Strategic Innovation Promotion Program (SIP) for Automated Driving Systems/Large-Scale Field Operational Test/Dynamic Map

Study Regarding Use of Lane-Level Road Traffic Information, etc.

Report Overview

Mitsubishi Research Institute, Inc.
Next-Generation Infrastructure Division

February 28, 2019

Project objectives

- In promoting the societal deployment of automated driving systems, using lane-specific traffic information, etc., will be effective in achieving safer, more stable autonomous vehicle control.
- In this study, we performed the following in order to investigate the use of lane-specific traffic information, etc.

Investigated use cases requiring lane-specific traffic information, etc., to be provided and structure of benefits of information provision

Exchanged information with information providers and other parties involved in a field operational test regarding the provision of lane-specific traffic information, etc.

Study contents

We performed the following studies regarding the use of dynamic map lane-specific traffic information, etc.

1) Study regarding the provision of lane-level road traffic information

a.Investigated content such as lane-specific traffic information, etc.

- Collected and organized information, including domestic and foreign case examples of traffic information which is expected to be used in automated driving, and investigated and organized content

b.Investigated use cases for lane-specific traffic information, etc.

- Investigated and considered use cases in which content investigated in item (a) is likely to be provided to as information to autonomous vehicles and drivers

c.Investigated benefits of use of lane-specific traffic information, etc.

- Investigated and systematically organized the expected benefits of using lane-specific traffic information, etc., in automated driving

2) Exchanged information with other parties in Japan involved in field operational testing of the provision of lane-specific restriction information

- Coordinated with the Dynamic Map Large-scale Field Operational Test contractor, created opportunities for related parties in Japan to exchange information, and investigated the efficacy of lane-specific restriction information, etc.

3) Summarized the results of our study regarding use of lane-level traffic flow information, etc.

- Shared information at SIP automated driving system meetings and other meetings and gathered feedback regarding study contents and approaches

1) Study regarding the provision of lane-level road traffic information

a. Investigation of content such as lane-specific traffic information, etc.

1. Study of measures being conducted overseas
Studied cases

- Overseas, research projects such as SENSORIS and inLane are being conducted. Commercial services have been released which provide lane-specific information via smartphone apps.
- Information was investigated and organized for the following national project, consortium, and content providers. Our investigations covered project summaries, target areas, data generation methods, the types of lane-specific traffic information and other content studied, and overviews of each type of content.

National project

- inLane: Project established as part of the EU's latest framework project (Horizon 2020). The project is carrying out research and development aimed at realizing low cost, high measurement accuracy lane-specific navigation.

Consortium

- SENSORIS: Project involving vehicle manufacturers, content providers, sensor manufacturers, etc. Considers standards, etc., for aggregating information collected from vehicle sensors in the cloud.

Content providers

- HERE: German company that provides map-related technologies. Developer of lane-specific traffic information technologies (Split Lane Traffic Reporting at Junctions algorithm, etc.)
- TomTom: Dutch company that provides map-related and navigation-related technologies. Developer of lane-specific traffic information technologies (lane-specific traffic congestion information, traffic jam forecasting, etc.)
- Live Roads: Provider of navigation application for smartphones. Develops and provides apps related to lane-specific navigation.

1. Study of measures being conducted overseas
Content being studied (1/2)

- We organized content being provided or studied overseas. In other countries, lane-specific content such as lane-specific route guidance or lane-specific speed restrictions are also being studied.

National project

Study scope	Devices used		Considered Content (◎: Lane-level information, ○: Road-level information)												Update frequency/accuracy		
	Collection/generation	Provision	Weather	Traffic congestion	Traffic accident	Road construction	Traffic signal state	POI (empty parking space information, etc.)	Temporary traffic restriction (speed restriction)	Vehicle location (cruising lane)	Lane route guidance	Traffic restriction	Warning (road surface condition, etc.)	Traffic congestion prediction	Vehicle location accuracy	Update frequency/accuracy of individual content (for content of each type with the highest accuracy)	Map accuracy/update frequency
inLane	Data collection from video cameras, GNSS, central computer Use of LIDAR, ultrasonic sensors, and radar is also being considered.	Vehicle-mounted display					◎			◎	◎	◎			0.5 m for highways, 1.5 m to 2m for urban areas including sections underneath elevated sections Ultimate goal: 5 cm	Latitudinal accuracy: Lane level ※ Longitudinal accuracy: Unknown Update frequency: Unknown	Use of HD Maps studied by TomTom -> Also see TomTom page

Consortium

* Accuracy added by MRI based on content details, etc.

Study scope	Devices used		Content being considered for standardization of interface (◎: Lane-level information, ○: Road-level information)												Update frequency/accuracy		
	Collection/generation	Provision	Weather	Traffic congestion	Traffic accident	Road construction	Traffic signal state	POI (empty parking space information, etc.)	Temporary traffic restriction (speed restriction)	Vehicle location (cruising lane)	Lane route guidance	Traffic restriction	Warning (road surface condition, etc.)	Traffic congestion prediction	Vehicle location accuracy	Update frequency/accuracy of individual content (for content of each type with the highest accuracy)	Map accuracy/update frequency
SENSORIS	- (The project studies formats for uploading data from vehicles to the cloud, etc. The devices and data generation methods used are not referred to.)		○	◎	◎			◎				○	◎		Latitudinal accuracy: Lane level ※ Longitudinal accuracy: 5 m to 10 m ※	Latitudinal accuracy: Lane level ※ Longitudinal accuracy: 5 m to 10 m ※ Update frequency: Unknown	- (Not addressed by study)

* Accuracy added by MRI based on content details, etc.

1. Study of measures being conducted overseas
Content being studied (2/2)

Content providers

Study scope	Devices used		Content being provided or considered (◎: Lane-level information, ○: Road-level information)											Update frequency/accuracy		
	Collection/generation	Provision	Weather	Traffic congestion	Traffic accident	Road construction	Traffic signal state	POI (empty parking space information, etc.)	Temporary traffic restriction (speed restriction)	Vehicle location (cruising lane)	Lane route guidance	Traffic restriction	Warning (road surface condition, etc.)	Traffic congestion prediction	Vehicle location accuracy	Update frequency/accuracy of individual content (for content of each type with the highest accuracy)	Map accuracy/update frequency
HERE	Generation of traffic congestion information by using algorithm to analyze probe data.	Vehicle-mounted display Smartphone		◎	○	○								○	Latitudinal accuracy: Lane level ※ Longitudinal accuracy: 10 m ※	Latitudinal accuracy: Lane level ※ Longitudinal accuracy: 10 m ※ Update frequency: 1 minute	Map accuracy: 10 cm to 20 cm Update frequency: Unknown * Unknown whether HD maps with the accuracy indicated above are used for content superposition
TomTom	Generation of traffic information using probe data, traffic information cameras, loop coils embedded in roads, etc.	Vehicle-mounted display		◎					◎		◎	◎		◎	Latitudinal accuracy: Lane level ※ Longitudinal accuracy: Unknown	Latitudinal accuracy: Lane level ※ Longitudinal accuracy: Unknown Update frequency: Maximum of 15 minutes	Map accuracy: 1 m (relative accuracy) Update frequency: Unknown
Live Roads	Unknown	Smartphone			○	○				◎	◎				Latitudinal accuracy: Lane level ※ Longitudinal accuracy: Unknown	Latitudinal accuracy: Lane level ※ Longitudinal accuracy: Unknown Update frequency: Unknown	Unknown

* Accuracy added by MRI based on content **details**, etc.

2. Study of measures being conducted in Japan
Lane-level content being provided or considered

- Event information and information owned by road administrators are being studied in Japan and overseas at the lane level, and some of this information is already being provided. Overseas, the lane-level content is currently being considered with a primary focus on traffic congestion information.

Content			Content being provided or considered (◎: Lane-level information, ○: Road-level information)									
			Japan					Overseas				
			FM multiplex broadcasting	ETC2.0	Optical beacon	Advanced infrared beacon	ITS wireless	inLane	SENSORIS	HERE	TomTom	Live Roads
Semi-static, semi-dynamic, dynamic	(1) Event information	Weather	○	○					○			
		Traffic congestion	○	○	○	○			◎	◎	◎	
		Traffic accident	○	○	○	○			◎	○		○
		Obstacles (disabled vehicles, fallen objects, etc.)	○	○	○	○						
		Road construction	◎	◎	◎	◎				○		○
	(2) Information owned by road administrators	Traffic signal state				◎	◎	◎				
		ETC lane closure information										
		POI (empty parking space information, etc.)	○		○	○			◎			
		Temporary traffic restrictions (road use restrictions)	◎	◎	◎	◎						
		Temporary traffic restrictions (speed restrictions)	◎	◎	◎	◎					◎	
	(3) Mobile object information	Nearby vehicles (merging areas and intersections, etc.)			◎		◎					
		Priority vehicles					◎					
		Nearby pedestrians, etc.					◎					
	(4) Vehicle-generated information	Vehicle status (failures, horizontal G-forces, etc.)										
		Vehicle location (cruising lane)						◎				◎
		Lane-specific route guidance						◎			◎	◎
Static information	(5) Road structure information											
	(6) Traffic restriction information (*)							◎	○		◎	

(*) In Japan, some traffic restriction information is available on the internet.

1) Study regarding the provision of lane-level road traffic information

b. Investigation of use cases for lane-specific traffic information, etc.

1. Investigation of use cases for lane-specific traffic information, etc.
(1) Examination of use cases

- In order to confirm which content is desired for use in safe driving support and automated driving, we investigated the use cases that are currently being considered.
- We categorized the use cases into highway use cases, ordinary road use cases, and parking lot use cases. For highway and ordinary road use cases, driving spaces are defined by main roadways, curves, etc.

Category	Use case	
Highway	(1)-1	Traversing toll booths
	(1)-2	Merging onto main roadways
	(1)-3	Merging from parking areas onto main roadways
	(1)-4	Driving on main roadways
	(1)-5	Curves
	(1)-6	Tunnels
	(1)-7	Construction restrictions
	(1)-8	Lane changes (from driving lanes to passing lanes)
	(1)-9	Lane changes (from passing lanes to driving lanes)
	(1)-10	Splitting off from main roadways
	(1)-11	Stopping in emergency parking zones

Category	Use case	
Ordinary road	(2)-1	Driving on main roadways
	(2)-2	Curves
	(2)-3	Construction restrictions
	(2)-4	Merging into through streets
	(2)-5	Lane change (from driving lanes to passing lanes)
	(2)-6	Lane change (from passing lanes to driving lanes)
	(2)-7	Driving straight through intersections
	(2)-8	Turning right at intersections
	(2)-9	Turning left at intersections
	(2)-10	Intersection with no traffic signal
	(2)-11	Collision avoidance
Parking areas	(3)	Parking within parking area lines

1. Investigation of use cases for lane-specific traffic information, etc.
(2) Content to be used

- Within the use cases being considered in Japan, we investigated which content is desired for use in safe driving support and automated driving, and how that content is defined.

Content to be used			Content definition
Semi-static / semi-dynamic / dynamic	(1) Event information	Weather (rain, temperature, road surface conditions, etc.)	Rain, temperature, road surface conditions, wind, and other weather conditions
		Traffic congestion	Traffic congestion status
		Traffic accidents	Presence of traffic accidents
		Obstacles (disabled vehicles, fallen objects, etc.)	Presence of obstacles (disabled vehicles, fallen objects, etc.)
		Road construction	Start positions of road construction Road construction sections
	(2) Information owned by road administrators	Traffic signal state	Traffic signal state
		ETC lane closure information	Locations of closed ETC lanes
		POI (empty parking space information, etc.)	Interior shape of parking area Availability of empty parking spaces in parking area
		Temporary traffic restrictions (road use restrictions)	Start positions of temporary traffic restrictions
		Temporary traffic restrictions (speed restrictions)	Contents of temporary speed restrictions
	(3) Mobile object information	Nearby vehicles (merging areas and intersections, etc.)	Driving positions, vehicle speeds, and approach directions of nearby vehicles (nearby vehicles in merging areas and intersections, vehicles in parking areas, etc.) Following distance from own vehicle
		Priority vehicles	Approach of priority vehicles
		Nearby pedestrians, etc.	Locations and speeds of nearby pedestrians, etc. (pedestrians, bicycles, etc., on sidewalks or in intersections)
	(4) Vehicle-generated information	Vehicle status (failures, horizontal G-forces, etc.)	Failures in own vehicle, horizontal G-forces affecting own vehicle Driver seatbelt status
		Vehicle location (cruising lane)	Lane the user's vehicle is driving in
		Lane-specific route guidance	Lane-specific route to be driven
Static information	(5) Road structure information		Road shape, road attributes, road facilities
	(6) Traffic restriction information		Content of access restrictions and permanent traffic restrictions such as stop signs, etc.

1. Investigation of use cases for lane-specific traffic information, etc.
(3) Methods for collecting data in order to generate information

- In order to investigate the methods for generating the "content to be used" indicated on the previous page, we investigated the methods for collecting data that is already in practical use.
- Potential methods for collecting data include collecting data from roadside sensors, collecting accumulated probe data via roadside sensors, and collecting private probe data via mobile phone networks.
- When using probe data, mobile phone networks, etc., can be used to collect data without transmitting it via roadside sensors, making real-time data collection possible even in locations without roadside sensors.

The use of probe data should be considered in order to gain an overall understanding of transportation environments

2. Dynamic Map Large-scale Field Operational Test evaluation results
(1) General overview of evaluation results and future issues

- As part of the "SIP for Automated Driving Systems/Large-Scale Field Operational Test/Dynamic Map," semi-dynamic information linking methods and effectiveness were evaluated.
- Based on the results of the evaluations of semi-dynamic information linking methods, we confirmed that there was deviation in distances when converting data because the dynamic map location referencing method (CRP) and the existing node locations of links for providing information did not match.
- However, with regard to effectiveness evaluation, based on the results of evaluations by field operational test participants, we confirmed that lane-level restriction information and traffic flow information would be effective for automated driving systems.

- Based on the above, lane-level road traffic information was evaluated as being effective for automated driving systems.
- However, the following were identified as issues which must be addressed in order to improve the performance of level 2 and higher automated driving systems.

Issue 1 Lane-level road traffic information (restriction information) is not being provided for the Metropolitan Expressway

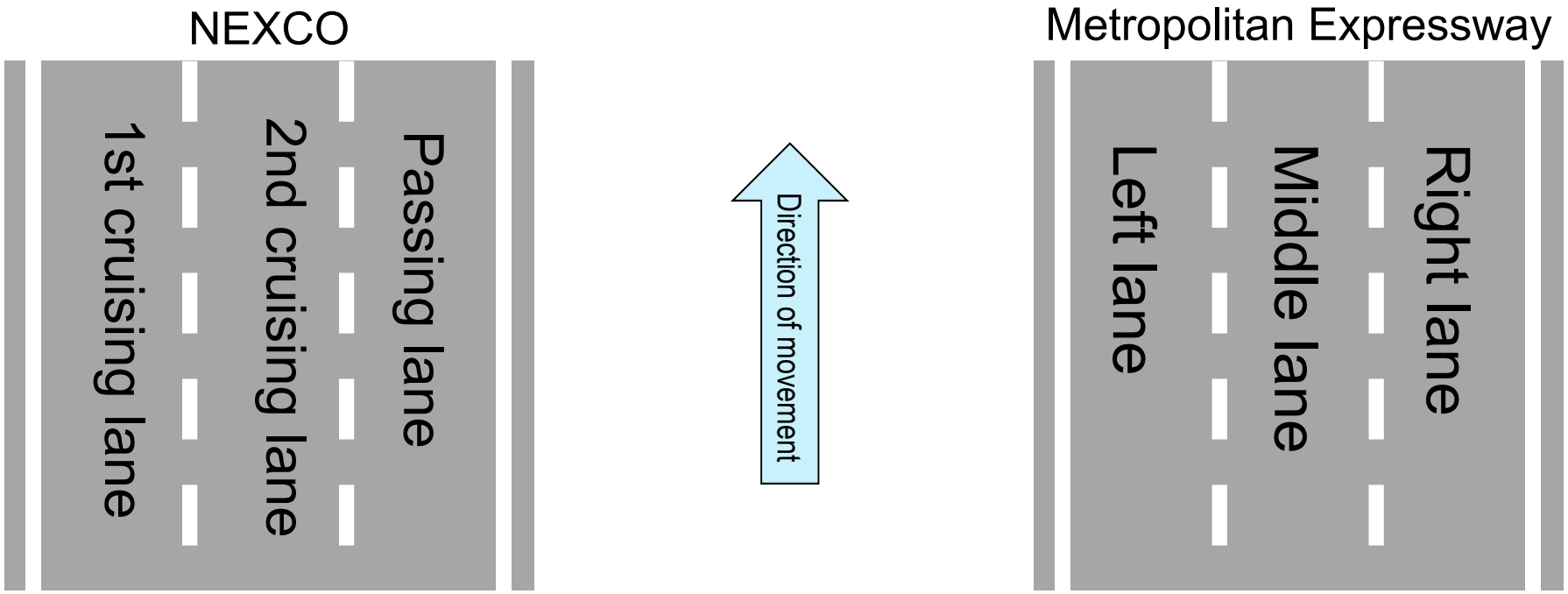
Issue 2 There is longitudinal conversion deviation

Issue 3 The sections indicated in restriction information distributed by road administrators (start and end point locations, etc.) does not match actual restriction sections

2. Dynamic Map Large-scale Field Operational Test evaluation results
(2) Approach to addressing these issues

Issue 1 Provision of lane-level restriction information for the Metropolitan Expressway

- Restriction information is managed at the lane level for the Metropolitan Expressway as well.
- However, the names of lanes differ between NEXCO and the Metropolitan Expressway, as indicated below. (for sections with three lanes)



On the Metropolitan Expressway, merging and branching occur frequently on both the left and right sides within short distances, so all lanes are considered cruising lanes.

- Only NEXCO names are defined for ETC2.0 and FM multiplex information provision formats, so on the Metropolitan Expressway, information is provided in the form of one-lane restrictions and two-lane restrictions.
- HIDO and others are currently considering the codes used to indicate lanes for the Metropolitan Expressway.

⇒Proposed handling approach: Lane indication codes should be defined for the Metropolitan Expressway, and verification and evaluation should be performed.

2. Dynamic Map Large-scale Field Operational Test evaluation results
(2) Approach to addressing these issues

Issue 2 There is longitudinal conversion deviation

- In order to confirm the factors producing longitudinal conversion deviation, we confirmed the standards used to define DRM link nodes
- Two standards are used to define branch/merger nodes for DRM links: i) Conventional standard and ii) New standard
- Nodes defined based on the conventional standard i) are to be redefined based on the new standard ii)

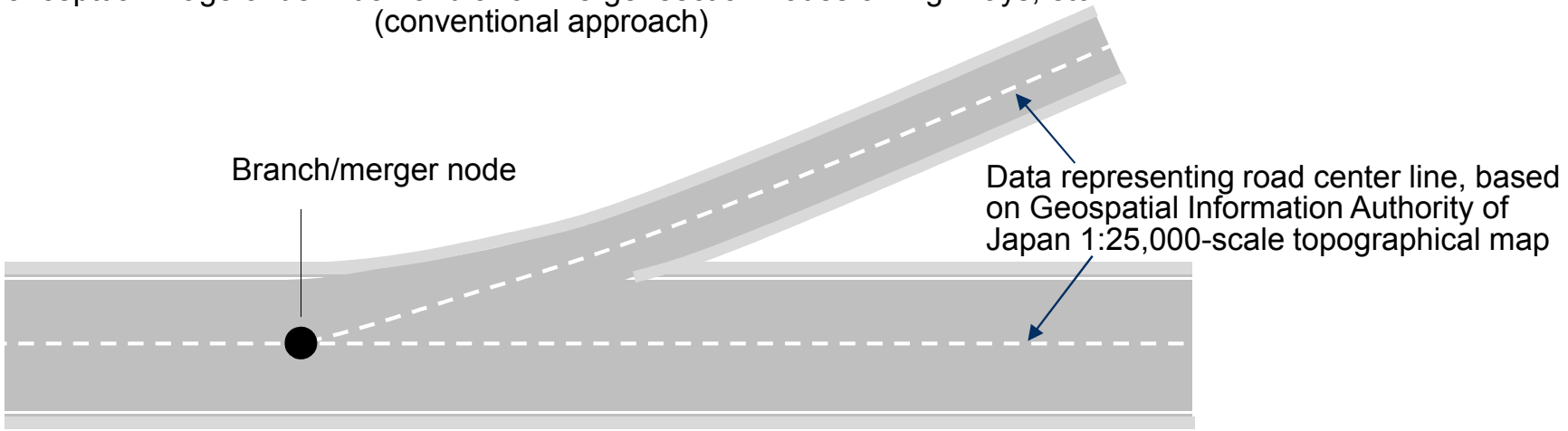
⇒Proposed handling approach: In order to improve the longitudinal location conversion accuracy of lane-specific restriction information, consideration should be given to defining branch/merger CRPs for high-accuracy map data based on the approach used to define nodes for DRM links.

i) Conventional standard

- The DRM-DB contains data that expresses the center line of the roads indicated with dual lines in the Geospatial Information Authority of Japan's 1:25,000-scale topographical map.
- Based on this road center line data, points where the center lines of main roadways and the center lines of branching/merging roadways intersect are defined as branch/merger nodes.

⇒ The above standards are expected to be used to define center lines and branch/merger nodes for the sections included in the SIP Dynamic Map Large-scale Field Operational Test (Tomei Expressway and Joban Expressway) as well.

Conceptual image of definition of branch/merger section nodes on highways, etc.
(conventional approach)



2. Dynamic Map Large-scale Field Operational Test evaluation results
(2) Approach to addressing these issues

Issue 2 There is longitudinal conversion deviation

ii) New standard (2016 branch/merger node definition standard)

- The following branch/merger node definition standards were formulated with the aim of producing higher accuracy maps.
- Node locations on directly managed national highways are currently being revised based on this standard.
- These standards will be used to redefine branch/merger nodes on NEXCO-managed highways in 2019. (It has not yet been decided when urban expressway nodes will be redefined.)

Acquisition position for intersection nodes on branch/merge ramps, etc., in the DRM-DB

* When zebra crossing zones, etc., are clearly indicated in plan views (design plan views), create data as indicated below.

1. Use the point 100 m from the edge of the branch/merging area (physical gore) of both acceleration and deceleration lanes as standards.
2. If the point 100 m from the edge of the branch/merging area is the outside of a taper edge, use the point equal to the distance to the taper edge as standard.
3. When using materials that indicate zebra crossing zones, if the point 100 m from the edge of the branch/merging area is closer to the edge of the branch/merging area than the edge of the zebra crossing zone (soft nose), then use the point equal to the distance to the edge of the zebra crossing zone as standard.

Based on the above criteria, **the standard locations of intersection nodes for ramps, etc., will be between soft noses and taper edges, 100m from the edges of merging areas.**

This standard is also to be used in the same way for city expressways and highways, etc. with different design speeds.

Source: Based on the Digital Road Map Database Updating Manual.

2. Dynamic Map Large-scale Field Operational Test evaluation results
(2) Approach to addressing these issues

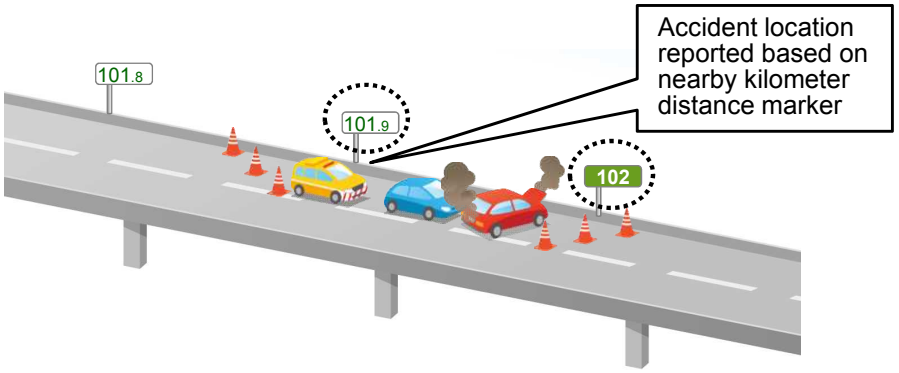
Issue 3 Deviation between restriction information sections and distributed information links

- It is currently possible for restriction location information (start and end points) to deviate from actual locations by anywhere from several tens of meters to several hundred meters due to (1) locations being based on information from emergency calls or patrol vehicles and/or (2) conversion of delivered information into links.

(1) Location information from emergency calls or patrol vehicles

- Generally speaking, the locations of traffic accidents, etc., are reported to offices, etc., based on nearby kilometer distance markers
- The kilometer distance marker used to determine locations are spaced 100 meters apart, so there is a potential deviation of several tens of meters

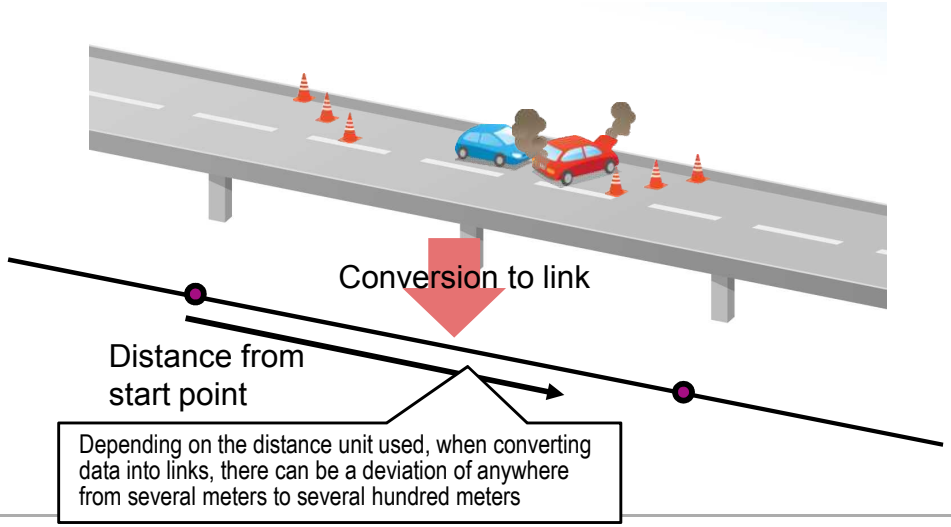
⇒Proposed handling approach:
Supplement information using probe data



(2) Conversion of distributed information into links

- When expressing restriction information locations, start point locations, and end point locations as links, the distance from the link end point is used.
- The distance from the link end point is expressed as an integer x the distance unit (units of 10 m to 500 m)
- When links are long, large distance unit values are used.
- Depending on the distance unit used, deviation can be anywhere from several meters to several hundred meters.

⇒Proposed handling approach:
Consider revising the location referencing method



2. Dynamic Map Large-scale Field Operational Test evaluation results (2) Approach to addressing these issues (general overview)

- The following potential methods could be used to address future issues.

Issue 1 Lane-level road traffic information (restriction information) is not being provided for the Metropolitan Expressway

⇒Lane indication codes should be defined for the Metropolitan Expressway, and verification and evaluation should be performed.

Issue 2 There is longitudinal conversion deviation

⇒Consideration should also be given to defining branch/merger CRPs for high-accuracy map data based on the approach used to define nodes for DRM links.

Issue 3 The sections indicated in restriction information distributed by road administrators (start and end point locations, etc.) does not match actual restriction sections

⇒ Supplement information using probe data

⇒ Consider revising the location referencing method

- Due to the above, SIP Phase Two, as well, should consider the optimal location referencing methods to be used in automated driving and the use of probe data to supplement infrastructure information.

1) Study regarding the provision of lane-level road traffic information

c. Investigation of benefits of use of lane-specific traffic information, etc.

1. Overview of expected benefits

- Providing information about vehicles, obstacles, and weather conditions in front of the vehicle, surrounding vehicles, traffic signals, and other information has the potential to provide autonomous vehicle users with benefits such as reductions in sudden braking and sudden turning, as well as potential benefits for overall road transport, by reducing the number of accidents and smoothing the flow of traffic.

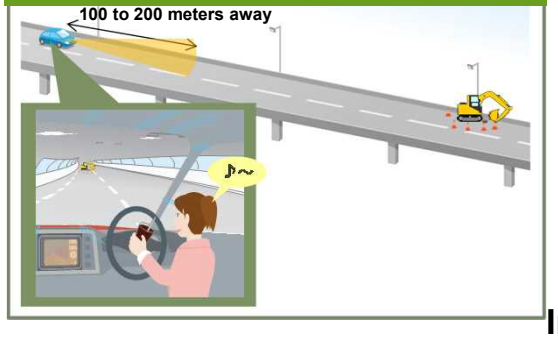
Main contents	Expected benefits: For autonomous vehicle users	Expected benefits: For overall road transport
Ⅰ. Information about vehicles and obstacles in front of the user's own vehicle • Traffic congestion (end position) • Traffic accidents • Obstacles (disabled vehicles, fallen objects, etc.) • Road construction • Temporary traffic restrictions	• **Reduction in amount of sudden braking and sudden turning** • Reduction in amount of unexpected automated driving disengagement • Greater peace of mind and comfort when driving	• Reduction in number of rear-end collisions with vehicles in front of own vehicle and collisions due to sudden lane changes • Smoothing of flow of traffic
Ⅱ. Weather information	• **Reduction in amount of unexpected automated driving disengagement** • Reductions in sudden braking • Greater peace of mind and comfort when driving	• Reduction in number of single-vehicle collisions and rear-end collisions with following vehicles • Smoothing of flow of traffic
Ⅲ. Information regarding nearby vehicles (merging support)	• **Smooth merging through use of automated driving** • Switching to manual driving well in advance of merging sections (when merging through use of automated driving is not feasible)	• Reduction in number of collisions, etc., with vehicles in inflow lanes • Smoothing of flow of traffic in merging sections
Ⅳ. Traffic signal information	• **Reductions in amount of sudden acceleration and sudden braking in intersections** • Greater leeway in passing through intersections	• Smoothing of flow of traffic in intersections • Reductions in number of collisions, etc., in intersections

2. Expected benefits of main contents

Ⅰ. Information about vehicles and obstacles in front of the user's own vehicle

- Lane-specific traffic information provided by roadside infrastructure can make it possible to change lanes while still far from obstacles or other vehicles in front of the user's vehicle, contributing to reductions in the number of accidents and smoother traffic flow.

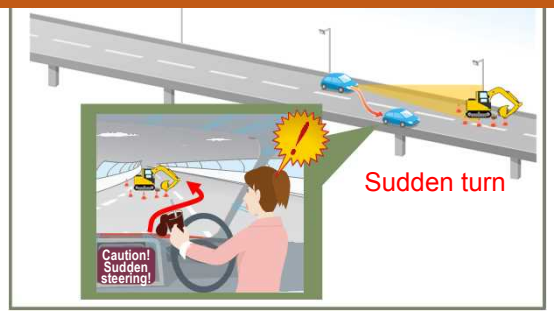
Before reaching other vehicles, obstacles, etc. (example: restriction section)



Information not provided by roadside infrastructure

- Sudden turning/braking immediately before other vehicles, obstacles, etc.
- Unexpected automated driving disengagement immediately before other vehicles, obstacles, etc.

Changing lanes by suddenly turning immediately before reaching other vehicles, obstacles, etc.

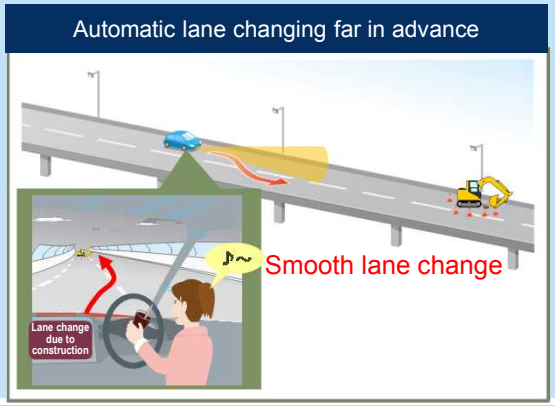


Information provided by roadside infrastructure

Autonomous vehicle user

- Lane changing while still far from preceding vehicles, obstacles, etc.
- Switchover to manual driving while still far from preceding vehicles, obstacles, etc.

Automatic lane changing far in advance



Overall road transport

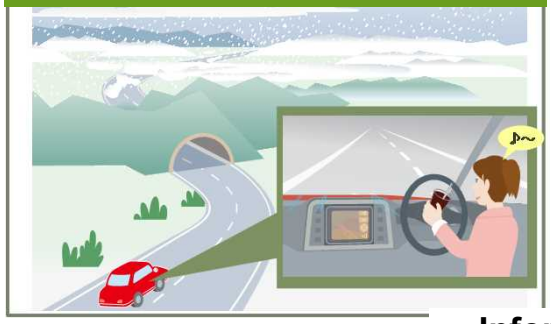
- Reduction in number of traffic accidents
  - ✓ Reduction in number of rear-end collisions with vehicles in front of own vehicle
  - ✓ Reduction in number of collisions caused by sudden lane changes
- Smoother traffic flow

2. Expected benefits of main contents

Ⅱ. Weather information

- Roadside infrastructure can provide information about weather conditions up ahead, which cannot be detected by vehicle sensors. This makes it possible to switch to manual driving far in advance, contributing to reductions in the number of accidents and smoother traffic flow.

Weather information (example: weather information at exit of tunnel)



Information not provided by roadside infrastructure

- Unexpected automated driving disengagement at exit from tunnel
- Sudden braking at exit from tunnel

Sudden automated driving disengagement at exit of tunnel

Information provided by roadside infrastructure

Autonomous vehicle user

- Switchover to manual driving well in advance of exit from tunnel
- Deceleration well in advance of exit from tunnel

Switchover to manual driving well in advance

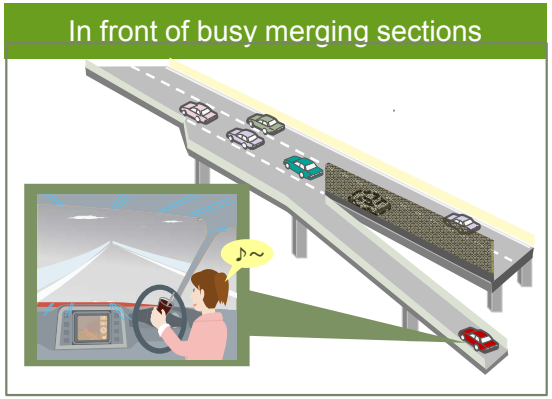
Overall road transport

- Reduction in number of traffic accidents
  - ✓ Reduction in number of single-vehicle collisions
  - ✓ Reduction in number of rear-end collisions from vehicles behind own vehicle
- Smoother traffic flow

2. Expected benefits of main contents

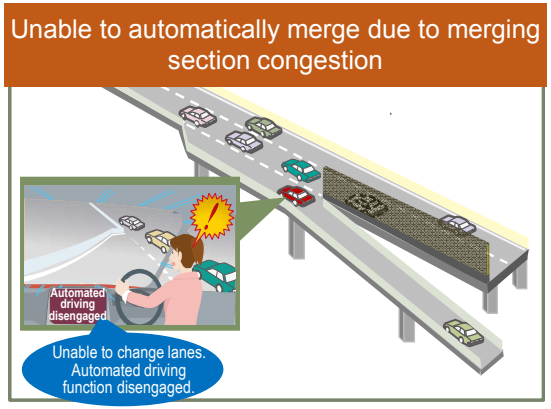
Ⅲ. Information regarding nearby vehicles (merging support)

- Roadside infrastructure can provide information about approaching vehicles on main roadways, which cannot be detected by vehicle sensors. This makes it possible to smoothly merge into main roadways and switch to manual driving far in advance, contributing to reductions in the number of accidents in merging areas and smoother traffic flow.



Information not provided by roadside infrastructure

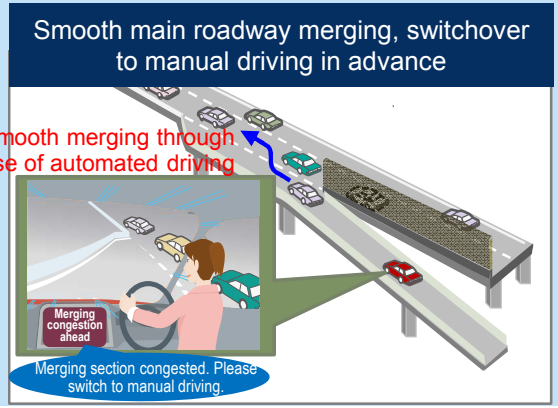
- Unexpected automated driving disengagement in merging sections
- Sudden braking in merging sections



Information provided by roadside infrastructure

Autonomous vehicle user

- Smooth merging through use of automated driving
- Switching to manual operation well in advance of merging sections (when merging through use of automated driving is not feasible)



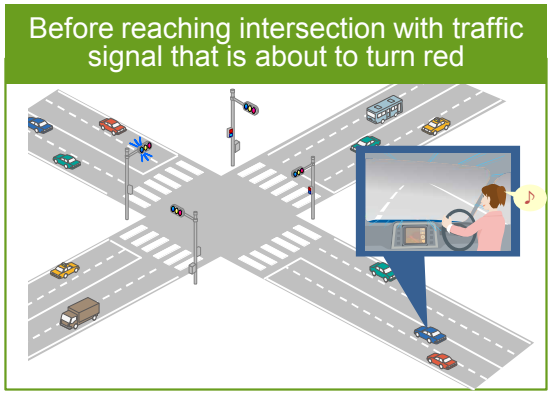
Overall road transport

- Reduction in number of traffic accidents
  - ✓ Reduction in number of collisions, etc., with inflow vehicles
- Smoothing of flow of traffic in merging sections

2. Expected benefits of main contents

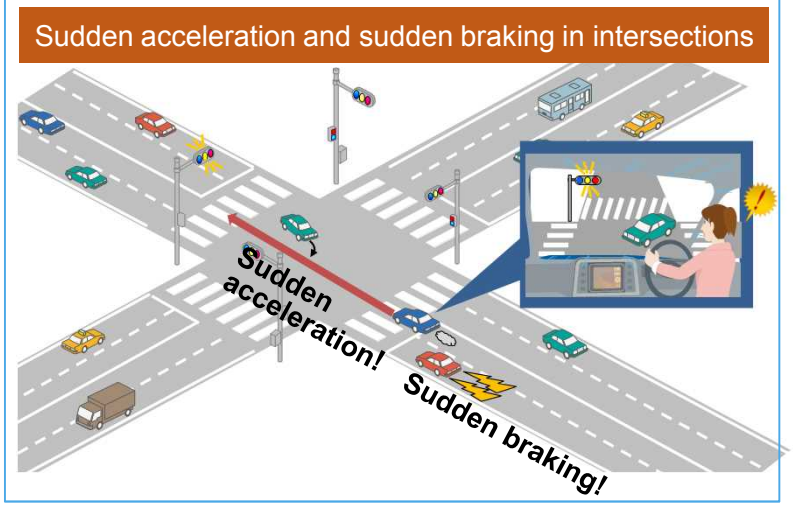
Ⅳ. Traffic signal information

- Roadside infrastructure can provide information about traffic signals, making it possible to assess the timing of traffic signal changes. This reduces the amount of sudden acceleration and braking in intersections, contributing to safer and smoother driving.



Information not provided by roadside infrastructure

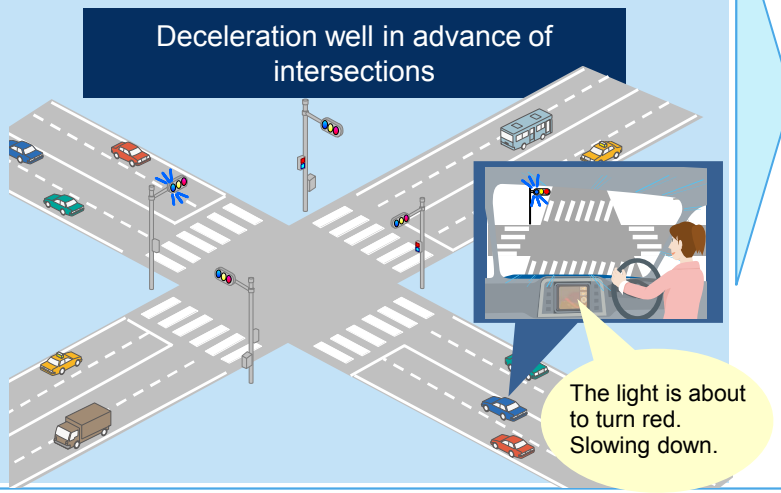
- Sudden acceleration and sudden braking at yellow traffic signals, etc.
- Collisions when making right turns, etc.



Information provided by roadside infrastructure

Autonomous vehicle user

- Reductions in amount of sudden acceleration and sudden braking in intersections
- Greater leeway in passing through intersections



Overall road transport

- Reduction in number of traffic accidents in intersections
  - ✓ Reduction in number of collisions when making right turns, etc.
- Smoothing of flow of traffic near intersections

2) Exchange of information with other parties in Japan involved in field operational testing of the provision of lane-specific restriction information

	Date	Agenda
1st meeting	September 13, 2018	(1) Overview of results of previous year and items to be implemented this year (2) Overview of the SIP 2020 Tokyo Waterfront City Area Field Operational Test (3) Report on the status of preparation for the testing of lane-specific restriction information
2nd meeting	November 30, 2018	(1) Domestic and international lane-specific traffic information measures (2) Evaluation of Dynamic Map Large-scale Field Operational Test lane-specific road traffic information (3) Use cases for lane-specific traffic information, etc. (4) Benefits of use of lane-specific traffic information, etc.
3rd meeting	January 18, 2019	(1) Results of Dynamic Map Large-scale Field Operational Test (2) Draft overview of this year's results