![SIP logo] Cross-ministerial **S**trategic **I**nnovation Promotion **P**rogram

Cross-ministerial Strategic Innovation Promotion Program (SIP) Phase 2
- Automated Driving (Expansion of Systems and Services)/
Study of Overseas Trends, etc., in Preparation for International Collaboration
Regarding Roadway Traffic Environmental Data

FY2020 Report

Overview

Mitsubishi Research Institute, Inc.

March 2021

Background and objectives

Background

The Cross-ministerial Strategic Innovation Promotion Program (SIP) Phase Two - Automated Driving (Expansion of Systems and Services) being conducted by the Cabinet Office is working to create systems for exploiting roadway traffic environmental data, such as dynamic information in dynamic maps, with the aim of practically implementing advanced automated driving and achieving Society5.0. In order to promote international standardization related to roadway traffic environmental data, it is essential to consider project strategies that are harmonized with global efforts through coordination with overseas organizations (such as the Open AutoDrive Forum (OADF)) that promote the industry standardization of high-accuracy 3D map information and roadway traffic environmental data.

Objectives

This study investigated domestic and overseas standardization trends related to roadway traffic environmental data, ways to share information with related parties in Japan, and international standardization strategies, with the objective of harmonizing the results of measures related to the creation of systems for exploiting SIP Phase 2 automated driving roadway traffic environmental data with overseas standards organizations and reflecting them appropriately in international standards.

Study items and results

This study was performed and completed over the course of two years, 2019 and 2020. It consisted of the following study items.

Table Study items and progress

Item	Objectives	Results
1. Study and analysis of domestic and foreign roadway traffic environmental data services, standards, etc.	Our objectives were to **collect basic information to be used in the deliberation of approaches to take in roadway traffic environmental data international standardization strategies** in Japan, to collect information regarding the state of handling of roadway traffic environmental data, both inside Japan and overseas, and trends in the formulation of standards, both de facto and de jure, and then to analyze and organize the contents of standards, etc.	• We organized information regarding the state of formulation of standards, etc., related to roadway traffic environmental data inside Japan and abroad. • In addition to a review of the literature, we conducted interviews regarding key study items and engaged in deeper information gathering and organization • We reported the contents of the above in Roadway Traffic Environmental Data Standardization Strategy Deliberation Council meetings
2. Operation of council for deliberation on the formulation of international standardization strategies for traffic environmental data in Japan and organization and summarization of council meeting results	Establish a Roadway Traffic Environmental Data Standardization Strategy Deliberation Council with the aims of **sharing information regarding foreign and domestic roadway traffic environmental data standardization trends with related parties in Japan and debating, coordinating, and collaborating regarding the direction of roadway traffic environmental data international standardization strategies in Japan.**	• We established a Roadway Traffic Environmental Data Standardization Strategy Deliberation Council, shared information with related parties, and engaged in discussions regarding the need for standardization for individual themes. • We promoted consensus between Japanese parties involved with international standardization strategies for roadway traffic environmental data in Japan. ✓ Information sharing regarding domestic and overseas standardization trends ✓ Proposal of approach for international standardization strategies ✓ Organization and summarization of deliberation results

1. Study and analysis of domestic and foreign roadway traffic environmental data services, standards, etc.

1-1. Overview of study

Our objective was to **collect basic information to be used in the deliberation of approaches to take in roadway traffic environmental data international standardization strategies** in Japan. We collected information regarding the state of handling of roadway traffic environmental data, both inside Japan and overseas, and trends in the formulation of standards, both de facto and de jure. We then analyzed and organized the contents of standards, etc.

[Implementation contents]

(1) Information collection and organization

- We identified standards concerning information necessary for vehicle driving (information regarding other vehicles, pedestrian information, information regarding traffic signals, traffic congestion information, traffic restriction information, information regarding fallen objects and obstacles, weather information, parking area information, etc.) through a review of the literature based on publicly disclosed information, for use in roadway traffic environmental data-related standards.

  * We placed greater emphasis on roadway traffic environmental data itself and methods for using it, and excluded from the study scope standards regarding the methods used to transmit it.

- We organized the roadway traffic environmental data-related standards that we discovered in the form of lists and individual sheets containing the names of standards, scope of standards/roadway traffic environmental data targeted by the standards, the organizations that formulated them and the levels of the standards (international standards, regional standards, industry standards).

1-1. Overview of study

[Implementation contents]

（2） Analysis related to standardization trends, etc.

- Based on the lists and individual sheets prepared in (1), we organized and summarized the scopes of existing standards and the contents of those standards, using diagrams and tables, to be used as basic materials when deliberating the formulation of roadway traffic environmental data international standardization strategies in Japan.

- Our study confirmed that existing standards contained standards that apply to the delivery of roadway traffic environmental data for traffic information (traveler information), traffic signal information, cooperative ITS, etc.
  With regard to the expressive accuracy of information (e.g.: provision of lane-level information), there were standards that were still being considered or which left room for further consideration, so we will continue to assess trends in the states of standardization measures by related organizations.

1-2. Information collection and organization: Identification of roadway traffic environmental data-related standards [1/4]

No.	Formulating body	Number	Name	Region
1	ISO/TC204WG8	22951	Data dictionary and message sets for preemption and prioritization signal systems for emergency and public transport vehicles (PRESTO)	Global
2	ISO/TC204WG9	14827-1	Transport information and control systems -- Data interfaces between centres for transport information and control systems -- Part 1: Message definition requirements	Global
3	ISO/TC204WG9	14827-2	Transport information and control systems -- Data interfaces between centres for transport information and control systems -- Part 2: DATEX-ASN	Global
4	ISO/TC204WG9	14827-3	Transport information and control systems -- Data interfaces between centres for transport information and control systems -- Part 3: Data interfaces between centres for intelligent transport systems (ITS) using XML (Profile A)	Global
5	ISO/TC204WG9	15784-1	Intelligent transport systems (ITS) -- Data exchange involving roadside modules communication -- Part 1: General principles and documentation framework of application profiles	Global
6	ISO/TC204WG9	15784-2	Intelligent transport systems (ITS) -- Data exchange involving roadside modules communication -- Part 2: Centre to field device communications using SNMP	Global
7	ISO/TC204WG9	15784-3	Intelligent transport systems (ITS) -- Data exchange involving roadside modules communication -- Part 3: Application profile-data exchange (AP-DATEX)	Global
8	ISO/TC204WG9	10711	Intelligent Transport Systems -- Interface Protocol and Message Set Definition between Traffic Signal Controllers and Detectors	Global
9	ISO/TC204WG9	19082	Intelligent transport systems -- Definition of data elements and data frames between roadside modules and signal controllers for cooperative signal control	Global
10	ISO/TC204WG10	14819-2	Intelligent transport systems -- Traffic and travel information messages via traffic message coding -- Part 2: Event and information codes for Radio Data System -- Traffic Message Channel (RDS-TMC) using ALERT-C	Global
11	ISO/TC204WG10	18234-5	Traffic and Travel Information (TTI) -- TTI via Transport Protocol Expert Group (TPEG) data-streams -- Part 5: Public Transport Information (PTI) application	Global
12	ISO/TC204WG10	18234-7	Intelligent transport systems -- Traffic and travel information via transport protocol experts group, generation 1 (TPEG1) binary data format -- Part 7: Parking information (TPEG1-PKI)	Global

No.	Formulating body	Number	Name	Region
13	ISO/TC204WG10	18234-8	Intelligent transport systems -- Traffic and travel information via transport protocol experts group, generation 1 (TPEG1) binary data format -- Part 8: Congestion and Travel Time application (TPEG1-CTT)	Global
14	ISO/TC204WG10	18234-9	Intelligent transport systems -- Traffic and travel information via transport protocol experts group, generation 1 (TPEG1) binary data format -- Part 9: Traffic event compact (TPEG1-TEC)	Global
15	ISO/TC204WG10	24530-3	Traffic and Travel Information (TTI) -- TTI via Transport Protocol Experts Group (TPEG) Extensible Markup Language (XML) -- Part 3: tpeg-rtmML	Global
16	ISO/TC204WG10	24530-4	Traffic and Travel Information (TTI) -- TTI via Transport Protocol Experts Group (TPEG) Extensible Markup Language (XML) -- Part 4: tpeg-ptiML	Global
17	ISO/TC204WG10	21219-14	Intelligent transport systems -- Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 14: Parking information application (TPEG2-PKI)	Global
18	ISO/TC204WG10	21219-15	Intelligent transport systems -- Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 15: Traffic event compact (TPEG2-TEC)	Global
19	ISO/TC204WG10	21219-16	Intelligent transport systems -- Traffic and travel information via transport protocol exports group, generation 2 (TPEG2) -- Part 16: Fuel price information and availability (TPEG2-FPI)	Global
20	ISO/TC204WG10	21219-18	Intelligent transport systems - Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 18: Traffic flow and prediction application (TPEG2-TFP)	Global
21	ISO/TC204WG10	21219-19	Intelligent transport systems -- Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 19: Weather information (TPEG2-WEA)	Global
22	ISO/TC204WG10	21219-25	Intelligent transport systems -- Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 25: Electromobility charging infrastructure (TPEG2-EMI)	Global
23	ISO/TC204WG14	20035	Intelligent transport systems — Cooperative adaptive cruise control systems (CACC) — Performance requirements and test procedures	Global
24	ISO/TC204WG14	26684	Intelligent transport systems (ITS) — Cooperative intersection signal information and violation warning systems (CIWS) — Performance requirements and test procedures	Global
25	ISO/TC204WG14	20901	Intelligent transport systems -- Emergency electronic brake light systems (EEBL) -- Performance requirements and test procedures	Global

1-2. Information collection and organization: Identification of roadway traffic environmental data-related standards [3/4]

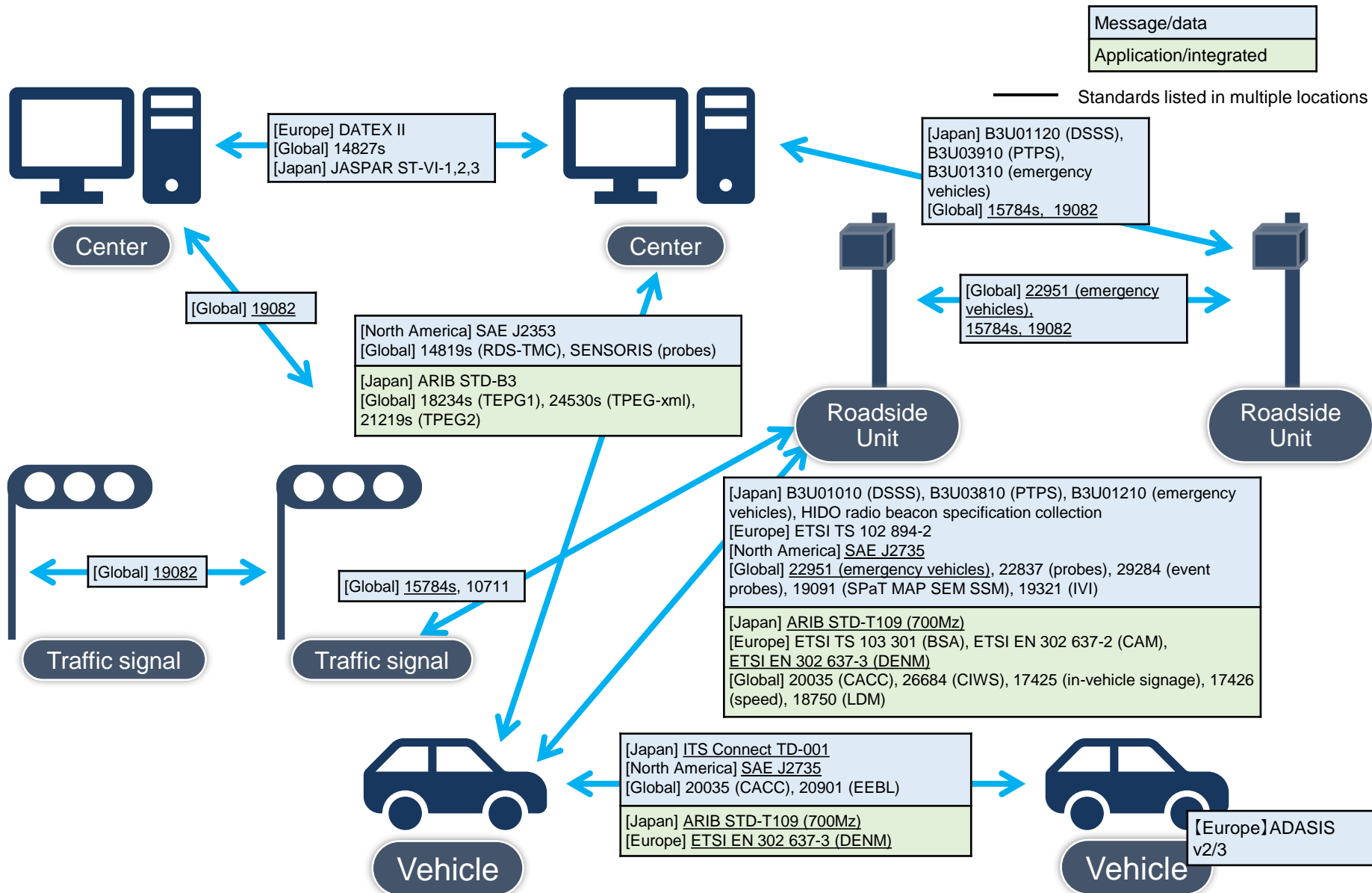| No.	Formulating body	Number	Name	Region
26	ISO/TC204WG16	22837	Vehicle probe data for wide area communications	Global
27	ISO/TC204WG16	29284	Intelligent transport systems -- Event-based probe vehicle data	Global
28	ISO/TC204WG18	19091	Intelligent transport systems -- Cooperative ITS -- Using V2I and I2V communications for applications related to signalized intersections	Global
29	ISO/TC204WG18	19321	Intelligent transport systems -- Cooperative ITS -- Dictionary of in-vehicle information (IVI) data structures	Global
30	ISO/TC204WG18	17425	Intelligent transport systems -- Cooperative systems -- Data exchange specification for in-vehicle presentation of external road and traffic related data	Global
31	ISO/TC204WG18	17426	Intelligent transport systems -- Cooperative systems -- Contextual speeds	Global
32	ISO/TC204WG18	18750	Intelligent transport systems -- Co-operative ITS -- Local dynamic map	Global
33	CEN/TC278	16157-1	Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 1: Context and framework	Europe
34	CEN/TC278	16157-2	Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 2: Location referencing	Europe
35	CEN/TC278	16157-3	Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 3: Situation Publication	Europe
36	CEN/TC278	16157-4	Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 4: Variable Message Sign (VMS) Publications	Europe
37	CEN/TC278	16157-5	Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 5: Measured and elaborated data publications	Europe
38	CEN/TC278	16157-6	Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 6: Parking Publications	Europe
39	CEN/TC278	16157-7	Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 7: Common data elements	Europe
40	ETSI	TS 103 301 V1.1.1(2016-11)	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Facilities layer protocols and communication requirements for infrastructure services	Europe

No.	Formulating body	Number	Name	Region
41	ETSI	ETSI EN 302 637-2 V1.4.0 (2018-08)	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 2: Specification of Cooperative Awareness Basic Service	Europe
42	ETSI	ETSI EN 302 637-3 V1.3.0 (2018-08)	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 3: Specifications of Decentralized Environmental Notification Basic Service	Europe
43	ETSI	ETSI TS 102 894-2 V1.3.1 (2018-08)	Intelligent Transport Systems (ITS); Users and applications requirements; Part 2: Applications and facilities layer common data dictionary	Europe
46	SENSORIS	-	Vehicle Sensor Data Cloud Ingestion Interface Specification (v2.0.2)	Industry (Europe)
44	SAE	J2735	Dedicated Short Range Communications (DSRC) Message Set Dictionary™	North America
45	SAE	J2353	Data Dictionary for Advanced Traveler Information Systems (Atis)	North America
47	UTMS Society	B3U01010	ITS Wireless Roadside Device DSSS Road-to-Vehicle Communication Application Standard	Japan
48	UTMS Society	B3U01120	ITS Wireless Roadside Device DSSS DATEX-ASN Message Standard	Japan
49	UTMS Society	B3U03810	ITS Wireless Roadside Device PTPS Road-to-Vehicle Communication Application Standard	Japan
50	UTMS Society	B3U03910	ITS Wireless Roadside Device PTPS DATEX-ASN Message Standard	Japan
51	UTMS Society	B3U01210	ITS Wireless Roadside Device Emergency Vehicle Approach Information Relay Road-to-Vehicle Communication Application Standard	Japan
52	UTMS Society	B3U01310	ITS Wireless Roadside Device Emergency Vehicle Approach Information Relay DATEX-ASN Message Standard	Japan
53	Association of Radio Industries and Businesses	ARIB STD-B3	ARIB Standard for Operation of the FM Multiplex Broadcasting System	Japan
54	Association of Radio Industries and Businesses	ARIB STD-T109	700 MHz Band Intelligent Transport Systems	Japan
55	ITS Info-communications Forum	ITSFORUM RC-013 1.0	700MHz BAND INTELLIGENT TRANSPORT SYSTEMS - Experimental Guideline for Vehicle-to-Vehicle Communication Messages ITSFORUM RC-013 1.0	Japan
56	JASPAR	ST-VI-1	Dynamic Vehicle Information Sharing API Specifications Ver.1.0	Japan
57	JASPAR	ST-VI-2	Dynamic Vehicle Information Sharing Concept Specifications Ver.1.0	Japan
58	JASPAR	ST-VI-3	Common Vehicle Information and Data Set SpecificationsVer.1.0	Japan

1-2. Information collection and organization:
Identification of roadway traffic environmental data-related standards [4/4]

No.	Formulating body	Number	Name	Region
41	ETSI	ETSI EN 302 637-2 V1.4.0 (2018-08)	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 2: Specification of Cooperative Awareness Basic Service	Europe
42	ETSI	ETSI EN 302 637-3 V1.3.0 (2018-08)	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 3: Specifications of Decentralized Environmental Notification Basic Service	Europe
43	ETSI	ETSI TS 102 894-2 V1.3.1 (2018-08)	Intelligent Transport Systems (ITS); Users and applications requirements; Part 2: Applications and facilities layer common data dictionary	Europe
46	SENSORIS	-	Vehicle Sensor Data Cloud Ingestion Interface Specification (v2.0.2)	Industry (Europe)
44	SAE	J2735	Dedicated Short Range Communications (DSRC) Message Set Dictionary™	North America
45	SAE	J2353	Data Dictionary for Advanced Traveler Information Systems (Atis)	North America
47	UTMS Society	B3U01010	ITS Wireless Roadside Device DSSS Road-to-Vehicle Communication Application Standard	Japan
48	UTMS Society	B3U01120	ITS Wireless Roadside Device DSSS DATEX-ASN Message Standard	Japan
49	UTMS Society	B3U03810	ITS Wireless Roadside Device PTPS Road-to-Vehicle Communication Application Standard	Japan
50	UTMS Society	B3U03910	ITS Wireless Roadside Device PTPS DATEX-ASN Message Standard	Japan
51	UTMS Society	B3U01210	ITS Wireless Roadside Device Emergency Vehicle Approach Information Relay Road-to-Vehicle Communication Application Standard	Japan
52	UTMS Society	B3U01310	ITS Wireless Roadside Device Emergency Vehicle Approach Information Relay DATEX-ASN Message Standard	Japan
53	Association of Radio Industries and Businesses	ARIB STD-B3	ARIB Standard for Operation of the FM Multiplex Broadcasting System	Japan
54	Association of Radio Industries and Businesses	ARIB STD-T109	700 MHz Band Intelligent Transport Systems	Japan
55	ITS Info-communications Forum	ITSFORUM RC-013 1.0	700MHz BAND INTELLIGENT TRANSPORT SYSTEMS - Experimental Guideline for Vehicle-to-Vehicle Communication Messages ITSFORUM RC-013 1.0	Japan
56	JASPAR	ST-VI-1	Dynamic Vehicle Information Sharing API Specifications Ver.1.0	Japan
57	JASPAR	ST-VI-2	Dynamic Vehicle Information Sharing Concept Specifications Ver.1.0	Japan
58	JASPAR	ST-VI-3	Common Vehicle Information and Data Set SpecificationsVer.1.0	Japan

Message/data

Application/integrated

———— Standards listed in multiple locations

Center

Center

Roadside Unit

Roadside Unit

Traffic signal

Traffic signal

Vehicle

Vehicle

[Europe] DATEX II
[Global] 14827s
[Japan] JASPAR ST-VI-1,2,3

[Japan] B3U01120 (DSSS),
B3U03910 (PTPS),
B3U01310 (emergency vehicles)
[Global] 15784s, 19082

[Global] 19082

[Global] 22951 (emergency vehicles),
15784s, 19082

[North America] SAE J2353
[Global] 14819s (RDS-TMC), SENSORIS (probes)

[Japan] ARIB STD-B3
[Global] 18234s (TEPG1), 24530s (TPEG-xml),
21219s (TPEG2)

[Japan] B3U01010 (DSSS), B3U03810 (PTPS), B3U01210 (emergency vehicles), HIDO radio beacon specification collection
[Europe] ETSI TS 102 894-2
[North America] SAE J2735
[Global] 22951 (emergency vehicles), 22837 (probes), 29284 (event probes), 19091 (SPaT MAP SEM SSM), 19321 (IVI)

[Japan] ARIB STD-T109 (700Mz)
[Europe] ETSI TS 103 301 (BSA), ETSI EN 302 637-2 (CAM),
ETSI EN 302 637-3 (DENM)
[Global] 20035 (CACC), 26684 (CIWS), 17425 (in-vehicle signage), 17426 (speed), 18750 (LDM)

[Global] 19082

[Global] 15784s, 10711

[Japan] ITS Connect TD-001
[North America] SAE J2735
[Global] 20035 (CACC), 20901 (EEBL)

[Japan] ARIB STD-T109 (700Mz)
[Europe] ETSI EN 302 637-3 (DENM)

【Europe】ADASIS v2/3

1-3. Analysis related to standardization trends, etc.: Relationships between roadway traffic environmental data-related standards

- "Message/data" indicates standards that apply to message and/or data items, formats, data sets, and/or message sets.
- "Application/integrated" indicates standards that apply to services that use messages/data, standards that apply to methods of using messages/data, and standards that collectively apply to both messages/data and applications.
- <u>Underlined standards</u> are standards covering multiple areas (such as center-infrastructure and infrastructure-infrastructure, etc.).

Scope	Japan		Europe		North America		Global * Numbers are listed alone for ISO standards * Series standards are denoted by an "s" following the number	
	Message/data	Application/integrated	Message/data	Application/integrated	Message/data	Application/integrated	Message/data	Application/integrated
Center-center	• ST-VI-1,2,3		• DATEX II				• 14827s	
Center-traffic signal							• <u>19082</u>	
Center-roadside unit	• B3U01120 • B3U03910 • B3U01310						• <u>15784s</u> • <u>19082</u>	
Center-vehicle		• ARIB STD-B3			• SAE J2353		• 14819s • SENSORIS	• 18234s • 24530s • 21219s
Traffic signal-traffic signal							• <u>19082</u>	
Traffic signal-roadside unit							• <u>15784s</u> • 10711	
Roadside unit-roadside unit							• <u>22951</u> • <u>15784s</u> • <u>19082</u>	
Roadside unit-vehicle	• B3U01010 • B3U03810 • B3U01210 • Radio beacon 5.8GHz specification collection	• <u>ARIB STD-T109</u>	• ETSI TS 102 894-2	• ETSI TS 103 301 • ETSI EN 302 637-2 • ETSI EN 302 637-3	• <u>SAE J2735</u>		• <u>22951</u> • 22837 • 29284 • 19091 • 19321 • 25114	• 20035 • 26684 • <u>20901</u> • 17425 • 17426 • 18750
Vehicle-vehicle	• ITS Connect TD-001	• <u>ARIB STD-T109</u>			• <u>SAE J2735</u>			• <u>20035</u> • <u>20901</u>

(3) Deeper study of standardization trends (interviews)

- Various parties around the world, including members of the automobile industry, are developing technologies aimed at the realization of automated driving. This includes the implementation of measures aimed at achieving standardization in collaborative areas.

- However, with respect to the dividing line between collaborative areas and competitive areas, there are differences between Japan and other countries, due to factors such as differences in their industrial structure. Because of this, while standardization measures have been making progress overseas, in Japan there have been cases of each company working independently due to viewing certain areas as competitive areas.

- One example of this is roadway traffic environmental data interface specifications. In Europe, a roadway traffic environmental data interface specification named ADASIS has been developed.

- Interviews were conducted with related parties from Europe to organize information regarding the contents of the process of formulating the ADASIS specification for roadway traffic environmental data interfaces and the contents of the specification itself, as well as to gather information regarding the state of ADASIS usage by OEMs and suppliers.

- These study results provided suggestions regarding the scope of standardization that should be applied in Japan.

1. Envisioned interviewees

- Interviews were envisioned as being conducted with European manufacturers, suppliers, etc.: As of present, TomTom has cooperated in our interviews.

2. Interview contents
1) Interviews and opinion sharing regarding ADASIS Ver3
- Opinions regarding Ver3
- Issues which interviewees believe require future consideration by ADASIS
2) Interviews and opinion sharing regarding the state of ADASIS usage in Europe
- ADASIS usage trends (ADAS applications/automated driving)
- (with regard to the above services) Types of information being distributed (dynamic, semi-dynamic, etc.), expectations for ADASIS, advantages of using ADASIS
- Issues which interviewees believe require future consideration by ADASIS
  - Issues and restrictions that apply when applying ADASIS to automated driving, in particular

(3) Deeper study of standardization trends (interviews)

TomTom interview participants	System architecture staff member (TomTom ADASIS Forum member) Product marketing manager for ADAS and ADSIS-related products Software architecture staff member, automated driving-related business development staff member
Interview contents	**Responses**
The status of adoption of ADASIS and TomTom's position in the ADASIS Forum	• TomTom provided support for both ADASIS V2 and ADASIS V3. • In particular, it is developing products that support ADASIS V3.1, and is considering supporting ADASIS V3.2 as well. • The timing of the launch of products that use V3.1 has not yet been clearly defined, but use cases on inter-city roads are envisioned for next year. • FOTs are also been performed using ADASIS V3, and testing is being performed using Elektrobit's robinos Predictor • TomTom has a neutral position with respect to ADASIS standardization activities. It is participating in the ADASIS Forum in order to produce better support for map products. In particular, ADSIS V3 assists the engineers of multimodal applications.
Differences between ADAIS V2 and V3	• ADASIS V2 was developed for CAN, but the V3 standard is not network-dependent. It has therefore been formulated as a standard that corresponds to the OSI 6/7 layer model. • ADASIS V3 is expandable, so it can support multiple providers. It is envisioned as being used for integration with various types of data, such as sensor data.
ADASIS and automated driving	• The next version of ADASIS will require a greater level of localization refinement.。 ADASIS V3.2 supports own location identification, seamless integration with map data, and GPS location accuracy. • Consideration is being given to the future development of ADASIS for level 4 and 5 automated driving, which involves no human intervention, but the details have not yet been released.

(3) Deeper study of standardization trends (interviews)

- As follow-up to the interviews with TomTom, a white paper published by TomTom/Elektrobit was reviewed.

- ADASIS V2 is an optimized and simplified version of the first version of ADASIS. Since 2011, ADASIS V2 has been implemented in various systems and ECUs, targeted at advanced driver assistance applications including ADAS (Advanced driver assistance systems). The first version of the specifications was developed in 2007, and the optimized and simplified second version was released in 2011. ADASIS V2 is still being produced, and it is widely used in Western ADAS and automated driving.
- ADASIS V3 was released in 2018. V3 is aimed at high end ADAS and supports level 2 and level 3 automated driving. The features of V2 and V3 are indicated below. V3 supports automated driving, so it also supports lane-level content.

	ADASIS V2	ADASIS V3
Objectives	Standardization with ADAS Map, including road-level data, for use in ADAS	High-accuracy maps including lane-level data for use in automated driving
Envisioned vehicle-side network	CAN bus	Broadband connection (Ethernet, TCP/IP)
Communication schema	Broadcast: 1 provider to n clients	Two-way communication (supports the following): • Broadcasting for most probably path • P2P for additional attribute information • Multiple sub-providers
Attribute accuracy	Meter level	Centimeter level
Content	Profiles of link level standard map attributes Traffic data	Profiles of lane-level map attributes Extended road/lane models, detailed intersection models Road borders, facilities, landmarks

Source: Tentative translation of "Extending the vision of automated vehicles with HD Maps and ADASIS" (TomTom/Elektrobit) by Mitsubishi Research Institute

2. Operation of council for deliberation on the formulation of international standardization strategies for roadway traffic environmental data in Japan and organization and summarization of council meeting results

2. Operation of council for deliberation on the formulation of international standardization strategies for traffic environmental data in Japan and organization and summarization of council meeting results

We established a Roadway Traffic Environmental Data Standardization Strategy Deliberation Council with the aims of **sharing information regarding foreign and domestic roadway traffic environmental data standardization trends with related parties in Japan and debating, coordinating, and collaborating regarding the direction of roadway traffic environmental data international standardization strategies in Japan**.

[Implementation contents]

(1) Establishment of a deliberation council

- In order to promote discussions regarding the direction of international standardization strategies for roadway traffic environmental data in Japan, a deliberation council was created, composed of SIP participants, the Japan Automobile Manufacturers Association, ISO/TC204 experts, and map makers.

- This deliberation council selected several topics related to roadway traffic environmental data being focused on in SIP Phase 2, shared information regarding the state of deliberations regarding each topic in Japan and abroad, and engaged in discussions regarding the direction to be used in standardization.

(2) Topics discussed by the deliberation council

- The deliberation council shared information regarding the state of formulation of standards regarding the following items, the state of technical development by SIP, and standardization strategies.
  - (1) Traffic signal information
  - (2) Roadway traffic environmental data interfaces
  - (3) Location referencing points (CRPs) used in high-accuracy 3D maps
  - (4) Merging support/maneuvering coordination
  - (5) Operational Design Domain (ODD)

2. Operation of council for deliberation on the formulation of international standardization strategies for traffic environmental data in Japan and organization and summarization of council meeting results

(3) Direction of traffic environmental data standardization strategies

- The deliberation council shared information regarding the status of deliberations in Japan and overseas on five traffic environmental data topics, and then based on this discussed the approach to take towards standardization in anticipation of the future practical implementation of automated driving.

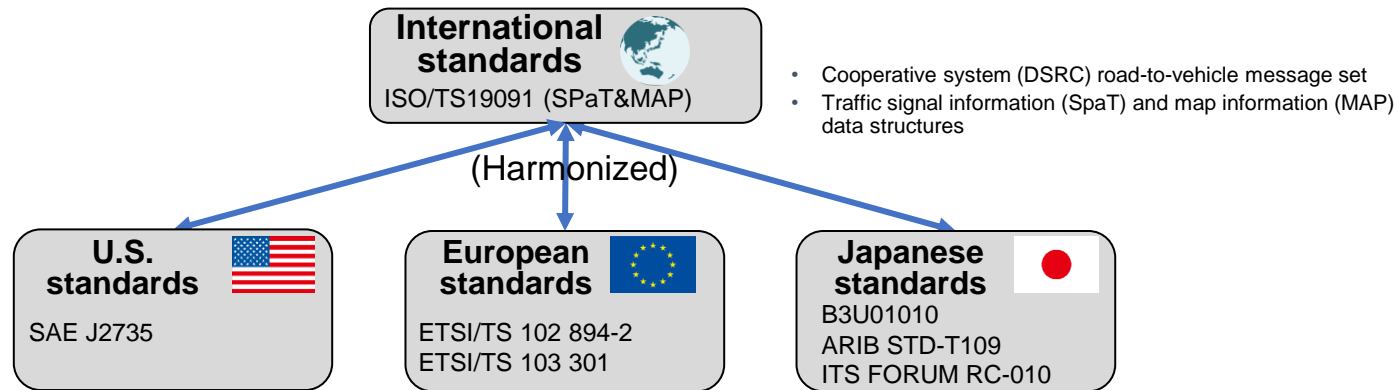|	Deliberation status	Discussion details	Future direction
Traffic signal information	• In March 2017, TS*19091 was issued by ISO/TC204/WG18 as a standard regarding the exchanging of traffic signal information. *TS: Technical Specification	• TS19091 defines various aspects of message sets exchanged between roadside equipment and vehicles in cooperative systems. It defines the data structures of traffic signal information (SpaT) and map information (MAP). • Japanese and Western specifications were used as input when developing the TS, and the TS was designed to match the specifications in Japan's DSSS and ITS Connect.	• **<u>A close eye will be kept on related trends for the time being</u>** Traffic signal information could be distributed to autonomous vehicles in compliance with TS19091, <u>so at present there is no need to develop a new standard.</u>
Roadway traffic environmental data interfaces	• The ADASIS V3 standard was developed with automated driving in mind (it supports high capacity communications, includes lane-level map attributes, etc.), and is designed with the leeway for development to be conducted in line with the conditions in individual companies.	• There is no suitable de jure standard, so this may become the de facto standard. We are considering coordinating with the Waterfront City FOT team, analyzing current issues, etc., and proposing this for use as the standard in Japan.	• **<u>We will continue to discuss and deliberate on the standardization approach</u>** We will conduct additional interviews with related European parties, etc., and collect information about local trends. Based on this, we will continue to discuss how to proceed with standardization.

2. Operation of council for deliberation on the formulation of international standardization strategies for traffic environmental data in Japan and organization and summarization of council meeting results

	Deliberation status	Discussion details	Future direction
Location referencing points (CRPs) used in high-accuracy 3D maps	• The method used to express locations with a high degree of accuracy based on reference points has been globally standardized by ISO17572-4.	• A promising proposal has been made to add CRP placement methods and expression methods as a Japanese case example to the Annex (informative) of ISO17572-4 (Precise relative location references).	• **A close eye will be kept on related trends for the time being and deliberations will continue** Some have expressed the opinion that it is too early to propose an international standard given that conditions within the country are still in flux. This issue will be handled based on future discussions in Japan.
Merging support/maneuvering coordination	• In the West, deliberation is underway regarding the use of Maneuver Coordination Messages (MCMs) for coordinating maneuvers, and environmental preparations, such as evaluations of communications capabilities, are underway. • In Japan, FOTs are being conducted ahead of other countries, especially with regard to merging support using ETC2.0, and know-how is being accumulated.	• The future roadmap for merging support is being deliberated and technical requirements are being summarized. During the course of these activities, discussions are underway regarding which items should be standardized. • With regard to the use of V2X in vehicle control and driving planning, the borders between competitive and collaborative areas have yet to be clearly defined, so it is still too early for standardization. ISO deliberations are also at a standstill.	• **A close eye will be kept on related trends for the time being** Standardization efforts will be carried out as appropriate when collaborative areas have been clarified to some degree. This standardization will take the state of technology development and commercialization into consideration.
Operational Design Domain (ODD)	• Although proposals have begun in Europe within ISO, etc., there have been no clear moves towards standardization. • Within Japan, a patterned reference model was announced in late 2019.	• There have been difficulties in comprehensively organizing the levels of expression used in ODD (such as what degrees of granularity should be used in indexing), so unified deliberations have made little ground.	• **A close eye will be kept on related trends for the time being and deliberations will continue** A close eye will be kept on related trends and the scope of deliberations will continue to be considered. This will include discussions regarding prioritized standardization beginning with ODD-related data items which it is highly likely that public agencies will provide.

[Ref] Supplementary materials regarding individual themes

(1) Discuss traffic signal information standardization strategies

■ **Status of standardization in Japan and abroad**

International standards
ISO/TS19091 (SPaT&MAP)

- Cooperative system (DSRC) road-to-vehicle message set
- Traffic signal information (SpaT) and map information (MAP) data structures

(Harmonized)

U.S. standards
SAE J2735

European standards
ETSI/TS 102 894-2
ETSI/TS 103 301

Japanese standards
B3U01010
ARIB STD-T109
ITS FORUM RC-010

■ **Overview of discussions regarding the need for future standardization**

- In March 2017, TS[*]19091 was issued by ISO/TC204/WG18 as a standard regarding the exchanging of traffic signal information.   *TS: Technical Specification

- TS19091 defines various aspects of messages exchanged between roadside equipment and vehicles in cooperative systems. It defines the data structures of traffic signal information (SpaT) and map information (MAP). Japanese and Western specifications were used as input when developing the TS, and the TS was designed to match the specifications in Japan's DSSS and ITS Connect.

- Traffic signal information could be distributed to autonomous vehicles in compliance with TS19091 (at present there is no need to develop a new standard).

(2) Discussions regarding standardization strategies for traffic environmental data interfaces

■ **<u>Status of standardization in Japan and abroad</u>**

- In Europe, Version 2 of ADASIS was released in 2011 as specifications for ADAS and Version 3 was released in 2018 for automated driving.
- V3 was designed with an eye towards the handling of data in automated driving. It supports broadband connectivity and lane-level map attribute expressions.
- Some European navigation system manufacturers and other companies are developing products based on ADASIS specifications and have plans for their commercial release.

■ **<u>Overview of discussions regarding the need for future standardization</u>**

- The ADASIS V3 standard was developed with automated driving in mind (it supports high capacity communications, includes lane-level map attributes, etc.), and is designed with the leeway for development to be conducted in line with the conditions in individual companies.
- There is no suitable de jure standard, so this may become the de facto standard. We are considering coordinating with the Waterfront City FOT team, analyzing current issues, etc., and proposing this for use as the standard in Japan.
- There is still room for deliberation regarding future standardization from the following perspectives.
  - ✓ Improvement proposals to ADASIS
  - ✓ How to enable map formats which differ between ADASIS V2 and V3 to coexist
  - ✓ Information prioritization for on-board communication lines, etc.

(3) Discussions regarding CRP standardization

■ <u>Status of standardization in Japan and abroad</u>

- The following two creation methods could be used when creating standardization proposals for ISO/TC204/WG3.However, there would be some scope overlap when proposing them as new work items, making the situation difficult.
- Taking feasibility into consideration, one approach would be to create a draft (materials presenting an overview of the proposal) envisioning adding the CRP placement methods and methods for expressing locations using these CRPs as an Annex to ISO17572-4.

Draft approach for creating standardization proposals	Feasibility (advantages and disadvantages)
(1) Add as planimetric features in conjunction with review/revision of Geographic Data Files (GDFs): [[Standardization of placement methods only]	+ : There have been moves to review/revise GDFs. - : This is a planimetric feature catalog work item and is part of other revisions, so deliberations could be protracted. - : This is a planimetric feature catalog work item, so this approach would only apply to installation methods, and it would be difficult to apply it to expression methods.
(2) Addition to the ISO17572-4 Annex (informative) as a Japanese case example: [[Standardization of placement methods and expression methods]	+ : This is a high-accuracy location referencing method work item. - : IS was just recently issued, so it might be difficult to get other parties to agree to making revisions. - : Annex E1 already contains a case study from Phase 1 of SIP, so there could be questions regarding the need to add this case example.

■ <u>Overview of discussions regarding the need for future standardization</u>

- A good approach to use would be to add CRP placement methods and expression methods as a Japanese case example to the Annex (informative) of ISO17572-4 (Precise relative location references).

- It seems too early to propose an international standard given that conditions within the country are still in flux. There is no reason to rush to propose an international standard.

(4) Discussions regarding the standardization of merging support/maneuver coordination

■ Status of standardization in Japan and abroad

- In Japan, field testing has begun of merging support systems that use roadside sensors and communications devices, and in Europe, as well, deliberation has begun regarding vehicle cooperation (maneuver coordination) using V2X.
- In the West, deliberation is underway regarding the use of Maneuver Coordination Messages (MCMs) for coordinating maneuvers, and environmental preparations, such as evaluations of communications capabilities, are underway. In Japan, FOTs are being conducted ahead of other countries, especially with regard to merging support using ETC2.0, and know-how is being accumulated.

■ Overview of discussions regarding the need for future standardization

- While deliberations are underway regarding merging support and maneuver coordination, the use of V2X for vehicle control is currently being directed by the approaches of individual automobile manufacturers. This falls within the competitive area, so further discussion will be necessary regarding what items to standardize.
  - ✓ For example, should a platform be developed as a collaborative area element through measures such as investigating what kind of network architecture to use for data processing, with an eye towards greater use of these technologies in vehicles and infrastructure, such as performing maneuver coordination involving vehicles from differing manufacturers?
- In order to implement merging support for even more vehicles at even more locations, it is essential to organize which points require further deliberation from the perspective of standardization.

> ■ Examples of aims related to the need for standardization
> - Organization of services (use cases) which use cooperative systems
> - Defining the characteristics of roads in which services can be utilized
> - Roadside sensor installation locations, recognition accuracy, arrival time forecast systems, and other infrastructure-end required specifications
> - Vehicle control and division of roles

(5) Discussions regarding ODD standardization

■ **Status of standardization in Japan and abroad**

- Deliberations are underway by industry groups, research projects, and the like regarding ODD categorization and organization. However, the granularity of the categories and the approaches used (qualitative and quantitative category definitions) vary widely depending on the parties that are defining the ODDs.

- Although proposals have begun in Europe within ISO, etc., there have been no clear moves towards standardization.

Table Differences in levels related to weather conditions

Item		Stipulation (highest level of detail)	Stipulation (lowest level of detail)
Weather conditions	Light	Divided into 10 levels based on illuminance (AVSC) * 107527 Lx * 10.752 Lx * 1075 Lx * 107 Lx * 10.8 Lx * 1.08 Lx * 0.108 Lx * 0.0108 Lx * 0.0011 Lx * 0.0001 Lx	Divided into 3 levels based on time of day (TierIV) * Early morning * Daytime * Nighttime
	Skies	Divided into 5 levels depending on sun visibility (BSI) * Clouds do not block sun, 0-1 okta * Cloud cover is such that direct light from between clouds reaches vehicle, 1-2 okta * Cloud cover is such that direct light from between clouds reaches vehicle, 3-4 okta * Cloud cover is such that direct light from between clouds reaches vehicle, 5-7 okta * Clouds completely block sunlight	Divided into 2 levels depending on weather conditions (MANTRA "Winter maintenance truck") * All weather other than heavy rain and heavy snow

■ **Overview of discussions regarding the need for future standardization**

- In order to achieve even safer and more reliable automated driving, conditions should be delineated with as much detail as possible. Investigations must be performed into the objectives of defining ODDs and the level of definitions to be used.

- Further deliberations are necessary regarding the positioning and objectives of ODDs, including whether to standardize them or simply issue guidelines.