Automated Driving System for Universal Service

Police Efforts toward Realization of Automated Driving

Mitsuhiro MAKINO
Counselor for ITS Administration Policy,
National Police Agency of Japan

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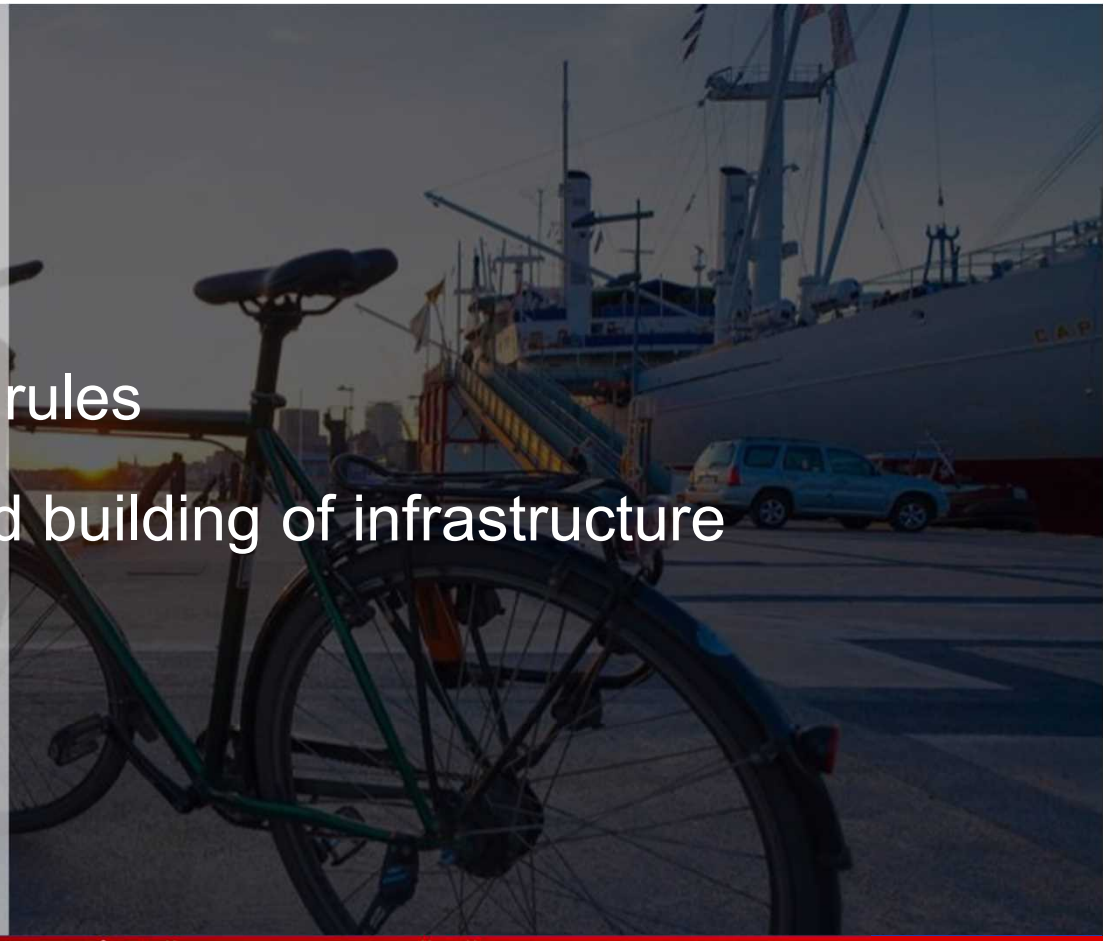
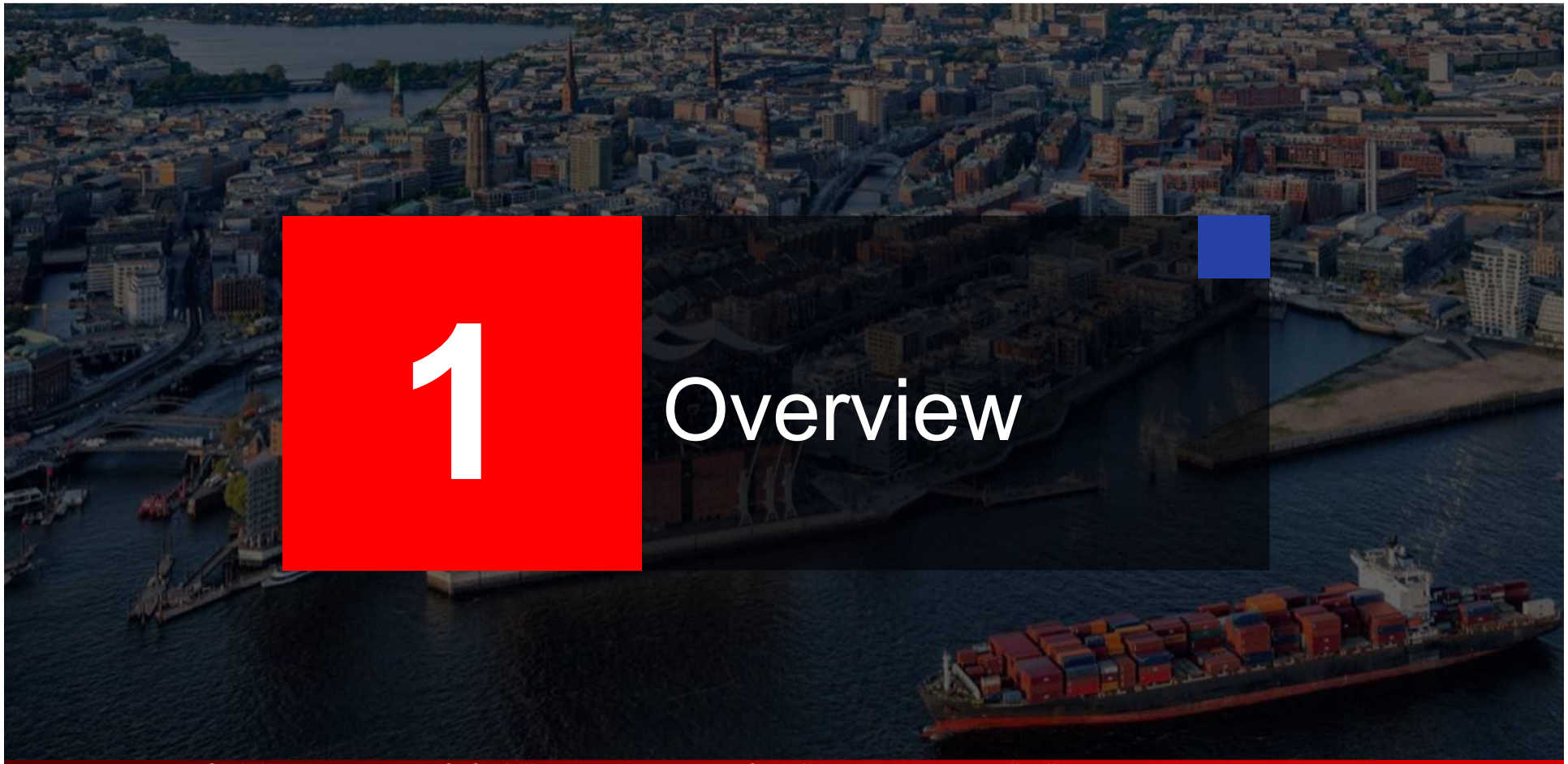




1 Overview

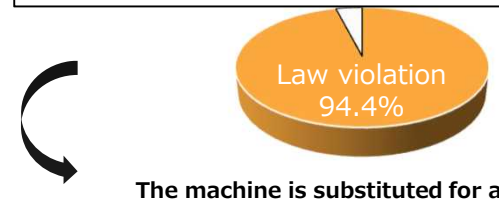
Expected benefit of automated driving

■Reduce traffic accident

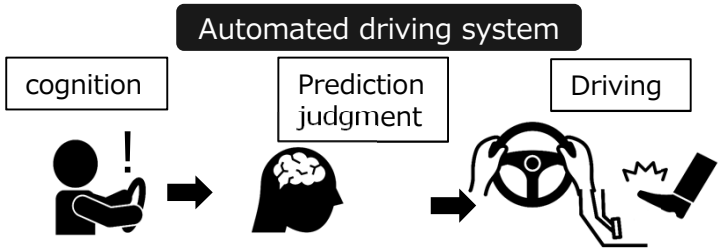
2,839 people died in traffic accidents in 2020.

⇒ About 95% of traffic fatal accidents occurred when a driver violated a law.

The number of traffic accidents by law violation（2020）



The machine is substituted for a Human.

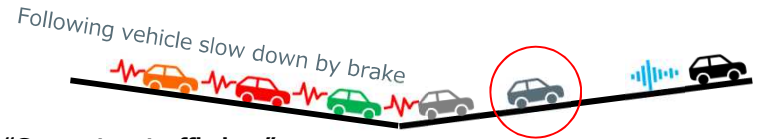


Reduce traffic accident caused by human's mistakes.

■Reduce traffic jam

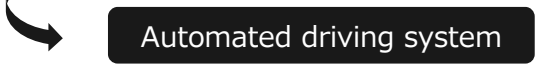
A traffic jam on highway

⇒It's caused when a smooth traffic flow is hindered such as drop in the speed on a downward slope.



"Generate a traffic jam"

Speed down on upward slope



V2V/V2I communication

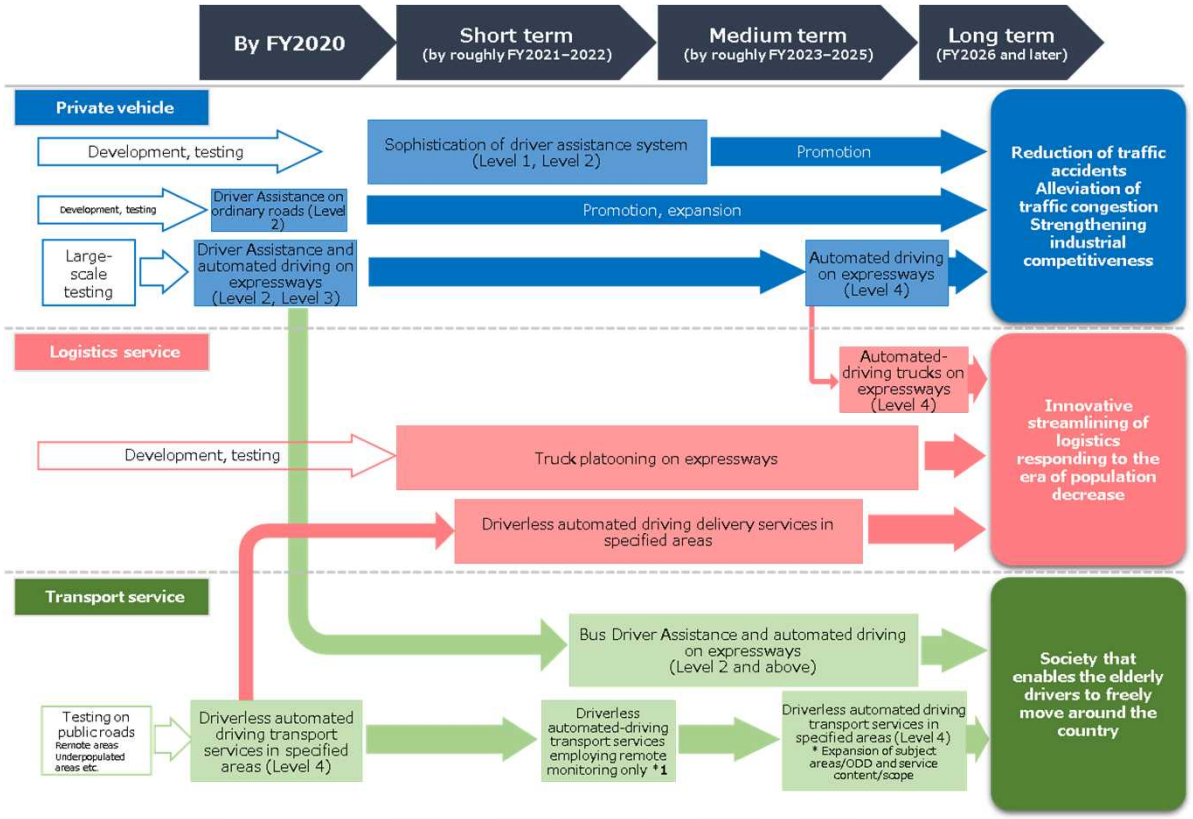
Reduce a traffic jam by creating a smooth traffic flow.

Summary of levels of driving automation

Referenced from SAE J3016
(issued by SAE international)

	Level	Name	Narrative Definition	DDT Fallback
Driver Performs Part or All of the DDT				
	Level 0	No Driving Automation	The performance by the driver of the entire DDT, even when enhanced by active safety systems.	Driver
Driver Support	**Level 1**	Driver Assistance	The sustained and ODD-specific execution by a driving automation system of **either** the lateral **or** the longitudinal vehicle motion control subtask of the DDT (but not both simultaneously) with the expectation that the driver performs the remainder of the DDT.	Driver
Driver Support	**Level 2**	Partial Driving Automation	The sustained and ODD-specific execution by a driving automation system of **both** the lateral **and** longitudinal vehicle motion control subtasks of the DDT with the expectation that the driver completes the OEDR subtask and supervises the driving automation system.	Driver
ADS ("System") Performs the Entire DDT (While Engaged)				
Automated Driving	**Level 3**	Conditional Driving Automation	The sustained and ODD-specific performance by an ADS of the entire DDT with the expectation that **the DDT fallback-ready user** is receptive to ADS-issued requests to intervene, as well as to DDT performance-relevant system failures in other vehicle systems, and **will respond appropriately**.	Fallback-ready user (becomes the driver during fallback)
Automated Driving	**Level 4**	High Driving Automation	The sustained and **ODD-specific** performance by an ADS of the entire DDT and DDT fallback without any expectation that a user will need to intervene.	System
Automated Driving	**Level 5**	Full Driving Automation	The sustained and **unconditional (i.e., not ODD-specific)** performance by an ADS of the entire DDT and DDT fallback without any expectation that a user will need to intervene.	System

Government's target for realization of automated driving



*1 When driverless automated-driving transport services are to come true depends on various conditions in the actual cruising environment, such as weather and traffic volume.
With regard to the creation of an environment for the realization of those services, each government agency will consider the appropriate timing and the way it should be and take measures, taking into account future technological developments, etc.

Our efforts towards the realization of automated driving

Automated driving technology is effective in reducing traffic accidents & alleviating traffic congestion

Conducting initiatives in support of early adoption and expansion of automated driving in accordance with the road environment of Japan.

Initiatives

- Improvement of Traffic Rules
- Developing a Test Environment
- Research and Development
- Public Relations and Awareness

2 Review of road traffic rules

Amendment to the Road Traffic Act for the safe deployment of SAE Level 3 automated driving

2019 Road Traffic Act Amendment, effective as of April 1, 2020

In cases of automated driving using Level 3 Automated Driving System(ADS) appropriately

Because ADS fully replaces capacities of recognition, prediction, judgement and operation associated with steering by a driver,

You are allowed

- ✓ **Not to check what is in front of the vehicle and its surroundings**
- ✓ **To talk on a mobile phone**
- ✓ **To watch the car navigation system**

However, when the Operational Design Domain (*) is not met,

* e.g.
  - When traveling on a highway at low speeds due to traffic jams
  - Not in bad weather conditions such as heavy rainfall, snowfall, or fog
  - Conditions do not make stable driving difficult due to road freeze or other reasons

The ADS issues a transition demand to a driver in order to take control of the vehicle.
While ADS is engaged, the driver must be in a state to immediately acknowledge the transition demand and to be prepared to take control of the vehicle securely.

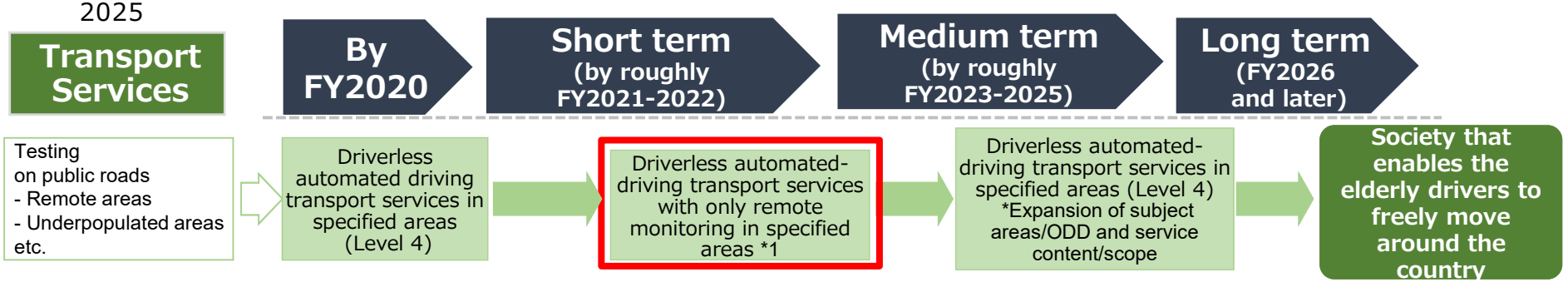
The driver must drive on their own without relying on ADS.
(Automated driving assuming the presence of a driver)

Government's target for realization of the automated driving

Public-private ITS Initiative/ Roadmaps 2020 (2020.7.17 IT Strategic Headquarters)

Around FY 2022 — **Implementation of driverless automated-driving transport services with only remote monitoring in limited areas such as defunct railroad tracks around**

BY around 2025 — Nation-wide spread of driverless automated-driving transport services in limited areas



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Guidelines for public road testing of automated driving systems

■May 2016

Guidelines for public road testing of automated driving systems

On the conditions that a driver sits in the driver's seat and is ready to take necessary measures in an emergency, you can conduct an experiment of automated vehicles on public roads without any permission or report.

⇒ Tests have been conducted in various parts of Japan.

Tests on public rods

＜Points of Attention＞

○ A vehicle has to comply with the requirements of the Safety Regulations for Road Vehicles.

○ A driver has to sit in the driver's seat and be ready to take over the control of the vehicle in an emergency.

○ Those who conduct the tests have to obey the laws.

Obligations of “Test driver”

・Obeying the driver's obligations

・Taking necessary measures in an emergency

Criteria for the permission for public road testing of automated driving

Requirements for the public road testing of automated driving which do not comply with the guideline have become apparent, so we have developed and clarified the criteria for the permission for this.

■Automated driving system with remote control technology(*1)

(*1) A system that enables a remote supervisor/operator to operate the vehicle remotely by utilizing telecommunication technology

- **Formulation and Release in June 2017 (Partially amended in September 2019 and September 2020)**

■ Vehicles with special control devices (*2)

(*2) A vehicle operated by a special control device different from a conventional steering wheel and brake pedal during manual driving

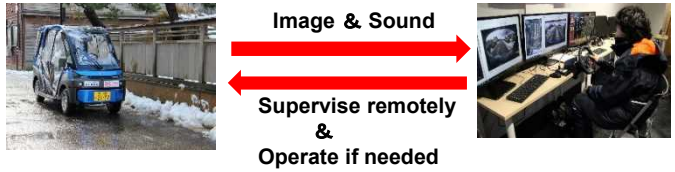
- **Formulation and Release in September 2019 (Partially amended in September 2020)**

＜Examples of common requirements＞

- The vehicle's maximum speed limit should be a speed at which the vehicle can come to a halt safely with a sufficient allowance of time in light of traffic conditions and road environments.
- The autonomous driving for the practical application of automated driving should be conducted with a certification of a police officer who has actually ridden the vehicle.
- The vehicle should be equipped with data recording devices, such as a car driving recorder and an event data recorder, in order to record the conditions in front of, behind, and inside it..

＜Examples of other requirements＞

- The test vehicle should come to a halt safely without any operations when there is a communication delay exceeding a decided-upon period of time.
- In principle, the number of test vehicles simultaneously supervised/operated by one person should be increased one at a time.
- Remote supervisor/operator has to be aware of the surrounding conditions of all the test vehicles by image and sound.



＜Examples of other requirements＞

- A supervisor/operator has to be on the test vehicle who has passed an examination conducted by police to verify the supervisor/operator is able to operate it manually in a facility and on a public road.

Developing a Test Environment（Automated Delivery Robots）

The NPA's efforts regarding public road testing of automated delivery robots

2020 April

○ Toward the deployment of automated delivery robots, NPA has published

"Procedure for Public Road Testing of Automated Delivery Robots (To be monitored and operated in proximity)"

and supported public road testing.

* In the procedure, "Criteria for Granting Permission for Road Use in Demonstration Tests of Automated Driving on Public Roads" is applied
* In 2020 September, added references about "To be monitored and operated remotely"

2020 October

○ Tests on public roads started in various locations

○ NPA Received requests from business side for the **facilitation of the tests** and the **smooth transition to commercialization**

2021 June

"Criteria for Granting Permission for Road Use in Demonstration Tests of Specified Automated Delivery Robots"

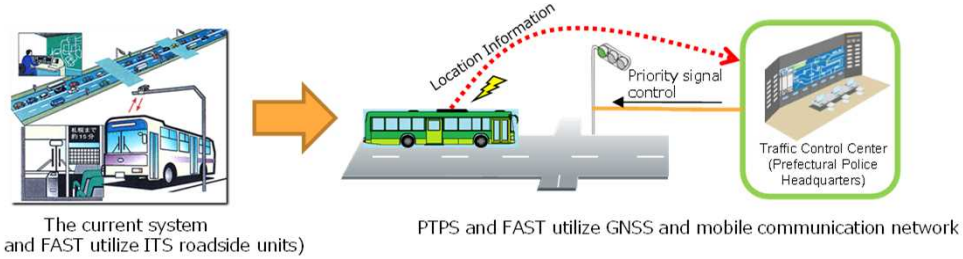
○ Based on the results of previous tests, NPA has established a new criteria to promote projects in which multiple low-speed, small automated delivery robots are operated remotely.

3 Promotion of R&D and building of infrastructure

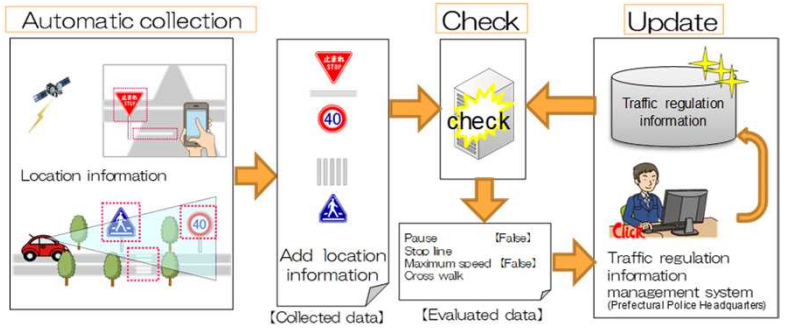
Research and Development

①Provision of Signal Phase and Timing (SPaT) information using cloud and other technologies

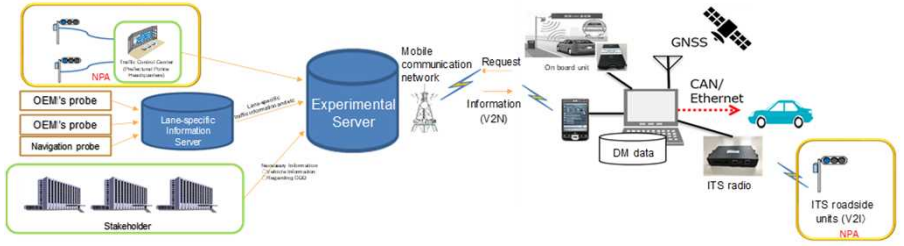
② Traffic signal control using GNSS (location information) and other technologies



③ Improving data accuracy of traffic regulation information



④ Tokyo Waterfront Area Field Operational Test



Research and Development①

■ Provision of Signal Phase and Timing (SPaT) information using cloud and other technologies

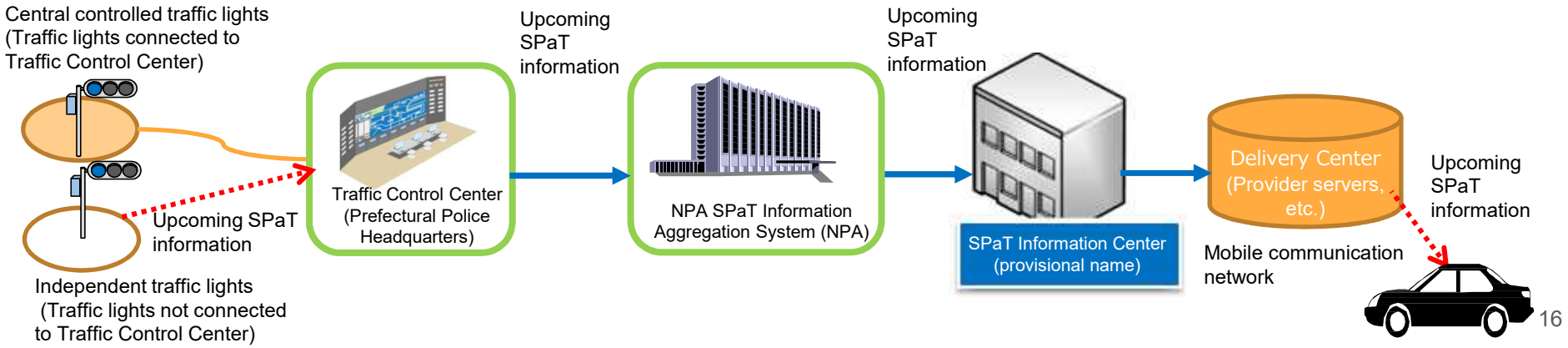
Purpose

With the aim of contributing to the realization of the provision of SPaT information using cloud and other technologies, this R&D project will verify the provision of upcoming SPaT information for automated driving by building a model system.

Things to be examined

- Method of the provision of SPaT information(transmission path, integration with map data and so on)
- Improve the accuracy of SPaT information
- Reduce the delay of SPaT information

etc



Research and Development②

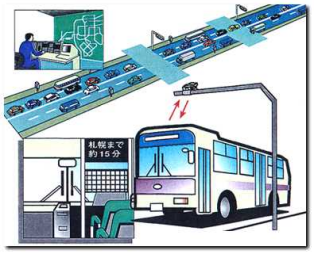
■ Traffic signal control using GNSS (location information) and other technologies

Purpose

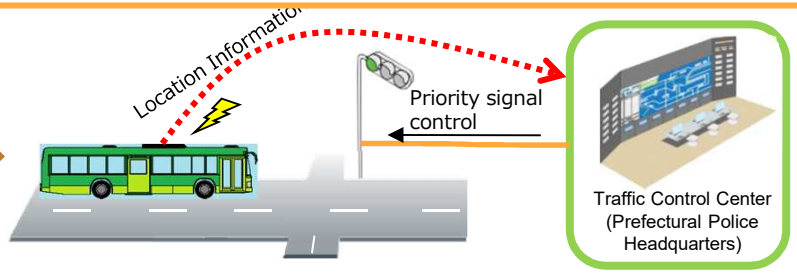
This R&D aims to enable a broader societal implementation of real-time priority traffic signal control by linking prefectural police traffic control systems with automated driving vehicles(buses and emergency vehicles) using location information from the Global Navigation Satellite System (GNSS) and a mobile communication network.

Things to be examined

- Construct the system using GNSS and a mobile communication network in Traffic Control Center
- Compare the current system and a system using GNSS and mobile communication network in terms of cost and benefit etc



The current system
(PTPS and FAST utilize ITS roadside units)



PTPS and FAST utilize GNSS and a mobile communication network

※ PTPS : Public Transportation Priority Systems
FAST : Fast Emergency Vehicle Preemption Systems

Research and Development③

■ Improving data accuracy of traffic regulation information

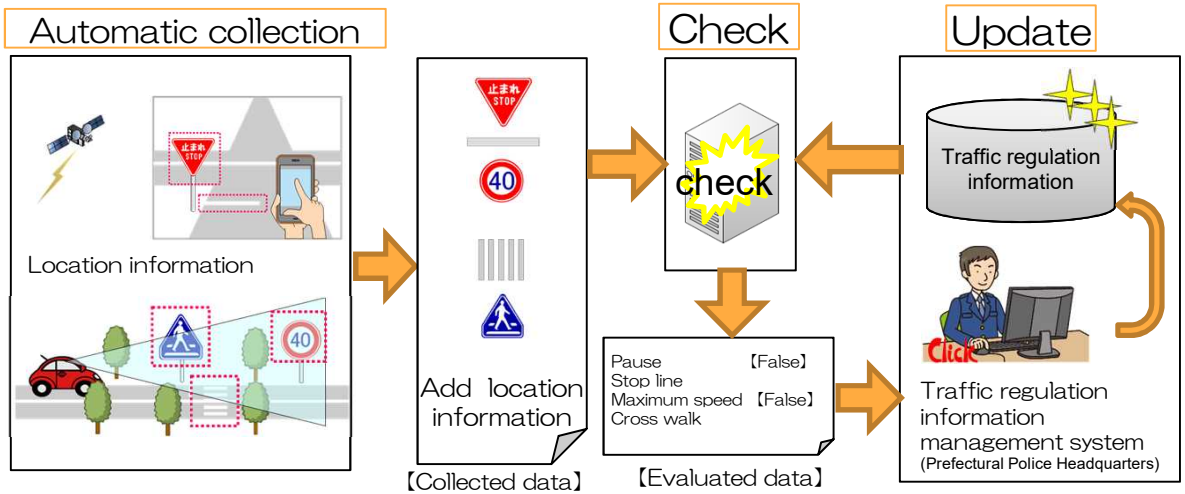
Purpose

This R&D is designed to improve data accuracy of traffic regulation information using ~~a~~ automatic collection technology for traffic regulation signs and displays. This will allow us to examine appropriate distribution and management of traffic regulation information for automated driving vehicles.

Things to be examined

- Check technical requirements of automatic data collection technology using image recognition and machine learning
- Research technology which evaluates accuracy of location information using information about traffic regulation
- Construct a model system and verify its effect

etc



Research and Development④

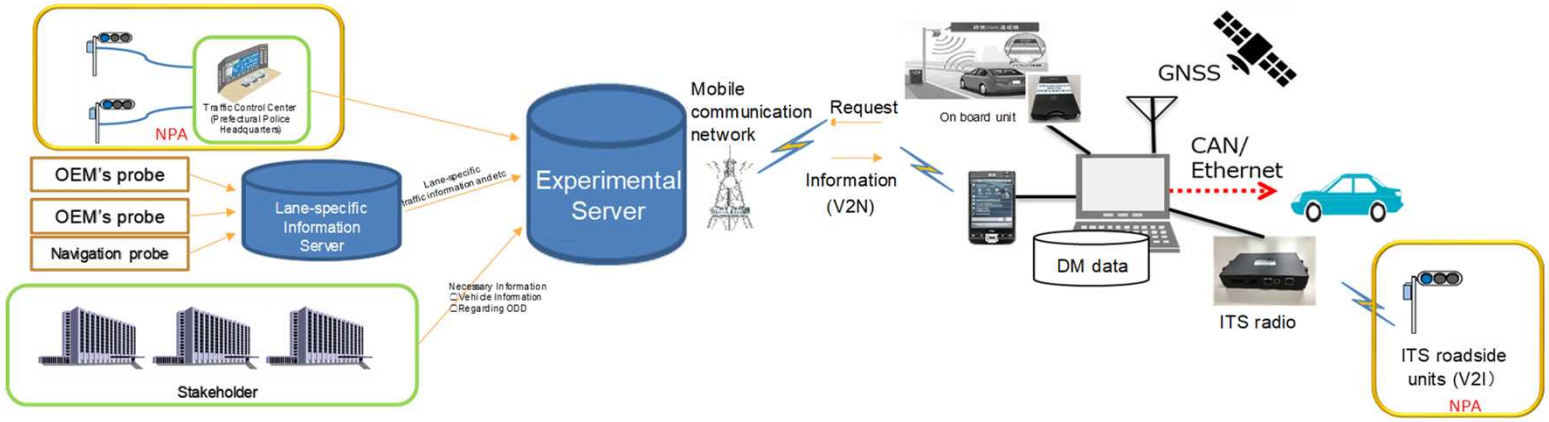
■ Tokyo Waterfront Area Field Operational Test

Purpose

In order to promote the more widespread use of traffic environment information, this test includes information provided from a mobile communication network, other than that provided from the infrastructures which had been installed during the past operations.

Things to be examined

- Construct the experimental environment for signal information provision using a mobile communication network for automated driving vehicles
- Provide signal information using a mobile communication network for assessment of this field operational test

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