Cross-ministerial Strategic Innovation Promotion Program (SIP) Phase 3: Building a Smart Mobility Platform—Research and Development of Support for Preemptive Prevention of Traffic Accidents Through Proactive Risk notification

Report of Project Results

March 2024

Traffic Accident Preemptive Prevention R & D Consortium

(Nippon Signal Co., Ltd., Sumitomo Electric Industries, Ltd., Honda Motor Company)

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1-1. Purpose and objectives of this research and development project

Societal issue to be resolved and purpose of the research and development project

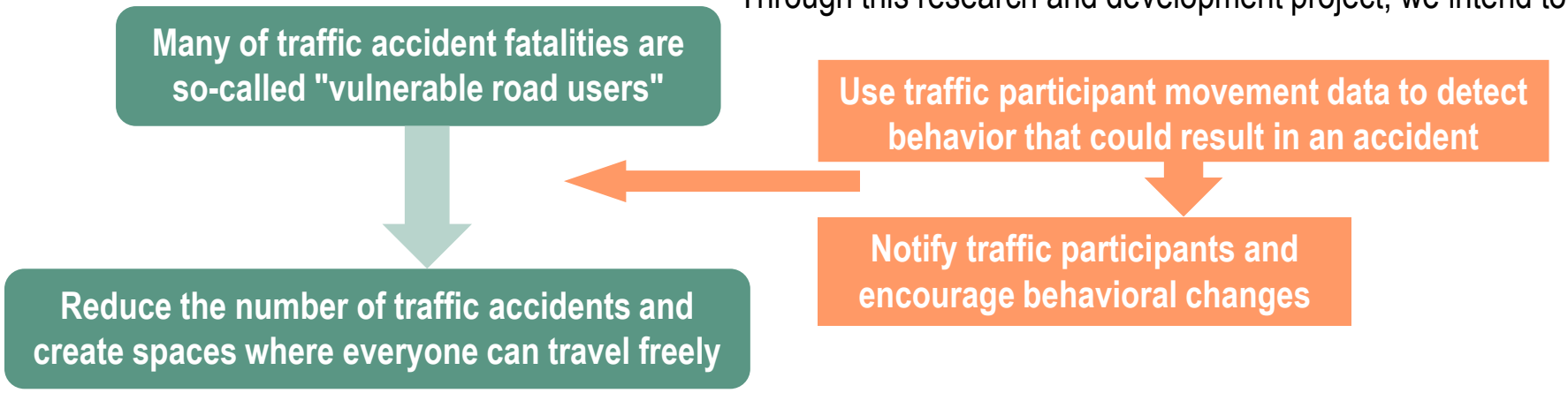
Societal issue to be resolved

- **Vulnerable road users** account for a large portion of traffic accident fatalities, so this project aims to **reduce the number of traffic accidents** by informing drivers of risks in advance.

Purpose of the research and development project

- This project consists of R&D regarding building data infrastructure that collects and integrates data, creating traffic infrastructure that uses advanced technologies, and utilizing V2X technologies, traffic signal information distribution technologies, and the like. The goal is to use these technologies to be able to **detect behavior from traffic participant movement data**, to **promote behavioral changes in users**, and to **create spaces where everyone can travel freely**.

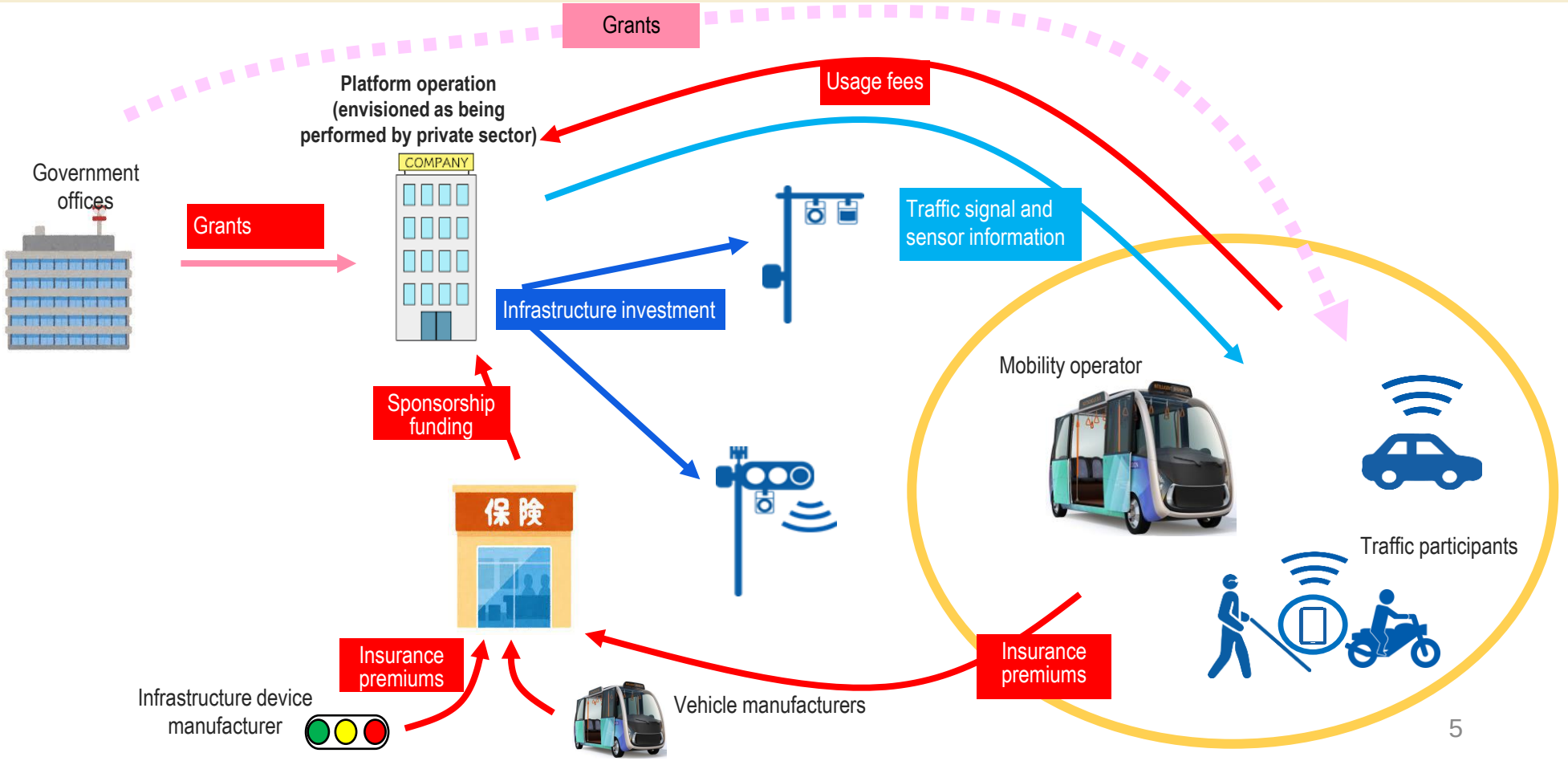
Through this research and development project, we intend to:



1-1. Purpose and objectives of this research and development project

Ideals when the results of this research and development project are deployed in the real world

- To maximize the traffic accident prevention effectiveness of the scheme created through this project, **it must be implemented across a wide range of manufacturers, without being limited to specific vehicle or device manufacturers**, and **ideally its specifications should be standardized and widely adopted**.
- The **platform at the heart of the scheme is envisioned as being operated by members of the private sector**.
- In addition to app usage fees, we have also considered **offsetting the cost by collecting insurance premiums, etc.** from mobility operators and vehicle manufacturers

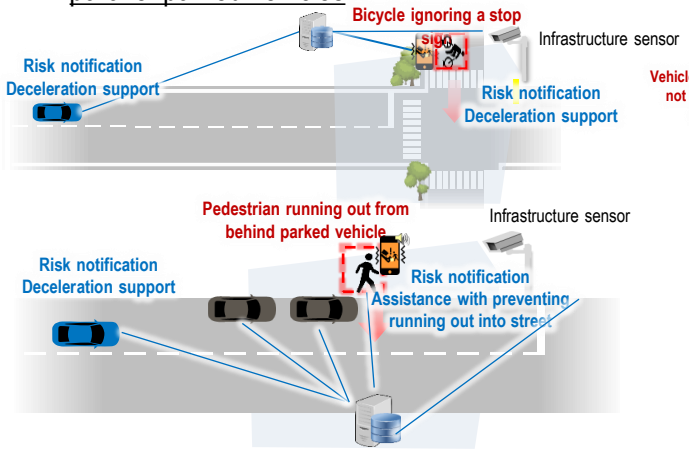


1-2. Overview of the research and development project

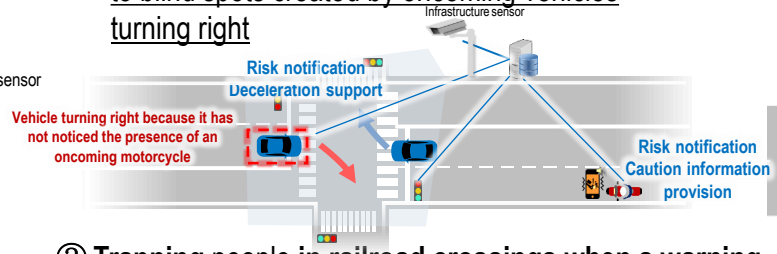
Use cases and categorization of research and development items

- We defined four use cases that represent specific traffic accident risks and are aiming to solve the problems involved.
- The research and development items consist of developing the devices and technologies needed to solve the problems involved in each representative use case, conducting technical verification projects, and verifying the effectiveness of each technology and service.

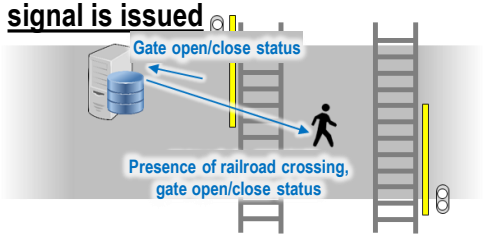
① **Pedestrians, etc., running out into the street** in intersections with blind spots or from between parallel-parked vehicles



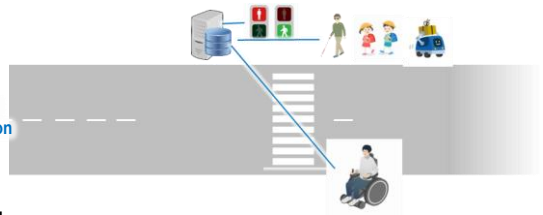
② **Not noticing the presence of motorcycles** due to blind spots created by oncoming vehicles turning right



③ **Trapping** people **in railroad crossings when a warning signal is issued**



④ **Traffic signal crossing by vulnerable road users/people using new means of mobility**



Research and development items	Activities performed in this research and development project
⑦-5	Perform and verify PoC for applying the technologies used to solve the problems involved in envisioned use cases to narrow urban streets and busy streets
⑦-6	Develop technical specifications for solve the problems involved in envisioned use cases, develop the technologies, and standardize the specifications
⑦-7	Based on the provision of V2X traffic signal information developed by SIP-adus, develop devices and verify information delivery when the scope of delivery of traffic signal information is expanded to all users within pedestrian spaces
⑦-9	Organize information regarding problems related to use cases and deliberate regarding countermeasures. Through this process, issue proposals for revisions to rules and systems that present bottlenecks to the implementation of envisioned services.

1-3. Process chart

Five year process chart for each implementation item

Research and development theme	Implementation item		2023 Q1	2023 Q2	2023 Q3	2023 Q4	2024 Q1	2024 Q2	2024 Q3	2024 Q4	2025 Q1	2025 Q2	2025 Q3	2025 Q4	2026 Q1	2026 Q2	2026 Q3	2026 Q4	2027 Q1	2027 Q2	2027 Q3	2027 Q4
⑦	5. Propose measures for creating narrow urban streets and busy streets that are free of fatal accidents and implement these measures in the real world	Develop specifications			■	■																
		Develop independent information collection and delivery app			■	■	■	■														
		Create independent risk evaluation algorithm technology			■	■	■	■														
		Internal testing					■	■	■	■												
		Comprehensive development and test course testing						■	■	■	■											
		Field verification										■	■	■								
		Deliberations aimed at standardization and real-world deployment													■	■	■	■	■	■	■	■
		Create input/output interfaces and standard message specifications													■	■	■	■				
		Coordinate with related organizations in real-world deployment																	■	■	■	■
		Large-scale verification testing (* deliberate on an as-needed basis based on work to be performed for theme 7 as a whole)													■	■	■	■	■	■	■	■
	6. Research and develop traffic infrastructure that reduces risk of road accidents, etc., involving cars, motorcycles, pedestrians, etc.	Develop specifications			■	■																
		Elemental technology verification integration testing					■	■	■	■												
		Field verification									■	■	■	■								
		Organize information regarding issues in preparation for standardization													■	■	■	■				
		Standardization																	■	■	■	■
	7. Develop V2X technologies and refine and perform verification tests of traffic signal information distribution, etc., to create safe spaces for pedestrians	Develop specifications			■	■																
		Elemental technology verification integration testing					■	■	■	■												
		Field verification									■	■	■	■								
		Organize information regarding issues in preparation for standardization													■	■	■	■				
		Standardization																	■	■	■	■
	9. Propose systems and rules	Perform theoretical study to identify legal systems and rules			■	■																
		Deliberate regarding each discussion point for use case implementation sites (specific regions, etc.)					■	■	■	■	■	■	■	■								
		Deliberate regarding each discussion point not only for specific regions, but for other regions as well													■	■	■	■	■	■	■	■

1-4. Goals

Research and development goals (for each research and development item)

Item	FY2025 interim goals	FY2027 ultimate goals
⑦-5	**Create verification testing specifications (documents)** in preparation for real-world deployment of roadside infrastructure and delivery applications. **Perform field verification and create summary of results.**	Based on field verification testing results, **arrange standardization and technology specifications necessary for real-world deployment, develop consensus with related organizations, exchange ideas with local governments**, etc.
⑦-6	**Define use cases and deliberate regarding technology specifications**, and then **carry out FOTs. Organize tasks involved in real-world deployment**, such as defining technology specifications, etc .	**Develop applications for users, perform real-world deployment**, **create specification documentation and standardize specifications in preparation for lateral roll-out, and create plans in preparation for practical application and commercialization**. (KGI: TRL of 7 or higher, BRL of 7 or higher, SRL of 6 or higher, HRL of 6 or higher (if the results of other R&D project plans have been integrated and an external environment has been prepared)
⑦-7	Conduct interviews with organizations for people with visual impairments, etc. and **identify issues with current Pedestrian Information and Communication Systems (PICS)**. Investigate latest technology trends and content of work performed by the UTMS Society of Japan in SIP Phase 3 and use this information for reference to propose and test an application that provides assistance to people with visual impairments when crossing intersections at traffic signal intersections. Furthermore, through this testing, **propose standards for system** used to deliver traffic signal information to compact mobility, etc., driving on sidewalks.	Have supporters experience services that use the platforms and applications that deli ver traffic signal information to people with visual impairments, compact mobility, auto nomous delivery robots, etc. Reach consensus with related parties (Japan Federatio n of the Visually Impaired, etc.) regarding **API specifications, HMI, etc. and create guidelines**. Additionally, **provide feedback to the UTMS Society of Japan, which deliberates standardization specifications, exchange opinions with local gover nments, and carry out promotional efforts to assist with deployment.** (KGI: TRL of 7 or higher, BRL of 7 or higher, SRL of 6 or higher, HRL of 6 or higher (if the result s of other R&D project plans have been integrated and an external environment has been prepared)
⑦-9	Perform a **theoretical study** to identify issues and bottlenecks in legal systems and rules and deliberate regarding business models. Then **organize information regarding legal issues and coordinate in prep aration to carry out initiatives at deployment sites to verify individu al use cases**.	**Exchange ideas and reach consensus with related government agencies, etc.**, regarding **issues and bottlenecks in legal systems and rules** (infrastructure preparation, power supply, procedures involving managing parties, etc.) identified through FOTs. At the same time, **provide recommendations regarding revisions to legal systems, etc., and create manuals**. Also **propose deployment business model**. (KGI: GRL of 5 or higher)

1-4. Goals

Research and development goals (overall)

SIP halfway point	End of SIP	After end of SIP
Target KPI • Complete mobility support technology development and technology evaluation • Flesh out mobility support technology specifications • Calculate accident reduction effectiveness in verification area	**Target KPI** • Propose production plans for mobility support technology • Publish reference roadmap for implementation of mobility support technologies in multiple cities • Calculate accident reduction effectiveness in multiple cities **Target X-RL** • TRL: Approx. 7 • BRL: Approx. 7 • GRL: Approx. 5 • SRL: Approx. 6 • HRL: Approx. 6	**Target KPI** • Create mobility support technology products • Deploy mobility support technology in multiple cities • Reduce number of traffic accidents

Further improvements

2. Results of research and development performed this fiscal year

2-1. Analysis of traffic accident causes and countermeasures

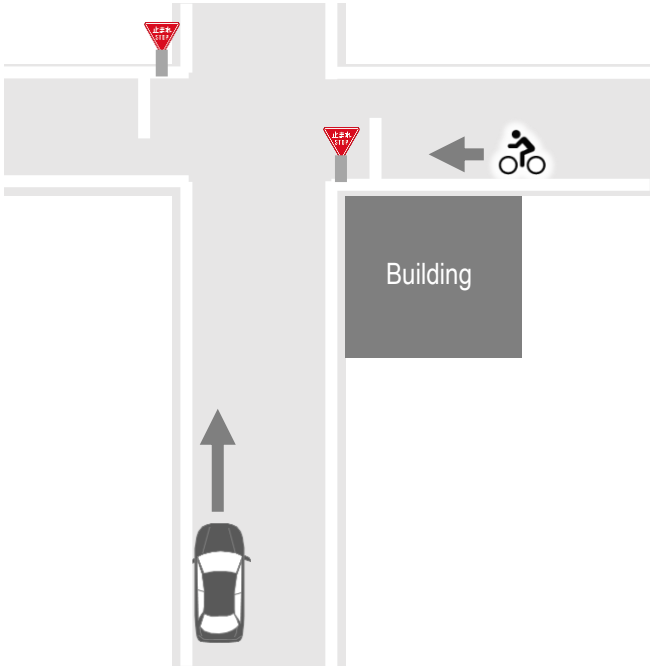
- A detailed analysis of traffic accidents was performed to deliberate support measures needed to ensure safety of vulnerable road users.
  - The majority of traffic accident fatalities are vulnerable road users (70% in Japan as a whole, 90% in the Tokyo metropolitan area).
  - Many pedestrian accidents are the result of driver-side human error, risky behavior by pedestrians (not checking if conditions are safe), or errors in judgment.
  - ➢ **We aimed to prevent accidents by providing danger alerts in advance, not only to drivers but also to pedestrians, etc., thereby promoting behavioral changes**.

2-1. Analysis of traffic accident causes and countermeasures

- Through our traffic accident analysis, we identified the following three scenarios (which we will refer to as use cases ①-1, ①-2, and ②) as common scenarios involving high numbers of fatalities. Through this project, we aimed to prevent these kinds of accidents by providing additional support.

Use case ①-1

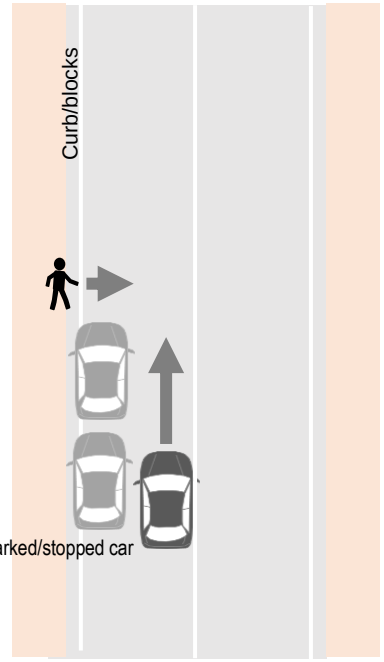
Automobile-bicycle, etc. accident



- ◆ The automobile has right of way
- ◆ The bicycle's road has a stop sign
- ◆ The intersection is a small one

Use case ①-2

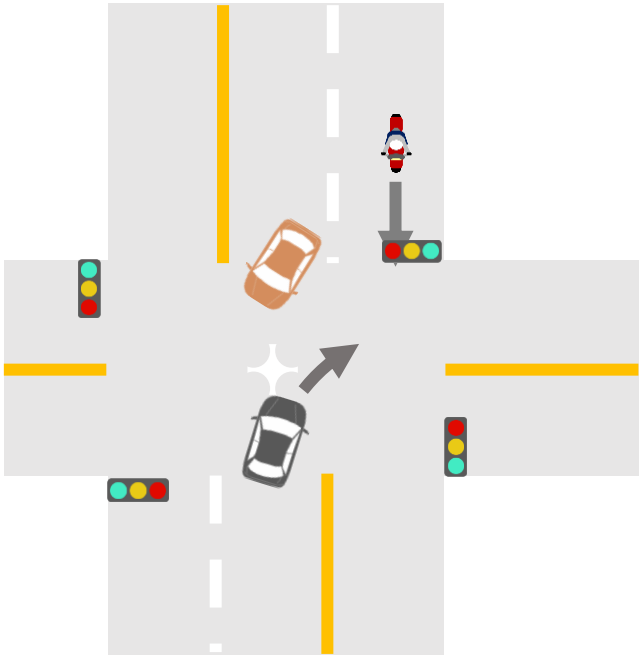
Automobile-pedestrian accident



- ◆ There are parked/stopped vehicles that obstruct visibility
- ◆ The sidewalk and carriageway are separated by a curb, blocks, etc.
- ◆ There is a median

Use case ②

Automobile-motorcycle accident

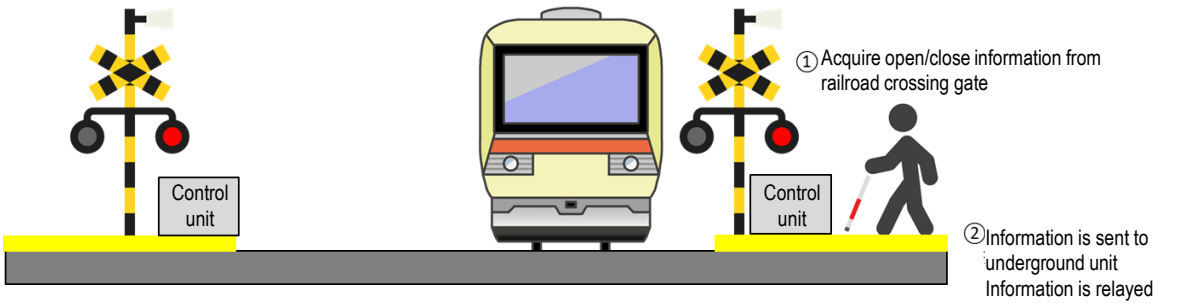


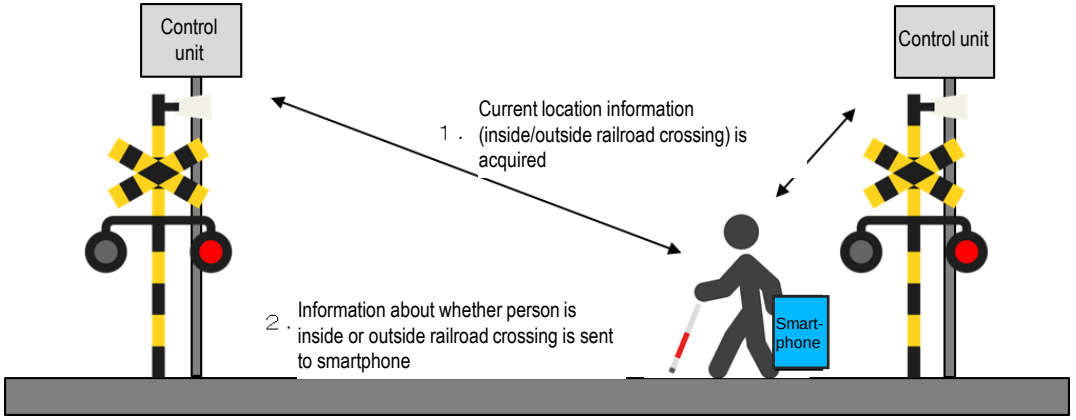
- ◆ The automobile is turning right
- ◆ The motorcycle is going straight
- ◆ The intersection is a large one
- ◆ There is a vehicle obstructing visibility

2-1. Analysis of traffic accident causes and countermeasures

- For use case ③ (trapping people requiring assistance in railroad crossings when a warning signal is issued), we considered initiatives for addressing this use case, reflecting input from experts, related government agencies, related organizations, etc.

[Conceptual image of use case after changes]





Concerns from the perspectives of people with visual impairments when crossing railroad crossings

* Can they recognize when they have entered or exited the railroad crossing?
* Can they distinguish railroad crossings from pedestrian crossings and sidewalks?
* Is it easy to cross the railroad crossing?

* From the Ministry of Land, Infrastructure, Transport and Tourism's Guidelines for Facilitating Smooth Transportation on Roads, etc.

* People with visual impairments, wheelchair users, and other people with transportation limitations are notified of the status of the railroad crossing.
* People with visual impairments, wheelchair users, and other people with transportation limitations are notified that they are inside the railroad crossing. Trains are informed that there are people with transportation limitations within the railroad crossing.

2-1. Analysis of traffic accident causes and countermeasures

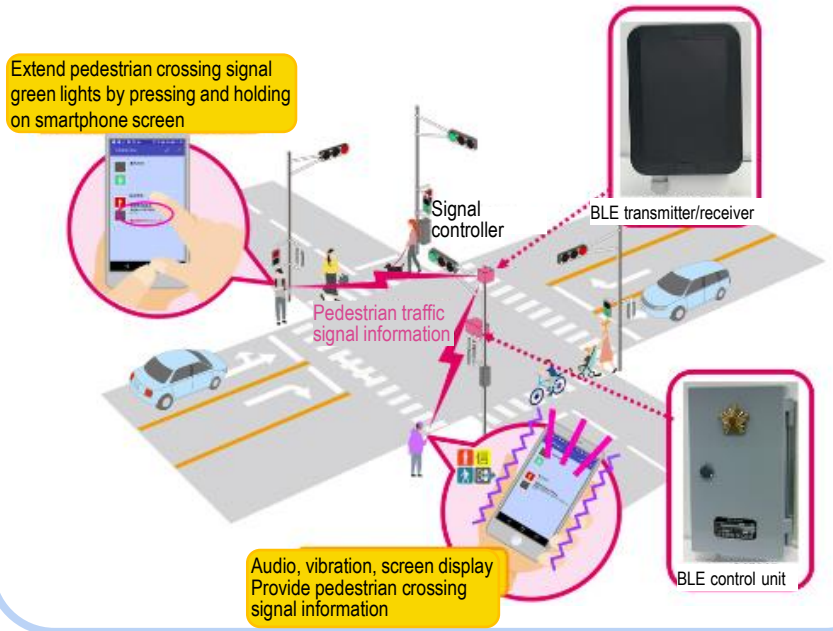
- We considered improvements to the current model for use case ④.

[Current model]

Movement support for people with transportation limitations

Preventing traffic accidents by assisting people with transportation limitations to safely cross intersections

- Pedestrian traffic signal information provision service
- Pedestrian road crossing support service

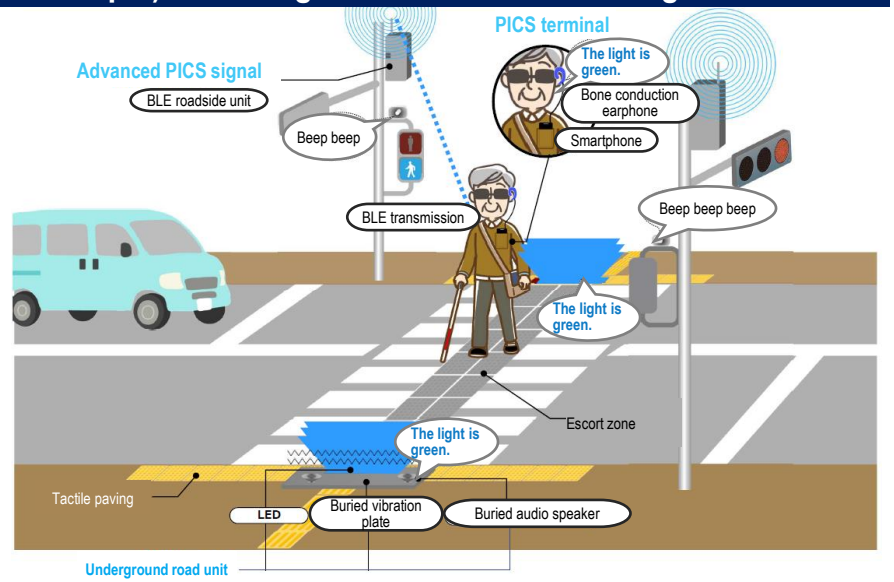


[Proposed]

Proposed additional services

- Remaining time information provision service
- Pedestrian green signal time extension service

Example) Providing information from underground units



In addition to verification of services for people with visual impairments, also verify services for use of traffic signal information by devices other than mobile phones, such as autonomous delivery robots (including making improvements to existing apps and providing information to vehicles)

We will coordinate with the UTMS Society of Japan Consortium to deliberate and verify services that leverage the UTMS Society's results.

2-2. Deliberation and development of necessary technologies

- To prevent traffic accidents in the aforementioned use cases, this fiscal year we focused on deliberating regarding technical specifications primarily for use cases ①-1, ①-2, and ②. The process we used in these deliberations is shown below.

① Deliberation regarding timing when support (information) should be provided (→p16)

▼

② Conversion of support (information) provision timing into equivalent distance (→p17)

▼

③ Calculation of distance from ② at which phenomena should be detected by infrastructure sensors (=device specifications) (→p17)

▼

④ Deliberation regarding content of support (information) to be provided in each stage and interface requirements (→p18～)

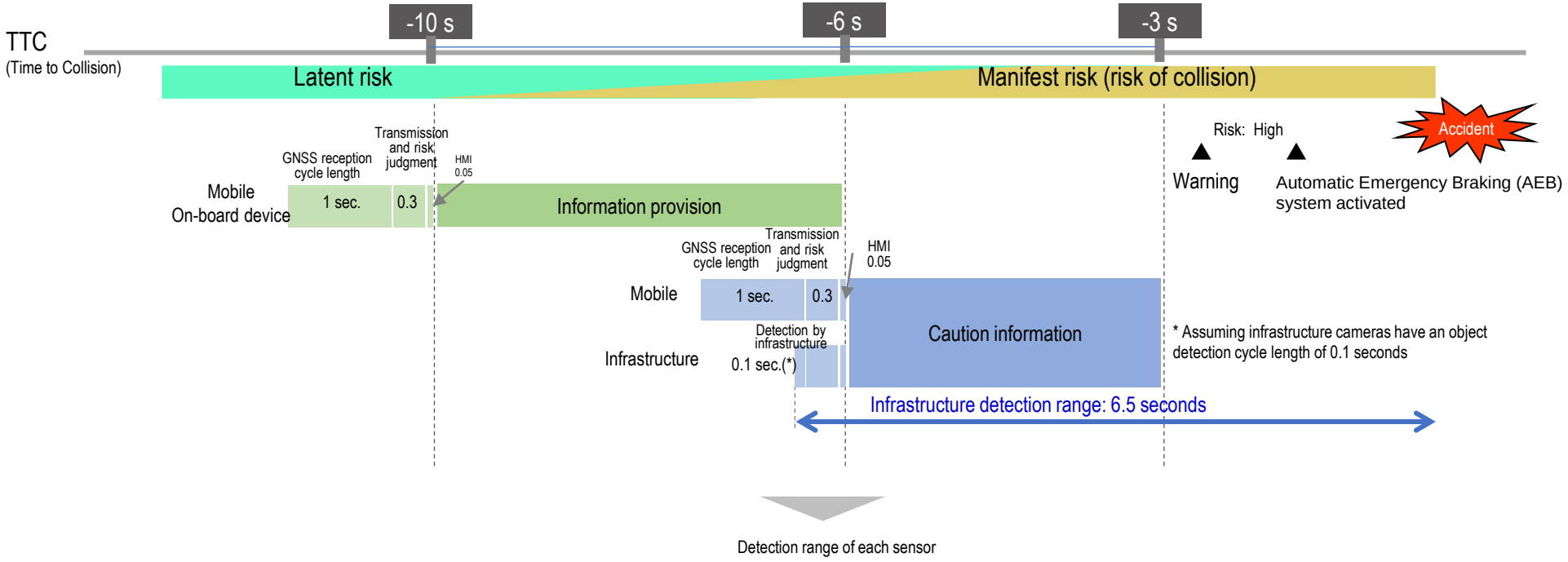
▼

⑤ Creation of architecture and sequences for functions required to provide necessary support (→P24～)

① Deliberation regarding timing when support (information) should be provided

- We separated the timing of support provision into when information would be provided and when warning would be issued. For each of these, we calculated the necessary sensor detection range in terms of time.

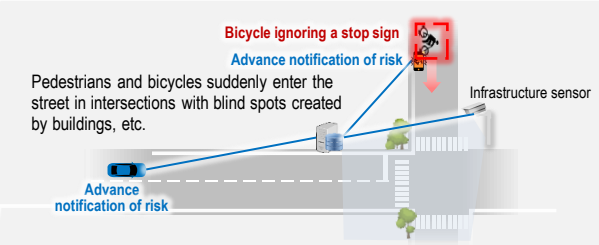
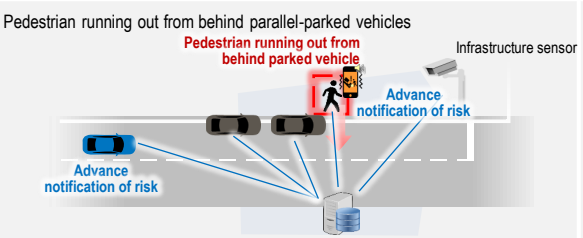
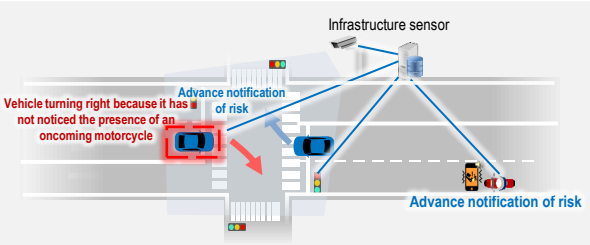
Item	TTC (Time to Collision)	Content of support (provided information)
Information provision	(Tentative) -10 to -6 s	Issue notifications of risks caused by site blind spots and other vehicles
Caution information	(Tentative) -6 to -3 s	Issue cautions or warnings recommending stopping



Mobile device (GNSS): Sensing performed at all times
Infrastructure sensors: Sensing performed at least 6.5 seconds in advance

② Distance conversion of required support timing / ③ Calculation of distance over which infrastructure must perform sensing

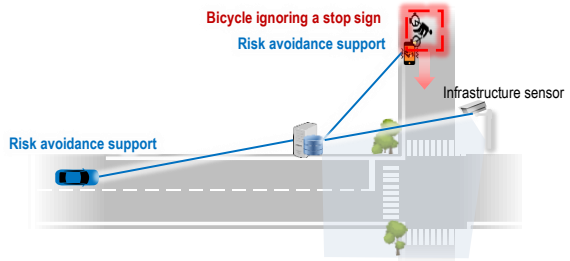
- For each use case (UC), we assumed that the speeds of the parties requiring support were as indicated in the table below, and we then determined the distance at which support should be offered given the timing of the support. We then determined the infrastructure detection range, using the example of providing caution information.

Item	UC ①				UC ②	
	①-1		①-2			
Target use case	Research and development of risk prediction support technology to help prevent accidents caused by unsafe behavior by vulnerable road users				Research and development of risk prediction support technology to help prevent accidents caused by failure to see issues in environments with blind spots	
Detection/support scope	Bicycles, automobiles		Pedestrians, automobiles		Motorcycles, automobiles	
						
Support scope	**Automobile**	**Bicycle**	**Automobile**	**Pedestrian**	**Automobile**	**Motorcycle**
Speed	60 km/h	15 km/h	60 km/h	5 km/h	20 km/h	60 km/h
Support timing: Information provision	100 to 167 m 60 km/h x 6 to 10 s	25 to 42 m 15 km/h x 6 to 10 s	100 to 167 m 60 km/h x 6 to 10 s	4 m Pedestrian standing on sidewalk	34 to 56 m 20 km/h x 6 to 10 s	100 to 167 m 60 km/h x 6 to 10 s
Support timing: Caution information	50 to 100 m 60 km/h x 3 to 6 s	13 to 25 m 15 km/h x 3 to 6 s	50 to 100 m 60 km/h x 3 to 6 s	4 m Pedestrian begins crossing from sidewalk: 5 km/h	17 to 34 m 20 km/h x 3 to 6 s	50 to 100 m 60 km/h x 3 to 6 s
Infrastructure detection range (for caution information example)	109 m 100 m (timing of provision of support) + 9 m (60 km/h x delay of 0.5 s) * Cruising lane determined at same time that caution information is provided	28 m 25 m (timing of provision of support) + 3 m (15 km/h x delay of 0.5 s) * Driving position determined at same time that caution information is provided	109 m 100 m (timing of provision of support) + 9 m (60 km/h x delay of 0.5 s) * Cruising lane determined at same time that caution information is provided	Near infrastructure camera * Determine location of pedestrian	20 m 17 m (timing of provision of support) + 3 m (20 km/h x delay of 0.5 s) * Cruising lane determined at same time that caution information is provided	109 m 100 m (timing of provision of support) + 9 m (60 km/h x delay of 0.5 s) * Cruising lane determined at same time that caution information is provided

* Use case ①-1 addresses providing support to bicycles, pedestrians, and motorcycles, but in this verification project, we used bicycles as a representative example when performing our verification work.

④ Deliberation regarding content of support (information) to be provided in each stage and interface requirements

- For each use case, we deliberated regarding the content of support, the information that should be detected or acquired to provide that support, and interface items required for detection, information acquisition, and delivery. This was performed for each support (information delivery) recipient and the timing of each type of support.



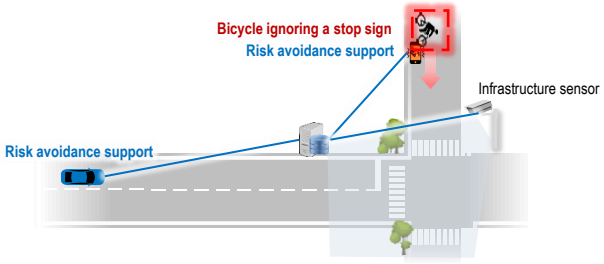
[Support (information delivery) for automobiles in UC ①-1]

		① Information provision KYT (100 to 167 m)	② Information provision ～ caution information (50 to 100 m)	Interface item
Delivery and utilization (HMI)		Provide information when there are blind spot risks	Provide caution information regarding the presence of an bicycle Issue warning recommending stopping	
Detection and information acquisition	Traffic signal control	–	–	
	Infrastructure	Acquire object information	←	Coordinates, speed, orientation, attributes
	Wearable devices	Acquire object information	←	
	Automobiles, motorcycles	Acquire object information	←	
Transmission and aggregation	Edge	TBD	TBD	
	V2N	* Function for transmitting detected information to platform * Function for delivering risk result information via platform	←	
Integration and processing	Risk determination	* Determine scenario - point of crossing with route blocked by blind spot * Determine collision risk * Create support information - automobile-side right of way	* Determine scenario - point of crossing with route blocked by blind spot * Determine collision risk * Create support information - bicycle ignoring a stop sign	* Coordinates, speed, orientation, attributes * Nearby link nodes, number of lanes * Link nodes and locations with high number of accidents
	Platform	* Register traffic participant information in DB * Acquire map information * Acquire blind spot information (map) * Intermediary functions: Merge corrective action, map matching, and infrastructure information with transmission device information	←	
Delivery	App	Deliver information regarding bicycle approaching from blind spot	* Deliver caution information about potential collision with bicycle emerging from blind spot * Issue warning recommending that the automobile stop	

2-2. Deliberation and development of necessary technologies / 2-2-1. Fleshing out of use cases (requirement deliberation)

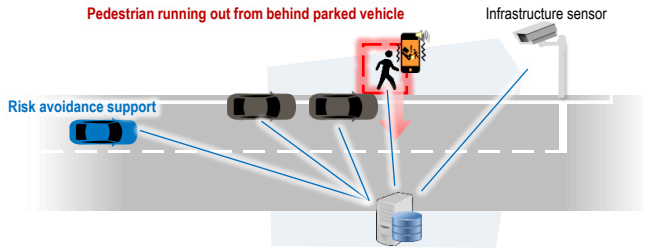
[Support (information delivery) for bicycles in UC ①-1]

In providing support to bicycles, we also considered the distance between the center of the intersection and the automobile.



		① Information provision KYT (25 to 42 m)	② Information provision ～ caution information (13 to 25 m)	Interface item
Delivery and utilization (HMI)		Provide information about existence of risk	Issue cautions recommending stopping Issue warning recommending stopping	
Detection and information acquisition	Traffic signal control	–	–	
	Infrastructure	Acquire object information	←	Coordinates, speed, orientation, attributes
	Wearable devices	Acquire object information	←	
	Automobiles, motorcycles	Acquire object information	←	
Transmission and aggregation	Edge	TBD	TBD	
	V2N	* Function for transmitting detected information to platform * Function for delivering risk result information via platform	←	
Integration and processing	Risk determination	* Determine scenario - point of crossing with route blocked by blind spot * Determine collision risk * Create support information - bicycle-side does not have right of way	* Determine scenario - point of crossing with route blocked by blind spot * Determine collision risk * Create support information - bicycle ignoring a stop sign	* Coordinates, speed, orientation, attributes * Nearby link nodes, number of lanes, stop sign information * Link node, coordinates, and type of link with blind spot
	Platform	* Register traffic participant information in DB * Acquire map information * Acquire blind spot information (map) * Intermediary functions: Merge corrective action, map matching, and infrastructure information with transmission device information	←	
Delivery	App	Deliver information regarding automobile approaching from blind spot	* Issue cautions recommending that the bicycle stop * Issue warning recommending that the bicycle stop	

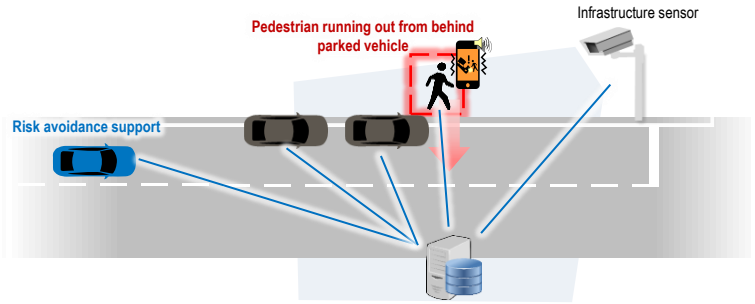
[Support (information delivery) for automobiles in UC ①-2]



		① Information provision (100 to 167 m)	② Caution information (50 to 100 m)	Interface item
Delivery and utilization (HMI)		Provide information about existence of risk of pedestrian running out from behind parked vehicle	Provide caution information regarding risk Issue warning recommending stopping	
Detection and information acquisition	Traffic signal control	–	–	
	Infrastructure	Acquire dynamic object information Parked vehicle/pedestrian: Use for determining blind spots * Infrastructure sensor requirements will vary depending on the installation location (pedestrian/automobile)	←	Coordinates, speed, orientation, attributes
	Wearable devices	Acquire object information	←	
	Automobiles, motorcycles	Acquire object information	←	
Transmission and aggregation	Edge	TBD	TBD	
	V2N	* Function for transmitting detected information to platform * Function for delivering risk result information via platform	←	
Integration and processing	Risk determination	* Determine scenario - pedestrian crossing street from behind parked vehicle * Determine collision risk * Create support information - automobile-side right of way	* Determine scenario - start of pedestrian crossing * Determine collision risk * Create support information - pedestrian jaywalking	* Coordinates, speed, orientation, attributes * Nearby link nodes, number of lanes * Link nodes and locations with high number of accidents
	Platform	* Register traffic participant information in DB * Acquire map information * Information about frequent crossing areas * Intermediary functions: Merge corrective action, map matching, and infrastructure information with transmission device information	←	
Delivery	App	Deliver information indicating that care must be taken with areas visually blocked by parked vehicles	* Deliver caution information about potential collision with pedestrian emerging from blind spot behind parked vehicle * Issue warning recommending that the automobile stop	

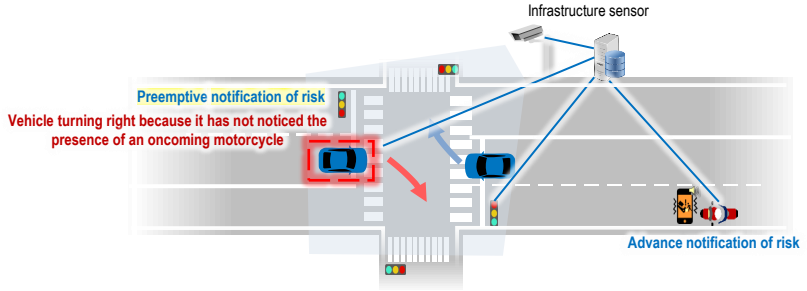
2-2. Deliberation and development of necessary technologies / 2-2-1. Fleshing out of use cases (requirement deliberation)

[Support (information delivery) for pedestrians in UC ①-2]



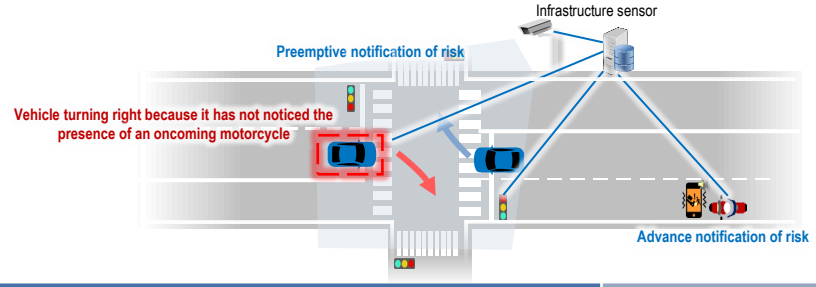
		① Information provision KYT (4 m)	② Information provision ～ caution information (4 m)	Interface item
Delivery and utilization (HMI)		Provide information regarding traffic conditions	Provide caution information regarding risks Issue warning recommending stopping	
Detection and information acquisition	Traffic signal control	–	–	
	Infrastructure	Acquire object information (pedestrian/automobile)	←	Coordinates, speed, orientation, attributes
	Wearable devices	Acquire object information	←	
	Automobiles, motorcycles	Acquire object information	←	
Transmission and aggregation	Edge	TBD	TBD	
	V2N	* Function for transmitting detected information to platform * Function for delivering risk result information via platform	←	
Integration and processing	Risk determination	* Determine scenario - pedestrian crossing street from behind parked vehicle * Determine collision risk * Create support information - pedestrian does not have right of way	* Determine scenario - start of pedestrian crossing * Determine collision risk * Create support information - pedestrian ignoring crossing restriction	* Coordinates, speed, orientation, attributes * Nearby link nodes, number of lanes * Link nodes and locations with high number of accidents
	Platform	* Register traffic participant information in DB * Acquire map information * Information about frequent crossing areas * Intermediary functions: Merge corrective action, map matching, and infrastructure information with transmission device information	←	
Delivery	App	Deliver information indicating that care must be taken with areas visually blocked by parked vehicles	* Deliver caution information about potential collision with automobile approaching from blind spot behind parked vehicle * Issue warning recommending that pedestrian stop	

[Support (information delivery) for automobiles in UC ②]



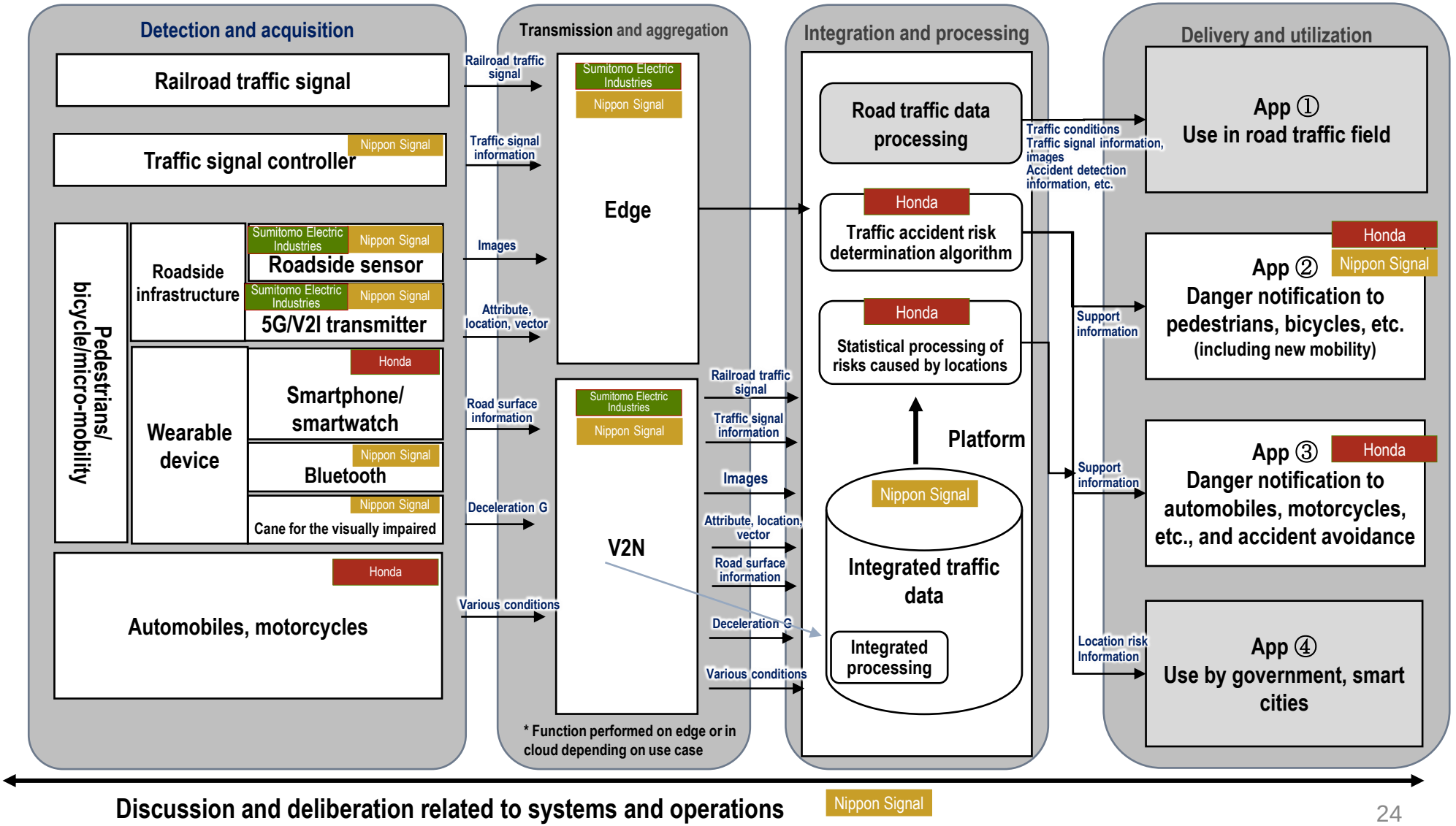
		① Information provision KYT (34 to 56 m)	② Information provision ～ caution information (17 to 34 m)	Interface item
Delivery and utilization (HMI)		Provide information about presence of motorcycle	Issue caution recommending stopping	
Detection and information acquisition	Traffic signal control	* Acquire traffic signal prediction information (determine motorcycle/automobile right of way)	←	
	Infrastructure	Acquire object information (vehicle waiting to make right turn: Use for determining blind spots)	←	* Coordinates, speed, orientation, attributes * Link node array
	Wearable devices	(No pedestrian)	←	
	Automobiles, motorcycles	* Acquire object information * Acquire destination information (vehicle turning right)	←	
Transmission and aggregation	Edge	* Strictly speaking, infrastructure image processing is performed using edge computing, but indicating this accurately would make the table more complex and confusing, so it is indicated here as being performed on the infrastructure side.		
	V2N	* Function for transmitting detected information to platform * Function for delivering risk result information via platform	←	
Integration and processing	Risk determination	* Determine scenario - right turn/straight traffic blind spot accident * Determine collision risk * Create support information - right turn (automobile) does not have right of way	* Determine scenario - right turn/straight traffic blind spot accident * Determine collision risk * Create support information - automobile enters intersection in violation of its requirement to drive safely (failure to check that conditions are safe)	* Coordinates, speed, orientation, attributes * Nearby link nodes, number of lanes
	Platform	* Register traffic participant information in DB * Acquire map information * Intermediary functions: Merge corrective action, map matching, and infrastructure information with transmission device information	←	
Delivery	App	Deliver information regarding motorcycle approaching from blind spot	Deliver caution information about potential collision with motorcycle emerging from blind spot	

[Support (information delivery) for motorcycles in UC ②]



		① Information provision KYT (100 to 167 m)	② Information provision ～ caution information (50 to 100 m)	Interface item
Delivery and utilization (HMI)		Provide information when there is a risk in the intersection	Provide caution information regarding the specific risk	
Detection and information acquisition	Traffic signal control	* Acquire traffic signal prediction information (determine motorcycle/automobile right of way)	←	
	Infrastructure	Acquire object information (vehicle waiting to make right turn: Use for determining blind spots)	←	* Coordinates, speed, orientation, attributes (2R) Interface items: Coordinates, speed, orientation, attributes, lane no. * Link node array
	Wearable devices		←	
	Automobiles, motorcycles	* Acquire object information * Acquire destination information (vehicle turning right)	←	
Transmission and aggregation	Edge	TBD	TBD	
	V2N	* Function for transmitting detected information to platform * Function for delivering risk result information via platform	←	
Integration and processing	Risk determination	* Determine scenario - right turn/straight traffic blind spot accident * Determine collision risk * Create support information - straight traffic (motorcycle) has right of way	* Determine scenario - right turn/straight traffic blind spot accident * Determine collision risk * Create support information - automobile enters intersection in violation of its requirement to drive safely (failure to check that conditions are safe)	* Coordinates, speed, orientation, attributes * Nearby link nodes, number of lanes
	Platform	* Register traffic participant information in DB * Acquire map information * Intermediary functions: Merge corrective action, map matching, and infrastructure information with transmission device information	←	
Delivery	App	Deliver information about intersection where caution is needed	Deliver caution information about potential collision with automobile emerging from blind spot	

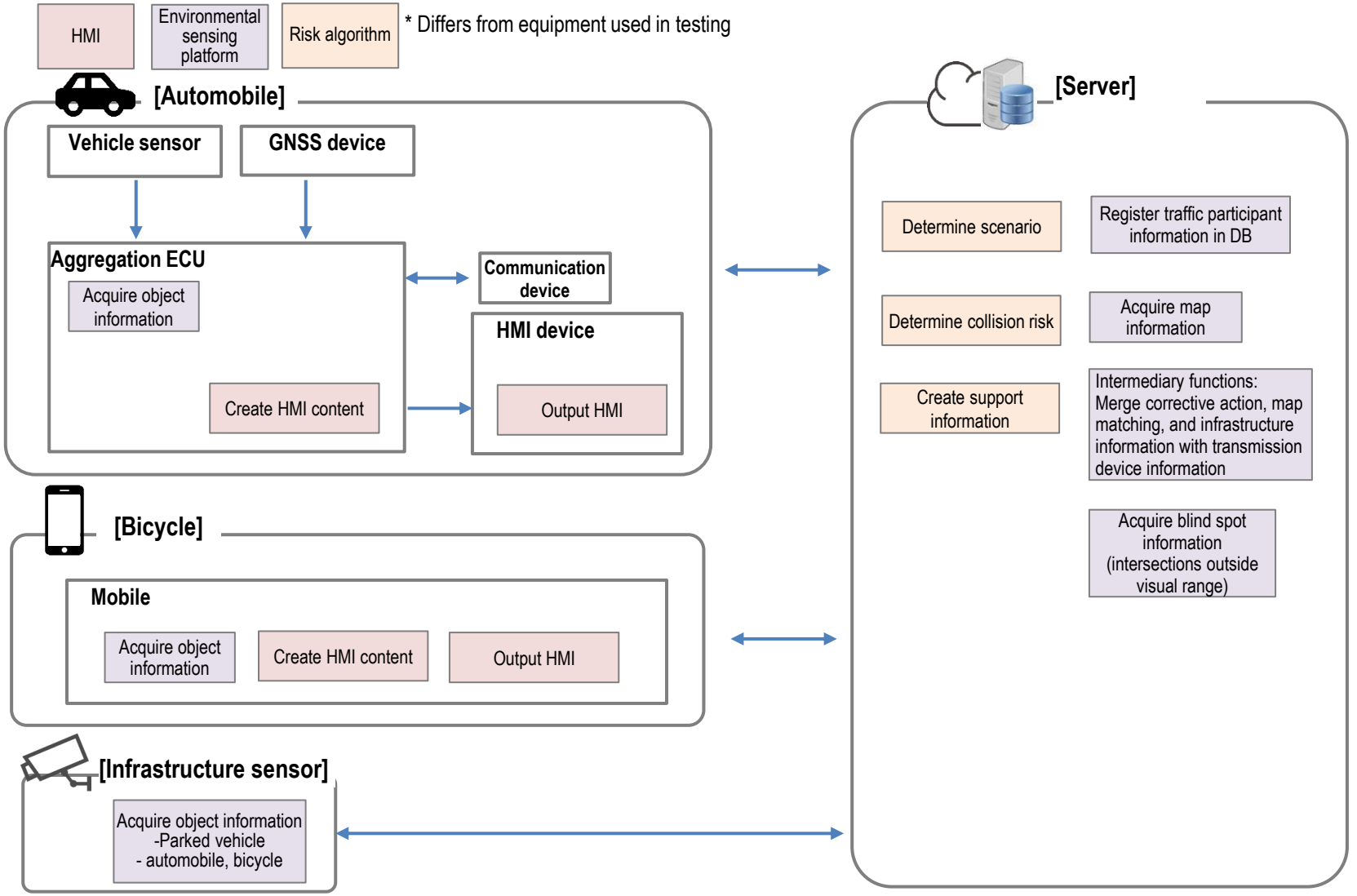
Overall architecture and division of roles



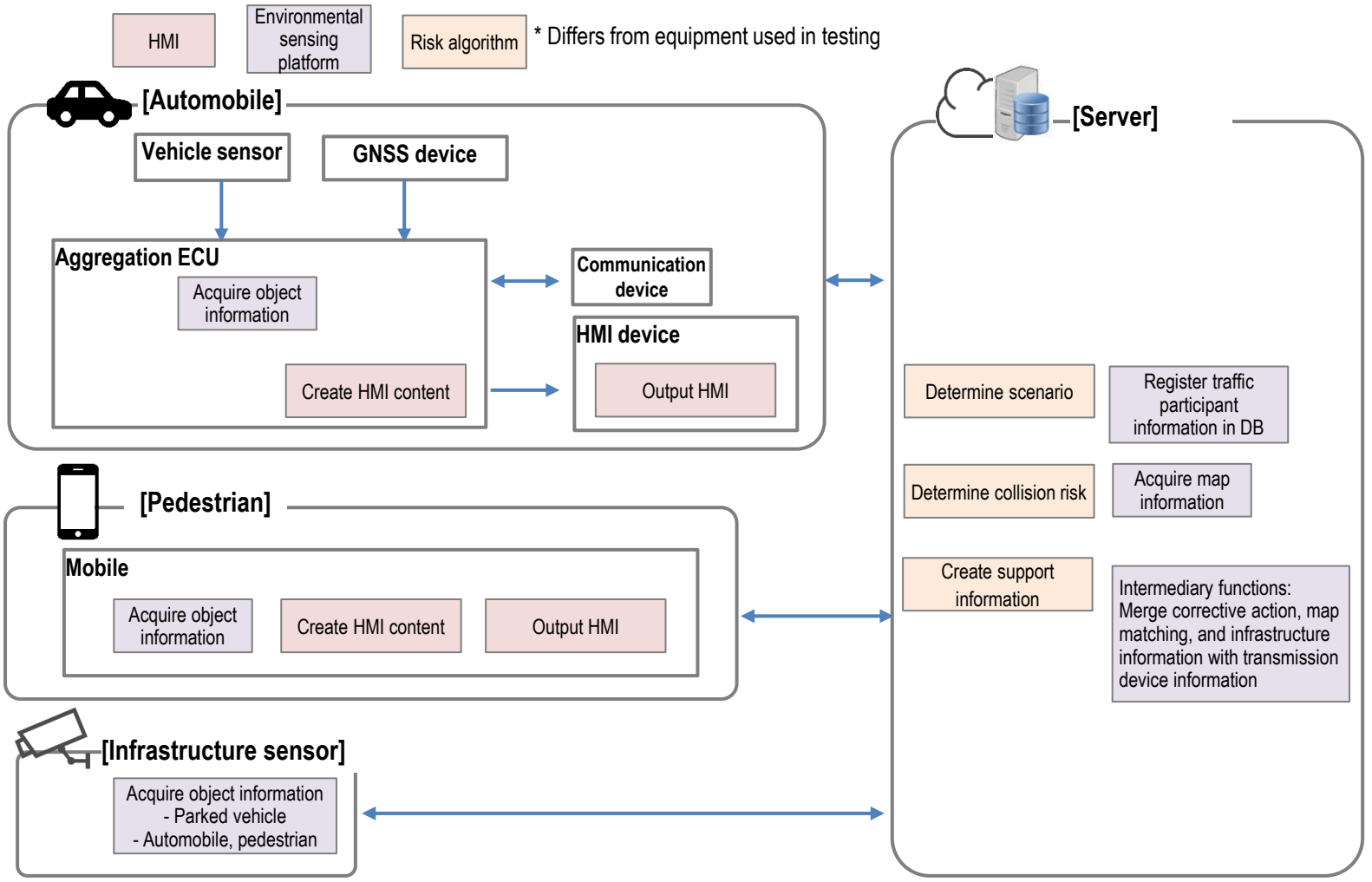
Creation of architecture for each use case

- Based on the overall architecture, we considered specific architecture for each use case.

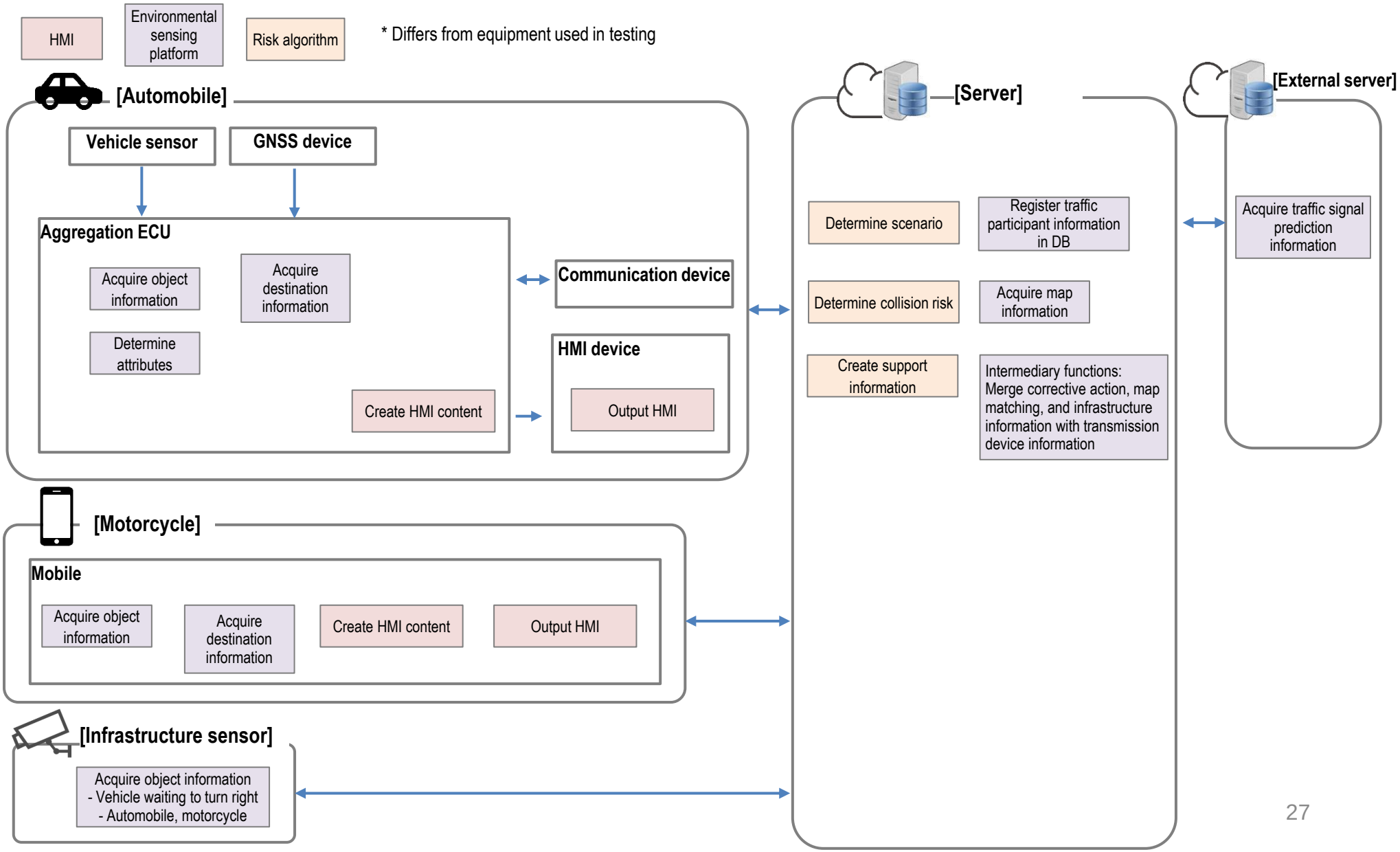
[Architecture for use case ①-1]



[Architecture for use case ①-2]



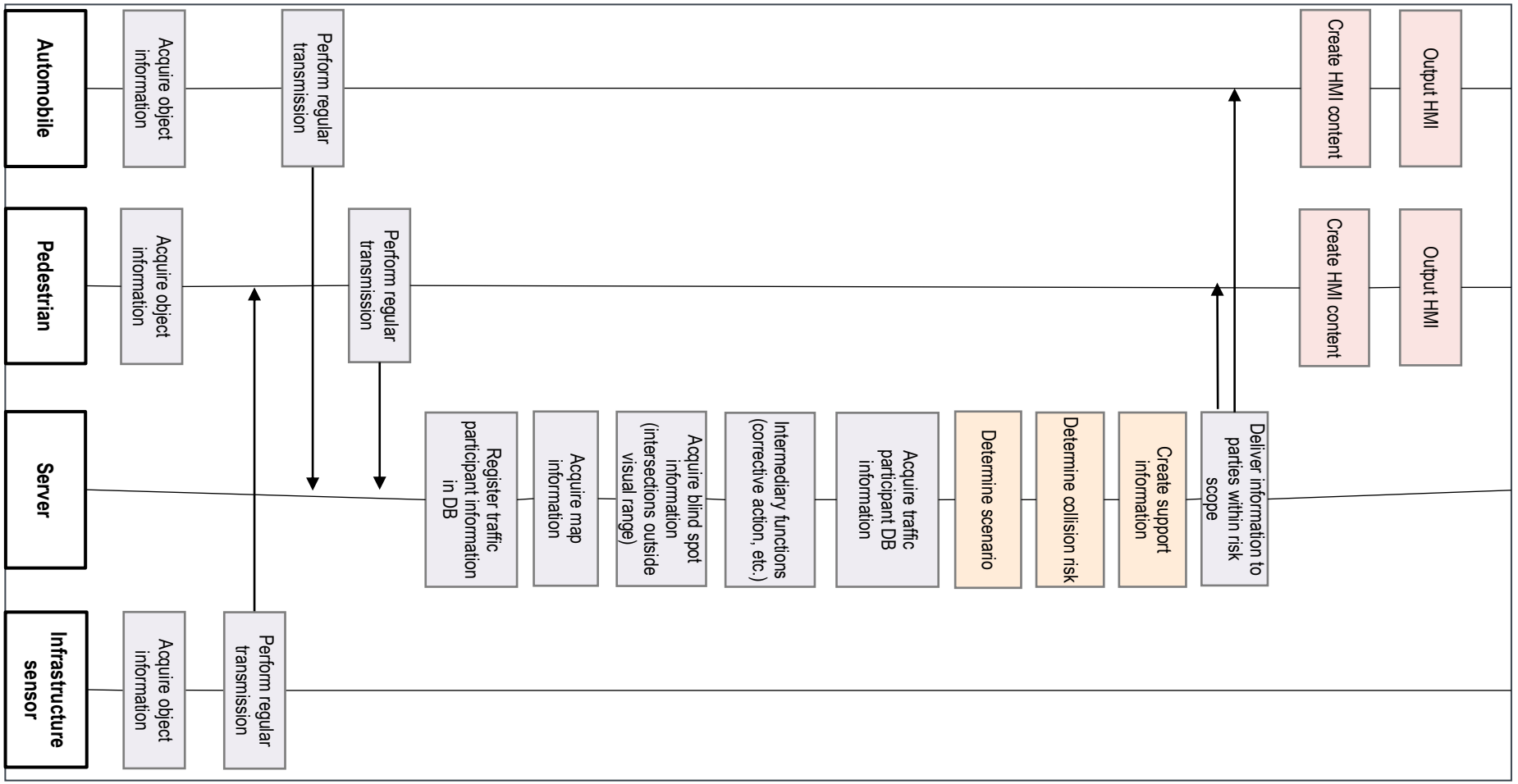
[Architecture for use case ②]



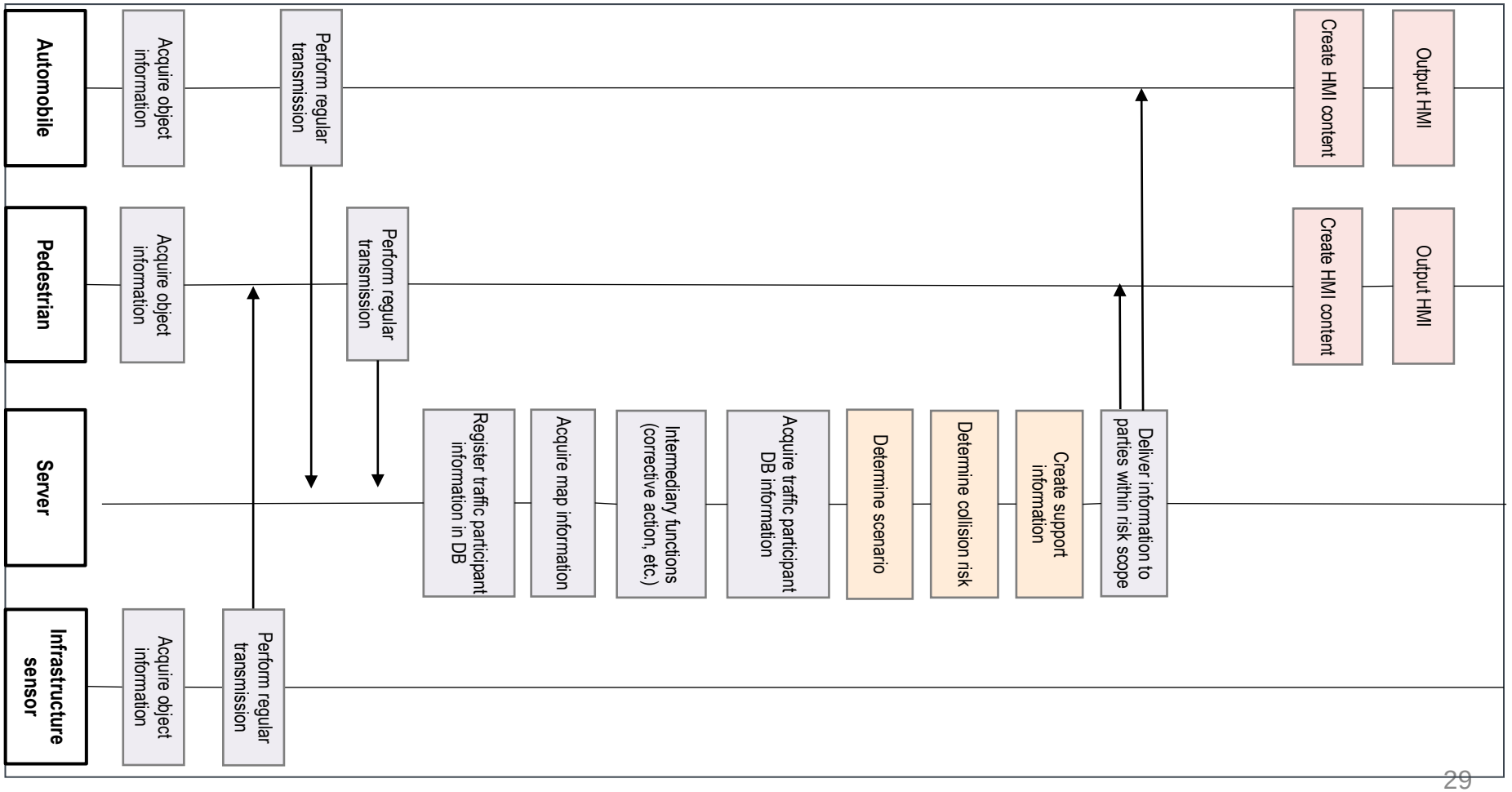
Organizing sequences corresponding to architecture

- For each use case, we organized sequences (operation processes) that corresponded to the architecture.

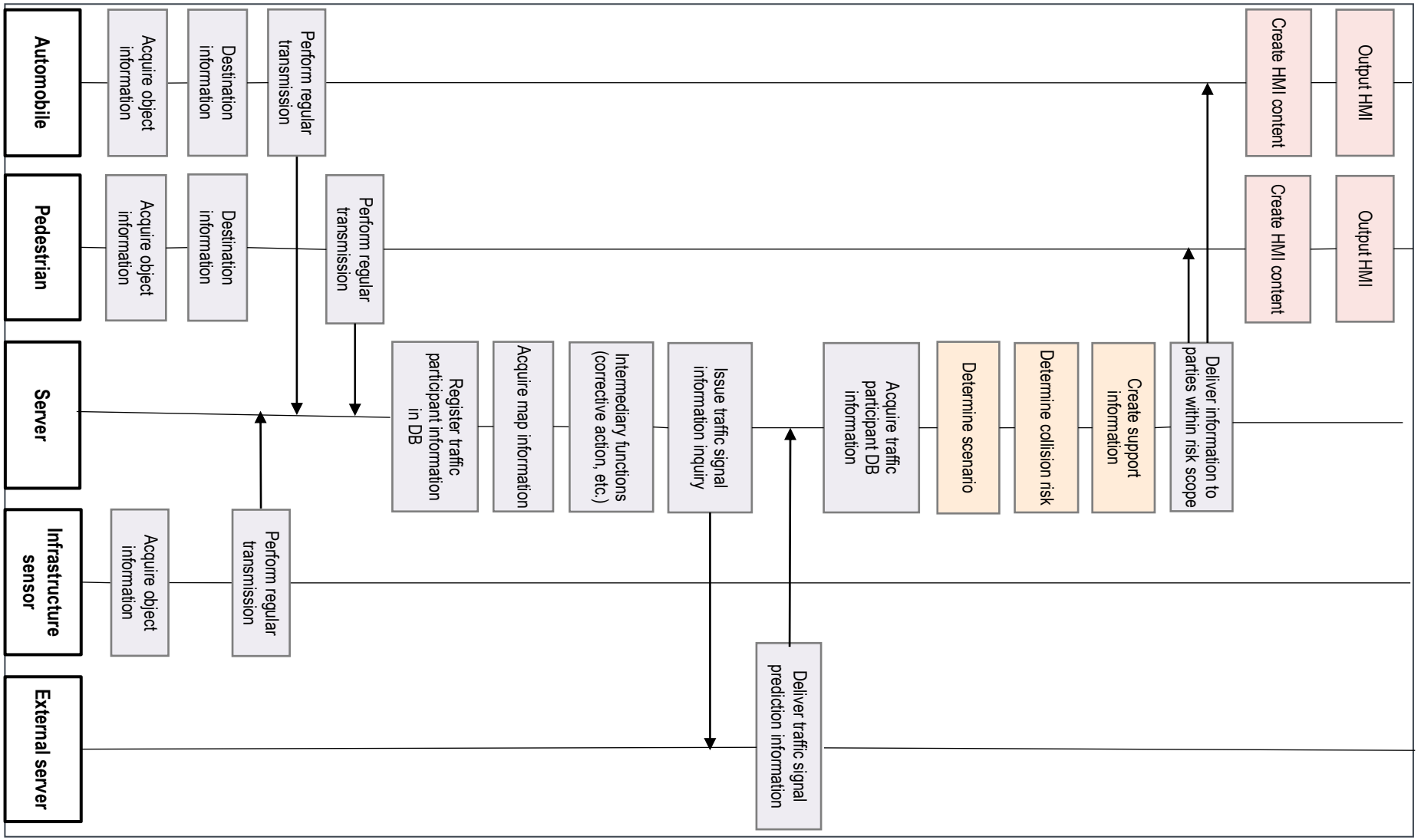
[Sequence for use case ①-1]



[Sequence for use case ①-2]

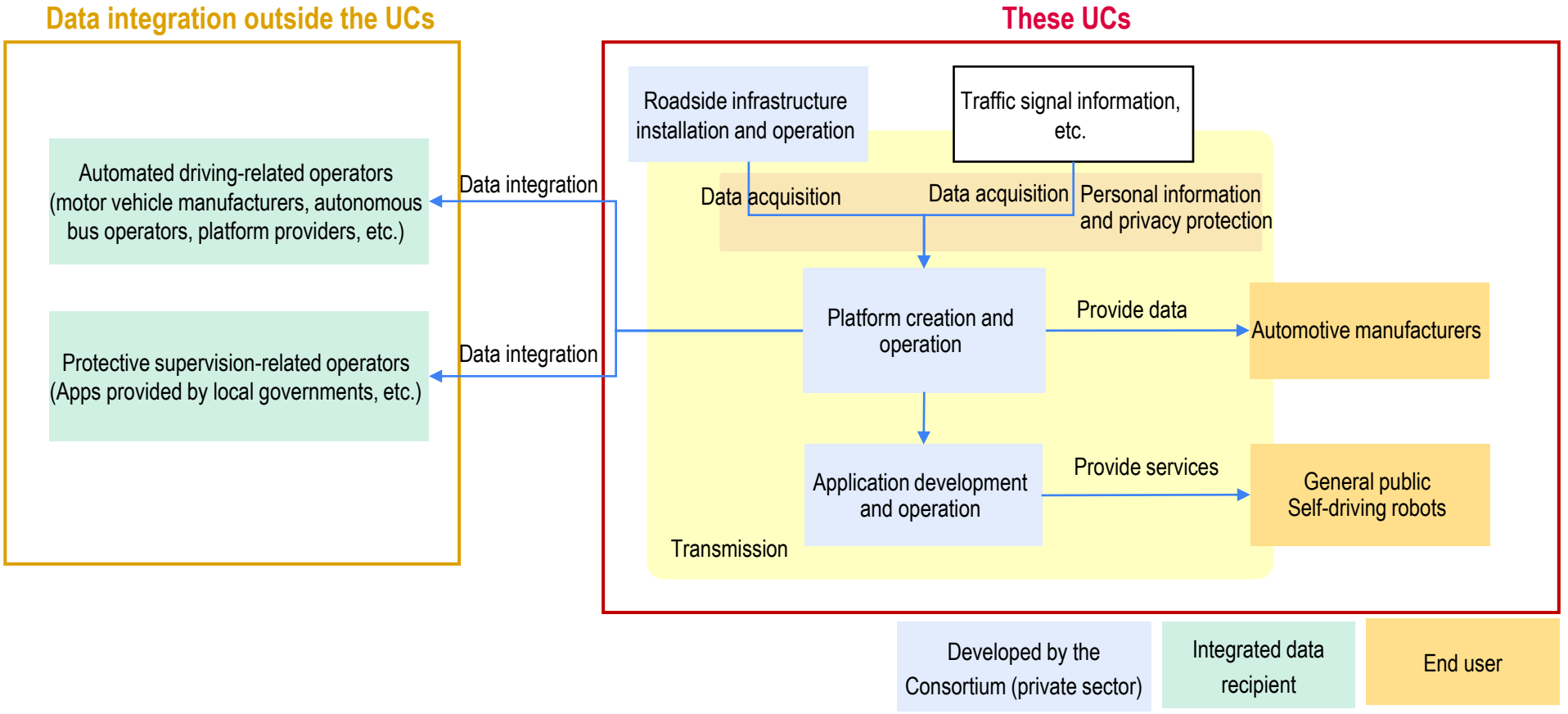


[Sequence for use case ②]



Ideals when implementing service

- **The private sector is envisioned as preparing and managing the roadside infrastructure and platform**
- **The applications for these UCs will be developed by the private sector** and **service will be provided to the general public and to self-driving robots**
- **Acquired data is envisioned as being provided to operators outside the UCs via the platform** (through API integration). Currently, we envision providing the data to automated driving-related operators and protective supervision-related operators



2-3. System and rule deliberation

Current status of systems and rules and potential future approach

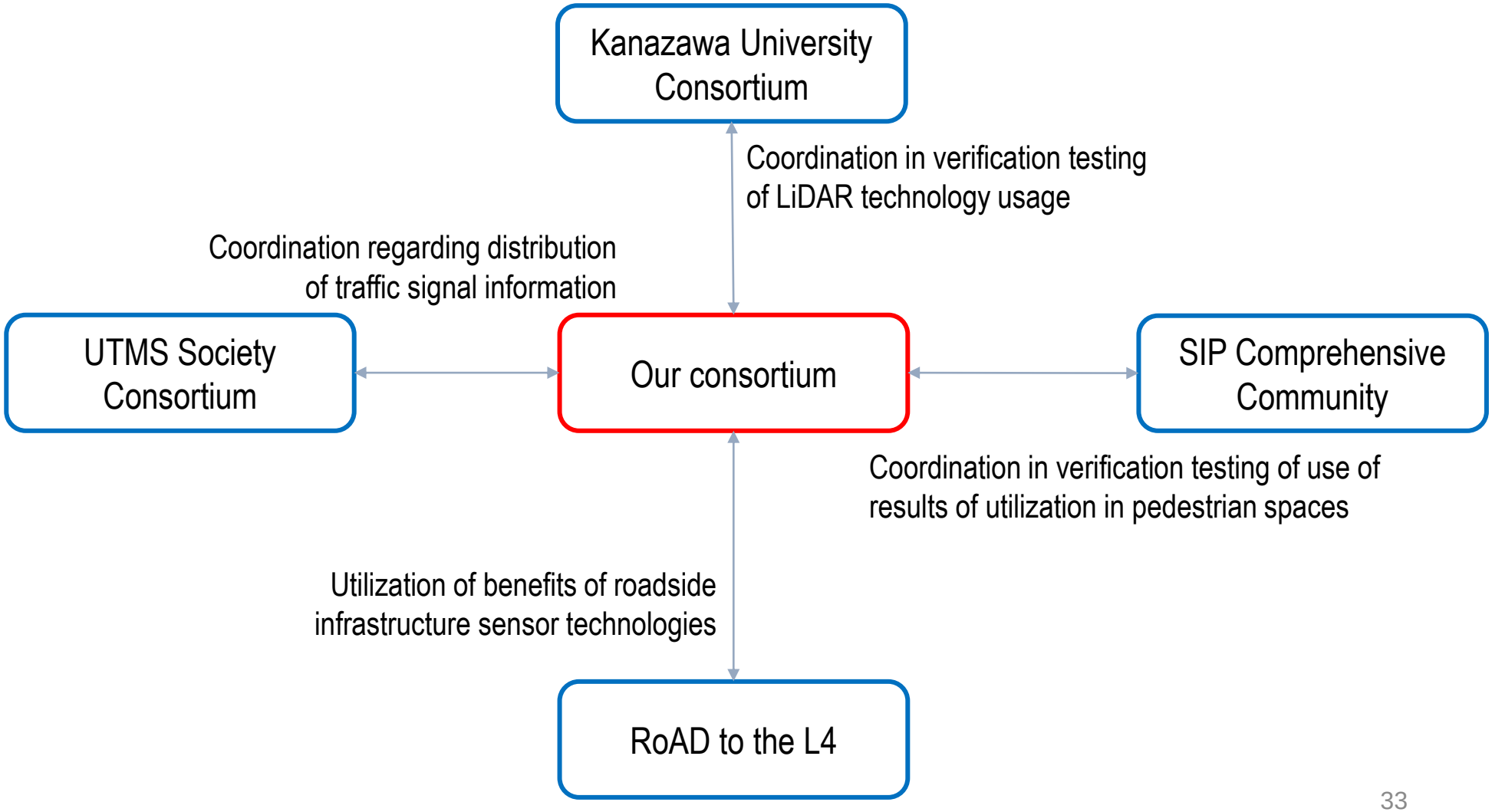
- We organized information regarding the current systems that could be used to achieve project ideals and the approaches to be used in the future
- In FY2024, we plan to deliberate and implement concrete measures to contribute to solutions based on these potential future implementation approach

Category	Current status	Potential future implementation approach
Roadside infrastructure installation and operation	The application process is cumbersome and time-consuming, many different parties need to be coordinated with	Considering issuing proposals, etc., for unification and streamlining of procedures for related government agencies, etc.
	The principle of one power supply contract per power usage location makes the power supply situation difficult, requiring coordination with power companies and pole operators	Coordinate with power companies, etc. early-on
	A foundation has not yet been established for exclusive road usage in the form of installing permanent roadside infrastructure on public roads	**Organize deployment schemes (who prepares and manages what, for what purpose) and discuss necessary procedures and legal matters with relevant government agencies**
Traffic signal information acquisition	**The National Police Agency and related organizations permit the installation of wireless communications equipment to acquire traffic signal information as part of the verification test.**	**Organize wireless communication equipment installation schemes at the time of deployment for field testing (who prepares and manages what) and discuss with relevant sections**
Communications	**Decisions must be made regarding whether or not to promote collaboration with and among telecommunication carriers and to coordinate with communication carriers (operators must deliberate regarding which carriers to coordinate with and inter-carrier collaboration is difficult)**	**Through the field testing, organize information regarding the need for collaboration with and among different telecommunication carriers in deployment (transmission speeds in UCs, need for low latency)**
	Procedures for applying for licenses when transmitting new radio signals, such as local 5G signals, are difficult and time-consuming	Closely review need for new radio signal transmission and carry out procedures early-on
Application	**Information reliability and responsibility demarcation points have not been clearly defined (who is responsible if incorrect information is transmitted?)**	**Through the field testing, determine where information delays or errors could occur and, if they occur, who they would affect, and deliberate countermeasures**
Personal information and privacy protection	Measures must be taken to protect personal information and privacy when using camera data (such as announcing how information will be used) (when performing private sector verification testing)	Carry out procedures based on camera image usage guidelines, etc. early-on
	It has not yet been determined who is responsible for implementing personal information and privacy protection measures for cameras installed on public roads during deployment	**Hold discussions with relevant government agencies regarding the division of responsibilities between the public and private sectors with respect to personal information and privacy protection measures when acquiring data from public roads during real-world deployment (including the need for public sector measures to be implemented in addition to private sector measures)**
Data integration	**The positioning has not been defined with respect to the provision of data (including the sale and purchase of data) acquired by private sector operators from public roads**	**Hold discussions with relevant government agencies regarding whether or not there are issues with the provision of data (including the sale and purchase of data) acquired from public roads**

* Underlined, bold items are key discussion points which must be deliberated on and addressed for deployment to occur

2-4. Coordination with other consortiums and research and development projects

This fiscal year, we deliberated coordinating with numerous research and development projects, both inside and outside the SIP smart mobility project.
In the fiscal year to come and beyond, we plan to deepen and further flesh out our coordination.



2-5. Future plan deliberation/2-5-1. Deliberation of contents of verification testing

- **The FY2025 verification project will be positioned as one of the processes involving parties that are essential for real-world deployment**
- Specifically, we will invite related parties to participate from early in the process and we will perform necessary coordination, including coordinating technical specifications. Doing so will assist with **technical development that reflects the ideas of related parties and the sharing of information with an eye toward deployment within society.**

[Main verification items (planned)]

- ☐ Is it possible to detect signs of potential risks and to generate notification information?
- ☐ Can detection, information generation, and notification be performed with sufficient time to transform behavior and prevent accidents?
- ☐ Can information be accurately relayed to devices and vehicles?
- ☐ Are there any other challenges that must be tackled to provide this support?
- ☐ Are the specifications (data formats, interfaces, etc.) appropriate for delivering information to traffic participants, and are there any potential improvements?

[Participants from outside the Consortium (envisioned)]

Given the positioning of the verification tests, from the next fiscal year onward, efforts will be made to actively involve entities related to the following potential end users.

- ☐ Bicycles
- ☐ Pedestrians (members of the local community, etc.)
- ☐ Motor vehicles
- ☐ Compact mobility
- ☐ People with visual impairments, etc.

[Verification test area]

We will look at candidate areas ① and ② and narrow down specific locations that meet the following requirements.

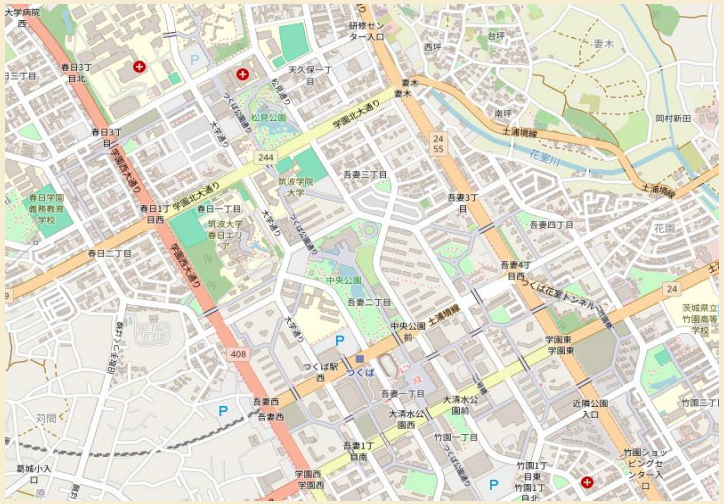
- ☐ Locations where use cases can be reproduced
- ☐ Locations where it is easy to coordinate with other consortiums
- ☐ Important locations where accidents frequently occur
- ☐ Locations where it is easy to install infrastructure

We will use ITS on-board equipment and roadside units developed by SIP Adus

We will deliberate separately regarding where to perform verification testing of use case ③.

[Candidate ①: Key intersections in Tsukuba City]

We will coordinate with the Ibaraki Police Department to narrow down implementation locations.



[Candidate ②: Odaiba]

We envision the following three circled locations.

Content of main research and development

[Technology development]

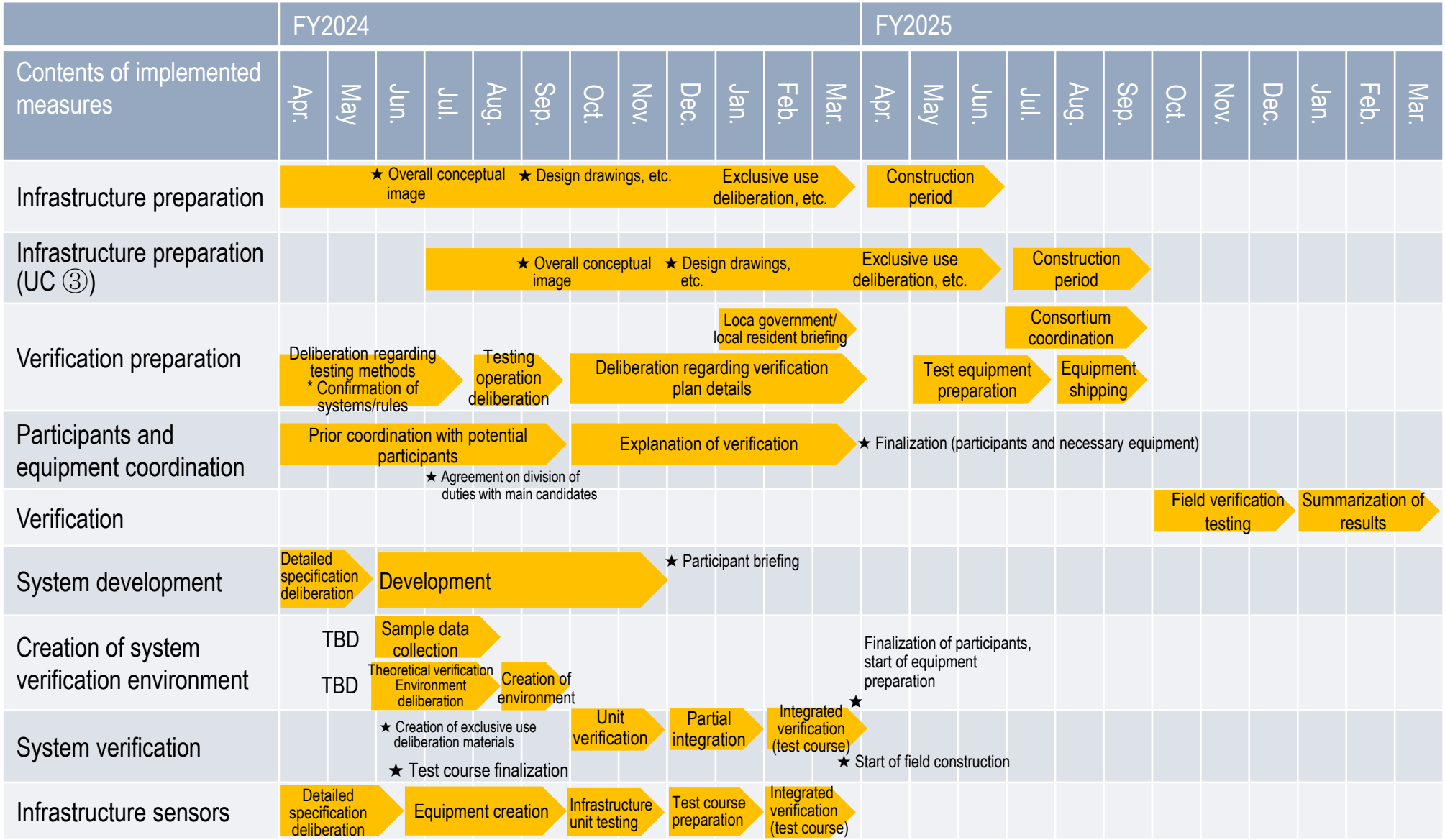
- Develop support system for use cases
  - ✓ Detection and information acquisition:
    Develop detection and information acquisition app for smartphones, automobiles, and motorcycles
  - ✓ Integration processing:
    Develop traffic accident risk identification algorithm and statistical processing of site-specific risk
  - ✓ Delivery and utilization:
    Develop danger notification app
- Perform integrated verification of overall system on a closed test course
- Deliberate regarding system and rules with eye toward achieving ideals during verification testing and real-world deployment

[Preparation for verification testing]

- Formulate detailed verification test plan
- Draw in participants from outside the Consortium
  - ✓ Coordinate with related parties in advance
  - ✓ Explain contents of test and coordinate with related parties

2-5. Future plan deliberation/2-5-2. Deliberation of contents of research and development

Schedule



This report includes the results of Cross-ministerial Strategic Innovation Promotion Program (SIP) 3rd Phase, “Development of Smart Mobility Platform” promoted by Council for Science, Technology and Innovation, Cabinet Office.（Project Management Agency：New Energy and Industrial Technology Development Organization (NEDO) (Project Code JPNP23023))