"Cross-ministerial Strategic Innovation Promotion Program (SIP) Phase Two - Automated Driving (Expansion of Systems and Services) /Implementation of FOTs in the Tokyo Waterfront Area"

- 2020 Results Report Overview (Attachment B) -

FOTs in the Tokyo Waterfront Area Consortium

Mitsubishi Electric Corporation (representative)

Aisan Technology Co., Ltd.
Increment P Corporation
Sumitomo Electric Industries, Ltd.
Zenrin Co., Ltd.

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Pasco Corporation

May 2021

Attachment B: Evaluation questionnaire results

1.Evaluation in the Waterfront City area

- **Roughly half of the participants used traffic signal color information** and **roughly 40% of the participants used traffic signal remaining seconds information** in vehicle control.

- Many participants indicated that they intend to use traffic signal information in **automated driving systems and drive assist systems.**

- Traffic signal color information was confirmed to be effective in all six situations of "backlighting," "direct lighting," "concealment/obstruction," "blending into the background," "nighttime," and "raindrops." A large number of participants indicated that it was **particularly effective for "concealment/obstruction" and "backlighting."**

- Traffic signal remaining seconds information was confirmed to be effective when traffic signals were obstructed, at intersections with high speeds, and at intersections in close proximity. Some participants also used it for appropriate acceleration and deceleration, preparation to accelerate from a start, and the provision of information for following vehicles.

- **Traffic signal color information/traffic signal remaining seconds information** was confirmed to be **effective for all intersections.**
  Many participants indicated that traffic signal color information was effective at Aomi 1-chome, at which backlighting and obstructions, etc. are major factors.
  Many participants indicated that traffic signal remaining seconds information was effective at Telecom Station-mae, at which the timing of visual recognition of the traffic signal color is late due to a curve.

- Some participants indicated that instead of defining individual intersections where the provision of traffic signal information is prioritized, they would prefer that **automated driving areas were defined and infrastructure prepared accordingly**.

- Many participants indicated that the current frequency and range of information provision are appropriate. Some participants also indicated that if communication stability were ensured, the frequency and range could even be decreased somewhat.

- Multiple participants stated that **they wanted confirmed traffic signal remaining seconds information, not traffic signal remaining seconds information with margins.**

- Some participants commented that drivers of ordinary vehicles should be informed of the behavior of vehicles that receive traffic signal information (such as preliminary deceleration).
  = Improved social acceptability

- Some participants indicated that they wanted system design to reflect global trends.

Attachment B: Evaluation questionnaire results

2.Evaluation on Metropolitan Expressway routes connecting Haneda Airport and the Waterfront City area, etc.

- **Some participants** used both ETC gate passing support and merging support information **for vehicle control and as information provided to drivers**. Other participants received and evaluated information for use in development.

- Participants indicated that they intend to use ETC gate passing support and merging support information in **automated driving systems and drive assist systems.**

- **ETC gate passing support information is effective for all toll booths.** In particular, it appears likely to be particularly effective for toll booths whose operating status cannot be visually confirmed until late and toll booth areas with numerous toll booths.

- Each participant has recognized issues with **cruising line conditions changing after merging support information was received during the FOTs (requiring handling of changes in vehicle speeds on the cruising line)**. **Many participants requested sensing across entire areas and continuous communications.** However, cruising line vehicle speed and vehicle spacing information is effective as information to be provided to drivers. In particular, participants desire installation in locations where cruising line conditions are difficult to assess from merging lanes.

- Multiple participants indicated that **they wanted notifications of approaching merging vehicles to be provided to cruising line vehicles.**

- Some participants indicated that they wanted **a test area other than the Metropolitan Expressway test area to be prepared**, and that they wanted an **impact assessment to be performed for expressways.**

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Attachment B: Evaluation questionnaire results

3.Evaluation in the Haneda Airport area

- Participants confirmed the effectiveness of traffic signal information in the same way as in the Waterfront City area.

- **Magnetic markers** were used for vehicle control and evaluated as a promising technology for the societal deployment of autonomous buses.

- All of the bus test participant teams said that the **Haneda Airport area SWG was very valuable** as it made it possible to engage in intensive discussions focused on the bus testing in the Haneda Airport area.

4. Evaluation of general road map data

- The only specific comments from test participants concerned lane node linkage within intersections.

- Many participants indicated that lane node linkage within intersections, which should be prepared as a cooperative area measure, **must connect to all exit route lanes for both left and right turns.**

- **Requests regarding lane node linkage within intersection varied between participants,** so some participants indicated that **sufficient links should be prepared as a cooperative area measure, and all other links should be prepared as competitive area measures.**

Map data specification guidelines will be created based on the above.

Attachment B: Evaluation questionnaire results

5.Achieving automated driving by using cooperative infrastructure

- **Roughly 40% of the participants performed driving tests as initially planned.** Roughly 60% of the participants did not make as much testing progress as planned as the result of COVID-19 and factors pertaining to individual companies, but **most participants intend to develop infrastructure cooperative systems.**

- Some participants indicated that they wanted **test environments to be maintained and expanded**, and that in the future they wanted automated driving areas to be defined and **infrastructure to be prepared for the entire areas.**

6.FOT operation

- The FOT working group serves not only as a space for explanations and discussions of the contents of the FOTs, but also as a **place where participants can learn about the direction being taken by other participants.**

- Many participants pointed out improvements to be made in the long-term operation of the FOTs, such as improvements relating to the holding of online meanings, the sharing of information using communication tools, and the methods of submitting test data.

- Many participants indicated that they wanted **video from fixed-point cameras (general road cameras+ expressway cameras) to be provided.**

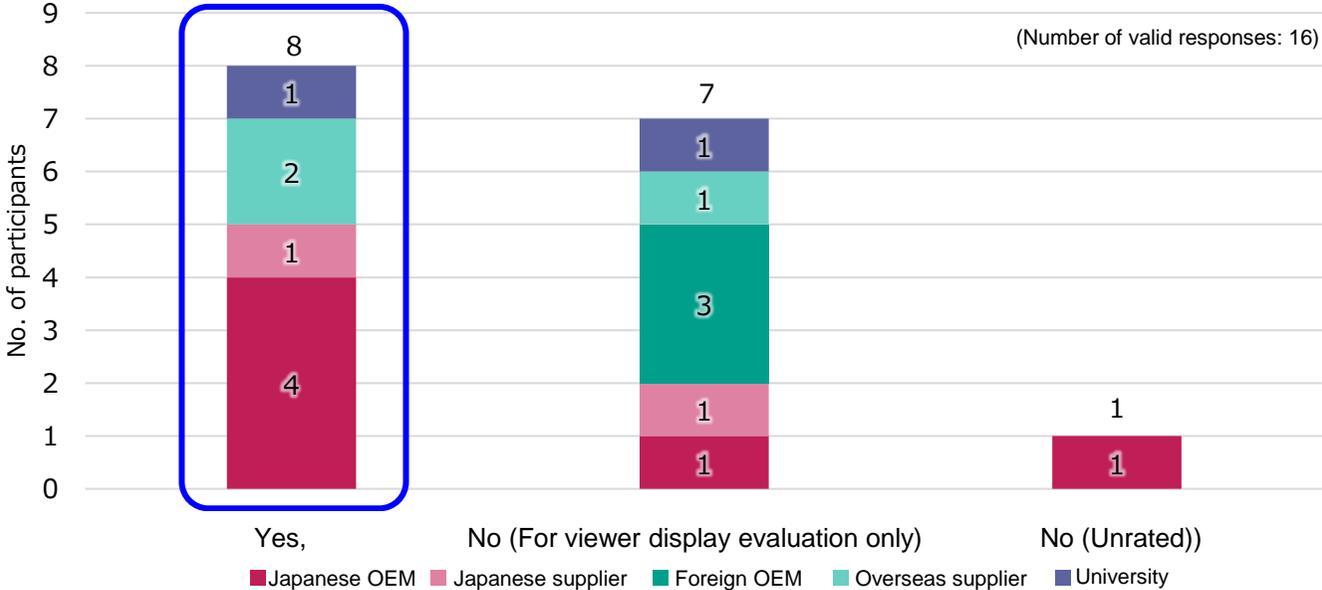- Many participants indicated that when participant data is used, they wished for the **data to be anonymized**.

1. Evaluation of the Tokyo Waterfront Area

(1) Signal information (Evaluation of the signal light color information)

(1) -1 Practical use of the traffic signal color information in vehicle control

Have you ever used light color information for vehicle control? <Choose either one>

(Yes; No (for Viewer display evaluation only); No (Unrated))

Half of the test participants that provided valid responses used traffic signal color information in vehicle control.
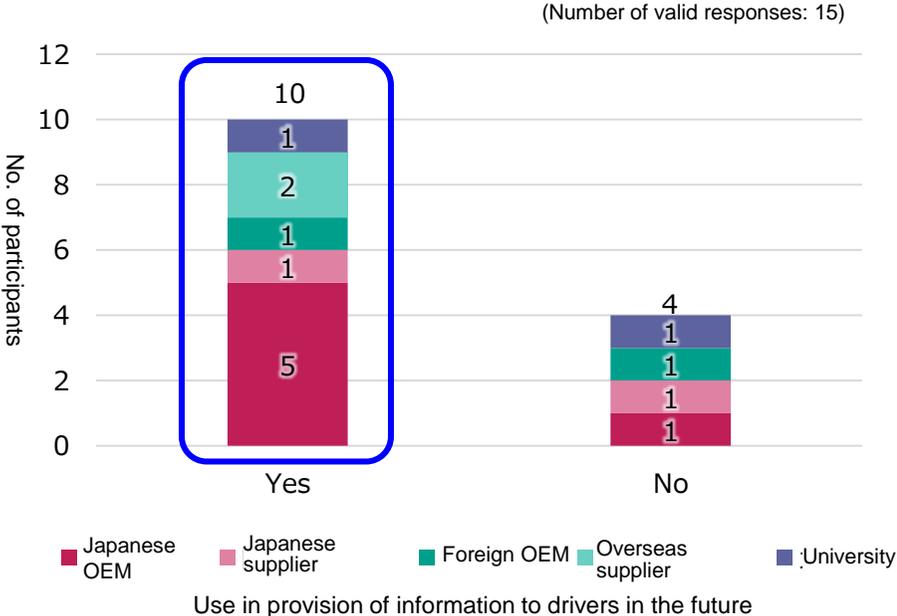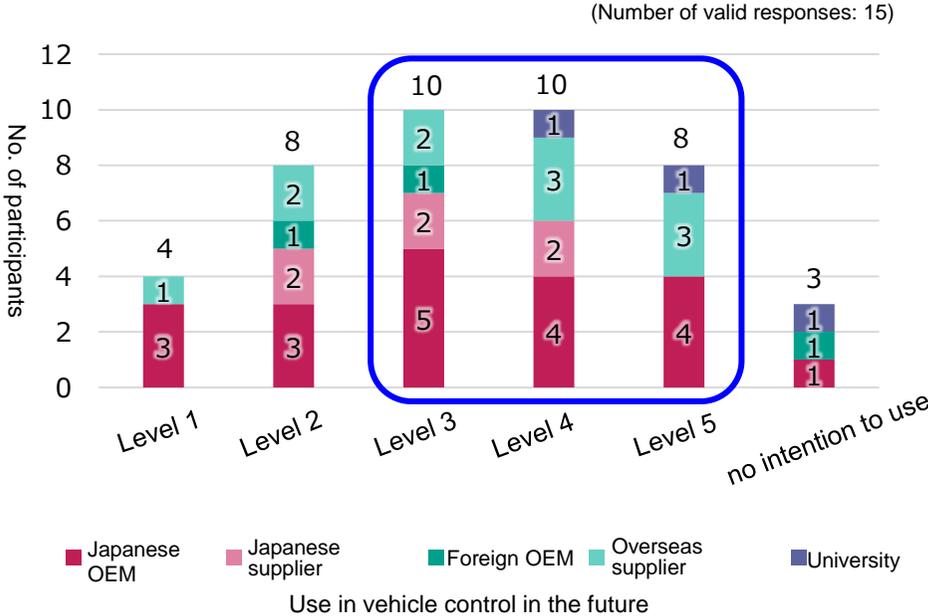

Practical use of the signal light color information in vehicle control

1. Evaluation of the Tokyo Waterfront Area

(1) Signal information (Evaluation of the signal light color information)

(1)-2 Intention to use the traffic signal color information in the future (intention to commercialize)

In the future, how do you want to utilize the traffic signal color information? <Multiple selection>

Application to vehicle control (Level 1, Level 2, Level 3, Level 4, Level 5, no intention to use)

Provision of the information for drivers (Yes, No)

<u>Many participants indicated that they intend to use traffic signal color information in automated driving systems and drive assist systems.</u>

(Number of valid responses: 15)

No. of participants

Level 1: 4 (Japanese OEM 3, Overseas supplier 1)
Level 2: 8 (Japanese OEM 3, Japanese supplier 2, Foreign OEM 1, Overseas supplier 2)
Level 3: 10 (Japanese OEM 5, Japanese supplier 2, Foreign OEM 1, Overseas supplier 2)
Level 4: 10 (Japanese OEM 4, Japanese supplier 2, Overseas supplier 3, University 1)
Level 5: 8 (Japanese OEM 4, Overseas supplier 3, University 1)
no intention to use: 3 (Japanese OEM 1, Foreign OEM 1, University 1)

Use in vehicle control in the future

(Number of valid responses: 15)

No. of participants

Yes: 10 (Japanese OEM 5, Japanese supplier 1, Foreign OEM 1, Overseas supplier 2, University 1)
No: 4 (Japanese OEM 1, Japanese supplier 1, Foreign OEM 1, University 1)

Use in provision of information to drivers in the future

Legend: ■Japanese OEM ■Japanese supplier ■Foreign OEM ■Overseas supplier ■University

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1. Evaluation of the Tokyo Waterfront Area

(1) Signal information (Evaluation of the signal light color information)
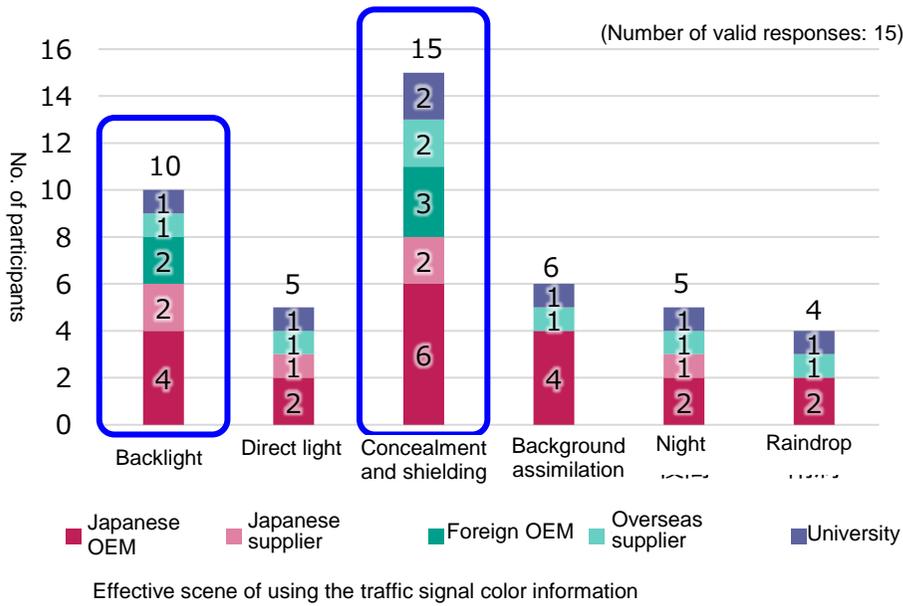
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(1)-3 Effective scene of using the traffic signal color information

In what kind of scene was the traffic signal color information particularly useful? <Multiple choice>

| Backlight | Direct light | Concealment and shielding | Background assimilation | Night | Raindrop |

In addition, please attach images of effective scenes of the traffic signal color information.

Traffic signal color information was confirmed to be effective in all six situations envisioned by the Consortium. Many respondents indicated that this information was particularly useful in situations involving "concealment and obstruction" and "backlighting."

Effective scene of using the traffic signal color information

(Number of valid responses: 15)

Legend: Japanese OEM, Japanese supplier, Foreign OEM, Overseas supplier, University

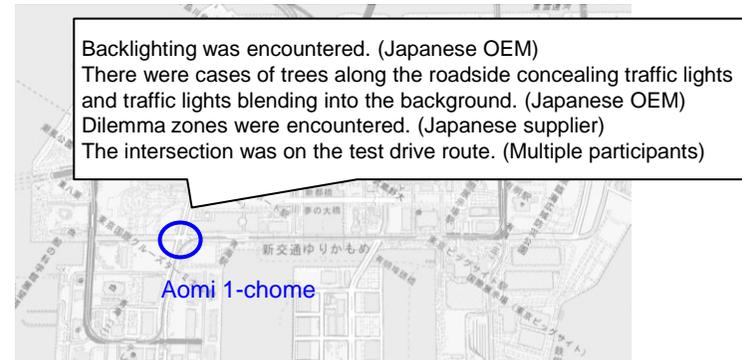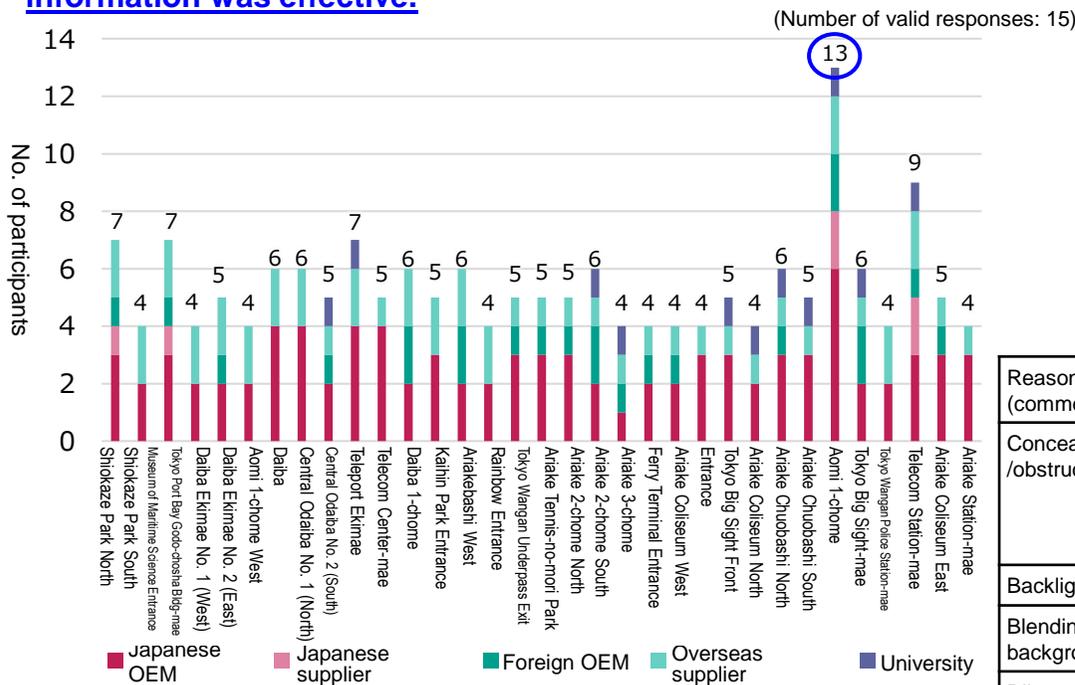| Free response comments	
Japanese OEM	● For LV3 and higher systems, 100% reliable traffic signal color recognition using vehicle cameras alone does not seem feasible, so we would like traffic signal color information to be provided for all situations. ● Pairing camera recognition with communications **would make robust decision-making possible.**
Overseas supplier	● In our automated driving systems, to verify redundancy for route recognition by cameras alone, **we also used ITS information alone as signal recognition input values**.
University	● We have confirmed that, when detecting traffic signal colors from a long distance using vehicle sensors, detection performance falls for all poor environmental conditions, so current indication status information would be effective as supplemental information. We have also confirmed that when the vehicle is near the intersection, in many cases the vehicle sensors can also accurately recognize the traffic signal color and the vehicle can enter the intersection. However, when there is backlighting, etc., the limits of the camera's capabilities sometimes prevent it from accurately recognizing the traffic signal color. In these situations, traffic signal color information would be highly effective. Therefore, **at intersections where there is only one visible traffic signal, this information would be particularly effective for making decisions regarding entering the intersection when there is backlighting**.

1. Evaluation of the Tokyo Waterfront Area

(1) Signal information (Evaluation of the signal light color information)

(1)-4 Intersection where the traffic signal color information is useful

Among the intersections where traffic signal color information was provided in the Tokyo Waterfront Area indicate intersections where the traffic signal color information was especially useful.

Traffic signal color information was confirmed to be effective for all intersections. On each company's driving routes, and at Aomi 1-chome, which was traversed numerous times because it was on the impact assessment evaluation course, backlighting and obstruction were major factors, and many participants indicated that traffic signal color information was effective.

(Number of valid responses: 15)

Backlighting was encountered. (Japanese OEM)
There were cases of trees along the roadside concealing traffic lights and traffic lights blending into the background. (Japanese OEM)
Dilemma zones were encountered. (Japanese supplier)
The intersection was on the test drive route. (Multiple participants)

Aomi 1-chome

No. of participants

Intersection where the traffic signal color information is useful

Legend: Japanese OEM | Japanese supplier | Foreign OEM | Overseas supplier | University

Reasons for selecting intersections where traffic signal color information was effective. (comment excerpts)	
Concealment /obstruction	● The traffic signal was obstructed by a roadside tree. (Japanese OEM) ● The intersection was located after a curve. (Japanese OEM, Japanese supplier) ● The view of the traffic light was obstructed by a large vehicle. (Foreign OEM, Japanese supplier)
Backlighting	● Backlighting was encountered. (Japanese OEM, Japanese supplier)
Blending into background	● The traffic signal blended into a roadside tree behind it. (Japanese OEM)
Dilemma	● Dilemma zones were encountered. (Japanese supplier)
Other	● The intersection was on the test drive route. (Multiple participants)

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1. Evaluation of the Tokyo Waterfront Area

(1) Signal information (Evaluation of the signal light color information)

(1)-5 Additions and amendments to the Consortium Discussion Draft

Based on the opinions we have received so far, the Consortium has prepared the following proposal.
Please provide additional or revised comments on this discussion.

[Proposed environmental conditions for the traffic signal color information]
- Signal-light color information is effective for automatic driving vehicles in the following scenes:
  - Backlight: A time zone when sunlight (including: building reflections) from the front overlaps the signal light;
    Traffic conditions where oncoming headlights overlap with signal lights;
  - Forward light: The time zone when the sunlight from the rear overlaps the signalling lamp;
  - Hiding and shielding: Traffic conditions in which signal light colors are hidden by surrounding large vehicles;
    A road structure in which the traffic signal becomes a blind spot due to a slope or immediately after a curve;
  - Background assimilation: A road structure and a time zone where buildings behind assimilate the traffic signal
  - Nighttime: A time zone when signal light color recognition accuracy decreases due to multiple light sources;
  - Raindrops: A weather condition in which rain drops appear in front of the camera
    to cause deterioration of signal light color recognition accuracy.

> It is effective when a traffic signal is hidden by a roadside tree. (University)

> This information is effective for traffic signals that are outside of cameras' angles of view. (Directly above stop lines, at the ends of downhill slopes, etc.) (Japanese OEM, Japanese OEM)

➡ Since the deterioration of the signal light color recognition accuracy can occur at all intersections due not only to the road structure but also to a certain time zone, a traffic condition, or a weather condition, it is desirable to provide the traffic signal color information at all signal intersections in road sections where automatic driving is to be performed.

> This information should be provided at all intersections for Lv4 automated driving.
> (Overseas supplier)

> This information is also effective for drive assist systems.
> (Japanese OEM)

> These situations could occur at any intersection, so instead of prioritizing intersections where this information is to be provided, consideration should be given to defining "automated driving areas."
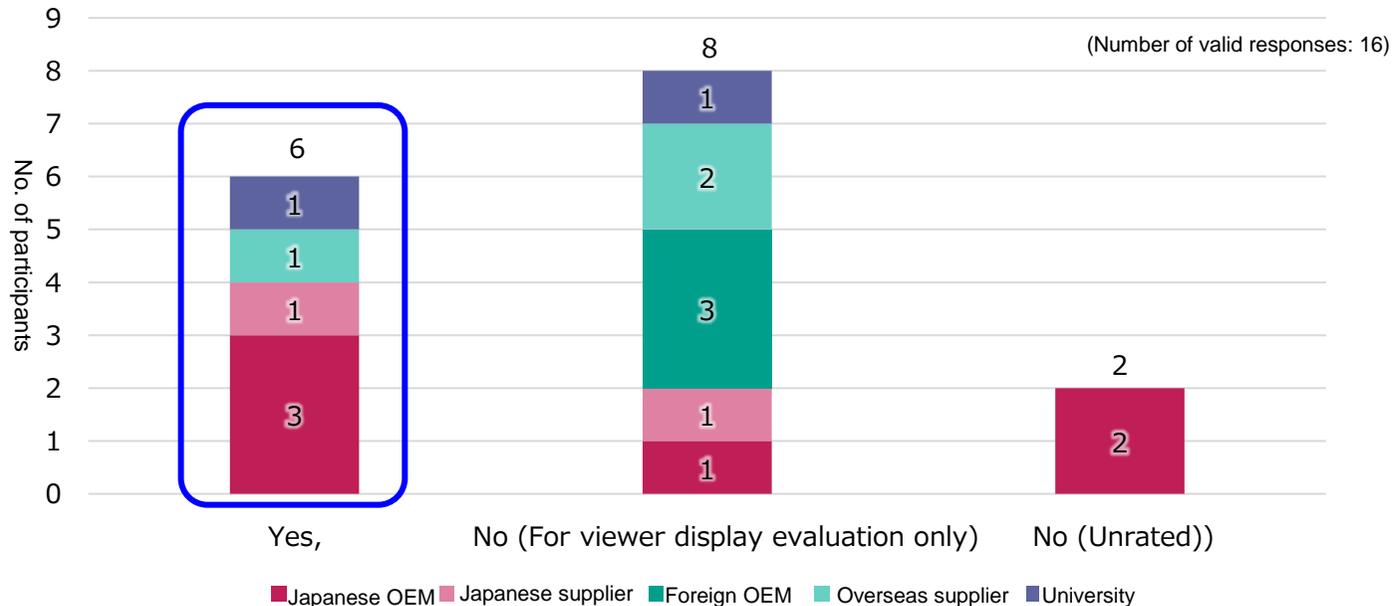> (Japanese OEM)

> Agreed.
> (Foreign OEM)

1. Evaluation of the Tokyo Waterfront Area

(2) Remaining seconds count information (Dilemma avoidance evaluation)

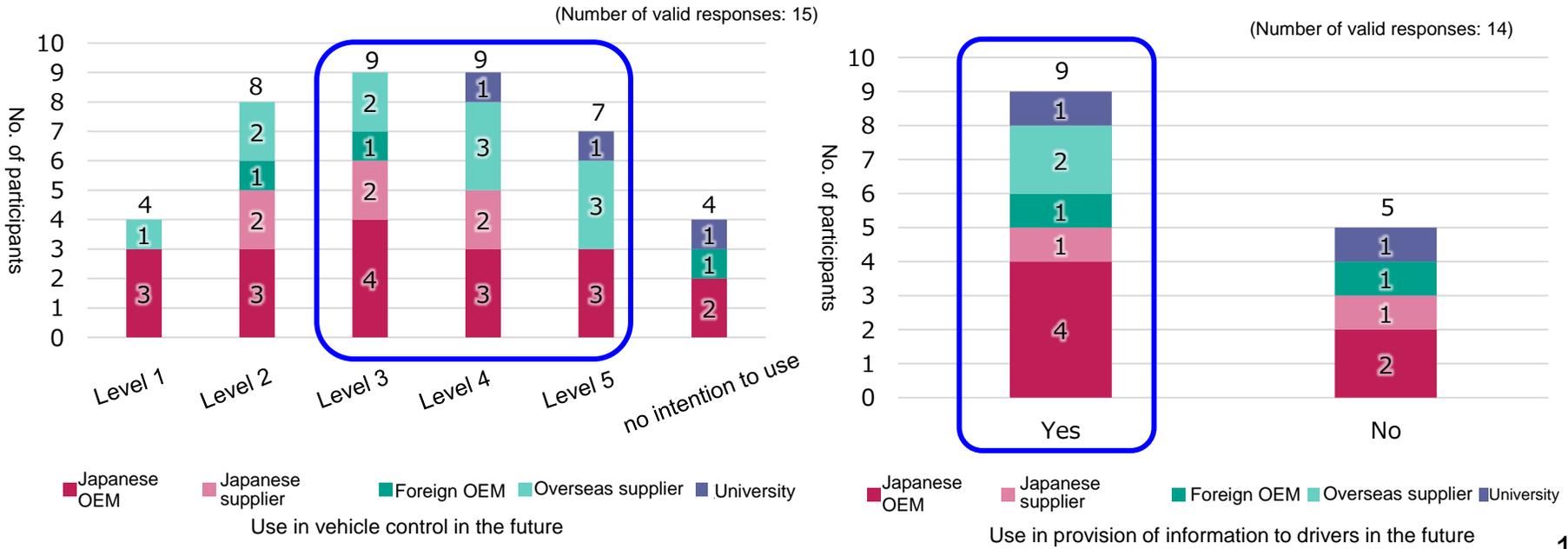**(2)-1 Actual results of use of the remaining seconds count information for vehicle Control**

Did you drive using the remaining seconds count information for vehicle control? <Single choice>
((Yes; No (for evaluation with Viewer Display only); No (Unrated))

Roughly 40% of the test participants that provided valid responses used traffic signal remaining seconds information in vehicle control.

(Number of valid responses: 16)

No. of participants

Yes,　　　　　No (For viewer display evaluation only)　　　No (Unrated))

■Japanese OEM　■Japanese supplier　■Foreign OEM　■Overseas supplier　■University

Results of use in vehicle control

(2) Remaining seconds count information (Dilemma avoidance evaluation)

[2]-2 Intention to use the remaining seconds count information in the future(intention to commercialize)

 How would you like to use the remaining seconds count information in the future? <Multiple choice>

Application to vehicle control (Level 1), Level 2, Level 3, Level 4, Level 5, No intention to use)

Information provision for drivers (Yes, No)

Many participants indicated that they intend to use traffic signal remaining seconds information in automated driving systems and drive assist systems.

(Number of valid responses: 15)

Use in vehicle control in the future

■Japanese OEM ■Japanese supplier ■Foreign OEM ■Overseas supplier ■University

(Number of valid responses: 14)

Use in provision of information to drivers in the future

■Japanese OEM ■Japanese supplier ■Foreign OEM ■Overseas supplier ■University

1. Evaluation of the Tokyo Waterfront Area

(2) Remaining seconds count information (Dilemma avoidance evaluation)

(2)-3 Effective scenes of using the remaining seconds count information

What kind of scene was the remaining seconds count information particularly useful?

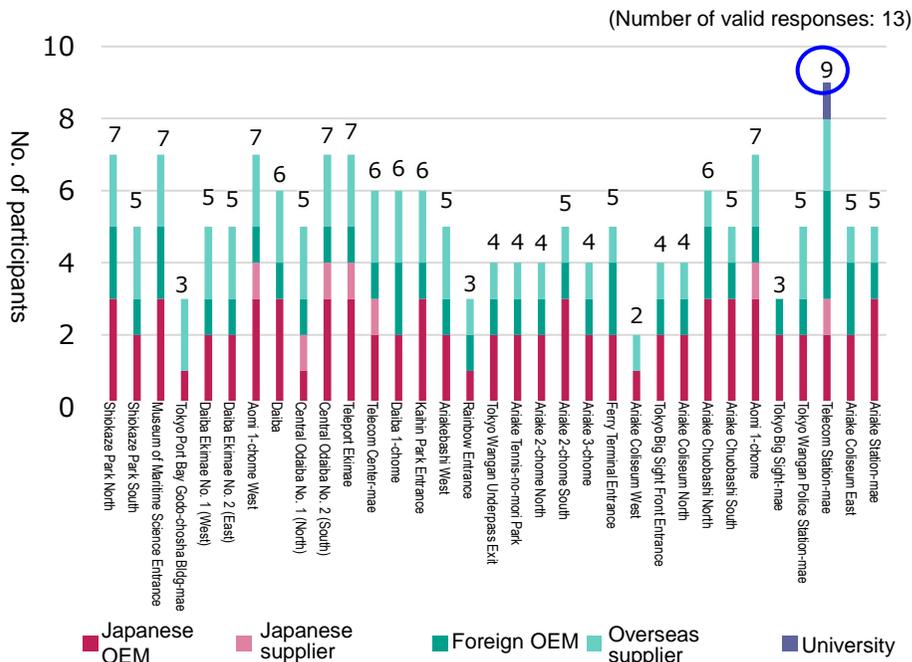| Free response comments		
Situations in which the information would be effective	Effective when **traffic signals are obstructed** by preceding vehicles, curves, etc.	This information would be effective at intersections such as Ariake 2-chome South or Kaihin Park Entrance, at which the vehicle moves while there are other vehicles in front of it, as it would make it possible to calculate in advance whether or not it would be possible to traverse the intersection through a green or yellow traffic light when using automated driving. (Japanese OEM)
		When approaching an intersection while a preceding vehicle was obstructing the view of the traffic signal, there were cases in which the vehicle was not able to recognize the signal color in time using the vehicle's camera, so traffic signal information for traffic signals that fall outside of line of sight would be beneficial. (Foreign OEM)
		This information would be effective at traffic signals in blind spots, located after curves, such as at the Telecom Station-mae intersection. It would also be effective for situations when traffic signals cannot be seen because they are obstructed by large preceding vehicles, etc., so it is not clear whether it would be okay to pass the large vehicle or if the light is yellow or red. (Foreign OEM)
	Effective for intersections with high speeds	The information would likely be effective for intersections which are often traversed at high speeds. (Japanese supplier)
	Effective at intersections located close to each other	There are several road sections in which there are multiple consecutive traffic lights, there is little congestion, so the legal speed limit could be reached and driven at following the immediately preceding traffic light, and the timing of each traffic signal is such that almost each traffic light is reached in the dilemma zone. This information would be effective for adjusting acceleration and deceleration speeds for road sections such as these. (Foreign OEM)
Multipurpose use	**Use in appropriate acceleration/deceleration**	This information would be useful in preventing sudden deceleration and performing smooth vehicle control when the light changes from green to yellow in an intersection where the color sequence is "green → yellow → right turn arrow." (Japanese supplier)
		This information would be effective in preventing dilemmas at all intersections. Furthermore, not only would it prevent dilemmas, but it would also be extremely useful in achieving appropriate acceleration and deceleration. (Foreign OEM)
	Use in preparing to accelerate from a stop	This information could be used not only for dilemma avoidance, but also to preparing in advance for accelerating from a stop when the traffic signal changes from red to green, thereby preventing delays when accelerating from a stop and improving traffic efficiency. (Japanese OEM)
	Use in providing information for following vehicles	We confirmed that the information could be effectively used by showing traffic signal information to a following vehicle which does not have communications capabilities, reducing the frustration felt by the driver of the following vehicle due to being unable to see the traffic light because it is visually obstructed by a large vehicle, etc. (Japanese OEM)
Requests and problems	**Request for confirmed information to be provided**	We confirmed the effectiveness of confirmed information in making improvements related to dilemma zones. (reducing maximum deceleration). We were not able to confirm that information with margins was sufficiently effective. If preliminary deceleration/stopping functions are implemented, for safety's sake, when receiving remaining seconds information with a margin, only the minimum number of seconds can be used, and when the number of seconds is [0.0], the vehicle could stop, even though the traffic signal is green. (University)
	Mixed traffic with ordinary vehicles	In the left turn lane of the Aomi 1-chome intersection, the remaining seconds information was used to safely stop the autonomous vehicle, but an ordinary vehicle in the straight lane drove into the intersection. Because the intersection is a spacious one, it took time for the vehicle to exit the intersection and the traffic signal turned red. (Japanese OEM)

(2) Remaining seconds count information (Dilemma avoidance evaluation)
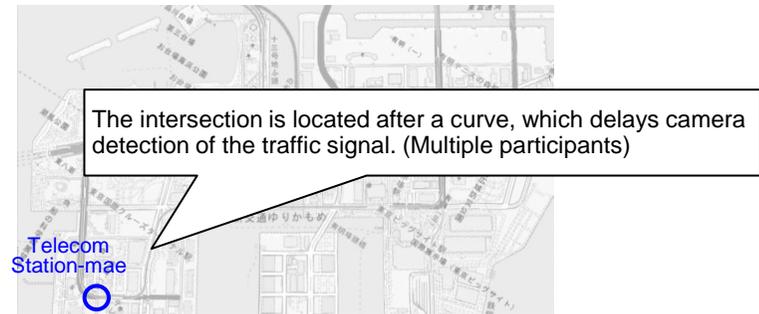
(2)-4 Intersections where the remaining seconds count information is useful

Among the intersections providing the remaining seconds count information in the Tokyo Waterfront Area (marked with red circles and blue triangles on the map), please indicate the remaining seconds count information is particularly useful.

Traffic signal remaining seconds information was confirmed to be effective for all intersections.
A notable number of participants indicated that it was effective at Telecom Station-mae, at which the timing of visual recognition of the traffic signal color is late due to a curve.

(Number of valid responses: 13)

No. of participants

Names of intersections where traffic signal remaining seconds information was useful

- Japanese OEM
- Japanese supplier
- Foreign OEM
- Overseas supplier
- University

The intersection is located after a curve, which delays camera detection of the traffic signal. (Multiple participants)

Telecom Station-mae

Reasons for selecting intersections where traffic signal remaining seconds information was useful. (comment excerpts)	
Immediately after a curve	● The intersection is located after a curve, which delays camera detection of the traffic signal. (Multiple participants)
Dilemma	● Dilemma zones were encountered. (Japanese supplier) ● Due to the timing of the intersections before and after this intersection, when driving close to the speed limit dilemma zones are often encountered. (Overseas supplier)
Other	● The intersection is one that is traversed at a relatively high speed. (Japanese OEM). ● The intersections were located close to each other. (Japanese supplier) ● The intersection was on the test drive route. (Multiple participants)

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1. Evaluation of the Tokyo Waterfront Area

(2) Remaining seconds count information (Dilemma avoidance evaluation)

(2)-5 Additions and amendments to the Consortium Discussion Draft

Based on the opinions received so far, the Consortium has prepared the following proposal.
Please provide additional or revised comments on this discussion.

[Proposed environmental conditions for the remaining seconds count information]
- In the following scenes, it is effective to provide the remaining seconds count information in the signal to the automatic driving vehicle.
  - Intersections having a short distance to adjacent signal intersection
  - Intersection of a route with a high speed limit

➡ It is desirable to provide the remaining seconds count information at all intersections in road sections where automatic driving is to be performed, because providing the same information enables avoidance of the dilemma zone and appropriate passage in the passage area, smooth stop in the stop area.

This information is also effective for drive assist systems.
(Japanese OEM)

The test data results alone are not sufficient to determine required environmental conditions; logical corroboration is also necessary.
(Japanese OEM)

Confirmed information should be provided.
(Japanese OEM, Japanese supplier, foreign OEM)

It should be noted that participants are being especially safety conscious in their driving.
(Japanese OEM)

Remaining seconds information is necessary in all intersections where dilemmas are encountered. Instead of prioritizing intersections where this information is to be provided, consideration should be given to defining "automated driving areas."
(Japanese OEM)

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1. Evaluation of the Tokyo Waterfront Area

Common to (1) Signal information (Evaluation of the traffic signal color information) and (2) remaining seconds count information (Dilemma avoidance evaluation)

(1)&(2)-6 Provision of signal information via ITS wireless communication (Signal light color, the number of seconds remaining)
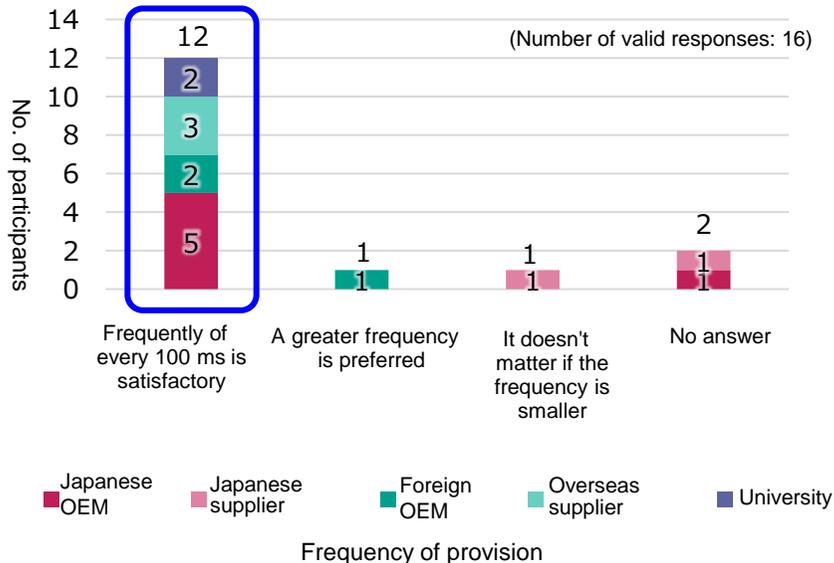   a. Frequency of provision
In ITS wireless communication, signal information is delivered every 100 ms. Are you satisfied with the frequency of provision? <Single choice>
(Frequently of every 100 ms is satisfactory; A greater frequency is preferred; It doesn't matter if the frequency is smaller; No answer)
If you choose "A greater frequency is preferred" or "It doesn't matter if the frequency is smaller", please indicate your desirable frequency.

Many participants indicated that delivering information ever 100 ms was satisfactory.
However, they indicated that the frequency with which information needs to be provided would vary depending on the information provision scope and communication stability.

Free response comments	
Japanese supplier	• **For the reception range used in this test, information could be delivered every 500 ms or 1,000 ms.**
Foreign OEM	• Information should be provided with greater frequency when there are obstacles such as moving objects within intersections. **Consideration should be given to changing the frequency based on whether or not there are moving obstacles.** • In some intersections, traffic signal information was not updated (there were momentary interruptions), though this may have been due to the location where the ITS wireless unit's antenna was installed. Given this situation, providing information in 100 ms intervals is appropriate. **If the stability of communications could be guaranteed, there might be no problem providing updates less frequently, such as every 200 ms.**

1. Evaluation of the Tokyo Waterfront Area

Common to (1) Signal information (Evaluation of the traffic signal color information) and (2) remaining seconds count information (Dilemma avoidance evaluation)

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(1)&(2)-6 Provision of signal information via ITS wireless (Signal light color, the number of seconds remaining)
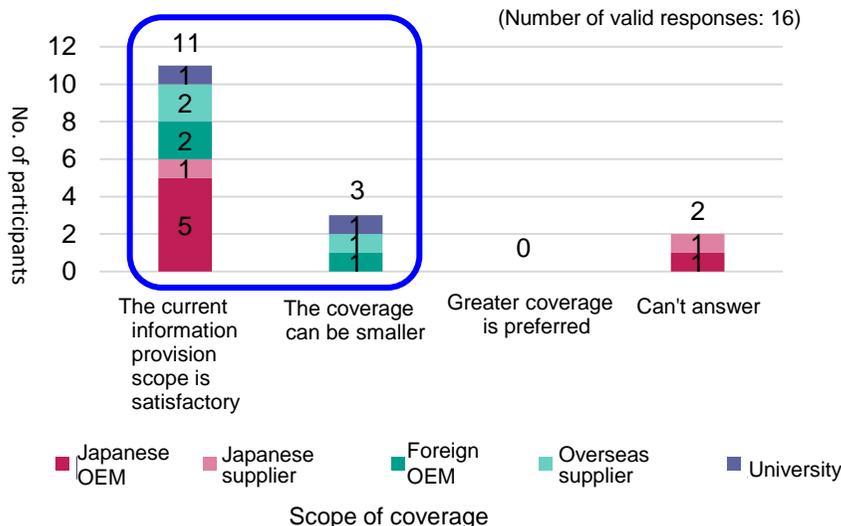
　　　　a. Scope of coverage

In FOTs, the ITS wireless actually covers about 900 meters around the intersection、depending on the on-board antenna installed. Are you satisfied with the scope of wireless coverage? <Single choice>

(Satisfied with the 900-meter coverage; The coverage can be smaller; Greater coverage is preferred; Can't answer)

 If you choose "The coverage can be smaller" or "Greater coverage is preferred", specify your desirable scope of coverage.

Participants were divided regarding whether the current coverage is preferable or if the coverage could be smaller.

(Number of valid responses: 16)

Free response comments		
Japanese OEM	●	The reception distance varies by intersection, so although we cannot make a definitive statement regarding all intersections, so far we have had no problems.
Foreign OEM	●	**A scope of roughly 200 meters would be best.** When driving at a speed of 11 m/2 (40 km/h), a vehicle will cover 500 meters in roughly 50 seconds, so we feel that the scope could be a bit smaller.
	●	**A scope of roughly 250 meters would be best.** However, this is based on the assumption that there are almost no momentary communication interruptions.
University	●	A **range of roughly 120 to 150 meters** from the stop line would be sufficient.

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1. Evaluation of the Tokyo Waterfront Area

Common to (1) Signal information (Evaluation of the traffic signal color information) and (2) remaining seconds count information (Dilemma avoidance evaluation)

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(1)&(2)-6 Providing signal information via ITS wireless

c. Improvement proposal for signal information format providing format of

In using signal information for vehicle control, please specify any information item that you wish to add to the format.

(Free response comments)
- **We would like traffic signal information to be provided to pedestrians. (Japanese OEM)**
- While this is not a result of this test, looking to the future, **a variety of signal control methods will need to be supported**.
  We would like the data elements presented by the UTMS Society at the 10th working group session on November 18 to be added. (Japanese OEM)
- **The Format No. 55 "Green arrow direction" was confusing.** (Japanese supplier)
- While this is not a required improvement, **we would like if the platform was aligned with global standards.** (University)

1. Evaluation of the Tokyo Waterfront Area

Common to (1) Signal information (Evaluation of the traffic signal color information) and (2) remaining seconds count information (Dilemma avoidance evaluation)

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(1)&(2)-7 Output of signal information to the vehicle control

a. Method of power output to vehicle (At the time of test):
The on-board equipment outputs signal information in the following five patterns. Specify the output method you have used.
<Multiple choice>
(CAN1, CAN2, CAN 3, LAN1, LAN2, Other)

The most commonly used method of output to the vehicle was LAN1 (same as received data format (all data) + traffic signal ID).

(1) Output patterns
  The following five methods (CAN1, CAN2, CAN3, LAN1 LAN2, Other) have been prepared for outputting to vehicle control. Output is performed using the designated pattern.
  The 100 ms output interval assumes an effective CAN speed of 50 kbps.
  Note) For CAN3 additional traffic signal ID output, there are intersections for which output is not possible every 100 ms.
    If data is received while CAN output is still in progress, this new data will not be output (it will be thinned).
    (This also applies to CAN1 and CAN2 for effective CAN speeds of 50 kbps or below)
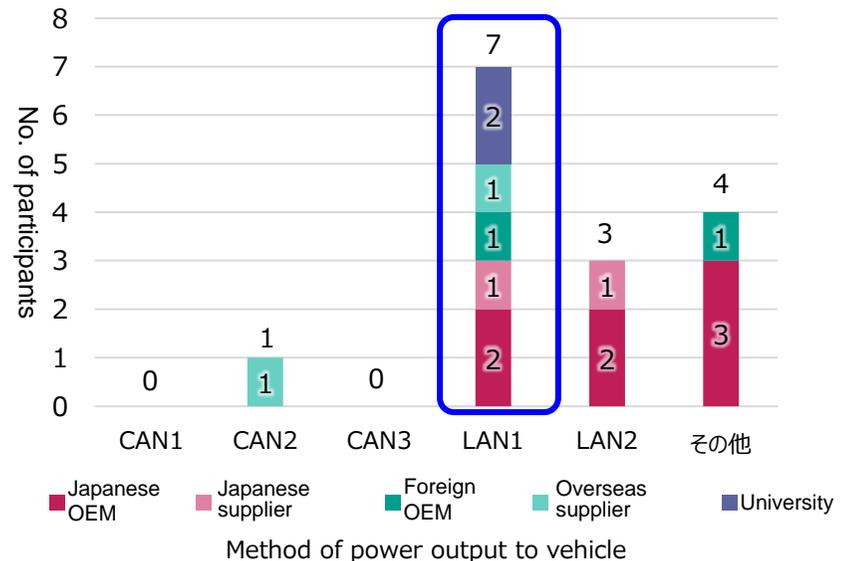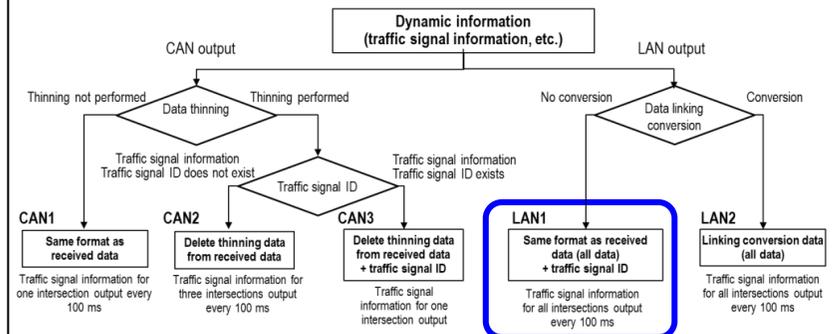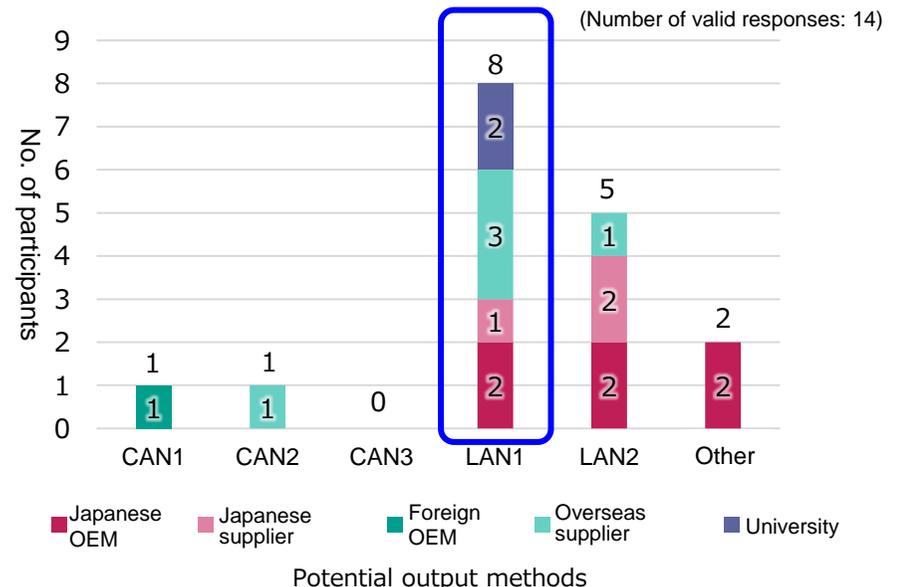

Fig. 3-1 Output patterns to vehicle control

(Number of valid responses: 15)

Method of power output to vehicle

Legend: Japanese OEM, Japanese supplier, Foreign OEM, Overseas supplier, University

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1. Evaluation of the Tokyo Waterfront Area

Common to (1) Signal information (Evaluation of the traffic signal color information) and (2) remaining seconds count information (Dilemma avoidance evaluation)

(1)&(2)-7 Output of signal information to the vehicle control

b. Method of outputting signal information to the vehicle (Intention to use in FY2021 test):

In the previous section, five patterns were used for outputs to the on-board equipment. Among these patterns, specify output methods you may use in the FY2021 tests. <Multiple choice>

(CAN1, CAN2, CAN 3, LAN1, LAN2, Other)

In FY2021, as well, LAN1 is expected to be used by the largest number of participants.

Fig. 3-1 Output patterns to vehicle control

Potential output methods

Common to (1) Signal information (Evaluation of the traffic signal color information) and (2) remaining seconds count information (Dilemma avoidance evaluation)

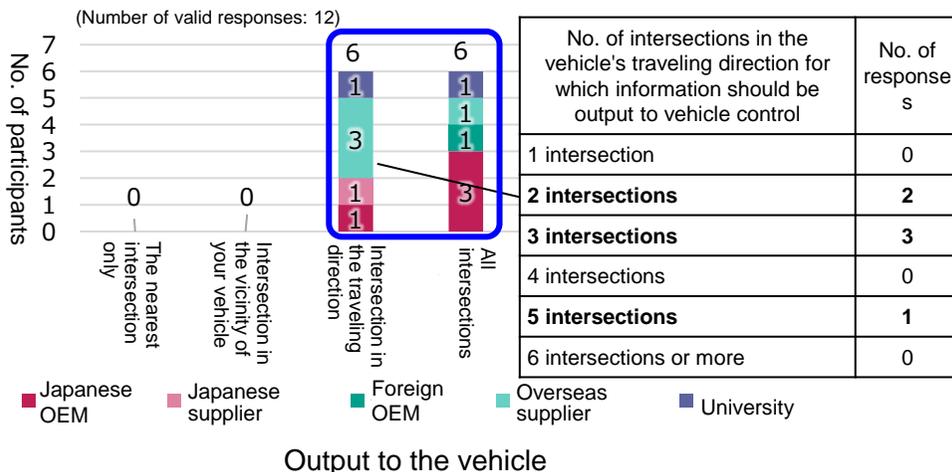**(1)&(2)-7 Output of signal information to vehicle control**
c. Output to the vehicle
Because the range of information provided by ITS wireless equipment was about 900 meters, the maximum number of intersections for a vehicle was 10 or so, depending on the reception position.　What form of output is desirable when you use received information for vehicle control? <Multiple choice>
　　　　　・The nearest intersection only
　　　　　・ Intersection (　　) in the vicinity of your vehicle (*Please specify a number)
　　　　　・ Intersection (　　) in the traveling direction (*Please specify a number)
　　　　　・ All intersections

All participants want to perform LAN output of traffic signal information for all received intersections and for two to five intersections in the vehicle's traveling direction.
We believe that LAN output will be used because received information will be used in design and deliberation regarding the optimal utilization of received information.

(Number of valid responses: 12)

No. of participants / Output to the vehicle

Legend: Japanese OEM / Japanese supplier / Foreign OEM / Overseas supplier / University

No. of intersections in the vehicle's traveling direction for which information should be output to vehicle control	No. of responses
1 intersection	0
2 intersections	**2**
3 intersections	**3**
4 intersections	0
5 intersections	**1**
6 intersections or more	0

Free response comments	
Japanese OEM	● Dilemma zone handling could be performed after receiving information for all intersections. ● When road structures are complex, it is not possible to identify entry intersections and routes, so it would be safest to **receive all information and select between it based on the route**.
Foreign OEM	● It would be sufficient to have information for traffic lights which could be stopped at with some degree of leeway even when driving at 60 km/h.
Overseas supplier	● Receiving information only for intersections in the vehicle's traveling direction could reduce the number of intersections for which information is received and prevent interference between received information. ● Information needs to be received for all intersections which could be traversed. The data to be used would then be determined based on the vehicle's route.
University	● We selected two intersections in the vehicle's traveling direction so that the state of the next intersection, following the one immediately in front of the vehicle, could be determined.

1. Evaluation of the Tokyo Waterfront Area

Common to (1) Signal information (Evaluation of the traffic signal color information) and (2) remaining seconds count information (Dilemma avoidance evaluation)

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(1)&(2)-8 Problems with using signal information
Regarding the use of signal information for automatic driving level 4, please provide us with any problem or request.   You are asked to give us any problem, needs, and request in levels 1 to 5, as well as in level 4.
Also describe any problem to be addressed when using this information for drivers.

Free response comments	
V2I	**This should be introduced for all intersections with traffic signals within automated driving level areas. We would like this to be provided universally, including at push-button traffic lights. (Japanese OEM)** **There needs to be a system for determining the operation state of the infrastructure** (infrastructure installation locations, operating status, contents of services provided to drivers). (Japanese OEM) - Information latency needs to be 300 ms or les and the reliability of the information needs to be ensured. (Japanese OEM) - When the accuracy of GNSS vehicle position estimation is low, highly reliable traffic signal color information would be useful. Consideration could be given to measures such as not displaying information, not using information for control, prioritizing vehicle-mounted sensor information, etc., when the level of reliability is low. (Japanese OEM) - Consideration also needs to be given to **how to ensure safety when there are issues with traffic signal information** caused by infrastructure factors, vehicle-side factors, or the like. (Foreign OEM) - To use automated driving systems with a high degree of reliability, the level of the traffic signal information must be ASIL-B or above. (Overseas supplier) - The **stability of communications should be improved**, such as by reconsidering how transmitters are installed, the number of transmitters that are installed, the method used to transmit traffic signal information, etc. (Foreign OEM) - There were times when we were unable to receive the information while still at a sufficient distance, so **reception quality must be improved**. (University) - We've heard that communication interruptions, etc., occurred due to causes such as GPS synchronization and power supply noise. Consideration should be given to improving communication reliability. (University)
Traffic signal control	- We would like detection-based remaining seconds information **to be confirmed as soon as possible**. (Japanese OEM) - There are issues with the provision of remaining seconds information with margins and its use in control, such as the minimum amount of remaining seconds being fixed at zero and the existence of situations in which the number of seconds could rise. (Japanese OEM) - When an emergency vehicle was approaching, there were cases of the remaining seconds information being interrupted and of green waves. **Consideration must also be given** to emergency vehicle information. (Japanese OEM) - When information delivery is stopped due to an emergency vehicle, etc., information should be provided that indicates why the normally supplied information was not received (including duration information). (Japanese OEM) - In preparation for practical implementation, we would like for the reliability of remaining seconds information to be ensured. (Japanese OEM) - For traffic signal remaining seconds, **confirmed** information is better than information with margins. (Japanese supplier) - Control specifications should be established to prevent sudden changes in the number of remaining seconds when it is 10 seconds or less (or 15 seconds or less, if that is possible). (Foreign OEM)
Social acceptability	**Drivers of ordinary vehicles should be made aware of the behavior of vehicles that receive traffic signal information (such as their preliminary deceleration).** In some situations, this behavior could prompt tailgating or road rage. (Foreign OEM) - When providing information to drivers, it should be possible to adjust and adapt the information based on driver characteristics (personality, mood, etc.). (Overseas supplier)
International cooperation	- With regard to the method used to deliver information such as traffic signal information, development should be carried out after gathering information regarding **global trends and the opinions of industry operators**. (Japanese supplier) - Systems should meet global standards. (University)

2. Evaluation of the Metropolitan Expressway Connecting Haneda Airport and the Tokyo Waterfront Area
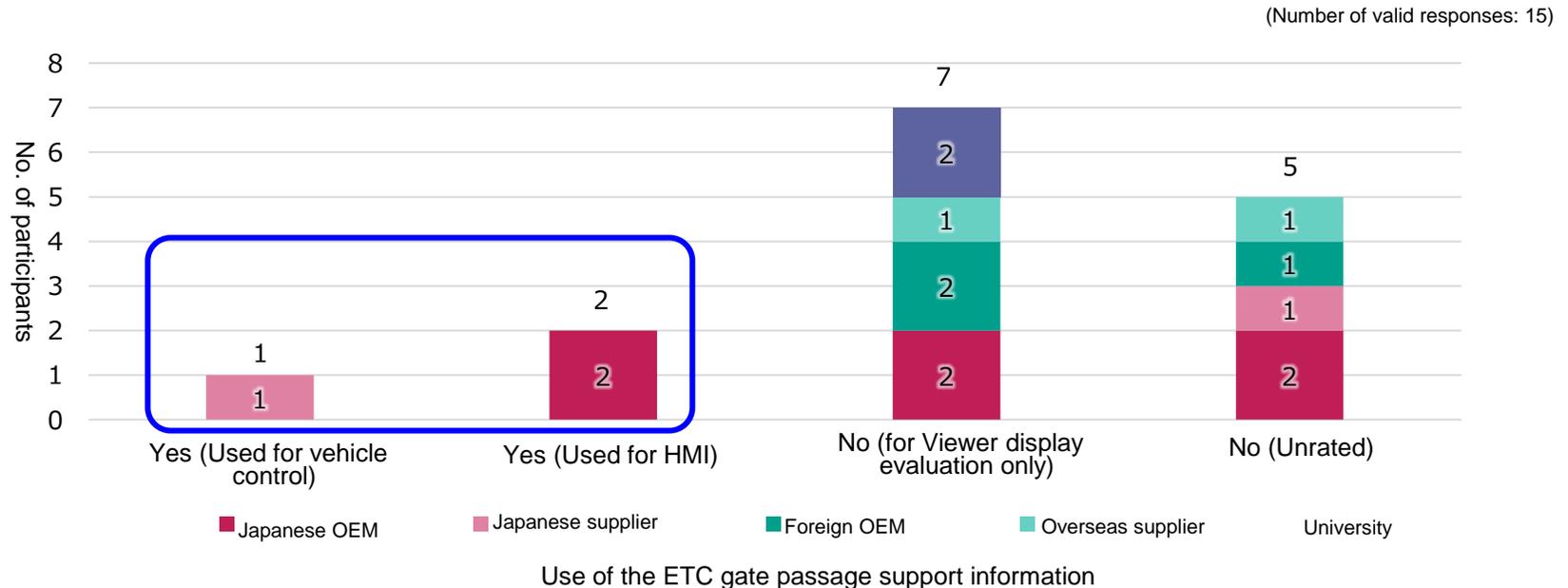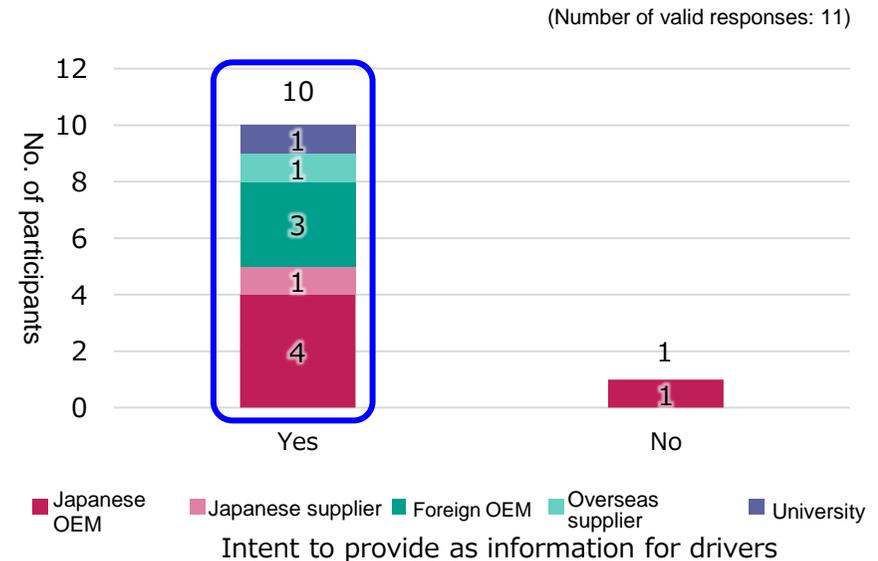
(3) Evaluation of of the ETC gate passage support information

(3)-1 Use of the ETC gate passage support information for vehicle control

Did you use of the ETC gate passage support information in the driving test? <Multiple choice>

(Yes (Used for vehicle control); Yes (Used for HMI); No (for Viewer display evaluation only); No (Unrated))

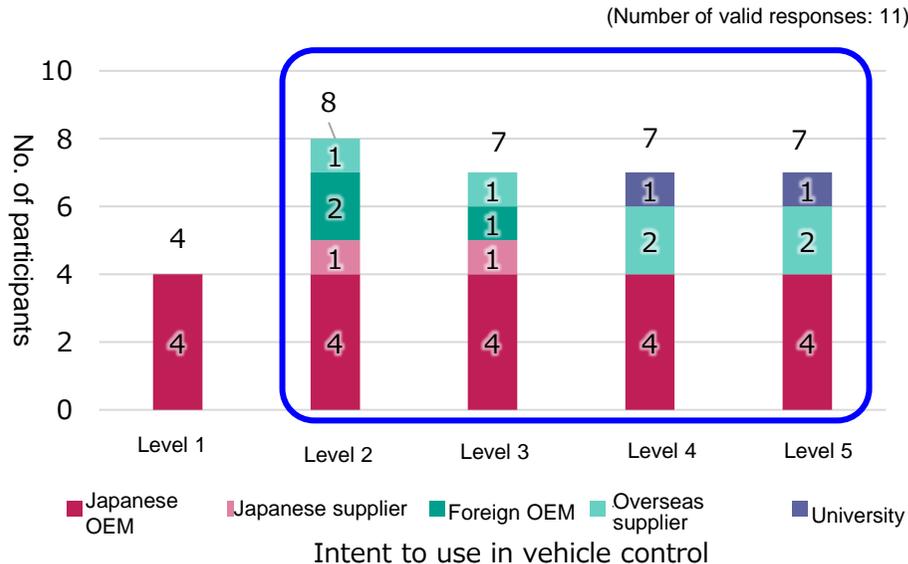**Some participants used ETC gate passing support information for vehicle control and HMI for drivers.**

(Number of valid responses: 15)

Use of the ETC gate passage support information

■Japanese OEM　　■Japanese supplier　　■Foreign OEM　　■Overseas supplier　　University

2. Evaluation of the Metropolitan Expressway Connecting Haneda Airport and the Tokyo Waterfront Area

(3) Evaluation of the ETC gate passage support information

(3)-2 Intention to use the ETC gate passage support information in the future

How do you intend to use the ETC gate passage support information in the future?

<Multiple choice>

Application to vehicle control (Level 1, Level 2, Level 3, Level 4, Level 5)

Provision of the information for drivers (Yes, No)

Participants indicated that they intend to use ETC gate passing support in automated driving systems and drive assist systems.

(Number of valid responses: 11)

Intent to use in vehicle control

(Number of valid responses: 11)

Intent to provide as information for drivers

2. Evaluation of the Metropolitan Expressway Connecting Haneda Airport and the Tokyo Waterfront Area
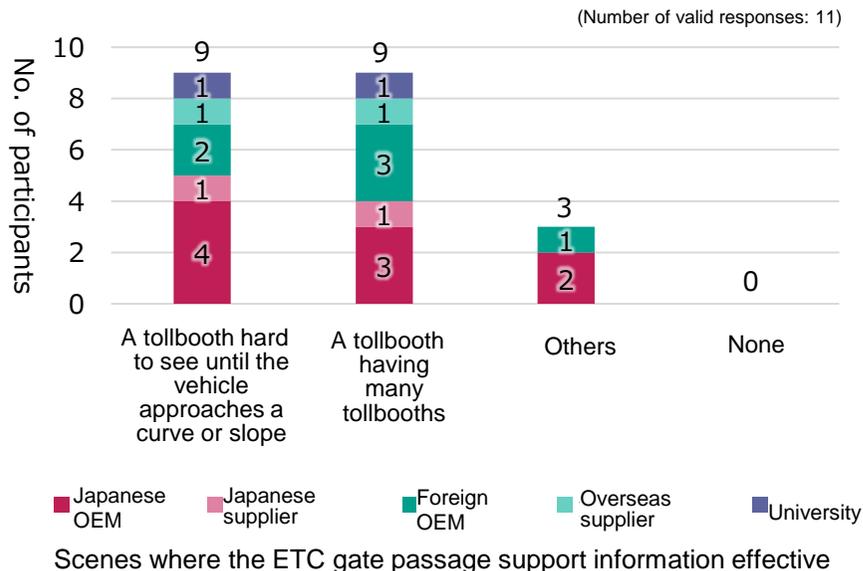
(3) Evaluation of the ETC gate passage support information

(3)-3 Scenes where the ETC gate passage support information is effective

In what kind of situation do you feel that the ETC gate transit assistance information is especially effective?   <Multiple choice>

(A tollbooth hard to see until the vehicle approaches a curve or slope; A tollbooth having many tollbooths; others; None)
Other than the above, please write down the features of the places where the ETC gate passage support information is effective.

ETC gate passing support information is effective for all toll booths.
In particular, it appears likely to be particularly effective for toll booths whose operating status cannot be visually confirmed until late and toll booth areas with numerous toll booths.

(Number of valid responses: 11)

No. of participants

Scenes where the ETC gate passage support information effective

- Japanese OEM
- Japanese supplier
- Foreign OEM
- Overseas supplier
- University

Free response comments	
Japanese OEM	● **At the first toll booth used,** information was received at an early point, regardless of whether the vehicle did or did not have an ETC device. This made path planning possible for the vehicle. ● **Even at a toll booth which a driver is familiar with,** there could be situations in which it is not possible to use the gate that the driver had intended to use, due to maintenance work on the ETC gate, etc., so being provided with information in advance would make path planning possible. ● **This information would be helpful when a gate cannot be used because a vehicle several positions ahead does not have its ETC card inserted, etc.**
Foreign OEM	● **This information would helpful at toll booths for which there are frequent status changes.**

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2. Evaluation of the Metropolitan Expressway Connecting Haneda Airport and the Tokyo Waterfront Area

(3) Evaluation of the ETC gate passage support information

(3)-4 Additions and amendments to the Consortium Discussion Draft

Based on the opinions we have received so far, the Consortium has prepared the following proposal. Please provide additional or revised comments on this discussion.

[Problems in finalizing specifications]

- The ETC gate passage support information was confirmed to be accurately delivered to automatic driving vehicles, and no problems have been presented by any participants concerning practical application.

There were no problems with the ETC gate passing support information itself.
(Japanese OEM)

When ETC gates are suddenly shut down for operation, the distance required for changing to a passable gate is required.
(Foreign OEM)

If a large number of autonomous vehicles all tried to use the same ETC gate, that would itself present a new problem
(University)

Sufficient maps must be created for the areas within toll booth areas on expressways, like the lane links within intersections on general roads.
The Airport West Entrance was prepared using curves, so there was no problem, but some other toll booths were prepared using straight lines. It was stated that for lane links within intersections and on expressways, "straight lines are accepted," but with respect to lane links for ETC gate passing, it would be best to create lane links using curves that match the actual flow of vehicles.
(Japanese OEM)

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2. Evaluation of the Metropolitan Expressway Connecting Haneda Airport and the Tokyo Waterfront Area

(3) Evaluation of the ETC gate passage support information

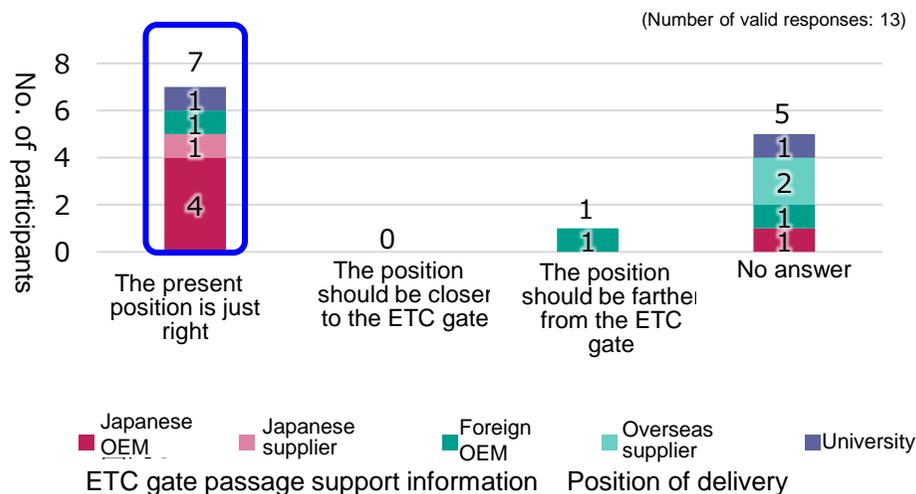**(3)-5 Provision of the ETC gate passage support information**

a. Position of delivery

At Haneda Airport West, we deliver the ETC gate passage support information about 180 meters before the ETC gate. How was the position of the service? <Single choice>
(The present position is just right; The position should be closer to the ETC gate; The position should be farther from the ETC gate; No answer)
If you have any comments other than the above, please indicate the desirable delivery position of the ETC gate passage support information.

Many participants indicated that the present position where ETC gate passing support information is provided is just right.

(Number of valid responses: 13)

No. of participants

Category	The present position is just right	The position should be closer to the ETC gate	The position should be farther from the ETC gate	No answer
Total	7	0	1	5
University	1			1
Foreign OEM	1		1	
Japanese supplier	1			
Overseas supplier				2
Japanese OEM	4			1

Japanese OEM   Japanese supplier   Foreign OEM   Overseas supplier   University

ETC gate passage support information   Position of delivery

Free response comments	
Japanese OEM	● **If this were combined with ETC card insertion check processing**, then when a vehicle does not have an ETC car inserted, this information could also be provided to following vehicles. ● For expressway toll booths, etc., **the location where information is provided** will likely be defined separately **based on vehicle speed**.
Japanese supplier	● Instead of defining the distance in terms of distance from the ETC gate, it would be better to define it as "○ m in front of the open space before the toll booth" or the like.

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2. Evaluation of the Metropolitan Expressway Connecting Haneda Airport and the Tokyo Waterfront Area

(3) Evaluation of the ETC gate passage support information

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(3)-5 Provision of the ETC gate passage support information
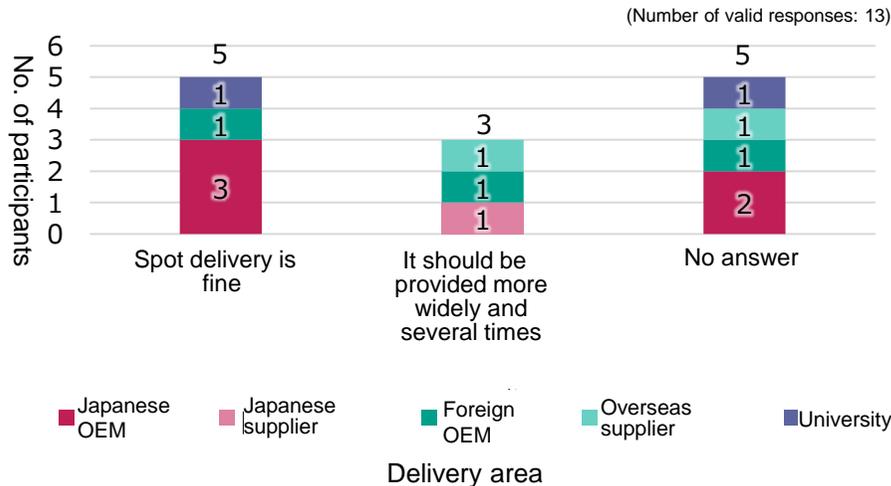
b. Delivery area

At Haneda Airport West, information was delivered in spots using ETC 2.0 wireless communication. How was it?
<Single choice>
 (Spot delivery is fine; It should be provided more widely and several times; No answer)
Regarding the delivery area of the ETC gate passage support information, please write down any comment:

A number of participants also responded that spot delivery of ETC gate passing support information is fine. However, with respect to practical implementation, there were also participants who asked that information be provided multiple times, and participants who were unable to answer at the present time.

(Number of valid responses: 13)

Free response comments		
Japanese OEM	●	Separate consideration must be given to providing information multiple times over a wide area during automated driving.
Japanese supplier	●	At the test level, spot delivery was fine, but **in practical implementation, providing the information multiple times would be better**.

Legend: Japanese OEM, Japanese supplier, Foreign OEM, Overseas supplier, University

Delivery area

2. Evaluation of the Metropolitan Expressway Connecting Haneda Airport and the Tokyo Waterfront Area

(3) Evaluation of the ETC gate passage support information

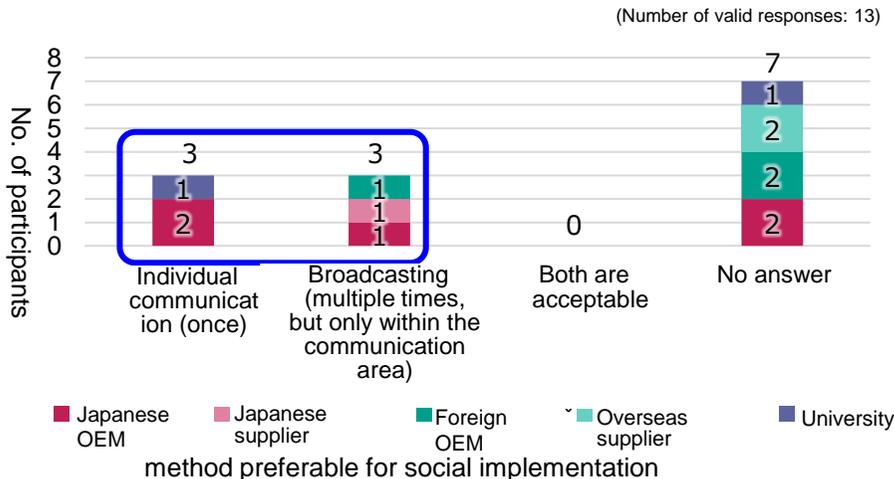**(3)-5 Provision of the ETC gate passage support information**

c. Delivery method (Individual communication/broadcast)

At Haneda Airport West, the information was provided by individual communication only once, while ETC 2.0 has a mechanism that allows information to be provided multiple times by broadcasting. Which method is preferable for social implementation? <Single choice>

   (Individual communication (once); Broadcasting (multiple times, but only within the communication area), Both are acceptable; No answer)

If you have any comments other than the above about the provision method for the ETC gate passage support information, please write them down.

Multiple participants indicated that ETC gate passing support information should be provided by broadcasting it.

(Number of valid responses: 13)

method preferable for social implementation

Free response comments	
Japanese OEM	● Separate consideration must be given to providing information multiple times over a wide area during automated driving. ● There were no problems during this testing, so individual (one time) communication would not appear to present a problem.
University	● If transit management is performed on an individual vehicle basis in the future, individual communication would be better. If this approach is not being considered at all, then broadcasting would be fine.

2. Evaluation of the Metropolitan Expressway Connecting Haneda Airport and the Tokyo Waterfront Area

(3) Evaluation of the ETC gate passage support information

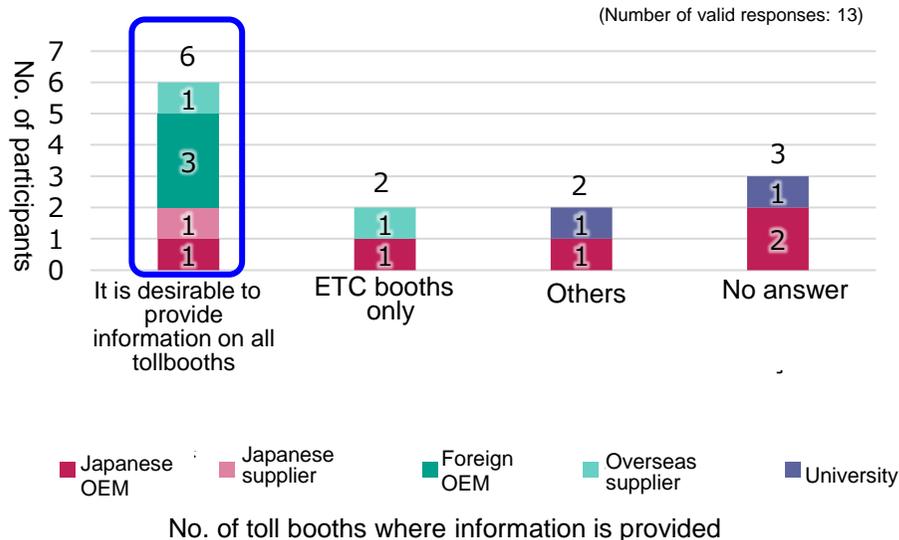**(3)-5 Provision of the ETC gate passage support information**

d. Number of tollbooths

There are 2 tollbooths at Haneda Airport West. In Japan, there are many tollgates having 10 tollbooths or more. How many tollbooths should be covered by the information?

(It is desirable to provide information on all tollbooths; ETC booths only; Others; No answer)

Information should be provided at all tollbooths.
However, the method for using this information on the vehicle side when there are many booths (vehicle driving application) has yet to be established.

(Number of valid responses: 13)

No. of participants

	It is desirable to provide information on all tollbooths	ETC booths only	Others	No answer
Japanese OEM	1	1	1	2
Japanese supplier	1			
Foreign OEM	3			
Overseas supplier	1	1		
University			1	1
Total	**6**	**2**	**2**	**3**

Legend: ■ Japanese OEM ■ Japanese supplier ■ Foreign OEM ■ Overseas supplier ■ University

No. of toll booths where information is provided

Free response comments	
Japanese OEM	● It would be best to provide information for all toll booths, but taking practical usage into consideration, it would probably be sufficient to provide information for the ETC booth and one or two adjacent toll booths. ● When there are 10 or more booths, **one issue would be how to succinctly provide information to drivers of all passable booths**.
University	● A realistic approach would be to increase the number of toll booths for which information is provided based on the rate of adoption of autonomous vehicles and the rate of usage of expressways.

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2. Evaluation of the Metropolitan Expressway Connecting Haneda Airport and the Tokyo Waterfront Area

(3) Evaluation of the ETC gate passage support information

(3)-5 Provision of the ETC gate passage support information

e. Proposal for improvement of the ETC gate passage support information deliver format

In using the ETC gate passage support information for vehicle control, please give us any suggestion concerning improvements to the information format. For reference, the section to follow shows a format for outputting ETC gate passage support information to the vehicle control.

Free response comments	
Japanese OEM	- If the **congestion status of each toll booth (such as the number of vehicles using the booth)** were known, this information could be used to select which booth to use. **Information regarding cruising line congestion conditions** should also be provided. - There is not enough information regarding the relationship between toll booths and lane links. There are only two toll booths for Airport West, so the relationships between toll booths and lane links was clear, but **in locations with numerous toll booths, the booth number alone may not be enough to determine the corresponding lane link**. **When narrowing down the number of toll booths for which to provide information, it may not be possible to count the lane links from the edge.**

2. Evaluation of the Metropolitan Expressway Connecting Haneda Airport and the Tokyo Waterfront Area

(3) Evaluation of the ETC gate passage support information

(3)-6 Problem with using the ETC gate passage support information

Please let us know any problems or requests when using the ETC gate passage support information for the automatic driving level 4. Also please describe problems, needs, and requirements of levels 1 to 5 and any problem concerning the use of this information for drivers.

Free response comments	
Distribution method	● It will be important to identify the **optimal V2I/V2N delivery method** after considering issues involved in societal deployment (such as ensuring that information is instantaneous, cost, etc.) (Japanese OEM)
Gate status	● Although this did not occur during the test, verification needs to be performed of what happens if, for some reason, **an ETC gate is closed**. (Foreign OEM) ● **With regard to changes in gate status,** when should gate information be updated, and how frequently should it be updated? (Foreign OEM)
High-accuracy map	● **For high-accuracy maps,** preparing lane links within intersections and associating lane links with toll booths will be issues. (Japanese OEM) ● Information should be prepared so that information, including **movement lines** from information provision locations **to ETC gates**, is provided. (Foreign OEM)
Information usage	● When there are multiple passable ETC gates, **how should gates be selected?** Should the decision be controlled by the gates, or should the decision be made by the autonomous vehicle? (Foreign OEM)
Adjusting spacing between vehicles	● Consideration should be given to passing management **when multiple autonomous vehicles try to use gates at the same time.** (University) ● **Should merging after gate passing** be controlled by the gate assigning priorities to vehicles or by automated vehicles sensing the conditions around them and deciding on which lane they should drive on? (Foreign OEM)

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2. Evaluation of the Metropolitan Expressway Connecting Haneda Airport and the Tokyo Waterfront Area
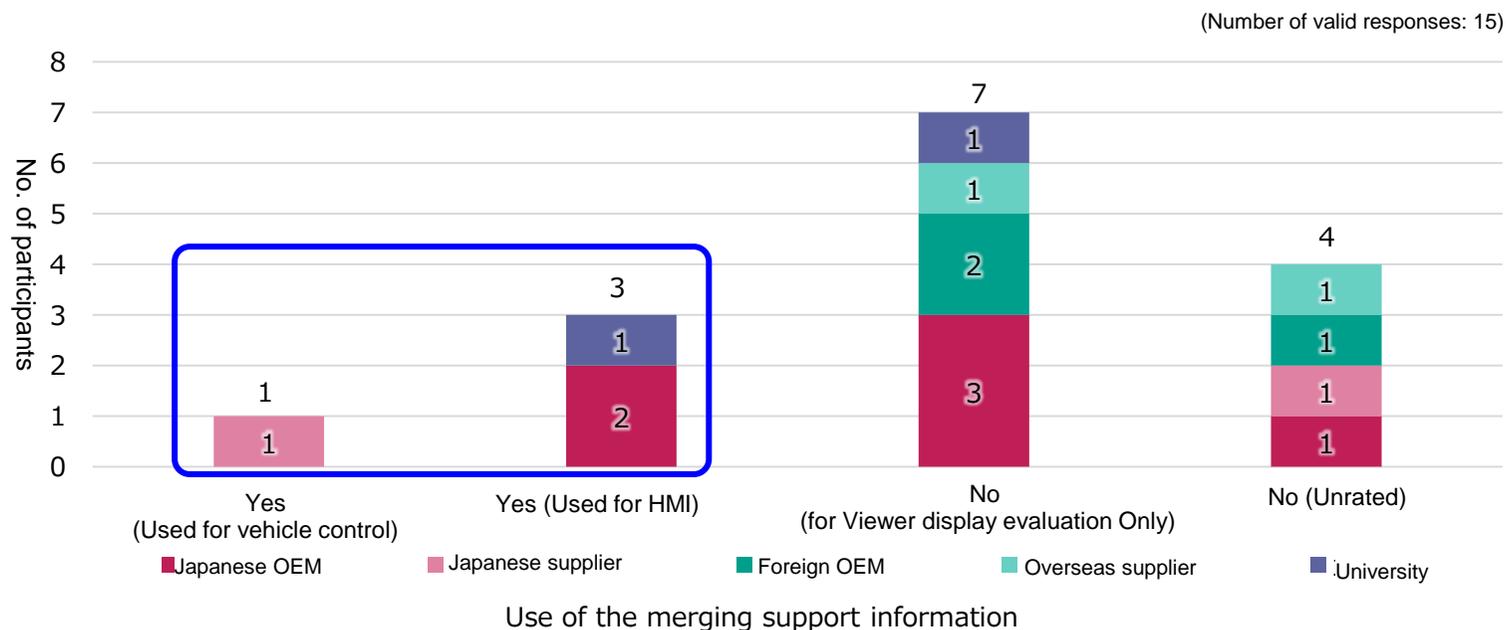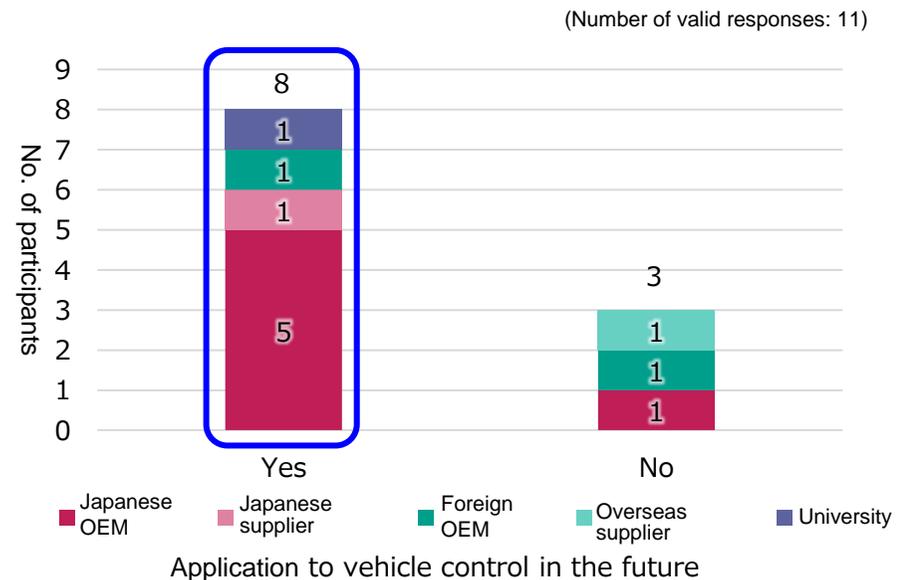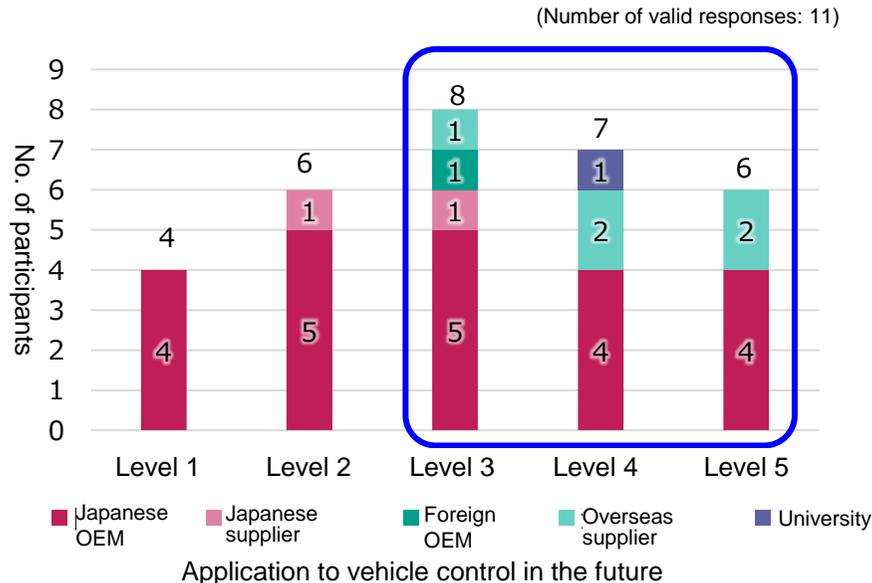
(4) Evaluation of the merging support information
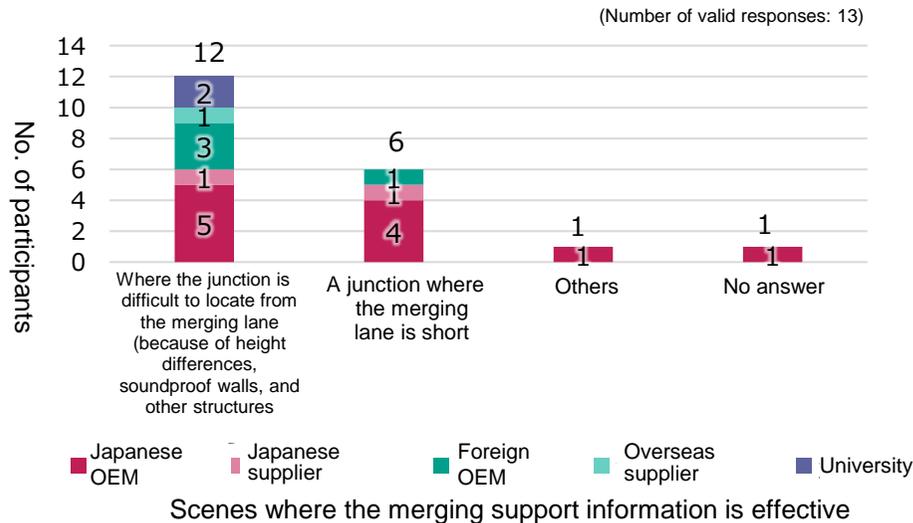
(4)-1 Use of the merging support information for vehicle control

Did you use this information in the driving test? <Single choice>

(Yes (Used for vehicle control); Yes (Used for HMI); No (for Viewer display evaluation Only); No (Unrated))

Some participants used merging support information for vehicle control and HMI for drivers.

(Number of valid responses: 15)

No. of participants

| | Yes (Used for vehicle control) | Yes (Used for HMI) | No (for Viewer display evaluation Only) | No (Unrated) |

Legend: ■ Japanese OEM   ■ Japanese supplier   ■ Foreign OEM   ■ Overseas supplier   ■ University

Use of the merging support information

2. Evaluation of the Metropolitan Expressway Connecting Haneda Airport and the Tokyo Waterfront Area

(4) Evaluation of the merging support information

(4)-2 Intention to use the merging support information in the future

In the future, how will you use this information? <Multiple choice>

Application to vehicle control (Level 1, Level 2, Level 3, Level 4, Level 5)

Delivery of this information to drivers (Yes, No)

<u>Many participants indicated that they intend to use merging support information in automated driving systems and drive assist systems.</u>

(Number of valid responses: 11)

No. of participants

Level 1: 4 (Japanese OEM 4)
Level 2: 6 (Japanese OEM 5, Japanese supplier 1)
Level 3: 8 (Japanese OEM 5, Japanese supplier 1, Foreign OEM 1, Overseas supplier 1)
Level 4: 7 (Japanese OEM 4, Overseas supplier 2, University 1)
Level 5: 6 (Japanese OEM 4, Overseas supplier 2)

Application to vehicle control in the future

Legend: Japanese OEM, Japanese supplier, Foreign OEM, Overseas supplier, University

(Number of valid responses: 11)

No. of participants

Yes: 8 (Japanese OEM 5, Japanese supplier 1, Foreign OEM 1, University 1)
No: 3 (Japanese OEM 1, Foreign OEM 1, Overseas supplier 1)

Application to vehicle control in the future

Legend: Japanese OEM, Japanese supplier, Foreign OEM, Overseas supplier, University

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2. Evaluation of the Metropolitan Expressway Connecting Haneda Airport and the Tokyo Waterfront Area

(4) Evaluation of the merging support information

(4)-3 Scenes where the merging support information is effective

In what kind of situations do you feel that this information is especially effective? <Multiple choice>

(Where the junction is difficult to locate from the merging lane (because of height differences, soundproof walls, and other structures; A junction where the merging lane is short; Other; NA)

Other than the above, please write down any feature of places where the merging support information is effective.

Merging support information is effective in situations in which it is difficult to determine cruising line conditions from merging lanes.
Furthermore, multiple participants indicated that they wanted notifications of approaching merging vehicles to be provided to cruising line vehicles.

(Number of valid responses: 13)

Scenes where the merging support information is effective

Free response comments		
Japanese OEM	●	This information would be effective in **locations where there are traffic jam contributing factors immediately after merging into a cruising line**, such as sharp curves, tunnel entrances, a reduction in the number of lanes, etc.
	●	**It would be effective in locations with large speed differences between cruising line vehicles and merging vehicles.**
Japanese supplier	●	It would be good if **vehicles on cruising lines** were also notified that merging vehicles were approaching.
University	●	In the future, when there are many automated vehicles on cruising lines, **information about approaching vehicles passing ETC gates would also be useful for vehicles on cruising lines.** This information would be effective for allowing merging vehicles in.

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2. Evaluation of the Metropolitan Expressway Connecting Haneda Airport and the Tokyo Waterfront Area

(4) Evaluation of the merging support information

(4)-4 Additions and amendments to the Consortium Discussion Draft

Based on the opinions we have received so far, the Consortium has prepared the following proposal. Please provide any additional or revised comment on this discussion.

[Problems with finalizing the specifications]

■ The merging support information provided by the FOT system is usable when the traffic on the cruising line is steady, but only providing information once makes it impossible to convey changes in the situation on the cruising line, so for borderline traffic and traffic jams, smooth merging is difficult.

The merging area calculated arrival time is not very reliable, and sometimes leads to erroneous driving support.
(Japanese OEM)

The FOT system functions *sometimes* when the traffic on the cruising line is steady.
(Japanese OEM)

The FOT system functions when the vehicles on the cruising line are driving at steady speeds, but that is a rare occurrence.
(Japanese OEM)

There were cases in which it wasn't clear if there were no vehicles, or if the vehicles were just outside the sensor's detection range.
(Japanese OEM)

2. Evaluation of the Metropolitan Expressway Connecting Haneda Airport and the Tokyo Waterfront Area

(4) Evaluation of the merging support information
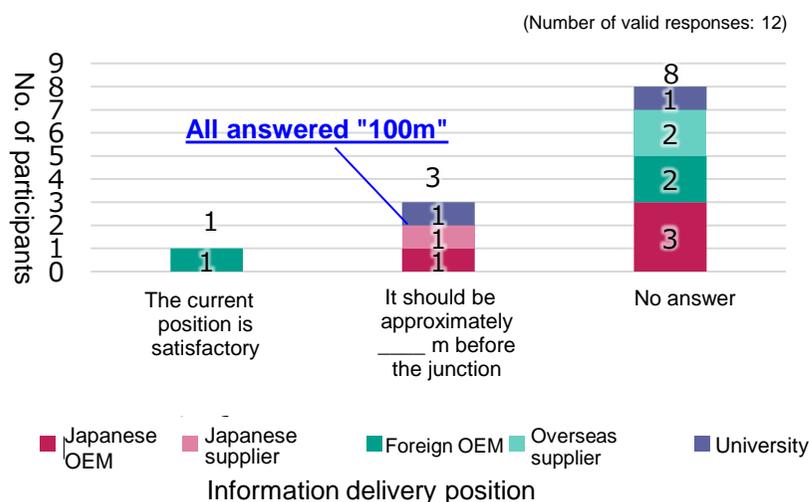
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(4)-5 Provision of the merging support information

a. Information delivery area

At Haneda Airport West, information was delivered in spots using ETC 2.0 wireless communication. How was it? <Single choice>
(Spot delivery suffices; Continuous communication is preferred; No response available)
If you have any other comment about the information delivery area, please write them down.

Many participants that continuous communication is preferable in order to deal with changes in cruising line vehicle speeds.

(Number of valid responses: 14)
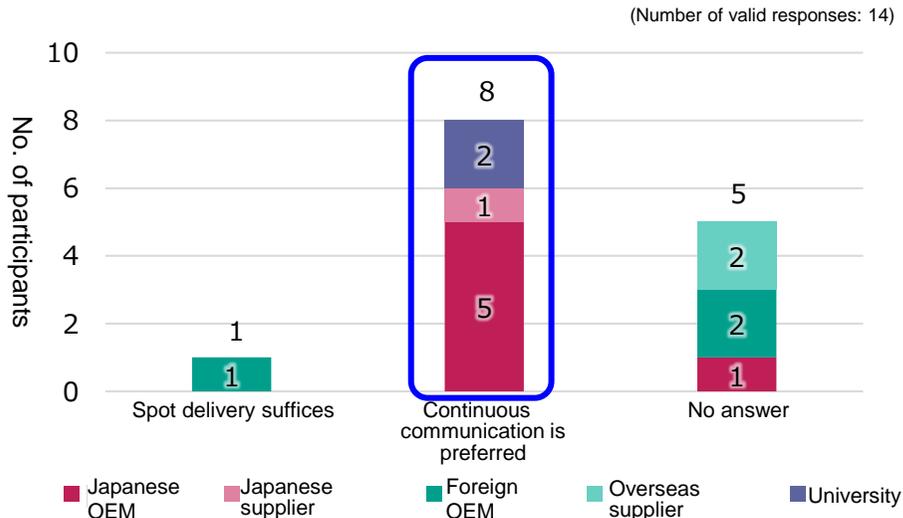
The merging support information delivery area

Free response comments	
Japanese OEM	• The continuous communication range should be considered in light of the **detection range of the cruising line sensors.** • **Communications (updates) must be performed sufficient times to assess changes** in cruising line vehicle speeds. • Continuous communications would be better in order to **avoid errors.** • Information is provided through spot delivery, which reduces the reliability of calculated arrival times.
Foreign OEM	• If cross-sectional sensing were used for the cruising lines, spot delivery would be fine, **but for cruising line planar sensing, continuous communications should be used.** If continuous communications are used, consideration must also be given to verifying how to handle dynamically changing vehicle information.
University	• Generally speaking, we'd like to use **continuous information** that changes over time. • Using a wider range would make it possible to continuously acquire **the most current information**, which would be useful.

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(4) Evaluation of the merging support information

(4)-5 Provision of the merging support information

b. Information delivery position (For spot communication)

At Haneda Airport West, the merging support information is distributed about 80m before the junction (hard nose), using spot communication. How was the position of information delivery? <Single choice>

(The current position is satisfactory; It should be approximately _____ m before the junction; No answer)

Please provide any comment about the position of delivering the merging support information:

"No answer" was the most selected answer in response to the question regarding where information should be provided. (The information freshness and vehicle control perspectives are mutually opposed)

(Number of valid responses: 12)

No. of participants

All answered "100m"

Information delivery position

- The current position is satisfactory
- It should be approximately _____ m before the junction
- No answer

Legend: ■ Japanese OEM ■ Japanese supplier ■ Foreign OEM ■ Overseas supplier ■ University

Free response comments	
Prefer to receive ahead of current position	● To adjust acceleration or deceleration, the information should be delivered **roughly 80 to 90 meters before the junction**. (Japanese OEM) ● In order to ensure that there is sufficient time to make acceleration decisions, **we'd like to receive the information slightly further ahead of the junction**. (Japanese OEM)
No answer	● If it's too close to the junction, there won't be enough time for path planning. If it's too far from the junction, the accuracy of cruising line vehicle predictions will fall. (Japanese OEM) ● The perspective of improving information freshness is **inversely related** to the perspective of securing enough time for vehicle control, so we were **unable to answer the question**. (Japanese OEM) ● The issue of reductions in the accuracy of the calculated junction arrival time **places limitations on the predictive information delivery system**. (Japanese OEM) ● We think that in this case, due to the road structure, the situation was unavoidable. (University)

(4) Evaluation of the merging support information

(4)-5 Provision of the merging support information

c. Information delivery position (For continuous communication)
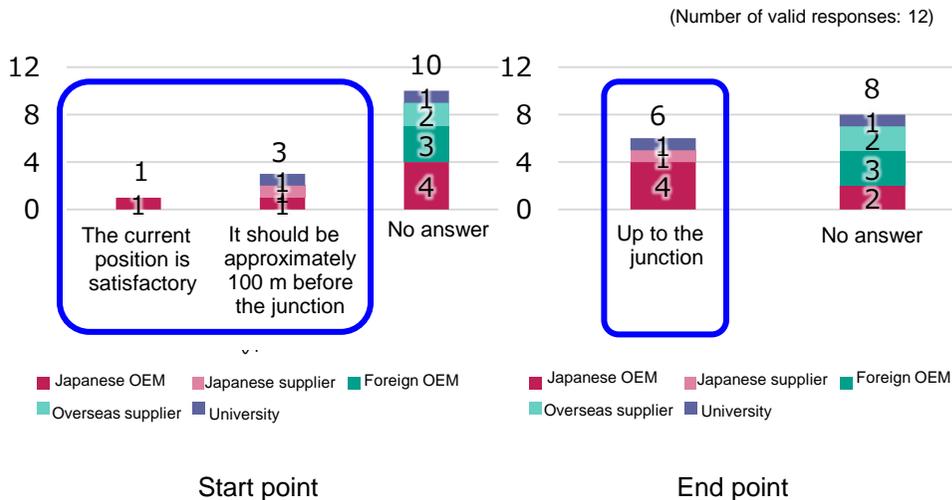
If continuous communication is used, please indicate the starting point and the ending point of the information delivery position. <Single choice>

Start point (The current position is satisfactory; It should be approximately _____ m before the junction; No answer)

End point (Up to the hard nose, it should be approximately _____ m before the junction; No answer)

Please provide any comment about the position of delivering the merging support information:

When using continuous communication, participants indicated that they wanted information to be provided continuously from roughly 100 meters in front of the junction to the location of the junction itself.
However, many participants also replied "No answer (cannot answer)," so further deliberation is necessary.

(Number of valid responses: 12)

Start point

End point

Free response comments	
Japanese OEM	● We would like to consider specific values for the start and end point locations after performing verification with related parties. ● We are considering start point locations for merging by entering spaces between vehicles on the cruising line. ● It would be best to use continuous communication up to the hard nose and to switch to autonomous driving using vehicle sensors beyond the hard nose.
University	● *It would be best to have enough distance for sufficient acceleration/deceleration before reaching the junction*, so the distance would vary depending on the speed limit in the area. ● We would not feel comfortable if we didn't receive information continuously up until the vehicle merged, **so we'd like to receive information up to the merging point.**

(4) Evaluation of the merging support information

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(4)-5 Provision of the merging support information

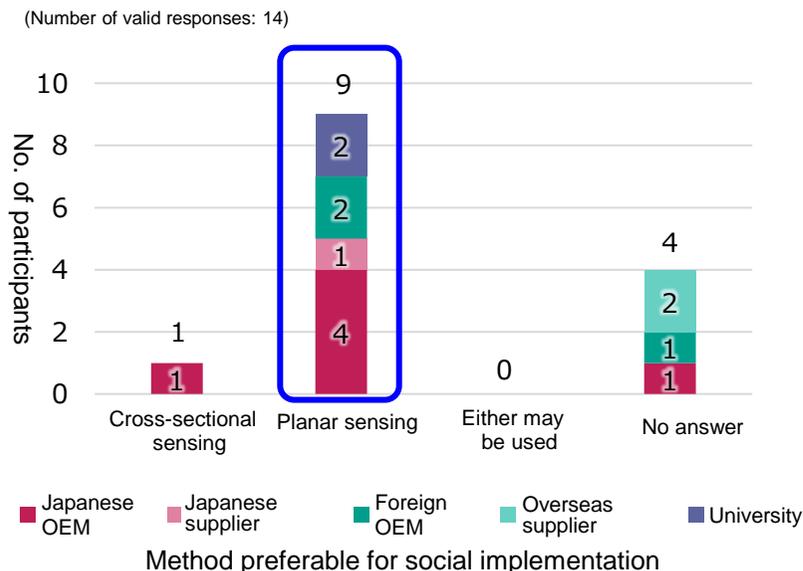#### d. Sensing of mainline vehicles (Cross-sectional/Planar)

At Haneda Airport West, vehicles on the mainline were sensed in cross section about 160m before the junction. On the other hand, we are also researching and developing a technology that senses the vehicle position on the main line in terms of plane rather than cross section. Which method is preferable for social implementation?
Which is method is more preferable for social implementation? <Single choice>
(Cross-sectional sensing; Planar sensing, Either may be used; No answer)
    Please give us any comment regarding the sensing of main-line vehicles provided in the merging support information.

Participants appear to have high hopes for the ability to merge without sudden acceleration or deceleration by using cruising line vehicle location information determined using planar sensing.

(Number of valid responses: 14)

No. of participants

Method preferable for social implementation

Legend: ■ Japanese OEM ■ Japanese supplier ■ Foreign OEM ■ Overseas supplier ■ University

Free response comments	
Reflecting cruising line vehicle acceleration/ deceleration	● Communications (updates) must be performed sufficient times to assess **changes** in cruising line vehicle **speeds**. (Japanese OEM) ● It would be best to use planar sensing for cruising line vehicle **speeds, acceleration and deceleration, forecasts of speeds when reaching the junction, lane changes, etc.** (Japanese OEM) ● **It would be best to perform tracking up to the merging area**, and then to update information as necessary. (Japanese supplier) ● Planar sensing should be used to take **acceleration and deceleration** into consideration. (Foreign OEM) ● We think that verification must be performed of how much **change in vehicle conditions** can be determined using planar sensing. (Foreign OEM) ● It is important to have information not only about the locations of cruising line vehicles, but also **speed and time changes**. (University)
Reliability/accuracy improvement	● We think there is potential to **improve the reliability** of calculated arrival times. (Japanese OEM) ● We believe that planar sensing can **improve the reliability of cruising line information**. (Foreign OEM) ● Cross-sectional sensing has **issues with location estimation accuracy**, so planar sensing would be better. (University)
Usage	● **Verification must also be performed regarding how to provide and use** information determined using planar sensing. (Foreign OEM)

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(4) Evaluation of the merging support information

(4)-5 Provision of the merging support information

e. Information delivery method (Individual communication/Broadcast)

At Haneda Airport West, the information was delivered by individual communication only once, but ETC 2.0 has a mechanism of delivering information multiple times by broadcasting.

Which would be a more desirable system for social implementation? <Single choice>

(Individual communication (once); Broadcasting (multiple times, but only within the communication area); Both are acceptable; No answer)

Please give us any comment regarding the method of delivering the merging support information.

Many participants indicated that broadcasting (multiple times, but only within the communication area) is preferable in order to handle the continuous delivery of changing information, as well as from the perspective of dealing with communication errors.

(Number of valid responses: 13)

Method preferable for social implementation
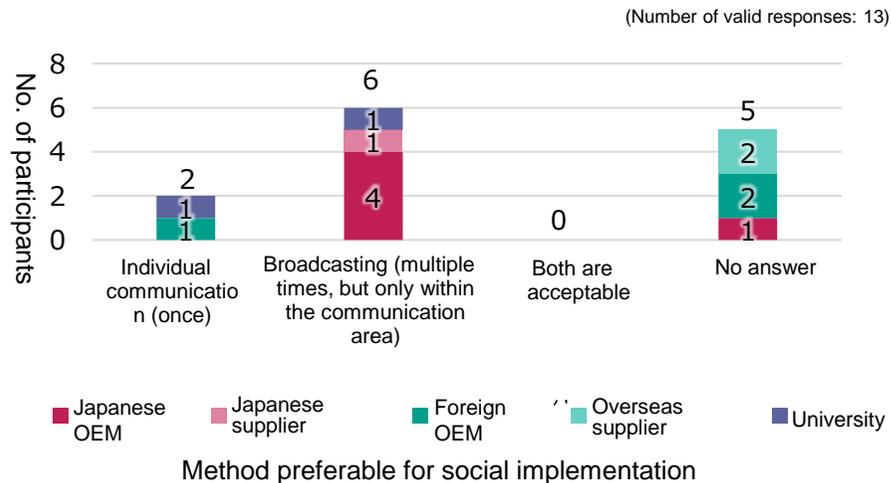
Free response comments	
Japanese OEM	• It would be best to use a method for continuously delivering information that is updated in real time within the communication area, **without affecting existing ETC/ETC2.0 systems (toll booths, etc.).** • If this is taken to mean "communicating the same information multiple times," given that communication failed several times during the test, this approach would be effective. • Multiple communications would be best in order to **avoid errors.** • When information is sent only once, **it results in the problem of arrival time predictions being less accurate**.
University	• Broadcasting would be fine for merging support alone, but **individual communication would be better in the future for assistance with merging arbitration.**

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2. Evaluation of the Metropolitan Expressway Connecting Haneda Airport and the Tokyo Waterfront Area

(4) Evaluation of the merging support information

(4)-5 Provision of the merging support information

f. Proposal to improve the format for providing the merging support information

In using the merging support information for vehicle control, please give us suggestions for improving the delivery format, etc. For reference, the following section provides a format for outputting the merging support information to the vehicle control.

Free response comments	
Japanese OEM	- We would like the **latitude and longitude of the information provision start position** to be provided. - We would like information to be provided for **distinguishing between inbound merging and outbound merging.** We would like for multiple spot communication points to be set up and for the following information to be provided. 　　**In front of the junction: cruising line traffic conditions** (overall traffic flow speed, degree of congestion, average time between vehicles) 　　**Near hard nose: Individual vehicle information** (location, speed) - We would like for continuous communication to be used to deliver **changing cruising line vehicle location information**. **We would like acceleration/deceleration, information regarding speed upon arrival,** and other information to be estimated and provided.
Japanese supplier	"Average vehicle speed (including vehicles in passing lanes)" is not necessary, but we need **information regarding the speeds of lanes beyond junctions**. The speeds in cruising lanes and passing lanes usually differ, so information for individual lanes is necessary.

(4) Evaluation of the merging support information

(4)-5 Provision of the merging support information

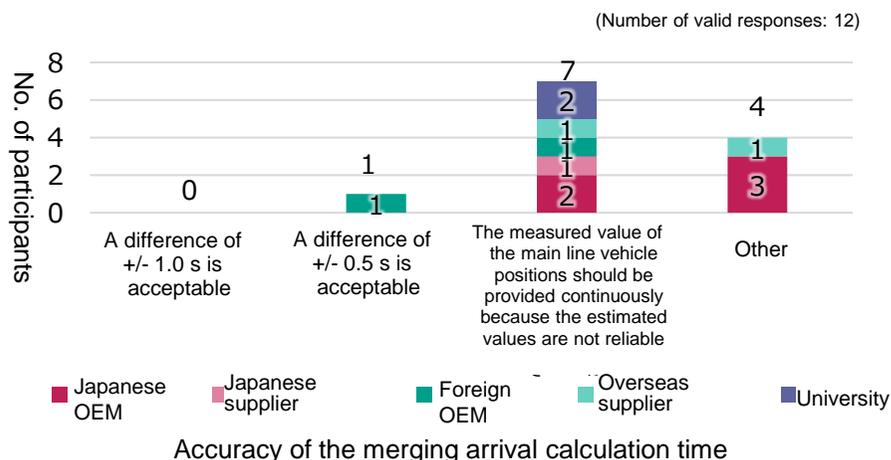**h. Accuracy of the merging arrival calculation time**

At Haneda Airport West, vehicle-to-vehicle time on the main line was about 3.1 seconds at normal conditions (smooth flow at 50 km/h)

In the traffic situation of the main line as mentioned above, what degree of accuracy should be required for calculation of time of arrival at the merging point? <Single choice>

(A difference of +/- 1.0 s is acceptable; A difference of +/- 0.5 s is acceptable; The measured value of the main line vehicle positions should be provided continuously because the estimated values are not reliable; Other)

Many participants responded that differences should be minimized, and requested high-accuracy measurement values/estimate values.
However, from the perspective of using delivered data, there were also participants who requested information regarding the level of uncertainty.

(Number of valid responses: 12)

Accuracy of the merging arrival calculation time

Free response comments	
Japanese OEM	• It would be best to determine this information in real time using continuous communication, so we are unable to comment about the accuracy of calculated merging area arrival times. • **Communications (updates) must be performed sufficient times to assess changes** in cruising line vehicle **speeds**. • **It would be best to have more accurate information**.
Japanese supplier	• **Accurate information** must be provided in all situations.
University	• It would be best to have **information regarding the degree of uncertainty** in order to determine to what degree the information can be relied on.

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2. Evaluation of the Metropolitan Expressway Connecting Haneda Airport and the Tokyo Waterfront Area

(4) Evaluation of the merging support information

(4)-6 Problems with using the merging support information

 Please give us any problem or request regarding the use of the merging support information for   automatic driving level 4, as well as for levels 1 to 5.
 Also describe any problem to be addressed when using this information for drivers.

Free response comments	
Improving information reliability	● Regardless of the level, at the merging point, **highly accurate location and speed information for cruising line vehicles** is essential. (Japanese OEM) ● We would like to quantitatively assess **roughly how much time between vehicles is required in order to merge without problems (without inconveniencing other drivers).** (Japanese OEM) ● The system must support merging while assessing cruising line conditions in real time using **continuous, planar sensing and communication.** (Japanese OEM) ● As indicated in the Consortium's findings, **the reliability of the information must be improved**. (Foreign OEM)
Cooperation with cruising line vehicles	● **We would like the vehicles that were merged with (cruising line vehicles) to provide evaluations** regarding whether merging results were positive or negative and if there was any sudden braking by the cruising line vehicles. (Japanese OEM) ● In the future, when there are many automated vehicles on cruising lines, **information about approaching vehicles passing ETC gates would also be useful for vehicles on cruising lines.** This would likely be effective for allowing merging vehicles in. (University) ● We look forward to the future advance from merging support to **merging arbitration**. (University)
Other	● The **public and private sectors will need to cooperate** to create a roadmap to social implementation and to detail where infrastructure will be installed. (Japanese OEM)

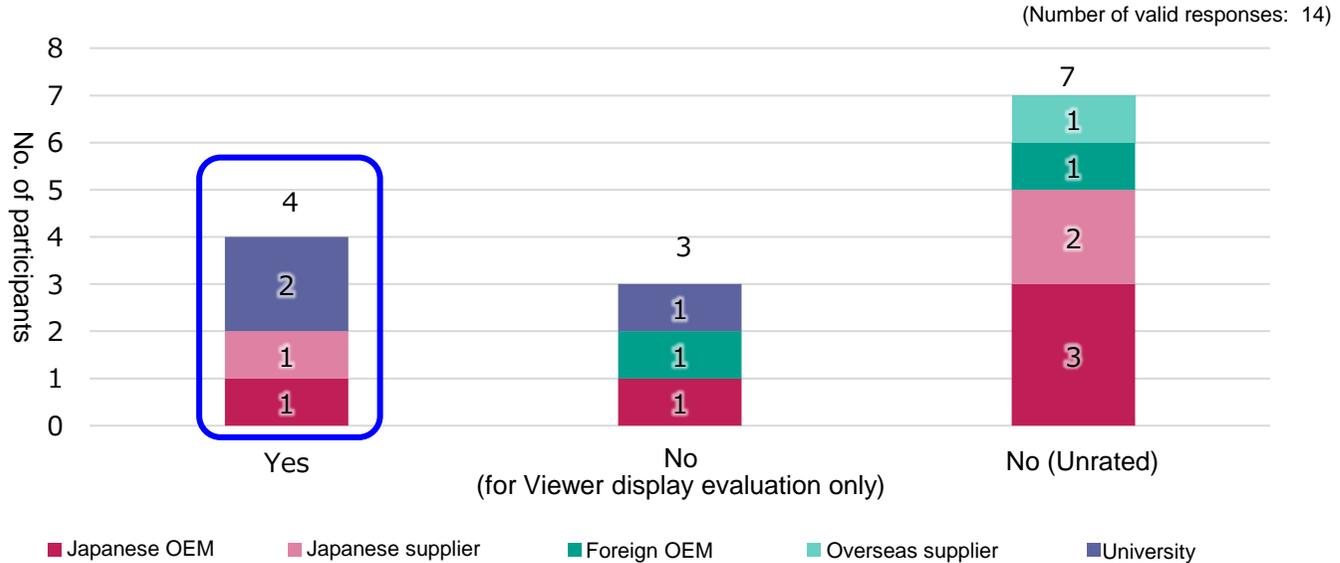# 3. Evaluation of the Haneda Airport Area

(5) Signal information (Evaluation of the traffic signal color information)

(5)-1 Practical use of the traffic signal color information for vehicle control

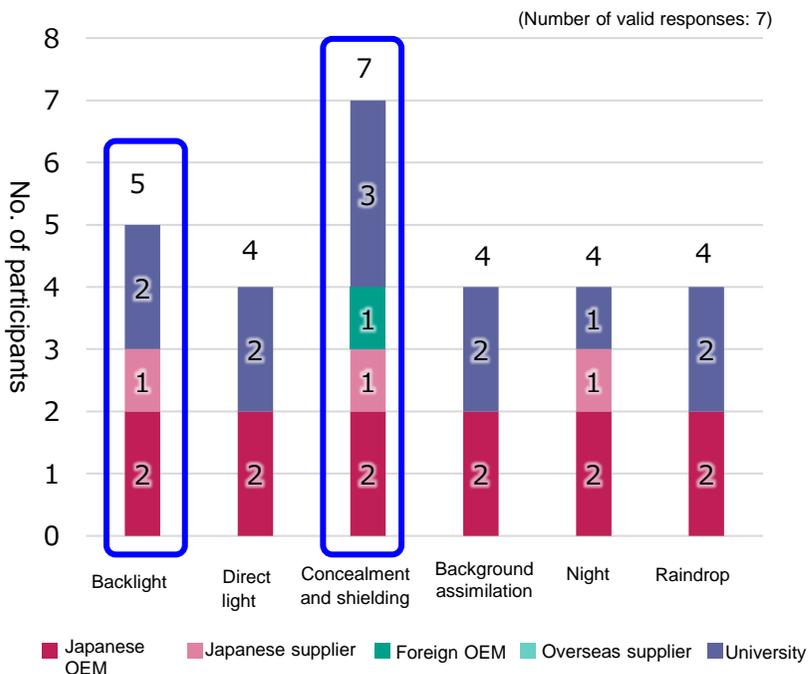Did you drive using the traffic signal color information for vehicle control? <Single choice>

(Yes; No (for Viewer display evaluation only); No (Unrated))

In the Haneda Airport area, four teams used traffic signal color information for vehicle control.

(Number of valid responses: 14)

Use of traffic signal color information for vehicle traffic signal color

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3. Evaluation of the Haneda Airport Area

(5) Signal information (Evaluation of the traffic signal color information)

(5)-2 Intention to use the traffic signal color information in the future (intention to commercialize)

In the future, how would you use the traffic signal color information?   <Multiple choice>

Application to vehicle control (Level 1, Level 2, Level 3, Level 4, Level 5;

No intention to use)

Information delivery to drivers (Yes, No)

<u>Many participants indicated that they intend to use traffic signal color information in level 4 and over automated driving systems and drive assist systems.</u>
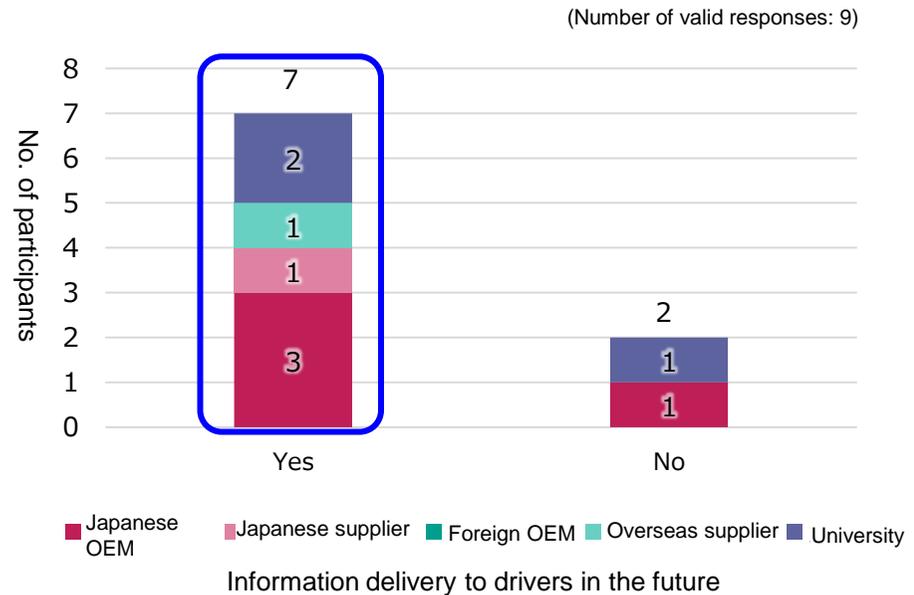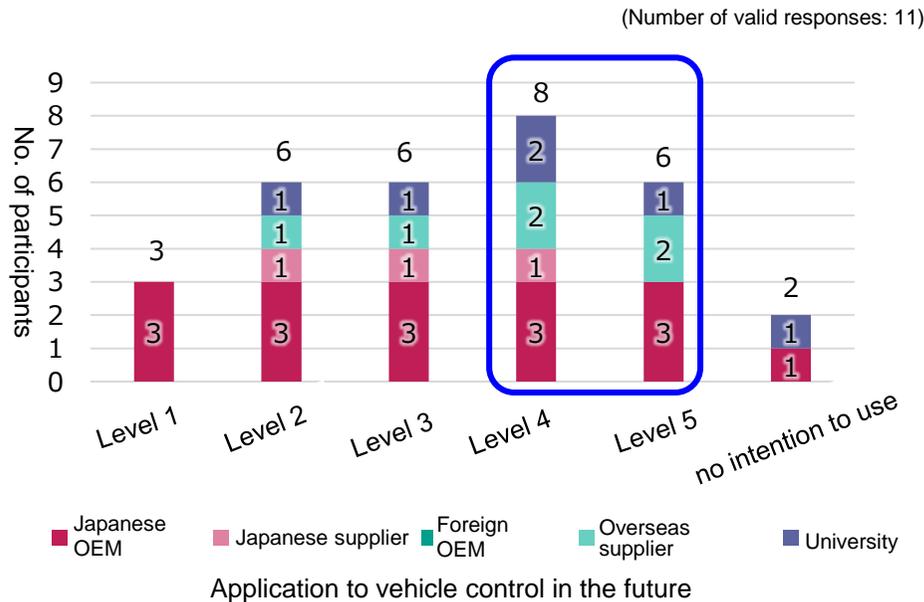
Application to vehicle control in the future

Information delivery to drivers in the future

3. Evaluation of the Haneda Airport Area

(5) Signal information (Evaluation of the traffic signal color information)

(5)-3 Effective scenes of using the traffic signal color information

In what kind of scene was the traffic signal color information particularly useful?   <Multiple choice>

Traffic signal color information was confirmed to be effective in all six situations envisioned by the Consortium. Many respondents indicated that this information was particularly useful in situations involving "concealment and obstruction" and "backlighting."

(Number of valid responses: 7)

No. of participants

Effective scenes of using the traffic signal color information

Legend: Japanese OEM, Japanese supplier, Foreign OEM, Overseas supplier, University

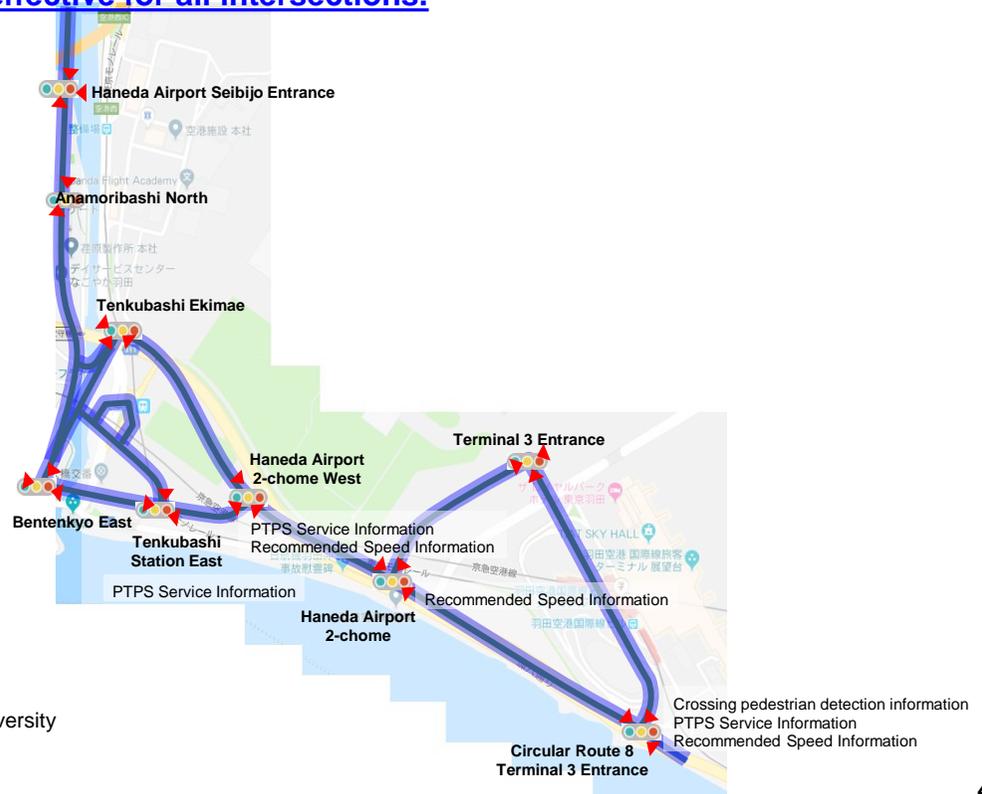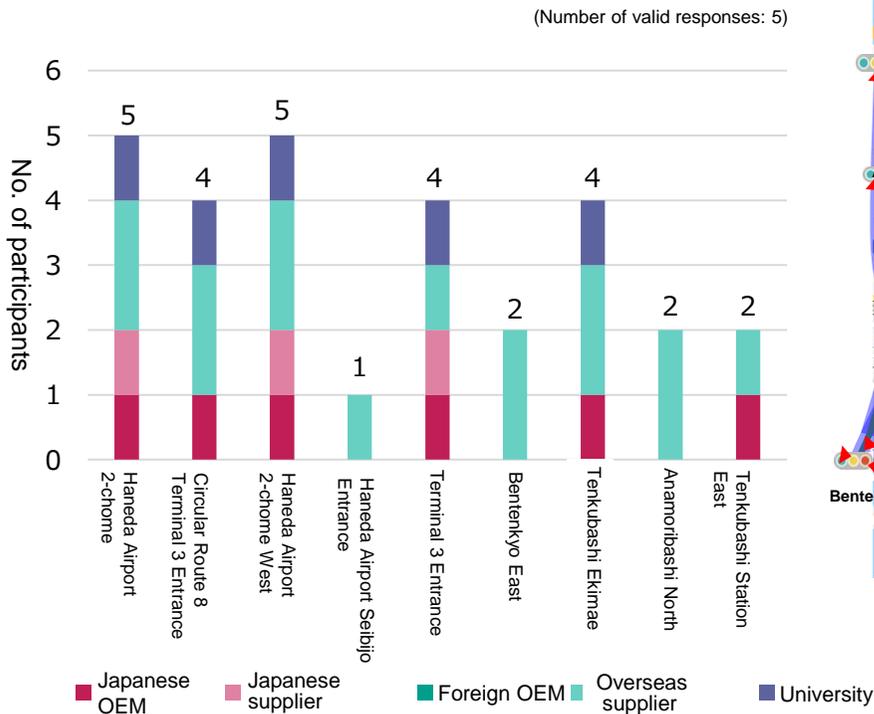| Free response comments		
Japanese OEM	●	Automated driving is still in the development stage, but for LV3 and higher systems, 100% reliable traffic signal color recognition using vehicle cameras alone does not seem feasible, so **we would like traffic signal color information to be provided for all situations**.
	●	We have not been able to perform evaluation in the Haneda Airport area, but we expect that the level of effectiveness would be equivalent to that of the Waterfront City area.
Overseas supplier	●	In our automated driving systems, to verify redundancy for route recognition by cameras alone, **we are using ITS information alone as signal recognition input values**.
University	●	In SIP Phase 2 we **only used ITS wireless information for traffic signal recognition**. During SIP Phase 1 we had problems with backlighting, direct lighting, raindrops, and concealment/obstruction, and in testing other than SIP testing we also had problems with blending into the background, so we believe this information would be useful for these scenarios.
	●	We have confirmed that, when detecting traffic signal colors from a long distance using vehicle sensors, detection performance falls for all poor environmental conditions, so current indication status information would be effective as supplemental information. We have also confirmed that when the vehicle is near the intersection, in many cases the vehicle sensors can also accurately recognize the traffic signal color and the vehicle can enter the intersection. However, when there is backlighting, etc., the limits of the camera's capabilities sometimes prevent it from accurately recognizing the traffic signal color. In these situations, traffic signal color information would be highly effective. Therefore, **at intersections where there is only one visible traffic signal, this information would be particularly effective for making decisions regarding entering the intersection when there is backlighting**.

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3. Evaluation of the Haneda Airport Area

(5) Signal information (Evaluation of the traffic signal color information)

(5)-4 Intersections where the traffic signal color information is useful

Among the intersections that provided traffic signal color information in the Haneda Airport area, select intersections where the traffic signal color information was especially useful.

Traffic signal color information was confirmed to be effective for all intersections.

(Number of valid responses: 5)

Legend:
- ■ Japanese OEM
- ■ Japanese supplier
- ■ Foreign OEM
- ■ Overseas supplier
- ■ University

Intersections where the traffic signal color information is useful

3. Evaluation of the Haneda Airport Area

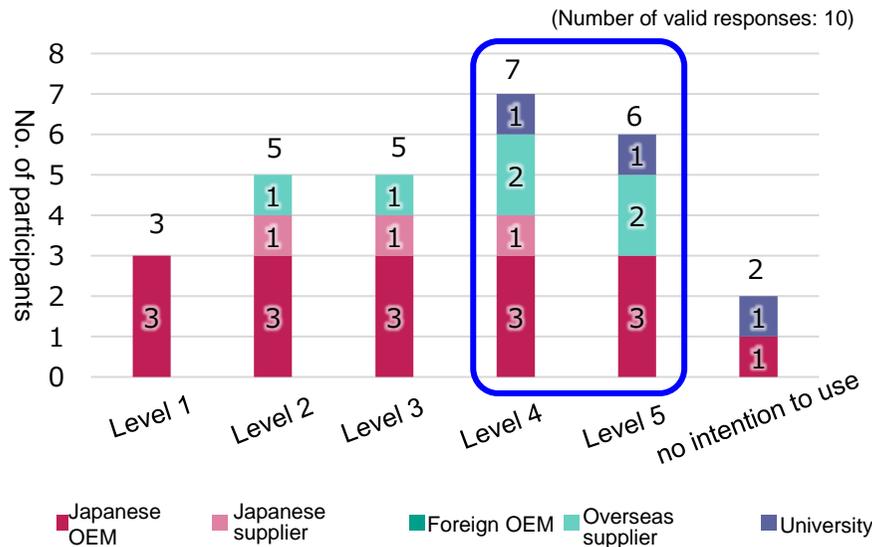## (6) Remaining seconds count information (Dilemma avoidance evaluation)

(6)-1 Practical use of the remaining seconds count information for vehicle control

Did you drive using the information of remaining seconds count for vehicle control?   <Single choice>

(Yes; No (for Viewer display evaluation only); No (Unrated))

In the Haneda Airport area, three teams used traffic signal remaining seconds information for vehicle control.
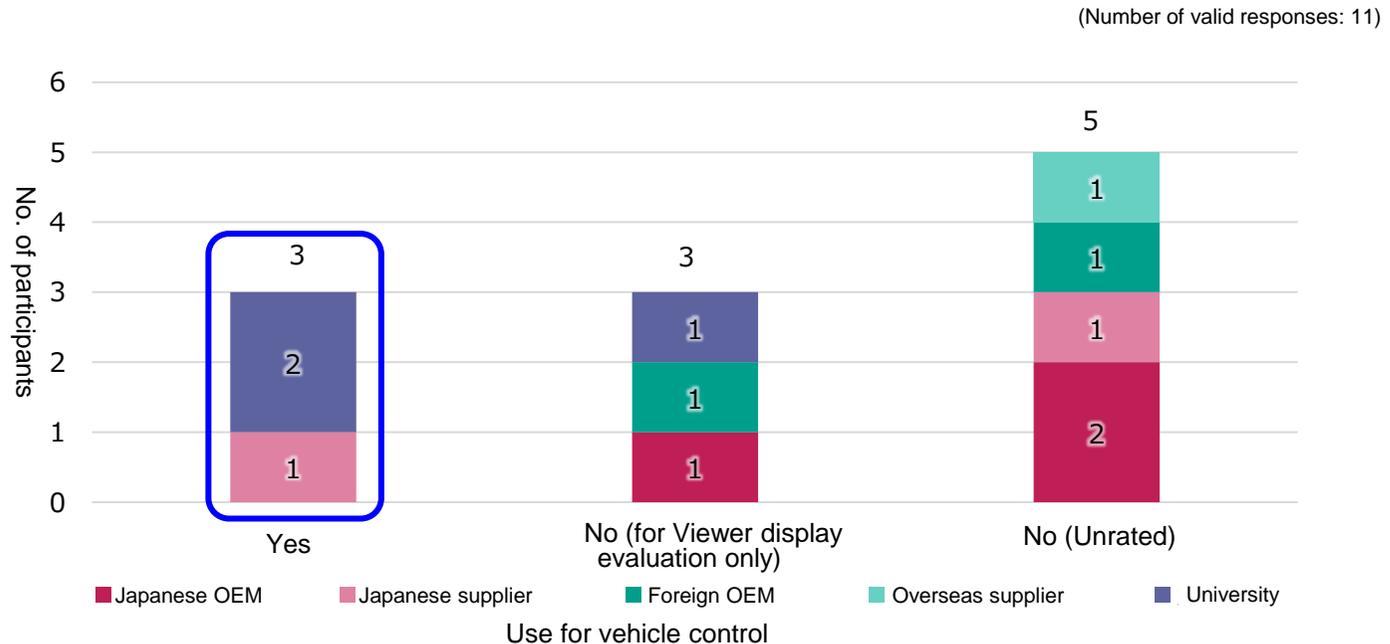
(Number of valid responses: 11)

3. Evaluation of the Haneda Airport Area

(6) Remaining seconds count information (Dilemma avoidance evaluation)

(6)-2 Intention to use the remaining seconds count information in the future (intention to commercialize)

How would you use the remaining seconds count information in the future? <Multiple choice>

Application to vehicle control (Level 1, Level 2, Level 3, Level 4, Level 5; No intention to use)

Information delivery to drivers (Yes, No)

Many participants indicated that they intend to use traffic signal remaining seconds information in level 4 and over automated driving systems and drive assist systems.

(Number of valid responses: 10)

Application to vehicle control in the future

(Number of valid responses: 8)

Information delivery to drivers in the future
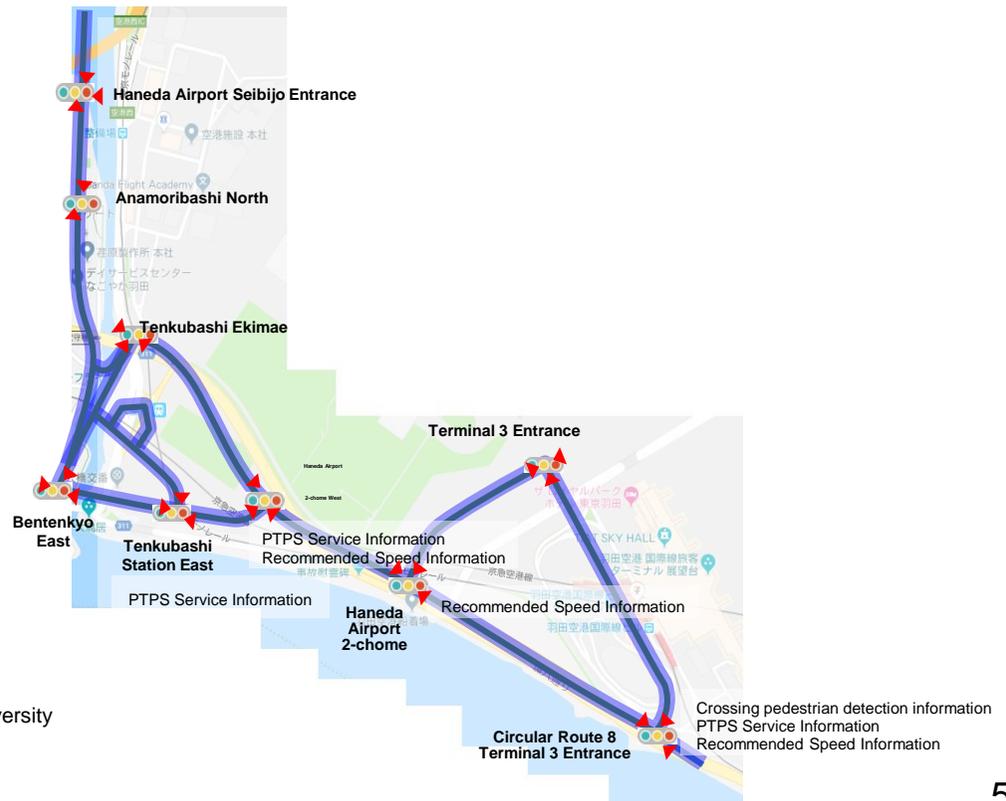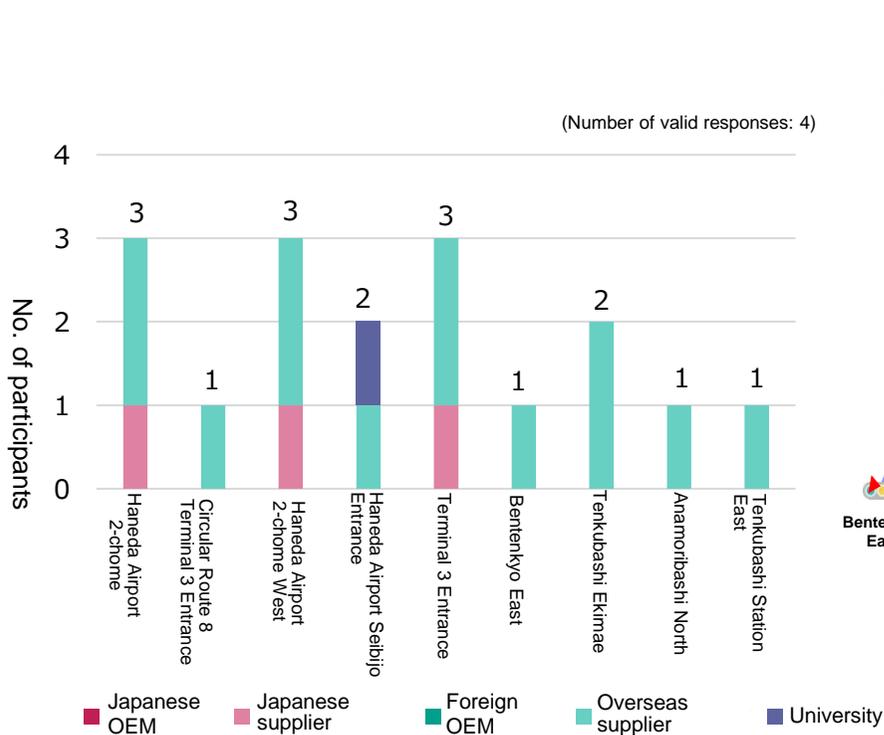
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3. Evaluation of the Haneda Airport Area

(6) Remaining seconds count information (Dilemma avoidance evaluation)

> **(6)-3 Effective scenes of using the remaining seconds count information**
>
> What kind of scene was the remaining seconds count information particularly useful?
>
> *For reference, the next section provides the status of the dilemma at intersections in the test area.

Multiple participants indicated that traffic signal remaining seconds information was effective in the Haneda Airport area, as it is in the Waterfront City area.

Free response comments	
Japanese OEM	● We have not been able to perform evaluation in the Haneda Airport area, but we expect that **the level of effectiveness would be equivalent to that of the Waterfront City area**.
Japanese supplier	● The information would likely be effective for **intersections which are often traversed at high speeds.**
Foreign OEM	● We believe that traffic signal remaining seconds information would be **effective in preventing dilemmas at all intersections**, not just specific intersections. Furthermore, not only would it prevent dilemmas, but **it would also be extremely useful in achieving appropriate acceleration and deceleration**.
University	● **It was useful in dilemma zones.**

(6) Remaining seconds count information (Dilemma avoidance evaluation)

(6)-3 Effective scenes of using the remaining seconds count information

What kind of scene was the remaining seconds count information particularly useful?

*For reference, the next section provides the status of the dilemma at intersections in the test area.

Traffic signal remaining seconds information was confirmed to be effective for all intersections.

(Number of valid responses: 4)

No. of participants

3	Haneda Airport 2-chome
1	Circular Route 8 Terminal 3 Entrance
3	Haneda Airport 2-chome West
2	Haneda Airport Seibijo Entrance
3	Terminal 3 Entrance
1	Bentenkyo East
2	Tenkubashi Ekimae
1	Anamoribashi North
1	Tenkubashi Station East

Legend:
- ■ Japanese OEM
- ■ Japanese supplier
- ■ Foreign OEM
- ■ Overseas supplier
- ■ University

Effective scenes of using the remaining seconds count information

Map labels:
- Haneda Airport Seibijo Entrance
- Anamoribashi North
- Tenkubashi Ekimae
- Terminal 3 Entrance
- Bentenkyo East
- Tenkubashi Station East
- PTPS Service Information / Recommended Speed Information
- PTPS Service Information
- Haneda Airport 2-chome
- Recommended Speed Information
- Circular Route 8 Terminal 3 Entrance
- Crossing pedestrian detection information / PTPS Service Information / Recommended Speed Information

3. Evaluation of the Haneda Airport Area

Common to (5) Signal Information (Evaluation of the traffic signal color information)
and (6) Remaining Seconds Count Information (Dilemma avoidance evaluation)
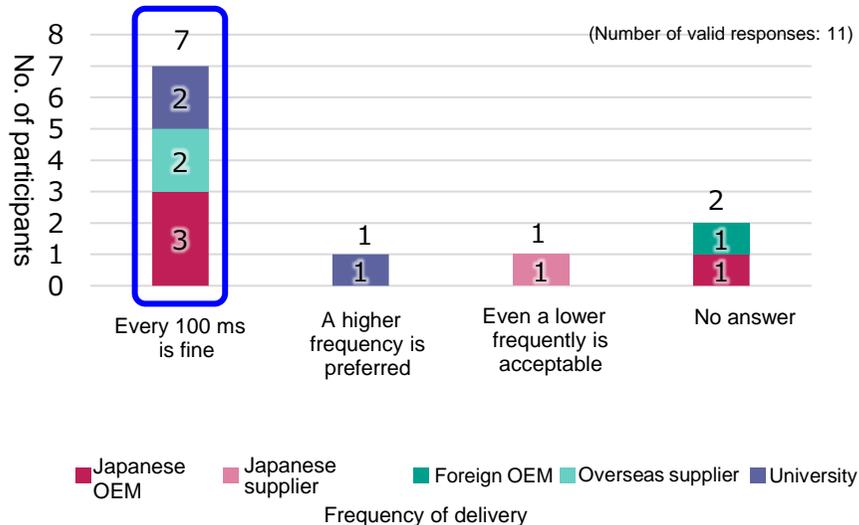
(5)&(6)-5 Provision of signal information (traffic signal color information, remaining seconds count information) via ITS wireless
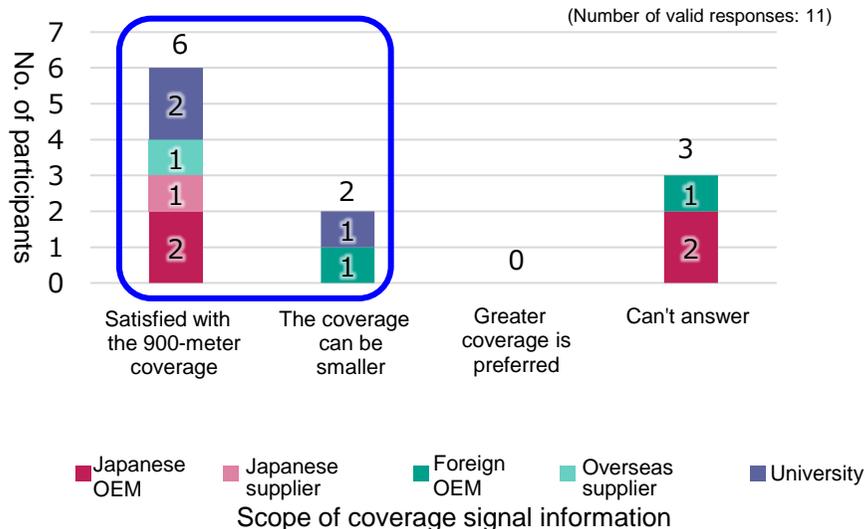
a. Frequency of delivery

In the ITS wireless, signal information is delivered every 100 ms. How was the frequency of delivery? <Single choice>
(Every 100 ms is fine; A higher frequency is preferred; Even a lower frequently is acceptable; No answer)
If you have chosen "A higher frequency is preferred" or "Even a lower frequency is acceptable", please specify your desired frequency.

Many participants indicated that delivering information ever 100 ms was satisfactory.
However, they indicated that the frequency with which information needs to be provided would vary depending on the information provision scope and communication stability.

Free response comments	
Japanese supplier	• If the reception range was large enough, even frequencies of 0.5 seconds or 1 second would be sufficient.
Foreign OEM	• In some intersections, traffic signal information was not updated (there were momentary interruptions), though this may have been due to the location where the ITS wireless unit's antenna was installed. Given this situation, providing information in 100 ms intervals is appropriate. **If the stability of communications could be guaranteed, there might be no problem providing updates less frequently, such as every 200 ms.**

3. Evaluation of the Haneda Airport Area

Common to (5) Signal Information (Evaluation of the traffic signal color information)
and (6) Remaining Seconds Count Information (Dilemma avoidance evaluation)

(5)&(6)-5 Provision of signal information (traffic signal color information, remaining seconds count information) via ITS wireless

b. Scope of coverage

In FOTs, the ITS wireless actually covers about 900 meters around the intersection, depending on the on-board antenna installed. Are you satisfied with the scope of wireless coverage? <Single choice>

(Satisfied with the 900-meter coverage; The coverage can be smaller; Greater coverage is preferred; Can't answer)

If you choose "The coverage can be smaller" or "Greater coverage is preferred", specify your desirable scope of coverage.

<u>Participants were divided regarding whether the current coverage is preferable or if the coverage could be smaller.</u>

(Number of valid responses: 11)

Scope of coverage signal information

Legend: Japanese OEM; Japanese supplier; Foreign OEM; Overseas supplier; University

Free response comments	
Japanese OEM	● We have not been able to perform evaluation in the Haneda Airport area, but we expect that the results would be equivalent to those of the Waterfront City area.
Foreign OEM	● **A scope of roughly 250 meters would be best.** However, this is based on the assumption that there are almost no momentary communication interruptions.
University	● There would be no problem if there were a range within which reception was 100% guaranteed. If this value was a best effort value, and a **separate, 100% guaranteed reception range were defined, there would be no problem provided that the guaranteed range were greater than the minimum distance required to stop with a G force of 0.2G or below**. We recall several cases of not being able to receive the information, though this may have been a device installation issue.
	● A **range of roughly 120 to 150 meters** from the stop line would be sufficient.

3. Evaluation of the Haneda Airport Area

Common to (5) Signal Information (Evaluation of the traffic signal color information) and (6) Remaining Seconds Count Information (Dilemma avoidance evaluation)

(5)&(6)-5 Provision of signal information via ITS wireless

c. Improvement proposal for a signal information format

In using the signal information for vehicle control, please specify any information items you would like to add to the format. For reference, the next section provides a format for outputting and mapping signal information to the vehicle control.

Free response comments	
Japanese OEM	● **There were repeated IDs**, so improvements will need to be made in this area in the future.
Japanese supplier	● **The Format No. 55 "Green arrow direction" was confusing.**
University	● While this is not a required improvement, **we would like if the platform was aligned with global standards.**

Common to (5) Signal Information (Evaluation of the traffic signal color information) and (6) Remaining Seconds Count Information (Dilemma avoidance evaluation)

(5)&(6)-6 Output of signal information for vehicle control

a. Method of power output to vehicle (in the test):
In the test, signal information was outputted to the on-board equipment in the following five patterns. Please specify the output methods you used. <Multiple choice>
(CAN1, CAN2, CAN 3, LAN1, LAN2, Other)

The most commonly used method of output to the vehicle was LAN1 (same as received data format (all data) + traffic signal ID).

(1) Output patterns
The following five methods (CAN1, CAN2, CAN3, LAN1 LAN2, Other) have been prepared for outputting to vehicle control. Output is performed using the designated pattern.
The 100 ms output interval assumes an effective CAN speed of 50 kbps.
Note) For CAN3 additional traffic signal ID output, there are intersections for which output is not possible every 100 ms. If data is received while CAN output is still in progress, this new data will not be output (it will be thinned). (This also applies to CAN1 and CAN2 for effective CAN speeds of 50 kbps or below)
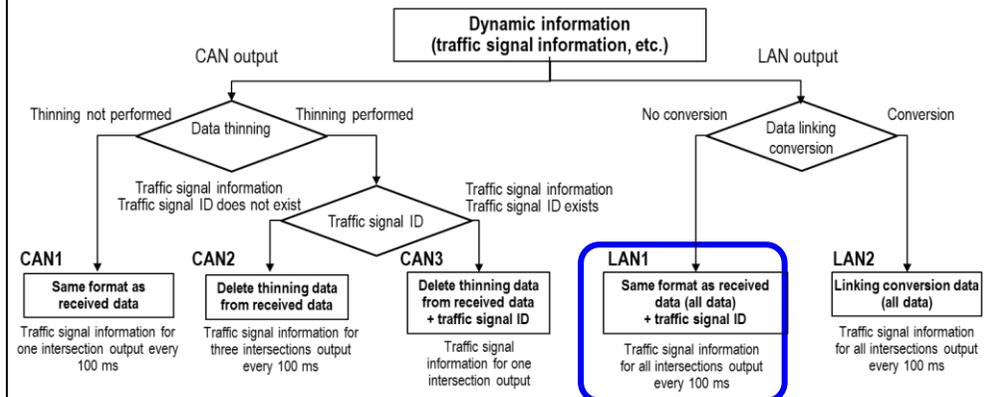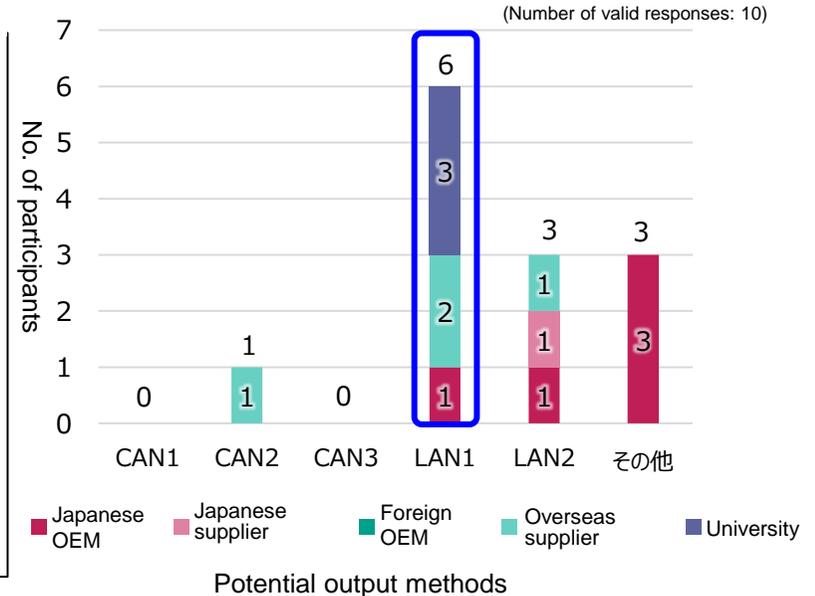
(Number of valid responses: 10)

Fig. 3-1 Output patterns to vehicle control

Output method used

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3. Evaluation of the Haneda Airport Area

Common to (5) Signal Information (Evaluation of the traffic signal color information)
and (6) Remaining Seconds Count Information (Dilemma avoidance evaluation)

(5)&(6)-6 Output of signal information to vehicle control

> b. Method of power output to vehicle (Intention to use in FY2021 test):
>
> In the previous section, 5 patterns were used for outputting the information to the on-board equipment. Of the five patterns, specify patterns you would use in the FY2021 test. <Multiple choice>
> (CAN1, CAN2, CAN 3, LAN1, LAN2, Other)

In FY2021, as well, LAN1 is expected to be used by the largest number of participants.

(1) Output patterns
The following five methods (CAN1, CAN2, CAN3, LAN1 LAN2, Other) have been prepared for outputting to vehicle control. Output is performed using the designated pattern.
The 100 ms output interval assumes an effective CAN speed of 50 kbps.
Note) For CAN3 additional traffic signal ID output, there are intersections for which output is not possible every 100 ms.
If data is received while CAN output is still in progress, this new data will not be output (it will be thinned).
(This also applies to CAN1 and CAN2 for effective CAN speeds of 50 kbps or below)

Fig. 3-1 Output patterns to vehicle control

(Number of valid responses: 10)

Potential output methods

Japanese OEM · Japanese supplier · Foreign OEM · Overseas supplier · University

Common to (5) Signal Information (Evaluation of the traffic signal color information) and (6) Remaining Seconds Count Information (Dilemma avoidance evaluation)

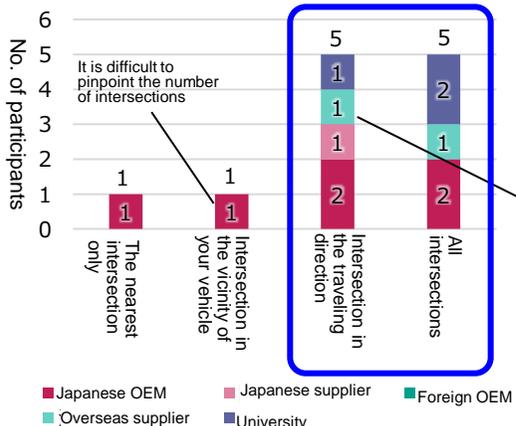**(5)&(6)-6 Output of signal information for vehicle control**

c. Output to the vehicle

Because the range of information provided by ITS wireless equipment was about 900 meters, the maximum number of intersections for a vehicle was 10 or so, depending on the reception position. What form of output is desirable when you use received information for vehicle control? <Multiple choice>

・ The nearest intersection only

・ Intersection (   ) in the vicinity of your vehicle (*Please specify a number)

・ Intersection (   ) in the traveling direction (*Please specify a number)

・ All intersections

All participants want to perform LAN output of traffic signal information for all received intersections and for two to five intersections in the vehicle's traveling direction.
We believe that LAN output will be used because received information will be used in design and deliberation regarding the optimal utilization of received information.

(Number of valid responses: 10)

Output to the vehicle

No. of intersections in the vehicle's traveling direction for which information should be output to vehicle control	No. of responses
1 intersection	0
2 intersections	**1**
3 intersections	**1**
4 intersections	0
5 intersections	**1**
6 intersections or more	0
Cannot answer at this time	**2**

Free response comments	
Japanese OEM	● The specific number of intersections in the vicinity/traveling direction depends on road conditions, so **it is difficult to pinpoint the number of intersections**. ● It would be best if it were possible to receive traffic signal information for traffic signals **300 to 400 meters away in the direction of travel.** ● We have not been able to perform evaluation in the Haneda Airport area, but we expect that the results would be equivalent to those of the Waterfront City area.
University	● We selected two intersections in the vehicle's traveling direction so that the state of the next intersection, following the one immediately in front of the vehicle, could be determined.

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3. Evaluation of the Haneda Airport Area

Common to (5) Signal Information (Evaluation of the traffic signal color information)
and (6) Remaining Seconds Count Information (Dilemma avoidance evaluation)

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(5)&(6)-7 Problems with the use of signal information

Please let us know any problem or request regarding the use of signal information for automatic driving level 4, as well as for levels 1 to 5.

Also describe any problem to be addressed when using this information for drivers.

Free response comments	
Japanese OEM	• The reliability of information will be key when using traffic signal color information and remaining time information. We think that all stakeholders will need to come together as one to deliberate this issue. • We have not been able to perform evaluation in the Haneda Airport area, but we expect that the results would be equivalent to those of the Waterfront City area.
Japanese supplier	• For traffic signal remaining seconds, **confirmed** information is better than information with margins.
Foreign OEM	• The **stability of communications should be improved**, such as by reconsidering how transmitters are installed, the number of transmitters that are installed, the method used to transmit traffic signal information, etc. • Control specifications should be established to prevent sudden changes in the number of remaining seconds when it is 10 seconds or less (or 15 seconds or less, if that is possible).
Overseas supplier	• To use automated driving systems with a high degree of reliability, the level of the traffic signal information must be ASIL-B or above.

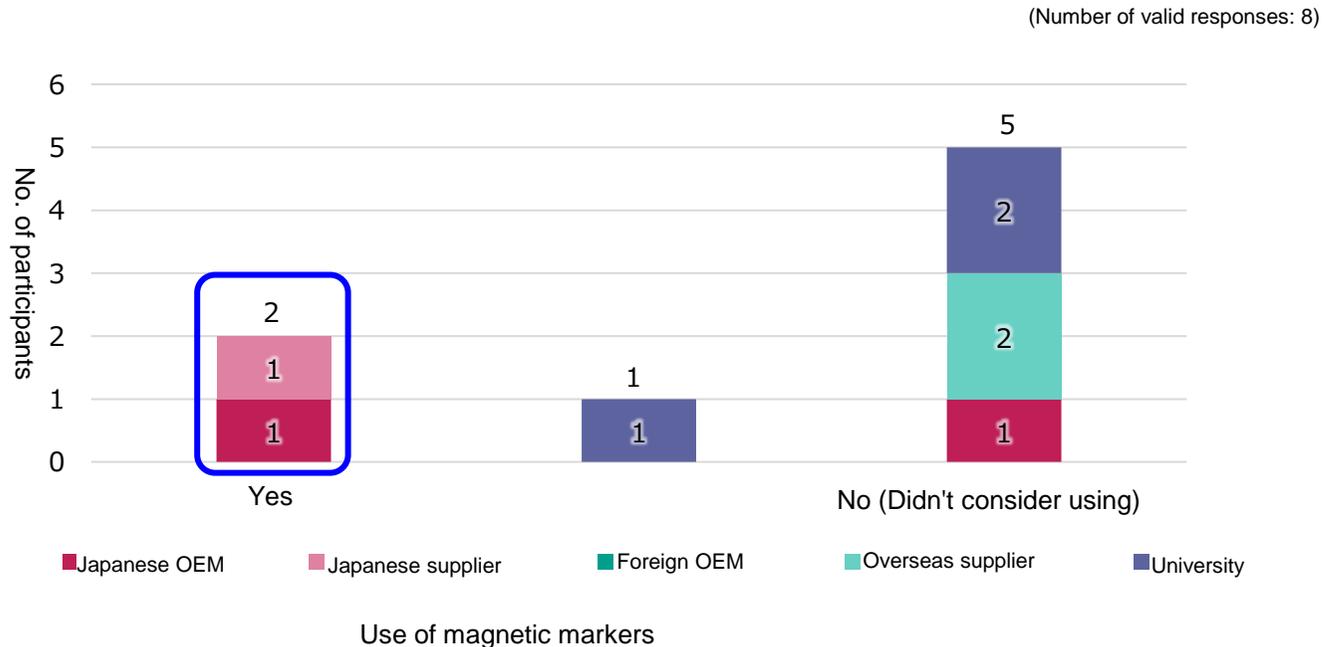# 3. Evaluation of the Haneda Airport Area

(7) Demonstration of buses in the Haneda Airport Area

(7)-1 Use of magnetic markers for vehicle control

Did you drive using a magnetic marker for vehicle control? <Single choice>

(Yes; No (Considered using but didn't use); No (Didn't consider using))

**Two participants used magnetic markers for vehicle control.**

(Number of valid responses: 8)

Use of magnetic markers

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(7) Demonstration of buses in the Haneda Airport Area

(7)-2 Intention to use magnetic markers in the future

How do you plan to use magnetic markers for vehicle control of automatic driving buses in the future? <Single choice>

(Most promising technology for operation of automatic driving buses; One of the promising technologies; One of our options; Not included in our options)

Magnetic markers are a promising technology for the societal deployment of autonomous buses.
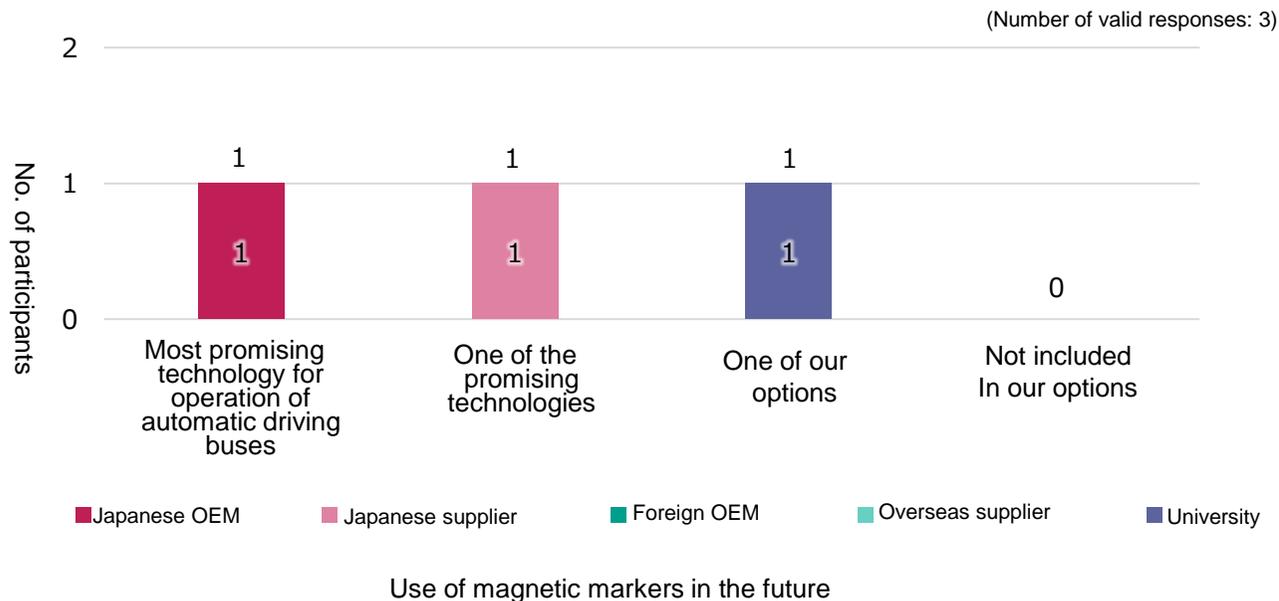
(Number of valid responses: 3)

Use of magnetic markers in the future

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3. Evaluation of the Haneda Airport Area

(7) Demonstration of buses in the Haneda Airport Area

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(7)-3 Haneda Airport SWG

In the Haneda Airport area, since the number of participants in the bus test is limited, we set up the SWG for the Haneda bus test to discuss the experiment method and evaluation contents. On the other hand, the Tokyo Waterfront area and the Tokyo Expressway are issues that are common to most of the test participants. For this reason, these issues were discussed by the WG for FOTs in the Tokyo Waterfront Area was discussing them. Did you need the Haneda Airport District SWG? <Single choice>

(We're happy we were able to narrow down the discussions at the Haneda Airport District SWG; We need the WG only)

All participants in the bus test indicated that the Haneda Airport area SWG meetings were valuable.

(Number of valid responses: 3)

No. of participants

We're happy we were able to narrow down the discussions at the Haneda Airport District SWG	We need the WG only
3 (1 University, 1 Japanese supplier, 1 Japanese OEM)	0

Necessity of the Haneda Airport area SWG

- Japanese OEM
- Japanese supplier
- Foreign OEM
- Overseas supplier
- University

Free response comments	
Japanese supplier	• At the meetings, we were able to share and deliberate regarding individual issues involved in the Haneda area FOTs, which contributed to smooth FOTs implementation. • We would like to have been able to check the magnetic marker design (locations, spacing, RFID, N/S, etc.) in advance and for the work to have been performed after improvements were made.
University	• The Haneda Airport area SWG was valuable.

3. Evaluation of the Haneda Airport Area

(7) Demonstration of buses in the Haneda Airport Area

(7)-4 Additions and amendments to the Consortium Discussion Draft

Based on the opinions received so far, the Consortium has prepared the following proposal.
Please provide additional or revised comments on this discussion.

[Effectiveness of the infrastructure and the proposed infrastructure requirements]

- **Magnetic marker**
  - ◆ Magnetic markers should be preferentially installed in places where the accuracy of vehicle position estimation by GNSS is reduced and at stops where correct arrival control is performed effectively.
  - ◆ When installing magnetic markers, it is desirable to improve the traffic environment, road structure and operation (adjustment of stop line position, etc.) that can require manual intervention.
  - ◆ It is desirable to install magnetic markers at short intervals in places such as intersections where the turning radius is small.

- **Signal information and PTPS**
  - ◆ Even when signal recognition is difficult, such as when the color of the signal light is blocked by a large vehicle, it is essential to provide signal information in order to realize smooth automatic driving.
  - ◆ In order to use signal information more effectively, it is desirable to provide the remaining seconds count after PTPS is activated.

- **Dedicated bus lane**
  - ◆ Under the current level of difficulty with continuing automatic driving due to road parking, a dedicated bus lane may contribute to improving the continuity of automatic driving.
  - ◆ However, in order for a dedicated bus lane to function effectively, it is important to promote the necessity of observance of the rules of exclusive bus lanes by publicizing and raising awareness about the behavior characteristics of automatic driving vehicles and by strengthening public awareness through signs, etc.

> In order to reduce OR, the locations where magnetic markers are installed in intersections and the design of driving trajectories are key issues (E.g., design that prevents vehicles from getting too close to the opposite lane.
> Specifically, vehicle trajectories that result in safe driving need to be designed, and then markers must be installed in positions where all markers can be detected by the two magnetic sensors installed in the rears of vehicles.)
> (Japanese supplier)

> Concrete information should be communicated regarding safe driving methods. When turning left at an intersection, it is not clear where the dedicated bus lane ends.
> (Japanese supplier)

4. Evaluation of general road map data

(8) Evaluation of the map data (Lane links in general roads and intersections)

(8)-1 In-intersection lane link specifications

a. To what extent is it desirable to install in-intersection lane links in map data of coordinating areas? <Single choice>
- (1) All connectable in-intersection lane links should be installed (Figure (1))
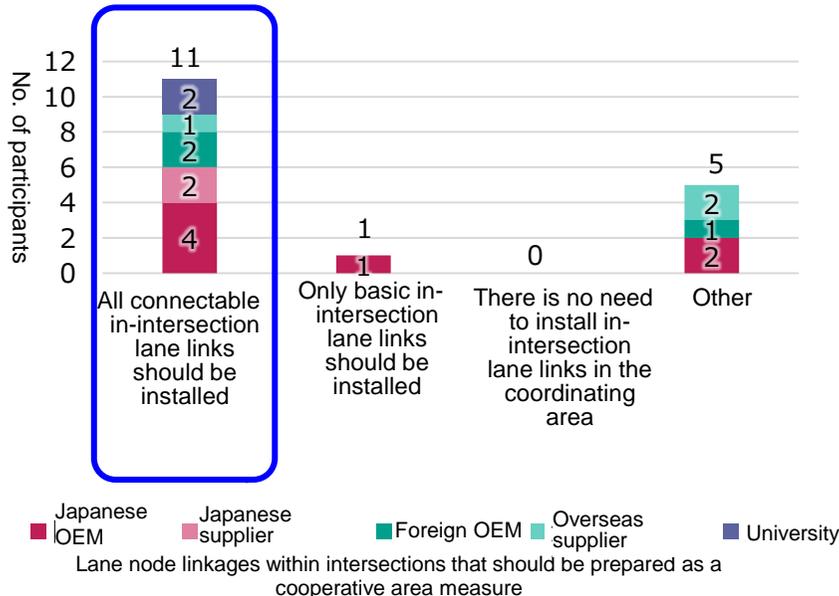 - ※ Within an intersection, lane links from the same approach route to the exit route may intersect.
- (2) Only basic in-intersection lane links should be installed(Figure (2))
  - ※ Within an intersection, lane links from the same approach route to the exit route shall not intersect.
- (3) There is no need to install in-intersection lane links in the coordinating area.
- (4) Other

Over half of the respondents answered "All connectable lane node linkages within intersections" should be installed."

Lane node linkages within intersections that should be prepared as a cooperative area measure

Free response comments		
Japanese OEM	●	Midway between what is shown in Figure (1) and Figure (2). Links to all lanes are necessary when turning left or right. There is no need for lane node linkage such as links for [Turning right from the left turn lane] or [Turning left from the right turn lane].
Foreign OEM	●	We have not considered this yet, but we believe that in the case of (1), it would be best to set priorities for all lane node linkages within intersections.
Overseas supplier	●	It would be best to prepare not only links but also connections between lanes (virtual lanes to be used as the vehicle's own lane).
University	●	If preparing (1) were expensive, it would be sufficient to assign information equivalent to that in (1), in calculable form, to the map. If the lane linkages in (1) were prepared, we believe that links which cannot be driven without violating traffic rules should not be prepared.

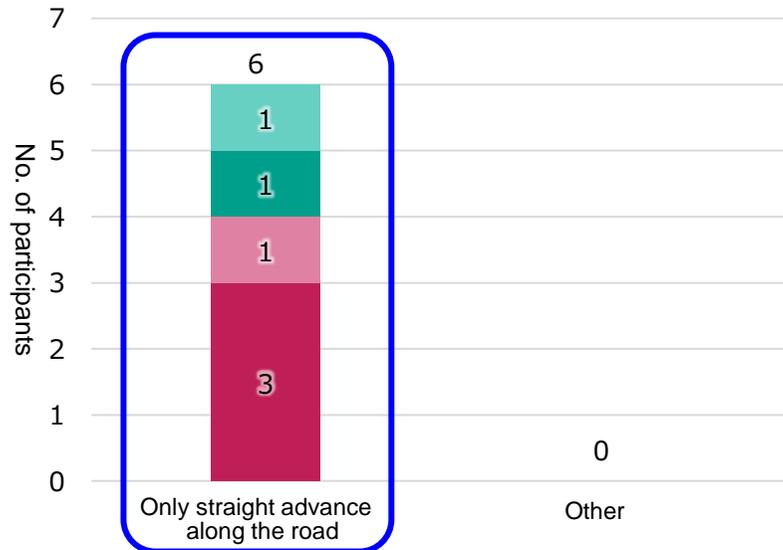# 4. Evaluation of general road map data

(8) Evaluation of the map data (Lane links in general roads and intersections)

(8)-1 In-intersection lane link specifications

a. If it is assumed that the test participants themselves add and modify the map data in the coordinating area, choose the one that best fits your addition and modification policy. <Single choice>

(1) Keep the existing connection of the in-intersection lane links in the coordinated area data

(2) Modify the connection of in-intersection lane links to match the system to be used

(3) The in-intersection lane links will not be used

(4) Other

Over half of the respondents answered "Modify the connections of lane node linkages within intersections to match the system to be used."
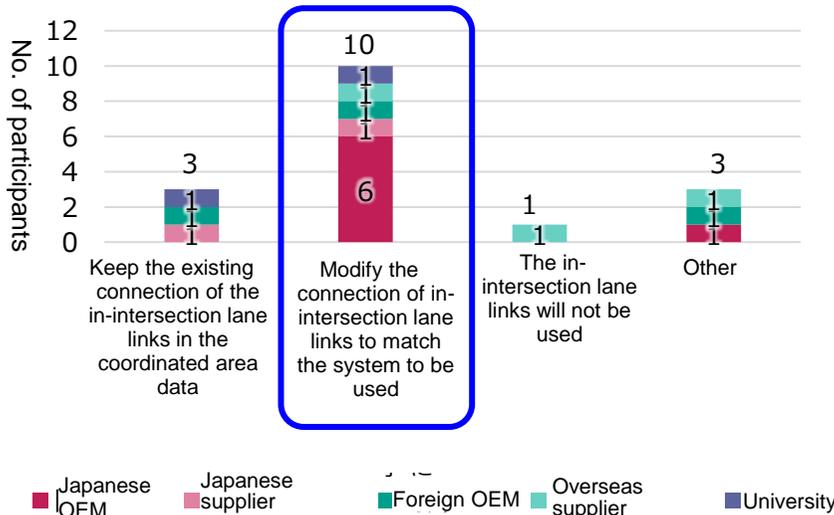
Free response comments		
Japanese supplier	●	We believe that it would be best to use method (1) in the future.
University	●	This information would also be used to infer the movement routes of other vehicles within intersections, so the same information should be used by all vehicles.

Legend: ■ Japanese OEM   ■ Japanese supplier   ■ Foreign OEM   ■ Overseas supplier   ■ University

Policy on making additions to or modifying data when addition/modification is performed by test participants themselves

4. Evaluation of general road map data

(8) Evaluation of the map data (Lane links in general roads and intersections)

(8)-2 In-intersection lane links to be connected <Single choice>

      a. Straight advance (1)Only straight advance along the road(Figure (1))

                         (2) Other(Please draw lines in the figure (2) below.)

<u>With regard to "straight advance," all participants replied "Only straight advance along the road."</u>

Figure (1) Straight advance along the road only
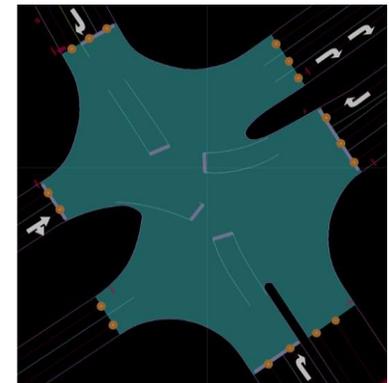
Figure (2) Illustration by test participant (Straight line)

Lane node linkages within intersections to be connected (straight advance)

Legend: Japanese OEM, Japanese supplier, Foreign OEM, Overseas supplier, University

Chart values — Only straight advance along the road: total 6 (Japanese OEM 3, Japanese supplier 1, Foreign OEM 1, Overseas supplier 1); Other: 0

4. Evaluation of general road map data

(8) Evaluation of the map data (Lane links in general roads and intersections)

(8)-2 In-intersection lane links to be connected <Single choice>

b. left turn (3) A left turn to the leftmost lane on the exit route (only 1 line) (Figure (3))

(4) A left turn to the leftmost lane and its adjacent lane on the exit route (2 lines) (Figure (4))

(5) A left turn to all lanes in exit route (Figure (5))

(6) Other(Please provide an illustration in Figure (6) below.)

<u>With regard to "left turn," most participants replied "A left turn to all lanes in exit route."</u>

No. of participants

In-intersection lane links to be connected (left turn)

- ■ Japanese OEM
- ■ Japanese supplier
- ■ Foreign OEM
- ■ Overseas supplier
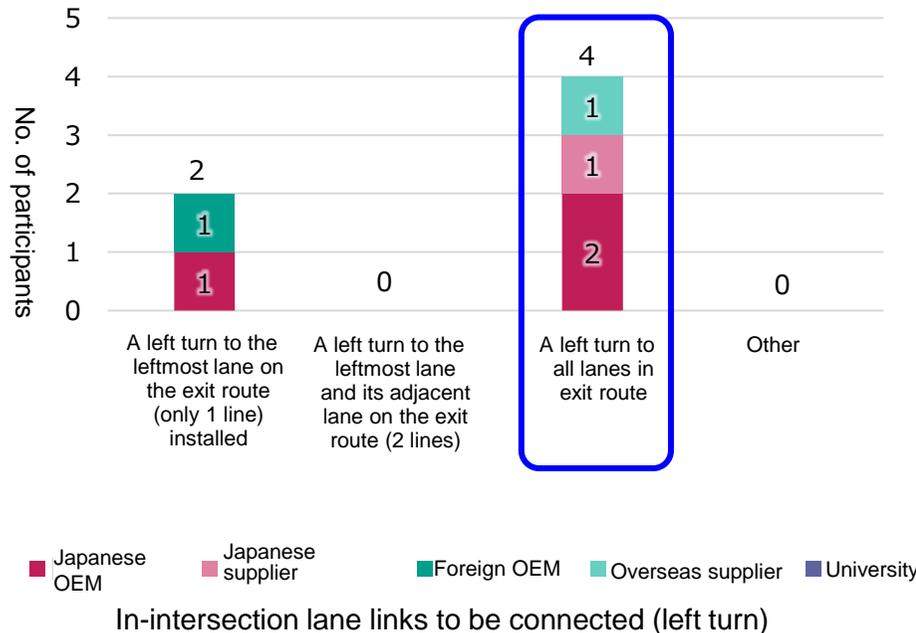- ■ University
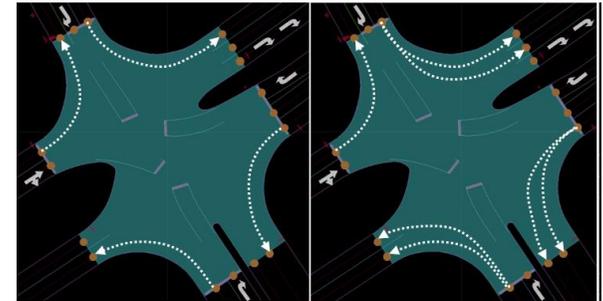
Figure (3)
A left turn to the leftmost lane

Figure (4)
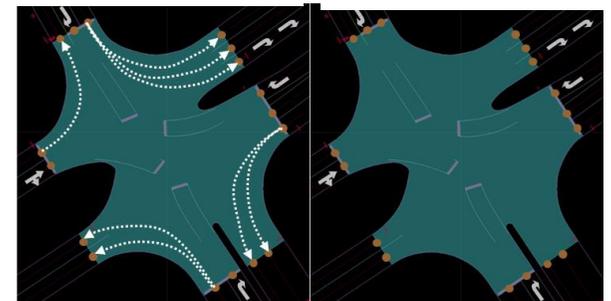A left turn to the lane adjacent to the leftmost lane on the exit route

Figure (5)
A left turn to all lanes in exit route

Figure (6)
Illustration by the test participant

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4. Evaluation of general road map data

(8) Evaluation of the map data (Lane links in general roads and intersections)

(8)-2 In-intersection lane links to be connected <Single choice>

c. Right turn (7) A right turn to the rightmost lane of the exit route (only 1 line) (Figure (7))
(8) A right turn to the rightmost lane and its adjacent lane on the exit route (2 lines) (Figure (8))
(9) A right turn to all lanes on exit route (Figure (9))
(10) Other (Please provide an illustration in Figure (10))

With regard to "right turn," most participants replied "A right turn to all lanes in exit route."

In-intersection lane links to be connected (right turn)

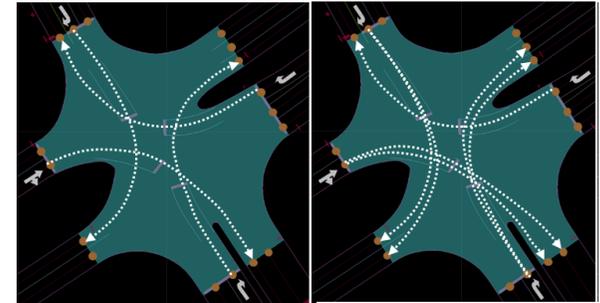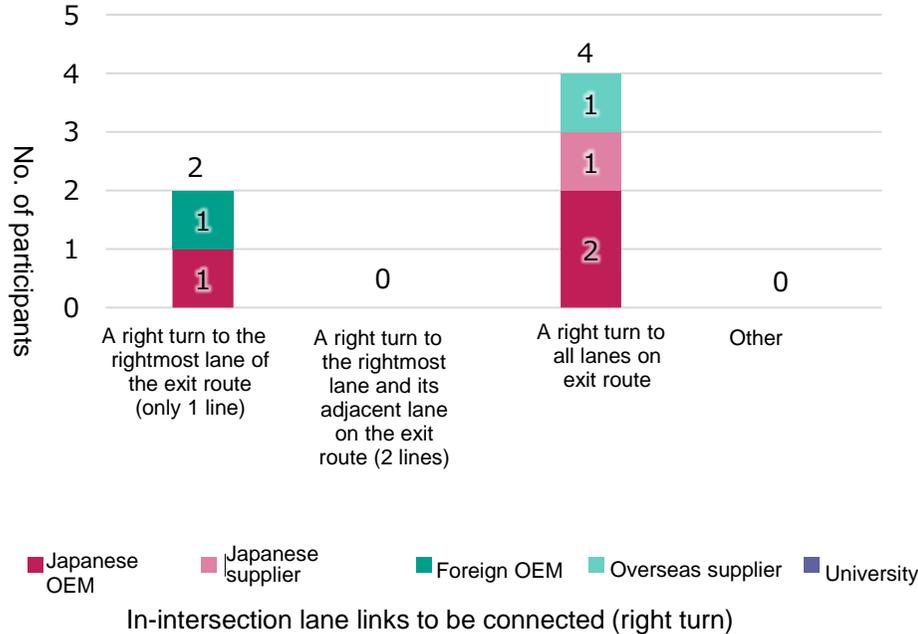Legend: Japanese OEM, Japanese supplier, Foreign OEM, Overseas supplier, University

Figure (7)
a right turn to the rightmost lane

Figure (8)
To the rightmost lane
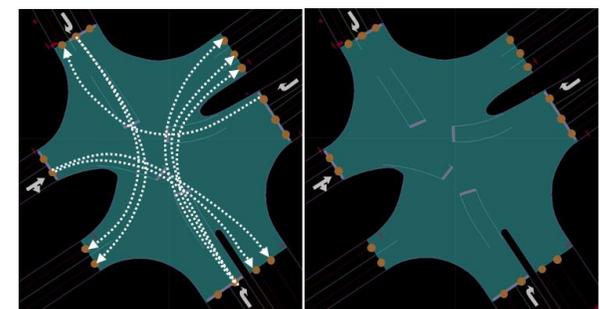Turn right to the lane bordering the rightmost lane

Figure (9)
right turn to all lanes
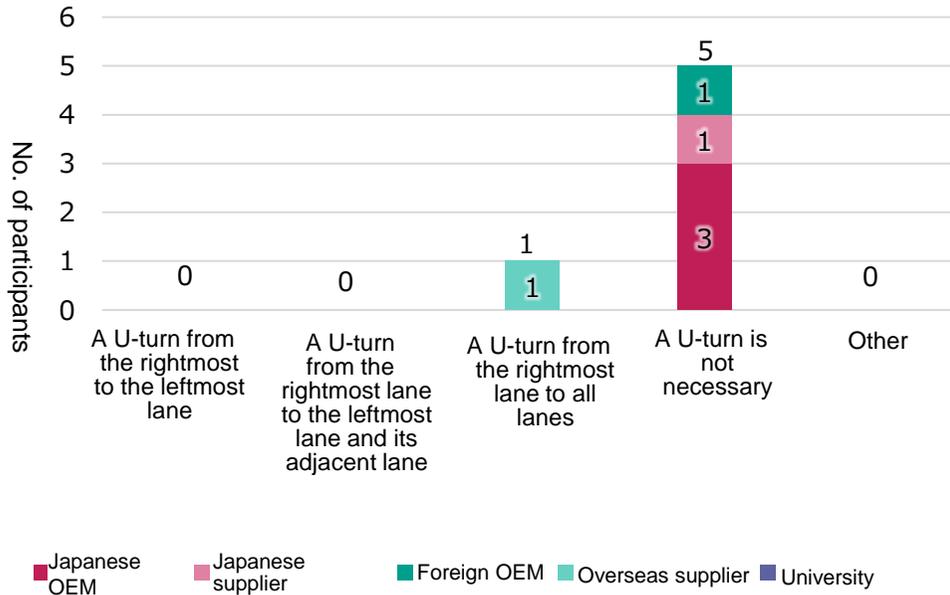
Picture (10)
Illustration by the test participant

4. Evaluation of general road map data

(8) Evaluation of the map data (Lane links in general roads and intersections)

(8) -2 Understanding in-intersection Lane Links to Be Connected <Single choice>

d. U-turn　　　(11) A U-turn from the rightmost to the leftmost lane (Figure (11))
　　　　　　　　(12) A U-turn from the rightmost lane to the leftmost lane and its adjacent lane (Figure (12))
　　　　　　　　(13) A U-turn from the rightmost lane to all lanes (Figure (13))
　　　　　　　　(14) A U-turn is not necessary
　　　　　　　　(15) Other (Please provide an illustration in Figure (15))

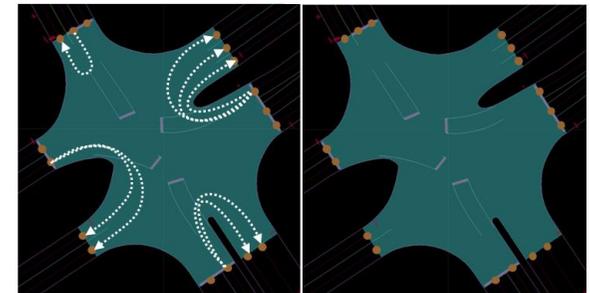**With regard to "U-turn," the majority of participants answered "A U-turn is not necessary."**
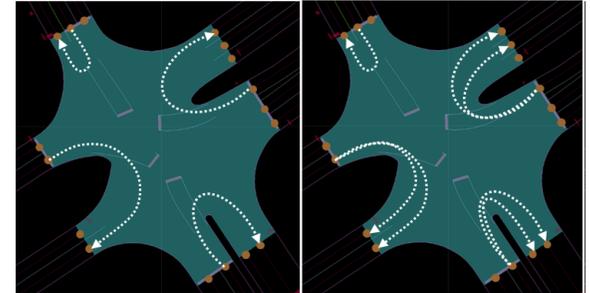
Picture (11)
U-turn to leftmost lane

Picture (12)
To the leftmost lane
Lane tangent to leftmost lane
U-turn to

Picture (13)
U-turn to all lanes

Picture (15)
Illustration of the test participants

No. of participants

In-intersection lane links to be connected (U-turn)

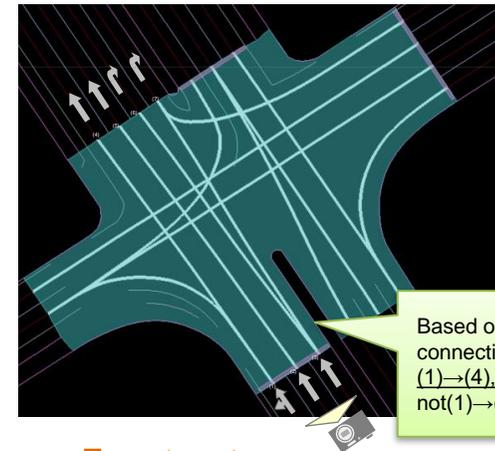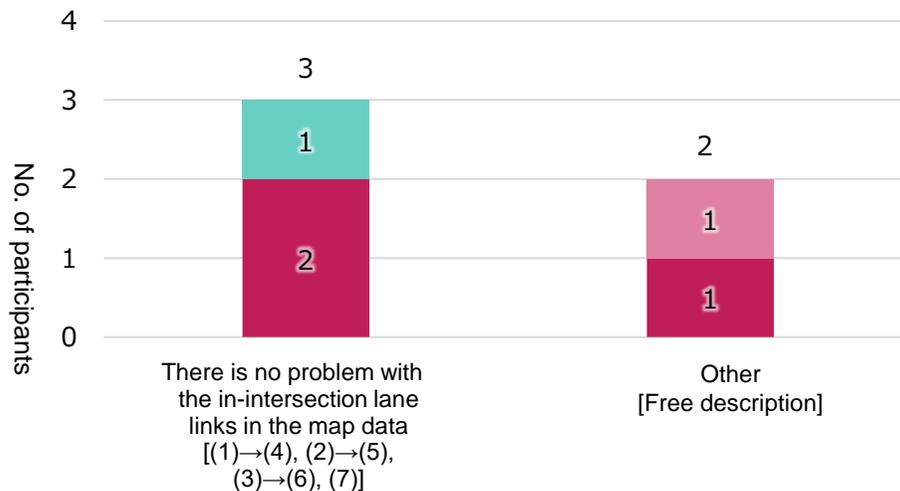|	Japanese OEM	Japanese supplier	Foreign OEM	Overseas supplier	University
A U-turn from the rightmost to the leftmost lane	0				
A U-turn from the rightmost lane to the leftmost lane and its adjacent lane	0				
A U-turn from the rightmost lane to all lanes				1	
A U-turn is not necessary	3	1	1		
Other	0				

(8) Evaluation of the map data (Lane links in general roads and intersections)

(8)-2 In-intersection lane links to be connected

e. Example: Connection in an intersection having different number of lanes on the approach and exit routes

(There is no problem with the in-intersection lane links in the map data [(1)→(4), (2)→(5), (3)→(6), (7)];

Other [Free description])

No. of participants

4

3 — 3

2 — 1

2

1 — 2

1

0

There is no problem with the in-intersection lane links in the map data [(1)→(4), (2)→(5), (3)→(6), (7)]

Other [Free description]

Japanese OEM | Japanese supplier | Foreign OEM | Overseas supplier | University

In-intersection lane links to be connected (intersections with a different number of lanes on approach and exit routes)

Based on the results of field measurements, connections were made in the map data as (1)→(4), (2)→(5), (3)→(6), and(3)→(7), not(1)→(4), (2)→ (5), (2)→(6), (3)→(7).

Target route

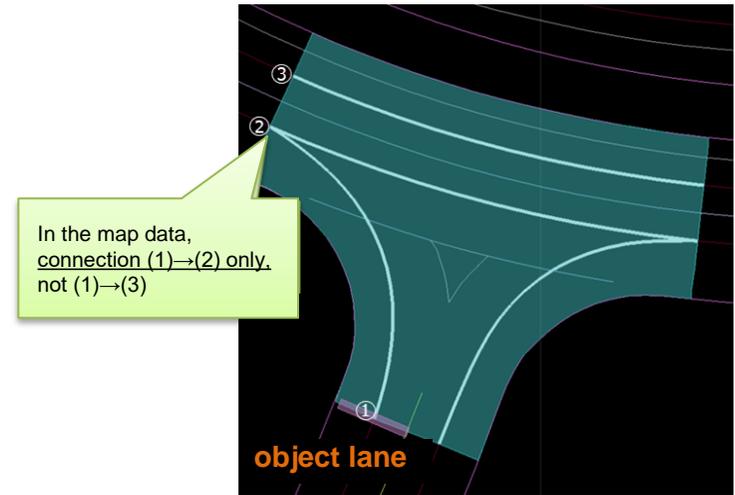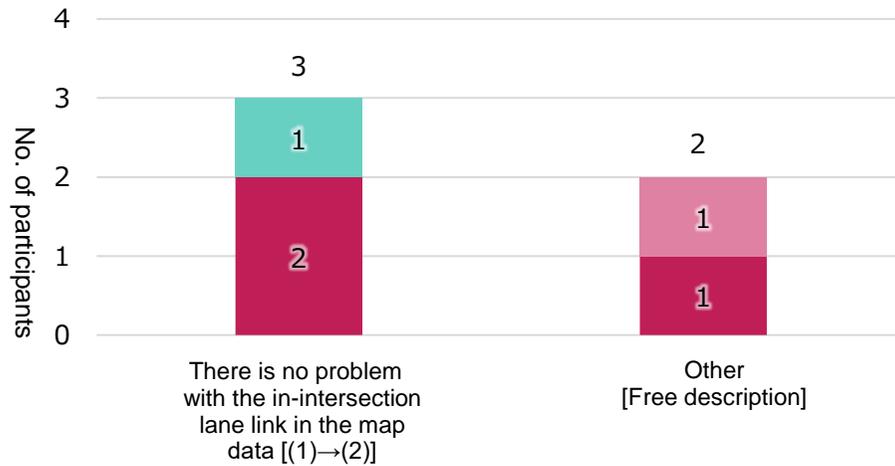| Free response comments	
Japanese OEM	● (2)→(6) should also be added.
Japanese supplier	● Connections should be based on actual driving environments. For Ariake 2-chome South (South→North), patterns (2)→(5), (2)→(6), and (3)→(7) would be common.

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4. Evaluation of general road map data

(8) Evaluation of the map data (Lane links in general roads and intersections)

(8)-2 In-intersection lane links to be connected

> f. Example: Connections at an intersection having no signal
>
> (There is no problem with the in-intersection lane link in the map data [(1)→(2)]; Other [free description])

In the map data, connection (1)→(2) only, not (1)→(3)

object lane

Chart (No. of participants):
- There is no problem with the in-intersection lane link in the map data [(1)→(2)]: Japanese OEM 2, Overseas supplier 1 (total 3)
- Other [Free description]: Japanese OEM 1, Japanese supplier 1 (total 2)

Legend: ■ Japanese OEM ■ Japanese supplier ■ Foreign OEM ■ Overseas supplier ■ University

In-intersection lane links to be connected
(intersections without traffic lights)

Free response comments	
Japanese OEM	● (1)→(3) should also be added.
Japanese supplier	● In addition to (1)→(2), (1)→(3) is also necessary.

4. Evaluation of general road map data

(8) Evaluation of the map data (Lane links in general roads and intersections)

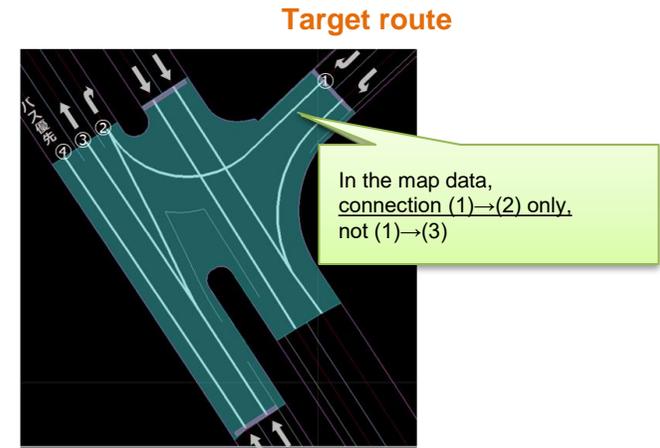**(8)-2 In-intersection lane links to be connected**

g. Example: Connections at an intersection having an exclusive right-turn lane on the exit route

(There is no problem with the in-intersection lane links in the map data [(1)→(2)]; Other [free description])

Target route

In the map data,
connection (1)→(2) only,
not (1)→(3)

No. of participants

In-intersection lane links to be connected
(when there are exclusive right-turn lanes on the exit route)

■ Japanese OEM	■ Japanese supplier	■ Foreign OEM	■ Overseas supplier	■ University

Free response comments	
Japanese OEM	● (1)→(3) and (1)→(4) should also be added.
Japanese supplier	● In addition to (1)→(2), (1)→(3) and (1)→(4) are also necessary.
Foreign OEM	● (1)→(2) would be a U-turn within the intersection. Normally, we'd like connection (1)→(4) to be made, but because buses are prioritized, connection (1)→(3) should be made.

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4. Evaluation of general road map data

(8) Evaluation of the map data (Lane links in general roads and intersections)

(8)-2 In-intersection lane links to be connected

h. Please provide your comments about the in-intersection lane links to be connected as a whole [Free response]

Free response comments	
Japanese OEM	● We have not evaluated the map data, so we cannot provide an answer.
Foreign OEM	● Given that vehicles will be driven by machines, not people, we think that connection links should be prepared to enable keeping to the left as a general rule. When there are two or more lanes, the fundamental approach should be to link to the leftmost lane.
Overseas supplier	● Some of the intersection lane node linkages differed from the actual road markings, so improvements must be made.

4. Evaluation of general road map data

(8) Evaluation of the map data (Lane links in general roads and intersections)

(8)-3 Descriptions of in-intersection lane links in the Map Data Specifications Guidelines [Free response]

Precautions on creating a map

(1) Concept of installation of travelable routes

- General roads shall be curved. Expressways may be straight lines.
- There shall be no lane links outside roadways.
- If a path is indicated by a road marking on the approach route, in-intersection lane links shall be connected in compliance with the instruction of the markings.
- On both the approach and exit routes, at least one lane shall connect in-intersection lane links.
- The number of in-intersection lane links connecting from one lane on the approach road shall be one for each exit route. However, if the number of lanes on the exit route increases with respect to the approach route, the number may be two or more depending on the instruction of the road marking.
- On both the approach and exit routes, prioritize the connection of the leftmost lane in a left turn and the rightmost lane in a right turn right.
- At an intersection, lane links connecting from the same approach route to the same exit route shall not mutually intersect.

Free response comments	
Japanese OEM	• Curves should also be used for lane node linkages within intersections and on expressways.
University	• Lane node linkages will be used not only for vehicle driving, but also to predict the movement routes of surrounding vehicles. We therefore think that it would be best to create specifications such that lane node linkage data is shared by all vehicles.

(9)Toward the realization of automatic driving by the use of the coordination system

(9)-1 Progress in development at individual enterprises through FOTs
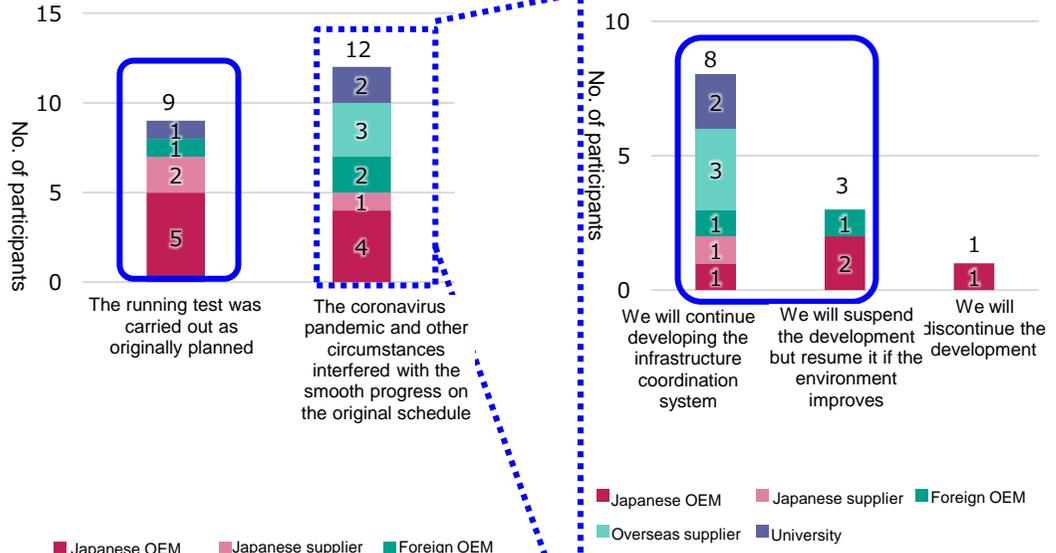
In FOTs, is your automatic driving development progressing as scheduled through infrastructure coordination? <Single choice>

(The running test was carried out as originally planned; The coronavirus pandemic and other circumstances interfered with the smooth progress on the original schedule)

If you have chosen "The coronavirus pandemic and other circumstances interfered with the smooth progress on the original schedule", please let us know your intention to develop the infrastructure coordination system in the future.
<Single choice>

(We will continue developing the infrastructure coordination system;
We will suspend the development but resume it if the environment improves; We will discontinue the development)

Roughly 40% of the participants performed driving tests as initially planned. Roughly 60% of the participants did not make as much testing progress as planned as the result of COVID-19 and factors pertaining to individual companies, but most participants intend to develop infrastructure cooperative systems.

(Number of valid responses: 21)

Free response comments	
Japanese OEM	● **We would be interested in performing testing of information delivered via cellphone connections**.
Foreign OEM	● We performed manual driving testing as initially planned. ● We will suspend development, but would like to prepare for future development if the environment improves.

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(9)Toward the realization of automatic driving by the use of the coordination system
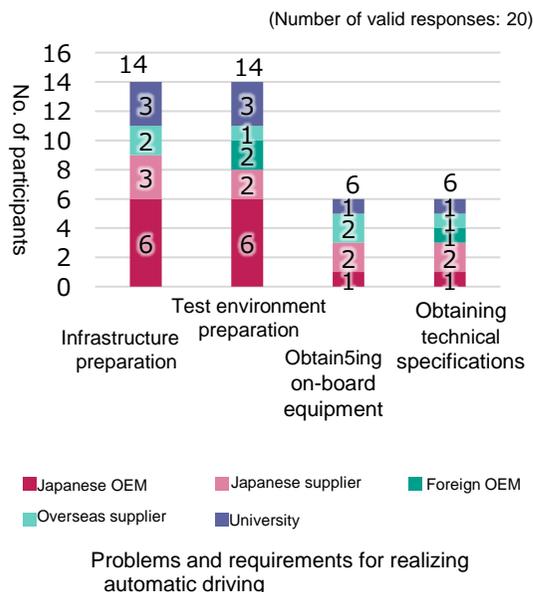
(9)-2 Problems and requirements for realizing automatic driving under the coordination systems
 Please tell us about the problems and requirements for the realization of automatic driving under coordination system in the future.   <Multiple choice>
 (More infrastructure should be developed for the coordination system; A testing environment should be developed using the coordination system; It is hard to procure on-board devices intended for the coordination system.; It is hard to procure technical specifications for the coordination systems are difficult to obtain)
   In addition, please tell us about the problems and requirements for realizing automatic driving under the coordination systems.

Some participants indicated that they wanted test environments to be maintained and expanded, and that in the future they wanted automated driving areas to be defined and infrastructure to be prepared for the entire areas.

(Number of valid responses: 20)

No. of participants

16 14 12 10 8 6 4 2 0

- Infrastructure preparation: 6 / 3 / 2 / 3 = 14
- Test environment preparation: 6 / 2 / 2 / 1 / 3 = 14
- Obtain5ing on-board equipment: 1 / 2 / 2 / 1 = 6
- Obtaining technical specifications: 1 / 2 / 1 / 1 / 1 = 6

Legend:
- Japanese OEM
- Japanese supplier
- Foreign OEM
- Overseas supplier
- University

Problems and requirements for realizing automatic driving

Free response comments	
Infrastructure preparation	• Instead of pinpoint implementation, **infrastructure must be provided for entire automated driving areas**, as in these FOTs. (Japanese OEM) • It would be best to **build a cooperative system that could be added on to existing infrastructure. There would be few advantages to building systems into vehicles if they could only be used in urban areas.** (Japanese OEM) • At present, preparing a cooperative system would be one good approach. From a long-term perspective, **development areas should be decided on and work should be carried out while taking return on investment into consideration**. (Japanese supplier) • With regard to the full-fledged deployment of cooperative infrastructure systems, development should be carried out after gathering information regarding **global trends and the opinions of industry operators**. (Japanese supplier)
Test environment preparation	• **We would like test environments to be maintained and supplied.** (Foreign OEM) • **We would like the number of locations where ETC2.0 evaluation can be performed to be increased.** (Foreign OEM)
Obtaining on-board equipment	• **We would like equipment that could be used in advance to perform reception confirmation on a test course** (test key ITS wireless unit, RSU, radio station license, etc.). This is necessary as part of the process of testing automated driving on public roads. (Overseas supplier)
Obtaining technical specifications	• V2I/V2N communications methods are being considered, but there need to be **guarantees regarding delay and reliability**. (Japanese OEM) • **Disclosing infrastructure-end technical specifications** would enable technical deliberations to go more smoothly. (Foreign OEM)

6. Management of the FOTs
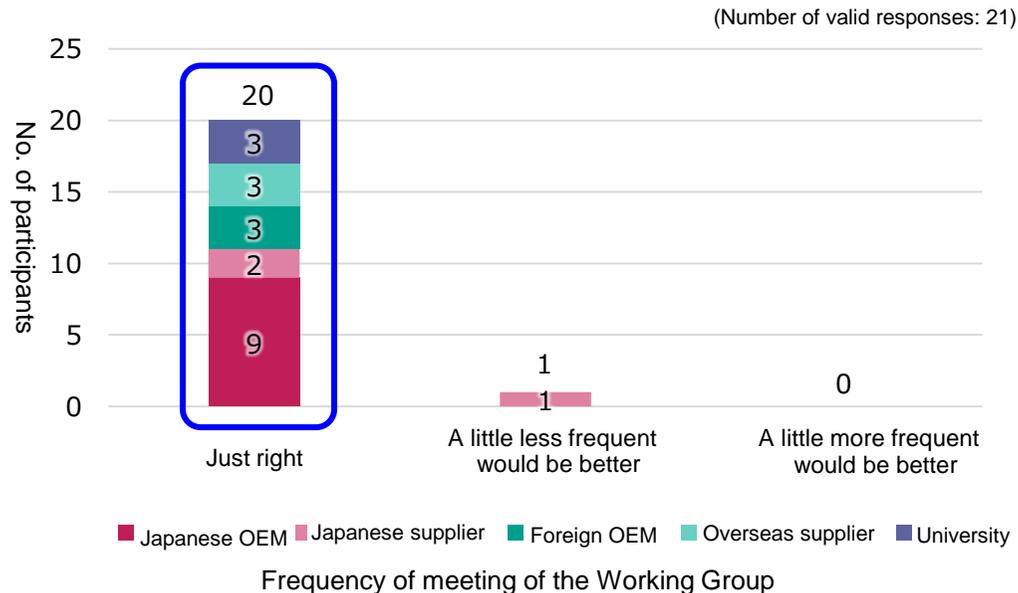
(10) Opinions concerning the FOTs

(10)-1 Frequency of meeting of the Working Group on FOTs in the Tokyo Waterfront Area

During the FOTs, the FOTs WG was held every other month (every month during the last stage of FOTs), for the purpose of sharing information on test method discussions, equipment explanations, data acquisition status, and evaluations. How was the frequency of the FOTs meeting? <Single choice>

(Just right; A little less frequent; A little more frequent)

The majority of respondents answered that they found the frequency of FOT WG meetings to be "Just right"

(Number of valid responses: 21)

Frequency of meeting of the Working Group

■ Japanese OEM ■ Japanese supplier ■ Foreign OEM ■ Overseas supplier ■ University

6. Management of the FOTs

(10) Opinions concerning the FOTs

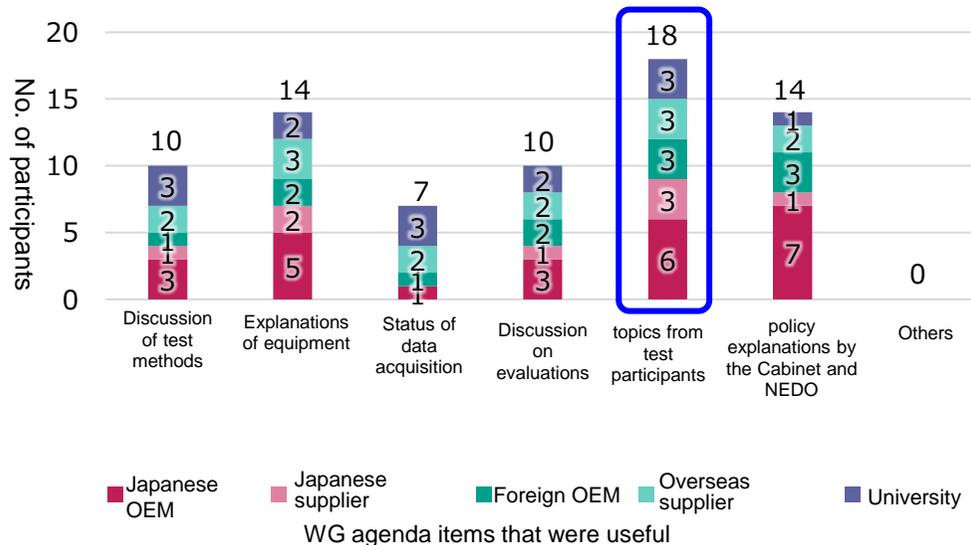**(10)-2 Agenda for the FOTs WG**

Please give us information that is useful for discussion at the FOTs meeting.   <Multiple choice>

(Discussion of test methods; Explanations of equipment; Status of data acquisition; Discussion on evaluations; topics from test participants, policy explanations by the Cabinet and NEDO; Others)

We welcome any other information useful for discussion at the FOTs meetings.

The most commonly selected answer was that the providing of topics from test participants was useful.
The FOT working group serves not only as a space for explanations and discussions of the contents of the FOTs, but also as a place where participants can learn about the direction being taken by other participants.

(Number of valid responses: 21)

No. of participants

WG agenda items that were useful

Legend: Japanese OEM, Japanese supplier, Foreign OEM, Overseas supplier, University

Free response comments	
Japanese OEM	● We liked that the working group provided information regarding the **direction take by other participants** (such as the frequency with which participants were performing test driving, without disclosing the names of individual companies). We also believe that it would be possible to tabulate participation rates and driving distances by weather condition and time of day. We think **it would be valuable to visualize situations in which there are automated driving difficulties.**

6. Management of the FOTs

(10) Opinions concerning the FOTs

**(10)-3 Method for holding FOTs WG meetings**

In order to prevent corona infection, the FOTs WG meeting was held at Teams' online conference.
How was the WG online meeting?   <Single choice>
(There was no problem in the online conference; There was some inconvenience with the online conference)
If you chose "There was some inconvenience with the online conference", please describe more specifically.

No participants indicated that they were inconvenienced by holding WG meetings online due to COVID-19. There was room for improvement with respect to the way the online meetings were held in order to address problems (participants forgetting to mute themselves, dropped frames in videos, etc.)
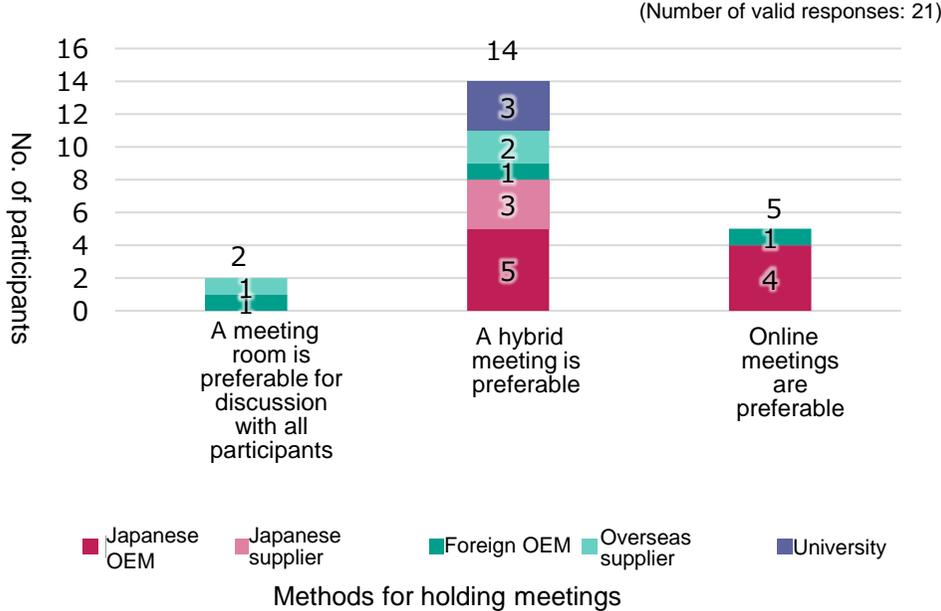
(Number of valid responses: 21)

Holding WG meetings online
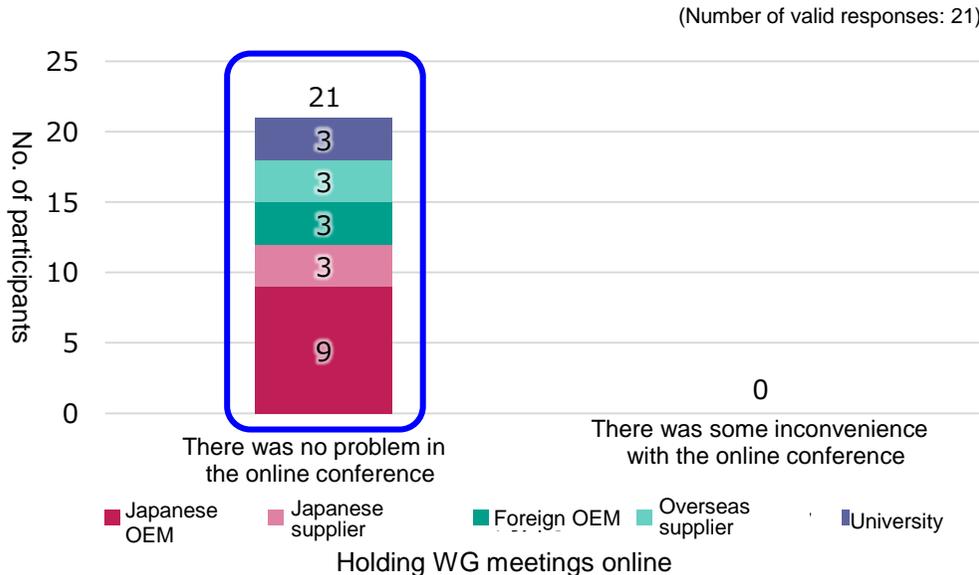
Free response comments	
Japanese OEM	● The **dropping of frames** is unavoidable when showing videos using screen sharing, so consideration should be given to other approaches, such as providing video files separately.
University	● **There were participants that did not mute themselves,** so the microphones picked up their voices and made speakers hard to hear.

6. Management of the FOTs

(10) Opinions concerning the FOTs

(10)-4 Method for holding FOTs WG meetings (for meetings in and after FY2021)
   Which of the three forms of meeting - face-to-face, online, and hybrid - is preferable for FOTs WG meetings in and after 2021? Meetings will be held online where there is a high risk of coronavirus infection. In an environment where the risk of coronavirus infection is low, which form of meeting would you prefer? <Single choice>
   (A meeting room is preferable for discussion with all participants; A hybrid meeting is preferable; Online meetings are preferable)

The majority of participants wanted WG meetings from next year on to be held using a hybrid approach. However, there are advantages and disadvantages to each method of holding meetings, so decisions must be made comprehensively, reflecting the COVID-19 situation and the state of related meetings.

(Number of valid responses: 21)

Free response comments		
Japanese OEM	●	When the hybrid approach is used, **it's often hard for those participating online to make out what those attending in person are saying**. When everyone participates online, everyone uses a microphone, so it's easier to hear people.
Japanese supplier	●	In-person meetings have the advantages of **networking and being able to share ideas outside of the meeting**, but sometimes attendance is difficult for scheduling reasons, so the hybrid approach is better.

Legend:
- Japanese OEM
- Japanese supplier
- Foreign OEM
- Overseas supplier
- University

Methods for holding meetings

6. Management of the FOTs

(10) Opinions concerning the FOTs

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(10)-5 Information deployment method (communication tool)
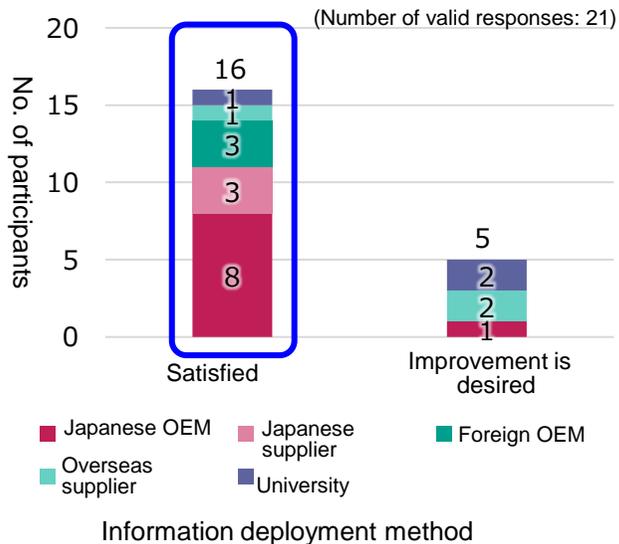
In the FOTs, various information and materials were provided, and driving and test plans were submitted using a communication tool (kintone). <Single choice>

   (Satisfied; Improvement is desired)

If you have chosen "Improvement is desired", please give us suggestions.
For information, kintone can be used for a bulletin board, document and data management, user inquiry, and data submission, and other applications. If there is an application that you want to improve, please write them down as well.

Sharing information using communication tools was effective, but many participants pointed out improvements to be made in the long-term operation of the FOTs.

(Number of valid responses: 21)

No. of participants

Information deployment method

- ■ Japanese OEM
- ■ Japanese supplier
- ■ Foreign OEM
- ■ Overseas supplier
- ■ University

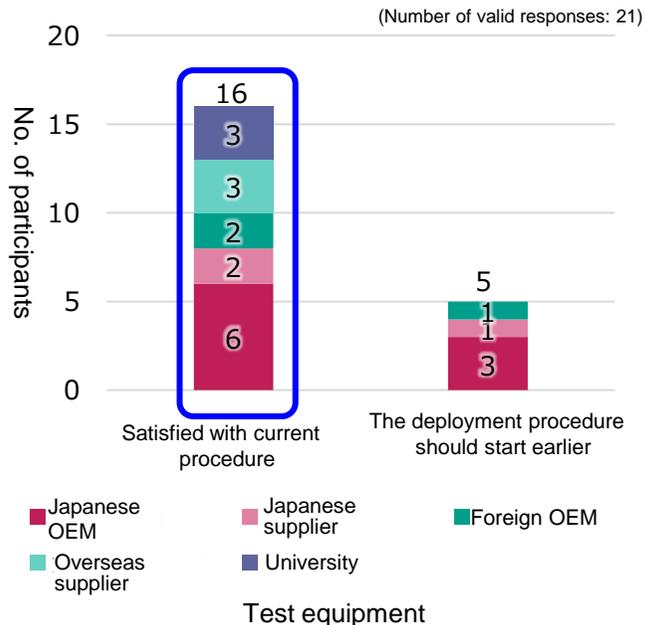| Free response comments	
Information sharing method	● Reminders regarding questionnaires, etc., **should only be sent out to participants that have not yet submitted their responses**. (Foreign OEM) ● **It was difficult to distinguish between administrative notices and requests.** (Overseas supplier)
Additional functions	● There should be a function that **creates tasks based on action items** and provides reminders. (Japanese OEM**)** ● We would like it if emergency contact information were displayed in advance in the User Inquiry app. If there are any equipment problems on the day of testing, it would be much easier to handle if there were a list of emergency contacts for device manufacturers, etc. **It would be helpful to have an app for use in dealing with emergencies.** (Japanese OEM) ● It would better if the user inquiry form were **threaded** or otherwise presented chronologically in a manner that made it easy to understand what was going on. (Japanese supplier) ● We would like it if kintone were **smartphone-accessible**. (Foreign OEM) ● It was great to be able to obtain and submit materials via kintone, but in the supplied version it was not possible to **manage what had been seen and what had not yet been seen**, resulting in things getting overlooked. We would like for there to be a tool for individually managing shared information. (Foreign OEM) ● **We would like to be able to perform searches across supplied materials.** In many situations, we end up opening materials one by one and performing searches, so we'd like there to be a system for more rapidly searching for necessary information. (Foreign OEM) ● **We'd like the notification email to include not only the kintone URL but also its contents.** We couldn't use the email software's keyword search function, which presented a lot of difficulties. (University)

(10) Opinions concerning the FOTs

(10)-6 Test equipment

Test hardware was mailed about one month before the test, and the test software was updated about two weeks before the test. How was the timing of deploying test hardware and software? <Single choice>

(Satisfied with current procedure; The deployment procedure should start earlier)

Let us know any problem or opinion about test equipment (box-type PC, ITS wireless receiver, on-vehicle equipment for highway testing, mobile terminal, GNSS on-board equipment, movement management system, drive recorder, lectronic counter).

Many participants indicated that there were no problems with the current test equipment procedure. However, some participants wanted the equipment to provided further in advance, and for further individual follow-up to be provided by Consortium personnel.

(Number of valid responses: 21)

No. of participants — Test equipment

Satisfied with current procedure: 16 (Japanese OEM 6, Japanese supplier 2, Foreign OEM 2, Overseas supplier 3, University 3)

The deployment procedure should start earlier: 5 (Japanese OEM 3, Japanese supplier 1, Overseas supplier 1)

Legend:
- Japanese OEM
- Japanese supplier
- Foreign OEM
- Overseas supplier
- University

Free response comments	
Test equipment	• Set up, software updates, and operation confirmation all take a lot of time, **so it would be very helpful if we could receive the test equipment earlier**. (Japanese OEM) • One of the five on-board equipment output patterns should be one that outputs vehicle location, speed, heading, and other information based on GNSS receiver data. (Japanese OEM) • We would like for the drive recorder **SD cards to be mailed earlier**. (Japanese OEM) • The **accuracy of the GNSS receivers** was a problem in the Waterfront City area. (Japanese supplier) • **The tally counters were analog,** making them difficult to use and sometimes forgotten. (Japanese supplier) • In order to prevent operation errors such as forgetting to save data, we would like for it to be possible for **received information to be saved automatically in the BOX-PCs**. (University)
Individual support	• It would be **even better if we could receive support from the personnel in charge** when hardware was mailed and when software was updated. (Japanese OEM) • We would like to be provided in advance with **contact information** for who we should contact in the event of equipment problems. Our BOX-PC failed on the day of the drive testing, and we also had problems even after replacement. (Japanese OEM) • The equipment distribution schedule was tight, and after receiving equipment, the installation and operation confirmation processes presented a significant burden, as it involved confirming personnel, replacing faulty equipment, dealing with difficult to understand procedures, contradictory information, on-site attended confirmation, and the like. We felt that things would go more smoothly if **schedule follow-up, technical follow-up, support, and the like** were also considered. We cannot guarantee the acquisition of accurate data unless personnel from the companies involved are dispatched to handle installation in advance, operation on the day of testing, and the like. (Japanese supplier)

6. Management of the FOTs
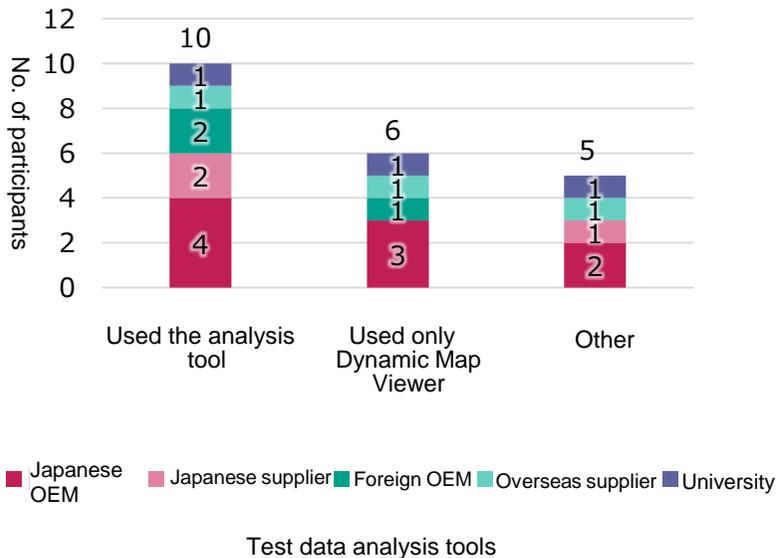
(10) Opinions concerning the FOTs

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(10)-7 Test data analysis tools

An excel tool was delivered to test participants to evaluate and analyze the signal information and the merging support information obtained from test equipment. Have you used the tool?   <Single choice>

(Used the analysis tool; Used only Dynamic Map Viewer; Other)

Many participants used the dynamic map viewer and analysis tool. There were requests for improvements to how they were distributed and how they were operated.

(Number of valid responses: 21)

Test data analysis tools

Free response comments	
Japanese OEM	● It would be better if the expressway analysis tool was capable of visualizing **cruising line vehicle-side driving trajectories, reflecting calculated merging area arrival time deviation values**. ● It would better if there were "+/-" indications for the merging area, etc. start point and distance indications in order to make it possible to determine direction. ● We would appreciate it if kintone could be used to create/collect apps such as a "Tool List" app for evaluation and analysis tools. ● We were able to identify areas where traffic signal information could not be received.
Japanese supplier	● There were times when data conversion was not possible, and we had this done for us by the Secretariat. **It would be better if improvements were made to the ease of use of the viewer**, such as making it possible to zoom in on areas you wish to see in more detail.
Foreign OEM	● Generally speaking, the tools were useful, but the traffic signal information visualization tool would be more useful if it were possible to **reorder the traffic signals** by the order they are encountered on driving routes or in order by intersection number.

6. Management of the FOTs

(10) Opinions concerning the FOTs

(10)-8 Submission of test data

Please let us know your problems and opinions concerning the submission of data obtained with the test equipment.
Data acquired from box-type PCs (signal information, merging support information, etc.); Submission by using a communication tool (kintone); video data from the drive recorder; mailing via SD card

Many kinds of data had to be submitted, which placed a great burden on participants. Some participants asked for improvements to be made.

Free response comments	
Overall	● **There were many types of data, so there was confusion when it came time to submit the data.** (Japanese supplier) ● The FOTs were performed using limited resources, so consideration needed to be given to how long it would take to organize data after driving. (Foreign OEM)
Submission via the communication tool (kintone)	● It was cumbersome having to prepare and submit BOX-PC data and tally counter data separately. (Foreign OEM) ● There were many cases in which we verified merging support at the Airport West from the Haneda area and then headed towards Odaiba, so separating the expressway verification and the traffic signal information verification was cumbersome. It would be better to have a method for submitting log data together as one (such as by centralizing measurement in the BOX-PC). (Foreign OEM)
Mailing data by SD card	● It was convenient being able to send SD cards by Letter Pack. (Japanese OEM) ● The drive recorder video data is very large, so it would be best to continue submitting the data via SD card. (Japanese OEM) ● We received a package for returning the SD card, so there were no problems. (Japanese OEM) ● When SD cards were sent to the office, we sometimes had difficulty receiving them because employees were working for home and due to the timing with which the cards were sent. We consulted regarding these issues, moved up the timing with which the cards were sent, and had several weeks sent at once. (Japanese supplier) ● The process of sending video data was a bit too complex. It would have been better if there were a method that did not involve physical mailing, such as uploading the data. (Foreign OEM) ● Creating driving plans a month in advance was somewhat difficult, so there were several cases in which we sent empty SD cards. (Foreign OEM) ● Sending SD cards even when no test driving was performed was cumbersome. We'd rather that SD cards only be sent when data was acquired. (University)

6. Management of the FOTs

(10) Opinions concerning the FOTs

(10)-9 Future treatment of test data

The test data acquired and provided in the FOTs will be used in the future in line with the purpose of SIP.
Please let us know your comments or requests regarding the use of the test data.

Many participants indicated that they wanted video from fixed-point cameras to be provided.
Also, with regard to the use of participant data, consideration must be given to anonymizing the data so that individual company names cannot be determined.

Free response comments		
Data provision requests	**Fixed-point cameras (general road cameras+ expressway cameras)**	● We would like fixed-point camera video for the Airport West Interchange to be provided. If possible, we would also like analysis results to be provided at the same time. (Japanese OEM) ● We would like fixed-point camera video to be provided, both for our own company and other companies. If other participants approved it, it might also be possible to share it via SIP-café. (Japanese OEM) ● We would like it to be possible to confirm fixed-point camera video when necessary. (Japanese supplier) ● With regard to merging support information, it is difficult to track vehicles on the cruising line using just the received information regarding vehicles driving on the cruising line and the on-board camera data. Receiving actual information regarding vehicles driving on the cruising line obtained from infrastructure-side cameras, etc., would assist with future analysis. (Foreign OEM) ● We would like fixed-point camera video to be provided. (Overseas supplier) ● We would like video and other data to be provided for the vicinities of expressway merging points, etc. (University)
	Other	● With regard to lane probe data, we could not participate in this FOT due to COVID-19, but we would appreciate it if this information were shared. (Japanese OEM) ● If we receive data analysis results and summaries, we don't need individual data. (Japanese OEM)
Requests for use in other measures		● We would prefer that submitted data be used only within the Consortium, and not shared with other companies. When disclosing information based on data in results reports, etc., we would like for the data to be **anonymized so that individual company names cannot be identified**. (Japanese OEM) ● We would like for individual company names to be kept confidential. (Japanese OEM) ● We would like for confirmation to be performed in advance before disclosing individual company names. (Japanese supplier)

6. Management of the FOTs

(10) Opinions concerning the FOTs

(10)-10 Window for the FOTs

The FOTs window is in place to handle submitted running plans, inquiries on test equipment and other affairs, by using a communication tool (kintone).

We welcome any request regarding the window services.

The contact process using the communication tool (kintone) was effective, but there were requests for improvements to the amount of time taken to deal with inquiries.

Free response comments		
Improvement requests	Communication tools,	• Using groupware was convenient. However, data submission, such as the submission of user inquiries and questionnaire responses, was split up in complicated ways, and there were cases where contact methods were not consistent (for example, NEDO contacted us directly by email but issues were handled via Kintone). There seemed to be an overall lack of consistency. Also, **it would be even more convenient if the notification emails from Kintone contained the contents posted on the forum**. (Foreign OEM)
	Inquiry handling	• We made an urgent technical inquiry, but **it was not quickly confirmed or answered** on Kintone, perhaps because of the handling process, which consisted of entering the inquiry into a form, the contents being confirmed by the receiving group with each person in charge, and an answer being supplied. The only way to have rapid confirmation performed was to find out the contact information for individual Consortium members. (Japanese supplier) • This does not directly relate to the intent of this question, but **if the Consortium is going to perform analysis, etc., it would be better if it performed actual drives and frequently checked local conditions**. We realize that there are many issues and restrictions involved, such as matters of personnel resources, confidentiality, and safety management, which would present difficulties, but the approach of explaining test drive conditions after performing test drives took a great deal of time and effort and was inefficient. (Japanese supplier)
No problems of note		• The contact point personnel dealt with issues quickly, for which we are very grateful. User inquiries were also handled speedily, which reduced the amount of time required to deal with problems. (Japanese OEM) • The person in charge in our organization changed midway, so we had issues with not understanding how to use the tool. We're sorry for the difficulty we caused. (Foreign OEM) • Inquiries were dealt with quickly. When we had problems, we were referred to the person in charge of the issue, who helped us solve the problems. (Overseas supplier)

6. Management of the FOTs

(10) Opinions concerning the FOTs

(10)-11 Evaluation of impact assessment

This time, two 2-week intensive driving periods were planned (October-November and February) .

<Questions to those (who drove>
Please give your comments on the test cooperation based on the planned traveling routes and target number of laps.

Multiple participants cooperated in testing based on planned traveling routes and target numbers of laps. Some indicated that the evaluation approach was not sufficiently explained in advance, but there were also responses stating that the testing was valuable.

Free response comments	
Evaluation perspectives	● **If we were informed in advance about what kind of data analysis would be performed, we could have performed testing aligned with those analysis objectives.** If, on the other hand, this approach was used in order to prevent that from happening, then we think that the current testing approach was a good choice. (Japanese OEM) ● We're sorry that we were unable to reach the target number of laps. **There were issues which we only discovered when collecting data for the same routes during the intensive driving period, so the test was a valuable one.** (Foreign OEM)
No. of laps	● We are sorry that we were unable to reach the high target number of laps. We're glad that we were able to learn about the direction taken by other participants. (Japanese OEM) ● Thanks to the coordination work performed for us in advance, we were able to perform driving without problem. (Japanese OEM) ● We are appreciative of the fact that the Consortium consulted with us regarding the target number of laps, taking our own situation into consideration. (Japanese supplier) ● We cooperated as best we could, but we're sorry that we unfortunately were unable to perform the automated driving expected of us due to issues on our end. (Foreign OEM) ● We cooperated to the greatest degree we could, but were not able to meet the targets, for which we are sorry. If there is another impact assessment in the future, we will make improvements. (Overseas supplier) ● We participated in October and November, but due to business trip restrictions prompted by the state of emergency in February, we were unable to participate in February's testing. (University)

6. Management of the FOTs

(10) Opinions concerning the FOTs

(10)-11 Evaluation of impact assessment

This time, two 2-week intensive driving periods were planned (October-November and February) .

<Questions to those who did not drive>

Please select reasons why you did not drive in the test. <Multiple choice>

- The test vehicle was not ready.
- The intensive driving period and our schedule did not match.
- We had planned to drive but we couldn't because of the coronavirus pandemic.
- We had no plan to drive from the beginning.
- We have never driven in the waterfront area.
- Other (   )

Multiple participants were unable to drive during the intensive driving period due to the impact of COVID-19 and due to schedule issues.

(Number of valid responses: 10)
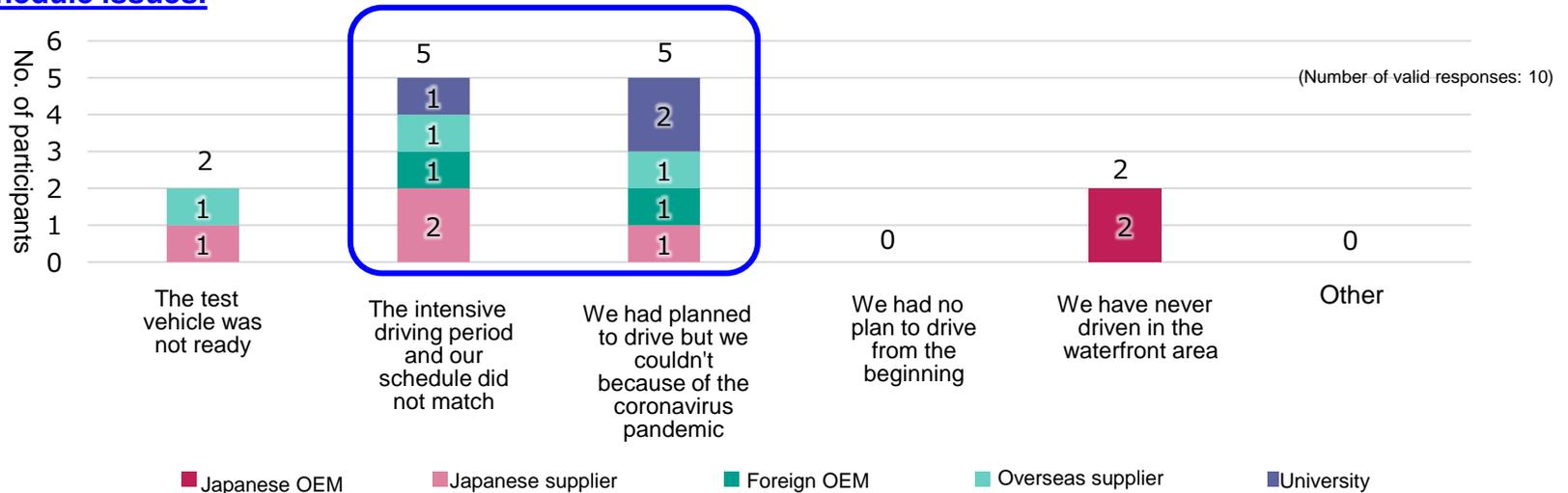
Reasons for not driving during the impact assessment period

6. Management of the FOTs

(10) Opinions concerning the FOTs

(10)-12 Evaluation of impact assessment

The evaluation scenes (right and left turns, pedestrians, bicycles, sudden braking on a straight, etc.) were set from a viewpoint of social acceptability. Please let us know if there are any other scenes to be evaluated or data you would like to obtain when developing and launching automatic driving equipment or services in the future.

Multiple participants indicated that evaluation needed to be performed of the impact that nearby ordinary vehicles had on autonomous vehicles and vice-versa, dealing with emergency vehicles, dealing with road construction, and dealing with vehicles parked on streets.

Free response comments	
Evaluation situation	● The **impact on following vehicles** when traversing or stopping at intersections. (Japanese OEM) ● In the future, we believe evaluation will also need to be performed of delays when accelerating from a stop, **processing emergency vehicles, etc**. (Japanese OEM) ● **Do nearby ordinary vehicles tend to decrease the distance between them and autonomous vehicles, or, conversely, increase that distance?** (Japanese supplier) ● Data acquisition and evaluation should also be performed for **lane-specific traffic congestion information, emergency vehicle information, rainfall information, accident/road construction information, and the like.** (Overseas supplier) ● Given that the shared map is used by all vehicles, evaluation should also be performed of driving behavior when **autonomous vehicles encounter autonomous vehicles made by other companies**. (University)
Road Traffic Law	● On-street parking, cutting (tailgating/road rage), poor weather, etc. The amount of on-street parking is particularly high for the Waterfront City area, and we felt that the ability of autonomous vehicles to avoid these parked vehicles and drive through the area presented a major challenge. (Japanese OEM) ● How to engage in truly safe driving in **actual traffic conditions which are not always in conformance with the Road Traffic Law**, such as when there are vehicles parked on the street or when actual driving speeds differ from indicated speed limits. (Foreign OEM)
Other	● Adding other situations is, of course, important, but we believe that **evaluation needs to be performed for the currently defined driving situations using a larger number of samples**. (Japanese OEM)

6. Management of the FOTs

(10) Opinions concerning the FOTs

(10)-12 Evaluation of impact assessment

This impact assessment is limited to situations where there are not many automatic driving cars running. Give us your opinion about the need for additional impact assessment?

Participants' opinions were divided on the topic of the need for additional impact assessments, but they stated that, if additional impact assessments were performed, they would like the burden placed on participants to be minimized. Also, multiple participants indicated that they wished to perform impact assessments on expressways.

Free response comments	
Additional impact assessment necessary	● **We were unable to perform sufficient impact assessments of automated driving,** so we would like to perform additional impact assessments from April onwards. (Overseas supplier) ● Assessments must be carried out of the **impact of autonomous vehicles on traffic flow** to check if they cause traffic jams. (University)
Additional impact assessment not necessary	● The current method in which participants are asked to submit driving data places a burden on participants. If additional impact assessments are necessary, **the methods used will need to be reconsidered**. (Japanese OEM) ● Automated driving tests require significant resources for preparation, safety confirmation, and the like. The data that has been acquired so far needs to be analyzed carefully, and only after that, close consideration must be given to whether or not there is a need for additional impact assessments to be performed. (Japanese OEM) ● **We don't feel that there is any need for additional impact assessments** at present. (Japanese supplier)
Other	● The impact assessment was extremely valuable because it enabled us to confirm the degree of affinity between autonomous vehicles and existing vehicles. As with the Tomei Expressway (autonomous truck platooning test), we would like if areas were set up on expressways, as well, in which numerous autonomous test vehicles could be driven. The Metropolitan Expressway is difficult for autonomous vehicles due to factors such as vehicle speed, vehicle spacing, merging and splitting frequency, traffic volume, and the like, so **we would like for an area other than the Metropolitan Expressway to be set up**. (Japanese OEM) ● We don't have any proposals regarding implementation methods, but we believe that **impact assessments must be performed on expressways**. (Foreign OEM)

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