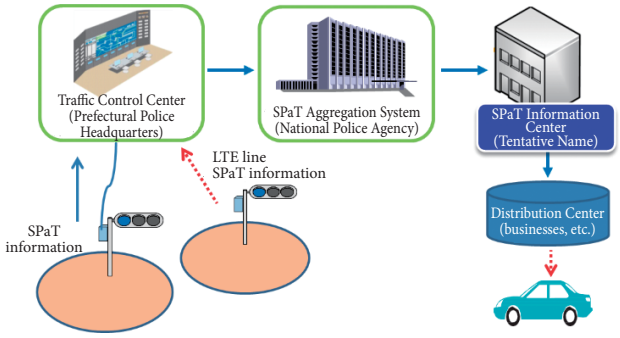

Fig.2: Provision of SPaT information using the cloud, etc.

other than V2I communication. In FY2019, we examined in detail functional and technical requirements, prepared draft specifications for a model system for providing SPaT information of Prefectural Police Headquarters, and studied specifications for the SPaT Information Aggregation System. In FY2020, we constructed a SPaT Information Provision Model System in Saitama Prefecture, measured the time accuracy of each device, recognition errors and delay times of SPaT information, and obtained comparative test results of three information provision methods. In FY2021, we studied what the SPaT Information Center should look like that receives nationwide SPaT information from the SPaT Information Aggregation System and transmits it to the Distribution Centers of businesses. In FY2022, we constructed the SPaT Information Aggregation System and the SPaT Information Provision System in Nara Prefecture as part of the Field Operational Tests (FOTs).

1.3. Research and Development on Traffic Signal Control using GNSS (location information)

The police are promoting the deployment of Public Transportation Priority Systems (PTPS) in which Traffic Control Centers prioritize traffic signal control, such as extending green light timing and shortening red light timing, so that public vehicles can pass through intersections smoothly. Currently, infrared beacons are used to detect public vehicles to implement priority signal control in PTPS. However, because of its fixed-point detection, PTPS is unable to respond to changes in traffic conditions immediately after detection, or to provide service in locations where infrared beacons have not been installed.

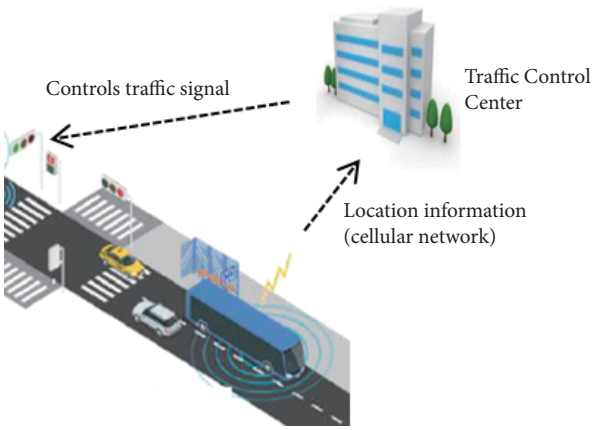

Fig.3: System using GNSS and cellular network

This project, therefore, aims to enable traffic signals to be controlled with priority in a timely manner over a wide area by linking the Prefectural Police Traffic Control Systems with automated buses and other public vehicles using GNSS location information and cellular networks. (Fig.3)

In FY2020, we studied the technical requirements, cost-effectiveness, and model system specifications for traffic signal control using GNSS and cellular networks, and in FY2021 we conducted FOTs in Shizuoka City and the Tokyo waterfront area.

1.4. Research and Studies on Improvement of Data Accuracy of Traffic Regulation Information

In this project, we conducted research and studies that contribute to the appropriate provision and management of traffic regulation information required by automated vehicles.

In FY2021, to reduce the workload of registering traffic regulation information and road sign and marking information, we studied image recognition technology to easily collect and extract location information on sign and marking from videos and still images collected from sources such as dashboard cameras. We also developed a model system to improve the accuracy of data on traffic regulation information by collating it with road sign information, and conducted FOTs in Kanagawa Prefecture. (Fig.4)

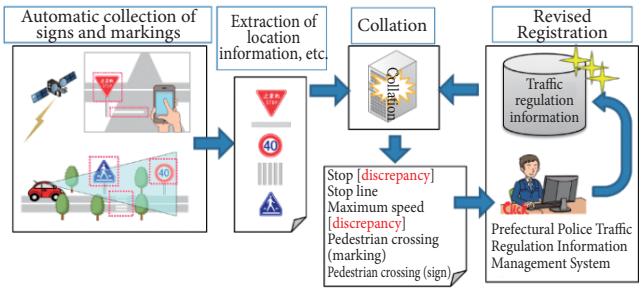

Fig.4: Improvement to traffic regulation information precision

In addition, we reviewed the standard format for traffic regulation information data developed in the first phase of SIP-adus and developed an extended version of the standard format to unitarily manage traffic regulation information and road sign and marking information corresponding to it. In FY2022, we developed a prototype system using the technologies we have researched and the extended version of the standard format, and conducted FOTs in Chiba Prefecture.

2 Conclusion

In the second phase of SIP-adus, the National Police Agency engaged in various studies toward the realization of automated driving. Because of the wide range of technologies required for automated driving, many organizations, groups, and businesses are currently collaborating to promote research and development, FOTs, and other activities. With recognition of their potential to reduce traffic accidents and congestion, the Police will continue to actively support the development of automated driving technologies designed for the road traffic environment in Japan, allowing them to be put to practical use in an early timing.

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Overview of Activities of the Digital Agency

Jun Usami (Digital Agency)

1 Introduction

In this article, we will introduce the "Establishment of environment for promoting the utilization of mobility-related data," which National Strategy Office of IT, Cabinet Secretariat, the predecessor of the Digital Agency, worked on in the second phase of SIP-adus (Cross-ministerial Strategic Innovation Promotion Program (SIP) Automated Driving for Universal Services), and the "Vision of Mobility and Society 2022," built based on the "Public-Private ITS Initiative/Roadmaps."

2 Establishment of environment for promoting the utilization of mobility-related data

In order to promote the social implementation of a data coordination mechanism for the distribution of transportation-related data, it is important to develop an environment in which various stakeholders inside and outside the mobility field can collaborate with each other. To this end, in service areas where use cases have not yet been established, we need to develop rules and standardize data specifications that are necessary for sharing functions and data common among stakeholders, as well as data distribution mechanisms for social implementation. In the future, it will be necessary to proceed with further studies among the parties concerned and to construct the system step by step.[1] Based on the awareness of these problems, we conducted a survey to find out what kind of environmental improvements are necessary to promote the utilization of mobility-related data.

Three use cases of data utilization were defined and discussed, and about the extracted issues, interviews were conducted with actually related entities, and the issues were

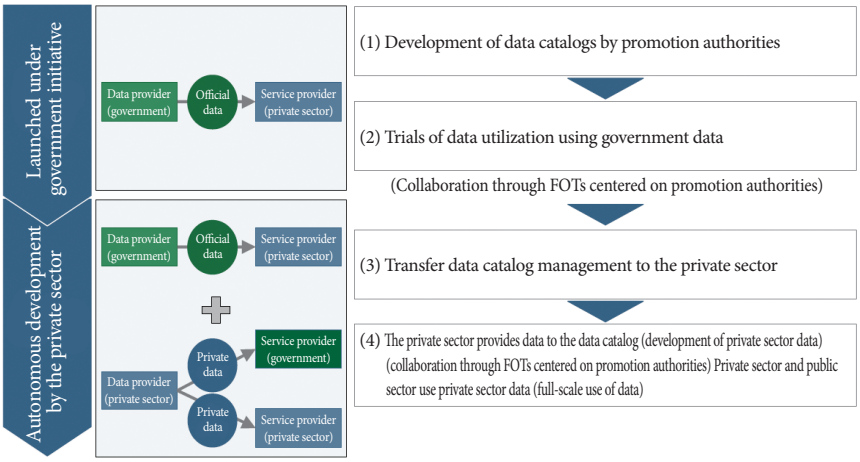

Fig.1: Promotion procedure for public-private sector data coordination[2]

further explored.

As a result, we found that "data handling" and "public-private partnership for data distribution" were issues regarding data coordination and utilization. We considered countermeasures, such as procedures to promote public-private data coordination. In the procedure shown in Fig.1, it is not possible to foresee the business feasibility of data utilization, and data distribution does not progress. Therefore, this shows an approach that aims to begin from official data utilization and then involving private parties.

3 Vision of Mobility and Society 2022[3]

This section will introduce Vision of Mobility and Society 2022, which was decided in August 2022 at the Director-Generals' Meeting for the Digital Society developed based on Public-Private ITS Initiative/Roadmaps, including initiatives related to the second phase of SIP-adus.

The "Public-Private ITS Initiative/Roadmaps", which is a government-wide strategy related to ITS and automated driving, was formulated in 2014, and related ministries and agencies, private companies, and other public-private efforts have promoted it. Initiatives that comprise the roadmap are proceeding steadily, including commercialization of the world's first a Level 3 automated driving vehicle passenger car and driverless automated driving transport services by 2021, and the revision of the Road Traffic Act leading to the establishment of a system for Level 4 automated driving in 2022.

On the other hand, when we look at the status of implementation of the technologies in local areas, there are many issues, such as the fact that there are many cases interrupted after FOTs (Field Operational Tests), and in the future it is necessary to aim for further development of the roadmap for full-scale social implementation.

For this reason, the "Study Group on Digital Transportation Society"[4] was established to study how society and lifestyles should be from the perspective of each individual citizen as the digital transportation society progresses. Backcasting from this to identify how mobility should be, we proceeded with the study while receiving opinions from a wide range of perspectives.

3.1. Issue

In Japan, social problems in various fields such as transportation, medical care, and education are becoming more serious as the population declines at an accelerated pace. In addition, as we move from the industrial society and information society to the new society, the economic model is undergoing major changes.

As the population declines, there is a shift from an economy in which demand meets supply (for example, passengers waiting for buses at bus stops) to an economy in which supply meets demand (service vehicles pick up passengers). The style of transportation services is also being forced to shift to a model that develops services starting from the demand side (perspective of each person's lifestyle) while utilizing digital technology.

In addition, technologies related to transportation services have progressed remarkably, and various means using digital technology have emerged. It is also necessary to have the perspective of reducing the marginal cost (the additional cost incurred when adding one unit of service supply) by aiming for overall optimization.

3.2. Service design from the perspective of citizen's life

Based on the recognition of the issues, we will organize examples of initiatives that have been implemented in Japan and overseas based on the perspective of each citizen's life and the actual methods used at that time, and the points that have been seen from the examples of social implementation are presented as 11 viewpoints, including "Each region decies its own vision for the future."

3.3. Technologies and systems for provision of services

From the perspective of realizing technologies and mechanisms that support service design from the angle of lifestyle, we will build a social implementation plan for the technology and promote its realization and dissemination in line with efforts toward implementation of services from the perspective of lifestyle.

The current public and private sector efforts were categorized by means (transport mode) in Vision of Mobility and Society 2022. The scope has been expanded from the framework centered on ITS/automated driving that has been dealt with in Public-Private ITS Initiative/Roadmaps to "from walking to flying," and "Automated driving and Driver Assistance," "road space," and "mobility service and MaaS," "drones," and "flying cars," we added a category called "mobility field cooperative Domain" as a cooperative area, and organized the efforts for each.

3.4. For realization

"Vision of Mobility and Society 2022" is just a snapshot of the current situation, and we will continue to update it in the future.

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Overview of Activities of the Ministry of Internal Affairs and Communications

Takanori Mashiko (Ministry of Internal Affairs and Communications)

1 MIC Initiatives Regarding ITS

The Ministry of Internal Affairs and Communications (MIC) is progressing initiatives regarding ITS (Intelligent Transport Systems) to realize V2X (vehicle to everything) communication that connects people, roads, and vehicles using information and communications technology, with the aim of achieving the safe and comfortable movement of people and things. V2X communication is a general term that refers to communication forms between vehicles and various other things, such as vehicle to infrastructure (V2I) communication, vehicle to vehicle (V2V) communication, and vehicle to network (V2N) communication.Regarding communication systems which use radio, such as VICS (Vehicle Information and Communication System), ETC (Electronic Toll Collection System), in-vehicle radar system, and ITS Connect (700 MHz Intelligent Transport Systems), until now MIC has allocated frequencies and developed technical standards while taking the status of radio wave use and interference with other wireless communication systems into consideration, and also promoted the adoption of these systems.

As an initiative towards the realization of an automated driving society, in recent years we have collaborated with related ministries and agencies to progress initiatives related to cooperative automated driving (automated driving realized by connecting vehicles and various other things through communication) using V2X communication. (Fig.1)

Through the uptake of vehicles that are connected to various things (connected cars), more advanced automated driving will be realized and cars will become a space where various social and economic activities can be performed instead of just a means of transportation, and it is expected that everyone will be able to enjoy safe and convenient mobility services.

2 MIC Initiatives for the Second Phase of SIP-adus

Regarding "Automated Driving for Universal Services", as a project of the second phase of SIP: Cross-ministerial Strategic Innovation Promotion Program, MIC has

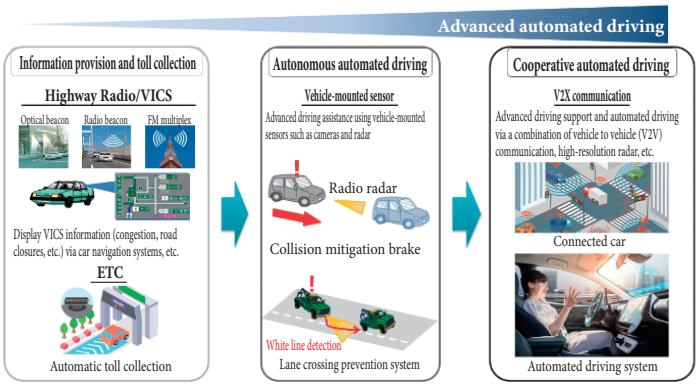

Fig.1: Image of the evolution of the ITS system

progressed research and development in cooperation with ITS-related ministries and agencies that is aimed towards the realization of cooperative automated driving, mainly from the perspective of wireless communication systems.

From FY2019 to FY2021, the "Research and development related to the collection, integration, and distribution of small-scale network and mid-scale network information" project conducted research and development into technology that continuously recognizes dynamic information obtained from various information sources and collects the necessary information from a small-scale network area, which is about the size of a general intersection, or a mid-scale network area which is about the size of a municipality, integrates it in real time and distributes it to vehicles, so that a bird's-eye view of surrounding traffic conditions can be ascertained in order to realize safe and secure automated driving.The results of this research were partially applied to the FOTs (Field Operational Tests) in the Tokyo waterfront area that was also conducted during the second phase of SIP-adus, and all of the target values were achieved within the scope of the use cases and prerequisites defined in the research project, and we were able to confirm the usefulness of the examined system architecture, although it depends on the application and conditions.[(1)]

In addition, From FY2019 to FY2021, we defined use cases that use communication as a base, clarified the communication requirements, and studied communication methods that satisfy the communication requirements, for the purpose of "Research for V2X Communication for Cooperative Driving Automation."

First, in FY2019, we defined 25 use cases where wireless communication systems are expected to be used in cooperative automated driving (SIP use cases for Cooperative Driving Automation) and clarified their communication requirements.The Japan Automobile Manufacturers Association, experts, and related ministries and agencies participated in the discussions to formulate the use cases, and we also received cooperation from many related organizations such as the ITS Info-communications Forum during the study of the communication methods.

From FY2020 to FY2021, we conducted a technical examination of the requirements of communication at each frequency band and for communication method, related to new communication technology in use cases that require communication for automated driving, with the aim of realizing a safe and comfortable automated driving society through vehicle-infrastructure cooperative driving automation technology that utilizes traffic signal information from traffic infrastructure installed on prefectural and municipal roads and merging lane assistance information on expressways. We then created a communication method roadmap that realizes the use cases for cooperative driving automation using more advanced V2X communication, based on the implementation period of the communication and the adoption rate of automated vehicles. (Fig.2) This roadmap shows that the introduction of a new communication method will be necessary from around 2030 in order for there to be a 30% adoption rate of cooperative automated vehicles by around 2040.[(1)]

In FY2022, we investigated and analyzed the latest trends regarding the institutionalization and standardization of 5.9GHz band V2X communication in areas such as Europe, the United States and China, and examined the communication requirements of a 5.9GHz band V2X system, based on the results of the examination in the previous fiscal year and taking into consideration the connection with the existing 700 MHz band safe driving support system.Then, based on the evaluation results of the communication simulation, we designed the communication protocol of this system, and devised the specifications of the wireless equipment necessary for the development and manufacturing of on-board equipment and roadside unit.

3 MIC Study of 5.9GHz Band V2X Communication

In order to realize automated driving, securing a new frequency band is an urgent matter in order to introduce a new V2X system that can handle the rapid increase in communication traffic.MIC has conducted technical examination work targeting the 5.9 GHz band, which is a frequency band that is being studied and commercialized for V2X systems internationally.

In FY2020, we started to study the technical conditions related to frequency sharing with existing wireless systems, which will be necessary when introducing a V2X system.In FY2021, in addition to demonstrations aimed at examining the sharing with existing wireless systems that use the 5.9 GHz band and adjacent frequencies (ETC, Wi-Fi, wireless systems of broadcasting businesses, etc.), we conducted a survey of the actual operation of the existing wireless systems and considered introduction measures in response. The results were carried over to the examination under the second phase of SIP-adus and accelerated the problem resolution and examination regarding 5.9 GHz band V2X communication.

4 Conclusion

In order to realize ITS and automated driving, it will be essential to develop information communication infrastructure since it is expected that a large amount of real-time data transfer and exchange will be required. Furthermore, research and operational tests are being conducted in various countries toward the realization of automated driving systems that utilize not only ITS but also LTE and 5G, so the advancement of 5G and other information communication infrastructure is also necessary in order to respond to the needs of automated driving and

Overview of Activities of the Ministry of Internal Affairs and Communications

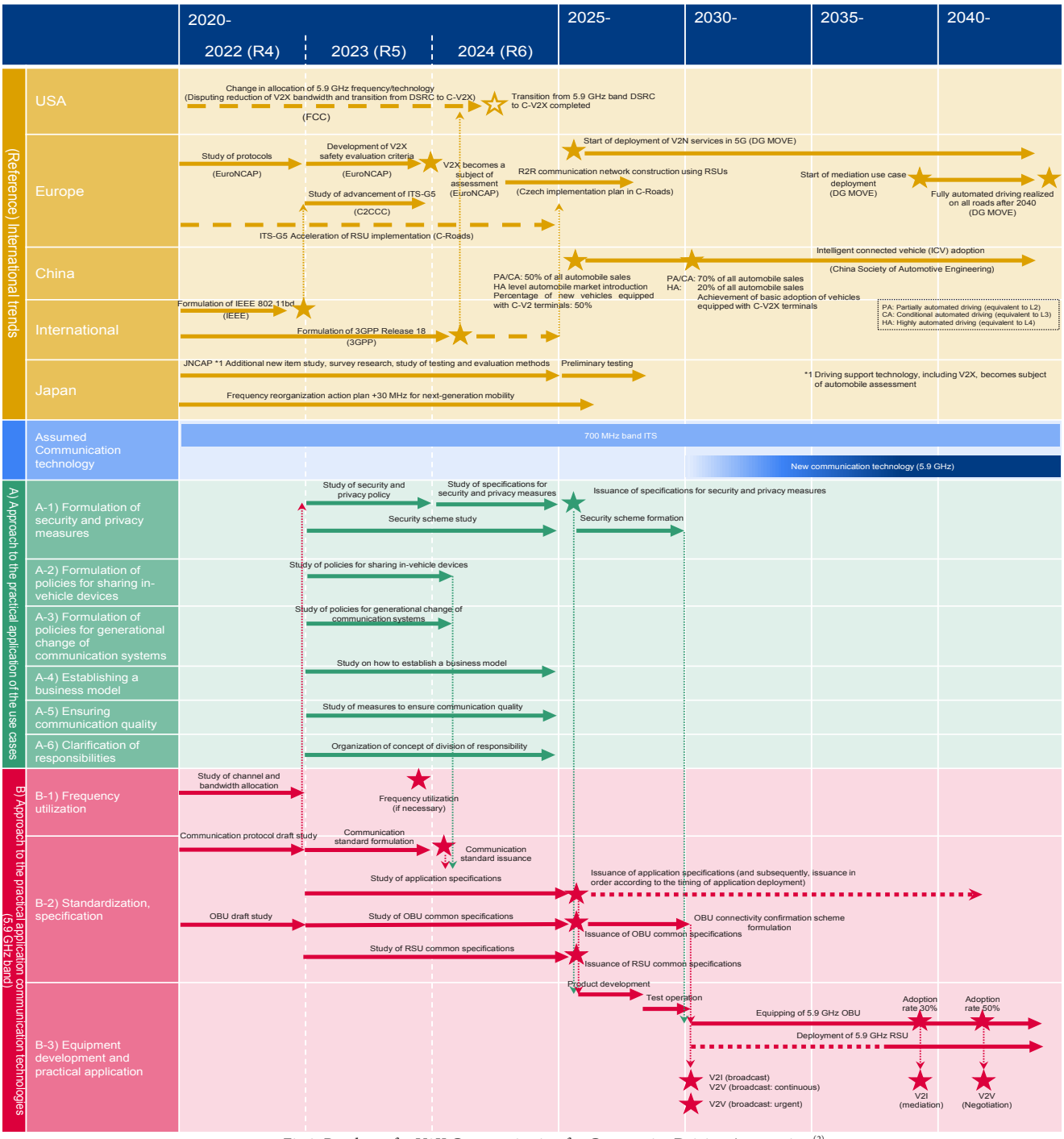

Fig.2: Roadmap for V2X Communication for Cooperative Driving Automation [2]

connected cars.

In the future, in addition to progressing with initiatives aimed at the adoption and deployment of 5G, we are planning to study specific frequency use policies for when systems are introduced, based on the results of studies through SIP and other activities related to the 5.9GHz band V2X communication system, while considering the existing wireless systems on the same frequency band.If the service providers of this system are defined and the system is introduced into the above mentioned frequency band, we plan to assign a frequency allocation to V2X communication after securing the necessary frequency bandwidth by migrating the existing wireless systems.

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1 The Second Phase of SIP-Automated Driving for Universal Services

Overview of Activities of the Ministry of Economy, Trade and Industry

Shigekazu Fukunaga (Ministry of Economy, Trade and Industry)

1 Main Activities of the second phase of SIP-adus

1.1. Research on recognition technology, required for automated driving technology (Level 3, 4)

In this research, three universities of Kanazawa University, Chubu University, and Meiji University aimed to find out the level of support by infrastructure needed and the recognition determination technology level by AI in automated driving. Therefore, researchers developed testing vehicles with level 3 and 4 automated driving technology and conducted FOTs (Field Operational Tests) for infrastructure-vehicle cooperative driving that used V2I and V2N, such as installing signal devices that can receive signal information (lights) wirelessly, on the public roads of the Tokyo waterfront area.

In the five years of the second phase of SIP-adus, the early period of 2018-2020 was spent developing signal devices and object recognition technology and studying basic infrastructure conditions for infrastructure-vehicle cooperative driving that used V2I. In the later period of 2021 and 2022, researchers constructed an environment to evaluate automated driving systems by simulators in order to execute safety assurance of automated driving technology using simulation technology and infrastructure-vehicle cooperative driving with V2N, which provides traffic signal information and emergency vehicle information.

In addition, researchers provided test-riding opportunities for testing vehicles in the Tokyo waterfront area, etc. and conducted activities to deepen understanding of automated driving technology and communicate results of R&D.

Based on the knowledge gained from these FOTs, we published the data sets of infrastructure support information needed for automated driving on prefectural and municipal roads. We are planning to utilize these results in the "Project on Research, Development, Demonstration and Deployment (RDD&D) of Autonomous Driving toward the Level 4 and its Enhanced Mobility Services" (RoAD to the L4) promoted by the Ministry of Economy, Trade and Industry and Ministry of Land, Infrastructure, Transport and Tourism.

2 Major activities for automated driving by the Ministry of Economy, Trade and Industry

2.1. RoAD to the L4

Until now, the Ministry of Economy, Trade and Industry took efforts with the Ministry of Land, Infrastructure, Transport and Tourism to realize driverless platooning driving technology on expressways and driverless automated driving services limited only to certain regions. However, these efforts were constrained to limited technology, services, and regions. Further activities are needed for the full development of automated driving services. In order to fully propagate driverless automated driving services, it is important to link services with a business based on comprehensive initiatives to enhance technological development, traffic environment, and social acceptance.

Based on this background, from fiscal 2021, aiming for the realization and propagation of driverless automated driving services, the government started a new project

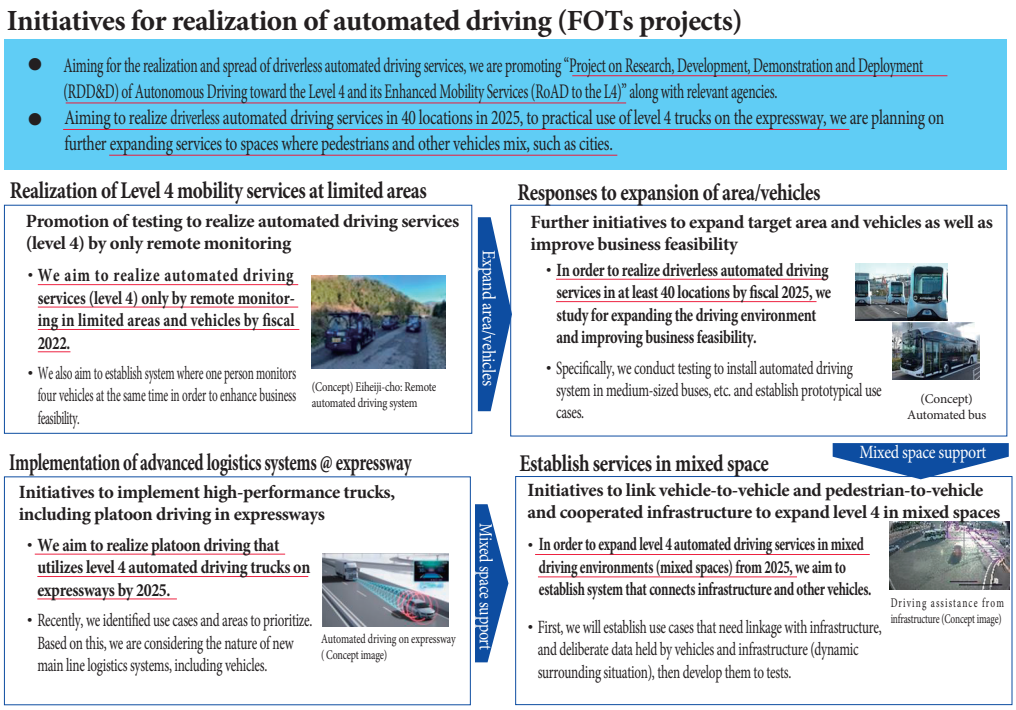

Fig.1: Overview of RoAD to the L4

RoAD to the L4 (Fig.1) with related agencies to take comprehensive efforts from R&D to FOTs and social implementation. (Refer to Section 8 3) "SIP-adus Achievement as Heritage and Next Step" for more details).

In the future, based on automated driving mobility services shifting to social implementation phases, the following goal was stated at the 2022 Automated Driving Business Symposium held in March 2022: "In order to realize automated driving mobility services designed to lead resolution of social issues such as: secured mobility amid depopulation and aging society, dissolution of traffic accidents and congestion, and contribution to carbon neutrality, we are going to work on primarily 4 issues, namely technological development, improvement of transport environment, enhancement of social acceptance, as well as acceleration of business implementation, under Road to the L4. The outcomes of this project will be developed and shared nationwide then advanced toward steady social application of the technologies always watching international trend."

Under this circumstance, the Road Traffic Act was revised in April 2022 and we had some good prospect for realizing level 4 driverless automated driving mobility services in Eiheiji-cho, Fukui Prefecture. On the other hand, scenes where automated driving is actually needed are expected to include multiple types of traffic participants, such as pedestrians, bicycles, motorcycles, and large vehicles. Therefore, efforts are needed in incorporating the technologies gained until now to realize automated driving mobility services that fit diverse traffic environments.

This project aims to fully spread the services in around fiscal 2030 in promoting these activities, then implementing such automated driving mobility services at 40 locations by 2025 to build up models for cost reductions and business implementation with know-how and outcomes which will have been resulted from these activities and will contribute to enhance technological development, traffic environment and social acceptance.

2.2. SAKURA Project

To achieve practical use of automated vehicles, we must develop new safety assurance methods for driving by automated driving systems, in addition to the conventional recognition of safety with driving by human drivers. However, there are no such established international methods. Each country is actively participating in the development of international regulations (WP29) and standards (ISO) related to safety assurance.

Until now, the Ministry of Economy, Trade and Industry has worked with the Ministry of Land, Infrastructure, Transport and Tourism on the SAKURA (Safety Assurance KUdos for Reliable Autonomous Vehicles) Project (Fig.2) to gather traffic data required to construct the safety assurance platform of automated vehicles and establish safety assurance scenarios. The outcome of this project was led to the development of the "Automated driving safety assurance framework Ver. 2.0" by the Japan Automobile Manufacturers Association in 2021, which was proposed to the

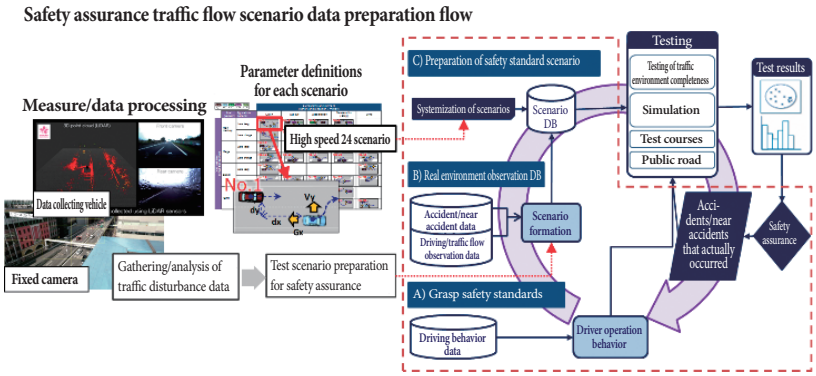

Fig.2: Overview of SAKURA Project

international regulations (WP29) and standards (ISO). Under the leadership of Japan, a safety assurance framework which is based on scenarios targeting highways was issued as an international standard, namely ISO 34502.

Succeeding the R&D results of the DIVP® (Driving Intelligence Validation Platform), we will develop and apply an infrastructure platform and persuasive real data that are both fair and transparent as we aim to make the safety assurance methods of Japan international de facto standards in cooperating with other countries. Specifically, we will conduct analyses and research for next international proposals, such as deploying safety assurance methods developed for expressways on prefectural and municipal roads, and contribute to establishing safety assurance mechanisms shared across the globe, including traffic on prefectural and municipal roads and level 4 automated driving.

3 Conclusion

The spread of automated driving will secure means of mobility in regions where aging society and population decline are worsening and lead to support for labor shortages in the logistics field. It can also be expected to reduce accidents and congestion and contribute to carbon neutrality by improving traffic flows. On the other hand, for the spread and popularization of the technologies, other than technological development by an individual company, it is important for industry, academic, and government to work together in cooperative areas to improve traffic environment including revisions of relevant lows, establish standardized safety assurance methods, construct sustainable business model, and foster social acceptance.

Based on this perspective, we must proceed with the initiatives in the RoAD to the L4 project and accelerate efforts targeting the construction of driverless automated driving services and advanced trunk line logistics systems. In addition, we must organize the topics and issues that are to be taken over from the second phase of SIP-adus to RoAD to the L4, construct a structure that allows affiliated agencies to work together closely, and aim for collaboration in the "Construction of smart mobility platform," for the next phase of SIP.

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1 The Second Phase of SIP-Automated Driving for Universal Services

Overview of Activities of the Road Bureau, Ministry of Land, Infrastructure, Transport and Tourism

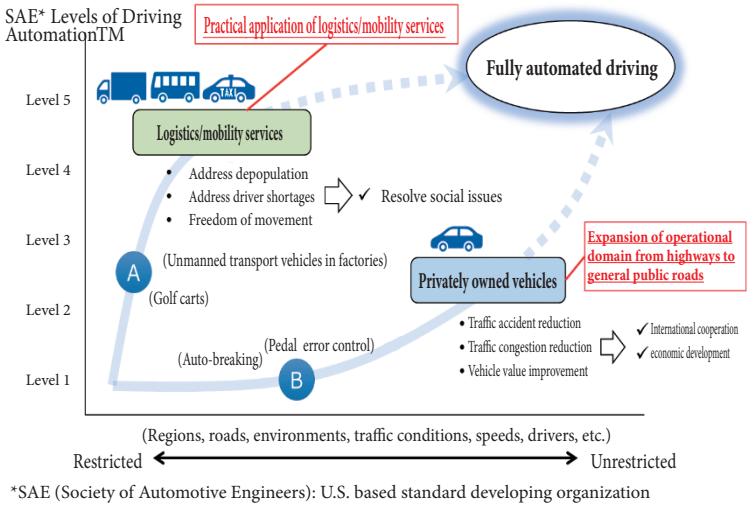
Masamitsu Waga
(Road Bureau, Ministry of Land, Infrastructure, Transport and Tourism)

1 Introduction

The realization of automated driving requires not only vehicle technology but also appropriate support from road infrastructure with consideration of status of development and spread of automated vehicles. Looking at the situation overseas, such efforts in the arena of road-vehicle coordination are accelerating; in Europe C-ROADS, an implementation project related to such developments as automated driving, is being deployed on roads in 43 cities, while in Las Vegas, USA, infrastructure has been established to provide information from cameras and sensors.

In Japan, the population is declining and increasing in age. In addition to the shortage of workers, such as drivers, it is becoming difficult to maintain public transportation services, especially in rural areas. The development and popularization of automated driving is expected to solve problems such as securing the flow of people and goods while ensuring safe and smooth road traffic. With this in mind, the Road Bureau of the Ministry of Land, Infrastructure, Transport and Tourism is undertaking numerous initiatives to support road infrastructure.

Automated driving technology development can be broadly divided into two types: "privately owned vehicles" and "logistics/mobility services." (Fig.1) The former runs on the nationwide road network, while the latter runs in a limited area. As such, there are differences in purpose of use, suitable areas and speed, meaning the required technology to support automated driving and the scenarios for development and spread are also different. In the following, we outline our undertakings for each scenario.



*SAE (Society of Automotive Engineers): U.S. based standard developing organization

Fig.1: Scenario for privately owned vehicles and logistics/mobility services

2 Activities in logistics and mobility services

2.1. Field Operational Tests of automated driving services based at such locations as Michi-no-Eki (Roadside Stations) in rural areas

There are rural areas where public transportation routes are shrinking due to population decline and driver shortage. In response to these issues, the introduction of automated driving is expected to maintain and secure regional traffic. The SIP-adus (Cross-ministerial Strategic Innnovation Promotion Program (SIP) Automated Driving for Universal Services) conducted short-term to long-term FOTs (Field Operational Tests) for automated driving services at 18 locations nationwide, based at such locations as Michi-no-Eki in rural areas.

Among the issues identified during the FOTs, regarding the problem of identifying the position of the automated vehicles, we confirmed the effect of the supporting infrastructure for automated driving such as electromagnetic induction lines. In order to avoid collisions with other vehicles and pedestrians, we also devised various measures according to the road conditions and traffic characteristics of the region, such as clearly indicating the driving position and creating exclusive lanes, and then confirmed these effects too. Based on the test results, full-scale introduction has started at four locations nationwide. (Fig.2)

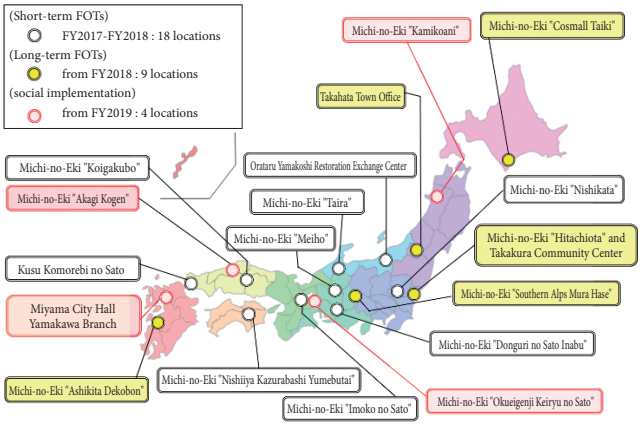


Fig.2: Main FOT locations

2.2. Deployment of automated driving services from rural areas into "machinaka" (town areas)

In order to realize safe and smooth automated driving in a more complex road traffic environment, the Road Bureau of the Ministry of Land, Infrastructure, Transport and Tourism is conducting FOTs of Vehicle-to-Infrastructure cooperative systems in multiple towns with the aim of realizing automated driving in Machinaka, town areas. We are studying a mechanism to generate necessary information relying on AI analysis of road surveillance cameras and traffic safety measures. (Fig.3)

3 Undertakings for privately owned vehicles

3.1. Merging assistance

We are also researching merging assistance to realize safe and smooth automated driving on expressways. By providing main lane traffic information (vehicle position, speed, inter-vehicle distance, etc.) in advance to merging vehicles, it is possible to achieve safe and smooth merging. (Fig.4)

The Japan Automobile Manufacturers Association (JAMA) envisions four phases of merging support, in accordance with how much implemented automated

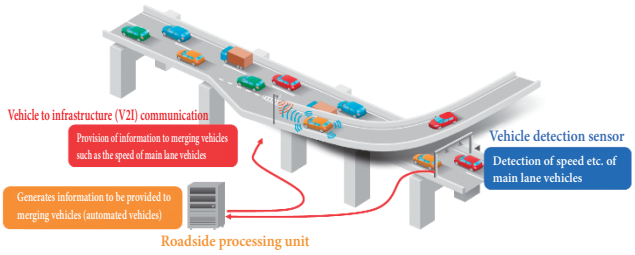


Fig.4: Concept for merging assistance

Fig.3: Investigation of traffic safety measures and information provision from the roadside

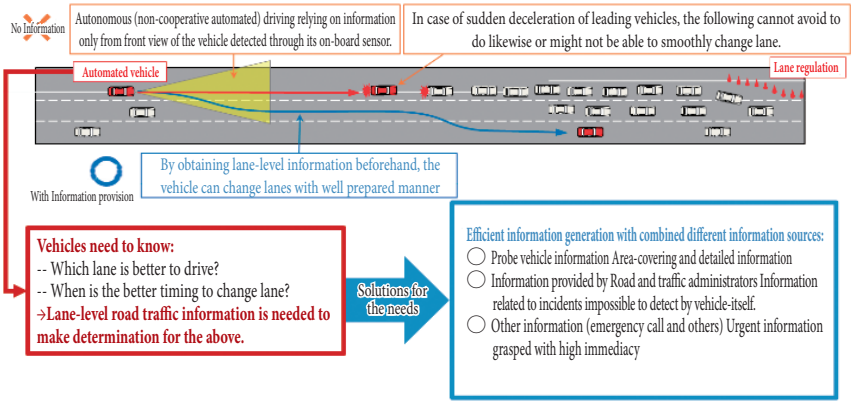


Fig.6: Conceptual Fig.for acquisition of lane-level road traffic information

vehicles are. We mainly studied on 2 systems: Day 1 system, assuming as early phase of implementation, combining spot measurement of main lane traffic and provision of main lane inter-vehicle gap forecast information, and Day 2 as implementation phase combining area-covering measurement of main lane traffic and continuous provision of inter-vehicle gap information on main lane. Specifically, FOTs for the Day 1 system were conducted in the Tokyo waterfront area, while the Day 2 system was tested through simulation.

As a result of these studies, we confirmed that safer and more efficient merging could be realized in free-flow to slightly dense traffic flows by distributing the movement of main lane vehicles to merging automated vehicles and having them adjust their speed accordingly.

3.2. Traffic prediction support information provision

Automated vehicles can be driven safely even under various conditions when using on-board sensors to detect and analyze such data as vehicle position, road conditions, and obstacles. On the other hand, especially during high-speed movement, data on more distant traffic is also required, but is difficult to detect with just on-board sensors. (Fig.5)

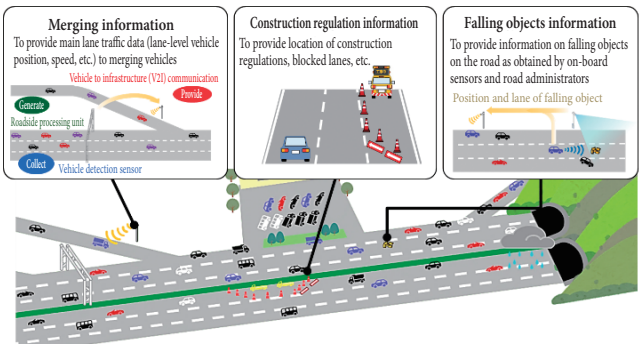


Fig.5: Conceptual Fig.for traffic prediction support information provision

If the traffic conditions further ahead in each lane can be obtained in advance, early deceleration can be performed and lane changes can be made with well prepared manner, enabling safer and smoother driving. In order to deal with these issues, we conducted tests in the Tokyo waterfront area.

The FOTs involved the creation of a system to aggregate probe vehicle data collected by the private-sector, and the generation of lane-level congestion tail positions from this aggregated data. The tests revealed the effectiveness of the system, but issues were also identified, such as the age and volume of available probe data having a large impact on the error in the generated congestion tail position (the deviation from the actual congestion tail position). In order to improve this accuracy, it is necessary to secure an appropriate volume of recent probe data, improve the processing logic, and supplement the data. (Fig.6)

In addition, the Road Bureau of the Ministry of Land, Infrastructure, Transport and Tourism launched their " Joint Research for Collaboration with Roads to promote widespread use of automated driving" in 2021, in order to proceed with the study of safe and smooth automated driving on expressways. We plan to continue to study for support from the road toward the realization of automated driving, including research on predictive information.

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1 The Second Phase of SIP-Automated Driving for Universal Services

Overview of Activities of the Road Transport Bureau, Ministry of Land, Infrastructure, Transport and Tourism

Yoshitaka Tada
(Road Transport Bureau, Ministry of Land, infrastructure, Transport and Tourism)

1 Overview of the Activities by Ministry of Land, Infrastructure, Transport and Tourism

The public and private sectors are working together to develop and disseminate automated driving technology. In particular, we recognize that the framework of SIP-adus (Cross-ministerial Strategic Innovation Promotion Program (SIP) Automated Driving for Universal Services) has further strengthened the cooperation system among related ministries and agencies, and has accelerated technological development.

The Road Transport Bureau of the Ministry of Land, Infrastructure, Transport and Tourism is promoting the establishment of systems, such as the formulation of safety standards, in accordance with the progress of automated driving technology. (Fig.1)

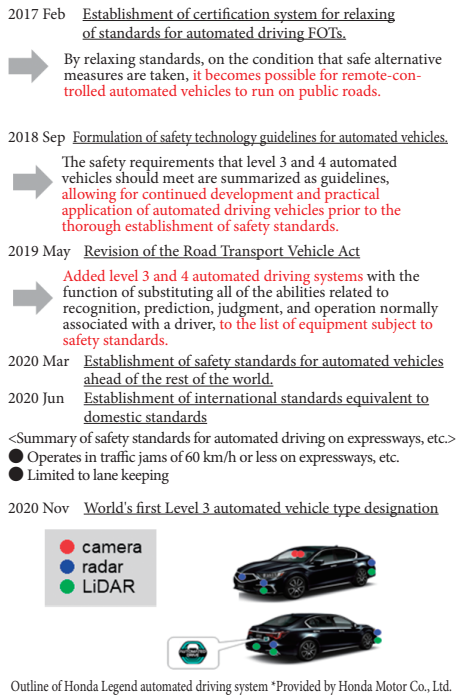

Fig.1: Undertakings by the Ministry of Land, Infrastructure, Transport and Tourism

2 Basic approach to vehicle safety measures

Vehicle safety measures are being implemented step by step in accordance with the status of technological progress and technological spread. (Table 1) For example, during the technology development stage, the direction of development is discussed with the participation of industry, academia, and government, with the aim of creating an environment in which it is easy for automobile manufacturers and others to introduce new technologies into the market, and we are promoting efforts such as formulating technical guidelines.

The international harmonization of standards is also absolutely vital because automobiles are internationally

Table 1: Approach to safety measures

Phase	Purpose of measures	Measures
(1) Technology development	Developing an environment that facilitates the introduction of new technologies into the market	Formulation of ASV promotion plan and technical guidelines
(2) Technological competition	Promoting technological competition in the market	Vehicle assessment (comparison and publication of performance between vehicle models)
(3) Popularization	Expansion of installation through incentives	ASV subsidy, ASV tax system
	National certification of performance	Performance certification system
(4) Standard installation	Installed in all vehicles, ensuring at least minimum performance	Formulation of (compulsory) safety standards

distributed products. For this reason, the World Forum for Harmonization of Vehicle Regulations (WP29) was organized under the United Nations Economic Commission for Europe (UNECE) to discuss international standards. From the viewpoint of ensuring the international competitiveness of Japanese manufacturers, it is important for Japan to lead this international discussion.

Based on these basic approaches, we are also proceeding with the establishment of systems related to automated driving technology.

3 Formulation of safety technology guidelines for automated vehicles

The year 2018 was a milestone year for the realization of automated driving. The "Outline on improvement of legal system and environment for automated driving system" (April 2018) was formulated, and the direction of the entire government regarding the review of the legal system related to automated driving was summarized. As a result, Japan has accelerated its efforts toward the early commercialization of Level 3 and Level 4 automated vehicles.

For the practical application of automated vehicles, it is necessary to establish new safety standards and evaluation methods that correspond to the operation of the vehicle by the system. International discussion on this topic is proceeding with the WP29, in which the Ministry of Land, Infrastructure, Transport and Tourism is participating.

The Ministry of Land, Infrastructure, Transport and Tourism, taking into account such developments as such as the formulation of a Japanese system development outline, seeks to promote the practical application of automated driving even before the international standards are formulated. Guidelines have therefore been created in regard to the safety requirements that Level 3 and 4 automated vehicles should satisfy. We believe that this has created an environment that facilitates development by automobile manufacturers and others, and that we have established a framework that allows us to reflect Japanese ideas in international discussions.

4 Revision of the Road Transport Vehicle Act

At the Ministry of Land, Infrastructure, Transport and Tourism, and based on the Road Transport Vehicle Act, safety is ensured in an integrated manner from the design and manufacturing stages of vehicles through to the stage of use on public roads. Specifically, we are working on formulating safety standards and measures for type certification, service and maintenance, inspections, and recalls and others.

On the other hand, this law was created in 1951, and at that time it was not considered that some non-human system would also operate vehicles.

For this reason, the law was revised in May 2019 to accommodate automated vehicles (Level 3 and Level 4). The main revisions are the following four points.

(1) When used under the conditions (driving environment conditions) attached by the Minister of Land, Infrastructure, Transport and Tourism, automated driving systems are defined as having the function of substituting all of the abilities related to recognition, prediction, judgment, and operation related to the operation of the driver, and said systems are now also made subject to safety standards.

(2) Approval from the Minister of Land, Infrastructure, Transport and Tourism is compulsory when performing wireless software updates for vehicles that are already running on public roads.

(3) Maintenance and remodeling of automated driving systems etc. will be designated as "specific maintenance." In order to carry out it, certification from the director of the District Transport Bureau will be required, and automobile manufacturers will be duty-bound to provide the technical information necessary for maintenance.

(4) Establishment of an environment in which inspection agencies nationwide can utilize the information necessary for electronic inspection of vehicles (OBD inspection).

5 Formulation of safety standards

The revisions to the Road Transport Vehicle Act made automated driving systems subject to safety standards. Based on this change, in March 2020, safety standards for automated vehicles were formulated for the first time in the world, based on the safety requirements of the safety technology guidelines for automated vehicles. In June of the same year, international standards were established by the WP29.

In order to realize more advanced automated driving technology, subsequent discussions on international standards were promoted by the WP29, and in November 2021, a revision was made to expand the applicable vehicle types to all passenger cars, buses, and trucks. Furthermore,

in June 2022, it was agreed to raise the upper speed limit to 130km/h and to implement a lane change function only for passenger cars. (Fig.2)

The Ministry of Land, Infrastructure, Transport and Tourism will continue to lead discussions on international standards.

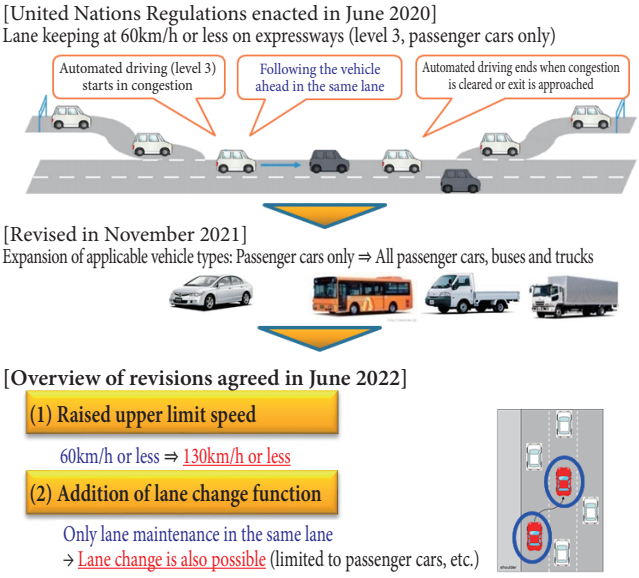

Fig.2: Study on international standards

6 Issues for future activities

In the future, in order to realize automated driving in a more complex driving environment, it is important to take comprehensive measures to further develop vehicle technology, improve the driving environment, and improve public acceptance. (Fig.3) Specifically, it is the responsibility of the operator to appropriately build, maintain, and manage the driving environment, and to review it as necessary. Therefore, it is important for the public and private sectors to work together to study measures to reduce the risk of all dangerous events that can occur on roads, with the automated vehicles strictly adhering to all traffic rules and driving manners along the route taken.

The Ministry of Land, Infrastructure, Transport and Tourism will continue studies toward the realization of advanced automated driving.

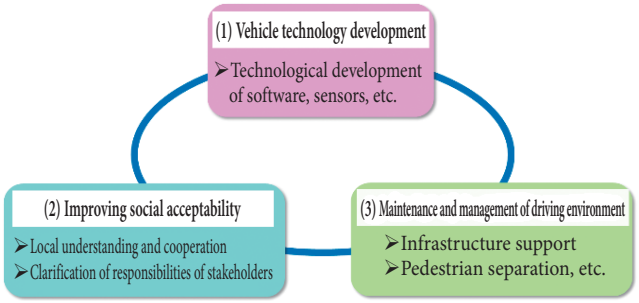

Fig.3 Toward the realization of automated driving

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