SIP Roadmap of V2X Communication Methods
for Cooperative Driving Automation
- Activity Report of Task Force on V2X Communication
for Cooperative Driving Automation in FY2021 -

I. Use Case Deployment Plan

The use case deployment plan was arranged for each communication method.

（1） Use Case Deployment Plan (V2I: Vehicle to Infrastructure)

		2025-	2030-	2035-	2040-
Safe driving support / Cooperative driving automation	Safe driving support	▼ Assumed from existing service provision status (assumed by contractor) b-1-1. Driving assistance by using traffic signal information (V2I) **Service has already started to be provided by ITS Connect for some uses cases (red light alert and guidance on preparing to start when waiting at a traffic light)** ▼ Assumed from existing service provision status (assumed by contractor) c-2-2. Driving assistance based on intersection information (V2I) **Service has already started to be provided by ITS Connect for some uses cases (right turn alert)**	▼: Assumptions on timing of use case start ●: Assumptions on development plans for related infrastructure, etc. **(Bold text=Assumed form descriptions in roadmap, etc. by related ministries and agencies;** fine text=Assumed by contractor)		
	Cooperative driving Automation	**▼ Public-Private ITS Initiative/Roadmaps "driverless automated driving transport services in limited areas may spread to 40 or more areas by the rough target of FY 2025"** ▼ In order to realize driverless automated driving transport services in limited areas, b-1-1 and c-2-2 are assumed to be necessary, and start in about 2025 is assumed (contractor assumption) b-1-1. Driving assistance by using traffic signal information (V2I) c-2-2. Driving assistance based on intersection information (V2I) ● **Locations where mobility services are deployed: 40 (Public-Private ITS Initiative/Roadmaps)**	● Locations where mobility services are deployed: 100 (contractor assumption)	● Locations where mobility services are deployed further expand (contractor assumption)	
		▼ Public-Private ITS Initiative/Roadmaps "Realization of Level 4 automated driving of trucks on expressways around FY 2025" ▼ Working to realize mainline merging assistance in order to realize goals of Public-Private ITS Initiative/Roadmaps in assumed (contractor assumption) Mainline merging assistance (V2I) *1 a-1-1, a-1-2			**▼ Merging assistance Day 3 system** **Adoption rate of automated driving 30% of greater (From JAMA materials)** a-1-3. Cooperative merging assistance with vehicles on the mainline by roadside control(V2I) ● About 30% adoption rate of automated driving (L3 or higher) reached (contractor assumption)

*1　a-1-1. Merging assistance by preliminary acceleration and deceleration
　　a-1-2. Merging assistance by targeting the gap on the mainline

（2）　Use Case Deployment Plan (V2V: Vehicle to Vehicle)

		2025-	2030-	2035-	2040-

▼：Assumptions on timing of use case start
●：Assumptions on development plans for related infrastructure, etc.
(Bold text=Assumed form descriptions in roadmap, etc. by related ministries and agencies;　fine text=Assumed by contractor)

Safe driving support support

▼ Assumed from existing service provision status (assumed by contractor)

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

Service has already started to be provided by ITS Connect for some uses cases (right turn alert)

▼ Assumed from existing service provision status (assumed by contractor)

e-1(1). Driving assistance based on emergency vehicle information (V2V) *1

Service has already started to be provided by ITS Connect for some uses cases (notification of emergency vehicle presence)

c-1. Collision avoidance assistance when a vehicle ahead stops or decelerates suddenly (V2V)

c-3. Collision avoidance assistance by using hazard information (V2V)

Cooperative driving Automation

▼ Assumed from provision status for existing services for safe driving (assumed by contractor)

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

e-1(1). Driving assistance based on emergency vehicle information (V2V)*1

▼ **Public-Private ITS Initiative/Roadmaps "Goal for 2030: Achieve a safe and convenient digital transportation society that supports the affluent lifestyles of people, ahead of the rest of the world"**
▼ Working to realize c-1 services in order to realize goals of Public-Private ITS Roadmaps is assumed (contractor assumption)

c-1. Collision avoidance assistance when a vehicle ahead stops or decelerates suddenly (V2V)

▼ Assumed to be realized later than c-1 because lane change assistance is also assumed (contractor assumption)

c-3. Collision avoidance assistance by using hazard information (V2V)

▼ **Merging assistance Day 4 system Adoption rate of automated driving 50% or greater (from JAMA materials)**

Merging assistance based on negotiations (V2V) *2
a-1-4, a-2, a-3

● About 50% adoption rate of automated driving (L3 or higher) reached (contractor assumption)

▼ **Commercialization of platooning (assumed in METI's "RoAD to the L4")**
▼ **Public-Private ITS Roadmaps "Realization of Level 4 automated driving of trucks on expressways around FY 2025"**
▼ Demonstration testing completed for similar services Deployment of demonstration results or early practical application assuming demonstration is assumed (contractor assumption)

Platooning (V2V) *3 *4
g-1. g-2

● Priority lanes set up on part of Osaka-Tokyo trunk expressway (contractor assumption)

● Priority lanes set up on Osaka-Tokyo trunk expressway (contractor assumption)

● Priority lanes expanded on Honshu trunk expressway (contractor assumption)

Vertical labels: Safe driving support / Cooperative driving automation

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*1　Transmissions of emergency vehicle information assumed to be limited to "in emergency driving"

*2　a-1-4. Merging assistance based on negotiations between vehicles (V2V)
　　a-2.　Lane change assistance when the traffic is heavy (V2V)
　　a-3.　Early assistance from non-priority roads to priority roads during traffic congestion (V2V)

*3　g-1.　Unmanned platooning of following vehicles by electronic towbar(V2V)
　　g-2.　Adaptive cruise control and manned platooning of following vehicles using adaptive cruise control (V2V)

*4　For limited vehicles (automated driving trucks, etc.)

（3） Use Case Deployment Plan (V2N: Vehicle to Network)

		2025-	2030-	2035-	2040-

▼：Assumptions on timing of use case start
●：Assumptions on development plans for related infrastructure, etc.
(Bold text=Assumed form descriptions in roadmap, etc. by related ministries and agencies; fine text=Assumed by contractor)

Safe driving support / Cooperative driving automation

Safe driving support

▼ Assumed that autonomous vehicles will take time to become adopted and that services for safe driving support will be provided for the time being
Assumed to start around 2025 based on SIP R&D trends (contractor assumption)

b-1-2. Driving assistance by using traffic signal information (V2N)

▼ Quick and extensive deployment is expected, and it is assumed that service will begin in 2025 as effects can be expected from starting early (contractor assumption)

Lookahead information: trajectory change (V2N) *1
d-1, d-2, d-3, d-4, d-5

▼ Assumed to start around 2025 based on SIP R&D trends (contractor assumption)

e-1(2). Driving assistance based on emergency vehicle information (V2N) *2

▼ Assumed from existing service provision status (assumed by contractor)

f-1. Request for rescue (e-Call) (V2N)

Service of some use cases has already started to be provided by HELPNET

▼ Service started by OEM telematics service (collection of vehicle and driving information)

▼ Assumed from existing service provision status (assumed by contractor)

f-2. Collection of information to optimize the traffic flow (V2N)

f-4. Distribution of dynamic map information (V2N)

▼Technical verification through demonstration testing is needed for f-3. *3

▼ Realization is expected later than other use cases because of the need for technical verification for realization (contractor assumption)

f-3. Update and automatic generation of maps (V2N)

Cooperative driving Automation

▼ Study and R&D for providing traffic signal information by V2N automated driving is underway at SIP
▼ Contractor assumption (Discussion is needed on when to start use cases for automated driving)

b-1-2. Driving assistance by using traffic signal information (V2N)

Lookahead information: trajectory change (V2N) *1
d-1, d-2, d-3, d-4, d-5

▼ Demonstration at SIP

▼ Assumed to the realized early based on SIP R&D trends (contractor assumption)

e-1(2). Driving assistance based on emergency vehicle information (V2N) *2

f-1. Request for rescue (e-Call) (V2N)

f-2. Collection of information to optimize the traffic flow (V2N)

f-4. Distribution of dynamic map information (V2N)

f-3. Update and automatic generation of maps(V2N)

▼ Practical application of mobile service vehicles using remote monitoring (assumed in METI's "Road to the L4")
▼ Public-Private ITS Initiative/Roadmaps "driverless automated driving transport services in limited areas may spread to 40 or more areas by the rough target of FY 2025"
▼ Demonstration testing implemented for similar services
▼ Deployment of demonstration results or early practical application assuming demonstration is assumed (contractor assumption)

h-1. Operation and management of mobility service cars (V2N) *4

● **Locations where mobility services are deployed: 40**   ● Locations where mobility services are deployed: 100 (contractor assumption)

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*1 d-1. Driving assistance by notification of abnormal vehicles (V2N), d-2. Driving assistance of wrong-way vehicles (V2N), d-3. Driving assistance based on traffic congestion information (V2N), d-4. Traffic congestion assistance at branches and exits (V2N), d-5. Driving assistance based on hazard information(V2N)
*2 Transmission of emergency vehicle information assumed to be "in emergency driving"
*3 From results of interviews with related organizations during the study of communication requirements
*4 For limited vehicles (on-demand bus, etc.)

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II. SIP Roadmap of V2X communication methods for cooperative driving automations to realize the use case deployment plan

The implementation items to realize the use case deployment plan were detailed, and a roadmap of V2X communication methods for cooperative driving automations was created.