13th Japan ITS Promotion Forum

1st Phase SIP-adus Large-scale Field Operational Tests

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SIP-adus International Cooperation WG

February 27, 2019

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Cabinet Office

1st Phase SIP-adus: Overall Schedule

2014 → 2015 → 2016 → 2017 → 2018

2014–2015

- **Establishment of framework**
- **R&D on specific themes**

Promoting Committee

- System Implementation Working Group
- International Cooperation Working Group
- Next Generation Transport Working Group

2016–2017

- **Integration into five key themes**

(1) Dynamic map

(2) Cyber security

(3) Interaction between humans and vehicles (HMI)

(4) Pedestrian traffic accident reduction

(5) Next generation transport

2017–2018

- **Large-scale field operational tests**


Activation of research/technical development


Evaluation/issue identification with more objectives


Focus on deployment


International cooperation and coordination

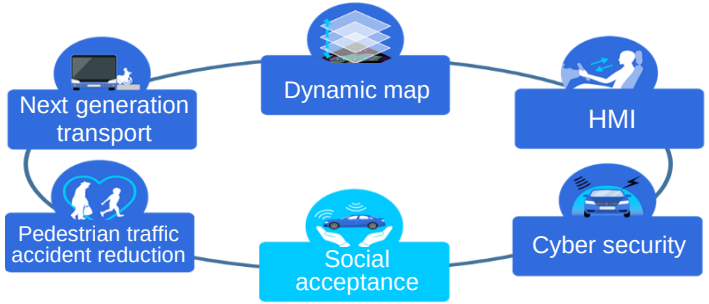

Nurturing of social acceptance

Practical application

Large-scale Field Operational Test (FOT)

Objective:

Provide **opportunities for open discussions** through large-scale FOTs on public roads and promote international standardization and R&D based on five key themes + events for nurturing social acceptance



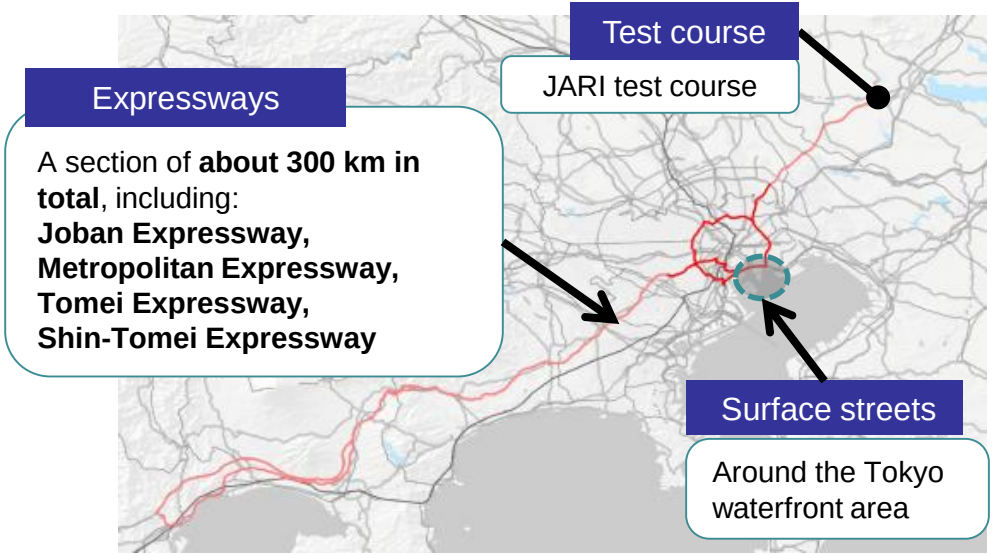
Period:

October 2017 to December 2018
(Test periods will be set individually depending on the content of the test.)

Participants:

ALPINE, BMW, MINI, BOSCH Invented for life, Calsonic Kansei, Continental, DAIHATSU, HONDA The Power of Dreams, mazda, Mercedes-Benz, MEIJI LogiTech, MITSUBISHI ELECTRIC, 名古屋大学 NAGOYA UNIVERSITY, NISSAN MOTOR CORPORATION, OMRON, Pioneer, 埼玉工業大学 SAITAMA INSTITUTE OF TECHNOLOGY, SUZUKI, SUBARU, TOYOTA, Valeo, VOLKSWAGEN AKTIENGESELLSCHAFT, ZMP

FOT sites:



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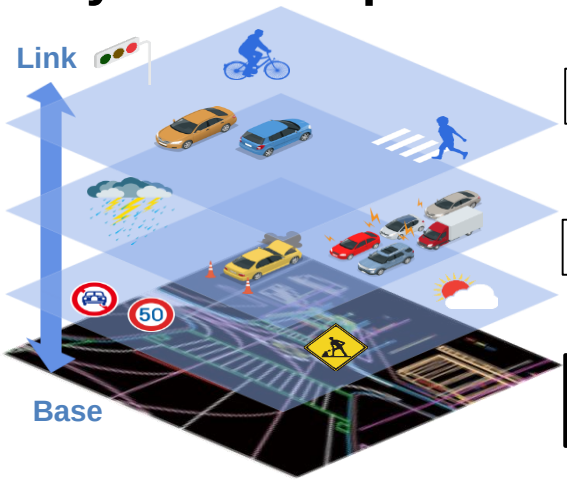
Dynamic Map

A concept to utilize the **high-definition 3D map** and positioning-enabling **dynamic data** held by various entities and that changes over time (dynamic data, semi-dynamic data, and semi-static data) while ensuring conformity by establishing **linkage rules**

Dynamic map



Dynamic data

Movement of vehicles, status of pedestrians, traffic signals, etc.

Semi-dynamic data

Accidents, congestion, traffic regulation, road construction, detailed weather, etc.

Semi-static data

Traffic regulation, road construction, weather, etc.

Static data
= **High-definition 3D map**

Road, lane, 3D shape of structures, etc.

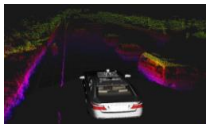
Competitive area

Additional data

Common (platform) data

Cooperative area

Platform



Digital mapping

3D common platform data

Point clouds, graphics, probe data, etc.

Dynamic Map FOT

FOT in FY2017:

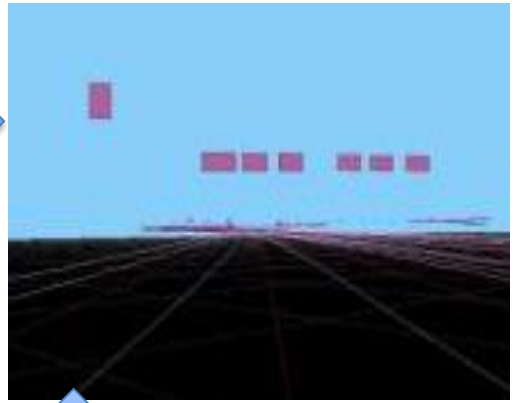
- Improvement of **high-definition 3D map** of 758 km in total and distribution to participants
- Verification of the specifications and precision of the map data in actual public road environments

Formation of consensus on essential features

Example of verification of information currentness:

(Image gathered by **FOT participants**)

(1) Identification of information nonconformity



(**Map data**)

(Image during **survey**)

(2) Check of conformity

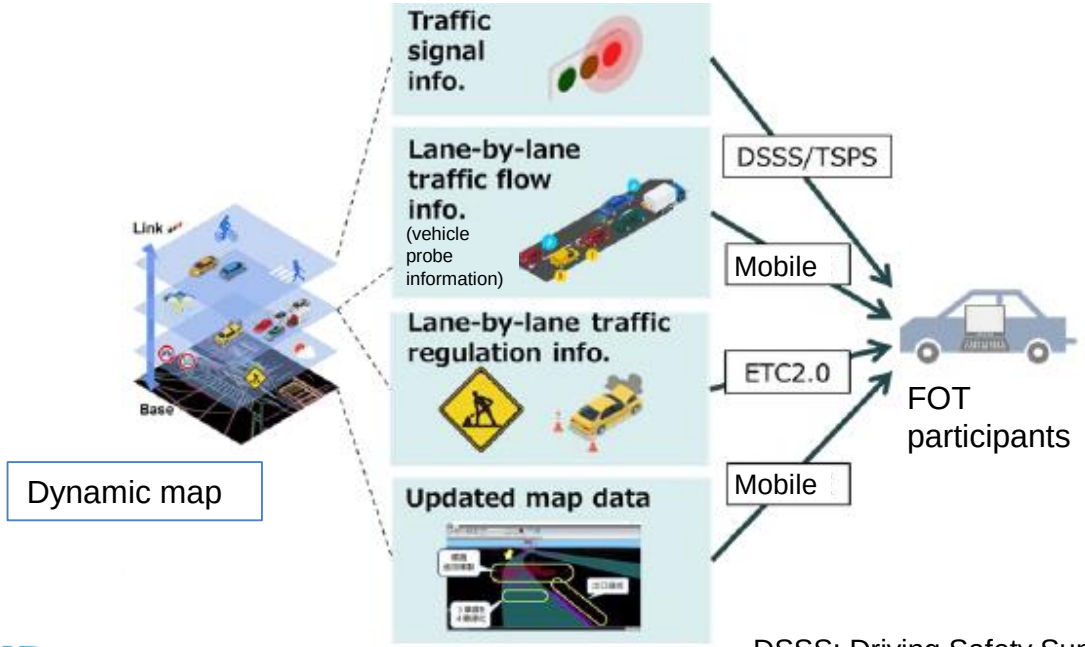
(3) Confirmation of changes in features after survey

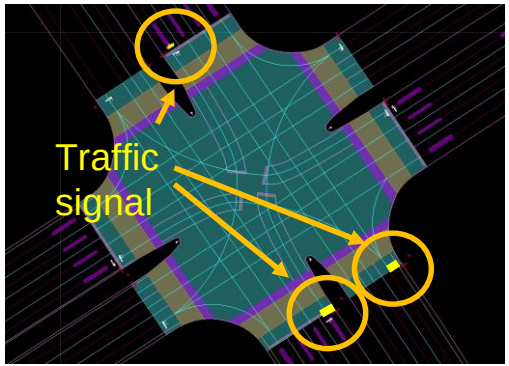
Dynamic Map FOT

FOT in FY2018:

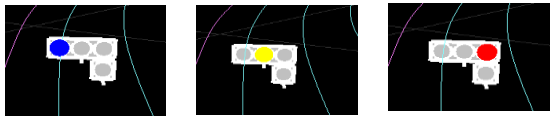
- Preparation and distribution of **real-time traffic information** linked to high-definition 3D map at public road

Confirmation and establishment of "dynamic map" concept





Data image viewer



E.g.) Traffic signal color

DSSS: Driving Safety Support System
TSPS: Traffic Signal Prediction System

Cyber Security

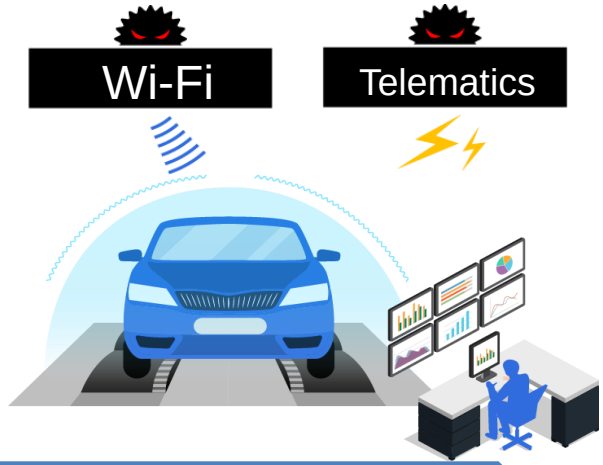
Objective: Establishment of guidelines for evaluating the cyber security defense performance of vehicles

Threat analysis

- Investigation of system configurations, such as automated driving demonstrations conducted in the world
- Investigation of known vulnerabilities and incidents
- Risk/Impact analysis

Formulation of security evaluation guidelines

Verification by FOTs with domestic OEM



Guidelines were competitively formulated by each of three leading security vendors.

FY2017

The best guidelines were selected and proven.

FY2018

Cyber Security: FOTs Based on the Guidelines

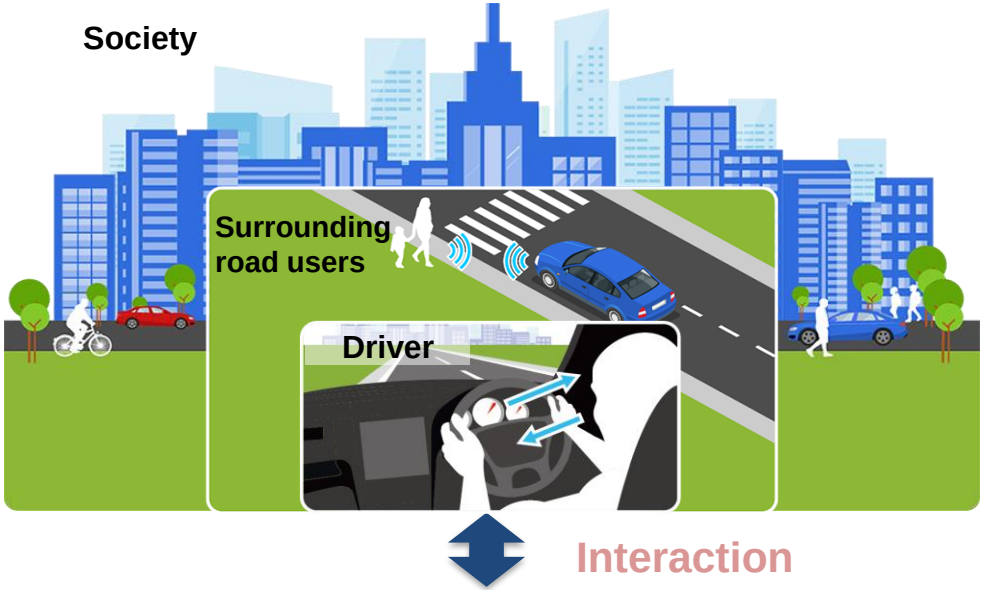
Demonstration of effectiveness of the guidelines through the vehicle vulnerability evaluation, which simulates various cyber attacks

Major category	Intermediate category	
1. Reconnaissance	1.1 HW investigation	1.2 SW investigation
2. Intrusion	2.1 Passive attacks that require user intervention	2.2 Passive attacks that do not require user intervention
	2.3 Active attacks that exploit vulnerabilities	2.4 Active attacks that utilize information obtained by intercepting communication
3. Privilege escalation	3.1 Disabling a protection function	3.2 Acquisition of a higher privilege level
4. Actions on objectives	4.1 Information leakage	4.2 Suspension of services
	4.3 Unauthorized operation (control system)	4.4 Unauthorized operation (other than the control system)

Removal of chips from ECUs

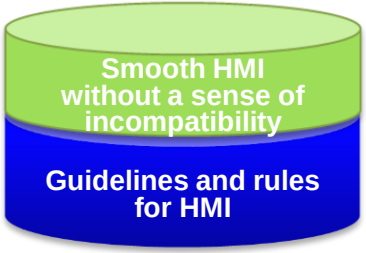
Firmware extraction

HMI



Competitive area

A sense of connectedness between the horse (car) and the driver



Minimum arrangements to ride a horse (car) safely

Cooperative area

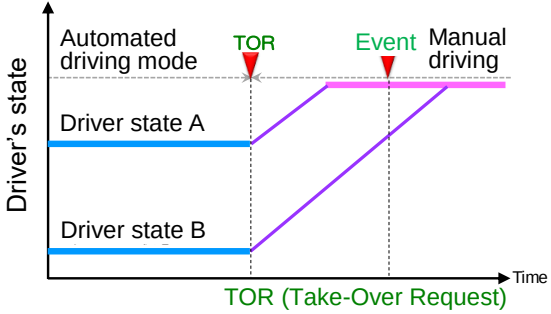
Main issues of the human-machine interface (cooperative area)

A. **Understanding the functions, readiness, and behavior** of the automated driving system
B. Detecting the driver's **readiness** and setting the **appropriate time required for take-over**
C. **Interface** between the automated driving system and other road users

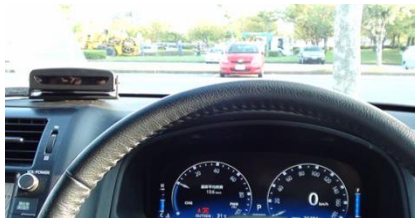
HMI: FOT to Determine the Driver's Readiness

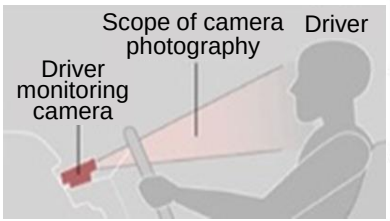
(1) Development of a driver monitor

Research on detection of driver readiness and time required for take-over



Development of a technology to estimate the driver's readiness based on eye movement by measuring various biometric information and evaluating the driving performance





(2) Gathering and analysis of data through a large-scale FOT

Data-gathering on public roads using Level 0 to 2 commercially available cars

+

Verification data on the test course using Level 2 and Level 3 development vehicles

Detection and maintenance of readiness

(3) International standardization ISO/TC22/SC39/WG8

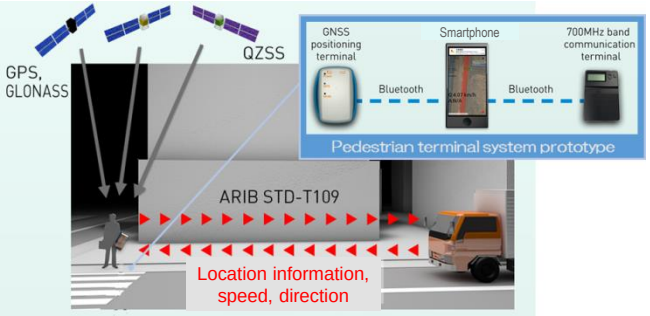
- TR 21959 Human Performance and State in the Context of AD: Part 1 – Terms and Definitions, Part 2 – Experimental Guidance

FOT for Pedestrian Traffic Accident Reduction

Objective: Evaluation of performance and effectiveness of the V2P communication system in actual traffic environments

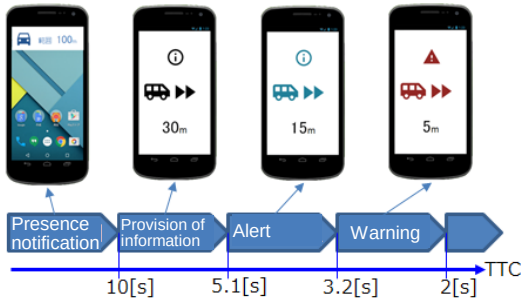
- Development of **communication terminal devices for pedestrians** and **an alert system** for both pedestrians and drivers utilizing vehicle-to-pedestrian communication technology (V2P) and verification through an FOT

Greater precision in pedestrian localization and behavior prediction



- Precision of pedestrian localization to be increased from ±20 m to ±5 m in multipath environment
- Development of hazard detection algorithm based on prediction of pedestrians' behavior

Alert function using communication terminal devices



- Development of HMI that gives a speech notification depending on the localization error and hazard level

FOT in the Odaiba area

- FOT plan based on pedestrian accident pattern analysis

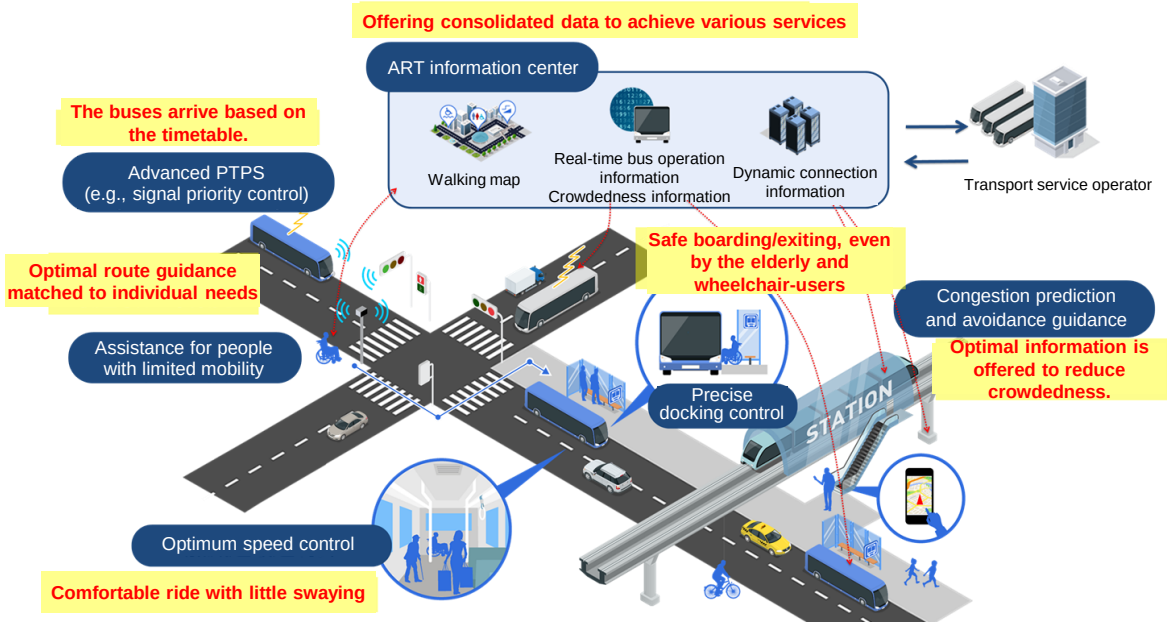
FOT for Next Generation Transport

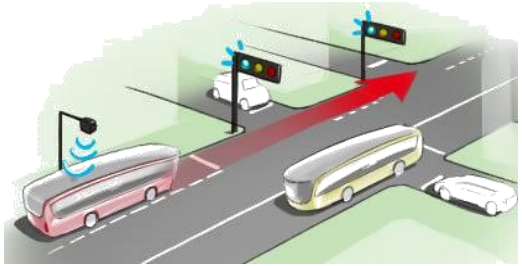
Objective: Evaluation of the impact and effectiveness of the ART* system in actual traffic environments

(*ART: Advanced Rapid Transit)

- Achievement of next generation transport by utilizing ITS technology and automated driving technology

FOT in the Odaiba, Ariake, and Toyosu areas





Advanced PTPS*

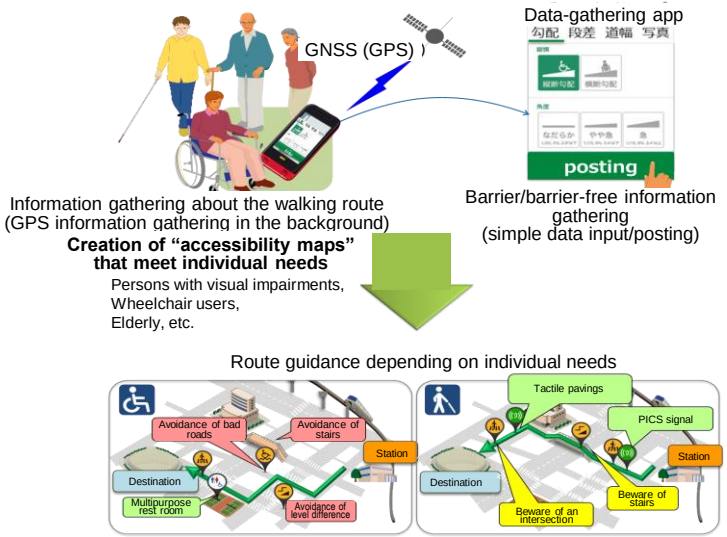
(*PTPS: Public Transportation Priority System)

Precise docking control

Next Generation Transport: FOT for Assistance for People with Limited Mobility

Optimal route guidance matched to individual needs

- Development of an app that enables users to **gather information about the walking route and post barrier/barrier-free information**



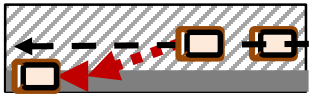
FOT in the area around Toyosu Station

- ✓ **An app for collecting barrier-free information has been developed and has already been publicly released.**
- ✓ **Navigation companies have been preparing to commercialize the services** (e.g. release of beta version, testers solicited from the general public).

FOTs in Local Areas

Automated driving bus FOT

■: Test area (3 types of location)



Precise docking control at bus stops

Ishigaki Island

Okinawa

(Based on the press release of CO)

- As the first step of introduction to local communities, FOTs of automated driving of buses are being conducted in Okinawa Prefecture, which is discussing **reorganizing public transportation means**.

Roadside station-based FOT

●: Regional assignment ●: Public offering ◌: Feasibility study

Magnetic guide line

(Based on the press release of MLIT)

- Social implementation of automated driving services through vehicle-infrastructure cooperation in **hilly and mountainous areas** where population-aging is extreme, etc. using "**Michi-no-eki (roadside stations)**" as core facilities to ensure mobility for daily lives

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Main Evaluation Items

(1) Road conditions


(a slope in a rural area)

(1) Road structures
(2) Roles of local governments
(3) Supplementation of mixed traffic
(4) Establishment of traffic centers

(2) Natural environment


(a snow-covered road)

(1) Weather and climate conditions
(2) Communication status

(3) Cost


(guidelines for installing magnetic guide lines)

(1) Cost of vehicle introduction and maintenance
(2) Necessary cost other than vehicles

(4) Social acceptance


(for passengers)

(1) Ride comfort and amenity
(2) Convenience

(5) Impact on the local economy


(Mixed transport of cargo and passengers on buses)

(1) Increase in social participation opportunities for the elderly
(2) Improved efficiency of collecting and delivering crops, etc.

2nd Phase SIP Tokyo Waterfront Area FOTs

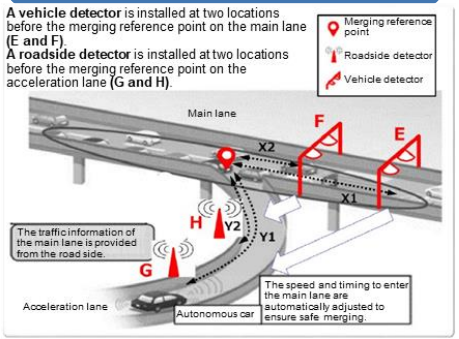
- **FOTs will commence in autumn 2019 toward the 2020 Summer Olympic/Paralympic Games in Tokyo in the Tokyo waterfront area** (in cooperation with the Japan Automobile Manufacturers Association).
- Efforts will be made to promote **R&D in the cooperative area** toward early implementation of automated driving (**L2 to 4 on expressways and surface streets**) and to improve social acceptance with the participation of local governments, the general public, etc.
- **Applications from FOT participants are being widely accepted both in Japan and abroad** (preliminary registration on the web: by February 22, submission of documents for applications: by March 15)

Details of FOTs

Providing traffic signal information

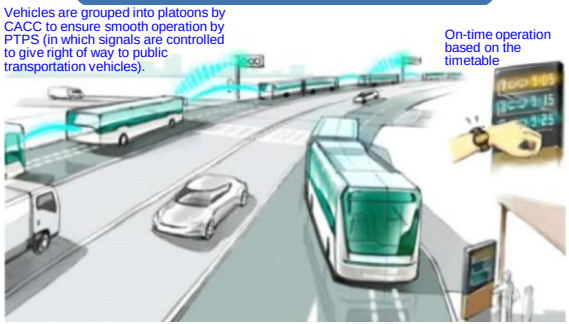
Vehicles are allowed to pass through intersections safely and smoothly based on **the signal display and change timing information** even **in environments where recognition is difficult using in-vehicle cameras**.

Merging assistance on the main lane of expressways



Providing vehicle information on the main lane

Public transport system (automated driving buses)



FOTs for the next generation ART will be implemented on public roads by using automated driving technology in **mixed traffic flow**.


Thank you