ENGLISH TRANSLATION

Experimental Guideline for 700 MHz Band Intelligent Transport Systems for Autonomous Driving Communication Utilization Use Cases —Support for SIP use cases—

ITS FORUM RC-018 Ver. 1.1

Version 1.0 July 15 2022

Version 1.1 January 17 2023

ITS Info-communications Forum of Japan

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Revision History

Ver.	Date (Y M D)	Chapter/Section	Reason	Revised Content
1.0	July 15, 2022	Establishment	Newly established	
1.1	January 17, 2023	Chapters 4 and 5	Review of Elements	Unification of "Message ID" element length

Introduction

This guideline specifies the specifications and interfaces of the communication functions to realize the use cases of V2I and V2V (hereinafter referred to as "SIP use cases"), which were examined in the research theme of "Evaluation of 700 MHz Band ITS" among the examination of communication methods to realize the use cases of Strategic Innovation Promotion Program (SIP) Phase II, Automated Operation (Extension of Systems and Services), and Cooperative Automated Operation.

It is expected that this guideline will be fully verified in the demonstration experiment for the private use of the 700 MHz Intelligent Transportation System, and that activities for practical use will be further promoted.

The guideline refers to the Study report on communication scenarios and requirements for "SIP Use Cases for Cooperative Driving Automation," ITS Forum RC-017 (hereafter referred to as "RC-017"), and the latest version of the RC-017. In the future, this guideline will need to be reviewed in line with revisions to RC-017.

Contents

Chapter1 General information

1.1 Overview

This guideline defines the specification of the communication functions and an interface for realizing the SIP use case.

1.2 Application scope

This guideline is applied to demonstration experiments that assume SIP use cases of general roads and highways in the 700 MHz Intelligent Transportation System.

A list of SIP use cases is shown in Table 1-1.

"supplement"

- This guideline does not cover V2N. (Corresponds to gray areas in Table 1-1)
- This guideline does not cover a-1-3, a-1-4, a-2, and a-3.

Table 1-1 SIP use case

No.	Large classification	Middle classification	Use case name	Communication type	Target (✓)
1	(1) Use cases where it is necessary to obtain information not detected by in-vehicle sensors	a. Merging/lane change assistance	a-1-1. Merging assistance by preliminary acceleration and deceleration	V2I	✓
2			a-1-2. Merging assistance by targeting the gap on the main lane	V2I	✓
3		b. Traffic signal information	b-1-1. Driving assistance by using traffic signal information (V2I)	V2I	✓
4			b-1-2. Driving assistance by using traffic signal information (V2N)	V2N	–
5		c. Lookahead information: collision avoidance	c-1. Collision avoidance assistance when a vehicle ahead stops or decelerates suddenly	V2V	✓
6			c-2-1. Driving assistance based on intersection information (V2V)	V2V	✓
7			c-2-2. Driving assistance based on intersection information (V2I)	V2I	✓
8			c-3. Collision avoidance assistance by using hazard information	V2V	✓
9		d. Lookahead information: trajectory change	d-1. Driving assistance by notification of abnormal vehicles	V2I, V2N	✓
10			d-2. Driving assistance by notification of wrong-way vehicles	V2I, V2N	✓

11			d-3. Driving assistance based on traffic congestion information	V2I, V2N	✓
12			d-4. Traffic congestion assistance at branches and exits	V2I, V2N	✓
13			d-5. Driving assistance based on hazard information	V2I, V2N	✓
14		e. Lookahead information: emergency vehicle notification	e-1. Driving assistance based on emergency vehicle information	V2V, V2N	✓
15	(2) Use cases that require provision of information held by own vehicle	f. Information collection/distribution by infrastructure	f-1. Request for rescue (e-Call)	V2N	–
16			f-2. Collection of information to optimize the traffic flow	V2I, V2N	✓
17			f-3. Update and automatic generation of maps	V2N	–
18			f-4. Distribution of dynamic map information	V2N	–
19	(3) Use cases that require communication between vehicles and between roads and vehicles	a. Merging/lane change assistance	a-1-3. Cooperative merging assistance with vehicles on the main lane by roadside control	V2I	–
20			a-1-4. Merging assistance based on negotiations between vehicles	V2V	–
21			a-2. Lane change assistance when the traffic is heavy	V2V	–
22			a-3. Entry assistance from non-priority roads to priority roads during traffic congestion	V2V	–
23		g. Platooning/adaptive cruise control	g-1. Unmanned platooning of following vehicles by electronic towbar	V2V	✓
24			g-2. Adaptive cruise control and manned platooning of following vehicles using adaptive cruise control	V2V	✓
25		h. Teleoperation	h-1. Operation and management of mobility service cars	V2N	–

It is assumed that the target system of the guideline is composed of a 700 MHz band ITS radio roadside unit (hereinafter referred to as "roadside unit") and a 700 MHz band ITS radio onboard unit (hereinafter referred to as "onboard unit"), and radio communication is performed with each other. Various information are transmitted directly from the an onboard unit to another onboard unit, i.e., by V2V, or transmitted via a roadside unit, i.e., by V2I. There may also be transmissions in the opposite direction.

Figure 1-1 shows the scope of application of this guideline.

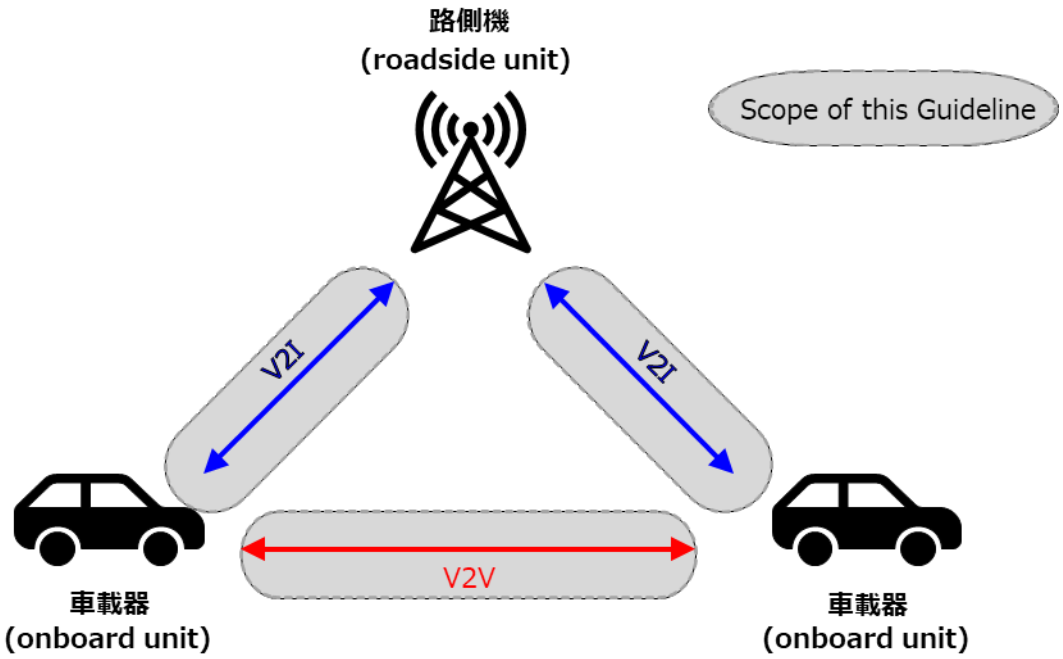


Figure 1-1 Target system and scope of application of this guideline

1.3 Notes

The following are precautions for conducting demonstration tests.

- Use of a roadside unit licensed by the experimental test station.
- Use of a onboard unit that has been certified to conform to technical standards.
- Confirm that existing services will not be affected in advance and during demonstration experiments.
- When using security information, consult ITS Connect Promotion Consortium.
- When roadside units are installed on public roads, if the prefectural police having jurisdiction over the area have roadside units installed nearby, it may be necessary to adjust the operation.

1.4 Reference documents

1.4.1 Compliant documents

This guideline complies with the following documents.

[1]. 700 MHz Band Intelligent Transport Systems ARIB Standard, ARIB STD-T109 Ver. 1.3

[2]. 700 MHz Band Intelligent Transport Systems – Extended Functions Guideline, ITS Forum RC-010 Ver. 1.1

[3]. 700 MHz Band Intelligent Transport Systems – Experimental Guideline for Inter-vehicle Communication Messages, ITS Forum RC-013 Ver. 1.1

[4]. Experimental Communication Messages Guideline of Bicycle/Pedestrian Accident Prevention Support System, ITS Forum RC-016 Ver. 1.0

1.4.2 Related documents

This guideline relates to the following documents:

[1]. SIP Use Cases for Cooperative Driving Automation, 2019 Cooperative Driving Automation Communication Method Study TF Activity Report (Publisher: SIP Autonomous Driving System Practical Application WG Cooperative Driving Automation Communication Method Study TF)

[2]. Study report on communication scenarios and requirements for "SIP Use Cases for Cooperative Driving Automation," ITS Forum RC-017 Ver. 1.0

1.5 Terms and Abbreviations

1.5.1 Terms

- Roadside unit: A generic term for equipment installed on the road to receive/detect/transmit various information on the road in the target system.
- Onboard unit: A generic term for any equipment installed in a vehicle to receive and transmit various information from roadside units and onboard units in a system.
- **V2I/V2V/V2N:** Refers to transmission from any one of onboard unit, roadside unit and network to any one of them. For example, transmission from an onboard unit to a roadside unit is V2I.
- Message: Application data exchanged between applications and communication protocols.
- Data frame (DF): Unit for message configuration data. Consists of one or more data elements. May also consists of multiple data frames or data elements.
- Data Element (DE): Smallest unit for message configuration data.
- Common service standard: A standard for a service (service system) defined by a standards/specifications developing organization (SDO) or similar. See reference [3].
- Individual service standard: A standard for a service (service system) defined by a private company or a specific alliance or similar. See reference [3].
- Individual application: Application software operating according to a private service standard. See reference [3].
- SIP use case: Use cases of V2I and V2V which were examined in the research theme of "Evaluation of 700 MHz Band ITS" among the examination of communication methods to realize the use cases of Strategic Innovation Promotion Program (SIP) Phase II, Automated Operation (Extension of Systems and Services), and Cooperative Automated Operation.

1.5.1.1 Notes

In this guideline, as a general term, communication between onboard unit and roadside unit is described as V2I. However, V2I and I2V are described differently depending on the section where the direction of communication is clearly indicated (Chapter5).

1.5.2 Abbreviations

- **GNSS** : Global Navigation Satellite System

Chapter2 System overview

2.1 System configuration

This system consists of roadside units and onboard units that are specified in the applicable document [1]. The communication network of the system is composed of vehicle-to-infrastructure communication, which is communication between a roadside unit and an onboard unit, and vehicle-to-vehicle communication, which is communication between the onboard units. Figure 2-1 shows the system configuration diagram.

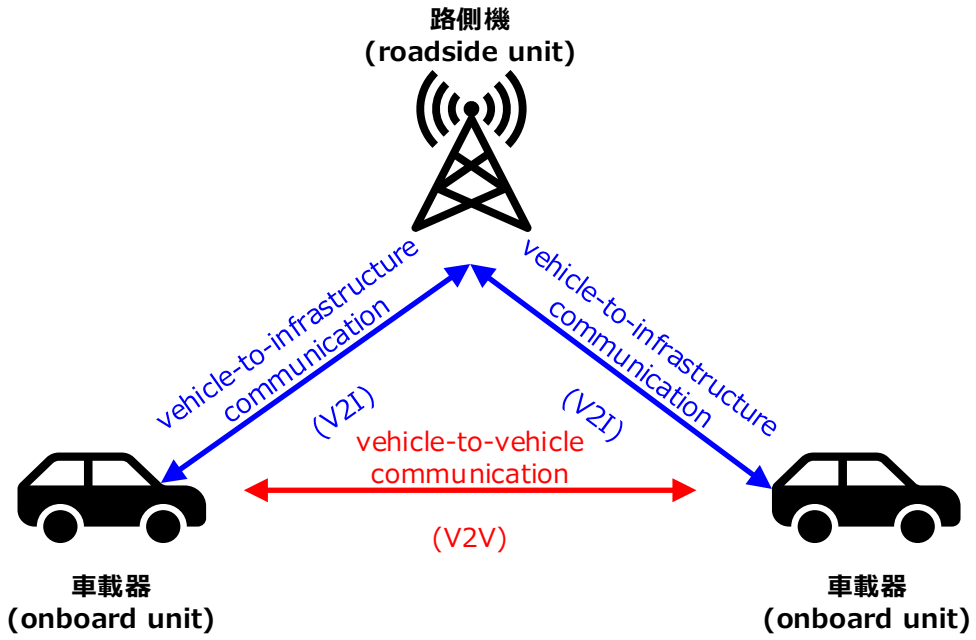


Figure 2-1 System configuration diagram

Chapter3 SIP use case

3. 1 SIP use case

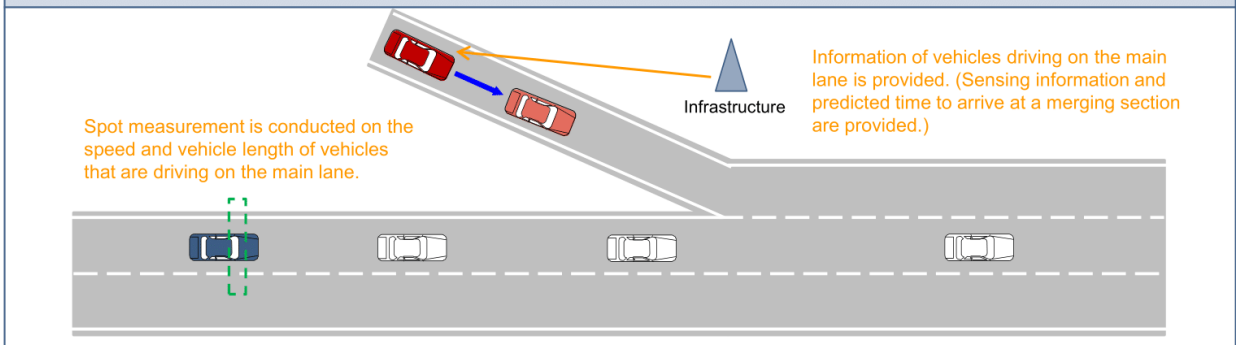
The use cases specified in this guideline target the SIP use cases described in the related document [1]. The description of each use case below is taken from the related document [1].

3. 1. 1 Use case a-1-1. Merging assistance by preliminary acceleration and deceleration

Information such as the speed of vehicles traveling on the main lane at measurement points on the main lane and the estimated time of arrival at the merging point will be provided from the infrastructure to the merging vehicles to support preliminary acceleration and deceleration.

Classification by function	a. Merging/lane change assistance		
Name of the use case	a-1-1. Merging assistance by preliminary acceleration and deceleration		
Target areas	Expressways + General roads	**Target vehicles**	Privately owned vehicles
Overview	Information, such as the speed of vehicles driving on the main lane at the measurement location on the main lane and predicted time to arrive at a merging section, is provided by the infrastructure to merging vehicles to assist preliminary acceleration and deceleration on the merging lane.		

Image of the use case



Remarks (communication requirements, etc.)	**Communication**	V2I	**Data category/ content of information**	**Message**	Predicted time to arrive at a merging section (vehicles on the main lane)
	Connection mode	One-to-many		**Sensor data**	Speed (spot measurement of vehicles on the main lane), vehicle length
	Control usage	Preliminary acceleration and deceleration		**Rich contents**	–
	Responsiveness	Required	**Data amount**		Small

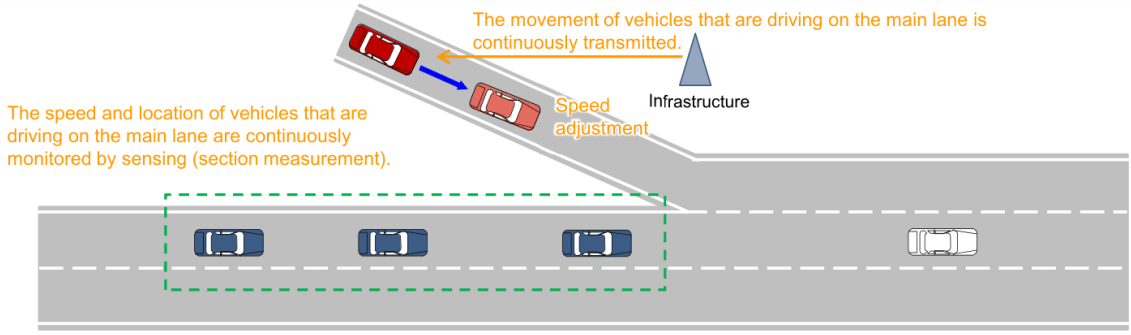
Fig. 3-1 a-1-1. Merging assistance by preliminary acceleration and deceleration

3. 1. 2 Use case a-1-2. Merging assistance by targeting the gap on the main lane

Information that continuously measures the position and speed of vehicles traveling on the main lane is continuously provided from the infrastructure to merging vehicles to support merging by targeting gaps between vehicles traveling on the main lane.

Classification by function	a. Merging/lane change assistance		
Name of the use case	a-1-2. Merging assistance by targeting the gap on the main lane		
Target areas	Expressways + General roads	**Target vehicles**	Privately owned vehicles
Overview	Continuous measurement information (e.g., location and speed of vehicles driving on the main lane) is continuously provided by the infrastructure to merging vehicles to assist merging by targeting the gap between vehicles driving on the main lane.		

Image of the use case



Remarks (communication requirements, etc.)	**Communication**	V2I	**Data category/ content of information**	**Message**	Predicted time to arrive at a merging section (vehicles on the main lane)
	Connection mode	One-to-many		**Sensor data**	Speed, location (continuous measurement of vehicles on the main lane), vehicle length
	Control usage	Speed adjustment		**Rich contents**	–
	Responsiveness	Required	**Data amount**		Small

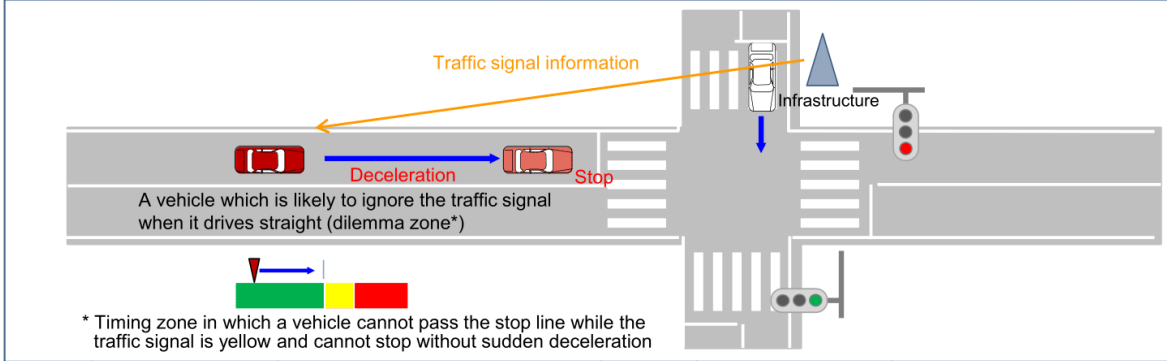
Fig. 3-2 a-1-2. Merging assistance by targeting the gap on the main lane

3. 1. 3 Use case b-1-1. Driving assistance by using traffic signal information (V2I)

The present traffic light color and signal cycle information (the time until the next traffic light color and switching) of traffic lights at an intersection are provided from a roadside unit to vehicles entering the intersection, and dilemmas are avoided by assisting the deceleration and stop of the vehicles.

Classification by function	b. Traffic signal information		
Name of the use case	b-1-1. Driving assistance by using traffic signal information (V2I)		
Target areas	General roads + Expressways	**Target vehicles**	Privately owned vehicles
Overview	Current traffic signal color and traffic signal phase and timing information (the next traffic signal color and the time until change), etc. at intersections are provided by the roadside infrastructure to vehicles that enter intersections to assist deceleration and stopping, and thereby avoid a dilemma.		

Image of the use case



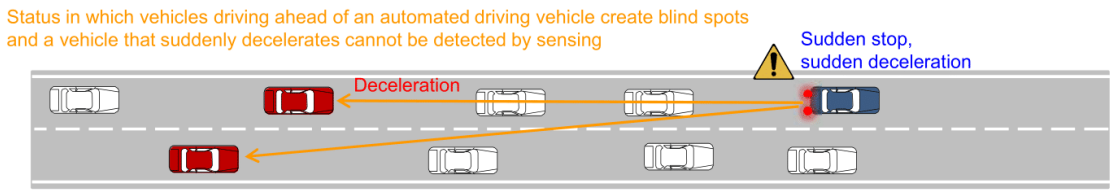
Remarks (communication requirements, etc.)	**Communication**	V2I	**Data category/ content of information**	**Message**	Current traffic signal color, traffic signal phase and timing information
	Connection mode	One-to-many		**Sensor data**	–
	Control usage	Speed adjustment, stop		**Rich contents**	–
	Responsiveness	Required	**Data amount**		Small

Fig. 3-3 b-1-1. Driving assistance by using traffic signal information (V2I)

3. 1. 4 Use case c-1. Collision avoidance assistance when a vehicle ahead stops or decelerates suddenly

Sudden braking information and position/speed information are provided from a rapidly decelerated vehicle to a following vehicle, and a slinging accident is prevented by urging the vehicle to stop or decelerate in advance.

Classification by function	c. Lookahead information: collision avoidance		
Name of the use case	c-1. Collision avoidance assistance when a vehicle ahead stops or decelerates suddenly		
Target areas	Expressways + General roads	**Target vehicles**	Privately owned vehicles
Overview	Sudden braking information as well as location and speed information are provided by the vehicle that suddenly decelerates to the following vehicles to prompt them to stop or decelerate in advance and prevent multiple-vehicle collision accidents.		
Image of the use case			



Remarks (communication requirements, etc.)	**Communication**	V2V	**Data category/ content of information**	**Message**	Sudden braking information
	Connection mode	One-to-many		**Sensor data**	Location, speed
	Control usage	Speed adjustment, stop		**Rich contents**	–
	Responsiveness	Required	**Data amount**		Small

Fig. 3-4 c-1. Collision avoidance assistance when a vehicle ahead stops or decelerates suddenly

3. 1. 5 Use case c-2-1. Driving assistance based on intersection information (V2V)

Information on the position and speed of a vehicle approaching an intersection is provided to a vehicle approaching or passing the intersection from an approaching vehicle, thereby assisting the passage or the right turn at an intersection with many blind spots.

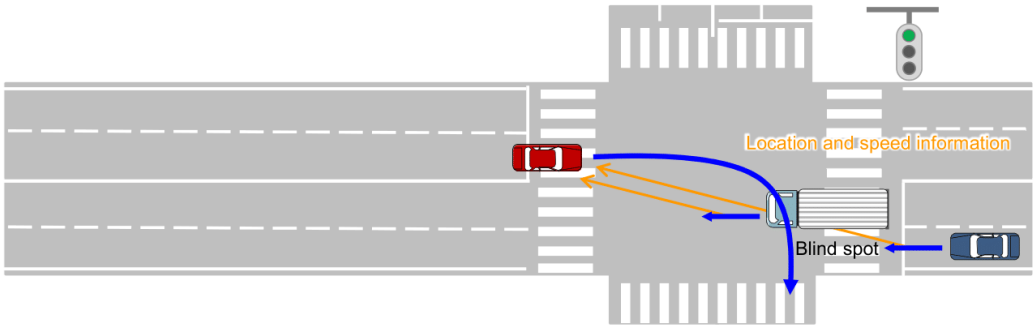
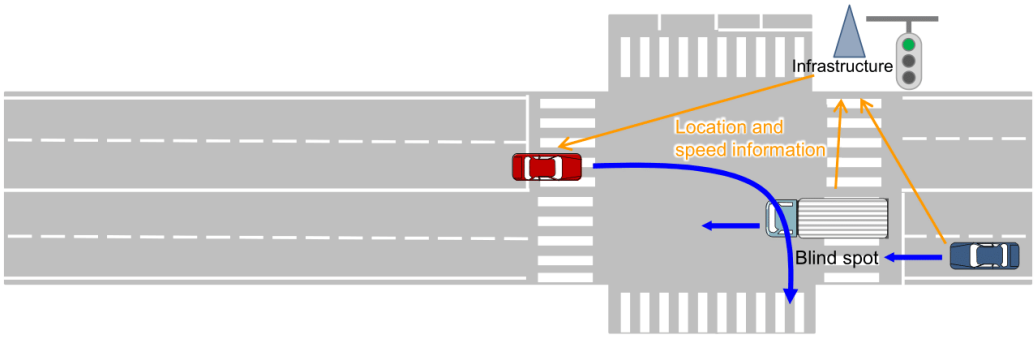
Classification by function	c. Lookahead information: collision avoidance				
Name of the use case	c-2-1. Driving assistance based on intersection information (V2V)				
Target areas	General roads	**Target vehicles**	Privately owned vehicles		
Overview	Location and speed information of vehicles that approach intersections is provided by the approaching vehicles to other vehicles that approach or pass through intersections to assist them to pass through or make a right turn at intersections with many blind spots.				
Image of the use case					
					
Remarks (communication requirements, etc.)	**Communication**	V2V	**Data category/ content of information**	**Message**	–
	Connection mode	One-to-many		**Sensor data**	Location, speed
	Control usage	Judgment whether the vehicle can start, speed adjustment, stop		**Rich contents**	–
	Responsiveness	Required	**Data amount**		Small

Fig. 3-5 c-2-1. Driving assistance based on intersection information (V2V)

3. 1. 6 Use case c-2-2. Driving assistance based on intersection information (V2I)

Information on the position and speed of a vehicle approaching an intersection obtained from a roadside sensor or a vehicle is provided to a vehicle approaching or passing the intersection from an infrastructure to assist the passage or the right turn at an intersection with a large number of blind spots.

Classification by function	c. Lookahead information: collision avoidance		
Name of the use case	c-2-2. Driving assistance based on intersection information (V2I)		
Target areas	General roads	**Target vehicles**	Privately owned vehicles
Overview	Location and speed information of vehicles that approach intersections, which is obtained from roadside sensors or vehicles, is provided by the infrastructure to other vehicles that approach or pass through intersections to assist them to pass through or make a right turn at intersections with many blind spots.		
Image of the use case			



Remarks (communication requirements, etc.)	**Communication**	V2I	**Data category/ content of information**	**Message**	–
	Connection mode	One-to-many		**Sensor data**	Location, speed
	Control usage	Judgment whether the vehicle can start, speed adjustment, stop		**Rich contents**	–
	Responsiveness	Required	**Data amount**		Small

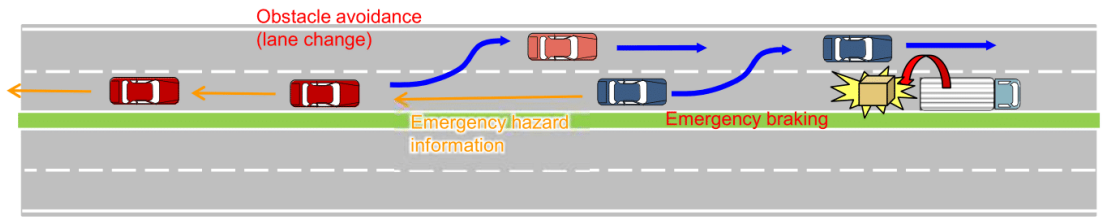
Fig. 3-6 c-2-2. Driving assistance based on intersection information (V2I)

3. 1. 7 Use case c-3. Collision avoidance assistance by using hazard information

In use case c-3, when a cooperative vehicle suddenly decelerates or changes lanes, emergency hazard information is delivered to the following vehicle, and the following vehicle smoothly implements avoidance control.

Classification by function	c. Lookahead information: collision avoidance		
Name of the use case	c-3. Collision avoidance assistance by using hazard information		
Target areas	Expressways + General roads	**Target vehicles**	Privately owned vehicles
Overview	When an automated driving vehicle performs emergency deceleration or emergency lane change, emergency hazard information is transmitted to the following vehicles to assist smooth avoidance control.		

Image of the use case



Remarks (communication requirements, etc.)	**Communication**	V2V	**Data category/ content of information**	**Message**	Obstacle information, emergency braking, steering
	Connection mode	One-to-many		**Sensor data**	Location
	Control usage	Trajectory change, lane change, automated driving control assistance level change		**Rich contents**	–
	Responsiveness	Required	**Data amount**		Small

Fig. 3-7 c-3. Collision avoidance assistance by using hazard information

3. 1. 8 Use case d-1. Driving assistance by notification of abnormal vehicles

Event information (a broken vehicle, an accident vehicle, etc.) and position information (a section, a lane) of an abnormal vehicle stopped on a road are provided from an infrastructure to the periphery of the vehicle or from the abnormal vehicle to the peripheral vehicle to assist early lane change and travel plan change.

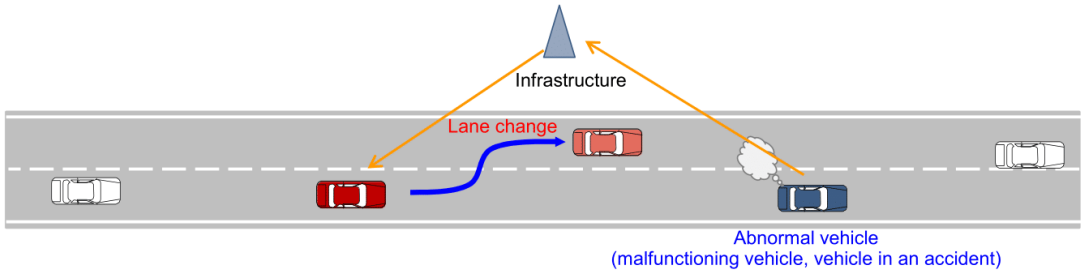
Classification by function	d. Lookahead information: trajectory change			
Name of the use case	d-1. Driving assistance by notification of abnormal vehicles			
Target areas	Expressways + General roads	**Target vehicles**	Privately owned vehicles	
Overview	Event information of abnormal vehicles that are stopped on roads (e.g., malfunctioning vehicles, vehicles in accidents) and location information (sections and lanes where such vehicles are located) are provided by the infrastructure to the surrounding vehicles or by abnormal vehicles to the surrounding vehicles to assist lane change and trajectory change at an early stage.			
Image of the use case				
				
Remarks (communication requirements, etc.)	**Communication**	V2I, V2N	**Data category/ content of information**	**Message**	Event information of abnormal vehicles
	Connection mode	One-to-many		**Sensor data**	Location
	Control usage	Lane change, trajectory change		**Rich contents**	–
	Responsiveness	Not required	**Data amount**		Small

Fig. 3-8 d-1. Driving assistance by notification of abnormal vehicles

3. 1. 9 Use case d-2. Driving assistance by notification of wrong-way vehicles

Information on the location and speed of the wrong-way driving vehicle and information on the existence of the wrong-way driving vehicle will be provided from the infrastructure to surrounding vehicles to assist in avoiding collisions by prompting them to change lanes in advance.

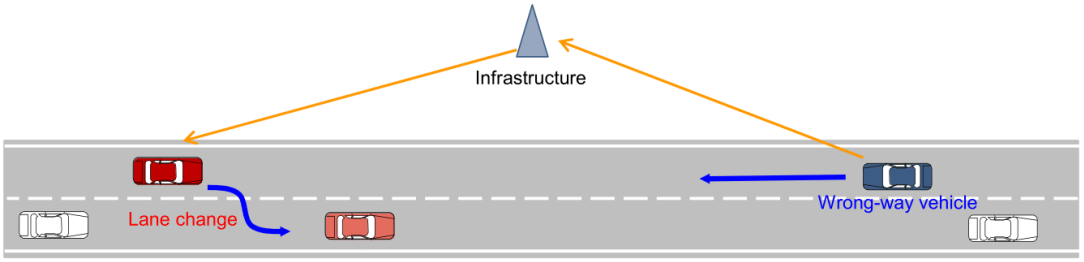
Classification by function	d. Lookahead information: trajectory change				
Name of the use case	d-2. Driving assistance by notification of wrong-way vehicles				
Target areas	Expressways + General roads	**Target vehicles**	Privately owned vehicles		
Overview	Location and speed information of wrong-way vehicles and information about the presence of wrong-way vehicles are provided by the infrastructure to the surrounding vehicles to prompt lane change, etc. in advance and assist collision avoidance.				
Image of the use case					
					
Remarks (communication requirements, etc.)	**Communication**	V2I, V2N	**Data category/ content of information**	**Message**	Presence of wrong-way vehicles
	Connection mode	One-to-many		**Sensor data**	Location, speed, and lane category of wrong-way vehicles
	Control usage	Lane change, trajectory change, pulling over		**Rich contents**	–
	Responsiveness	Not required	**Data amount**		Small

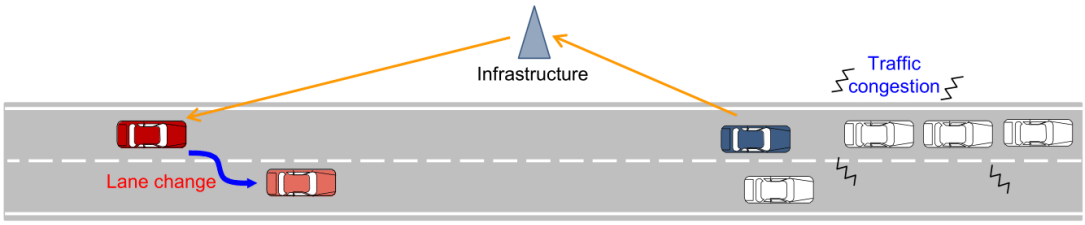
Fig. 3-9 d-2. Driving assistance by notification of wrong-way vehicles

3. 1. 10 Use case d-3. Driving assistance based on traffic congestion information

Traveling assistance by providing information on a traffic congestion situation obtained from a vehicle in a traffic congestion to a peripheral vehicle from an infrastructure.

Classification by function	d. Lookahead information: trajectory change		
Name of the use case	d-3. Driving assistance based on traffic congestion information		
Target areas	Expressways + General roads	**Target vehicles**	Privately owned vehicles
Overview	Traffic congestion status information obtained from vehicles that are caught in traffic congestion is provided by the infrastructure to the surrounding vehicles to assist driving.		

Image of the use case



Remarks (communication requirements, etc.)	**Communication**	V2I, V2N	**Data category/ content of information**	**Message**	Status of traffic congestion
	Connection mode	One-to-many		**Sensor data**	–
	Control usage	Trajectory change, speed adjustment, stop		**Rich contents**	–
	Responsiveness	Not required	**Data amount**		Small

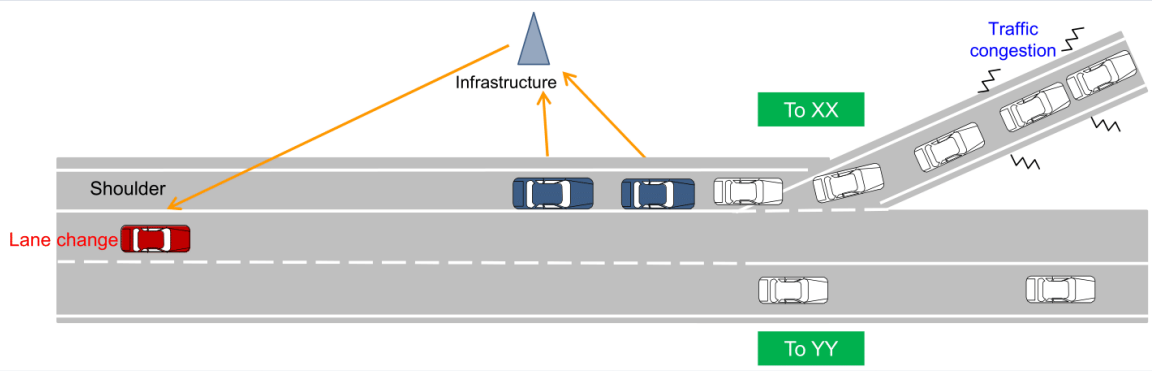
Fig. 3-10 d-3. Driving assistance based on traffic congestion information

3. 1. 11 Use case d-4. Traffic congestion assistance at branches and exits

The information (position and speed) on the road-shoulder congestion is provided from the infrastructure to the main lane vehicle, and assistance for entry into the branch is provided.

Classification by function	d. Lookahead information: trajectory change		
Name of the use case	d-4. Traffic congestion assistance at branches and exits		
Target areas	Expressways + General roads	**Target vehicles**	Privately owned vehicles
Overview	Information about traffic congestion on shoulders (location, speed) is provided by the infrastructure to vehicles on the main lane to assist entry to branches.		

Image of the use case



Remarks (communication requirements, etc.)	**Communication**	V2I, V2N	**Data category/ content of information**	**Message**	Status of traffic congestion on shoulders (toward branches)
	Connection mode	One-to-many		**Sensor data**	Speed, location
	Control usage	Speed adjustment, trajectory change		**Rich contents**	–
	Responsiveness	Not required	**Data amount**		Small

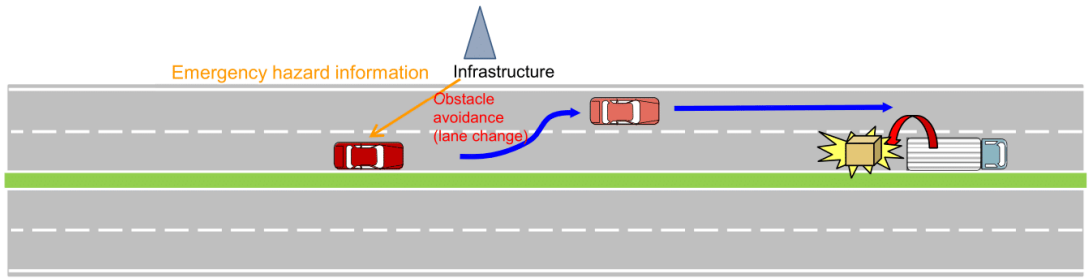
Fig. 3-11 d-4. Traffic congestion assistance at branches and exits

3. 1. 12 Use case d-5. Driving assistance based on hazard information

Information on obstacles, construction work, traffic congestion, etc., is provided from the infrastructure to surrounding vehicles to assist driving.

Classification by function	d. Lookahead information: trajectory change		
Name of the use case	d-5. Driving assistance based on hazard information		
Target areas	Expressways + General roads	**Target vehicles**	Privately owned vehicles
Overview	Information about obstacles, construction work, traffic congestion, etc. is provided by the infrastructure to the surrounding vehicles to assist driving.		

Image of the use case



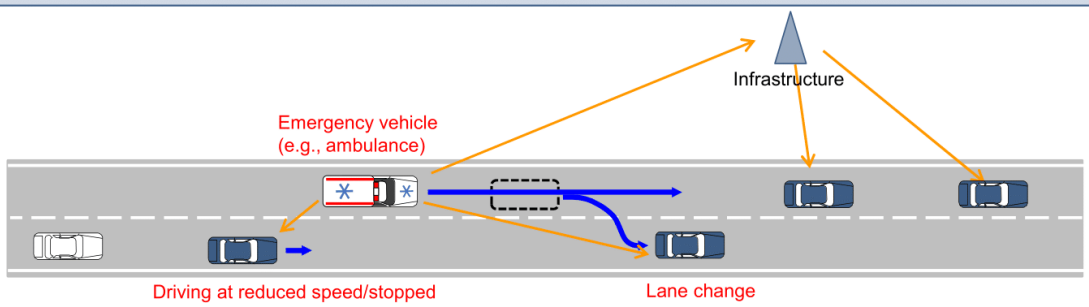
Remarks (communication requirements, etc.)			Data category/ content of information		
	Communication	V2I, V2N		**Message**	Obstacle information
	Connection mode	One-to-many		**Sensor data**	Location
	Control usage	Trajectory change, lane change, automated driving control assistance level change		**Rich contents**	–
	Responsiveness	Not required	**Data amount**		Small

Fig. 3-12 d-5. Driving assistance based on hazard information

3. 1. 13 Use case e-1. Driving assistance based on emergency vehicle information

To support the smooth passage of the emergency vehicle, information on its direction, speed, and planned travel route (planned travel lane) is provided to surrounding vehicles to encourage them to slow down or stop.

Classification by function	e. Lookahead information: emergency vehicle notification		
Name of the use case	e-1. Driving assistance based on emergency vehicle information		
Target areas	Expressways + General roads	**Target vehicles**	Privately owned vehicles
Overview	Information about the driving direction, speed, and planned driving route (planned driving lane) of emergency vehicles is provided by the emergency vehicles to the surrounding vehicles to prompt the surrounding vehicles to drive at reduced speed or to stop, etc. and thereby assist the emergency vehicles to pass smoothly.		
Image of the use case			



Remarks (communication requirements, etc.)	**Communication**	V2V, V2I, V2N	**Data category/ content of information**	**Message**	Information about approaching emergency vehicles
	Connection mode	One-to-many		**Sensor data**	Location, speed
	Control usage	Speed adjustment, lane change, stop (shoulder)		**Rich contents**	–
	Responsiveness	Not required	**Data amount**		Small

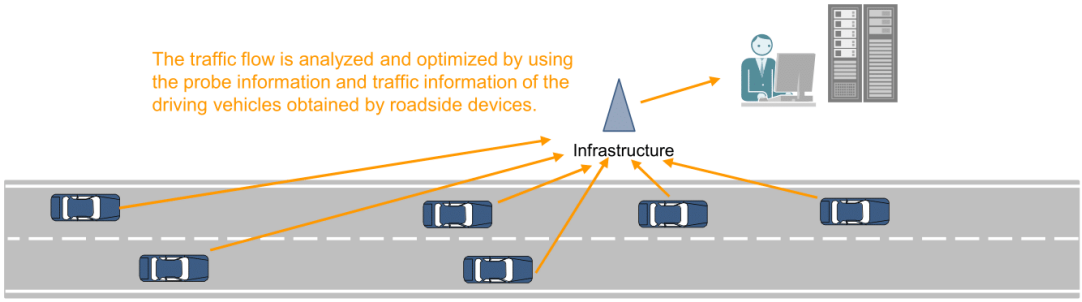
Fig. 3-13 e-1. Driving assistance based on emergency vehicle information

3. 1. 14 Use case f-2. Collection of information to optimize the traffic flow

Collect vehicle position and speed information via infrastructure for traffic analysis and optimization.

Classification by function	f. Information collection/distribution by infrastructure		
Name of the use case	f-2. Collection of information to optimize the traffic flow		
Target areas	Expressways + General roads	**Target vehicles**	Privately owned vehicles
Overview	Information about the location and speed of driving vehicles is collected via the infrastructure to analyze and optimize the traffic flow.		

Image of the use case



Remarks (communication requirements, etc.)	**Communication**	V2I, V2N	**Data category/ content of information**	**Message**	–
	Connection mode	One-to-one		**Sensor data**	Location, speed
	Control usage	–		**Rich contents**	–
	Responsiveness	–	**Data amount**		Small

Fig. 3-14 f-2. Collection of information to optimize the traffic flow

3. 1. 15 Use case g-1. Unmanned platooning of following vehicles by electronic towbar

The operation information of platoon vehicles is communicated between trucks forming a platoon to support platooning (electronic towbar).

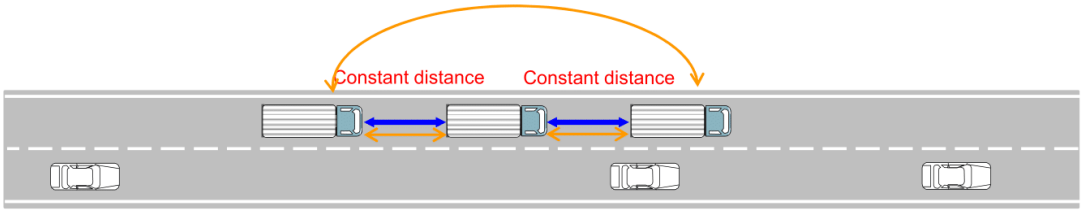
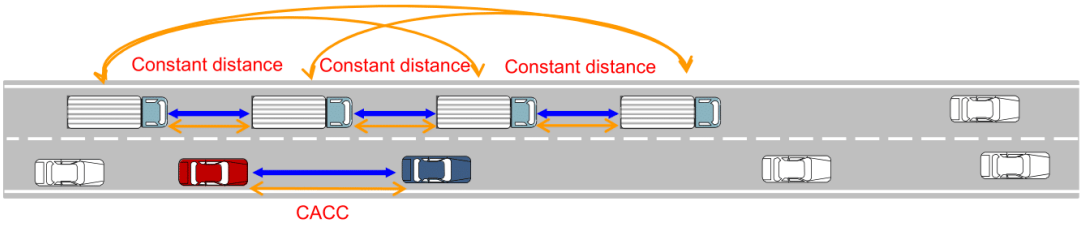
Classification by function	g. Platooning/adaptive cruise control				
Name of the use case	g-1. Unmanned platooning of following vehicles by electronic towbar				
Target areas	Expressways	**Target vehicles**	Logistics service cars		
Overview	Operation information, etc. of platooning vehicles is communicated between trucks that form a platoon to assist platooning (electronic towbar).				
Image of the use case					
					
Remarks (communication requirements, etc.)	**Communication**	V2V	**Data category/ content of information**	**Message**	Acceleration, braking, steering operation, information about following vehicles
	Connection mode	One-to-many		**Sensor data**	Location, speed, gap, acceleration/deceleration speed
	Control usage	Keeping distance, platoon maintenance		**Rich contents**	Transmission of image from the second truck to the first truck by using an electronic mirror
	Responsiveness	Required	**Data amount**		Large

Fig. 3-15 g-1. Unmanned platooning of following vehicles by electronic towbar

3. 1. 16 Use case g-2. Adaptive cruise control and manned platooning of following vehicles using adaptive cruise control

The position, speed, driving operation information of the vehicle in front, etc., are communicated between the front and rear vehicles to assist following driving.

Classification by function	g. Platooning/adaptive cruise control		
Name of the use case	g-2. Adaptive cruise control and manned platooning of following vehicles using adaptive cruise control		
Target areas	Expressways (Logistics service cars) Expressways + General roads (Privately owned vehicles)	**Target vehicles**	Logistics service cars, Privately owned vehicles
Overview	Location and speed information and driving operation information of vehicles at the front, etc. are communicated with the following vehicles to assist adaptive cruise control.		
Image of the use case			



Remarks (communication requirements, etc.)	**Communication**	V2V	**Data category/ content of information**	**Message**	Acceleration/braking operation
	Connection mode	One-to-one or one-to-many		**Sensor data**	Location, speed, acceleration/deceleration speed
	Control usage	Keeping distance		**Rich contents**	–
	Responsiveness	Required	**Data amount**		Small

Fig. 3-16 g-2. Adaptive cruise control and manned platooning of following vehicles using adaptive cruise control

Chapter4 Message

For the definition of each message, apply the contents of the latest version of the related document [2].

4.1 Onboard unit transmission message

Table 4-1 shows the correspondence between "ITS FORUM RC-013 (compliant document [3])" (hereafter abbreviated as "RC-013") and OBE transmission messages in "SIP use cases." This table shows the correspondence between the elements included in each message of RC-013 and SIP use case.

"supplement"

- Elements not defined in the RC-013 common area are stored in the free area.
- The study policy for onboard unit transmission messages is described in the later section, "Study Policy for Inter-Vehicle Messages."

Fig. 4-1 Onboard unit transmission message

Data frame/element	size [bit]							
	RC-013	SIP use case						
		c-2-1	c-1, 3	e-1	g-1	g-2	d-1 ~d-4	f-2
Common field								
Common application header field								
DF_CommonFieldManagementInformation								
DE_CommonServiceStandardID	3	N/A	N/A	N/A	3	3	N/A	N/A
DE_MessageID	2	N/A	N/A	N/A	2	2	N/A	N/A
DE_Version	3	N/A	N/A	N/A	3	3	N/A	N/A
DE_VehicleID	32	32	32	32	32	32	32	32
DE_IncrementCounter	8	8	N/A	N/A	8	8	N/A	N/A
DE_CommonAppDataLength	8	8	N/A	N/A	8	8	N/A	N/A
DE_OptionFlag	8	N/A	N/A	N/A	8	8	N/A	N/A
Common application data field								
DF_TimeInformation (*1)								
DE_LeapSecondsCorrectionAvailability	1	1	1	N/A	1	N/A	N/A	1
DE_Hour	7	7	7	N/A	7	N/A	N/A	7
DE_Minute	8	8	8	N/A	8	N/A	N/A	8
DE_Second	16	16	16	N/A	16	N/A	N/A	16
DF_PositionInformation (*1)								
DE_Latitude	32	32	32	N/A	32	32	N/A	32
DE_Longitude	32	32	32	N/A	32	32	N/A	32
DE_Elevation	16	16	16	N/A	16	16	N/A	16
DE_PositionConfidence	4	4	4	N/A	4	4	N/A	4
DE_ElevationConfidence	4	4	4	N/A	4	4	N/A	4
DF_VehicleStatusInformation (*1)								

DE_Speed	16	16	16	N/A	16	16	N/A	16
DE_Heading	16	16	N/A	N/A	16	N/A	N/A	16
DE_Acceleration	16	16	16	N/A	16	16	N/A	16
DE_SpeedConfidence	3	N/A	N/A	N/A	3	N/A	N/A	N/A
DE_HeadingConfidence	3	N/A	N/A	N/A	3	N/A	N/A	N/A
DE_AccelerationConfidence	3	N/A	N/A	N/A	3	N/A	N/A	N/A
DE_TransmissionState	3	N/A	N/A	N/A	3	N/A	N/A	N/A
DE_SteeringWheelAngle	12	N/A	N/A	N/A	12	N/A	N/A	N/A
DF_VehicleAttributeInformation (*1)								
DE_VehicleSizeClassification	4	4	4	N/A	4	N/A	N/A	N/A
DE_VehicleRoleClassification	4	4	4	N/A	4	N/A	N/A	N/A
DE_VehicleWidth	10	N/A	N/A	N/A	10	N/A	N/A	N/A
DE_VehicleLength	14	16	16	N/A	14	N/A	N/A	14+2
DF_PositionOptionalInformation (*2)	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DF_GPSStatusOptionalInformation (*2)	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DF_PositionAcquisitionOptionalInformation (*2)	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DF_VehicleStatusOptionalInformation (*2)								
DE_YawRate	16	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DE_BrakeAppliedStatus	6	N/A	N/A	N/A	6	6	N/A	N/A
DE_AuxiliaryBrakeAppliedStatus	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DE_ThrottlePosition	8	N/A	N/A	N/A	8	8	N/A	N/A
E_ExteriorLights	8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DE_AdaptiveCruiseControlStatus	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DE_CooperativeAdaptiveCruiseControlStatus	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DE_PreCrashSafetyStatus	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DE_AntilockBrakeStatus	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DE_TractionControlStatus	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DE_ElectronicStabilityControlStatus	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DE_LaneKeepingAssistStatus	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DE_LaneDepartureWarningStatus	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DF_IntersectionInformation (*2)	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DF_ExtendedInformation (*2)	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Free field								
Free application header field								
DF_FreeFieldManagementInformation								
DE_IndivisualAppHeaderLength	5	5	5	5	5	5	5	5
DE_NumberOfIndividualAppData	3	3	3	3	3	3	3	3
DF_IndividualAppDataManagementInformationSet								
DF_IndividualAppDataManagementInformation (#1)								
DE_IndividualServiceStandardID	8	8	8	8	8	8	8	8
DE_IndividualAppDataAddress	8	8	8	8	8	8	8	8
DE_IndividualAppDataLength	8	8	8	8	8	8	8	8
DF_IndividualAppDataManagementInformation (#2)	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A
: * Repeat "DE_NumberOfIndividualAppData"	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DF_IndividualAppDataManagementInformation (#N)	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Free application data field	No regulation	Follow the definition of each use case						

(*1) Must be stored

(*2) Storage is optional

4.1.1 Use case c-2-1. Driving assistance based on intersection information (V2V)

4.1.1.1 References

See related documents [2].

4.1.1.2 Message

Table 4-2 c-2-1 message

SIP use case		RC-013		Remarks
Dataframe /Element	Size [bit]	Dataframe /Element	Size [bit]	
Management Information		-	-	
Message ID	16	Free application data field	16	See Chapter 5
Increment counter	8	DE_IncrementCounter	8	See RC-013
Data length	8	DE_CommonAppDataLength	8	See RC-013
Time information	32	DF_TimeInformation	32	See RC-013
Vehicle Information		-	-	
Onboard unit ID	32	DE_VehicleID	32	See RC-013
Vehicle position	88	DF_PositionInformation	88	See RC-013
Speed	16	DE_Speed	16	See RC-013
Vehicle acceleration information	16	DE_Acceleration	16	See RC-013
Vehicle heading	16	DE_Heading	16	See RC-013
Vehicle length	16	DE_VehicleLength	14	See RC-013 [Note 1]
Vehicle attributes information	8	DE_VehicleSizeClassification DE_VehicleRoleClassification	4+4	See RC-013 [Note 4]

[Note 1] "Vehicle length" is assumed to be in the same format as “DE_VehicleLength" of RC-013, "16 = 14 + 2 (empty bits)".

[Note 4] It is assumed that the following "4+4 = 8[bit]" corresponds to "vehicle attributes information (8 bits)".

DE_VehicleSizeClassification (4 bits)

DE_VehicleRoleClassification (4 bits)

4.1.1.3 Notes

None

4.1.2 Use case c-1. Collision avoidance assistance when a vehicle ahead stops or decelerates suddenly

4.1.2.1 References

See related documents [2].

4.1.2.2 Message

Table 4-3 c-1 message

SIP use case		RC-013		Remarks
Dataframe /Element	size [bit]	Dataframe /Element	size [bit]	
Management Information		-	-	
Message ID	16	Free application data field	16	See Chapter 5
Vehicle Information		-	-	
Onboard unit ID	32	DE_VehicleID	32	See RC-013
Information update time	32	DF_TimeInformation	32	See RC-013
Vehicle position	88	DF_PositionInformation	88	See RC-013
Speed	16	DE_Speed	16	See RC-013
Vehicle acceleration information	16	DE_Acceleration	16	See RC-013
Vehicle length	16	DE_VehicleLength	14	See RC-013 [Note 1]
Event Information		-	-	
Emergency action occurrence time	32	Free application data field	32	See Chapter 5
Emergency action type	8	Free application data field	8	See Chapter 5
Object information	24	Free application data field	24	See Chapter 5
Event position information	88	Free application data field	88	See Chapter 5
Event distance information	16	Free application data field	16	See Chapter 5
Lane information	8	Free application data field	8	See Chapter 5
Road type information	8	Free application data field	8	See Chapter 5
Passability information	8	Free application data field	8	See Chapter 5
Source onboard unit ID	32	Free application data field	32	See Chapter 5
Delivery target lane information	8	Free application data field	8	See Chapter 5
Validity period	32	Free application data field	32	See Chapter 5
Redelivery distance	16	Free application data field	16	See Chapter 5

[Note 1] "Vehicle length" is assumed to be in the same format as “DE_VehicleLength" of RC-013, "16 = 14 + 2 (empty bits)".

4.1.2.3 Notes

None

4.1.3 Use case c-3. Collision avoidance assistance by using hazard information

Description is omitted because it is the same as c-1.

4.1.4 Use case e-1. Driving assistance based on emergency vehicle information

4.1.4.1 References

See related document [2].

4.1.4.2 Message

Table 4-4 e-1 message

SIP use case		RC-013		Remarks
Dataframe /Element	size [bit]	Dataframe /Element	Size [bit]	
Management Information		-	-	
Message ID	16	Free application data field	16	See Chapter 5 [Note 6]
Vehicle ID	32	DE_VehicleID	32	See RC-013
Event Information		-	-	
Occurrence time	32	Free application data field	32	See Chapter 5
Occurrence event	8	Free application data field	8	See Chapter 5
Object information (speed, vehicle type)	24	Free application data field	24	See Chapter 5
Position Information		-	-	
Longitude latitude altitude	88	Free application data field	88	See Chapter 5
Longitude latitude altitude 2	88	Free application data field	88	See Chapter 5
Distance	16	Free application data field	16	See Chapter 5
Lane information/up-down lane	4	Free application data field	4	See Chapter 5
Lane information/up-down lane2	4	Free application data field	4	See Chapter 5
Road type, etc.	8	Free application data field	8	See Chapter 5
Road type, etc. 2	8	Free application data field	8	See Chapter 5
Traffic Information		-	-	
Passability information	8	Free application data field	8	See Chapter 5
Redelivery designation Information		-	-	
Source onboard unit ID	32	Free application data field	32	See Chapter 5
Delivery target lane information	8	Free application data field	8	See Chapter 5
Validity period	32	Free application data field	32	See Chapter 5
Redelivery distance	16	Free application data field	16	See Chapter 5
Spare (main lane regulation information, etc.)	4	Free application data field	4	

[Note 6] In the related document [2], the data size of this element is defined as 8 bits, but it is extended to 16 bits for consistency with the element of the same name in other use cases.

4.1.4.3 Notes

None

4.1.5 Use case g-1. Unmanned platooning of following vehicles by electronic towbar

4.1.5.1 References

See related document [2].

4.1.5.2 Message

Table 4-5 g-1 message

SIP use case		RC-013		Remarks
Dataframe /Element	size [bit]	Dataframe /Element	size [bit]	
Management Information				
Message ID	16	Free application data field	16	See Chapter 5 [Note 2]
Common Field Management Information	64	DF_CommonFieldManagementInformation	64	See RC-013
Time information	32	DF_TimeInformation	32	See RC-013
Position information	88	DF_PositionInformation	88	See RC-013
Vehicle Status Information		-	-	
Speed	72	DE_Speed	16	See RC-013
Heading		DE_Heading	16	See RC-013
Acceleration		DE_Acceleration	16	See RC-013
Speed confidence		DE_SpeedConfidence	3	See RC-013
Heading confidence		DE_HeadingConfidence	3	See RC-013
Acceleration confidence		DE_AccelerationConfidence	3	See RC-013
Transmission state		DE_TransmissionState	3	See RC-013
Steering wheel angle		DE_SteeringWheelAngle	12	See RC-013
Vehicle attributes information	32	DF_VehicleAttributeInformation	32	See RC-013
Following vehicle information	Max. 60 byte	Free application data field	-	See Chapter 5
Inter-vehicular distance		Free application data field	-	See Chapter 5
accelerator, brake		Free application data field	-	See Chapter 5

[Note 2] Added because it exists in other messages. It is assumed that this is an omission in the related document [2].

4.1.5.3 Notes

The communication requirements for this use case are defined as follows.

- Normal time: Transmit at 100 ms cycle.
- Sudden braking: Send 5 times at 20 ms cycle.

Hence, during sudden braking, the standard of the compliant document [1] cannot be satisfied. Therefore , in the case of an experimental test station, it is possible to conduct experiments during sudden braking if approval is obtained from the competent authority (experimental test station license). Commercial stations cannot be serviced by the current standard.

4.1.6 Use case g-2. Adaptive cruise control and manned platooning of following vehicles using adaptive cruise control

4.1.6.1 References

See related document [2].

4.1.6.2 Message

Table 4-6 g-2 message

SIP use case		RC-013		Remarks
Dataframe /Element	size [bit]	Dataframe /Element	size [bit]	
Management Information				
Message ID	16	Free application data field	16	See Chapter 5 [Note 2]
Common field management information	64	DF_CommonFieldManagementInformation	64	See RC-013
Time information	32	DF_TimeInformation	32	See RC-013
Position information	88	DF_PositionInformation	88	See RC-013
Vehicle Status Information		-	-	
Speed	72	DE_Speed	16	See RC-013
Heading		DE_Heading	16	See RC-013
Acceleration		DE_Acceleration	16	See RC-013
Speed confidence		DE_SpeedConfidence	3	See RC-013
Heading confidence		DE_HeadingConfidence	3	See RC-013
Acceleration confidence		DE_AccelerationConfidence	3	See RC-013
Transmission state		DE_TransmissionState	3	See RC-013
Steering wheel angle		DE_SteeringWheelAngle	12	See RC-013
Vehicles compatible with CACC	Within 100 bytes for the entire g-2 message	Free application data field	-	See Chapter 5

[Note 2] Added because it exists in other messages. It is assumed that this is an omission in the related document [2].

4.1.6.3 Notes

None

4.1.7 Use case d-1. Driving support by notification of abnormal vehicles

4.1.7.1 References

See related document [2].

4.1.7.2 Message

Table 4-7 d-1 message

SIP use case			RC-013		Remarks
Dataframe /Element		size [bit]	Dataframe /Element	size [bit]	
Management Information			-	-	
	Message ID	16	Free application data field	16	See Chapter 5 [Note 6]
	Vehicle ID	32	DE_VehicleID	32	See RC-013
Individual hazard information (#1)			-	-	
	Event Information		-	-	
		Occurrence time	32	Free application data field	32	See Chapter 5
		Type of event (hazard type)	8	Free application data field	8	See Chapter 5
		Speed	16	Free application data field	16	See Chapter 5
	Position Information		-	-	
		Longitude latitude altitude	88	Free application data field	88	See Chapter 5
		Distance	16	Free application data field	16	See Chapter 5
		Lane information/up-down lane	4	Free application data field	4	See Chapter 5
		Road type, etc.	8	Free application data field	8	See Chapter 5
	Traffic Information		-	-	
		Passability information	8	Free application data field	8	See Chapter 5
	(Blank)		4	Free application data field	4	
: Repeat "individual hazard information" up to "20 times"						

[Note 6] In the related document [2], the data size of this element is defined as 8 bits, but it is extended to 16 bits for consistency with the element of the same name in other use cases.

4.1.7.3 Notes

None

4.1.8 Use case d-2. Driving assistance by notification of wrong-way vehicles

Description is omitted because it is the same as d-1.

4.1.9 Use case d-3. Driving assistance based on traffic congestion information

4.1.9.1 References

See related document [2].

4.1.9.2 Message

Table 4-8 d-3 message

SIP use case		RC-013		Remarks
Dataframe /Element	size [bit]	Dataframe /Element	size [bit]	
Management Information		-	-	
Message ID	16	Free application data field	16	See Chapter 5 [Note 6]
Vehicle ID	32	DE_VehicleID	32	See RC-013
Individual vehicle information (#1)		-	-	
Event Information		-	-	
Occurrence time	32	Free application data field	32	See Chapter 5
Type of event (hazard type)	8	Free application data field	8	See Chapter 5
Driving speed	16	Free application data field	16	See Chapter 5
Position Information		-	-	
Longitude latitude altitude	88	Free application data field	88	See Chapter 5
Distance	16	Free application data field	16	See Chapter 5
Lane information/up-down lane	4	Free application data field	4	See Chapter 5
Road type, etc.	8	Free application data field	8	See Chapter 5
Traffic Information		-	-	
Passability information	8	Free application data field	8	See Chapter 5
(Blank)	4	Free application data field	4	
: Repeat "individual vehicle information" up to "20 times"				

[Note 6] In the related document [2], the data size of this element is defined as 8 bits, but it is extended to 16 bits for consistency with the element of the same name in other use cases.

4.1.9.3 Notes

None

4.1.10 Use case d-4. Traffic congestion assistance at branches and exits

Description is omitted because it is the same as d-3.

4.1.11 Use case f-2. Collection of information to optimize the traffic flow

4.1.11.1 References

See related document [2].

4.1.11.2 Message

Table 4-9 f-2 message

SIP use case			RC-013		Remarks
Dataframe /Element		size [bit]	Dataframe /Element	size [bit]	
Common Information			-	-	
	Message ID	16	Free application data field	16	See Chapter 5 [Note 6]
	Vehicle ID	32	DE_VehicleID	32	See RC-013
Vehicle Information			-	-	
	V2I/fixed cycle/event delivery	2 + 6	Free application data field	8	See Chapter 5, 6 bits available
	Vehicle length	14 + 2	DE_VehicleLength	14	See RC-013, 2 bits available
	Vehicle information transmission time	32	DF_TimeInformation	32	See RC-013
	Lane information	14 + 2	Free application data field	16	See Chapter 5, 2 bits available
	Vehicle position (latitude, longitude, altitude)	88	DF_PositionInformation	88	See RC-013
	Vehicle traveling direction	16	DE_Heading	16	See RC-013
	Speed	16	DE_Speed	16	See RC-013
	Acceleration	16	DE_Acceleration	16	See RC-013

[Note 6] In the related document [2], the data size of this element is defined as 8 bits, but it is extended to 16 bits for consistency with the element of the same name in other use cases.

4.1.11.3 Notes

None

4. 2 Roadside unit transmission message

The roadside unit transmission message are classified into a newly defined "highway message" and a "general road message" which can be realized by extending an existing service. Highway messages and general road messages are described thereafter.

4. 2. 1 Highway Message

Table 4-10 shows a list of roadside unit transmission messages (for highways) for SIP use cases.

"supplement"

- A review policy of a vehicle-to-infrastructure communication message is described in " reference commentary2".

Table 4-10 Roadside unit transmission message (for highway)

Data frame/element	size [bit]		
	SIP use case		
	a-1-1	a-1-2	d-1~d-5
Common Information or Management Information			
Message ID	16	16	16
Increment ID or information update time	32	32	N/A
Roadside control information	8	8	N/A
Roadside unit ID	32	32	32
Merge starting point information	16	16	N/A
Road number	32	32	N/A
Number of driving vehicles	8	8	N/A
Position Information (#1)			
Vehicle ID	16	16	N/A
Vehicle position (latitude, longitude, altitude)	N/A	88	N/A
Driving lane	8	8	N/A
Driving speed	16	16	N/A
Vehicle length	14 + 2	14 + 2	N/A
Estimated time of arrival at merging starting point	32	32	N/A
Sensor information acquisition time	32	32	N/A
Information reliability	8	8	N/A
: Repeat "Position Information (#N)" at "Number of driving vehicles" times.			
Individual hazard information (#1) or individual traffic congestion information (#1)			
Event information			
Occurrence time	N/A	N/A	32
Type of event (hazard type)	N/A	N/A	8
Speed	N/A	N/A	16
Position information			
Longitude latitude altitude	N/A	N/A	88
Distance	N/A	N/A	16
Lane information/up-down lane	N/A	N/A	4

	Road type, etc.	N/A	N/A	8
	Traffic information			
	Passability information	N/A	N/A	8
	(Blank)	N/A	N/A	4
: Repeat ”Individual hazard information” or ”individual traffic congestion information” up to "20 times.				

4.2.1.1 Use case a-1-1. Merging assistance by preliminary acceleration and deceleration

4.2.1.1.1 References

See related document [2].

4.2.1.1.2 Message

Table 4-11 a-1-1 message

SIP use case		Remarks
Data frame/element	size [bit]	
Common Information		
Message ID	16	See Chapter 5
Increment ID or information update time	32	See Chapter 5
Roadside control information	8	See Chapter 5
Roadside unit ID	32	See Chapter 5
Merge starting point information	16	See Chapter 5
Road number	32	See Chapter 5
Number of driving vehicles	8	See Chapter 5
Position Information (#1)		
Vehicle ID	16	See Chapter 5
Driving lane	8	See Chapter 5
Driving speed	16	See Chapter 5
Vehicle length	14 + 2	See Chapter 5, 2 bits available
Estimated time of arrival at merging starting point	32	See Chapter 5
Sensor information acquisition time	32	See Chapter 5
Information reliability	8	See Chapter 5
: Repeat "Position Information (#N)" at "Number of driving vehicles" times.		

4.2.1.1.3 Notes

None

4.2.1.2 Use case a-1-2. Merging assistance by targeting the gap on the main lane

4.2.1.2.1 References

See related document [2].

4.2.1.2.2 Message

Table 4-12 a-1-2 message

SIP use case		Remarks
Data frame/element	size [bit]	
Common Information		
Message ID	16	See Chapter 5
Increment ID or information update time	32	See Chapter 5
Roadside control information	8	See Chapter 5
Roadside unit ID	32	See Chapter 5
Merge starting point information	16	See Chapter 5
Road number	32	See Chapter 5
Number of driving vehicles	8	See Chapter 5
Position Information (#1)		
Vehicle ID	16	See Chapter 5
Vehicle position (latitude, longitude, altitude)	88	See Chapter 5
Driving lane	8	See Chapter 5
Driving speed	16	See Chapter 5
Vehicle length	14 + 2	See Chapter 5, 2 bits available
Estimated time of arrival at merging starting point	32	See Chapter 5
Sensor information acquisition time	32	See Chapter 5
Information reliability	8	See Chapter 5
: Repeat "Position Information (#N)" at "Number of driving vehicles" times.		

4.2.1.2.3 Notes

None

4.2.1.3 Use case d-1. Driving support by notification of abnormal vehicles

4.2.1.3.1 References

See related document [2].

4.2.1.3.2 Message

Table 4-13 d-1 message

SIP use case				Remarks
Data frame/element			size [bit]	
Management Information				
	Message ID		16	See Chapter 5 [Note 6]
	Roadside unit ID		32	See Chapter 5
Individual hazard Information (#1)				
	Event information			
		Occurrence Time	32	See Chapter 5
		Type of event (hazard type)	8	See Chapter 5
		Speed	16	See Chapter 5
	Position Information			
		Longitude Latitude Altitude	88	See Chapter 5
		Distance	16	See Chapter 5
		Lane information/up-down lane	4	See Chapter 5
		Road type, etc.	8	See Chapter 5
	Traffic information			
		Passability information	8	See Chapter 5
	(Blank)		4	
: Repeat "individual hazard information" up to "20 times"				

[Note 6] In the related document [2], the data size of this element is defined as 8 bits, but it is extended to 16 bits for consistency with the element of the same name in other use cases.

4.2.1.3.3 Notes

None

4.2.1.4 Use case d-2. Driving assistance by notification of wrong-way vehicles

Description is omitted because it is the same as d-1.

4.2.1.5 Use case d-3. Driving assistance based on traffic congestion information

4.2.1.5.1 References

See related document [2].

4.2.1.5.2 Message

Table 4-14 d-3 message

SIP use case				Remarks
Data frame/element			size [bit]	
Management Information				
	Message ID		16	See Chapter 5 [Note 6]
	Roadside unit ID		32	See Chapter 5
Individual Traffic Information (#1)				
	Event information			
		Occurrence time	32	See Chapter 5
		Type of event (hazard type)	8	See Chapter 5
		Driving speed	16	See Chapter 5
	Position Information			
		Longitude Latitude Altitude	88	See Chapter 5
		Distance	16	See Chapter 5
		Lane Information/up-down lane	4	See Chapter 5
		Road type, etc.	8	See Chapter 5
	Traffic information			
		Passability information	8	See Chapter 5
	(Blank)		4	
: Repeat "individual traffic information" up to "20 times"				

[Note 6] In the related document [2], the data size of this element is defined as 8 bits, but it is extended to 16 bits for consistency with the element of the same name in other use cases.

4.2.1.5.3 Notes

None

4.2.1.6 Use case d-4. Traffic congestion assistance at branches and exits

Description is omitted because it is the same as d-3.

4.2.1.7 Use case d-5. Driving assistance based on hazard information

Description is omitted because it is the same as d-1.

4. 2. 2 General road message

In this chapter, Table 4-15 shows a list of roadside unit transmission messages (for general roads) for SIP use cases.

To standardize the onboard units used in the experiment, the roadside unit transmission message described in the compliant document [4] may be used.

"supplement"

- A review policy of a vehicle-to-infrastructure communication message is described in " reference commentary2".

Table 4-15 Roadside unit transmission message (for normal roads)

Data frame/element	size [bit]	
	SIP use case	
	b-1-1	c-2-2
Common header		
DE_MessageTypeCode	3	3
DE_MessageVersion	4	4
DE_ Reserved1	1	1
DF_RadioUnitManagementNumber		
DE_PrefectureCode	8	8
DF_RadioUnitID	16	16
DE_OperationClassificationCode	1	1
DE_MessageID	7	7
DE_IncrementCounter	8	8
DF_TransmissionTime		
DE_Year	16	16
DE_Month	8	8
DE_Day	8	8
DE_SummerTimeDesignation	1	1
DE_HolidayDesignation	1	1
DE_Day	3	3
DE_Reserved3	3	3
DE_Hour	8	8
DE_Minute	8	8
DE_Second	8	8
DE_Time(100ms)	8	8
DE_Reserved8	8	8
DE_MessageSize	16	16
DE_Reserved8	8	8
DE_Reserved8	8	8
Signal Information		
DF_ProvisionPointManagementNumber		
DE_PrefectureCode	8	8
DE_ProvisionPointTypeCode	1	1
DE_IntersectionID/SingleRoadID	15	15
DE_Reserved8	8	8
DE_SystemState	8	8

DE_EventCounter		8	8
DE_VehicleLightsNumber		8	8
DE_PedestrianLightsNumber		8	8
DE_ConnectionRouteNumber(I)		8	8
DE_ ServiceRouteNumber(J)		8	8
DF_ ServiceRouteSignalInformation: 1			
	DE_RouteID	8	8
	DE_SignalTrafficDirectionInformationPresenceFlag	1	1
	DE_Reserved7	7	7
	DE_SignalTrafficDirectionInformation	8	8
	DE_VehicleLightsInformationPointer: 1	16	16
	: Repeat "DE_VehicleLightsInformationPointer" at "DE_ConnectionRouteNumber(I)" times.		
	DE_PedestrianLightsInformationPointer: 1	16	16
	: Repeat “DF_PedestrianLightsInformationPointer" at "DE_ConnectionRouteNumber(I)" times.		
: Repeat "DE_ ServiceRouteSignalInformation:" at "DE_ ServiceRouteNumber(J)" times.			
DF_VehicleLightsInformation			
	DE_VehicleLightsID	4	4
	DE_LightColorOutputChangeNumber (K)	4	4
	DF_VehicleLightsInformation(1)		
		DE_RoundSignalLightColor	8	8
		DE_BlueArrowSignalDisplayDirection	8	8
		DE_CountdownStopFlag	1	1
		DE_MinRemainingSeconds(0.1sec)	15	15
		DE_MaxRemainingSeconds(0.1sec)	16	16
	: Repeat “DF_VehicleLightInformation" at "DE_LightColorOutputChangeNumber (K)"		
: Repeat “DF_VehicleLightInformation" at “DE_VehicleLightsNumber"			
Intersection identification information			
DF_ProvisionPointManagementNumber			
	DE_PrefectureCode	8	8
	DE_ProvisionPointTypeCode	1	1
	DE_IntersectionID/SingleRoadID	15	15
Reserve registration		80	80
DE_ConnectionRouteNumber(I)		8	8
DF_RouteIdentificationInformation: 1			
	DE_RouteID	8	8
	Reserve registration	48	48
: Repeat “DF_RouteIdentificationInformation" at "DE_ConnectionRouteNumber(I)"			
Vehicle detection information		N/A	
DF_ProvisionPointManagementNumber		N/A	-
	DE_PrefectureCode	N/A	8
	DE_ProvisionPointTypeCode	N/A	1
	DE_IntersectionID/SingleRoadID	N/A	15
DE_SensorID		N/A	8
DE_SystemState		N/A	8
DE_SensorVersion		N/A	8
DE_LocationType		N/A	1
DE_SystemDesignDelayTime		N/A	7

DE_ResendDelayTime		N/A	8
DF_RoadDetectionAreaInformation		N/A	-
	DE_RouteID	N/A	8
	DE_BaseNodeID	N/A	8
	DE_BasePointNearEndDistance	N/A	16
	DE_BasePointFarEndDistance	N/A	16
DE_RoadDetectionAreaUnitNumber(I)		N/A	8
DF_RoadDetectionAreaUnit(1)		N/A	-
	DE_DetectionTargetLane	N/A	16
	DE_Four-wheelVehicleExistance	N/A	1
	DE_Two-wheelVehicleExistance	N/A	1
	DE_Reserved6	N/A	6
	DE_Reserved8	N/A	8
	DE_Reserved8	N/A	8
	DE_Four-wheelDetectionUpperLimitFlag	N/A	1
	DE_Four-wheelStoredInformationNumber(J)	N/A	7
	DF_Four-wheelVehicleInformation (1)	N/A	-
		DE_Speed	N/A	8
		Distance from DE_StartingPoint	N/A	16
		DE_ExtensionFieldSize	N/A	16
	: Repeat “DF_Four-wheelVehicleInformation" at “DE_Four-wheelStoredInformationNumber" times.		N/A	-
	DE_Two-wheelsDetectionUpperLimitFlag		N/A	1
	DE_Two-wheelsInformationStorageNumber(K)		N/A	7
	DF_Two-wheelVehicleInformation (1)		N/A	-
		DE_Speed	N/A	8
		Distance from DE_StartingPoint	N/A	16
		DE_ExtensionFieldSize	N/A	16
	: Repeat “DF_Two-wheelVehicleInformation" at “DE_Two-wheelsInformationStorageNumber" times.		N/A	
: Repeat "DF_RoadDetectionAreaUnit" at “DF_RoadDetectionAreaUnitNumber" times.			N/A	

4.2.2.1 Use case b-1-1. Driving assistance by using traffic signal information (V2I)

4.2.2.1.1 References

See related document [2].

4.2.2.1.2 Message

Table 4-16 b-1-1 message

SIP use case		Remarks
Data frame/element	size [bit]	
Common header		
DE_MessageTypeCode	3	See related documents [2].
DE_MessageVersion	4	See related documents [2].
DE_ Reserved1	1	See related documents [2].
DF_RadioUnitManagementNumber		
DE_PrefectureCode	8	See related documents [2].
DF_RadioUnitID	16	See related documents [2].
DE_OperationClassificationCode	1	See related documents [2].

DE_MessageID		7	See related documents [2].
DE_IncrementCounter		8	See related documents [2].
DF_TransmissionTime			
	DE_Year	16	See related documents [2].
	DE_Month	8	See related documents [2].
	DE_Day	8	See related documents [2].
	DE_SummerTimeDesignation	1	See related documents [2].
	DE_HolidayDesignation	1	See related documents [2].
	DE_Day	3	See related documents [2].
	DE_Reserved3	3	See related documents [2].
	DE_Hour	8	See related documents [2].
	DE_Minute	8	See related documents [2].
	DE_Second	8	See related documents [2].
	DE_Time(100 ms)	8	See related documents [2].
	DE_Reserved8	8	See related documents [2].
DE_MessageSize		16	See related documents [2].
DE_Reserved8		8	See related documents [2].
DE_Reserved8		8	See related documents [2].
Signal Information			
DF_ProvisionPointManagementNumber			
	DE_PrefectureCode	8	See related documents [2].
	DE_ProvisionPointTypeCode	1	See related documents [2].
	DE_IntersectionID/SingleRoadID	15	See related documents [2].
DE_Reserved8		8	See related documents [2].
DE_SystemState		8	See related documents [2].
DE_EventCounter		8	See related documents [2].
DE_VehicleLightsNumber		8	See related documents [2].
DE_PedestrianLightsNumber		8	See related documents [2] [Note3]
DE_ConnectionRouteNumber(I)		8	See related documents [2].
DE_ ServiceRouteNumber(J)		8	See related documents [2].
DF_ ServiceRouteSignalInformation: 1			
	DE_RouteID	8	See related documents [2].
	DE_SignalTrafficDirectionInformationPresenceFlag	1	See related documents [2].
	DE_Reserved7	7	See related documents [2].
	DE_SignalTrafficDirectionInformation	8	See related documents [2].
	DE_VehicleLightsInformationPointer: 1	16	See related documents [2].
	: Repeat "DE_VehicleLightsInformationPointer" at "DE_ConnectionRouteNumber(I)" times.		
	DE_PedestrianLightsInformationPointer: 1	16	See related documents [2] [Note5]
	: Repeat "DF_PedestrianLightsInformationPointer" at "DE_ConnectionRouteNumber(I)" times.		
: Repeat "DE_ ServiceRouteSignalInformation:" at "DE_ ServiceRouteNumber(J)" times.			
DF_VehicleLightsInformation			
	DE_VehicleLightsID	4	See related documents [2].
	DE_LightColorOutputChangeNumber (K)	4	See related documents [2].
	DF_VehicleLightsInformation(1)		
		DE_RoundSignalLightColor	8	See related documents [2].
		DE_BlueArrowSignalDisplayDirection	8	See related documents [2].
		DE_CountdownStopFlag	1	See related documents [2].

			DE_MinRemainingSeconds(0.1sec)	15	See related documents [2].
			DE_MaxRemainingSeconds(0.1sec)	16	See related documents [2].
		: Repeat “DF_VehicleLightInformation" at "DE_LightColorOutputChangeNumber (K)			
	: Repeat “DF_VehicleLightInformation" at “DE_VehicleLightsNumber				
Intersection identification information					
	DF_ProvisionPointManagementNumber				
		DE_PrefectureCode		8	See related documents [2].
		DE_ProvisionPointTypeCode		1	See related documents [2].
		DE_IntersectionID/SingleRoadID		15	See related documents [2].
	Reserve registration			80	See related documents [2].
	DE_ConnectionRouteNumber(I)			8	See related documents [2].
	DF_RouteIdentificationInformation: 1				
		DE_RouteID		8	See related documents [2].
		Reserve registration		48	See related documents [2].
	: Repeat “DF_RouteIdentificationInformation" at "DE_ConnectionRouteNumber(I)"				

[Note 3] The related document [2] stipulates that there is no pedestrian light. Therefore, it is assumed that “pedestrian light device information" does not exist.

[Note 5] The related document [2] stipulates that there is no pedestrian light. Therefore, it is assumed that “pedestrian light device information" does not exist.

4.2.2.1.3 Notes

None

4.2.2.2 Use case c-2-2. Driving assistance based on intersection information (V2I)

4.2.2.2.1 References

See related documents [2].

4.2.2.2.2 Message

Description is omitted because the following information is the same as b-1-1.

- Common header
- Signal information
- Intersection identification information

Only the following information is listed in Table 4-17.

- Vehicle detection information

Table 4-17 c-2-2 message

SIP use case Data frame/element	size [bit]	Remarks
Vehicle detection information		
DF_ProvisionPointManagementNumber	-	
DE_PrefectureCode	8	See related documents [2].
DE_ProvisionPointTypeCode	1	See related documents [2].
DE_IntersectionID/SingleRoadID	15	See related documents [2].
DE_SensorID	8	See related documents [2].
DE_SystemState	8	See related documents [2].
DE_SensorVersion	8	See related documents [2].
DE_LocationType	1	See related documents [2].
DE_SystemDesignDelayTime	7	See related documents [2].
DE_ResendDelayTime	8	See related documents [2].
DF_RoadDetectionAreaInformation	-	
DE_RouteID	8	See related documents [2].
DE_BaseNodeID	8	See related documents [2].
DE_BasePointNearEndDistance	16	See related documents [2]. See reference [4]
DE_BasePointFarEndDistance	16	See related documents [2]. See reference [4]
DE_RoadDetectionAreaUnitNumber(I)	8	See related documents [2].
DF_RoadDetectionAreaUnit(1)	-	
DE_DetectionTargetLane	16	See related documents [2].
DE_Four-wheelVehicleExistance	1	See related documents [2].
DE_Two-wheelVehicleExistance	1	See related documents [2].
DE_Reserved6	6	See related documents [2].
DE_Reserved8	8	See related documents [2].
DE_Reserved8	8	See related documents [2].
DE_Four-wheelDetectionUpperLimitFlag	1	See related documents [2].
DE_Four-wheelStoredInformationNumber(J)	7	See related documents [2].
DF_Four-wheelVehicleInformation (1)	-	
DE_Speed	8	See related documents [2].
Distance from DE_StartingPoint	16	See related documents [2]. See reference [4]
DE_ExtensionFieldSize	16	See related documents [2].
: Repeat "DF_Four-wheelVehicleInformation" at "DE_Four-wheelStoredInformationNumber" times.	-	
DE_Two-wheelsDetectionUpperLimitFlag	1	See related documents [2].
: Repeat "DF_Two-wheelVehicleInformation" at "DE_Two-wheelsInformationStorageNumber" times.	7	See related documents [2]. Stored value is "0"
: Repeat "DF_RoadDetectionAreaUnit" at "DF_RoadDetectionAreaUnitNumber" times.		

4.2.2.2.3 Notes

None

Chapter5 Data frame/Data element

The definition of each data frame and data element constituting the free app data area of the message used in the SIP use case is described.

For the definition of each data element and data frame, apply the contents of the latest version of the related document [2].

If the latest version of the related document [2] omits a specific definition of "data type/expression range/resolution/allocation," any value can be set. However, the value of the "reference use example" described as a reference example can be used.

5.1 Emergency action occurrence time

Data name	Emergency action occurrence time
Definition	Time when sudden deceleration/emergency lane change was done
Data size	32 bit
Data type/expression range/resolution/allocation	"Reference usage example" Leap second correction information (1 bit) + time (hour) (7 bits) + time (minute) (8 bits) + time (second) (16 bits)

5.2 Emergency action type

Data name	Emergency action type
Definition	Emergency action type
Data size	8 bit
Data type/expression range/resolution/allocation	"Reference usage example" 0: Reserved, 1 to 15: T.B.D. (up to 15 types such as stop, slow down, tow)

5.3 Object information

Data name	Object information
Definition	Speed, vehicle type
Data size	24 bit
Data type/expression range/resolution/allocation	"Reference usage example" ・ Speed = Expression range: 0 to 163.83 m/s, resolution: 0.01 m/s ・ Vehicle type = 0: reservation, 1 to 15: T.B.D. (maximum 15 types such as ordinary cars, buses, trucks, special vehicles, police vehicles, ambulances, fire engines)

5.4 Event Position Information

Data name	Event Position Information
Definition	Latitude, longitude and altitude information of event occurrence
Data size	88 bit
Data type/expression range/resolution/allocation	"Reference usage example" Latitude (32bit) + Longitude (32bit) + Altitude (16bit) + Location acquisition information (4bit) + Elevation acquisition information (4bit)

5.5 Event distance information

Data name	Event distance information
Definition	Distance to incident point
Data size	16 bit
Data type/expression range/resolution/allocation	"Reference usage example" 0 to 1000 [m]

5.6 Lane information

Data name	Lane information
Definition	Lane information at the incident point
Data size	8 bit
Data type/expression range/resolution/allocation	"Reference usage example" 0: reserved, 1 to T.B.D. (lane number)

5.7 Road type information

Data name	Road type information
Definition	Road type at the incident point
Data size	8 bit
Data type/expression range/resolution/allocation	"Reference usage example" 0: Undefined, 1: Highway (excluding urban highway), 2: Urban Highway, 3: National road/prefectural road, 4: Other Roadway (small street, etc.), 5: Sidewalk, 6: Off-road, 7: Reservation

5.8 Passability information

Data name	Passability information
Definition	c-3: Passability information at the point where the event occurred d-1 (V2I): Passability information d-1 (I2V): Passability information d-2 (V2I): Passability information d-2 (I2V): Passability information d-3 (V2I): (Not used) d-3 (I2V): Passability information d-4 (V2I): (Not used) d-4 (I2V): Passability information d-5 (I2V): Passability information e-1 (V2V): Passability information e-1 (V2I): Passability information e-1 (I2V): Passability information
Data size	8 bit
Data type/expression range/resolution/allocation	"Reference usage example" 0: reserved, 1 to T.B.D. (Maximum 15 types such as normal driving, speed regulation, etc.)

5.9 Source onboard unit ID

Data name	Source onboard unit ID
Definition	c-1: ID of the incident vehicle c-3: ID of the incident vehicle e-1: Assumed not to be used
Data size	32 bit
Data type/expression range/resolution/allocation	"Reference usage example" 0 to 4,294,967,295

5.10 Delivery target lane information

Data name	Delivery target lane information
Definition	c-3: Target lane for relay c-3: Target lane for relay e-1: Assumed not to be used
Data size	8 bit
Data type/expression range/resolution/allocation	"Reference usage example" 0: reserved, 1 to T.B.D. (lane number)

5.11 Validity period

Data name	Validity period
Definition	c-1: Validity period to relay messages c-3: Validity period to relay messages e-1: Assumed not to be used
Data size	32 bit
Data type/expression range/resolution/allocation	"Reference usage example" Leap second correction information (1 bit) + time (hour) (7 bits) + time (minute) (8 bits) + time (second) (16 bits)

5.12 Redelivery distance

Data name	Redelivery distance
Definition	c-1: Validity range to relay messages c-3: Validity range to relay messages e-1: Assumed not to be used
Data size	16 bit
Data type/expression range/resolution/allocation	"Reference usage example" 0 to 1000 [m]

5.13 Occurrence Time

Data name	Occurrence Time
Definition	d-1 (V2I): Time when the hazard occurred d-1 (I2V: Time when the hazard occurred d-2 (V2I): Time when the hazard occurred d-2 (I2V): Time when the hazard occurred d-3 (V2I): Time to distribute driving information d-3 (I2V): Current time in traffic congestion d-4 (V2I): Time to deliver vehicle information d-4 (I2V): Current time in traffic congestion d-5 (I2V): Time when the hazard occurred e-1 (V2V): Time the emergency vehicle started driving e-1 (V2I): Time the emergency vehicle started driving e-1 (I2V): Time the emergency vehicle started driving
Data size	32 bit
Data type/expression range/resolution/allocation	"Reference usage example" Leap second correction information (1 bit) + time (hour) (7 bits) + time (minute) (8 bits) + time (second) (16 bits)

5.14 Occurrence event

Data name	Occurrence event
Definition	Notification of approaching emergency vehicles
Data size	8 bit
Data type/expression range/resolution/allocation	"Reference usage example" 0: reserved, 1 to 15: T.B.D. (up to 15 types such as emergency vehicle approaching, emergency vehicle stopped, emergency vehicle working)

5.15 Object information (speed, vehicle type)

Data name	Object information (speed, vehicle type)
Definition	Speed, vehicle type
Data size	24 bit
Data type/expression range/resolution/allocation	"Reference usage example" ・ Speed = Expression range: 0 to 163.83 m/s, resolution: 0.01 m/s ・ Vehicle type = 0: reservation, 1 to 15: T.B.D. (maximum 15 types such as ordinary cars, buses, trucks, special vehicles, police vehicles, ambulances, fire engines)

5.16 Longitude Latitude Altitude

Data name	Longitude Latitude Altitude
Definition	d-1 (V2I): Hazard occurrence place d-1 (I2V): Hazard occurrence place d-2 (V2I): Hazard occurrence place d-2 (I2V): Hazard occurrence place d-3 (V2I): Vehicle position d-3 (I2V): Congestion position d-4 (V2I): Vehicle position d-4 (I2V): Congestion position d-5 (I2V): Hazard occurrence place e-1 (V2V): Emergency vehicle driving location e-1 (V2I): Current emergency vehicle travel location e-1 (I2V): Emergency vehicle driving location
Data size	88 bit
Data type/expression range/resolution/allocation	"Reference usage example" Latitude (32bit) + Longitude (32bit) + Altitude (16bit) + Location acquisition information (4bit) + Elevation acquisition information (4bit)

5.17 Longitude Latitude Altitude 2

Data name	Longitude Latitude Altitude 2
Definition	Estimated travel location of emergency vehicle after 30s
Data size	88 bit
Data type/expression range/resolution/allocation	"Reference usage example" Latitude (32bit) + Longitude (32bit) + Altitude (16bit) + Location acquisition information (4bit) + Elevation acquisition information (4bit)

5.18 Distance

Data name	Distance
Definition	d-1 (V2I): Delivery distance (distance from the hazard occurrence point) d-1 (I2V): Delivery distance (distance from the hazard occurrence point) d-2 (V2I): Delivery distance (distance from the hazard occurrence point) d-2 (I2V): Delivery distance (distance from the hazard occurrence point) d-3 (V2I): (Not used) d-3 (I2V): (Not used) d-4 (V2I): (Not used) d-4 (I2V): (Not used) d-5 (I2V): Delivery distance (distance from the hazard occurrence point) e-1 (V2V): Assumed no use e-1 (V2I): Delivery distance e-1 (I2V): Delivery distance
Data size	16 bit
Data type/expression range/resolution/allocation	"Reference usage example" 0 to 1000 [m]

5.19 Lane information/up-down lane2

Data name	Lane information/up-down lane2
Definition	d-1 (V2I): Hazard occurrence lane d-1 (I2V): Hazard occurrence lane d-2 (V2I): Hazard occurrence lane d-2 (I2V): Hazard occurrence lane d-3 (V2I): Vehicle lane d-3 (I2V): traffic congestion lane d-4 (V2I): Vehicle lane d-4 (I2V): traffic congestion lane d-5 (I2V): Hazard occurrence lane e-1 (V2V): emergency vehicle driving lane e-1 (V2I): emergency vehicle driving lane e-1 (I2V): emergency vehicle driving lane
Data size	4 bit
Data type/expression range/resolution/allocation	"Reference usage example" 0: reserved, 1 to T.B.D. (lane number)

5.20 Lane information/up-down lane2

Data name	Lane information/up-down lane2
Definition	Emergency vehicle driving lane after 30s
Data size	4 bit
Data type/expression range/resolution/allocation	"Reference usage example" 0: reserved, 1 to T.B.D. (lane number)

5.21 Road type, etc.

Data name	Road type, etc.
Definition	d-1 (V2I): Road type d-1 (I2V): Road type d-2 (V2I): Road type d-2 (I2V): Road type d-3 (V2I): (Not used) d-3 (I2V): (Not used?) d-4 (V2I): (Not used) d-4 (I2V): (Not used?) d-5 (I2V): Road type e-1 (V2V): Road type e-1 (V2I): Road type e-1 (I2V): Road type
Data size	8 bit
Data type/expression range/resolution/allocation	"Reference usage example" 0: Undefined, 1: Highway (excluding urban highway), 2: Urban Highway, 3: National road/prefectural road, 4: Other Roadway (small streets, etc.), 5: Sidewalk, 6: Off-road, 7: Reservation

5.22 Road type, etc. 2

Data name	Road type, etc. 2
Definition	Road type after 30s
Data size	8 bit
Data type/expression range/resolution/allocation	"Reference usage example" 0: Undefined, 1: Highway (excluding urban highway), 2: Urban Highway, 3: National road/prefectural road, 4: Other Roadway (small streets, etc.), 5: Sidewalk, 6: Off-road, 7: Reservation

5.23 Inter-vehicular distance

Data name	Inter-vehicular distance
Definition	Inter-vehicular distance
Data size	Up to 60 bytes including "following vehicle information, inter-vehicle distance, accelerator, brake"
Data type/expression range/resolution/allocation	"Reference usage example" 0 to 1000 [m]

5. 24 Increment ID or information update time

Data name	Increment ID or information update time
Definition	Increment ID: An increment ID is provided for the receiving side to determine whether the message has been acquired. The increment ID is provided by giving an increment number to each message (after the increment number reaches the maximum value, it is returned to 0, and in the case of continuous sending or retransmission, it is performed with the same increment value). Information update time: Time information (when message is determined) is assumed when the message to be transmitted is determined at the application layer.
Data size	32 bit
Data type/expression range/resolution/allocation	"Reference usage example" ・ Increment ID = 0 to 4,294,967,295 ・ Information update time = leap second correction information (1 bit) + time (hour) (7 bits) + time (minute) (8 bits) + time (second) (16 bits)

5. 25 Roadside control information

Data name	Roadside control information
Definition	Indicates whether or not an traffic control request message is being received.
Data size	8 bit
Data type/expression range/resolution/allocation	For a-1-1 and a-1-2, set to "no control request message". "Reference usage example" 0: reserved, 1 to T.B.D. (Control request message accepted, not accepted, etc.)

5.26 Roadside unit ID

Data name	Roadside unit ID
Definition	a-1-1, a-1-2: The identifier of the source node for messages that match the dynamic map d-1 (I2V): Roadside unit ID of the transmission source, undecided if the transmission source is the management server d-2 (I2V): Roadside unit ID of the transmission source, undecided if the transmission source is the management server d-3 (I2V): Roadside unit ID of the transmission source, undecided if the transmission source is the management server d-4 (I2V): Roadside unit ID of the transmission source, undecided if the transmission source is the management server d-5 (I2V): Roadside unit ID of the transmission source, undecided if the transmission source is the management server e-1 (I2V): Roadside unit ID of the transmission source, undecided if the transmission source is the management server
Data size	32 bit
Data type/expression range/resolution/allocation	"Reference usage example" 0: reserved, 1 to T.B.D. (Roadside unit ID number)

5.27 Merge starting point information

Data name	Merge starting point information
Definition	Information consistent with dynamic maps
Data size	16 bit
Data type/expression range/resolution/allocation	"Reference usage example" 0: reserved, 1 to T.B.D. (merging starting point number)

5.28 Road number

Data name	Road number
Definition	Road numbers recognized by vehicles consistent with dynamic maps
Data size	32 bit
Data type/expression range/resolution/allocation	"Reference usage example" 0: reserved, 1 to T.B.D. (Road number)

5.29 Number of driving vehicles

Data name	Number of driving vehicles
Definition	Provide the number of vehicles provided by Position Information and control information
Data size	8 bit
Data type/expression range/resolution/allocation	"Reference usage example" 0: reserved, 1 to T.B.D. (number of vehicles with Position Information message delivery)

5.30 Vehicle ID

Data name	Vehicle ID
Definition	Provides an ID assigned by the Roadside unit. The same vehicle ID is given when the Roadside unit recognizes that the vehicle is the same between messages transmitted with different timings or different message types.
Data size	32 bit or 16 bits or 8 bits
Data type/expression range/resolution/allocation	"Reference usage example" 0: Reserved, 1~0xFFFF (Vehicle ID assigned by roadside unit)

5.31 Driving lane

Data name	Driving lane
Definition	Road numbers recognized by vehicles consistent with dynamic maps
Data size	8 bit
Data type/expression range/resolution/allocation	"Reference usage example" 0: reserved, 1 to T.B.D. (lane number)

5.32 Driving speed

Data name	Driving speed
Definition	a-1-1, a-1-2: For spot sensors, provides the speed at detection, and for planar sensors, provides the speed calculated from the time and position before and after the update. Cooperating vehicles on the connecting road coordinate preliminary acceleration/deceleration and acceleration after the merging point. d-3 (V2I): Speed d-3 (I2V): Speed
Data size	16 bit
Data type/expression range/resolution/allocation	"Reference usage example" Expression range: 0 to 163.83 m/s, resolution: 0.01 m/s

5.33 Speed

Data name	Speed
Definition	d-1 (V2I): Driving speed d-1 (I2V): Driving speed d-4 (V2I): Driving speed d-4 (I2V): Driving speed d-5 (I2V): Driving speed
Data size	16 bit
Data type/expression range/resolution/allocation	"Reference usage example" Expression range: 0 to 163.83 m/s, resolution: 0.01 m/s

5.34 Vehicle length

Data name	Vehicle length
Definition	Provides vehicle length measured by sensors or obtained from each vehicle.
Data size	16 bit
Data type/expression range/resolution/allocation	"Reference usage example" Expression range: 0.01 to 163.82m, resolution: 0.01 m

5.35 Estimated time of arrival at merging starting point

Data name	Estimated time of arrival at merging starting point
Definition	Provides an estimated time of arrival in absolute time. Cooperating vehicles on the access road adjust the estimated time of passing the merging starting point. Since the Roadside unit is calculated considering acceleration and deceleration information and other information, it may differ from the estimated arrival time calculated only from the vehicle position and traveling speed in the same message.
Data size	32 bit
Data type/expression range/resolution/allocation	"Reference usage example" Leap second correction information (1 bit) + time (hour) (7 bits) + time (minute) (8 bits) + time (second) (16 bits)

5.36 Sensor information acquisition time

Data name	Sensor information acquisition time
Definition	Provides the time information obtained or predicted for each running vehicle.
Data size	32 bit
Data type/expression range/resolution/allocation	"Reference usage example" Leap second correction information (1 bit) + time (hour) (7 bits) + time (minute) (8 bits) + time (second) (16 bits)

5.37 Information reliability

Data name	Information reliability
Definition	It provides information and prediction information that considers the case where the acquisition cycle and the obtained positional accuracy differ depending on the type of installed sensor.
Data size	8 bit
Data type/expression range/resolution/allocation	"Reference usage example" Indicates the reliability of the estimated time of arrival at the merging origin calculated by the roadside unit. 0: Reserved, 1 to T.B.D. (Less than 100 ms, 100 ms ~ 500 ms, 500 ms ~ 1s, 1s or more, etc.)

5.38 Vehicle position (latitude, longitude, altitude)

Data name	Vehicle position (latitude, longitude, altitude)
Definition	c-2-1, c-1, c-3, g-1, g-2, f-2: The vehicle during message determination that the vehicle matched with the dynamic map recognizes (head car?) Position Information a-1-1, a-1-2: Provides the latest position information measured by roadside sensors or obtained from each vehicle. Cooperating vehicles on the access road use the combination of vehicle position and vehicle length information to identify the merging point.
Data size	88 bit
Data type/expression range/resolution/allocation	"Reference usage example" Latitude (32bit) + Longitude (32bit) + Altitude (16bit) + Location acquisition information (4bit) + Elevation acquisition information (4bit)

5.39 Type of event (hazard type)

Data name	Type of event (hazard type)
Definition	d-1 (V2I): Notify the type of event d-1 (I2V): Notify the type of event d-2 (V2I): Notification of occurrence event (wrong-way driving event identification) d-2 (I2V): Notification of occurrence event (wrong-way driving event identification) d-3 (V2I): (Not used) d-3 (I2V): Traffic congestion notification d-4 (V2I): (Not used) d-4 (I2V): Traffic congestion notification d-5 (I2V): Notify the type of event
Data size	8 bit
Data type/expression range/resolution/allocation	"Reference usage example" 0: Reservation, 1 to 15: T.B.D. (Maximum 15 types such as traffic congestion, reverse driving, falling object, broken vehicle, slip warning, poor visibility, etc.)

5.40 V2I/fixed cycle/event delivery

Data name	V2I/fixed cycle/event delivery

Definition	Identify V2I/Regular/Event
Data size	8 bits (2 bits [+ 6 free bits])
Data type/expression range/resolution/allocation	"Reference usage example" 0: reserved, 1 to T.B.D. (regular delivery, event delivery)

5.41 Lane information

Data name	Lane information
Definition	Lane information
Data size	16 bits (14 bits [+ 2 free bits])
Data type/expression range/resolution/allocation	"Reference usage example" 0: reserved, 1 to T.B.D. (lane number)

5.42 Message ID

Data name	Message ID
Definition	c-2-1, c-1, c-3: Message type identifier d-1 to d-5, e-1, f-2: ID that identifies the message a-1-1, a-1-2, g-1, g-2: T.B.D.
Data size	d-1 to d-5, e-1, f-2, g-1, g-2: 16 bits a-1-1, a-1-2, c-2-1, c-1, c-3: 16 bits
Data type/expression range/resolution/allocation	"Reference usage example" 0: reserved, 1~TBD (Define ID for each message used in each use case)

5.43 Following vehicle information

Data name	Following vehicle information
Definition	Engine starting status, water temperature, fuel level, abnormality information (system failure information, etc.)
Data size	Up to 60 bytes including "following vehicle information, inter-vehicle distance, accelerator, brake"
Data type/expression range/resolution/allocation	"Reference usage example" ・ Engine start status = 0: reserved, 1 to T.B.D. (started, stopped) ・ Water temperature = 0: reserved, 1 to T.B.D. (defined in 1 degree increments) ・ Remaining fuel = 0: reserved, 1 to T.B.D. (defined in 1 liter increments) ・ Abnormality information (system failure information, etc.) = 0: reservation, 1 to T.B.D. (water temperature abnormality, fuel abnormality, vibration abnormality, etc.)

5.44 Vehicles compatible with CACC

Data name	Vehicles compatible with CACC
Definition	Information of vehicles compatible with CACC
Data size	Within 100 bytes for the entire g-2 message including this element
Data type/expression range/resolution/allocation	"Reference usage example" ・ Followability = 0: Reserved, 1 to T.B.D. (followable, not followable, etc.) ・ Manufacturer = 0: reserved, 1 to T.B.D. (car manufacturer, etc.) ・ Leading vehicle ID = 0 to 4,294,967,295

5.45 Accelerator, brake

Data name	Accelerator, brake
Definition	Accelerator, brake
Data size	Up to 60 bytes including "following vehicle information, inter-vehicle distance, Accelerator, brake"
Data type/expression range/resolution/allocation	"Reference usage example" ・ Throttle Position = Expression range: 0-100%, resolution: 0.5% ・ Brake status = Data type = bit string, Assignment = [0] Left front brake (0: OFF, 1: ON), [1] Left rear brake (0: OFF, 1: ON), [2] Right front brake (0: OFF, 1: ON), [3] Right rear brake (0: OFF, 1: ON), [4] Brake information valid (0: undefined, 1: valid), [5] Wheel-specific information acquisition (0: disabled, 1: enabled)

Commentary 1

1 Policy for consideration of vehicle-to-vehicle messages

We examined whether the message of inter-vehicle communication can be realized by RC-013 message for each SIP use case. Figure D1 shows the concept of creating a message format.

"Basic policy"

- Data elements defined in RC-013 make use of the definitions of RC-013.
- Data elements not defined in RC-013 are stored in the "free application data field."

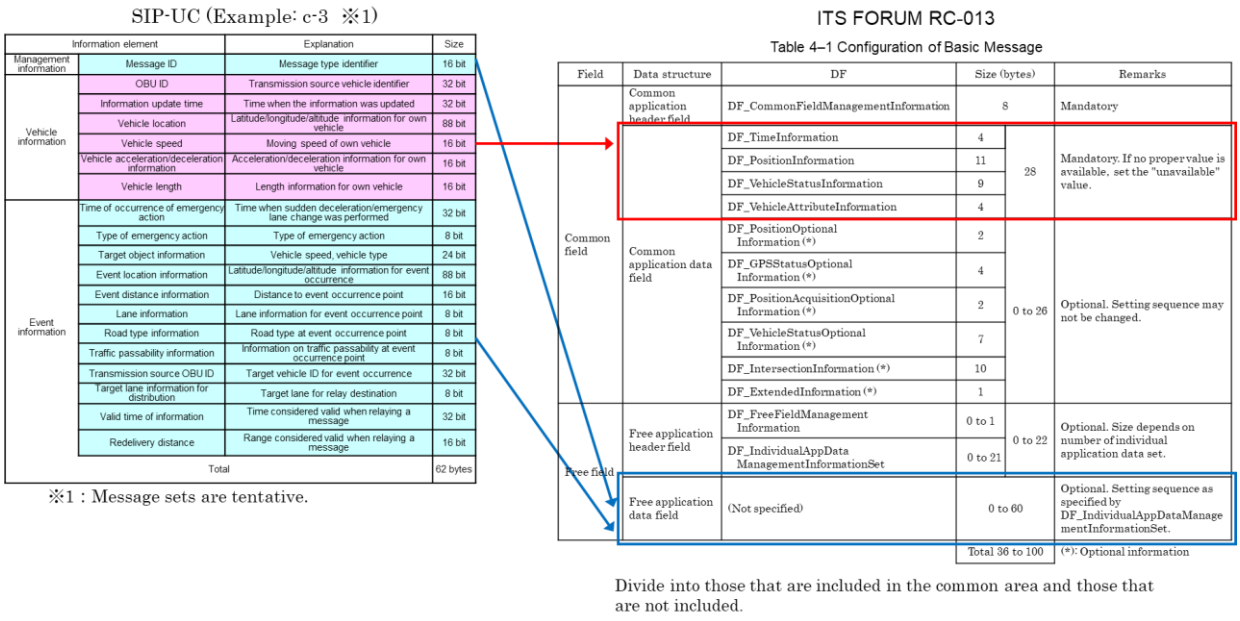


Figure D 1 Message implementation method

Commentary 2

1 Policy for consideration of vehicle-to-infrastructure messages

As for the message set of highway roadside unit, a message is newly defined because there is no 700 MHz band ITS vehicle-to-infrastructure communication service.

For the message of general roadside unit, whether it can be included or extended in the existing 700 MHz band ITS vehicle-to-infrastructure communication service is examined and defined as follows.

- b-1-1. Driving assistance by using traffic signal information (V2I)

  Since it is necessary to add information of "generation time" and "remaining seconds from generation time" based on the 700 MHz band ITS vehicle-to-infrastructure communication system, a message is defined by partially extending the existing 700 MHz band ITS vehicle-to-infrastructure communication system.

- c-2-2. Driving assistance based on intersection information (V2I)

  Defines the messages included in the 700 MHz band ITS vehicle-to-infrastructure communication system.