ITU FNC Session 4

V2X communication for Cooperative Driving Automation

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SIP Cabinet Office

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1.SIP-adus Initiative

ADS (Automated Driving Systems)

Safe and secure mobility for all

Competition

Cooperation

- **FOTs (Tokyo waterfront area etc.)**
- **Technology**
  - Establishment of digital infrastructure
  - Unification of data format and interface
  - Safety assurance and cybersecurity etc.
- **Public acceptance**
- **International cooperation/ Standardization**

SIP ; Strategic Innovation Promotion Program

adus; Automated driving system for universal service

2. Current status and challenges of Cooperative Driving Automation (CDA)

◆ Current status of ITS wireless communication in Japan

- ETC / ETC2.0 (DSRC): Toll collection and Expressway information since 2000
- ITS Connect (DSRC): Support for safe driving at general road intersections since 2015

◆ Challenges for realizing CDA

- Can ITS communication, which has already been put into practical use, be used for CDA?
- What kind of communication method is needed in the era of automated driving?

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- **TF on V2X communication for CDA has been established in SIP-adus since 2019**
- **Started researching communication methods for CDA**

3. Activities of TF on V2X Communication for CDA

◆ Activities of TF on V2X Communication for CDA

- Define CDA
- Develop CDA use cases based on the definition

Phase1

Done

- Define communication requirements based on use cases
- Examination of applicability of existing ITS communication

Phase2

- Technology verification for Communication methods (frequency / bandwidth) for CDA
- Proposal of communication method and the roadmap

Phase3

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4. SIP Use Case for CDA 1st Edition Overview

SIP Cooperative Driving Automation Use Case 1st Edition

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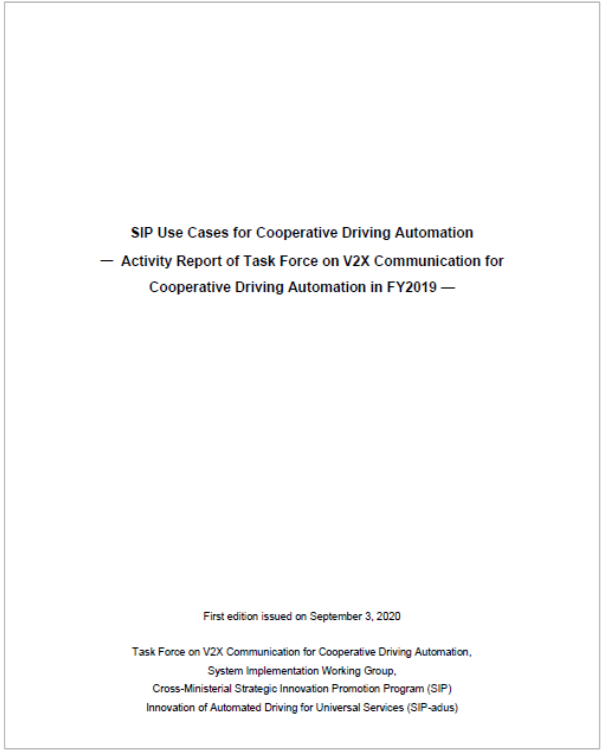

SIP Use Cases for Cooperative Driving Automation

— Activity Report of Task Force on V2X Communication for Cooperative Driving Automation in FY2019 —

First edition issued on September 3, 2020

Task Force on V2X Communication for Cooperative Driving Automation,
System Implementation Working Group,
Cross-Ministerial Strategic Innovation Promotion Program (SIP)
Innovation of Automated Driving for Universal Services (SIP-adus)

https://en.sip-adus.go.jp/rd/rddata/usecase.pdf

4. SIP Use Case for CDA 1st Edition Overview

◆ Cooperative automated driving system definition

Cooperative automated driving system is that enables safer and smoother automated driving control based on the autonomous driving system, by obtaining the information not detected by the in-vehicle sensor, by providing the information possessed by the vehicles, and by communicating mutually by using V2I and V2V.

- **Communication reliability cannot be guaranteed 100%**
- **Automated Driving control must be done by in-vehicle sensors**
- **Support on autonomous driving by communication**
- **Utilize communication to enable safer and smoother automated driving**

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5. V2X communication and Roadmap for CDA

Selected 25 feasible use cases

3.communicating mutually by using V2I and V2V (7)

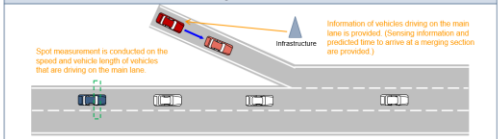
2.providing the information possessed by the vehicles (4)

1.obtaining the information not detected by the in-vehicle sensor (14)

(1) Use cases in which information outside the detection range of on-board sensors must be obtained
a. Merging/lane change assistance
a-1-1. Merging assistance by 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

SIP Use case for CDA

study communication method based on the use case

Communication requirements for CDA

Proposal for V2X communication method

5. V2X communication and Roadmap for CDA

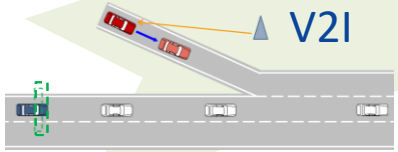
Merging and lane change support

congestion

Complexity of traffic environment

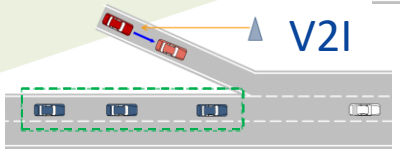
SIP FOT in Tokyo

Preliminary acceleration and deceleration support



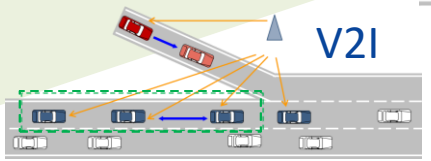
Traffic flow sensing by spot

Main line gap aiming merge support



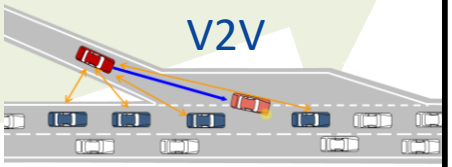
Traffic flow sensing by area

Merging control by infrastructure



Control request by infrastructure

Merging by negotiation between cars



Negotiation between cars

Difficulty of communication

Free flow

2020

20XX

Penetration of CDA

6. Next step

- Define CDA
- Develop CDA use cases based on the definition

Phase1

Done

- Define communication requirements based on use cases
- Examination of applicability of existing ITS communication

Phase2
FY2020

- Technology verification for Communication methods (frequency / bandwidth) for CDA
- Proposal of communication methods and the roadmap

Phase3
FY2021

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6. Next step

◆ Organization

TF on V2X communication for CDA

Phase1

-ITS-related ministries
-Academic experts
-Japan Automobile Manufacturers Association

Phase2/Phase3

-National Institute for Land and Infrastructure Management
-UTMS Society of Japan
-Japan Electronics and Information Technology Industries Association
-ITS Info-communications Forum
-Society Automotive Engineers of Japan

7. Summary

- Studying communication methods for CDA in SIP-adus
- Completed the development of use cases to be the basis for the next research
- Use cases opened to the public

  (SIP-adus homepage: https://en.sip-adus.go.jp/rd/rddata/usecase.pdf)
- Started to define the communication requirements based on the use cases and the applicability to existing ITS communication.
- If it is not applicable to existing ITS wireless communication, a new communication method to be considered
- Provide the proposal of communication method for CDA and roadmap by the end of FY2021

Thank you