Cross-Ministerial Strategic Innovation Promotion Program (SIP) / Automated driving system / Large-scale Field Operational Tests

Study of specifications for providing traffic information, etc. for individual lanes in dynamic maps

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Next-Generation Infrastructure Division

March 31, 2018

Study content

- The following studies will be conducted to develop practical automated driving technologies using dynamic maps and identify the technical issues that must be resolved to achieve these technologies.

1) Study of provision of road traffic information, etc. for individual lanes in Japan

- Document survey of efforts in Japan relating to quasi-static and quasi-dynamic information for individual lanes, and site visits, etc. to study the following items
  - ✓ Specifications for quasi-static and quasi-dynamic information for individual lanes, and technical trends and specifications for methods of provision, etc.
  - ✓ Domestic projects and mechanisms for handling quasi-static and quasi-dynamic information for individual lanes
  - ✓ Other items relating to quasi-static and quasi-dynamic information for individual lanes

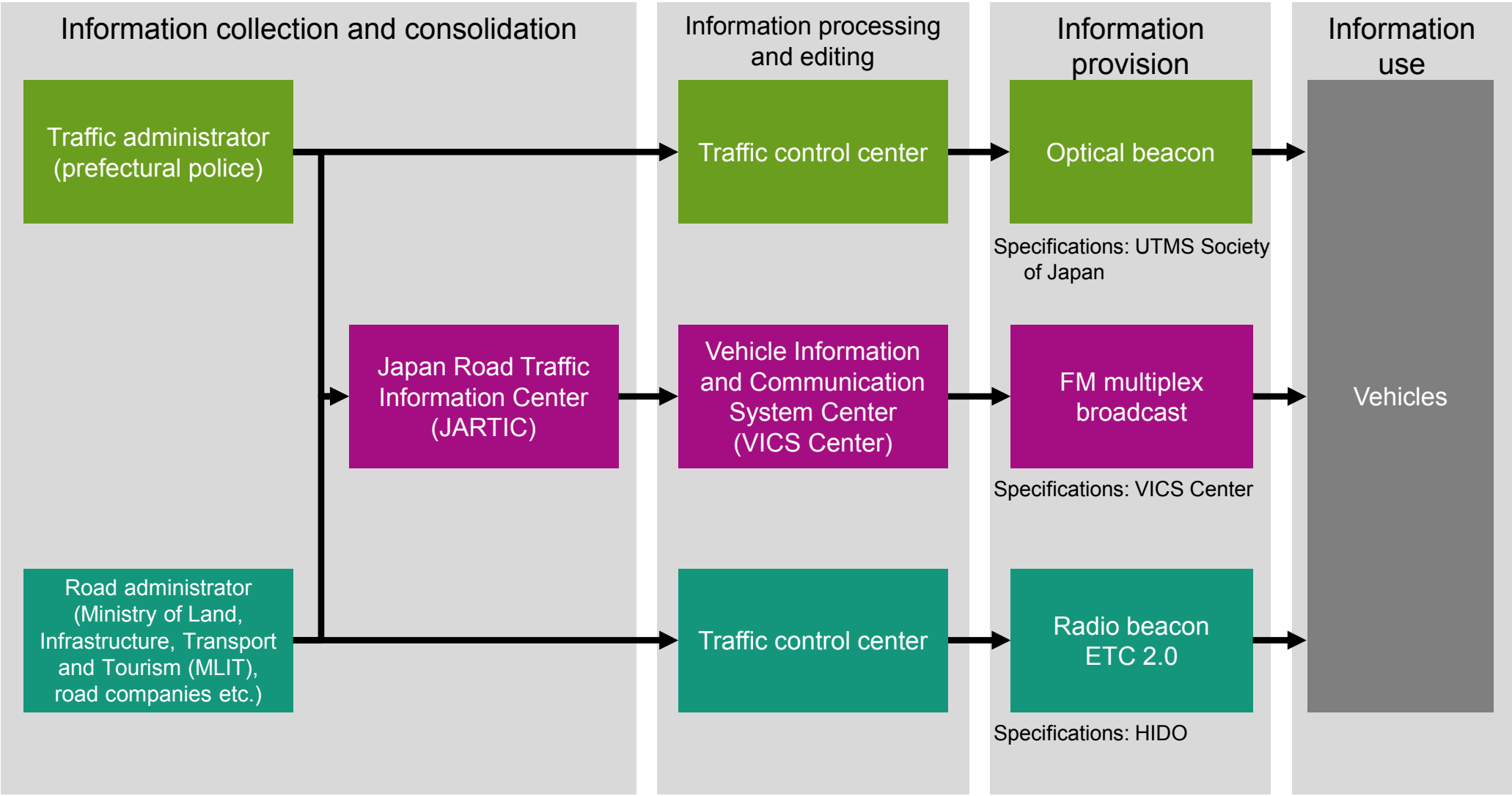
2) Study of domestic efforts relating to the provision of road traffic information, etc. for individual lanes

- Study (in cooperation with relevant organizations) of information needed to promote automated driving technologies for vehicles that use dynamic maps
  - a. Exchange of information with relevant entities in Japan regarding the provision of road traffic information, etc. for individual lanes
  - b. Study of the specifications for road traffic information, etc. for individual lanes needed to achieve automated driving
  - c. Summary of study content relating to road traffic information for individual lanes and dynamic maps in preparation for proving tests

Schedule

Study content	FY 2017		
	2nd quarter	3rd quarter	4th quarter
1) Study of provision of road traffic information, etc. for individual lanes in Japan			
2) Study of efforts in Japan for provision of road traffic information, etc. for individual lanes			
a. Exchange of information with relevant entities in Japan regarding the provision of road traffic information, etc. for individual lanes		★1st study session	★2nd study session ★3rd study session
b. Study of the specifications for road traffic information, etc. for individual lanes needed to achieve automated driving			
c. Summary of study content relating to road traffic information for individual lanes and dynamic maps in preparation for proving tests			

Flow of provision of road traffic information



Legend: Road administrator | JARTIC / VICS Center | Road administrator

Source: Prepared by MRI based on VICS Center website（http://www.vics.or.jp/know/about/pdf/vics_pamphlet_j.pdf）

Overview of road traffic information provision (for each medium)

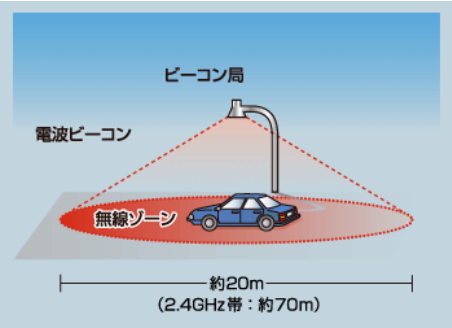
	FM multiplex broadcast	Radio beacon	Optical beacon
Provision equipment	FICS FM multiplex broadcast (FM broadcasting station)	Radio beacon	Optical beacon
Congestion information (LV1-3)	○	○	○
Link travel time (LV3)	○ (Expressway information)	○ (Expressway only)	○
Information on travel time per sector (LV1-3)	○	○	○
Information on traffic restrictions imposed due to event (LV1-3)	○ (Accident, construction, disaster, weather conditions etc.)	○ (Accident, vehicle breakdown, construction, disaster, weather conditions etc.)	○ (Accident, construction, disaster, weather conditions etc.)
Parking area information (LV2-3)	○ (Full / space available)		○ (Full / space available)
Service area (SA) / parking area (PA) information (LV1-3)		○	
Message information (LV1)			○

※ LV1 = text display LV2 = simple graphic display LV3 = map display Prepared by MRI based on VICS Center reference

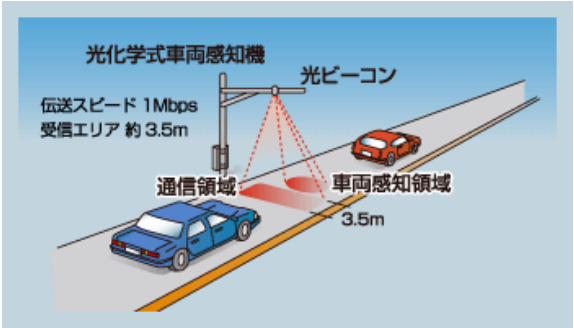
Reception range

Source: VICS Center reference

FM multiplex broadcast (VICS Tokyo coverage area)

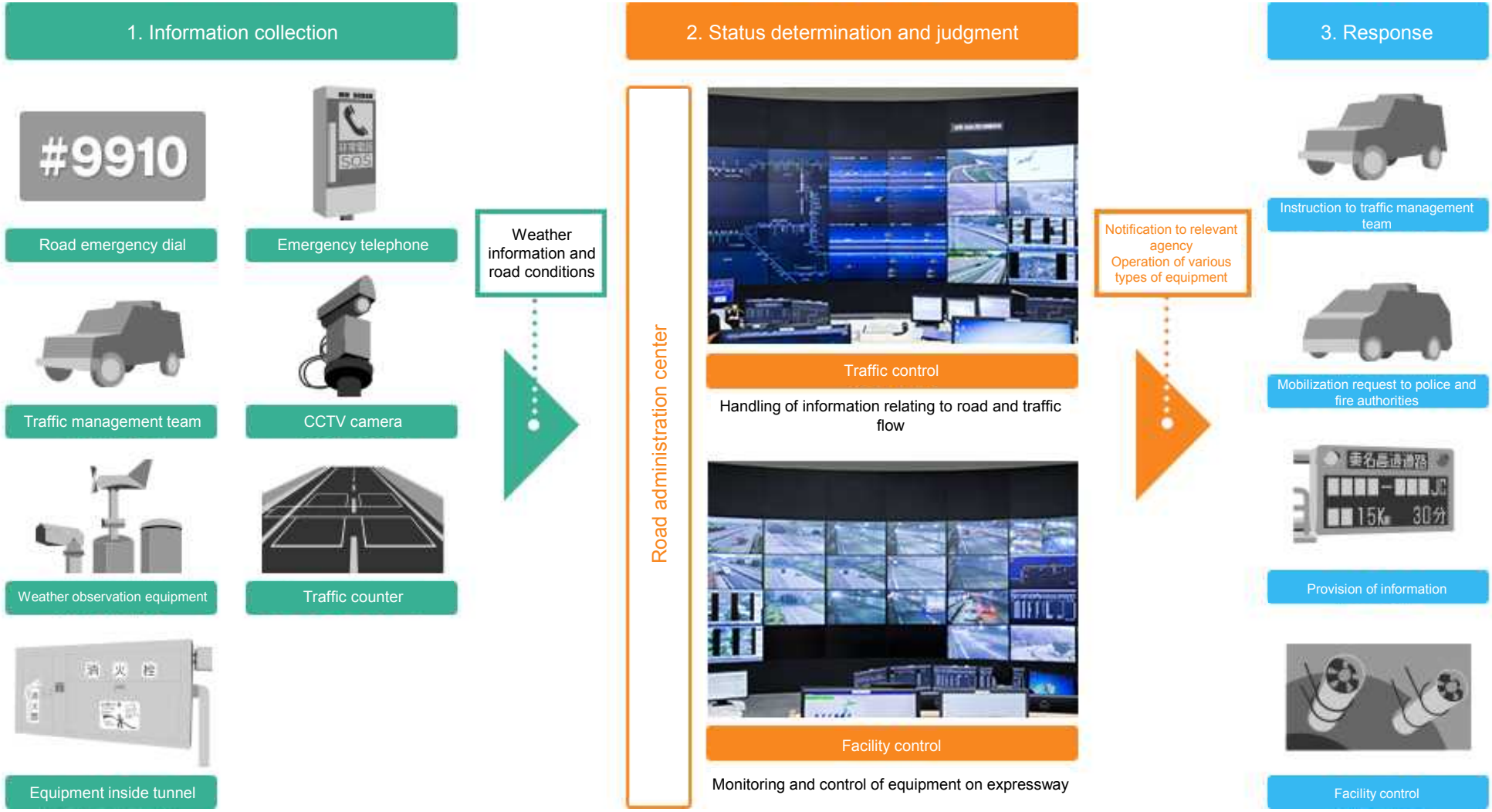


Radio beacon reception range



Optical beacon reception range

Flow of road traffic information generation at road administration center



Source: Central Nippon Expressway Company reference

Example of road traffic information provision for individual lanes (Central Nippon Expressway Company route)

- JARTIC provides road traffic information on its website as well.
- That information includes information on traffic restrictions whose content indicates individual lanes, such as “No. 1 lane driving traffic restriction.”

Example of provision of traffic restrictions for individual lanes on website (JARTIC)

Source: JARTIC website

Overview of road traffic information for individual lanes that is currently being provided

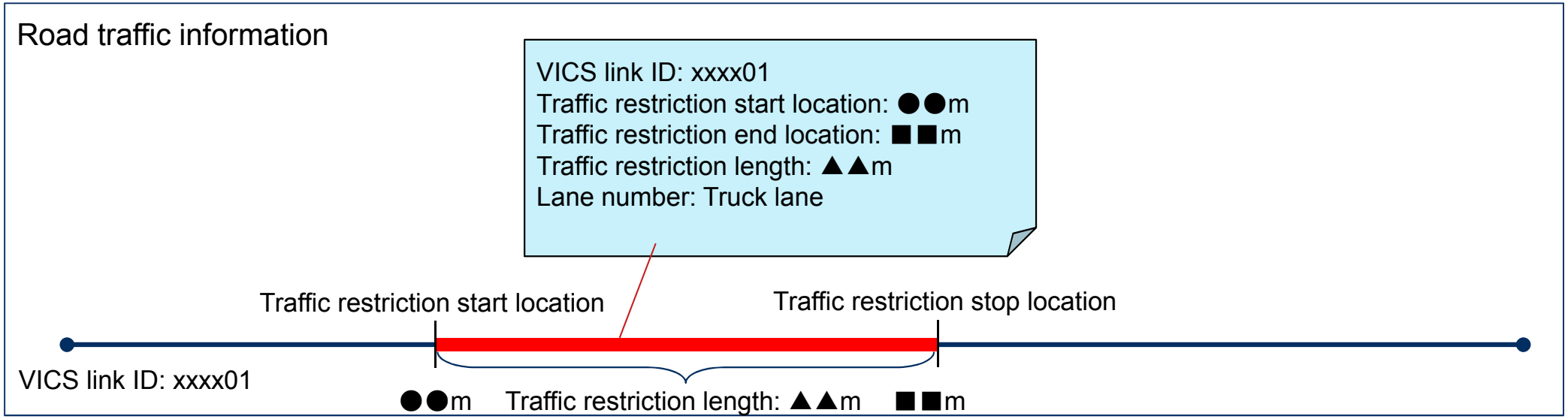
Type of road traffic information	Traffic restriction information
Type of road	Expressway
Lane depiction method	Lanes will be depicted using either ① or ② below: ① Lane number (truck lane, passing lane, driving lane 1, driving lane 1 + driving lane 2, etc.) • NEXCO East / Central / West, HSBE, Fukuoka ② Number of lanes (1-lane traffic restriction, 2-lane traffic restriction etc.) • Shutoko, Nagoya, Hanshin
Media used to provide information	FM multiplex broadcast, ETC 2.0 Note: Provision by optical beacon is expected to use the same provision format as the two types of media listed above
Method used to generate traffic restriction information	• Immediately after the report, or in other cases in which the location of the dropped object or breakdown vehicle cannot be determined immediately • In some cases traffic restrictions are imposed for all lanes • But subsequently as time passes and more information about the situation is obtained, more detailed traffic restriction information is entered.

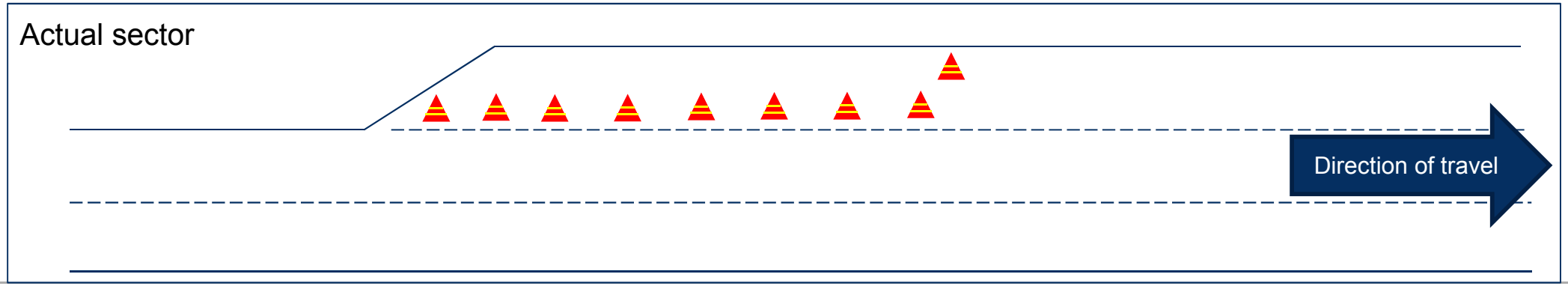
Supplementary information: Abbreviated names for expressway corporations

East Nippon Expressway Company: NEXCO East, Central Nippon Expressway Company: NEXCO Central, West Nippon Expressway Company: NEXCO West, Metropolitan Expressway Company Limited: Shutoko, Hanshin Expressway Company Limited: Hanshin, Honshu-Shikoku Bridge Expressway Company Limited: HSBE, Nagoya Expressway Public Corporation: Nagoya, Urban Expressway: Fukuoka

Specifications for provision of road traffic information, etc. for individual lanes (diagram)

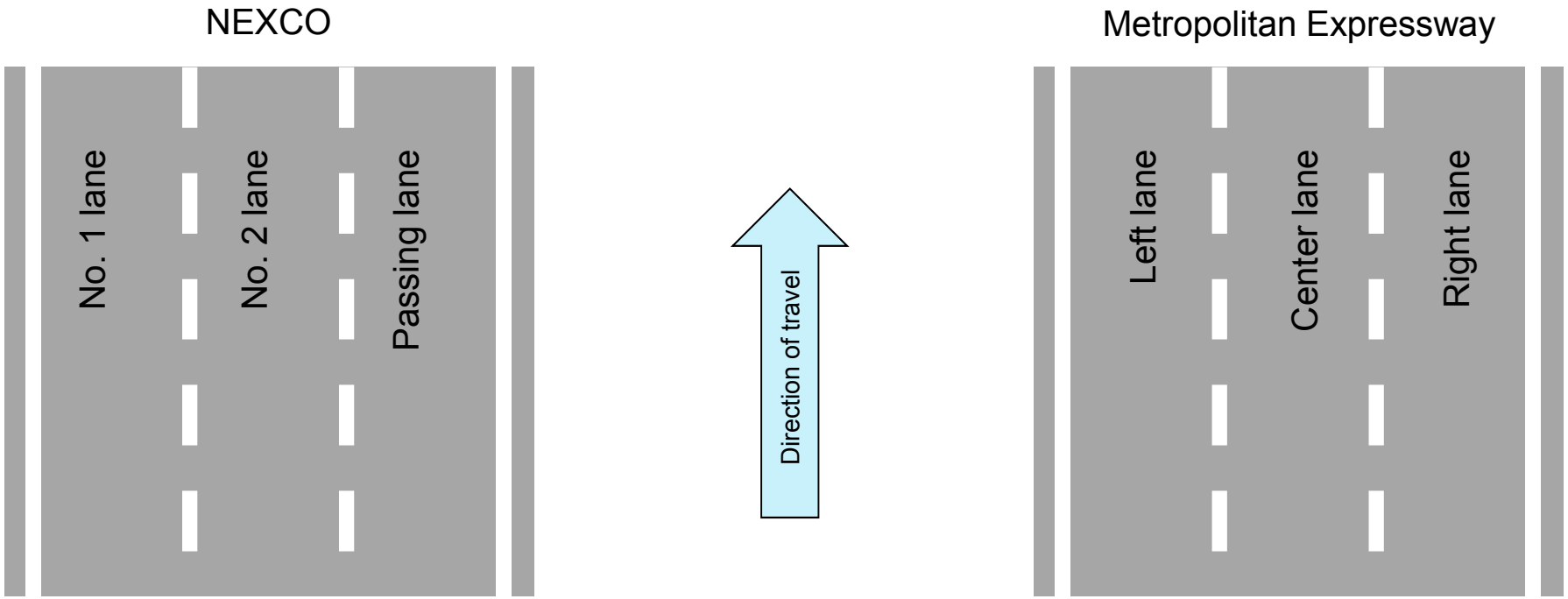
- Indication of lanes
  - Lanes are indicated by either lane number or number of lanes.
- Traffic restriction location and length
  - The start and stop locations for traffic restrictions are indicated as the distance from the endpoint of the VICS link that includes the location in question.





Status of management of traffic restriction information on Metropolitan Expressway control system

- Traffic restriction information is managed for individual lanes on the Metropolitan Expressway as well.
- However, the name of the lane is different for NEXCO and the Metropolitan Expressway as shown below. (example: in the case of a 3-lane sector)



On the Metropolitan Expressway, there are many sectors with left and right lane branching/joining at frequent intervals, so all of the lanes are driving (as opposed to passing) lanes.

- In the format for provision of information using ETC 2.0 and FM multiplex broadcasts, only the NEXCO names are defined, so on the Metropolitan Expressway information is provided in the form of “No. 1 lane traffic restriction” and “No. 2 lane traffic restriction”

Study sessions for road traffic information for individual lanes

	Date of study session	Issues discussed
1st	October 13	① Large-scale Field Operational Tests for SIP adus ② Overview and objectives of study session for road traffic information for individual lanes ③ Current status of road traffic information provision ④ Format for provision of road traffic information
2nd	December 1	① Current mechanism for provision of road traffic information ② Links used for provision of road traffic information
3rd	February 5	① Current mechanism for provision of road traffic information (results of confirmation of additional questions at study session) ② Proving tests for provision of road traffic information for individual lanes

Study session attendees	Observers	Secretariat
Traffic Bureau, National Police Agency Telecommunications Bureau, Ministry of Internal Affairs and Communications Road Bureau, MLIT	Vehicle Information and Communication System (VICS) Center Highway Industry Development Organization Japan Traffic Management Technology Association (from 2nd meeting onward) Japan Automobile Manufacturers Association, Inc. Japan Digital Road Map Association Japan Road Traffic Information Center UTMS Society of Japan East Nippon Expressway Company Limited Central Nippon Expressway Company Limited (from 2nd meeting onward) Dynamic Map Large-Scale Field Operational Test Consortium (from 3rd meeting onward)	Cabinet Office NEDO MRI

Points to be verified when using road traffic information for automated driving systems

Verification point 1: Differences in maps used

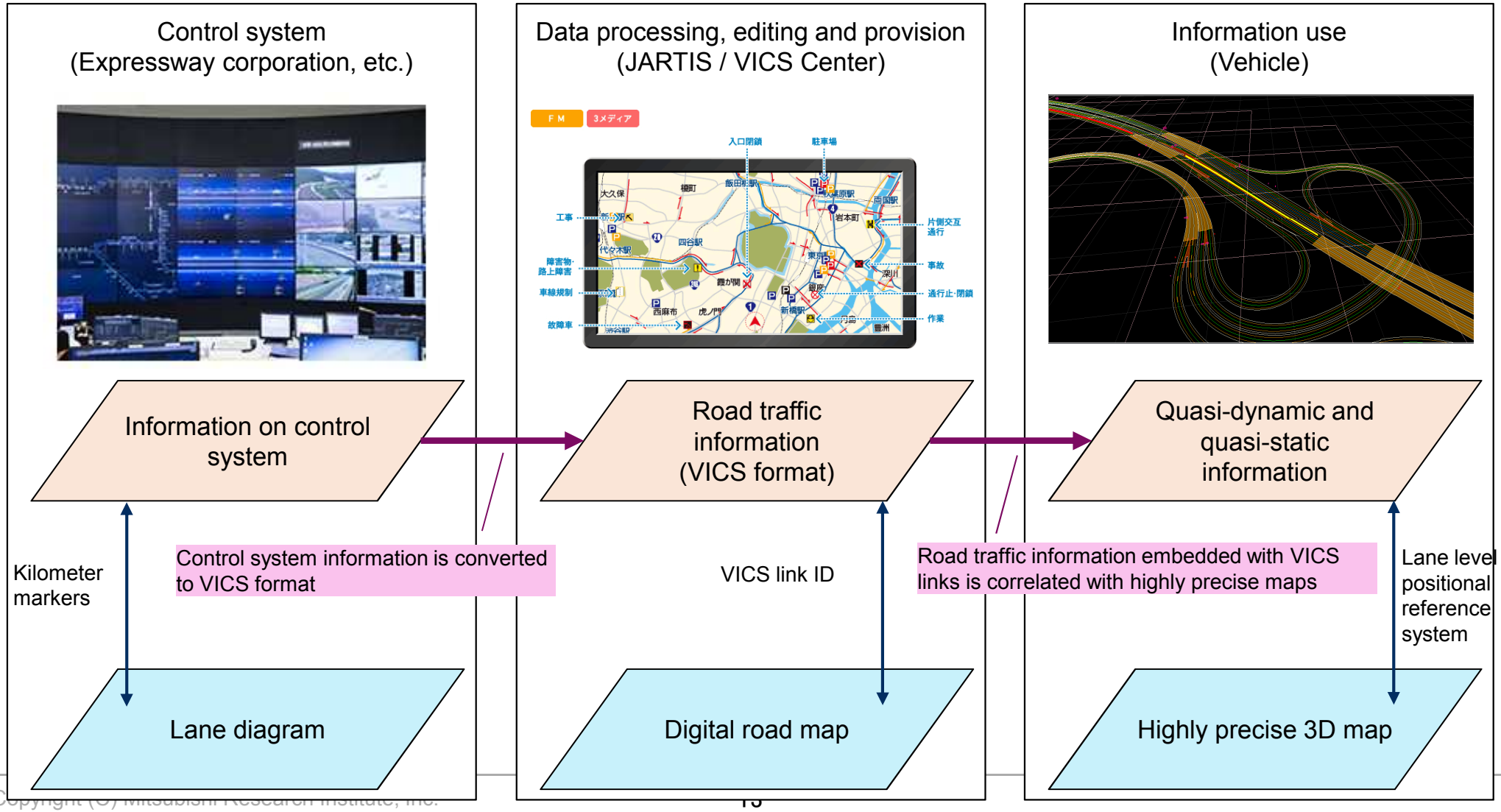
- If the map used to provide road traffic information and the map used by the automated driving system are different, it must be verified that the road traffic information can be correctly correlated with the dynamic map.

	Automated driving system (presumed)	Road traffic information (current)
Map used	Dynamic map	Digital road map
Map accuracy	1/500 (Note: relative precision)	1/25,000
Map updating frequency	As soon as possible after updating	Once per year (March)
Map creation method	Mobile mapping system (MMS) Note: Measurement vehicle equipped with laser radar	Geographical Survey Institute 1/25,000 topographic map Road administrator references Newly published topographic map

Points to be verified when using road traffic information on automated driving systems

Verification point 2: Conversion error

- Various types of conversion are performed in the process of providing road traffic information, so verification is needed to ensure that there are no discrepancies in positional recognition.



Preliminary draft plan for test of the provision of traffic restriction information for individual lanes

Background

- At the Mapping Task Force and other organizations, there has been discussion regarding the need for information at the individual lane level in order to achieve automated driving systems.
- However, it has not been verified whether the traffic restriction information for individual lanes that has already been distributed can be used by maps designed for automated driving systems (dynamic maps).

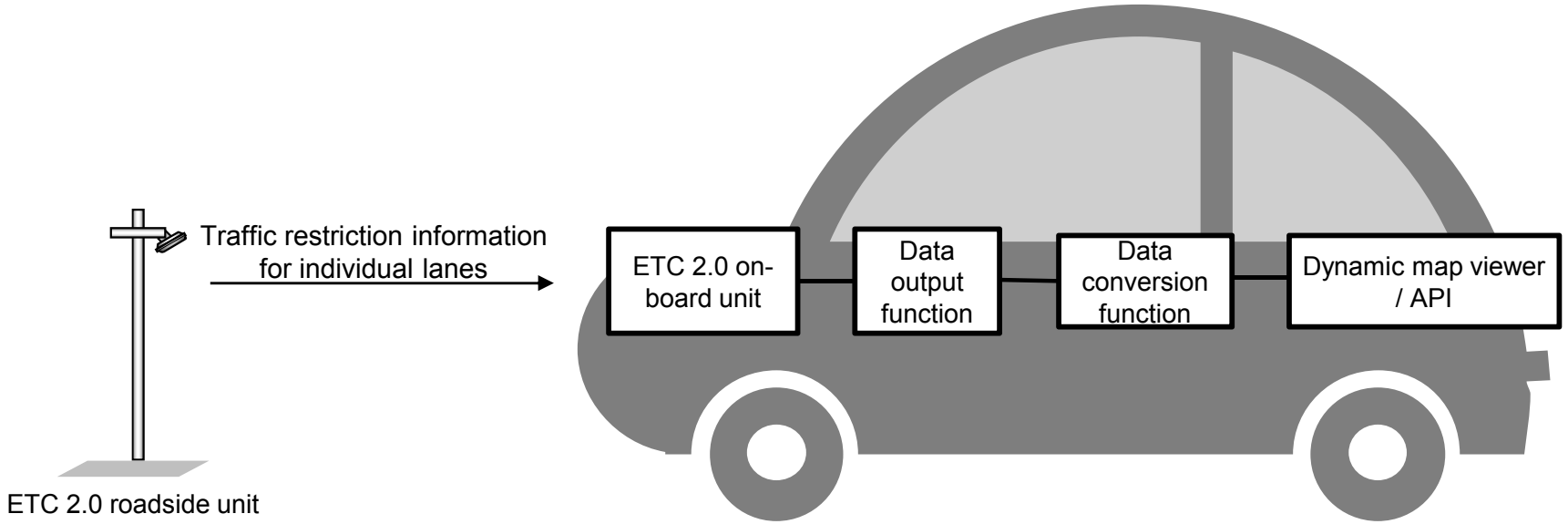
Items for study

- Study of test plans in anticipation of the proving tests to be conducted during the next fiscal year by the Cross-Ministerial Strategic Innovation Promotion Program (SIP), in order to confirm the following two points:
  - ① Technical confirmation that traffic restriction information for individual lanes can be used in dynamic maps
  - ② Confirmation by test participants in the dynamic map proving tests that traffic restriction information for individual lanes can be used

Proposed configuration of equipment to be used for technical verification

Proposed equipment configuration

- For the “dynamic map” proving tests in the SIP Automated driving system / Large-scale Field Operational Tests, the test functions that are used by the dynamic map on the vehicle side are expected to be employed for the traffic restriction information for individual lanes that is provided by the ETC 2.0 roadside unit.
- Verification of the test functions (on the vehicle side) that have been constructed in the dynamic map proving tests



Anticipated equipment configuration

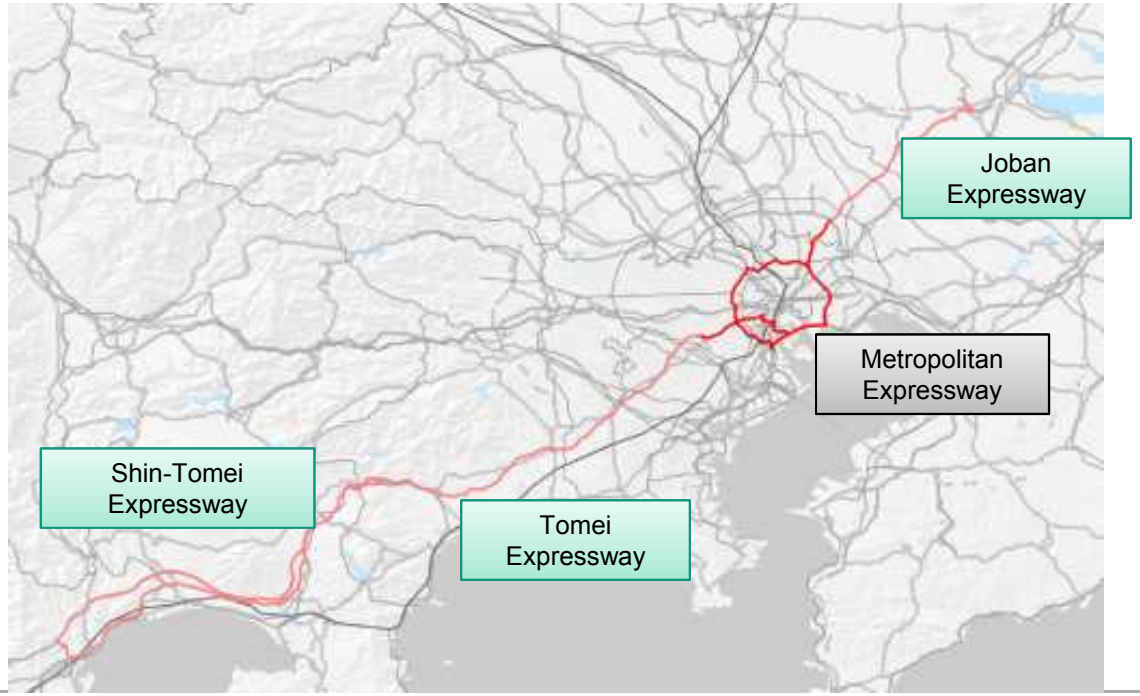
Proposed test schedule and test locations

Proposed test schedule

- Development of test functions (vehicle side) By August 2018
- Evaluation by developer September 2018
- Evaluation by test participants October - December 2018

Test locations

- Expressways on which traffic restriction information for individual lanes is provided

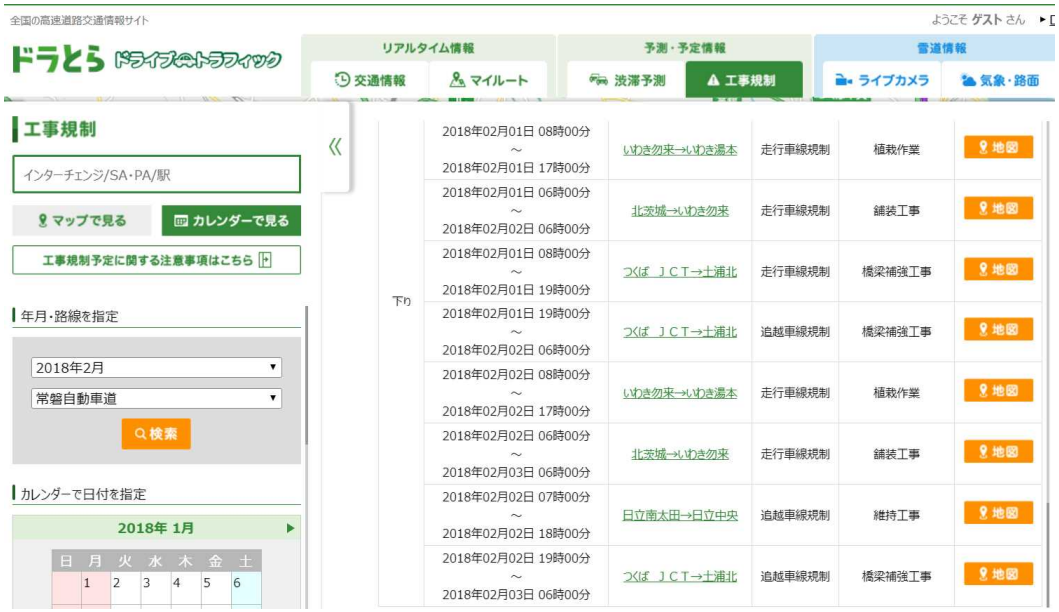


Traffic restriction information for individual lanes is currently being provided

Traffic restriction information for individual lanes is not currently being provided

Proposed test method (1)

- Since the test will be conducted on public roads, no dummy data will be distributed.
  - ※ Whether traffic restriction data for individual lanes will be produced will depend on the road conditions at the site on that day.
- Test participants will be invited to access a website that will provide information on scheduled construction traffic restrictions, and this information will be used to formulate driving plans.
  【Website with information on scheduled construction traffic restrictions】
  East Nippon Expressway Company: https://www.drivetraffic.jp/construction
  Central Nippon Expressway Company: https://www.c-nexco.co.jp/construction
- However, it will be thoroughly explained that whether or not the traffic restrictions are put into effect, and the time period of the traffic restrictions, may change as a result of traffic or weather conditions or other factors on that day.



Example of scheduled construction traffic restrictions posted by East Nippon Expressway Company

Source: East Nippon Expressway website（https://www.drivetraffic.jp/construction）

Example of scheduled construction traffic restrictions posted by Central Nippon Expressway Company

Source: Central Nippon Expressway website（https://www.c-nexco.co.jp/construction）

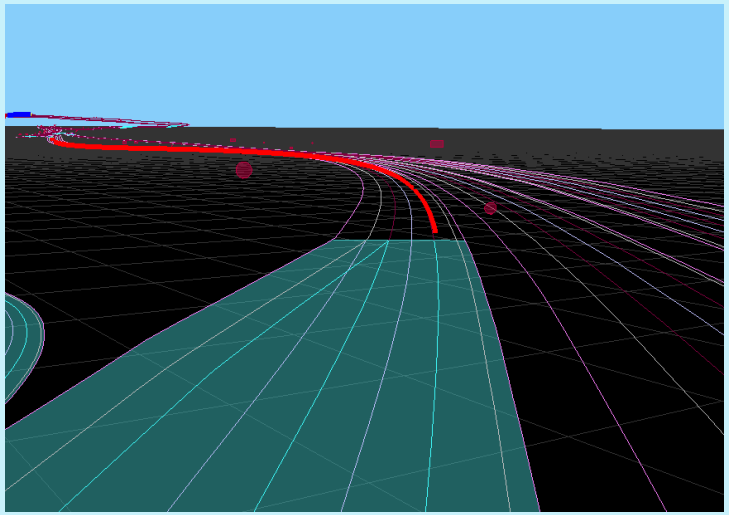
Proposed test method (2)

- The purpose of road traffic information is to provide information to drivers. This information is not expected to be used for vehicle control.

  → In the test, traffic restriction information for individual lanes that has been received by the ETC 2.0 on-board unit will be plotted on a dynamic map, and this information will be compared with actual driving images to allow test participants to confirm its potential usefulness.

Assessment by test participants

※ In accordance with National Police Agency guidelines, test participants will be asked to ensure that drivers do not look at PCs or other equipment.



Sample dynamic map viewer

Image taken by on-board camera

Summary

1) Study of the provision of road traffic information for individual lanes in Japan

- It was confirmed that traffic restriction information for individual lanes (restrictions on driving in driving lanes, passing lanes, etc.) is currently being provided on some expressways using FM multiplex broadcast and the ETC 2.0 system.
- The points of contention regarding the use of traffic restriction information for individual lanes on automated driving systems were identified.

2) Study of domestic efforts relating to the provision of road traffic information for individual lanes, etc.

- Study sessions regarding the provision of road traffic information for individual lanes were held to exchange information with relevant entities in Japan regarding the mechanism, etc. for providing road traffic information.
- During the next fiscal year, proving tests to verify that traffic restriction information for individual lanes can be used in dynamic maps are expected to be conducted during the Large-scale Field Operational Tests by the Cross-Ministerial Strategic Innovation Promotion Program (SIP), and preliminary draft plans for the proving tests are currently being studied.