ENGLISH TRANSLATION

Experimental Communication Messages Guideline of BICYCLE/PEDESTRIAN Accident Prevention Support System

ITS FORUM RC-016 Version 2.0

Established on March 29, 2022

Revised on April 23, 2025

ITS Info-communications Forum of Japan

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Revision History

Version	Date	Chapter/Section	Reason	Revised Content
1.0	March 29, 2022	Establishment	Newly established	
2.0	April 23, 2025	1.2	Separated descriptions concerning road-to-vehicle messages for inclusion in RC-019 Deleted the descriptions from these specifications and changed to a format that references RC-019	Revised descriptions concerning transmission messages for roadside units to a format that references RC-019
		1.3		Added RC-019 to the reference materials
		1.5		Added a section describing the reasons for revision
		2.1, Chapter 4. , Appendix 1.		Deleted descriptions relating to transmission messages for roadside units
		2.5, Appendix 2.		Deleted descriptions concerning complementation and integration functions and made corresponding revisions to sentences providing a summary explanation
		2.2	Adjusted use case descriptions	Made the direct communication use case independent and deleted descriptions concerning use cases involving road-to-vehicle communications that are no longer within the scope of these specifications
		Chapter 3.	Reviewed document structure	Described pedestrian and bicycle passages, which were previously described together in Chapter 3, in newly-created Chapter 4 (Data Frames) and Chapter 5 (Data Element) and organized

		3.1.2. , 3.2.	Reviewed explanations and expressions Reviewed item titles	Clarified the positional relationships of the message specifications defined in these Guidelines
		Chapter 4.		Revised, since data frames were expressed as messages
		5.1.2. , 5.4.1. , 5.4.2.		Added unspecified expressions for data elements that cannot be described as unspecified
		5.1.3. , 5.2.2.		Changed expressions and clarified details

Introduction

This document establishes experimental communication message Guideline to provide notification to roadside units (RSUs, infrastructure) and vehicles regarding the presence of bicycles and pedestrians using wireless communications (700 MHz band and Bluetooth®) in order to prevent accidents involving bicycles and pedestrians. In particular, it is anticipated that the system will prevent accidents where a bicycle or pedestrian suddenly emerges from an intersection (broadside collision) not equipped with a traffic signal, and it is also expected that the system will be effective in various other situations such as preventing contact when overtaking a vehicle and overlooking vehicles and so on in the vicinity when turning left or right.

These Guidelines can also be used for applications other than accident prevention (e.g., autonomous driving support and monitoring support).

We hope that these Guideline will be fully verified through demonstration tests of the relevant systems and that various activities for practical application will be undertaken.

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Chapter 1. General Matters

1.1 Overview

These Guideline establish message specifications for conducting demonstration trials intended to achieve systems that support the prevention of traffic accidents involving bicycles and pedestrians (referred to as "Bicycle and Pedestrian Accident Prevention Support Systems") through wireless communications among bicycles, pedestrians, roadside units (RSUs, infrastructure), and vehicles (in these Guidelines, automobiles and motorcycles are referred to as vehicles, but vehicle does not include light vehicles such as bicycles).

1.2 Scope of Application

Systems covered by these Guideline are expected to be systems that comprise bicycles, pedestrians, RSUs, and vehicles and conduct wireless communications among them. Information regarding bicycles and pedestrians is transmitted directly from bicycles and pedestrians to vehicles, i.e., B2V/P2V, or to roadside units, i.e., B2I/P2I. Bicycle and pedestrian transmission messages via such B2V/P2V or B2I/P2I are included in the scope of these Guidelines. For other messages, refer to Reference Materials [3] and [5].

The wireless communication methods anticipated for application are described in Chapter 3

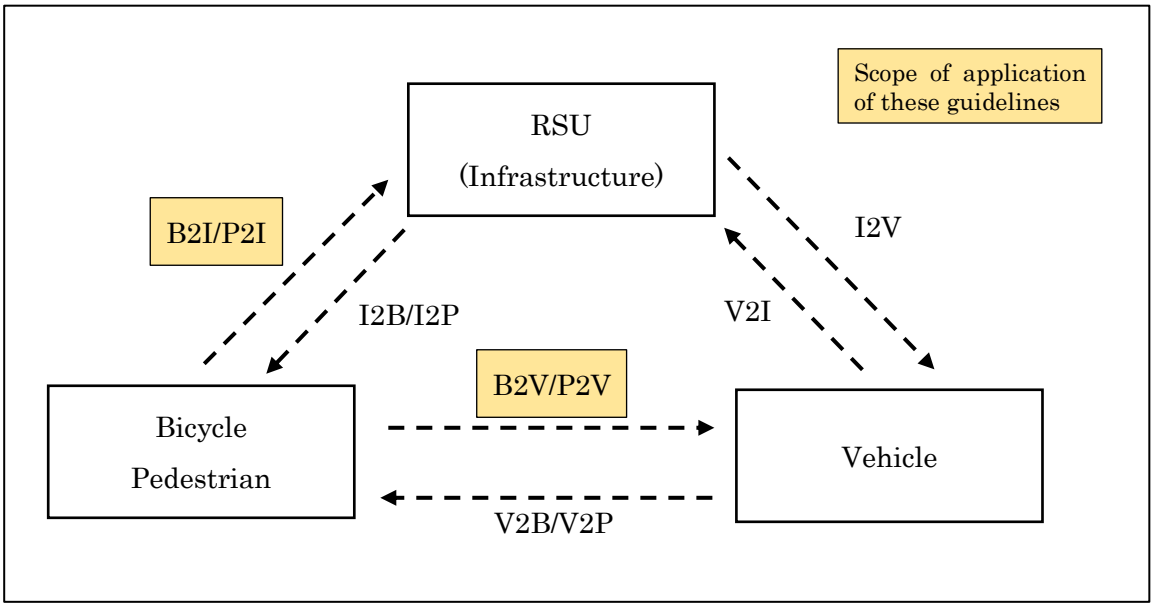


Figure 1-1. Covered Systems and Scope of Application of These Guideline

Table 1-1. Guidelines and their Scopes of Application (for General Roads)

		Receiving side			
		Roadside unit	(Manually-operated) vehicle	Autonomous vehicle	Bicycle/pedestrian
Transmitting side	Roadside unit	Specified other than by ITS Forum	RC-019 RC-016 ver. 1.0※1	RC-019	RC-019 RC-016 ver. 1.0※1
	(Manually-operated) vehicle	RC-013	RC-013	RC-013	RC-013
	Autonomous vehicle	Common area: RC-013 Free area: RC-018※2	Common area: RC-013 Free area: RC-018※2	Common area: RC-013 Free area: RC-018※2	Common area: RC-013 Free area: RC-018※2
	Bicycle/pedestrian	Common area: RC-013 Free area: RC-016	Common area: RC-013 Free area: RC-016	Common area: RC-013 Free area: RC-016	Common area: RC-013 Free area: RC-016

Note 1: It is recommended that these Guidelines (RC-019) be used for roadside unit transmission messages, but use of RC-016 version 1.0 is not prohibited.

Note 2: Expanded information relating to emergency vehicles and hazards.

Table 1-2. Guidelines and Their Scope of Application (for Highways)

		Receiving side		
		Roadside Unit	(Manually-operated) vehicle	Autonomous vehicle
Transmitting side	Roadside unit	Specified other than by ITS Forum	RC-018	RC-018
	(Manually-operated) vehicle	Common area: RC-013 Free area: RC-018	Common area: RC-013 Free area: RC-018	Common area: RC-013 Free area: RC-018
	Autonomous vehicle	Common area: RC-013 Free area: RC-018	Common area: RC-013 Free area: RC-018	Common area: RC-013 Free area: RC-018

1.3 Reference Materials

[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] Bluetooth® Technology Core Specification

https: //www.bluetooth.com/ja-jp/specifications/specs/core-specification/

[5] Experimental Communication Message Guidelines of Safe Driving Support and Autonomous Driving Support Systems for General Roads, ITS FORUM RC-019 Ver. 1.0

1.4 Terms and Abbreviations

1.4.1 Terms

- **Roadside unit**: A general term for a device installed on the roadside for receiving, detecting, and transmitting information regarding the presence of bicycles and pedestrians for use with covered systems.
- **Target**: A general term for bicycles, pedestrians, vehicles, and so on treated as transmission subjects by RSUs.
- **Target information**: Information on the presence of a target.
- **B2V, I2V**, etc.: Refers to transmission from any of a bicycle, pedestrian, vehicle, or infrastructure to any of these. For example, transmission from a bicycle to vehicle is B2V, and transmission from a vehicle to a pedestrian is V2P.
- **Message**: Application data exchanged between an application and communications protocol.
- **Message set**: An aggregation of message specifications defined for the relevant application.
- **Data frame (DF)**: A unit of data that comprises a message. Made up of one or more data elements. There are also cases where a message comprises multiple data frames or data elements.
- **Data element (DE)**: The smallest unit of data that comprises a message.
- **Common service standard**: A standard for a service (service system) defined by a standards or specifications organization or the like. See Reference Material [3].
- **Individual service standard**: A standard for a service (service system) defined by an individual company, specific alliance, or the like. See Reference Material [3].
- **Individual application**: Application software that performs operations defined by an individual service standard. See Reference Material [3].

1.4.2 Abbreviations

- **AoA**: Angle of Arrival
- **BLE**: Bluetooth Low Energy
- **GAP**: Generic Access Profile
- **GNSS**: Global Navigation Satellite System
- **HMI**: Human Machine Interface
- **LED**: Light Emitting Diode
- **ToF**: Time of Flight

1.5 Revision details

1.5.1 Revision from Version 1.0 to Version 2.0

Information elements for autonomous vehicles and so on were added to the transmission messages for roadside units described in Chapter 4 of version 1.0 and issued as RC-019 (Reference Material [5]). Accordingly, descriptions of transmission messages for roadside units were deleted from version 2.0. It should be noted that the message structures described in RC-019 and RC-016 version 1.0 are not compatible, and therefore, test implementation areas are separated so that different messages are not both received within the area where the receiver is moving.

The “supplementation and integration processing of target information by RSUs” (described in sections 2.5.3 and 2.5.4 and Appendix 2 of version 1.0) has been deleted due to issues regarding feasibility (such as difficulty identifying communication partners) and the absence of clear benefits for providing integrated information.

Chapter 2. System Overview

This chapter provides an overview of Bicycle and Pedestrian Accident Prevention Support Systems.

2.1 System Structure

Figure 2-1 shows the system structure of the Bicycle and Pedestrian Accident Prevention Support Systems. The system is made up of bicycles, pedestrians, RSUs, and vehicles.

Bicycles, pedestrians, and vehicles acquire information from GNSS receiver units, accelerometers, and various other sensors and provide notice regarding their presence information to others in the vicinity via wireless communications (in the figure, B2V and so on).

RSUs acquire target presence information (“target information”) concerning bicycles, pedestrians, vehicles, and so on from radio units and roadside sensors and notify others in the vicinity using wireless communications and HMI such as LED display units. In addition, information is shared with other RSUs, cloud servers, and so on using external interfaces connecting to external networks such as the Internet.

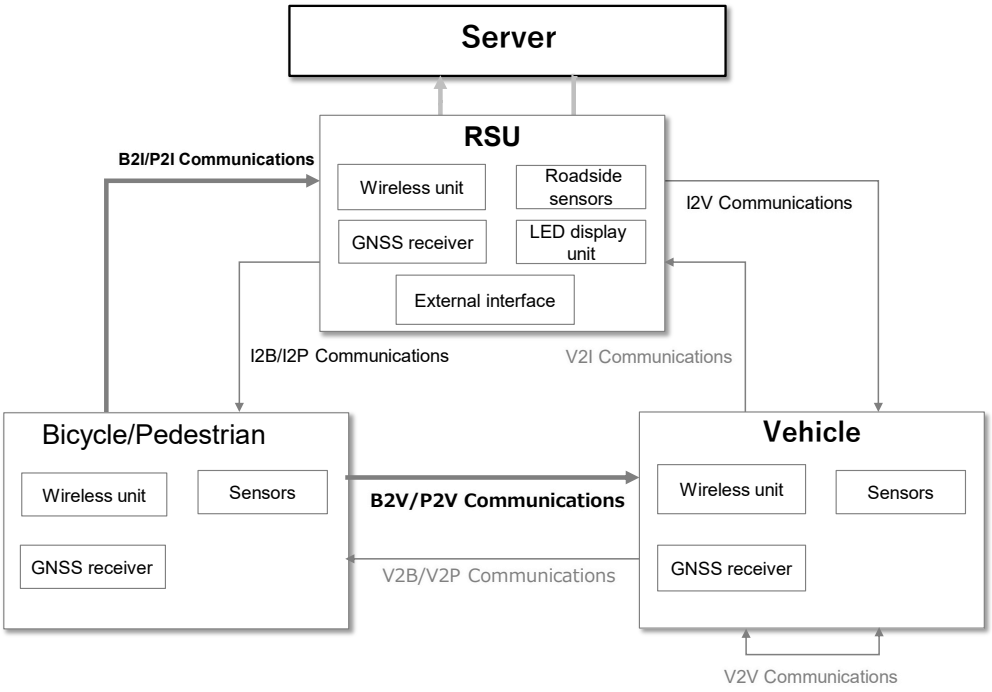


Figure 2-1. System Structure Conceptual Diagram

2.2 Use Cases

The system will be used to prevent accidents involving bicycles and pedestrians. The following use cases are anticipated.

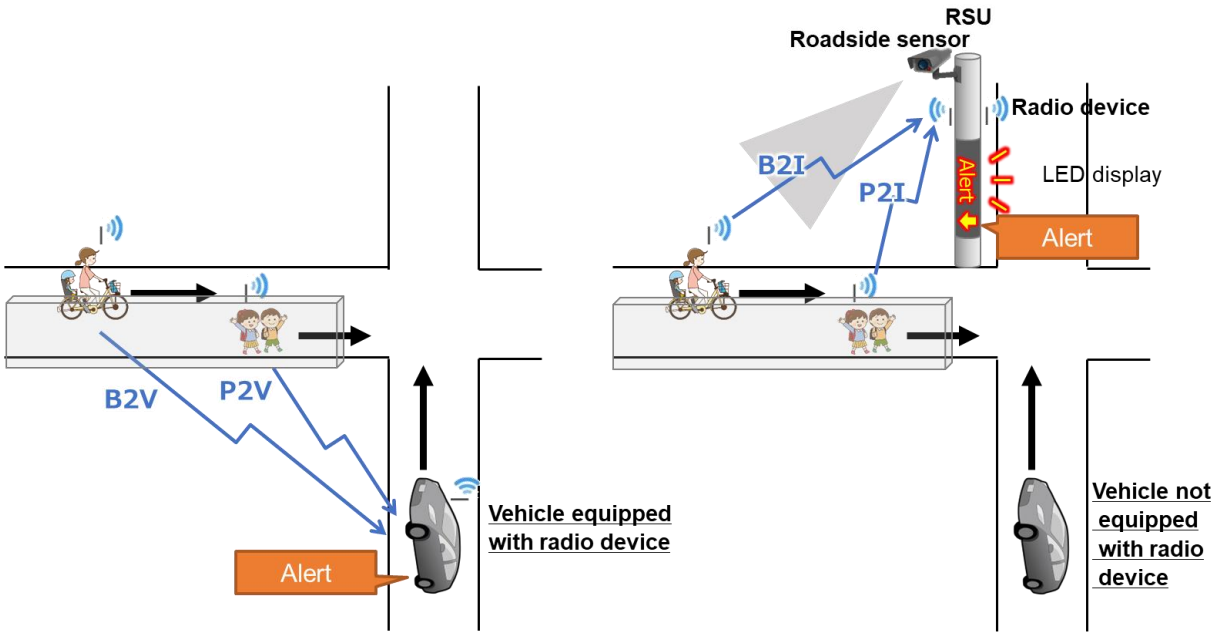
(a) Prevention of accidents involving an oncoming vehicle when entering an intersection without a traffic signal

(b) Prevention of accidents involving contact with an oncoming vehicle or other object when overtaking a vehicle to the front

(c) Prevention of accidents involving an oncoming vehicle when turning right across traffic

(d) Prevention of entrapment-type accidents when a vehicle hits a motorcycle or bicycle while turning left

Figure 2-2 provides an overview of the prevention of a typical accident that may occur at an intersection that does not have a traffic signal as described in (a). Bicycles and pedestrians periodically transmit their own presence information via wireless communication, and vehicles that receive that information issue a warning to the driver if the vehicle is approaching an intersection. Also, roadside units that receive this information issue a warning using an LED display to vehicles approaching the intersection.



(a) Support to vehicles equipped with radio devices (B2V / P2V)

(b) Support to vehicles not equipped with radio devices (B2I / P2I)

Figure 2-2. Conceptual Diagram of Prevention of Broadside Accidents

2.3 Use Cases Other Than Accident Prevention Support

Testers can use these Guidelines for applications other than accident prevention by the system. Some possible examples include use cases for support for watching over children and the elderly using external networks and for mitigating traffic congestion by providing information regarding road construction, stopped vehicles, and so on.

2.4 Transmissions by Bicycles and Pedestrians

The devices used by bicycles and pedestrians with the system must be compact and energy efficient, and for this reason, the transmitted information, transmission cycle, and wireless communications method may differ from those of vehicles. The wireless communications method and transmission frequency are described in Chapter 3.

Chapter 3. Bicycle and Pedestrian Transmission Message Specifications

This chapter defines the test message specifications for bicycles and pedestrians to provide notice of their own presence information to roadside units and vehicles.

3.1 Messages Specified in these Guidelines

3.1.1 Wireless Communications Method

These Guidelines anticipate that the 700 MHz band ITS system or Bluetooth® will be the wireless communications method used by bicycles and pedestrians.

In the case where the 700 MHz band is used, communications are carried out in accordance with the inter-vehicle communications format described in ARIB STD-T109 (Reference Material [1]) and ITS Forum RC-010 (Reference Material [2]).

In the case where Bluetooth® is used, the Extended Advertising (Bluetooth 5.0 or higher) described in the Bluetooth Low Energy GAP is used. The reason why Extended Advertising is used is that there are restrictions on the data set size, as described below, but for experimental purposes, the standard Advertising (Bluetooth 4.2, etc.) may be used.

For details concerning Bluetooth® and Bluetooth Low Energy, refer to the Bluetooth® Technology Core Specification (Reference Material [4]).

3.1.2 Positional Relationship of Message Specifications Defined in These Guidelines

For both the 700 MHz band and the Bluetooth®, the bicycle and pedestrian transmission message specifications comply with ITS FORUM RC-013 (Reference Material [3]). The layer structure relating to bicycle and pedestrian transmission messages is shown in Figure 3-1. These Guidelines define the method of setting the common fields of bicycle and pedestrian transmission messages and the specifications of data for use by bicycles and pedestrians stored in the free fields.

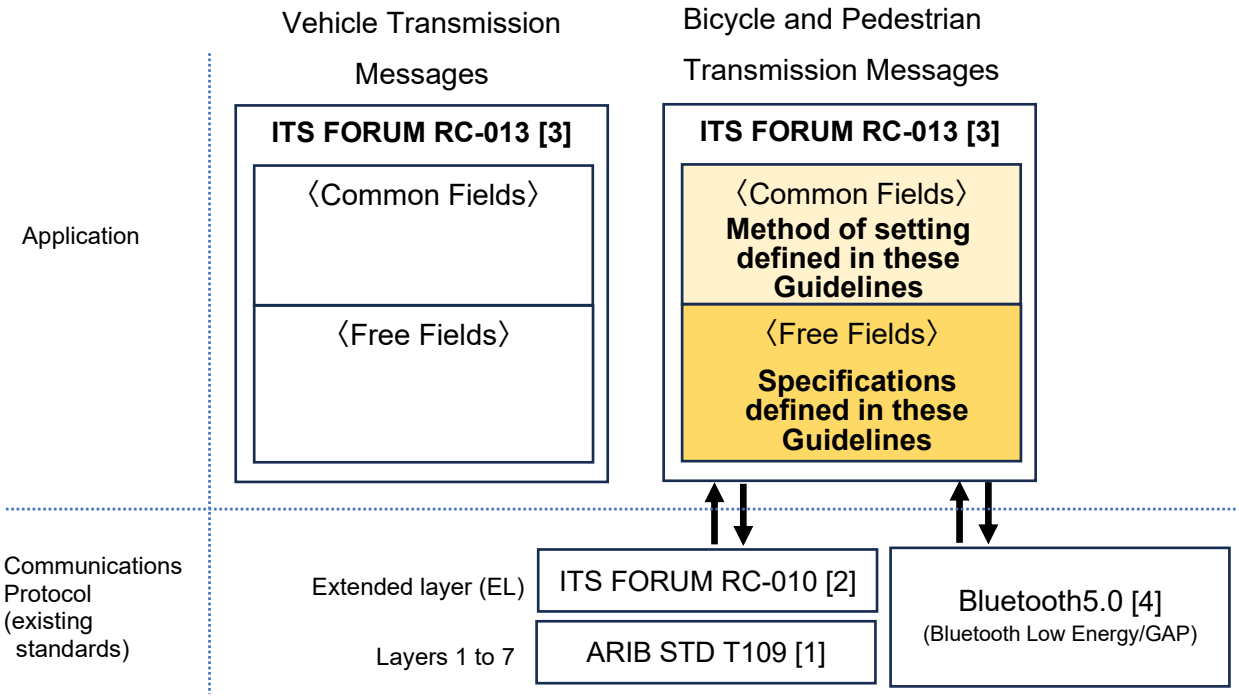


Figure 3-1. Layer Structure Relating to Bicycle and Pedestrian Messages in These Guideline

3.1.3 Transmission Cycle

Messages from bicycles and pedestrians are transmitted by sending periodic broadcasts. The transmission cycle is fundamentally 100 ms. In cases where the transmission cycle is made longer to curtail energy consumption by bicycle and pedestrian devices, it is recommended that a multiple of 100 ms be used. In cases where ARIB STD-T109 is used as the transmission format, the transmission cycle cannot be set to less than 100 ms. Also, in cases where Bluetooth® is used as the transmission format, the transmission cycle must be between 20 ms and 10.24 s.

3.1.4 Security Requirements

Practical application of the system's services requires security functions such as prevention of tampering and spoofing. Specifically, message authentication and encryption processing will be necessary. These Guidelines do not specify the methods for these functions, it is recommended that appropriate information security be insured according to the circumstances, even during experimentation.

3.2 Message Specifications

3.2.1 Common Fields

The common fields comply with RC-013. RC-013 is written with the premise of onboard devices equipped in vehicles, and accordingly, it is necessary to read the sections as applying to bicycles and pedestrians as well. Depending on the device installed on or worn by bicycles and pedestrians, it is expected that even for DEs where setting a value is mandatory, it may be possible to set only on undefined values. Therefore, device levels are defined, and Table 3-1 shows the DEs that permit undefined values to be input on each level. There are five device levels, with level 5 comprising devices capable of setting values other than undefined values for all DEs. Level 1 comprises devices that permit undefined values to be set, since values other than undefined values cannot be set for all DEs within DF_TimeInformation, DF_LocationInformation, and DF_VehicleStatusInformation. Levels two through four, which are intermediate levels, are also defined according to the scope of DEs that allow undefined value settings. Note that DEs for which undefined value input was originally permitted in RC-013 are indicated as “arbitrary.”

Table 3-1. Correspondence Table of DEs That Allow Undetermined Value Settings in Common Fields by Device Level

	Data Frame	Data Element	Data Length (bit)	Level 1	Level 2	Level 3	Level 4	Level 5
Common App Header Field	DF_CommonFieldManagementInformation	DE_CommonServiceStandardID	3	Possible	Possible	Possible	Possible	Possible
		DE_MessageID	2	Possible	Possible	Possible	Possible	Possible
		DE_VersionInformation	3	Possible	Possible	Possible	Possible	Possible
		DE_IncrementCounter	32	Possible	Possible	Possible	Possible	Possible
		DE_OptionFlag	8	Possible	Possible	Possible	Possible	Possible
		DE_CommonAppDataLength	8	Possible	Possible	Possible	Possible	Possible
Common App Data Field (excluding optional fields)	DF_TimeInformation	DE_LeapSecondCorrectionInformation	1	0 Fixed	0 Fixed	0 Fixed	0 Fixed	Possible
		DE_Time(Hours)	7	RC-013 Undetermined	RC-013 Undetermined	RC-013 Undetermined	RC-013 Undetermined	Possible
		DE_Time(Minutes)	8	RC-013 Undetermined	RC-013 Undetermined	RC-013 Undetermined	RC-013 Undetermined	Possible
		DE_Time(Seconds)	16	RC-013 Undetermined	RC-013 Undetermined	RC-013 Undetermined	RC-013 Undetermined	Possible
	DF_LocationInformation	DE_Latitude	32	RC-013 Undetermined	RC-013 Undetermined	RC-013 Undetermined	Possible	Possible
		DE_Longitude	32	RC-013 Undetermined	RC-013 Undetermined	RC-013 Undetermined	Possible	Possible
		DE_Elevation (Arbitrary)	16	RC-013 Undetermined	RC-013 Undetermined	RC-013 Undetermined	Arbitrary	Arbitrary
		DE_PositionConfidence	4	RC-013 Undetermined	RC-013 Undetermined	RC-013 Undetermined	Possible	Possible
		DE_ElevationConfidence (Arbitrary)	4	RC-013 Undetermined	RC-013 Undetermined	RC-013 Undetermined	Arbitrary	Arbitrary
	DF_VehicleStatusInformation	DE_VehicleSpeed	16	RC-013 Undetermined	Possible	Possible	Possible	Possible
		DE_Heading	16	RC-013 Undetermined	RC-013 Undetermined	Possible	Possible	Possible
		DE_Forward/RearAcceleration	16	RC-013 Undetermined	Possible	Possible	Possible	Possible
		DE_SpeedConfidence	3	RC-013 Undetermined	Possible	Possible	Possible	Possible
		DE_HeadingConfidence	3	RC-013 Undetermined	RC-013 Undetermined	Possible	Possible	Possible
		DE_Forward/RearAccelerationConfidence	3	RC-013 Undetermined	Possible	Possible	Possible	Possible
		DE_TransmissionState(Arbitrary)	3	RC-013 Undetermined	RC-013 Undetermined	Arbitrary	Arbitrary	Arbitrary
		DE_SteeringWheelAngle(Arbitrary)	12	RC-013 Undetermined	RC-013 Undetermined	Arbitrary	Arbitrary	Arbitrary
	DF_VehicleAttributeInformation	DE_VehicleSizeClassification	4	Possible	Possible	Possible	Possible	Possible
		DE_VehicleRoleClassification	4	Possible	Possible	Possible	Possible	Possible
		DE_VehicleWidth(Arbitrary)	10	Arbitrary	Arbitrary	Arbitrary	Arbitrary	Arbitrary
		DE_VehicleLength(Arbitrary)	14	Arbitrary	Arbitrary	Arbitrary	Arbitrary	Arbitrary

3.2.2 Free Fields

In free fields, bicycle transmission individual app data is stored for messages transmitted by bicycles, and pedestrian transmission individual app data is stored for messages transmitted by pedestrians (DF_FreeFieldManagementInformation and DF_IndividualAppDataManagementInformationSet are configured in accordance with RC-013). Figure 3-2 shows the data structure of the free fields for bicycle transmission messages and pedestrian transmission messages. Bicycle transmission individual app data

comprises DF_Bicycle/PedestrianCommonInformation, DF_BicycleSpecificBasicInformation, and DF_BicycleSpecificExtendedInformation. Pedestrian transmission individual app data comprises DF_Bicycle/PedestrianCommonInformation and DF_PedestrianSpecificInformation.

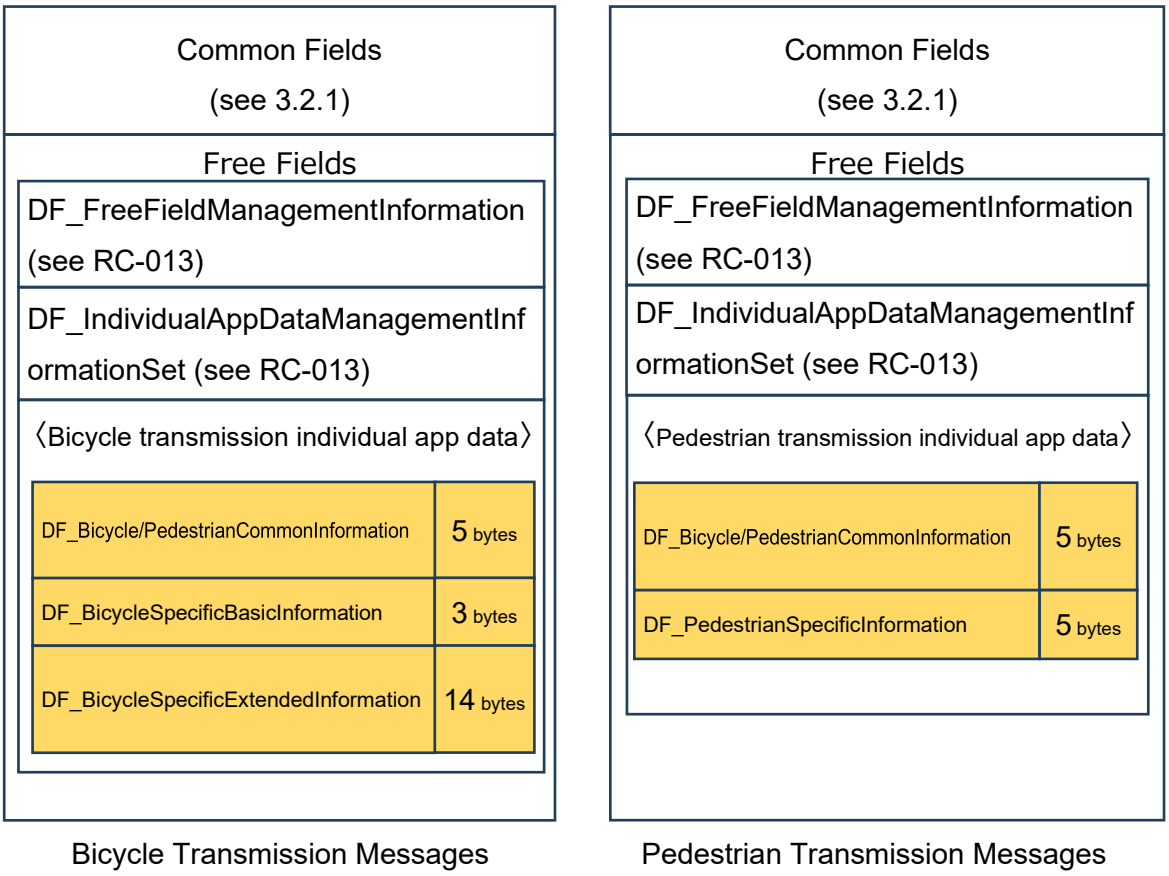


Figure 3-2. Data Structure of the Free Fields for Bicycle and Pedestrian Transmission Messages

Chapter 4. Data Frames

This chapter describes data frames stored in the free fields of bicycle and pedestrian transmission messages.

4.1 DF_Bicycle/PedestrianCommonInformation

Bicycle and pedestrian common information is information stored in common in bicycle transmission messages and pedestrian transmission messages. The structure is indicated in Table 4-1. This data frame comprises DE_EquippedDeviceLevelInformation, DE_TransmissionLagTime, and DE_MonitoringData. The total data size is 5 bytes (equal to 40 bits).

Table 4-1. DF_Bicycle/PedestrianCommonInformation

Structure DF/DE	Size	Remarks
DF_Bicycle/PedestrianCommonInformation	40bit	
DE_EquippedDeviceLevelInformation	3 bits	
DE_TransmissionLagTime	5 bits	
DE_MonitoringData	32 bits	

4.2 DF_BicycleSpecificBasicInformation

DF_BicycleSpecificBasicInformation

DF_BicycleSpecificBasicInformation is basic information regarding the bicycle stored in bicycle transmission messages. The structure is shown in Table 4-2. This data frame comprises DE_AssistType, DE_BicycleType, and other data elements. The total data size is 3 bytes (equal to 24 bits).

Table 4-2. DF_BicycleSpecificBasicInformation

Structure DF/DE	Size	Remarks
DF_BicycleSpecificBasicInformation	24bit	
DE_AssistType	4 bits	
DE_BicycleType	4 bits	
DE_AssistStatus	2 bits	
DE_PedalingStatus	2 bits	
DE_BicycleDriveForce	8 bits	
DE_Collision/FallDetection	4 bits	

4.3 DF_BicycleSpecificExtendedInformation

DF_BicycleSpecificExtendedInformation is detailed information relating to the bicycle stored in bicycle transmission messages. It is information that can be expected to be used in the future as functions of the system as an accident prevention support system are expanded. The structure is shown in Table 4-3. This data frame comprises DE_ShiftStagesNumber(Main), DE_TireCircumference, and other data elements. The total data size is 14 bytes (equal to 112 bits). The reserved element is for future expanded use, and under the current version, all four bits are set to 0.

Table 4-3. DF_BicycleSpecificExtendedInformation

Structure DF/DE	Size	Remarks
DF_BicycleSpecificExtendedInformation	112bit	
DE_ShiftStagesNumber(Main)	5bit	
DE_ShiftStagesNumber(MainMaximum)	5bit	
DE_ShiftStagesNumber(Sub)	5bit	
DE_ShiftStagesNumber(SubMaximum)	5bit	
DE_TireCircumference	8bit	
DE_Cadence	8bit	
DE_GearRatio	10bit	
DE_DriverTorque	8bit	
DE_MotorTorque	8bit	
DE_AssistPowerLimit	8bit	
DE_AssistPower	8bit	
DE_Power(HumanPower)	8bit	
DE_RemainingBatteryLimit	8bit	
DE_RemainingBattery	8bit	
DE_RearLight	2bit	
DE_DUStatus	2bit	
DE_MaintenanceAlert	2bit	
Reserved	4bit	

4.4 DF_PedestrianSpecificInformation

DF_PedestrianSpecificInformation is information regarding the pedestrian's portable or wearable device and the pedestrian's status that is stored in pedestrian transmission messages. The structure is shown in Table

4-4. This data frame comprises DE_Portable/WearableItemInformation, DE_ActivityStatus, and other data elements. The total data size is 5 bytes (equal to 40 bits).

Table 4-4. DF_PedestrianSpecificInformation

Structure DF/DE	Size	Remarks
DF_PedestrianSpecificInformation	40bit	
DE_Portable/WearableItemInformation	6bit	
DE_StepsNumber	16bit	
DE_ActivityStatus	2bit	
Reserved	16bit	

Chapter 5. Data Elements

This chapter describes the data elements that comprise bicycle and pedestrian transmission messages.

5.1 DF_Bicycle/PedestrianCommonInformation

The definitions of the data elements that comprise DF_Bicycle/PedestrianCommonInformation are set forth below.

5.1.1 DE_DE_EquippedDeviceLevelInformation

Data name	DE_DE_EquippedDeviceLevelInformation
Definition	Information indicating the level of the equipped, carried, or worn device. For information regarding device levels, see Table 3-1. If unspecified, set to 7.
Data size	3 bits
Data type	Unsigned integer
Expression range	1 to 5
Resolution	1

5.1.2 DE_TransmissionLagTime

Data name	DE_TransmissionLagTime
Definition	Indicates the lag time that occurs from data acquisition from a sensor or other device to message transmission in a device equipped, carried, or worn by a pedestrian. Such to the longest delay that can occur in the device. If the lag time is 300 ms or more, set to 300 ms (30). If unspecified, set to 31.
Data size	5 bits
Data type	Unsigned integer
Expression range	0 ms to 300 ms
Resolution	10 ms

5.1.3 DE_Monitoring Data

Data name	DE_MonitoringData
Definition	A data element used for monitoring applications. The DE is not described with specificity in these Guidelines. If used, it is necessary to take measures to protect personal information and so on. If this DE is not used, set all bits to 0.
Data size	32 bits
Data type	T.B.D
Expression range	T.B.D
Resolution	T.B.D

5.2 DF_BicycleSpecificBasicInformation

The definitions of the data elements that comprise DF_BicycleSpecificBasicInformation are set forth below.

5.2.1 DE_AssistType

Data name	DE_AssistType
Definition	Indicates the bicycle power assist type. If unspecified, set to 0.
Data size	4 bits
Data type	Enumerated
Allocation	0: Undefined 1: Non-electric power assist bicycle 2: Electric-power assist bicycle (up to 24 km/h) 3 to 15: Reserved (for legal amendment, overseas use, etc.)

5.2.2 DE_BicycleType

Data name	DE_BicycleType
Definition	Indicates the bicycle type. If unspecified, set to 0.
Data size	4 bits
Data type	Enumerated
Allocation	0: Undefined 1：City 2：Cross 3：Road 4：MTB 5：Child seat 6：For kids 7：Tricycle 8 to15：Reserved

5.2.3 DE_AssistStatus

Data name	DE_AssistStatus
Definition	Indicates the assist status of the bicycle. If unspecified, set to 0.
Data size	2 bits
Data type	Enumerated
Allocation	0: Undefined 1: Assist OFF 2: Assist ON 3: Self-driving function ON

5.2.4 DE_PedalingStatus

Data name	DE_PedalingStatus
Definition	Indicates the pedaling status of the bicyclist. If unspecified, set to 0.
Data size	2 bits
Data type	Enumerated
Allocation	0: Undefined 1: No pedaling 2: Currently pedaling 3: Reserved

5.2.5 DE_BicycleDriveForce

Data name	DE_BicycleDriveForce
Definition	Indicates the drive force of the bicycle. In the case of 2,540 W or more, set as 254 (0xFE), and if unclear because of a lack of a sensor or otherwise, set as 255 (0xFF).
Data size	8 bits
Data type	Unsigned integer
Expression range	0 W – 2,540 W
Resolution	10 W

5.2.6 DE_Collision/FallDetection

Data name	DE_Collision/FallDetection
Definition	Indicates the collision or fall status of the bicycle (TBD).
Data size	4 bits
Data type	Enumerated
Allocation	0: Undefined 1 to 15: TBD

5.3 DF_BicycleSpecificExtendedInformation

The definitions of the data elements that comprise DF_BicycleSpecificExtendedInformation are set forth below.

5.3.1 DE_ShiftStagesNumber(Main)

Data name	DE_ShiftStagesNumber(Main)
Definition	Indicates the number of stages of the main gear of the bicycle. This item is used for bicycles that have only one gear. If unspecified, set to zero (0x00).
Data size	5 bits
Data type	Unsigned integer
Expression range	1 speed (low end) to 31 speeds (top end)
Resolution	1 speed

5.3.2 DE_ShiftStagesNumber(MainMaximum)

Data name	DE_ShiftStagesNumber(MainMaximum)
Definition	Indicates the maximum number of stages of the main gear of the bicycle. This item is used for bicycles that have only one gear. If unspecified, set to zero (0x00).
Data size	5 bits
Data type	Unsigned integer
Expression range	1 speed (low end) to 31 speeds (top end)
Resolution	1 speed

5.3.3 DE_ShiftStagesNumber(Sub)

Data name	DE_ShiftStagesNumber(Sub)
Definition	Indicates the number of stages of the sub gear of the bicycle. Unspecified for bicycles that have only one gear. (If unspecified, set to zero (0x00)).
Data size	5 bits
Data type	Unsigned integer
Expression range	1 speed (low end) to 31 speeds (top end)
Resolution	1 speed

5.3.4 DE_ShiftStagesNumber(SubMaximum)

Data name	DE_ShiftStagesNumber(SubMaximum)
Definition	Indicates the maximum number of stages of the sub gear of the bicycle. Unspecified for bicycles that have only one gear. (If unspecified, set to 0(0x00)).
Data size	5 bits
Data type	Unsigned integer
Expression range	1 speed (low end) to 31 speeds (top end)
Resolution	1 speed

5.3.5 DE_TireCircumference

Data name	DE_TireCircumference
Definition	Indicates the tire circumference of the bicycle. If 2,550 mm or more, set to 255 (0xFF), if unspecified, set to 0 (0x00).
Data size	8 bits
Data type	Unsigned integer
Expression range	10 mm to 2,550 mm
Resolution	10 mm

5.3.6 DE_Cadence

Data name	DE_Cadence
Definition	Indicates the cadence of the bicycle. If 254 rpm or higher, set to 254 (0xFE), if unspecified, set to 255 (0xFF).
Data size	8 bits
Data type	Unsigned integer
Expression range	0 rpm to 254 rpm
Resolution	10 rpm

5.3.7 DE_GearRatio

Data name	DE_GearRatio
Definition	Indicates the gear ratio of the bicycle. The gear ratio is expressed as the number of rotations of the rear wheel/number of rotations of the crank. If 1,023% or higher, set to 1023 (0x3FF), if unspecified, set to 0 (0x00).
Data size	10 bits
Data type	Unsigned integer
Expression range	1% to 1,023%
Resolution	1%

5.3.8 DE_DriverTorque

Data name	DE_DriverTorque
Definition	Indicates the driver torque of the bicycle. If 254 Nm or higher, set to 254 (0xFE), if unspecified, set to 255 (0xFF).
Data size	8 bits
Data type	Unsigned integer
Expression range	0 Nm to 254 Nm
Resolution	1 Nm

5.3.9 DE_MotorTorque

Data name	DE_MotorTorque
Definition	Indicates the motor torque of the bicycle. If 254 Nm or higher, set to 254 (0xFE), if unspecified, set to 255 (0xFF).
Data size	8 bits
Data type	Unsigned integer
Expression range	0 Nm to 254 Nm
Resolution	1 Nm

5.3.10 DE_AssistPowerLimit

Data name	DE_AssistPowerLimit
Definition	Indicates the upper limit of power assist of the bicycle. If 2,540 W or higher, set to 254 (0xFE), if unspecified, set to 255 (0xFF).
Data size	8 bits
Data type	Unsigned integer
Expression range	0 W to 2,540 W
Resolution	10 W

5.3.11 DE_AssistPower

Data name	DE_AssistPower
Definition	Indicates the power assist of the bicycle. If 2,540 W or higher, set to 254 (0xFE), if unspecified, set to 255 (0xFF).
Data size	8 bits
Data type	Unsigned integer
Expression range	0 W to 2,540 W
Resolution	10 W

5.3.12 DE_Power(HumanPower)

Data name	DE_Power(HumanPower)
Definition	Indicates the power of the driver. If 1,270 W or higher, set to 254 (0xFE), if unspecified, set to 255 (0xFF).
Data size	8 bits
Data type	Unsigned integer
Expression range	0 W to 1,270 W
Resolution	5 W

5.3.13 DE_RemainingBatteryLimit

Data name	DE_RemainingBatteryLimit
Definition	Indicates the upper limit of the remaining battery power of the bicycle. If 2,540 Wh or higher, set to 254 (0xFE), if unspecified, set to 255 (0xFF).
Data size	8 bits
Data type	Unsigned integer
Expression range	0 Wh to 2,540 Wh
Resolution	10 Wh

5.3.14 DE_RemainingBattery

Data name	DE_RemainingBattery
Definition	Indicates the remaining battery power of the bicycle. If 2,540 Wh or higher, set to 254 (0xFE), if unspecified, set to 255 (0xFF).
Data size	8 bits
Data type	Unsigned integer
Expression range	0 Wh to 2,540 Wh
Resolution	10 Wh

5.3.15 DE_RearLight

Data name	DE_RearLight
Definition	Indicates the status of the bicycle's rear light. If unspecified, set to 0.
Data size	2 bits
Data type	Enumerated
Allocation	0: Unspecified 1: OFF 2: ON 3: Reserved

5.3.16 DE_DUStatus

Data name	DE_DUStatus
Definition	Indicates the status of the bicycle's drive unit. If unspecified, set to 0.
Data size	2 bits
Data type	Enumerated
Allocation	0: Unspecified 1: Normal 2: Abnormal 3: Reserved

5.3.17 DE_MaintenanceAlert

Data name	DE_MaintenanceAlert
Definition	Indicates whether the bicycle needs maintenance. If unspecified, set to 0.
Data size	2 bits
Data type	Enumerated
Allocation	0: Unspecified 1: Normal 2: Abnormal 3: Reserved

5.4 DF_PedestrianSpecificInformation

The definitions of the data elements that comprise DF_PedestrianSpecificInformation are set forth below.

5.4.1 DE_Portable/WearableItemInformation

Data name	DE_Portable/WearableItemInformation
Definition	Indicates the item to which the device that collects pedestrian information is attached. If unspecified, set to 63.
Data size	6 bits
Data type	Enumerated
Allocation	0：Reserved 1: Children's shoes 2: Shoes for seniors 3~62：Reserved 63：Unspecified

5.4.2 DE_StepsNumber

Data name	DE_StepsNumber
Definition	Indicates the number of steps taken by the pedestrian. If 65,534 or more, set to 65534(0xFFFE). If unspecified, set to 0xFFFF.
Data size	16 bits
Data type	Unsigned integer
Expression range	0 steps to 65,534 steps
Resolution	1 step * The device transmits the detected number of steps without modification. In cases where one shoe is equipped with a radio device, two steps are counted as one, but the transmitted value is the detected number of steps not multiplied by two. Multiplication by two is performed on the server side.

5.4.3 DE_ActivityStatus

Data name	DE_ActivityStatus
Definition	Indicates the number of steps the pedestrian is taking per minute. If unspecified, set to 3.
Data size	2 bits
Data type	Enumerated
Allocation	0：Stationary (less than 20 steps) 1：Walking (20 to less than 140 steps) 2：Running (140 or more steps) 3: Unspecified