

"Cross-ministerial Strategic Innovation Promotion Program (SIP)  
Phase Two - Automated Driving (Expansion of Systems and Services)  
/Implementation of FOTs in the Tokyo Waterfront Area"  
**- FY2021 Results Report Overview -**  
**Appendix**

FOTs in the Tokyo Waterfront Area Consortium  
Mitsubishi Electric Corporation (representative)

Aisan Technology Co., Ltd.  
GeoTechnologies, Inc.  
Sumitomo Electric Industries, Ltd.  
Zenrin Co., Ltd.

Toyota Mapmaster Incorporated  
Nippon Koei Co., Ltd.  
Pacific Consultants Co., Ltd.  
Pasco Corporation

March 2022

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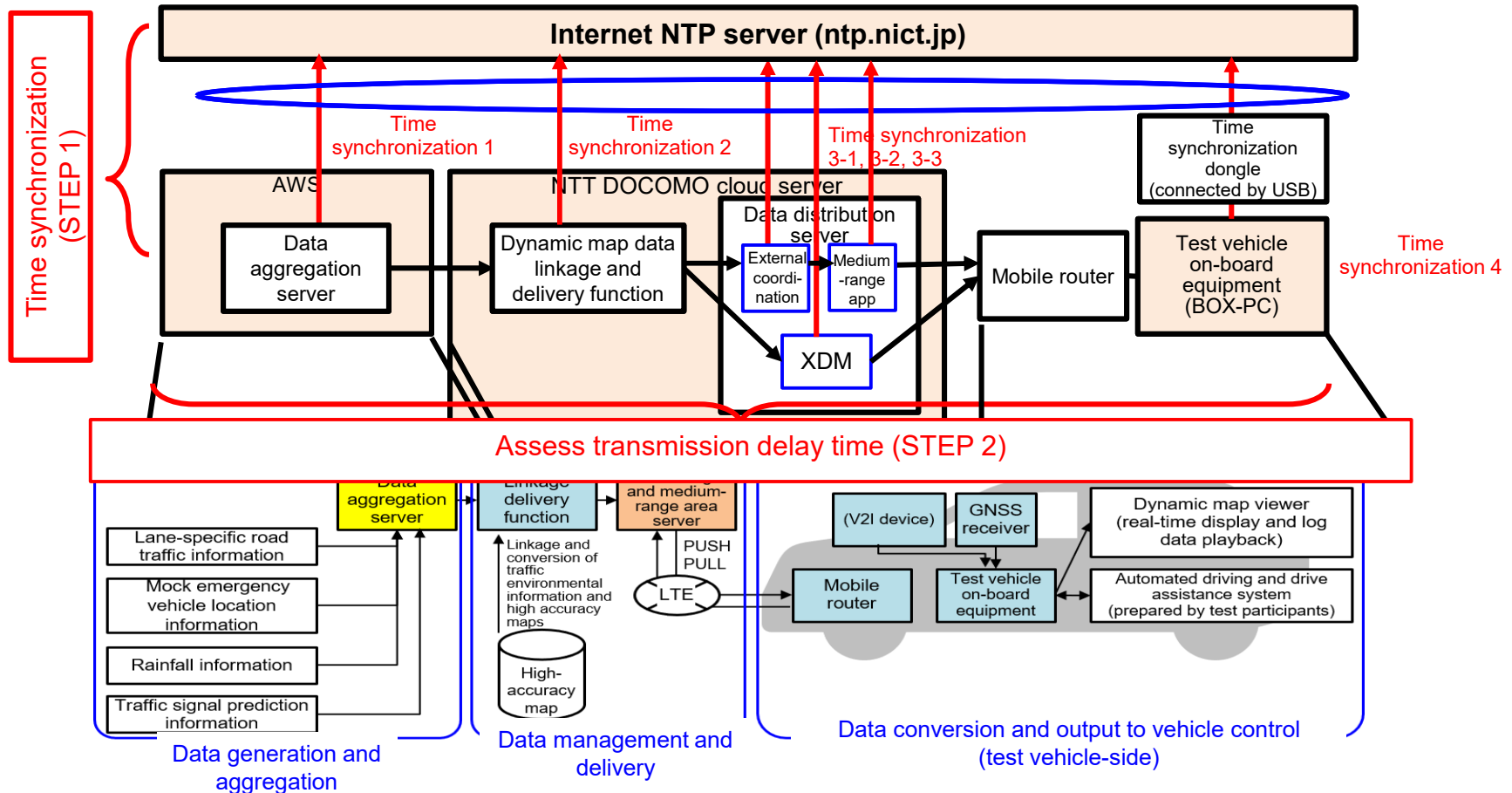
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# 1. Test system equipment-side testing

## (1) Time synchronization and transmission delay time test procedures

- After synchronizing each device's time with the same NTP server on the internet (STEP 1), the transmission delay time between devices is determined (STEP 2)

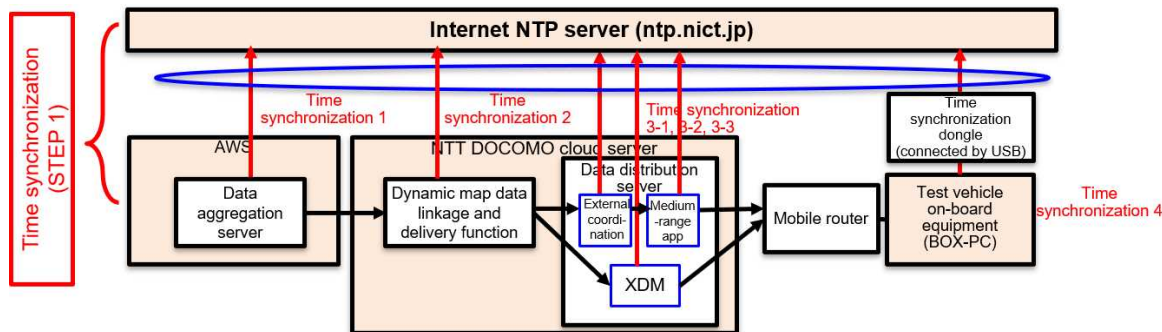


# 1. Test system equipment-side testing

## (2) STEP 1: Time synchronization

- Minimize time deviation between devices, reducing it to an average of 1.6 ms (max.  $\pm 20$  ms) by synchronizing device times with an NTP server on the internet

Device		Time: Difference between device time and NTP server time	Deviation (- ahead, + behind)	Flow of data
Data aggregation server		2 $\mu$ s behind	-47 $\mu$ s to 52 $\mu$ s	PUSH/PULL
Linkage delivery function		716 $\mu$ s ahead	-3.17 ms to 0.6 $\mu$ s	PUSH/PULL
Data distribution server	External coordination server	19 $\mu$ s ahead	-1.72 ms to 727 $\mu$ s	PUSH
	Medium-range app server	10 $\mu$ s ahead	-818 $\mu$ s to 1.75 ms	PUSH
	XDM server	17 $\mu$ s ahead	-766 $\mu$ s to 1.45 ms	PULL
Test vehicle on-board equipment		878 $\mu$ s ahead	-14.8 ms to 16.4 ms	PUSH/PULL

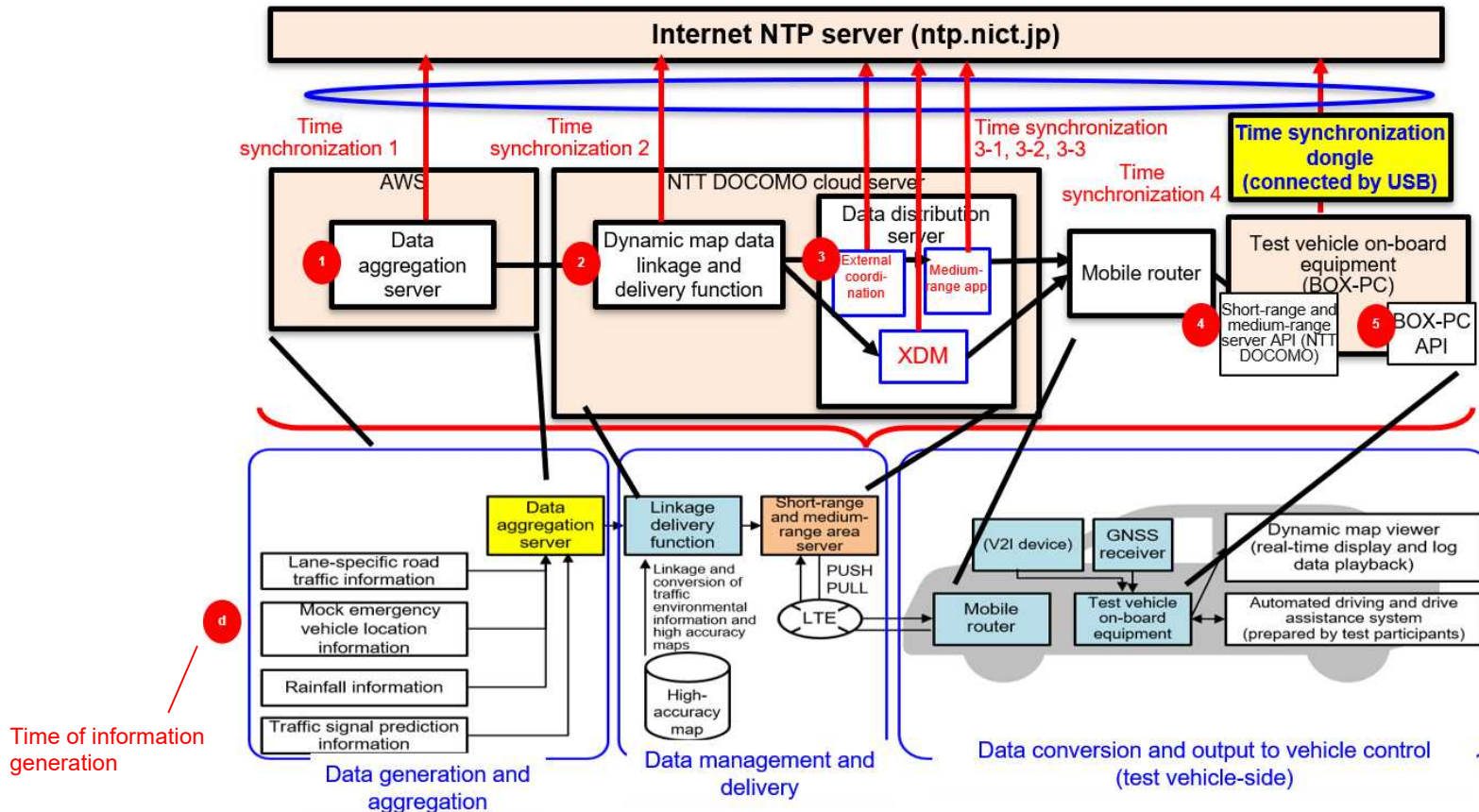


Results of time synchronization between 10:00 and 12:00 on November 19, 2021  
 (Servers: Results of measurement performed in 30 second intervals)  
 (Test vehicle on-board equipment: Results of measurement performed in 8 second intervals)

# 1. Test system equipment-side testing

## (3) STEP 2: Transmission delay times

- Assess amount of time required for delivery between devices, based on the time taken to transmit data between the data aggregation server and the test vehicle on-board equipment



➔ See the Main Section document for the results of the rainfall information tests and the lane-specific road traffic information tests and an overview of the mock emergency vehicle location information tests and the traffic signal prediction information tests

# 1. Test system equipment-side testing

## (3) STEP 2: Transmission delay time [mock emergency vehicle location information (general overview)]

- The amount of time required for the uplink from the mock emergency vehicle to the data aggregation server was 0.249 to 0.259 seconds, on average
- The amount of time required for delivery from the data aggregation server to the test vehicle on-board equipment was 0.967 to 0.992 seconds, on average
- ➔ The amount of time required for information to reach the test vehicle on-board equipment from the mock emergency vehicle was 1.217 to 1.251 seconds, on average  
(When the mock emergency vehicle was driving at high speeds, there was a large difference between the location in the received data and the actual location where the vehicle was confirmed to be)

Mock emergency vehicle no. 1: 2,272 samples (Received Jan. 10, 2022, in the test room)

Unit: seconds

	Reception interval (seconds)						Time deviation (seconds)							
	d	(1)	(2)	(3)	(4)	(5)	d-(1)	(1)-(2)	(2)-(3)	(3)-(4)	(4)-(5)	(1)-(5)	d-(5)	
Max.	2.100	2.723	2.733	2.732	3.016	3.016	0.950	0.070	0.016	1.902	0.016	1.913	2.210	
Min.	1.899	1.406	1.406	1.406	0.985	1.000	0.120	0.008	-0.001	0.064	0.000	0.077	0.204	
Avg.	2.000	2.000	2.000	2.000	2.000	2.000	0.249	0.010	0.002	0.953	0.001	0.967	1.217	

Mock emergency vehicle no. 2: 2,167 samples (Received Jan. 10, 2022, in the test room)

Unit: seconds

	Reception interval (seconds)						Time deviation (seconds)							
	d	(1)	(2)	(3)	(4)	(5)	d-(1)	(1)-(2)	(2)-(3)	(3)-(4)	(4)-(5)	(1)-(5)	d-(5)	
Max.	2.110	2.885	2.884	2.885	3.001	3.001	1.327	0.075	0.030	1.082	0.016	1.103	2.228	
Min.	1.890	1.083	1.083	1.083	1.000	1.000	0.115	0.008	-0.001	0.085	0.000	0.095	0.226	
Avg.	2.000	2.000	2.000	2.000	2.000	2.000	0.259	0.011	0.002	0.978	0.001	0.992	1.251	

# 1. Test system equipment-side testing

(3) STEP 2: Transmission delay time [mock emergency vehicle location information (mock emergency vehicle 1)]

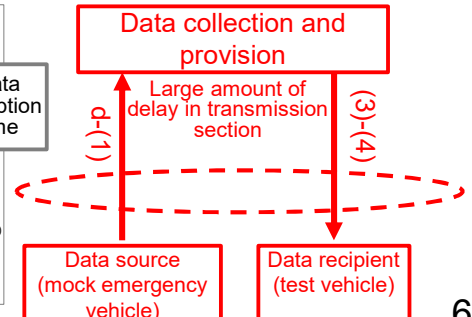
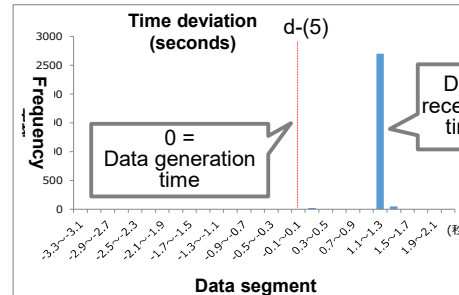
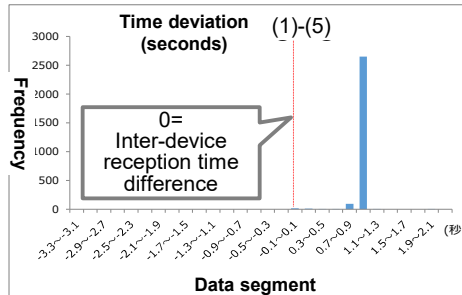
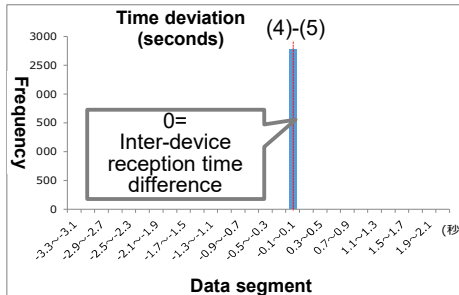
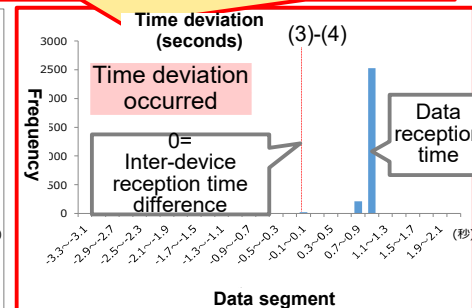
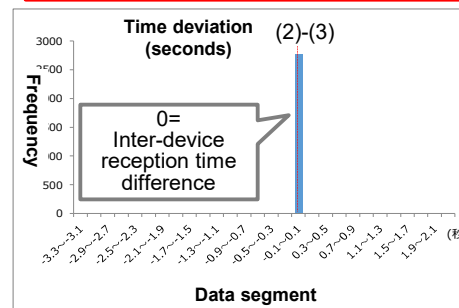
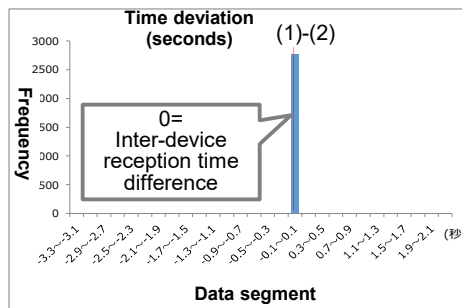
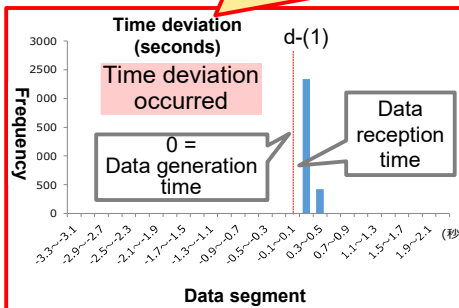
- Of all of the segments, **the largest relative transmission delays occurred in the d-(1) and (3)-(4) segments, which included wireless transmission portions**
- For (3)-(4), **there is potential for delay to be reduced by making changes to the periodic delivery frequency**

(N=2,772)

	Reception interval (seconds)						Time deviation (seconds)						
	d	(1)	(2)	(3)	(4)	(5)	d-(1)	(1)-(2)	(2)-(3)	(3)-(4)	(4)-(5)	(1)-(5)	d-(5)
Max.	2.100	2.723	2.733	2.732	3.016	3.016	0.950	0.070	0.016	1.902	0.016	1.913	2.210
Min.	1.899	1.406	1.406	1.406	0.985	1.000	0.120	0.008	-0.001	0.064	0.000	0.077	0.204
Avg.	2.000	2.000	2.000	2.000	2.000	2.000	<b>0.249</b>	<b>0.010</b>	<b>0.002</b>	<b>0.953</b>	<b>0.001</b>	0.967	1.217
Median	2.000	2.003	2.003	2.003	2.000	2.000	0.228	0.010	0.002	0.976	0.000	0.991	1.222
Variance	0.000	0.007	0.007	0.007	0.016	0.016	0.004	0.000	0.000	0.010	0.000	0.010	0.008

This includes the time difference between the GNSS time and the NICT time server time

Information is delivered regularly (in 1 second intervals), not synchronized with data update times, so there may be delays not exceeding the number of seconds designated



# 1. Test system equipment-side testing

## (3) STEP 2: Transmission delay time [mock emergency vehicle location information (mock emergency vehicle 2)]

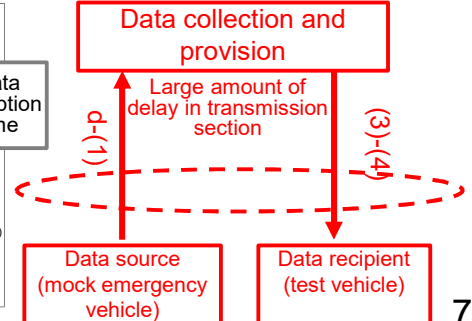
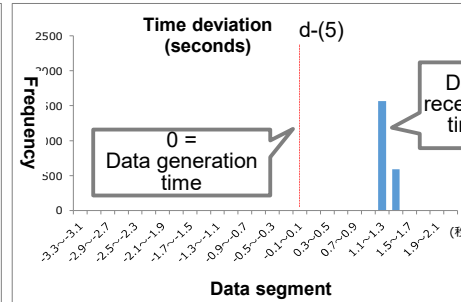
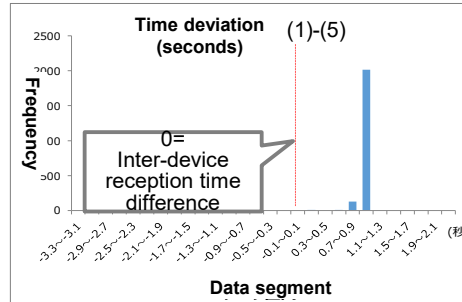
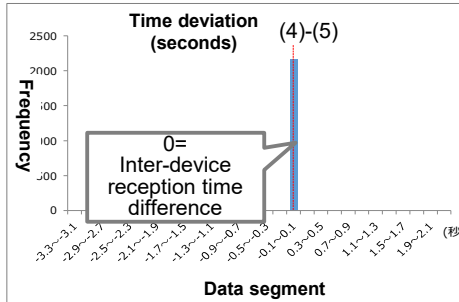
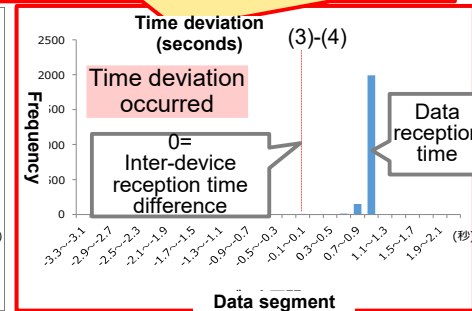
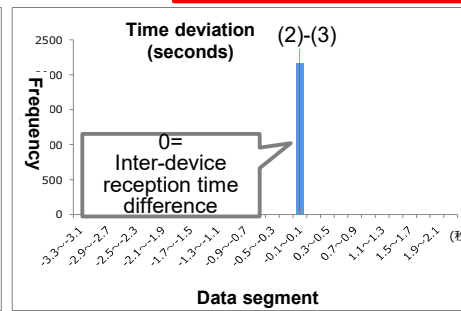
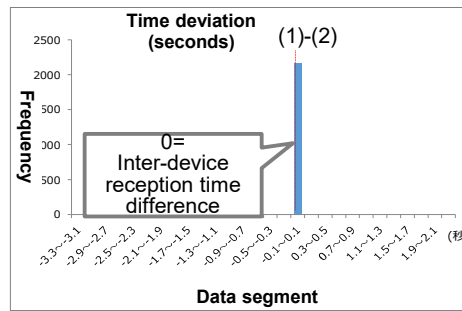
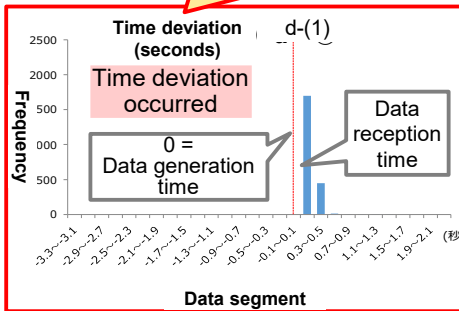
- The same results were also found for mock emergency vehicle 2

(N=2,167)

	Reception interval (seconds)						Time deviation (seconds)						
	d	(1)	(2)	(3)	(4)	(5)	d-(1)	(1)-(2)	(2)-(3)	(3)-(4)	(4)-(5)	(1)-(5)	d-(5)
Max.	2.110	2.885	2.884	2.885	3.001	3.001	1.327	0.075	0.030	1.082	0.016	1.103	2.228
Min.	1.890	1.083	1.083	1.083	1.000	1.000	0.115	0.008	-0.001	0.085	0.000	0.095	0.226
Avg.	2.000	2.000	2.000	2.000	2.000	2.000	0.259	0.011	0.002	0.978	0.001	0.992	1.251
Median	2.000	2.003	2.003	2.003	2.000	2.000	0.256	0.010	0.002	0.969	0.000	0.983	1.231
Variance	0.000	0.013	0.013	0.013	0.006	0.006	0.007	0.000	0.000	0.008	0.000	0.008	0.006

This includes the time difference between the GNSS time and the NICT time server time

Information is delivered regularly (in 1 second intervals), not synchronized with data update times, so there may be delays not exceeding the number of seconds designated



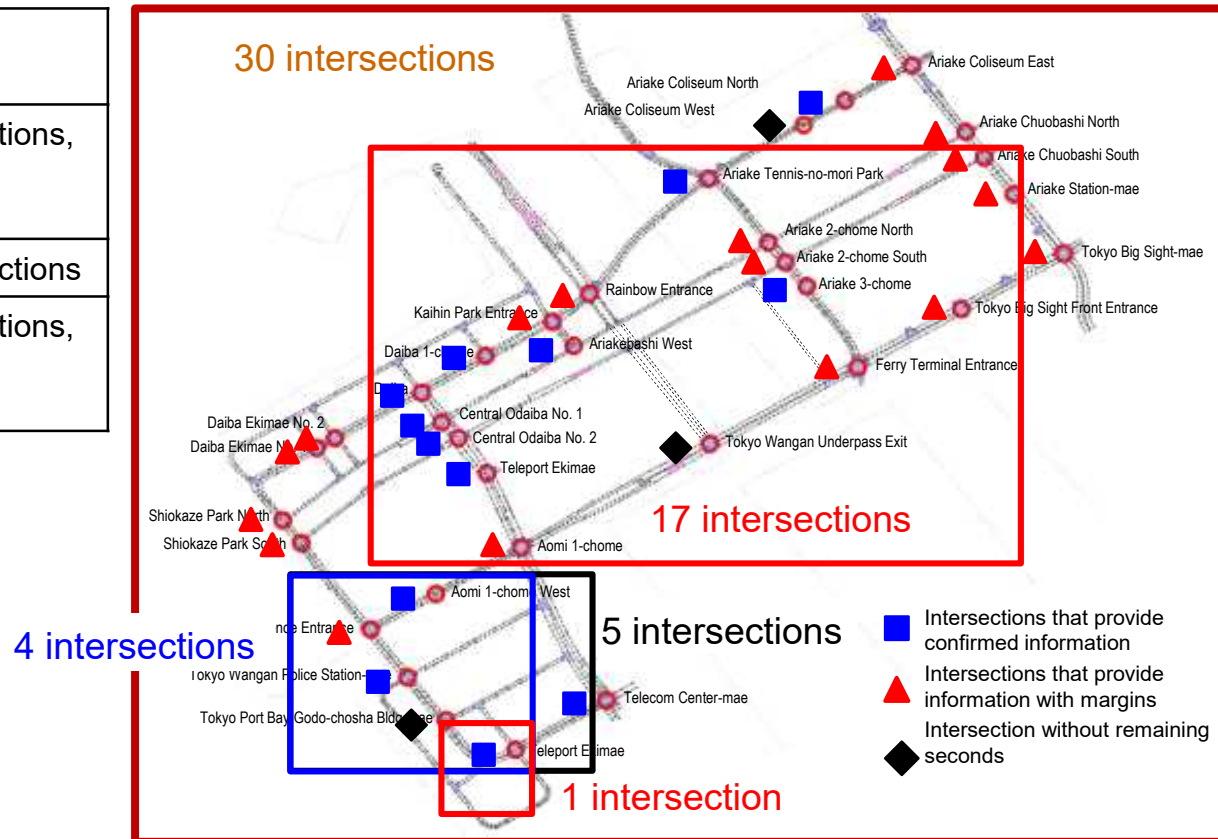


# 1. Test system equipment-side testing

## (3) STEP 2: Transmission delay time [traffic signal prediction information]

- Testing was performed using the three methods of the specified distance PUSH method, the PULL method, and the specified intersection PUSH method.

Delivery method	Test pattern
Specified distance PUSH method	1 intersection, 4 intersections, 17 intersections, 30 intersections
PULL method	5 intersections, 7 intersections
Specified intersection PUSH method	1 intersection, 5 intersections, 17 intersections, 30 intersections



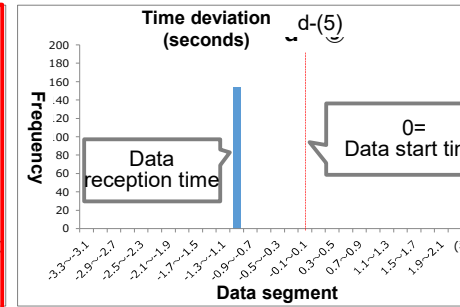
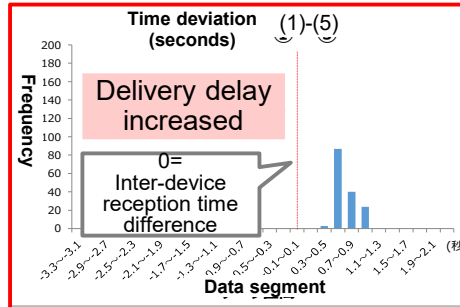
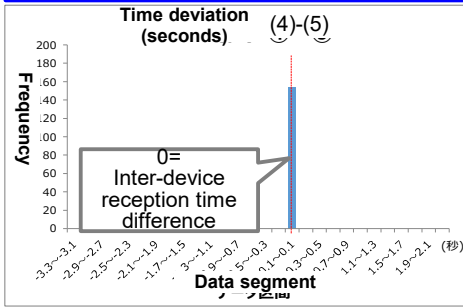
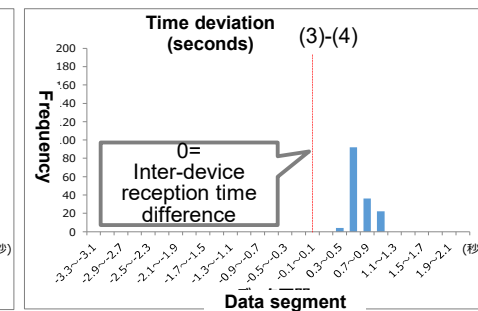
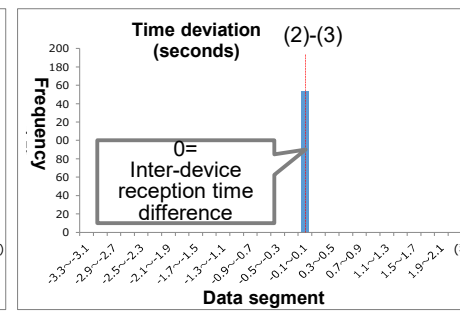
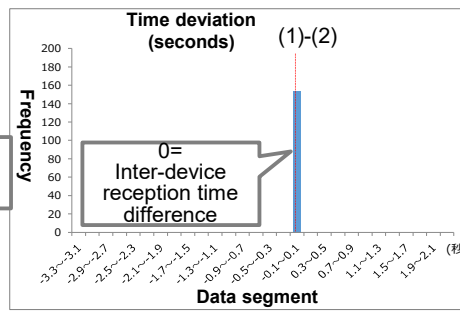
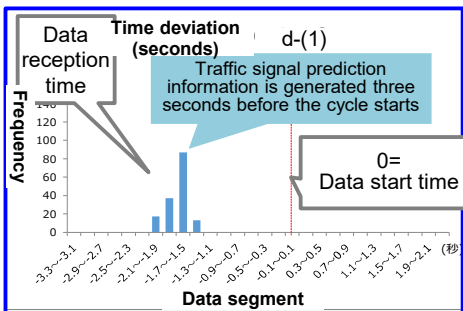
# 1. Test system equipment-side testing

## (3) STEP 2: Transmission delay time [traffic signal prediction information (specified distance PUSH method)]

- When using the specified distance PUSH method, information is delivered regularly (in 1 second intervals), not synchronized with data update times, so in the ③-④ segment, there may be delays not exceeding the number of seconds designated

(N=154)

	Reception interval (seconds)						Time deviation (seconds)						
	d	(1)	(2)	(3)	(4)	(5)	d-(1)	(1)-(2)	(2)-(3)	(3)-(4)	(4)-(5)	(1)-(5)	d-(5)
Max.	110.000	110.201	110.203	110.205	110.091	110.091	-1.410	0.025	0.010	1.014	0.016	1.039	-0.912
Min.	76.000	76.166	76.165	76.166	76.010	76.010	-2.019	0.005	-0.002	0.457	0.000	0.468	-1.003
Avg.	100.427	100.433	100.433	100.433	100.428	100.428	-1.676	0.010	0.001	0.697	0.002	0.710	-0.966
Median	110.000	109.913	109.914	109.914	109.998	109.998	-1.648	0.010	0.001	0.660	0.000	0.675	-0.964
Variance	195.165	195.134	195.136	195.136	195.165	195.171	0.022	0.000	0.000	0.020	0.000	0.021	0.000



The test results are shown below

- Specified distance PUSH method
- 4 intersections

# 1. Test system equipment-side testing

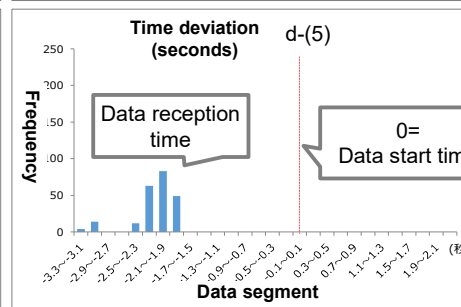
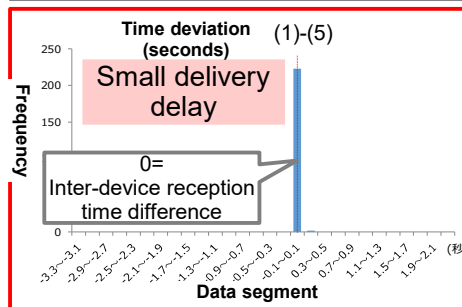
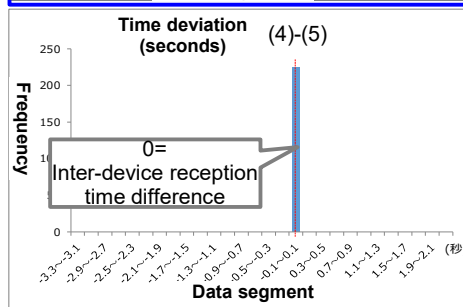
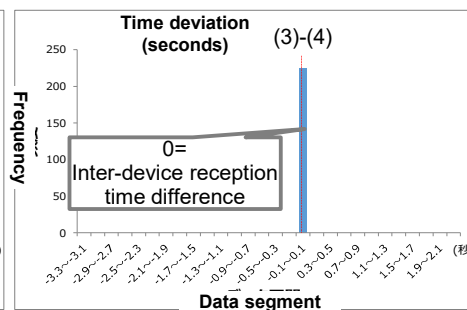
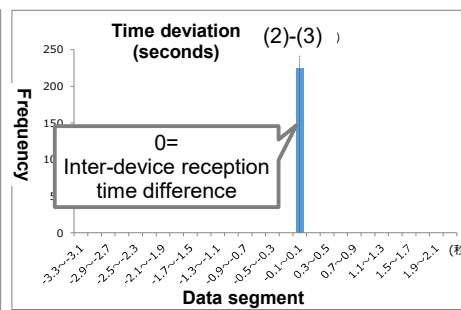
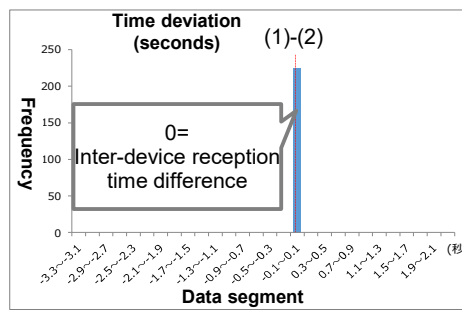
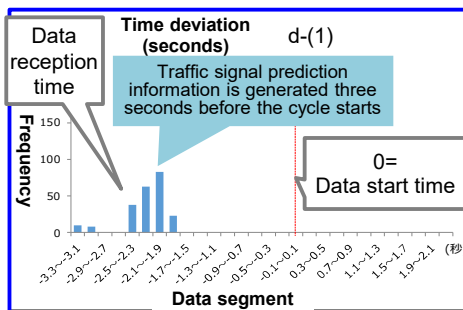
## (3) STEP 2: Transmission delay time [traffic signal prediction information (specified intersection PUSH method)]

- When using the specified intersection PUSH method, the MQTT protocol\*1 can be used to shorten the delay time in comparison to the specified distance PUSH method

\*1: MQTT: Message Queuing Telemetry Transport  
(Used in the application layer of message oriented middleware)

(N=225)

	Reception interval (seconds)						Time deviation (seconds)						
	d	(1)	(2)	(3)	(4)	(5)	d-(1)	(1)-(2)	(2)-(3)	(3)-(4)	(4)-(5)	(1)-(5)	d-(5)
Max.	160.000	160.285	160.289	160.283	160.296	160.280	-1.788	0.053	0.009	0.090	0.016	0.112	-1.710
Min.	77.000	76.874	76.868	76.878	76.885	76.885	-3.228	0.004	-0.005	0.032	0.000	0.043	-3.147
Avg.	107.481	107.499	107.499	107.499	107.499	107.499	-2.198	0.011	0.001	0.062	0.001	0.075	-2.123
Median	110.000	109.948	109.945	109.947	109.947	109.948	-2.131	0.010	0.000	0.066	0.000	0.078	-2.051
Variance	560.514	560.696	560.691	560.693	560.688	560.696	0.102	0.000	0.000	0.000	0.000	0.000	0.099



The test results are shown below

- Specified intersection PUSH method
- 5 intersections

## 2. High-accuracy 3D maps

### (1) Overview of map update data

- High-accuracy 3D map update data was released on October 25, 2021

[Overview of update data]

- The data specifications, data format, and planimetric features within the development scope are identical to those in the map data that has already been supplied.

(1) [Version number: S11.02.01] A. Waterfront City area (**updated**)

B. Metropolitan Expressway routes connecting Haneda Airport and the Waterfront City area, etc. (only Metropolitan Expressway was updated)

(2) [Version number: S12.00.00] above and C. overall data for the Haneda Airport area (**not updated**)

Overview of planimetric features (birds-eye view)

**Fig. 1 - Entire area**

**Area A** **Blue lines** (Waterfront City - updated)

**Area B** **Orange lines** (Metropolitan Expressway; Bayshore Route - updated)

**Lime green lines** (Metropolitan Expressway: Haneda Route - updated)

**Red lines** (General roads - not updated)

**Area C** **Green lines** (Haneda Airport area - not updated)



Fig. Overview of areas A., B., and C.

Source: Geospatial Information Authority of Japan map acquired on September 28, 2021.  
<https://maps.gsi.go.jp/#12/35.632884/139.810982/&base=pale&ls=pale&disp=1&vs=c0j0h0k0l0u0t0z0r0s0m0f0>

# 2. High-accuracy 3D maps

## (2) Correspondence with lane node linkages within intersections

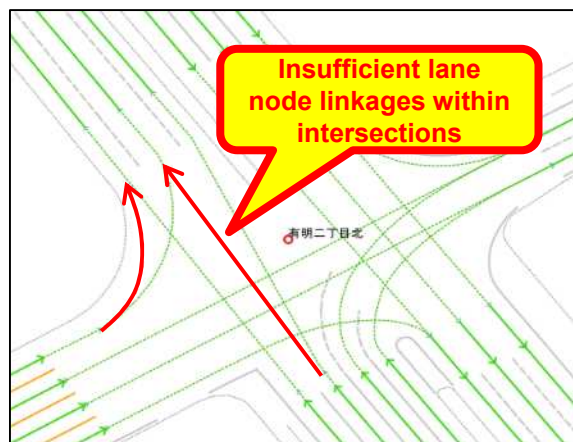
- There were inconsistencies in the connections of lane node linkages within intersections in the map data distributed in June 2020 (reported in the 11th working group meeting)
  - Lane node linkages within intersections were revised for five intersections in the map data distributed in January 2021, and participant opinions were sought regarding how to handle link connections
  - Based on their feedback, "Automated Driving System Map Data Specification Proposal Ver.1.1 [Map Data Creation Guidelines]" was revised in March 2021
- ➔ Given the above, in the map data that was distributed in October 2021, the lane node linkages within intersections were fixed for all intersections requiring updates, in accordance with the guidelines.

自動走行システム向け地図データ仕様への提案  
Ver.1.1  
【地図データ作成時におけるガイドライン】

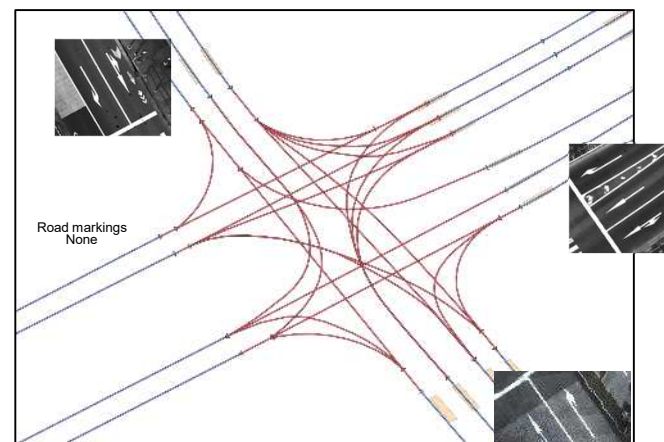
※本ガイドラインは、自動走行システム向け地図データの作成・更新に関する指針を示す。本ガイドラインは、自動走行システム向け地図データの作成・更新に関する指針を示す。本ガイドラインは、自動走行システム向け地図データの作成・更新に関する指針を示す。

1. 属性  
場所：線型  
取得位置  
交差点領域上の車線リンク上の形状線ノードのうち走行可能な経路を結ぶ線分を取得する。走行可能な経路（一部又は全部）を記述する。しくは直線で接続関係を記述する。（図 4-36）  
座標点列の記載順  
進行方向に従って取得する。  
走行経路記述の有無  
走行経路の記述の有無  
定義域  
true、false  
走行経路を記述した場合「true」、直線で接続関係を示した場合「false」とする。

Acquisition standards for lane node linkages within intersections



Intersections with insufficient lane node linkages within intersection



Revised in accordance with guidelines

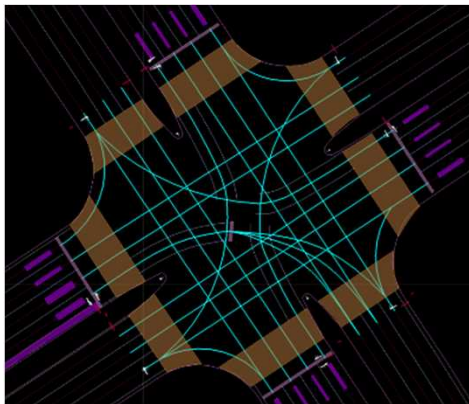
## 2. High-accuracy 3D maps

### (2) Correspondence with lane node linkages within intersections

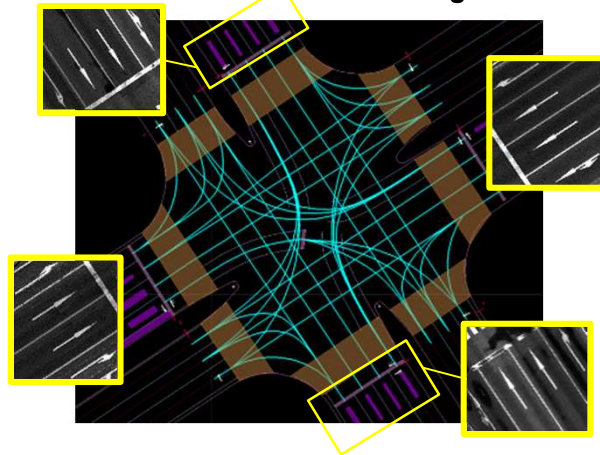
- Lane node linkages within intersections were connected for all intersections in the map data distributed in October 2021, as indicated in the guidelines

In the previous version, as a general rule, each inflow was connected with a single outflow

Tokyo Big Sight-mae



Connected as indicated in the guidelines

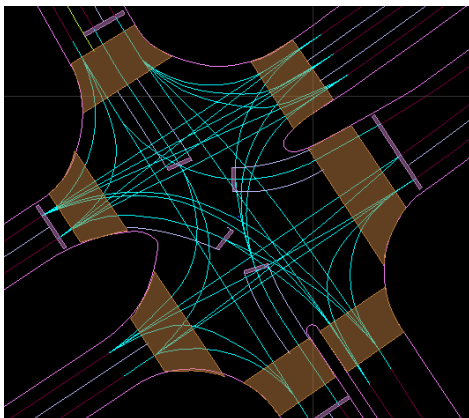


In the January 29 version, all traversable lane node linkages within intersections were connected

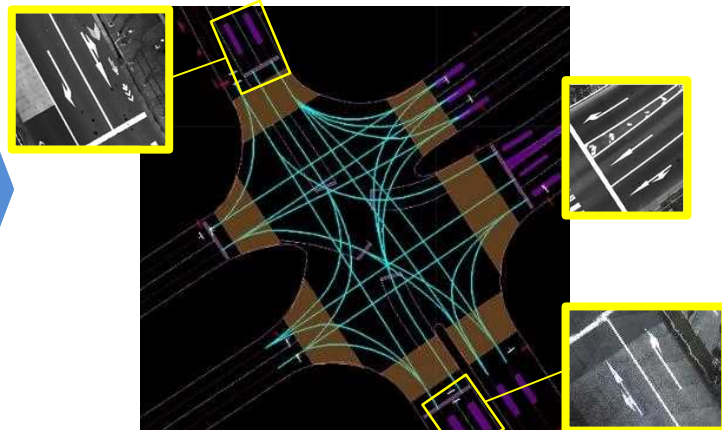
Kaihin Park Entrance

Five intersections fixed  
in January 29 release

- ✓ Kaihin Park Entrance
- ✓ Ariake 2-chome North
- ✓ Ariake 3-chome
- ✓ Ferry Terminal Entrance West
- ✓ Ferry Terminal Entrance (no traffic signal)



Connected as indicated in the guidelines



## 2. High-accuracy 3D maps

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### (3) Evaluation questionnaire

- Numerous participants indicated that in the future they wished to use lane node linkage within intersections for vehicle control, for driving lane selection, or for both
- Participants made the following comments regarding overall map data specifications and the specifications for lane node linkages within intersections. However, due to the costs of preparing maps data and the changes in the requests made regarding map data due to advances in on-board sensors, etc., these are all considered issues to be addressed in the competitive area.

#### [Requests regarding lane node linkages within intersections]

- "It would be better to indicate if a linkage is a straight (no turn) linkage or a left/right turn linkage. There are some intersections in which the road curves, so driving without turning involves following the curve, while driving a straight line would actually be considered turning left or right. It can be hard to determine this based on the shape of the road alone, so we would like this to be included in the map information."
- "When there are two entry route lanes and one exit route lane, it would be best to clearly indicate that merging is permitted."
- "We don't know which line is the reference line in the cruising lane information, so we would like for a reference line to be designated, even if it is not an actual line. This would make it possible to more accurately designate cruising lane widths and use the information in actual operation."

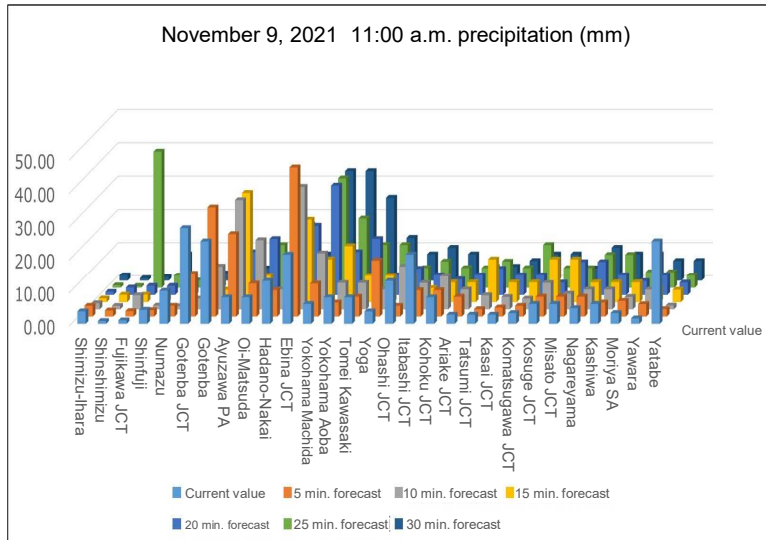
#### [Requests regarding map data specifications]

- "There was little data in the cooperative area portion, so there was not enough data to use it in direct vehicle control."
- "The maps would be easier to use if flags were set so that it was possible to determine which side of the road edge lines were the drivable sides."
- "If the order of the point sequences for road markings indicating areas were counterclockwise, when seen from above, it would make it easy to determine which part is inside and which is outside."

# 3. Results of rainfall information-related testing

## (1) Equipment-side test results

- We confirmed that rainfall information generated by the Japan Meteorological Business Support Center was delivered correctly via V2N



### (1) Rainfall information characteristics

Precipitation for the entire test area is shown as values from current values to forecasts for 30 minutes in the future. Information is shown for the time periods to be evaluated

→ This makes it possible to assess the precipitation conditions of the entire area.

\* See the Main Section document for an overview of the information and the method used to deliver the information

(2) Dynamic map viewer rainfall information characteristics  
Precipitation for the current time is shown for the entire test area  
→ Based on driving plans, precipitation amounts and the vehicle's own peripheral monitoring capabilities will be compared, and participants will consider whether or not the information can be used to make decisions regarding whether to continue or stop automated driving

表示中: 現在  
降水量 [mm/h]  
80.0  
50.0  
30.0  
20.0  
10.0  
5.0

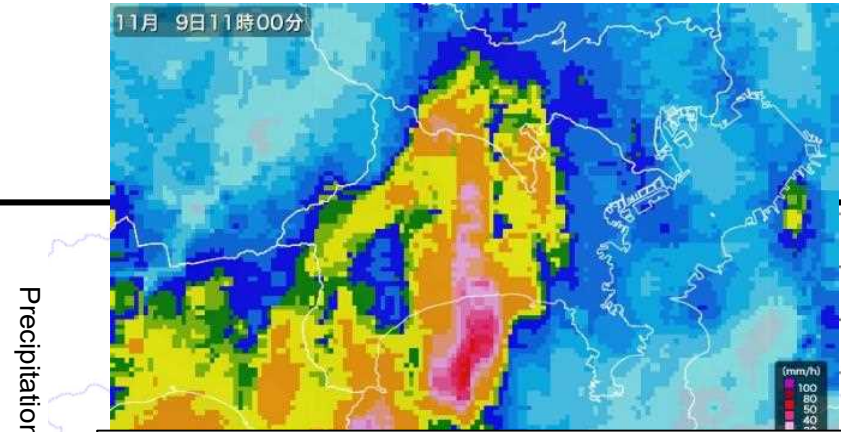
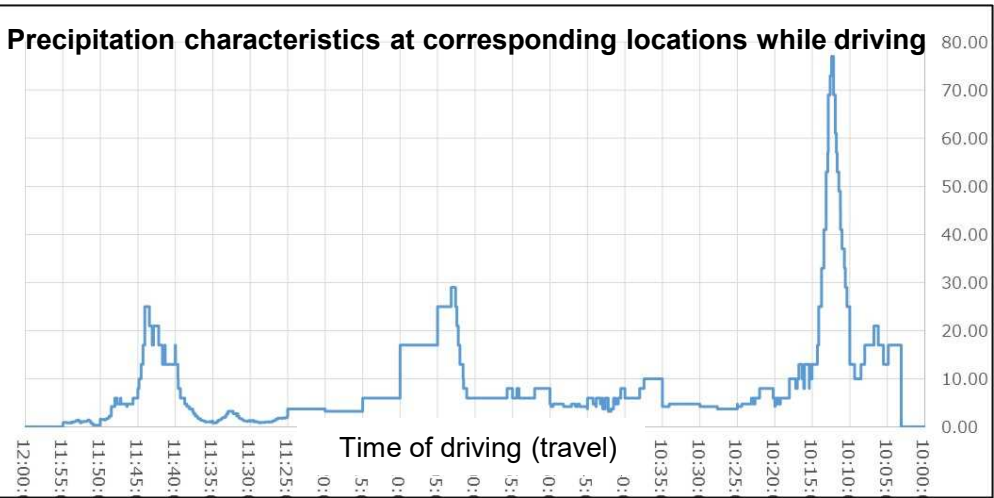
準備完了 平面直角座標系: 9系



# 3. Results of rainfall information-related testing

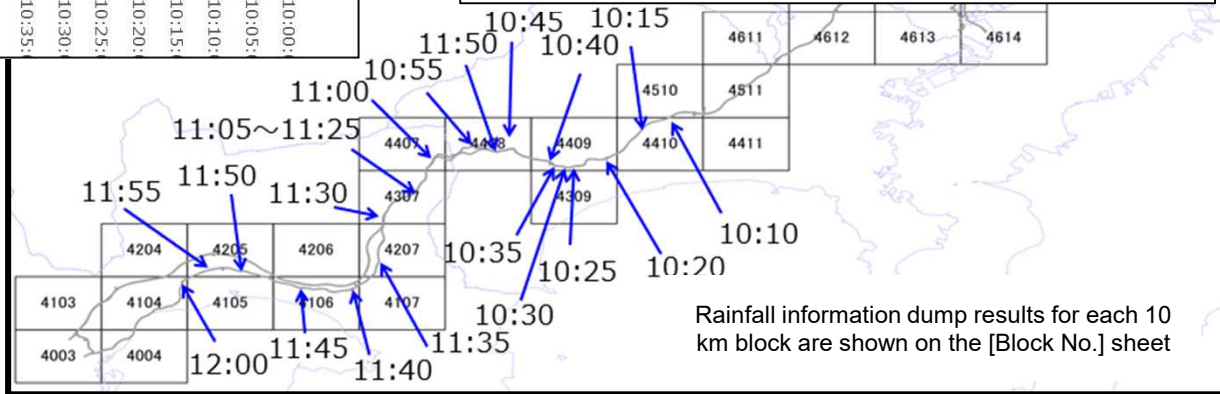
## (1) Equipment-side test results

- We confirmed that rainfall information generated by the Japan Meteorological Business Support Center was delivered correctly via V2N



(4) Reference information (Japan Weather Association website)  
 Source: Japan Weather Association tenki.jp: Kanagawa Prefecture weather radar (November 9, 2021)  
<https://tenki.jp/past/2021/11/09/radar/3/17/>  
 (viewed on November 18, 2021)

(3) Time of driving (travel) and precipitation characteristics  
 Travel areas and travel times between test area start and end points, precipitation characteristics → Participants will consider whether or not the information can be used to make decisions regarding whether to continue driving, stop driving, change routes, etc., when there is a large amount of precipitation



Driving times and driving locations on map

### 3. Results of rainfall information-related testing

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#### (2) Analysis of test participant driving data

- Rainfall information reception and driving data from test participants was organized and analyzed by reception environment and weather condition

<b>Reception environment</b>	<b>Weather condition</b>	<b>Date/time</b>
On-site driving	Rainy	1) Dec. 8, 2021 11:06-15:31
	Clear skies	2) Dec. 16, 2021 11:46-15:51
Received in test room environment	Rainy	3) Nov. 22, 2021 14:23-18:05
	Clear skies	4) Nov. 30, 2021 15:30-16:15

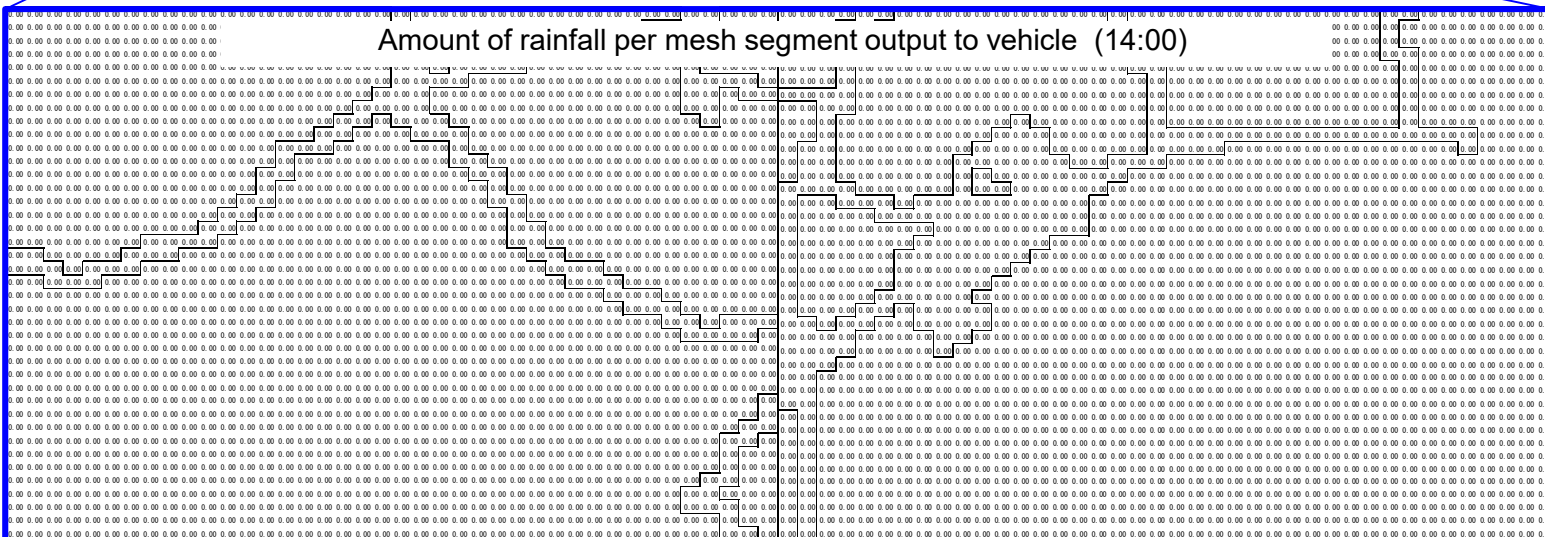
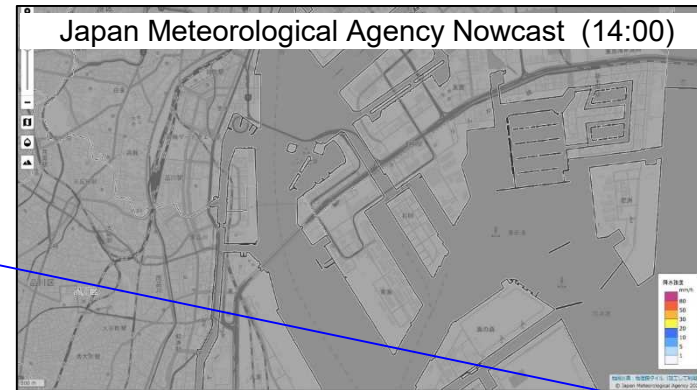
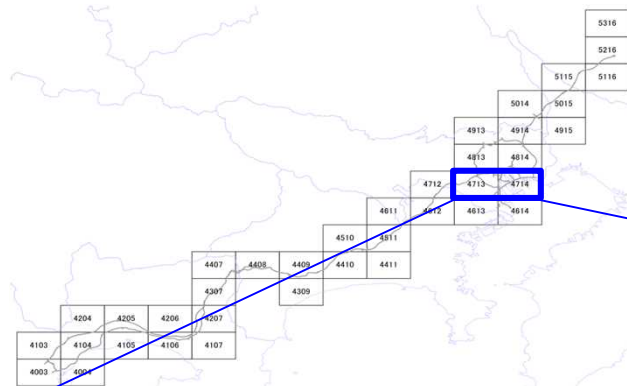
\* See the Main Section for the results of the on-site driving in rain

### 3. Results of rainfall information-related testing

#### (2) Analysis of test participant driving data    2) On-site driving, clear skies

##### 1) Short-range driving (Metropolitan Expressway and Waterfront City area): Clear skies

- We confirmed that rainfall information output to the vehicle by the test environment matched rainfall information on the Japan Meteorological Agency website



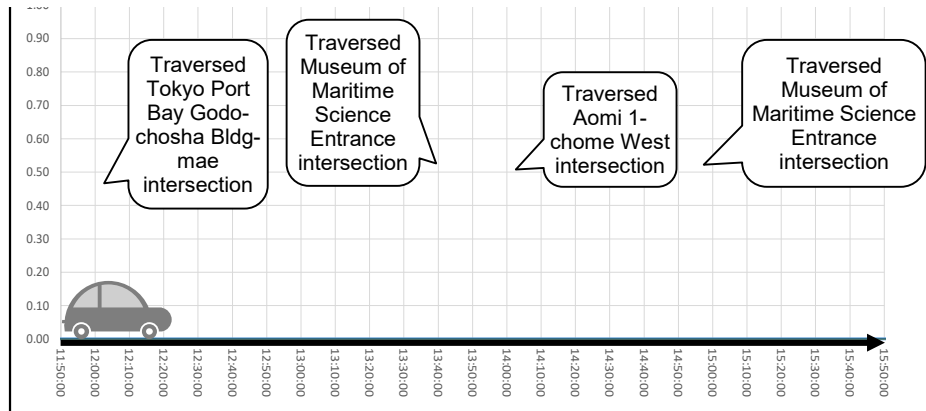
# 3. Results of rainfall information-related testing

## (2) Analysis of test participant driving data

### 2) On-site driving, clear skies

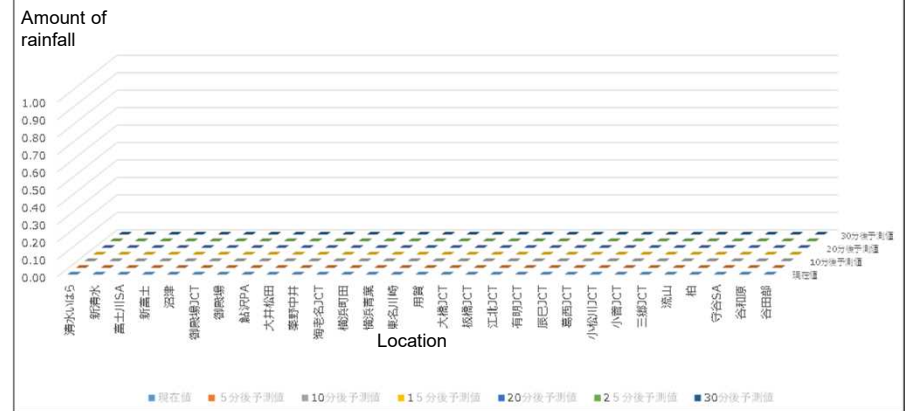
- We confirmed that vehicles were provided, in chronological order, with information on the amount of rainfall for the mesh segment in which the vehicle was located (because it was clear, the amount of rainfall was zero)
- We confirmed that long-range rainfall information could also be received in the Odaiba area via V2N

Rainfall volume characteristics when driving in the Odaiba area (11:50-15:50)



■ Current value - 5 min. forecast - 10 min. forecast - 15 min. forecast  
 - 20 min. forecast - 25 min. forecast - 30 min. forecast

Rainfall volume characteristics for each location (14:00)

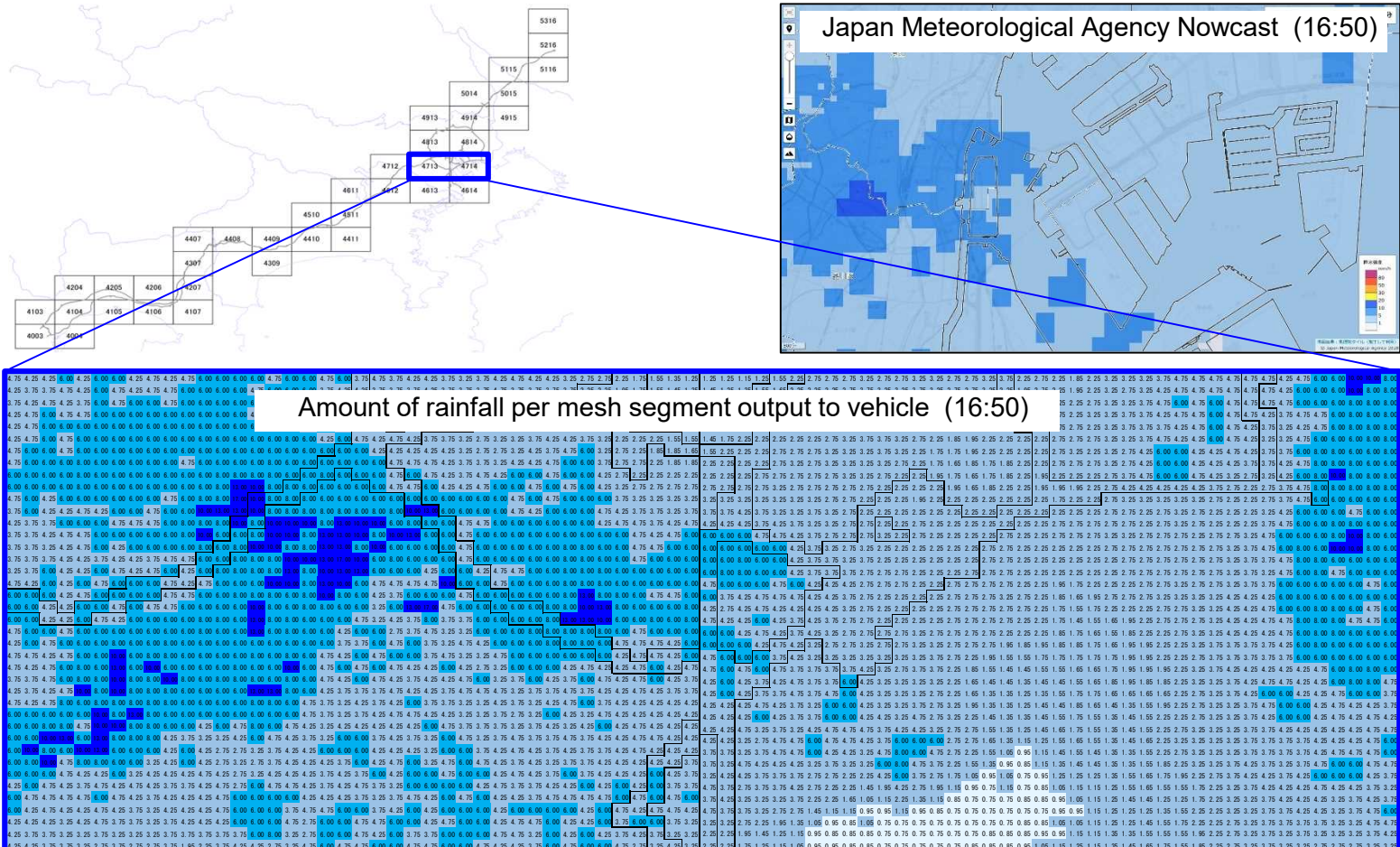


# 3. Results of rainfall information-related testing

## (2) Analysis of test participant driving data

### 3) Received in test room environment, rain

- We confirmed that rainfall information output to the vehicle by the test environment matched rainfall information on the Japan Meteorological Agency website

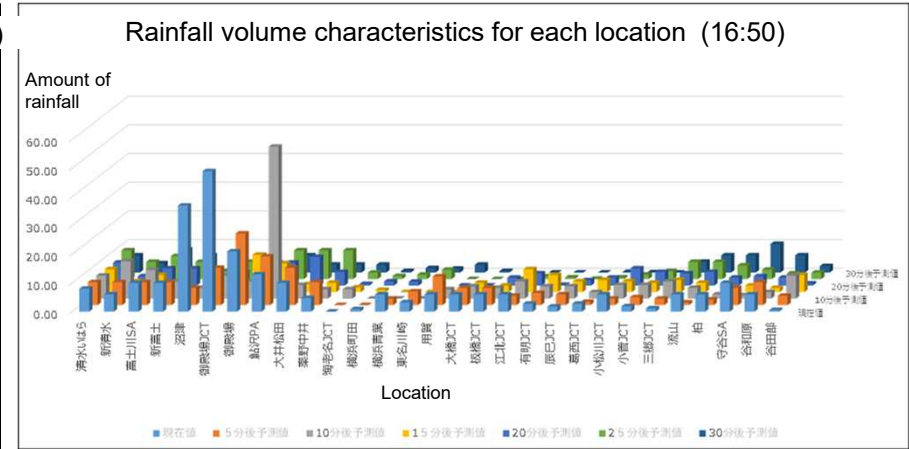
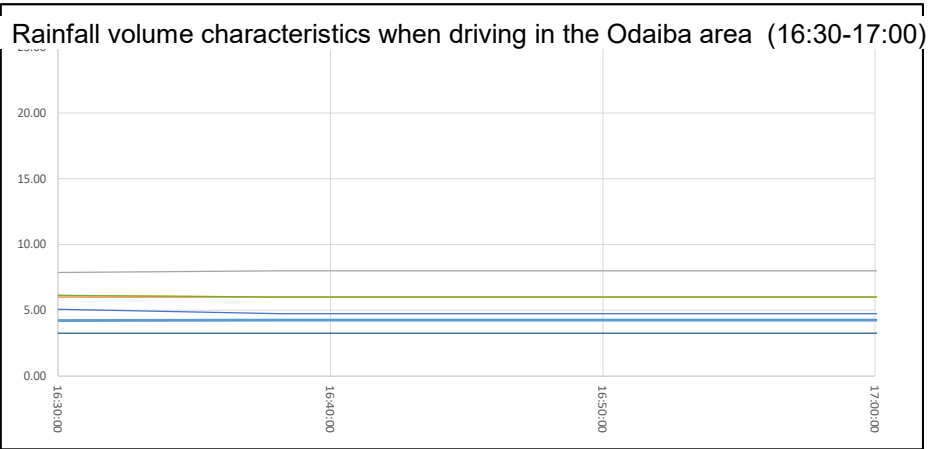


# 3. Results of rainfall information-related testing

## (2) Analysis of test participant driving data

### 3) Received in test room environment, rain

- We confirmed that vehicles were provided, in chronological order, with information on the amount of rainfall for the mesh segment in which the vehicle was located
- We confirmed that long-range rainfall information could also be received in the Odaiba area via V2N



- Current value - 5 min. forecast - 10 min. forecast - 15 min. forecast
- 20 min. forecast - 25 min. forecast - 30 min. forecast

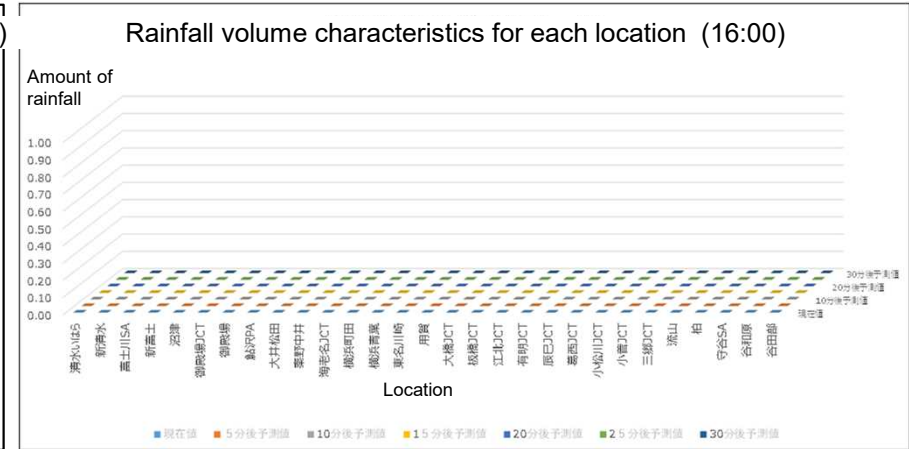
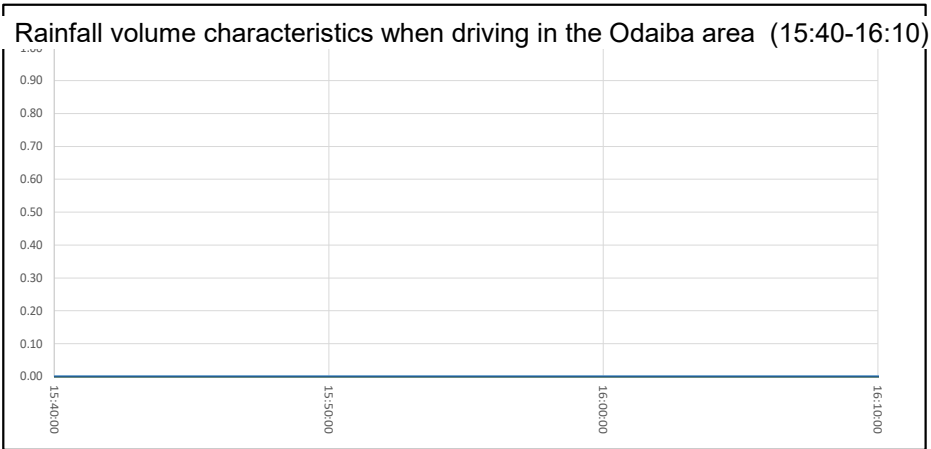


### 3. Results of rainfall information-related testing

#### (2) Analysis of test participant driving data

##### 4) Received in test room environment, clear skies

- We confirmed that vehicles received, in chronological order, with information on the amount of rainfall for the mesh segment in which the vehicle was located (because it was clear, the amount of rainfall was zero)
- We confirmed that long-range rainfall information could also be received in the Odaiba area via V2N



- Current value - 5 min. forecast - 10 min. forecast - 15 min. forecast
- 20 min. forecast - 25 min. forecast - 30 min. forecast

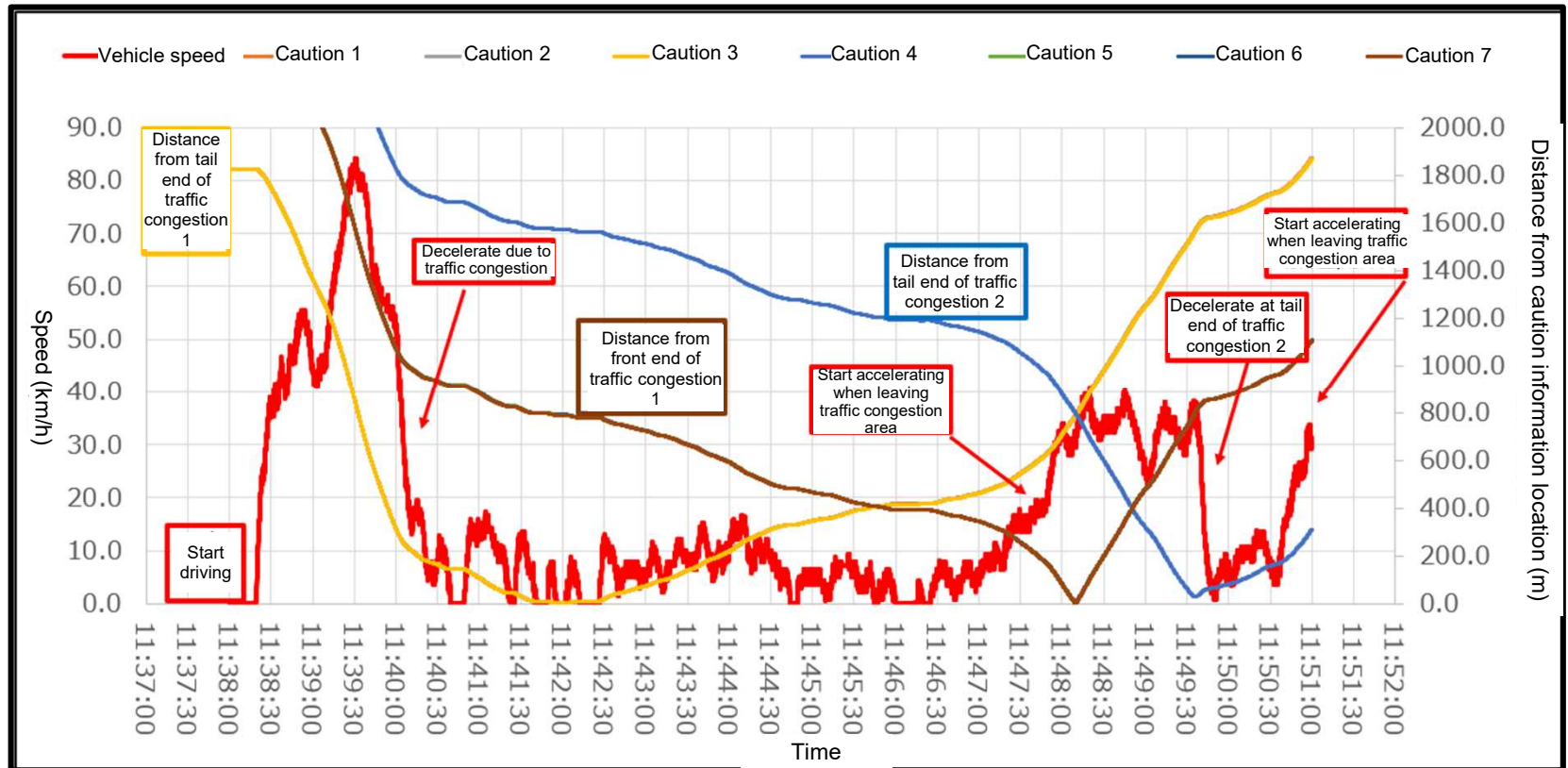


# 4. Results of lane-specific road traffic information testing

## (1) Equipment-side test results

\* See the Main Section document for an overview of the information, the method used to deliver the information, and analyses of the information's benefits

- Traffic congestion tail end/front end location information was received and checked for consistency against test vehicle acceleration and deceleration data

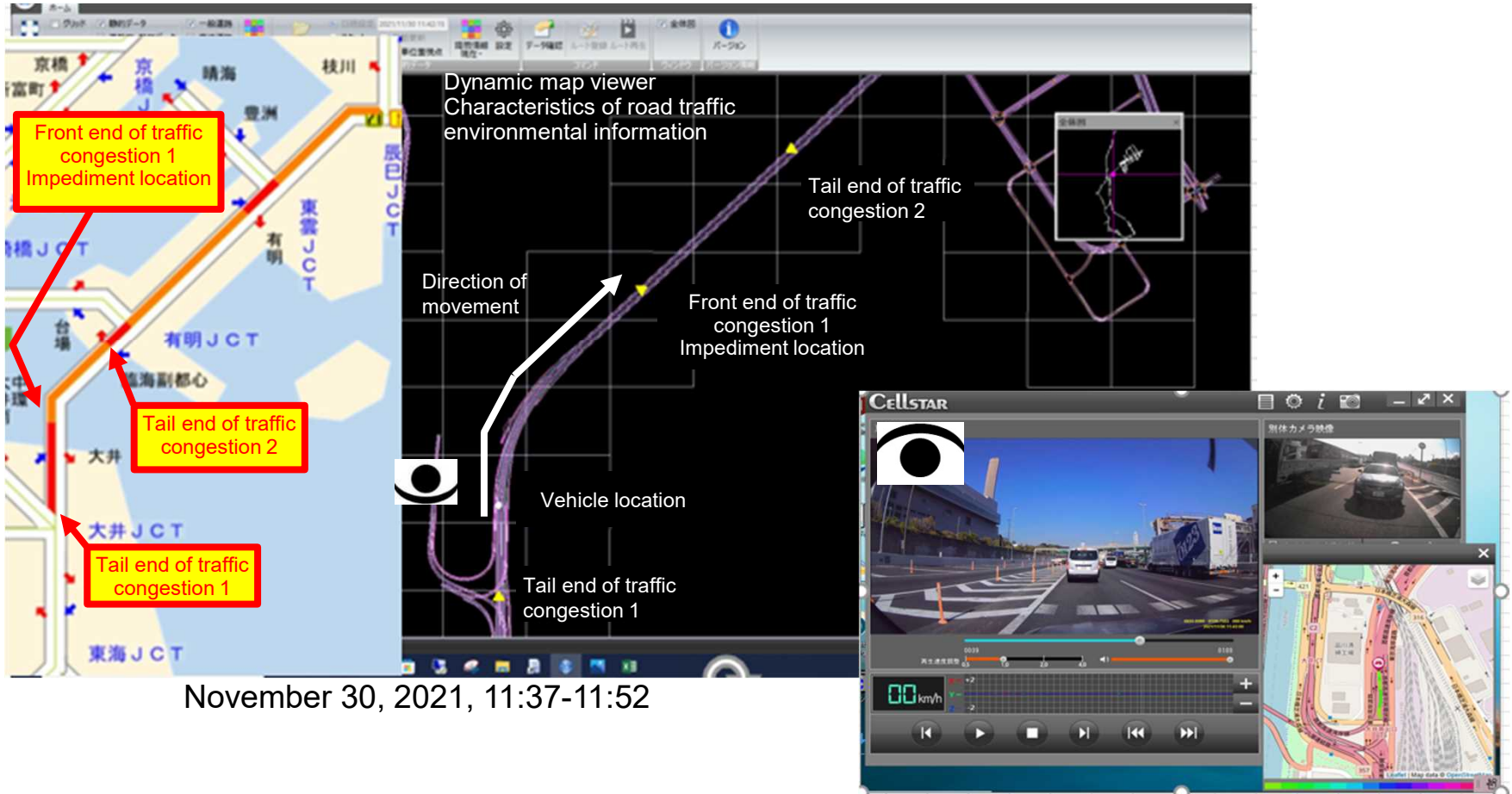


November 30, 2021, 11:37-11:52

# 4. Results of lane-specific road traffic information testing

## (1) Equipment-side test results

- We checked that the delivered information was consistent with the timing of actual congestion encounters (using drive recorder video)



November 30, 2021, 11:37-11:52

Device for recording video data for use in evaluation  
(image from drive recorder)

## 4. Results of lane-specific road traffic information testing

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### (2) Results of analysis of test participant driving data

- Lane-specific road traffic information reception and driving data from test participants was organized and analyzed by route and traffic condition

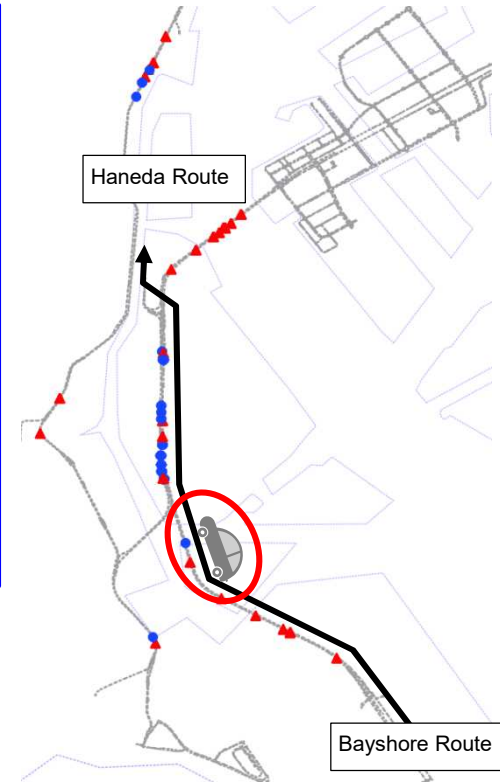
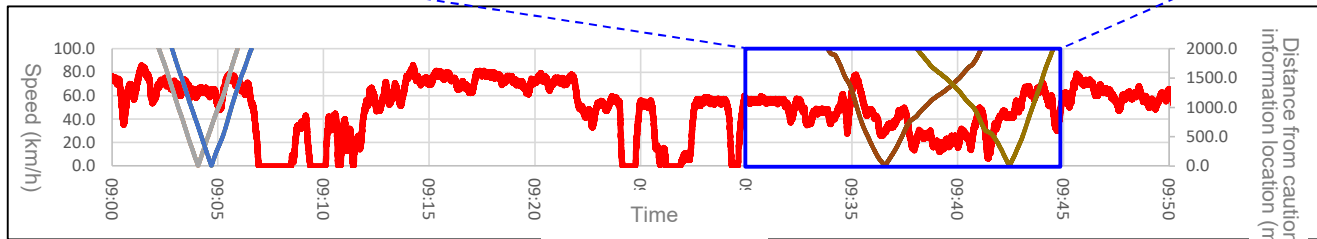
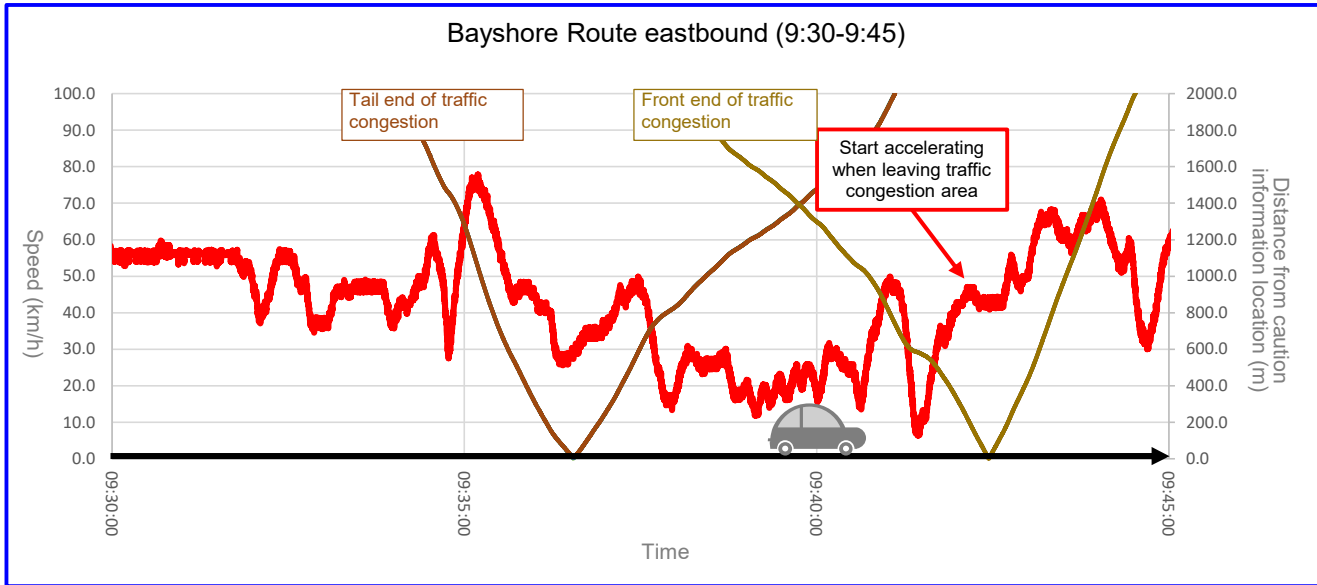
<b>Route</b>	<b>Traffic conditions</b>	<b>Date/time</b>
Bayshore Route	traffic congestion tail end + front end	1) Dec. 28, 2021 9:30-9:45
	Traffic congestion tail end only	2) Jan. 12, 2022 9:00-9:15
Haneda Route	Traffic congestion tail end only	3) Dec. 28, 2021 9:00-9:15
		4) Jan. 25, 2022 9:00-9:20

# 4. Results of lane-specific road traffic information testing

## (2) Results of analysis of test participant driving data

### 1) Bayshore Route traffic congestion tail end + front end

- We confirmed that vehicles decelerated when they approached the tail ends of traffic congestion and began accelerating once they passed the front ends of traffic congestion



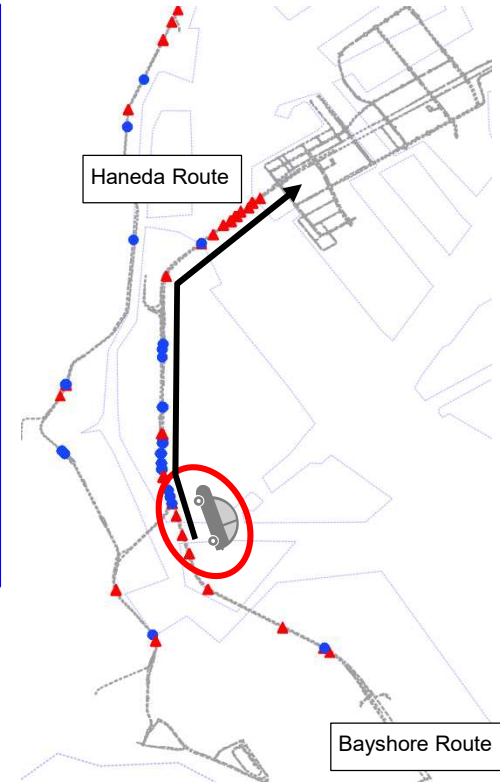
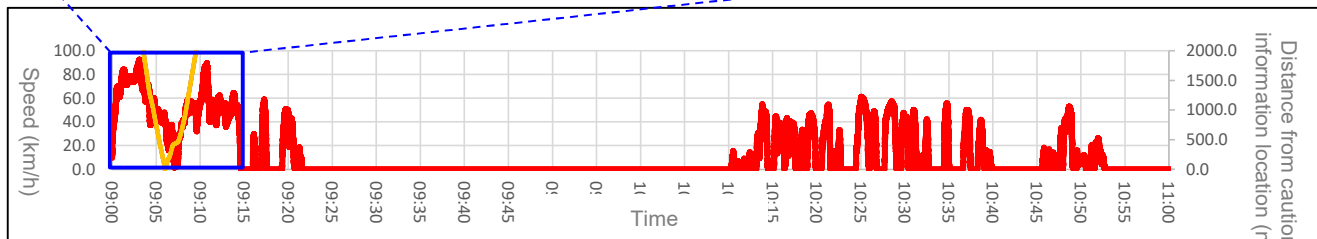
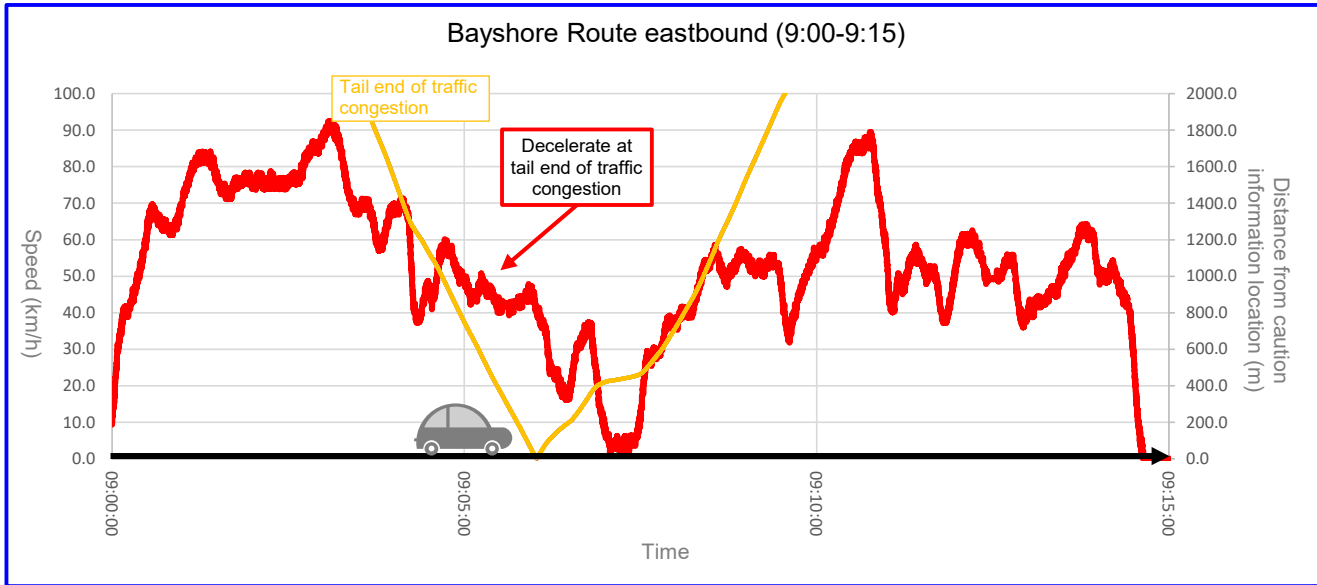
- : Traffic congestion front end,
- ▲ : Traffic congestion tail end
- : Driving area (9:30-9:45)
- : Test vehicle location (approx. 9:40)

# 4. Results of lane-specific road traffic information testing

## (2) Results of analysis of test participant driving data

### 2) Bayshore Route traffic congestion tail end only

- We confirmed that vehicles decelerated as they approached the tail ends of traffic congestion areas



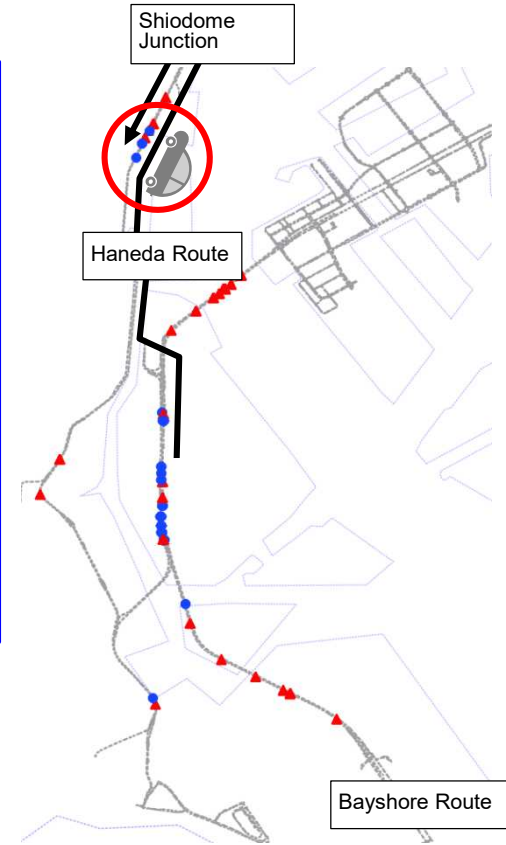
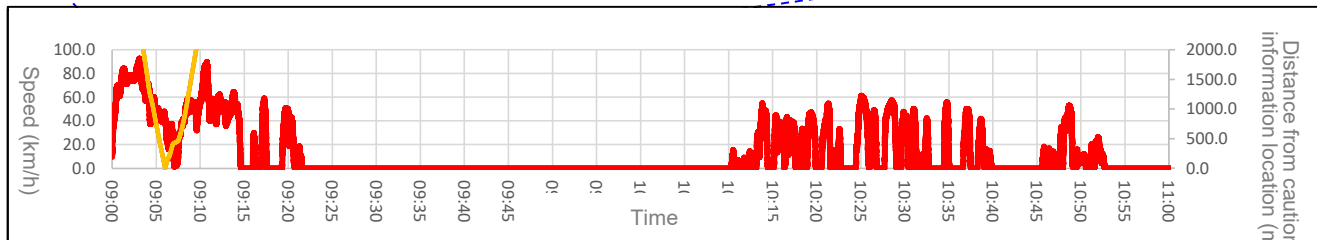
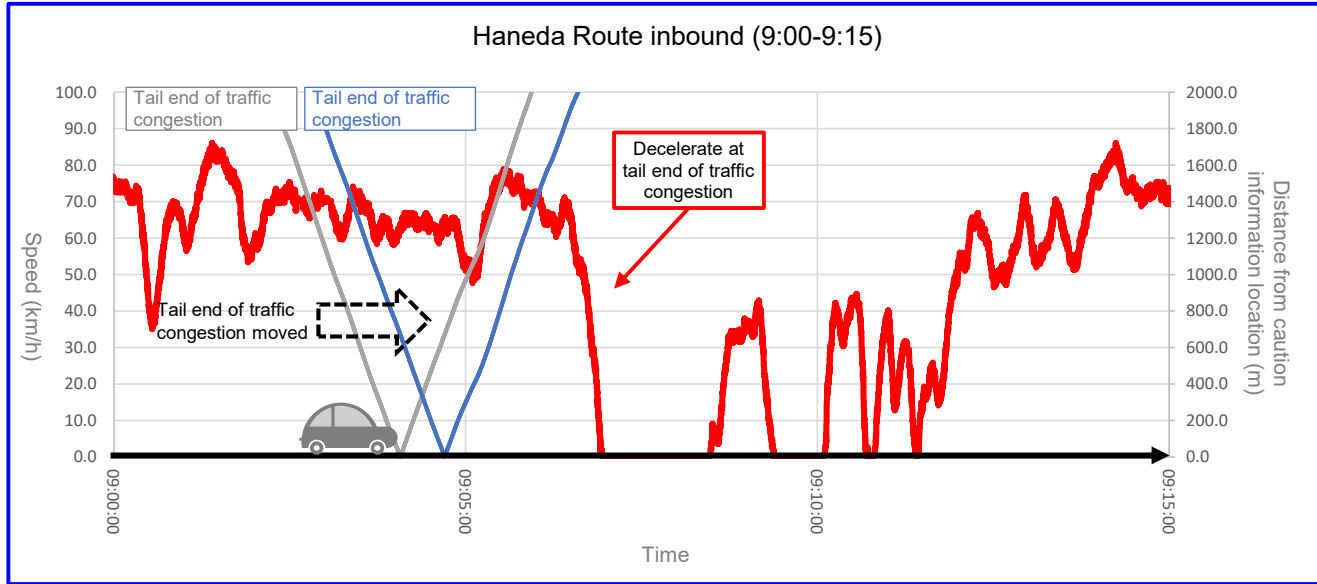
- : Traffic congestion front end,
- ▲ : Traffic congestion tail end
- : Driving area (9:00-9:15)
- : Test vehicle location (approx. 9:05)

# 4. Results of lane-specific road traffic information testing

## (2) Results of analysis of test participant driving data

### 3) Haneda Route traffic congestion tail end only

- We confirmed that vehicles decelerated as they approached the tail ends of traffic congestion areas (the locations of the tail ends of traffic congestion areas moved)



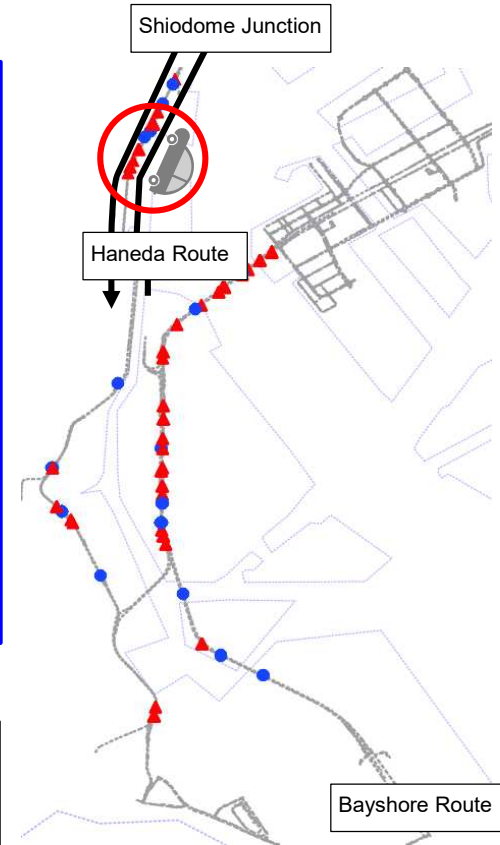
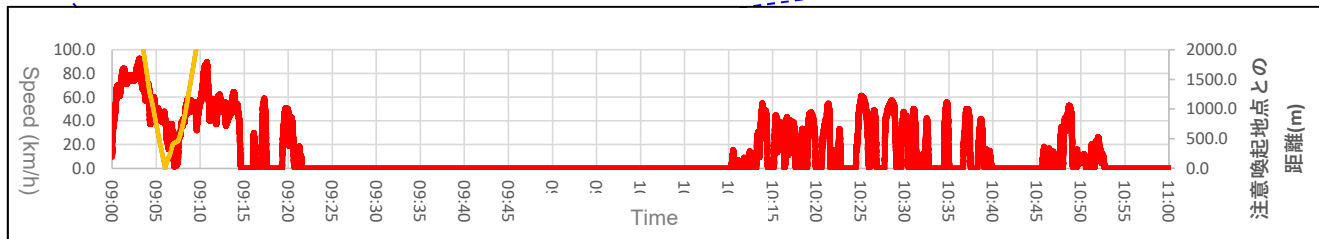
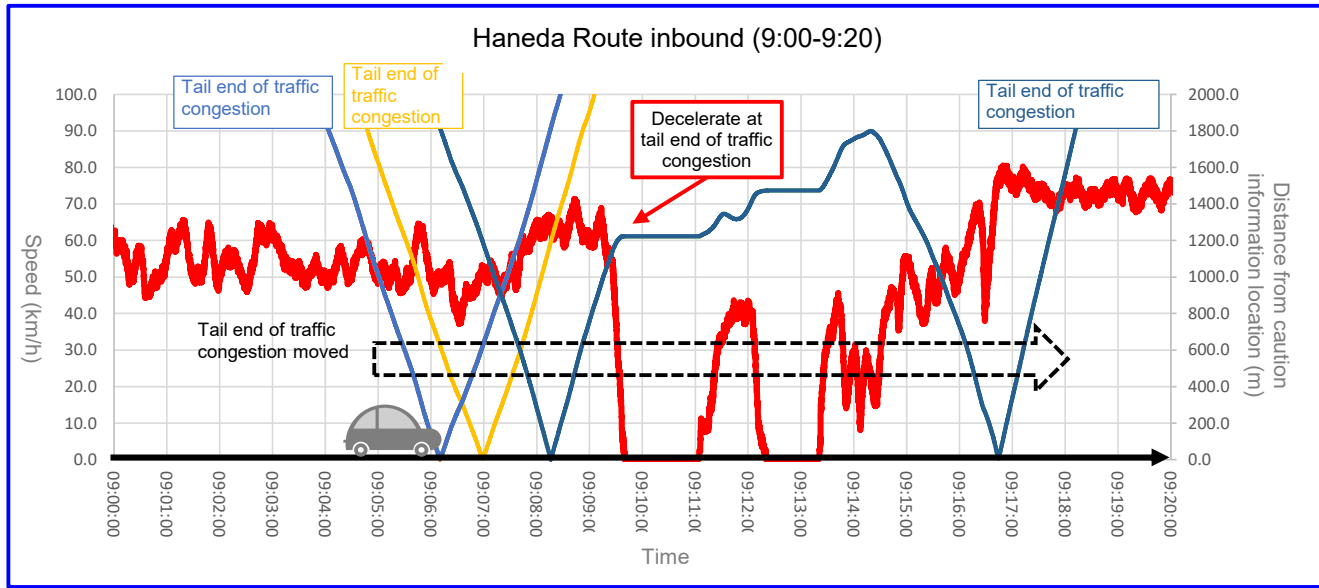
- : Traffic congestion front end,
- ▲ : Traffic congestion tail end
- : Driving area (9:00-9:15)
- : Test vehicle location (approx. 9:03)

# 4. Results of lane-specific road traffic information testing

## (2) Results of analysis of test participant driving data

### 4) Haneda Route traffic congestion tail end only

- We confirmed that vehicles decelerated as they approached the tail ends of traffic congestion areas (the locations of the tail ends of traffic congestion areas moved)



- : Traffic congestion front end,
- ▲ : Traffic congestion tail end
- : Driving area (9:00-9:20)
- : Test vehicle location (approx. 9:06)

## 5. Results of mock emergency vehicle location information testing

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### (1) Analysis of test participant driving data

\* See the Main Section document for an overview of the information, the method used to deliver the information, and the equipment-side test results

- Mock emergency vehicle location information reception and driving data from test participants was organized and analyzed by driving route and location relationship

<b>Driving route</b>	<b>Location relationship</b>	<b>Date/time</b>
Route A	Forward	1) Jan. 20, 2022 10:20-10:30
	Reverse	2) Jan. 17, 2022 14:20-14:35
Route C	Forward	3) Jan. 13, 2022 15:15-15:21
	Reverse	4) Jan. 13, 2022 13:35-13:40
Route E	Forward	5) Jan. 19, 2022 15:00-15:30
	Reverse	6) Jan. 21, 2022 13:25-13:35

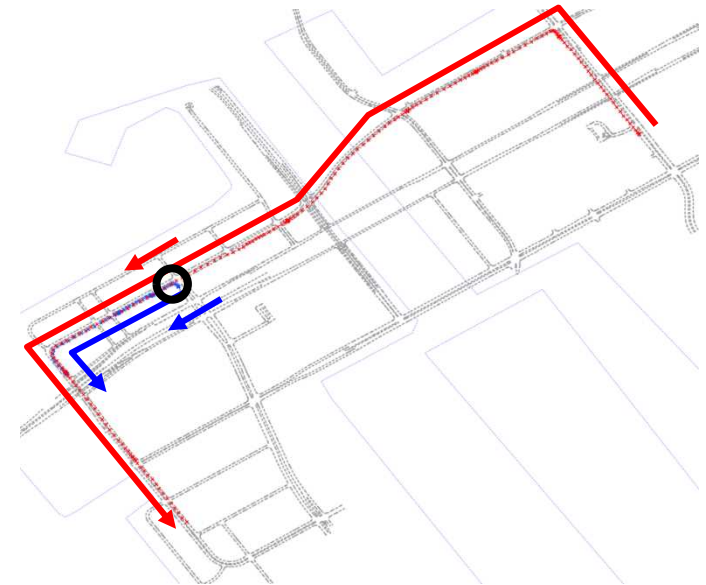
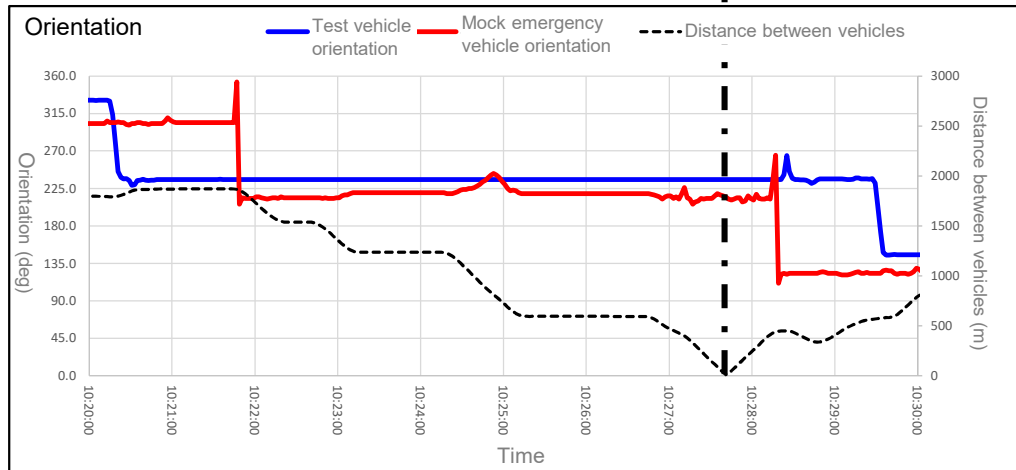
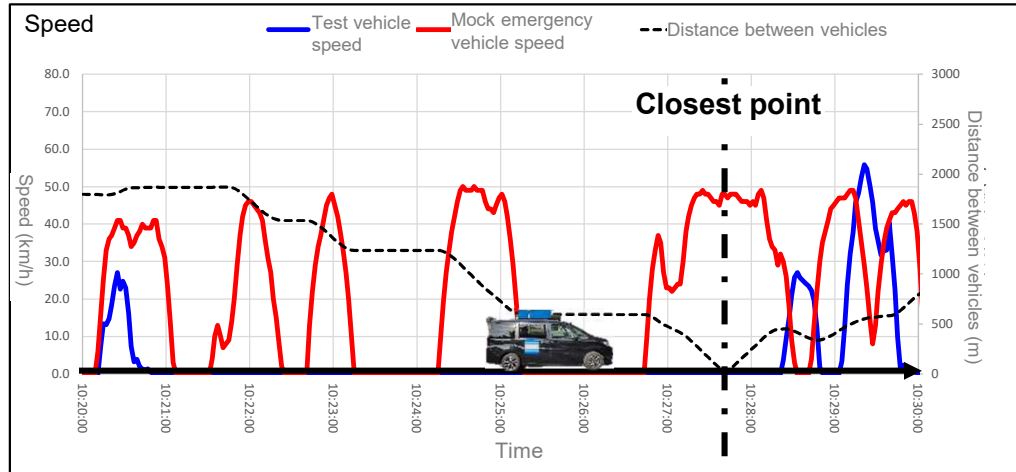


# 5. Results of mock emergency vehicle location information testing

## (1) Analysis of test participant driving data

### 1) Route A, forward

- At approximately 10:28, the mock emergency vehicle, driving forward along the route, was confirmed to have passed the test vehicle, which was stopped near the Daiba intersection



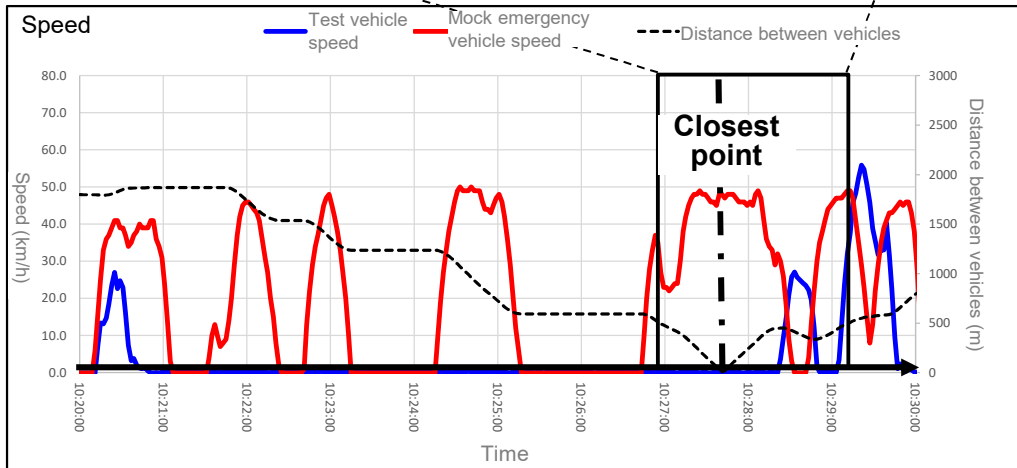
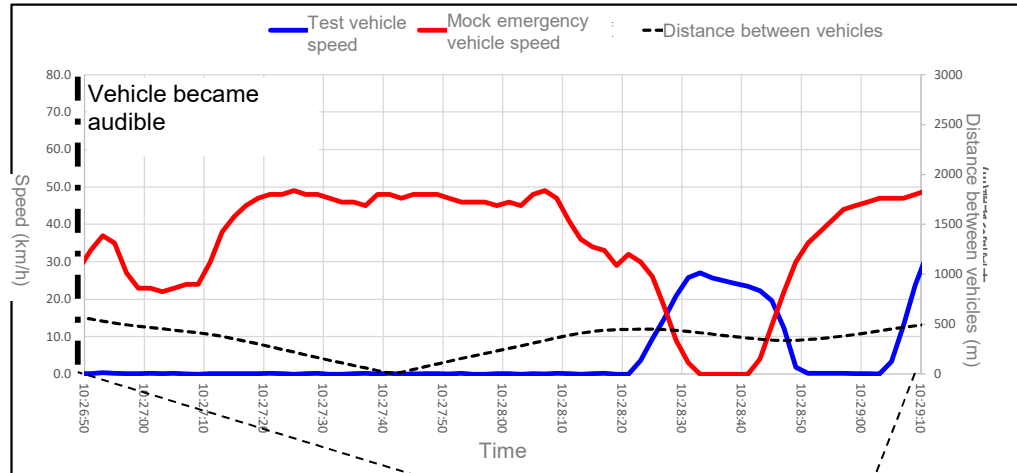
- ◆ : Route traveled by test vehicle (10:20-10:30)
- ◆ : Route traveled by the mock emergency vehicle
- : Closest point (approx. 10:27:40)

# 5. Results of mock emergency vehicle location information testing

## (1) Analysis of test participant driving data

### 1) Route A, forward

- At roughly 10:28, the mock emergency vehicle, driving forward along the route, was confirmed to have passed the test vehicle, which was stopped near the Daiba intersection

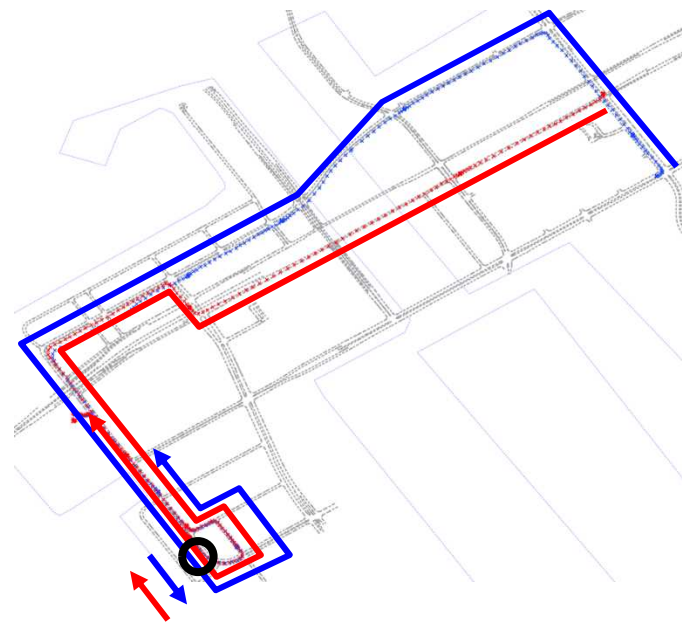
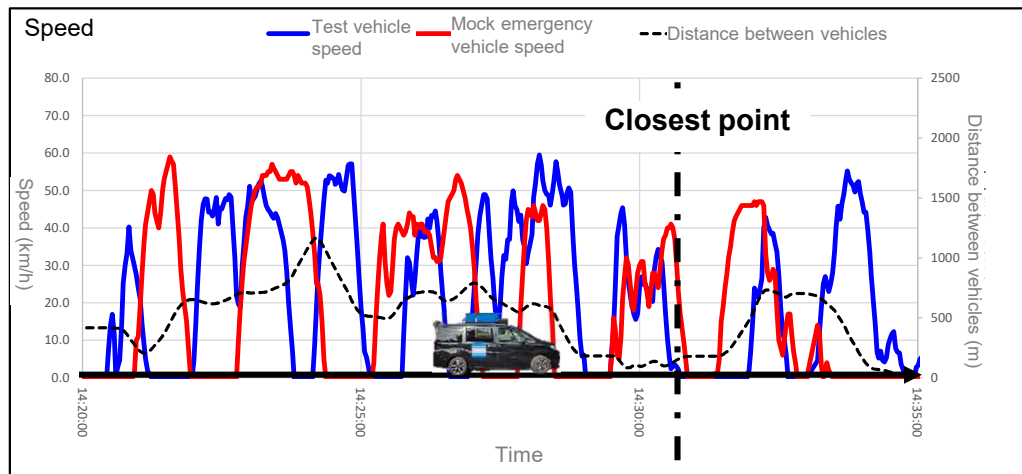


# 5. Results of mock emergency vehicle location information testing

## (1) Analysis of test participant driving data

### 2) Route A, reverse

- At roughly 14:30, the mock emergency vehicle, driving the route in reverse, was confirmed as driving between the Tokyo Port Bay Godo-chosha Bldg intersection and the Telecom Station-mae intersection



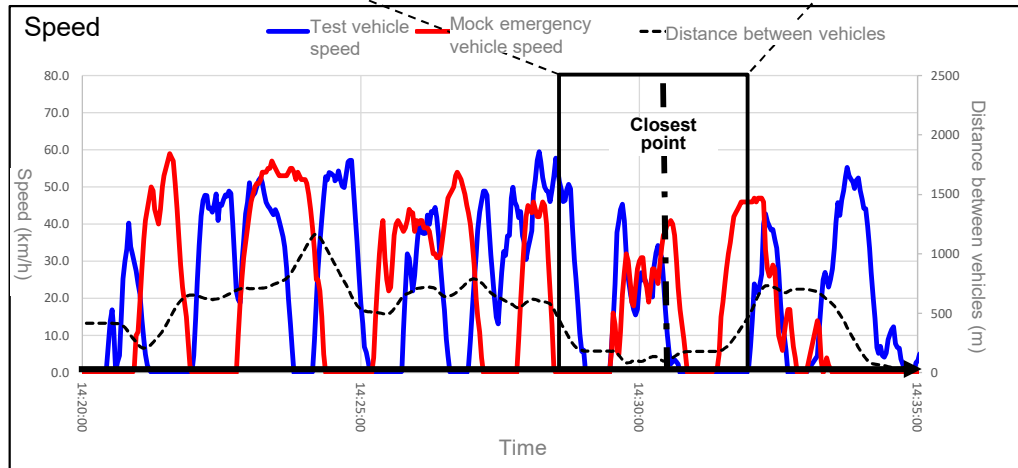
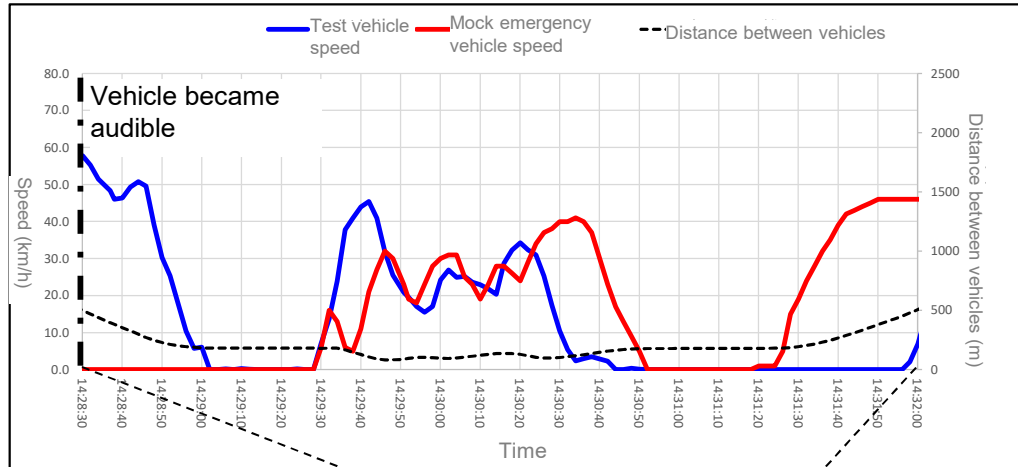
- ◆ : Route traveled by test vehicle (14:20-14:35)
- ◆ : Route traveled by the mock emergency vehicle
- : Closest point (approx. 14:30:24)

# 5. Results of mock emergency vehicle location information testing

## (1) Analysis of test participant driving data

### 2) Route A, reverse

- At roughly 14:30, the mock emergency vehicle, driving the route in reverse, was confirmed as driving between the Tokyo Port Bay Godo-chosha Bldg intersection and the Telecom Station-mae intersection

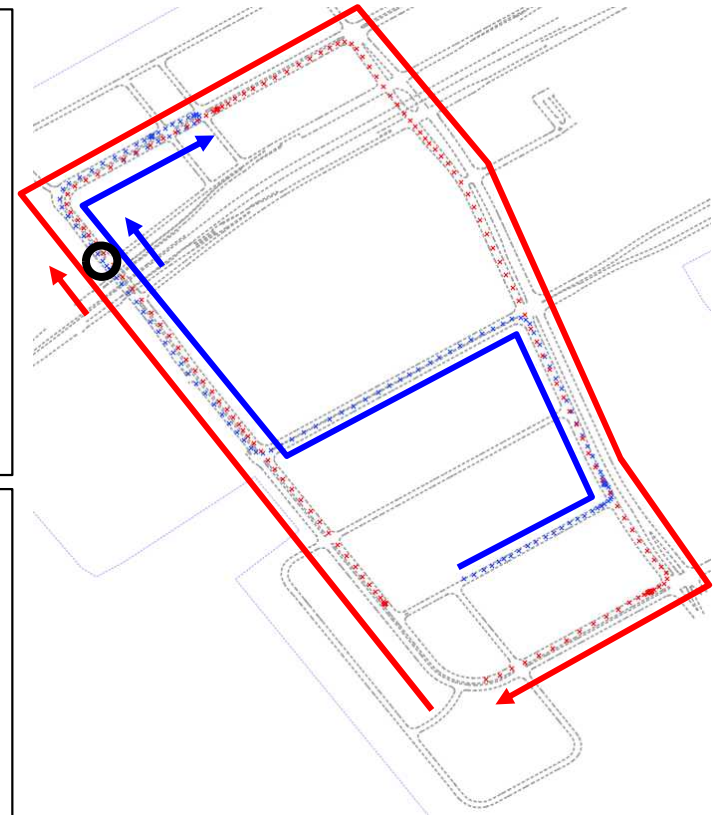
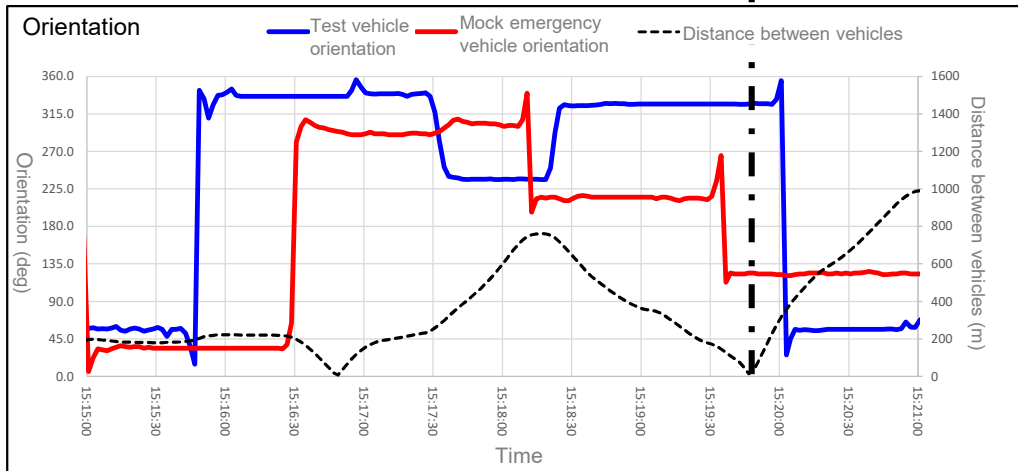
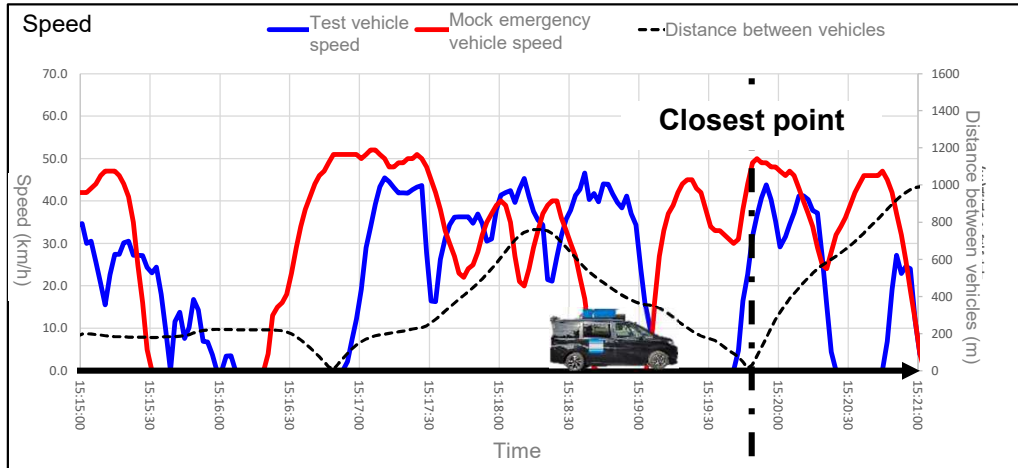


# 5. Results of mock emergency vehicle location information testing

## (1) Analysis of test participant driving data

### 3) Route C, forward

- At roughly 15:20, the mock emergency vehicle, driving forward along the route, was confirmed just beyond the Shiokaze Park North intersection



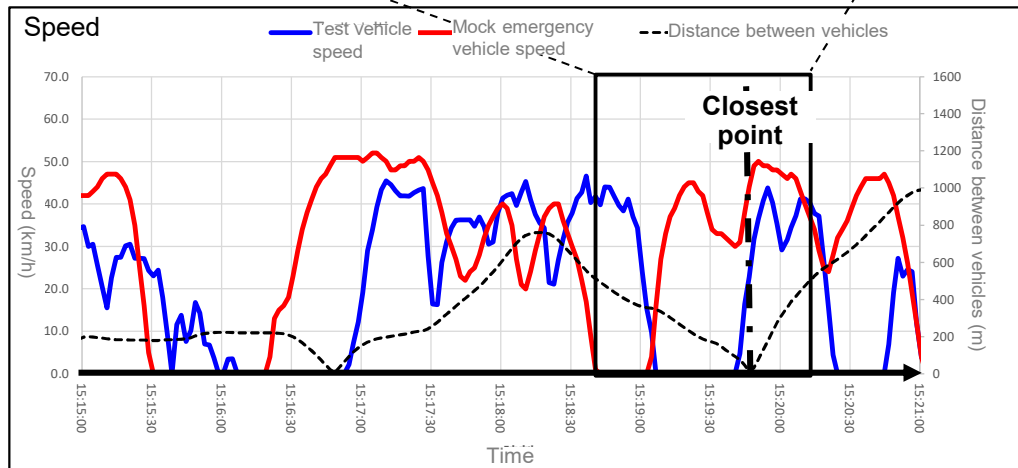
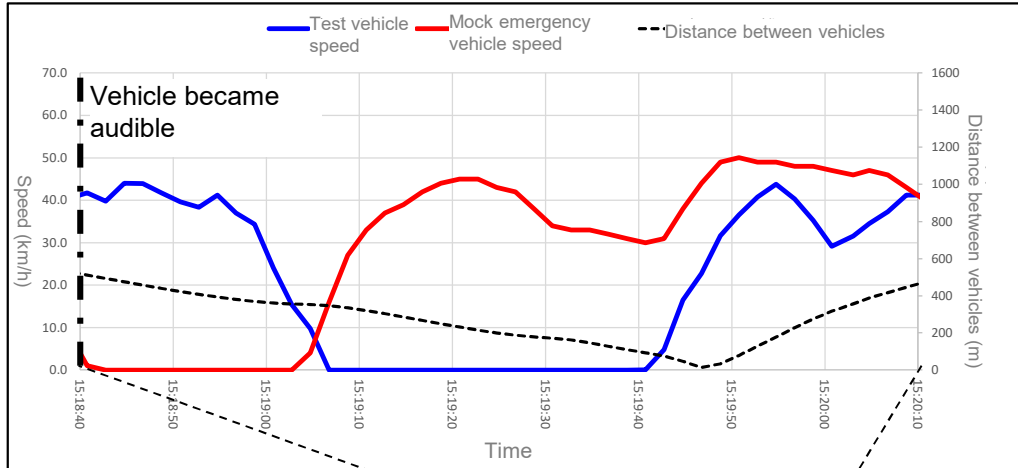
- :Route traveled by test vehicle (15:15-15:21)
- :Route traveled by the mock emergency vehicle
- :Closest point (approx. 15:19:46)

# 5. Results of mock emergency vehicle location information testing

## (1) Analysis of test participant driving data

### 3) Route C, forward

- At roughly 15:20, the mock emergency vehicle, driving forward along the route, was confirmed just beyond the Shiokaze Park North intersection

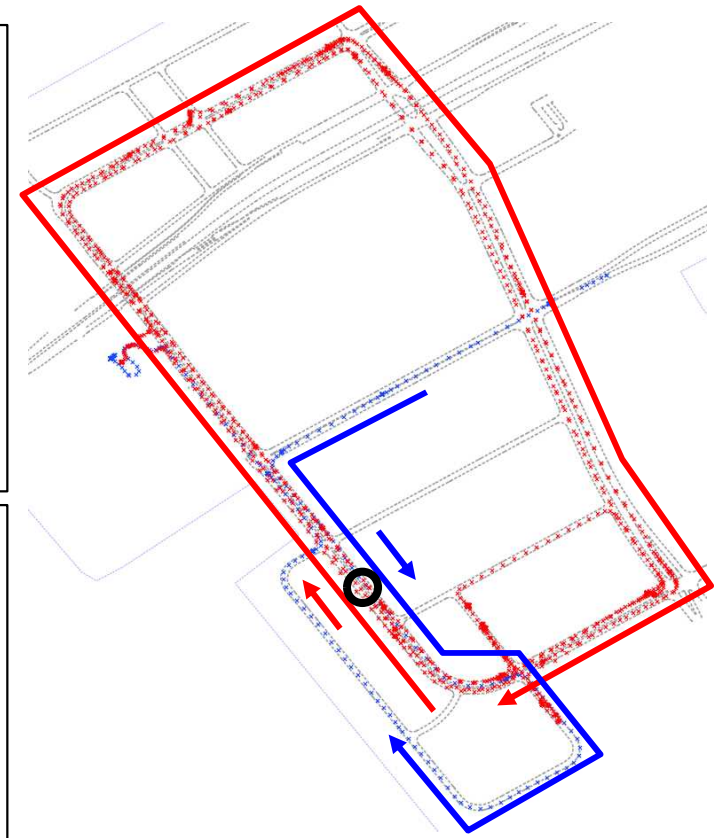
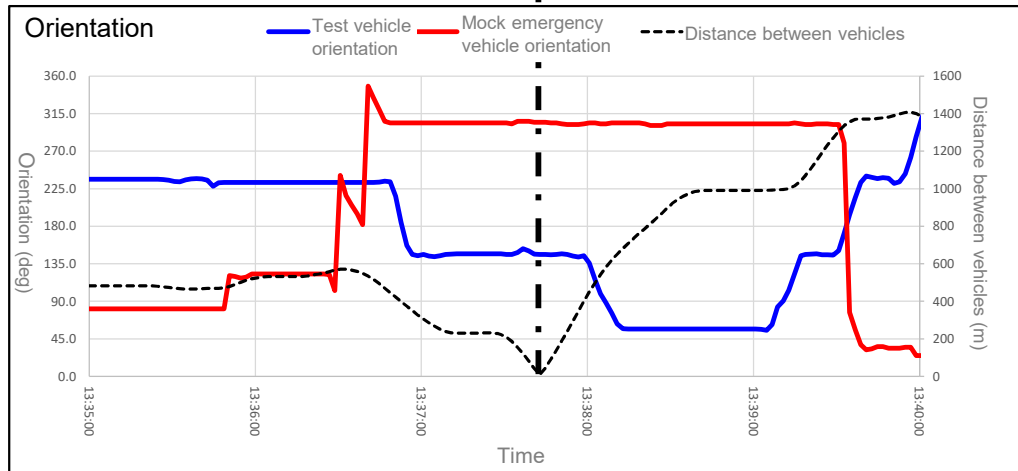
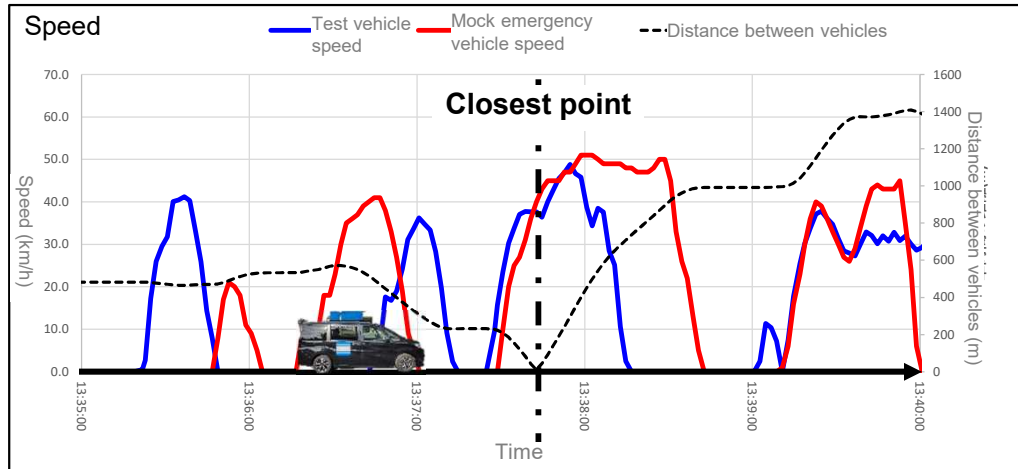


# 5. Results of mock emergency vehicle location information testing

## (1) Analysis of test participant driving data

### 4) Route C, reverse

- At roughly 13:38, the mock emergency vehicle, driving the route in reverse, was confirmed just beyond the Tokyo Wangan Police Station-mae intersection



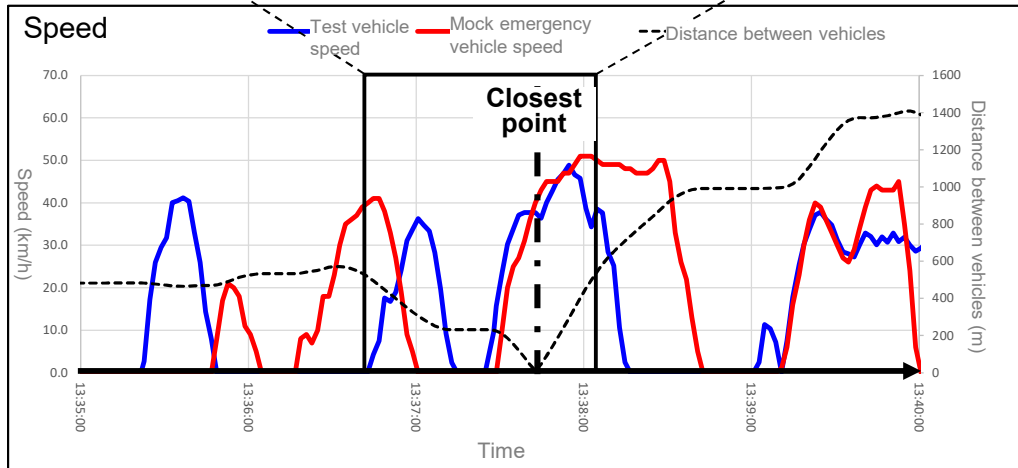
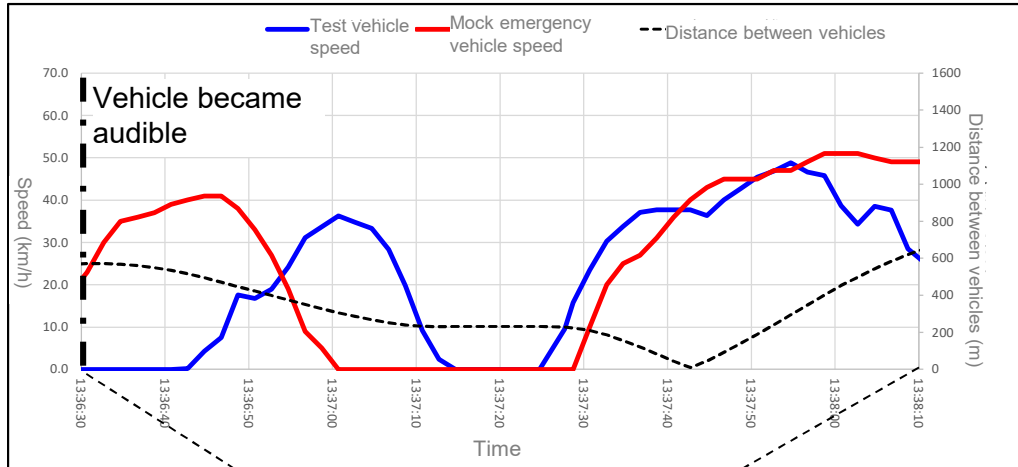
- ➡ :Route traveled by test vehicle (13:35-13:40)
- ➡ :Route traveled by the mock emergency vehicle
- :Closest point (approx. 13:37:42)

# 5. Results of mock emergency vehicle location information testing

## (1) Analysis of test participant driving data

### 4) Route C, reverse

- At roughly 13:38, the mock emergency vehicle, driving the route in reverse, was confirmed just beyond the Tokyo Wangan Police Station-mae intersection



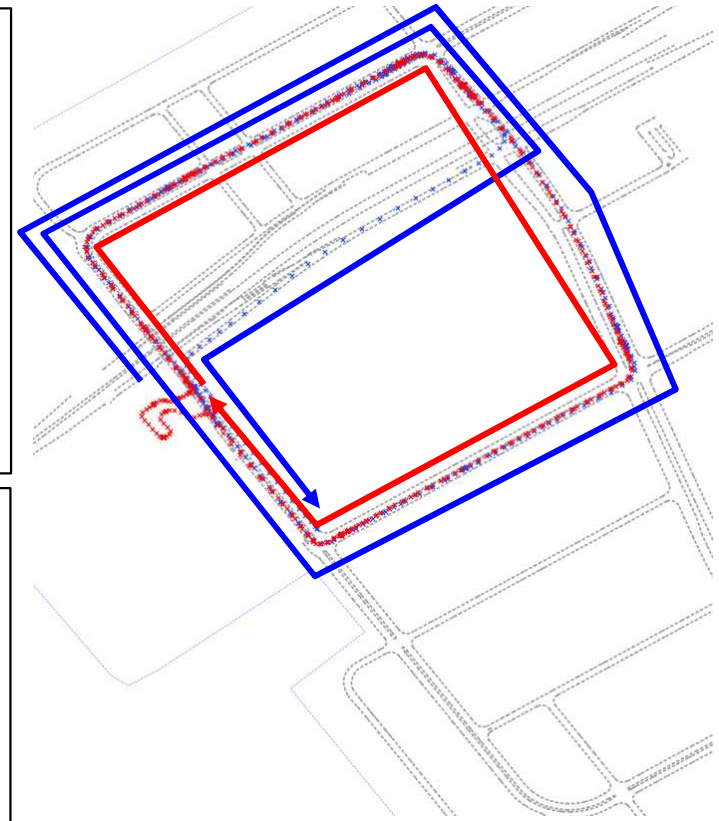
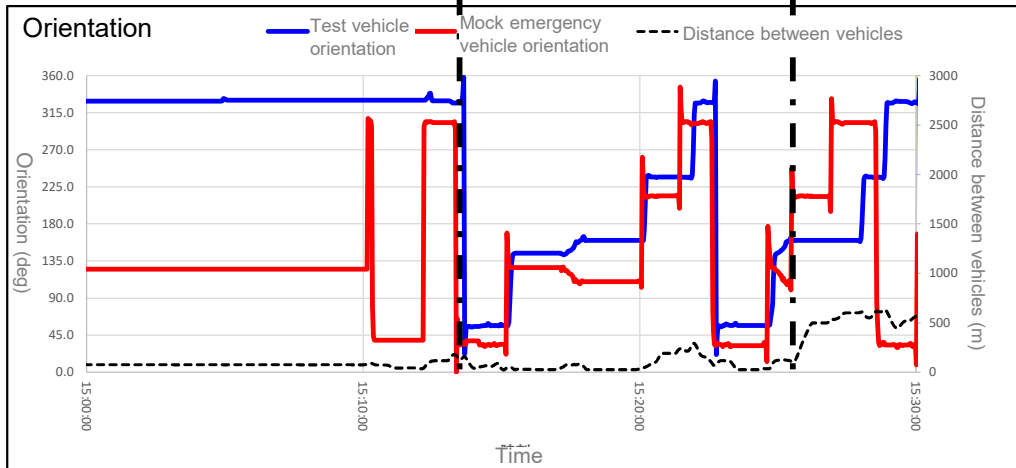
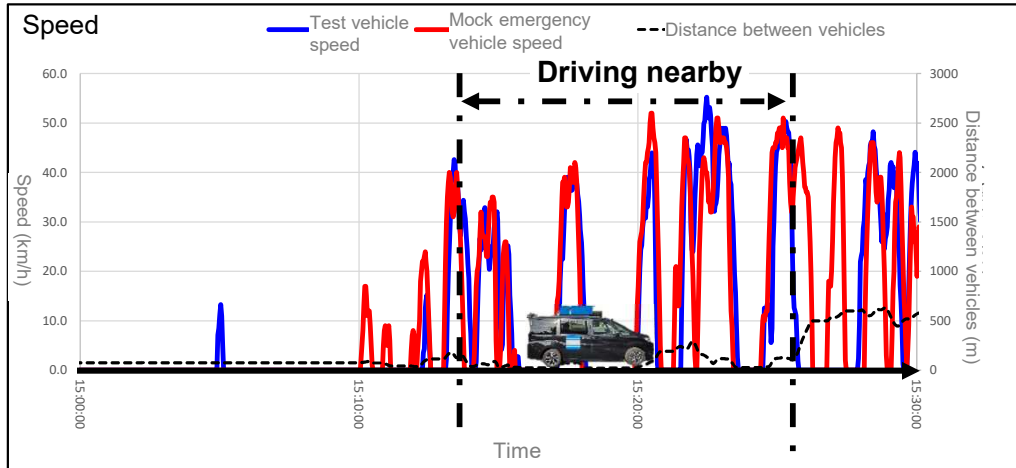


# 5. Results of mock emergency vehicle location information testing

## (1) Analysis of test participant driving data

### 5) Route E, forward

- Between 15:13 and 15:26, the mock emergency vehicle, driving forward on route E, was confirmed to be driving near the test vehicle



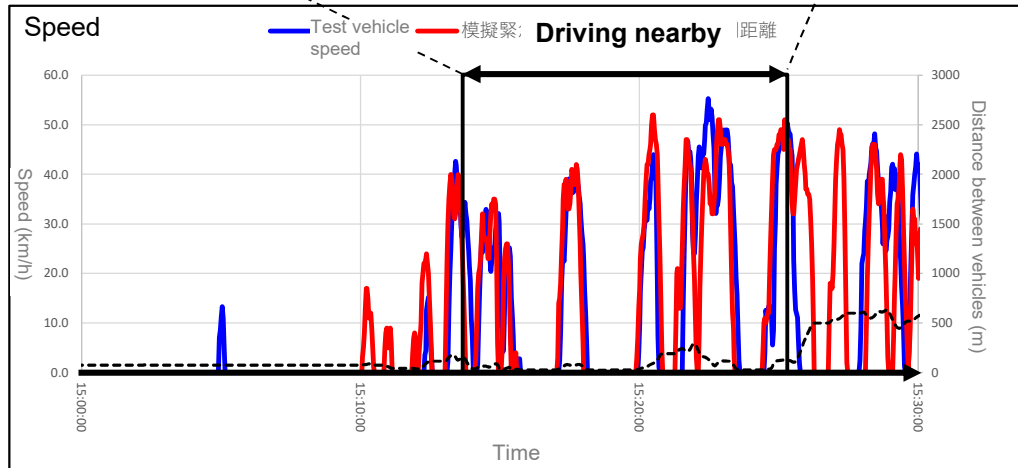
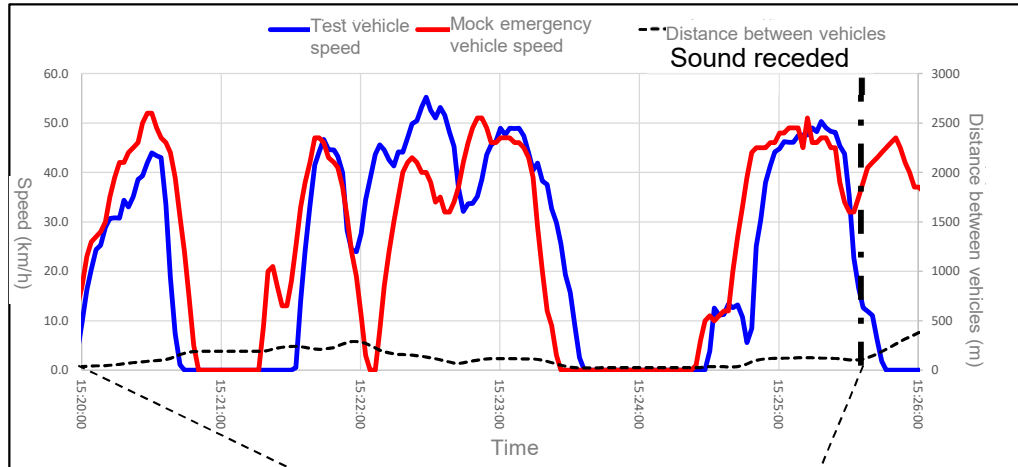
- ◆ :Route traveled by test vehicle (15:00-15:30)
- ◆ :Route traveled by the mock emergency vehicle
- \* The mock emergency vehicle drove near the test vehicle from 15:13 to 15:26

# 5. Results of mock emergency vehicle location information testing

## (1) Analysis of test participant driving data

### 5) Route E, forward

- Between 15:13 and 15:26, the mock emergency vehicle, driving forward on route E, was confirmed to be driving near the test vehicle

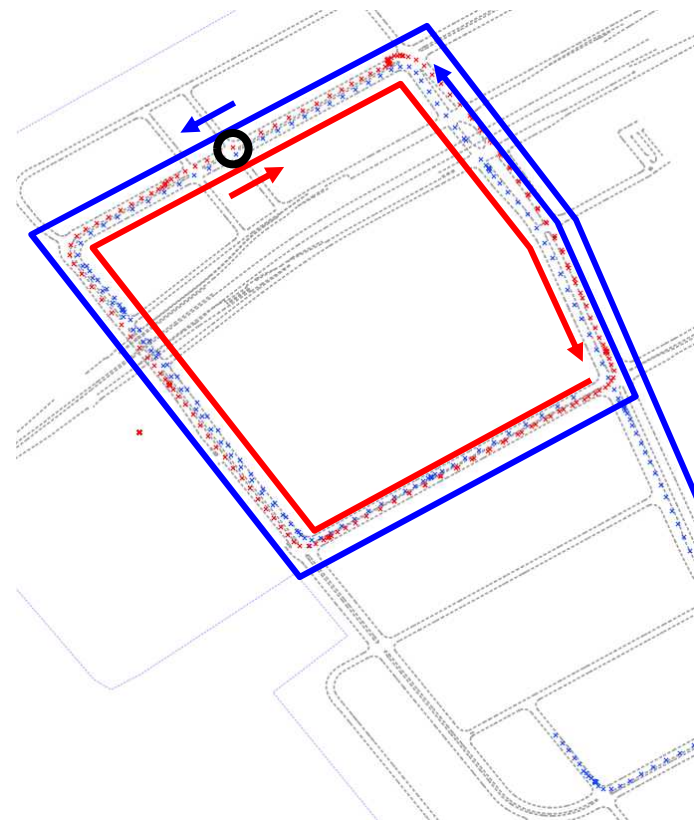
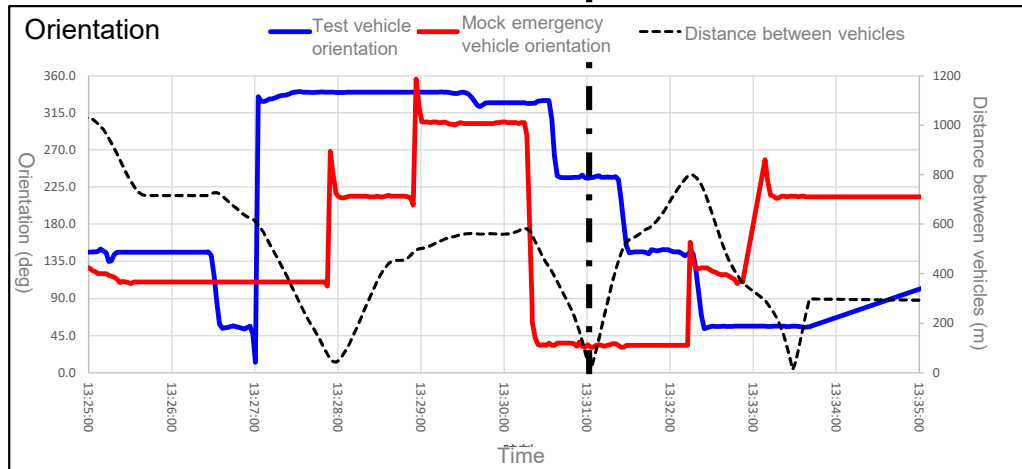
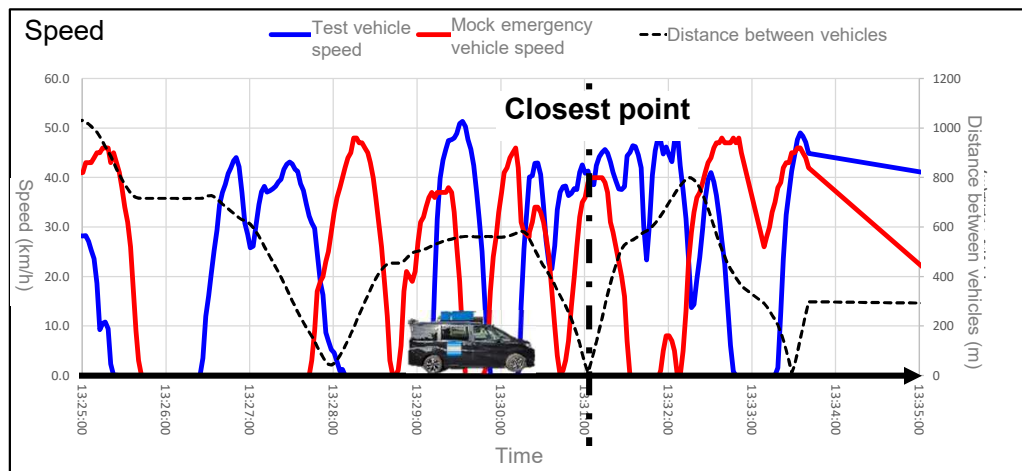


# 5. Results of mock emergency vehicle location information testing

## (1) Analysis of test participant driving data

### 6) Route E, reverse

- At roughly 13:31, the mock emergency vehicle, driving the route in reverse, was confirmed near the Daiba Ekimae No. 2 (East) intersection



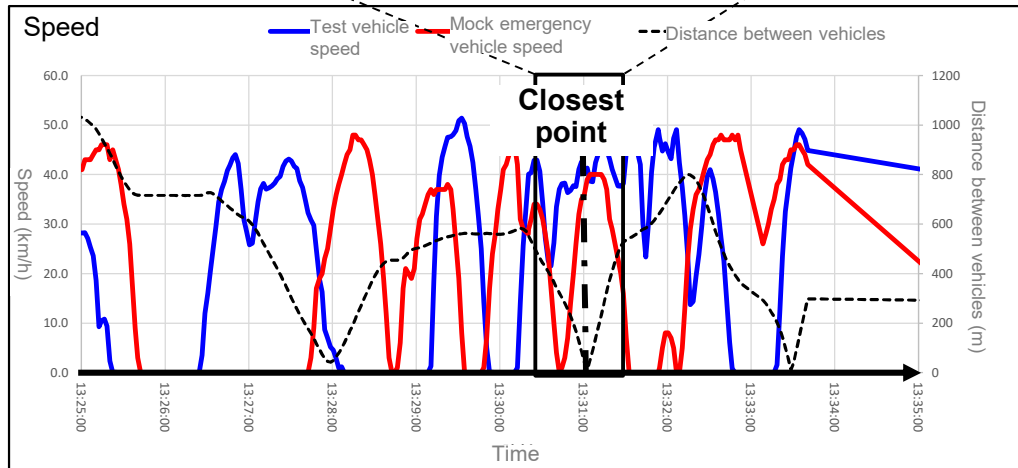
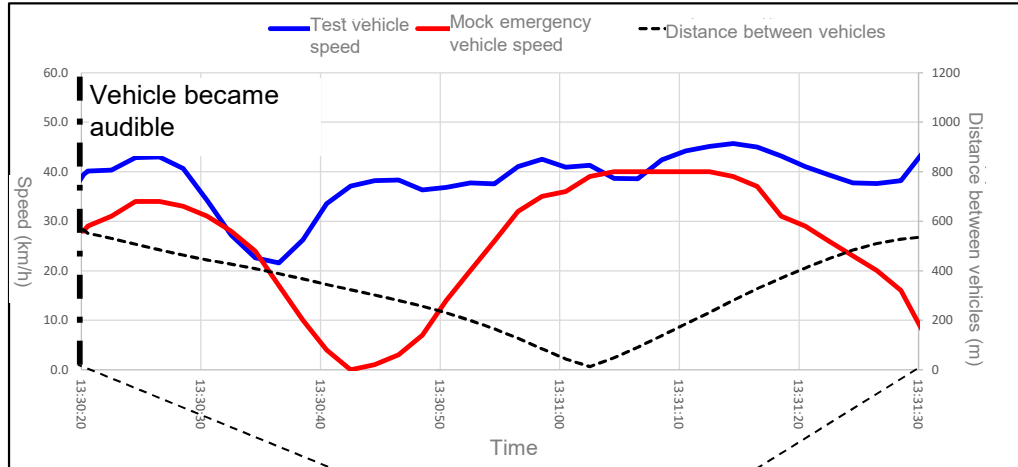
- :Route traveled by test vehicle (13:25-13:37)
- :Route traveled by the mock emergency vehicle
- :Closest point (approx. 13:31:02)

# 5. Results of mock emergency vehicle location information testing

## (1) Analysis of test participant driving data

### 6) Route E, reverse

- At roughly 13:31, the mock emergency vehicle, driving the route in reverse, was confirmed near the Daiba Ekimae No. 2 (East) intersection

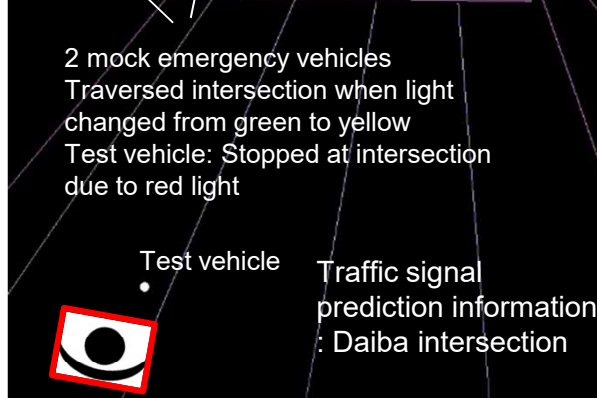
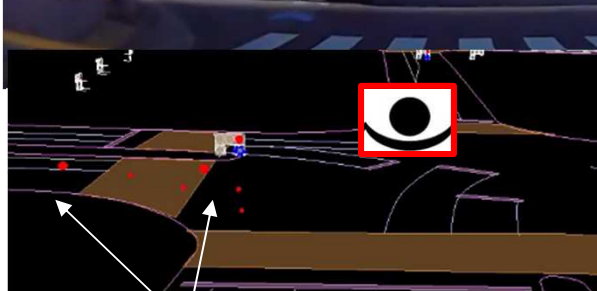


# 6. Results of traffic signal prediction information testing

## (1) Equipment-side test results

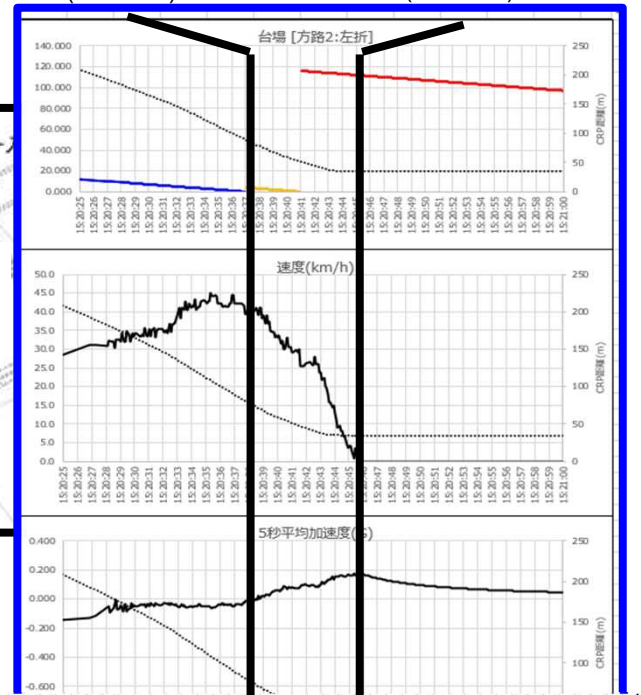
- When entering the Daiba intersection (with confirmed information), the traffic color change from yellow to red was confirmed in the traffic signal prediction information as well

\* See the Main Section document for an overview of the information, the method used to deliver the information, and other equipment-side test results



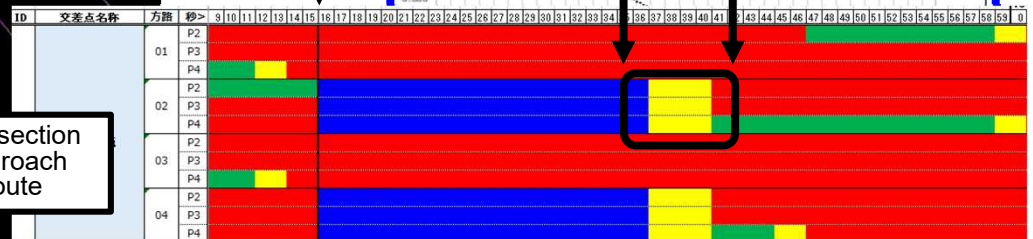
Decelerated in order to stop at intersection (15:20:38)

Fully stopped at intersection (15:20:46)



Cycle start

Intersection approach route



## 6. Results of traffic signal prediction information testing

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### (1) Equipment-side test results

- The results of the equipment-side tests performed on January 14 were analyzed and organized separately for each traversed intersection for tests using the specified intersection PUSH method, tests using the specified distance PUSH method, and tests using the PULL method.

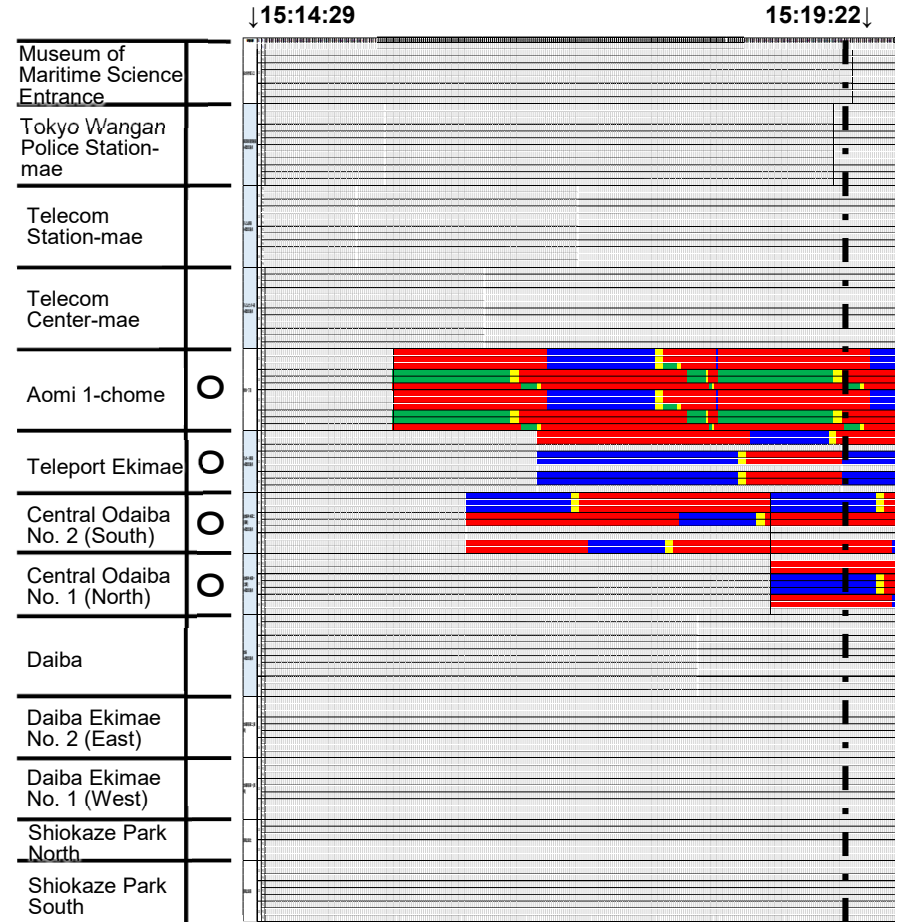
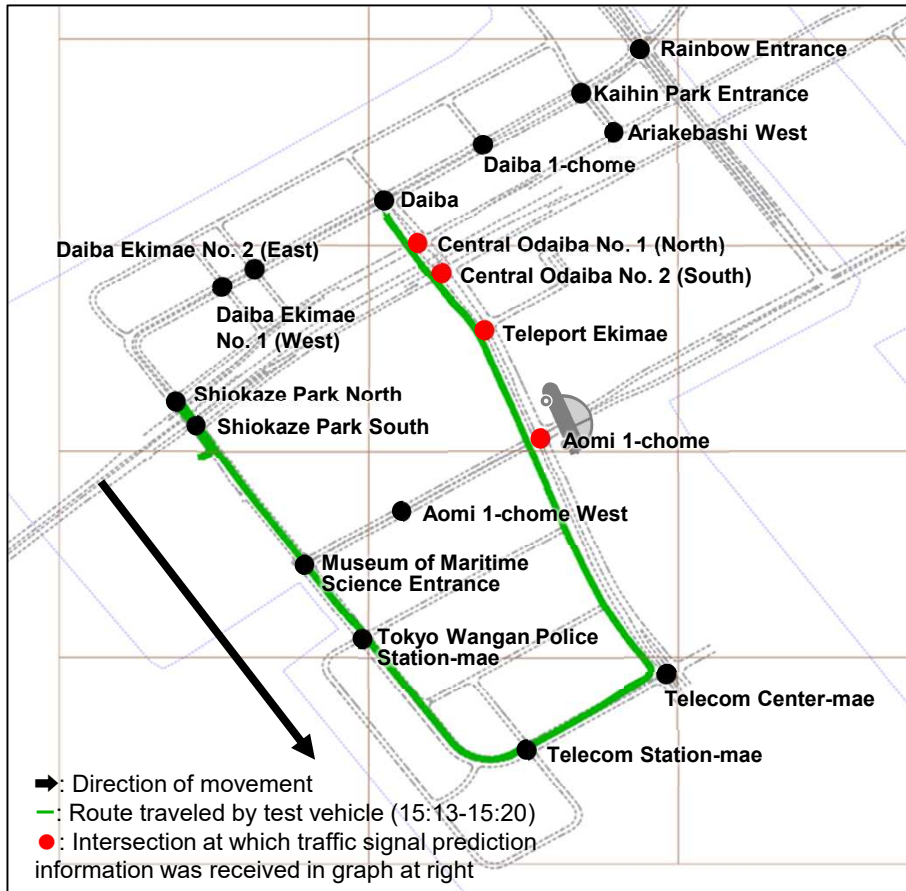
#	Delivery pattern	Analysis time period
1)	Specified intersection PUSH	15:14:29-15:30:28 (Overall: 15:00-15:44)
2)	Specified distance PUSH	15:49:51-15:52:38 (Overall: 15:46-15:57)
3)	PULL	15:59:52-16:07:27 (Overall: 15:58-16:19)

# 6. Results of traffic signal prediction information testing

## (1) Equipment-side test results

1) Specified intersection PUSH (Aomi 1-chome traversal time: 15:18:56)

- Traffic signal prediction information was received between Aomi 1-chome and Central Odaiba No. 1 (North)

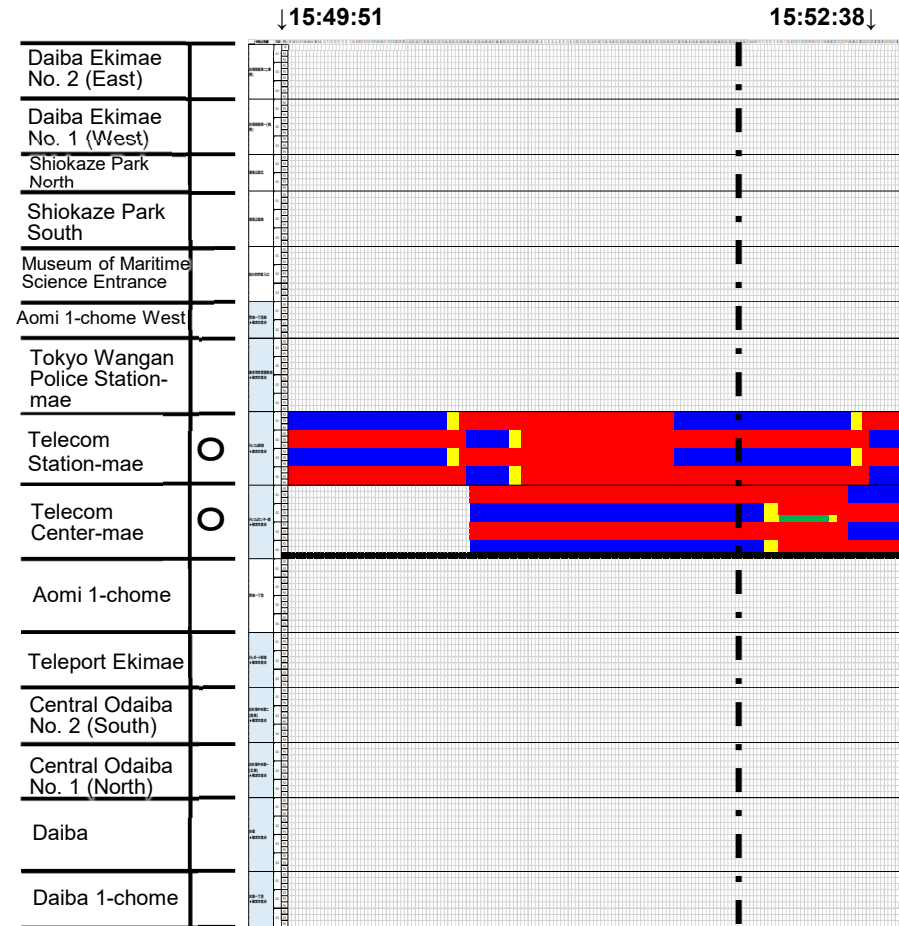
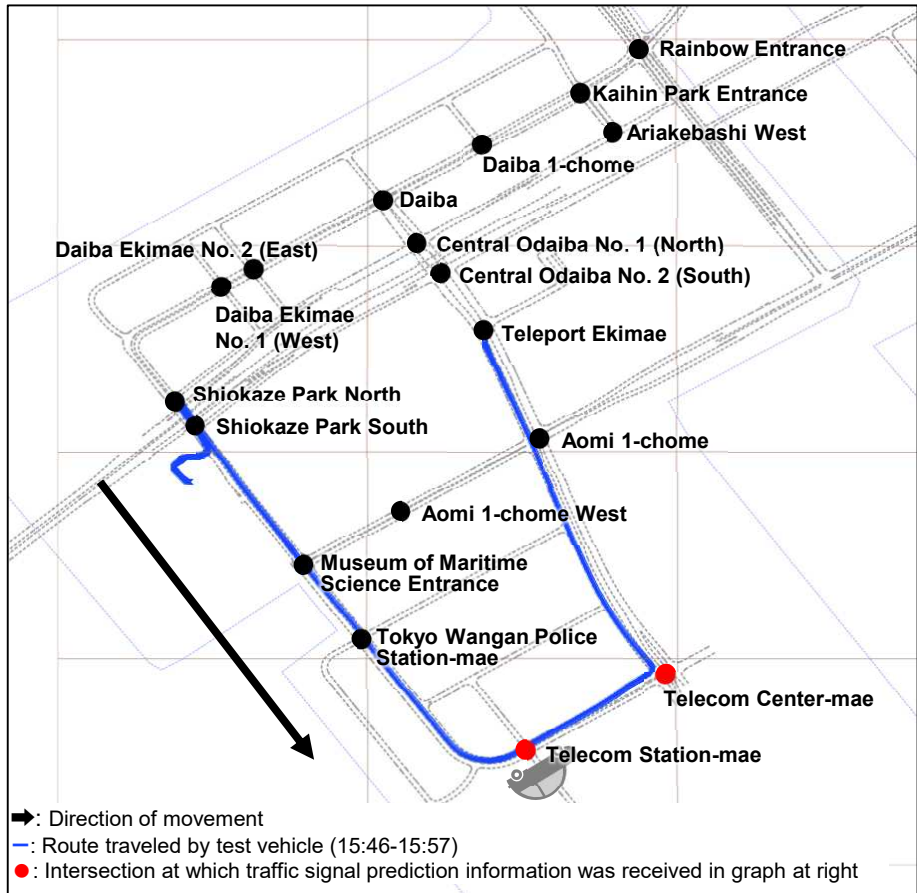


# 6. Results of traffic signal prediction information testing

## (1) Equipment-side test results

2) Specified distance PUSH (Telecom Station-mae traversal time: 15:51:55)

- Traffic signal prediction information was received for the 2 intersections in front of the vehicle, including the Telecom Station-mae intersection



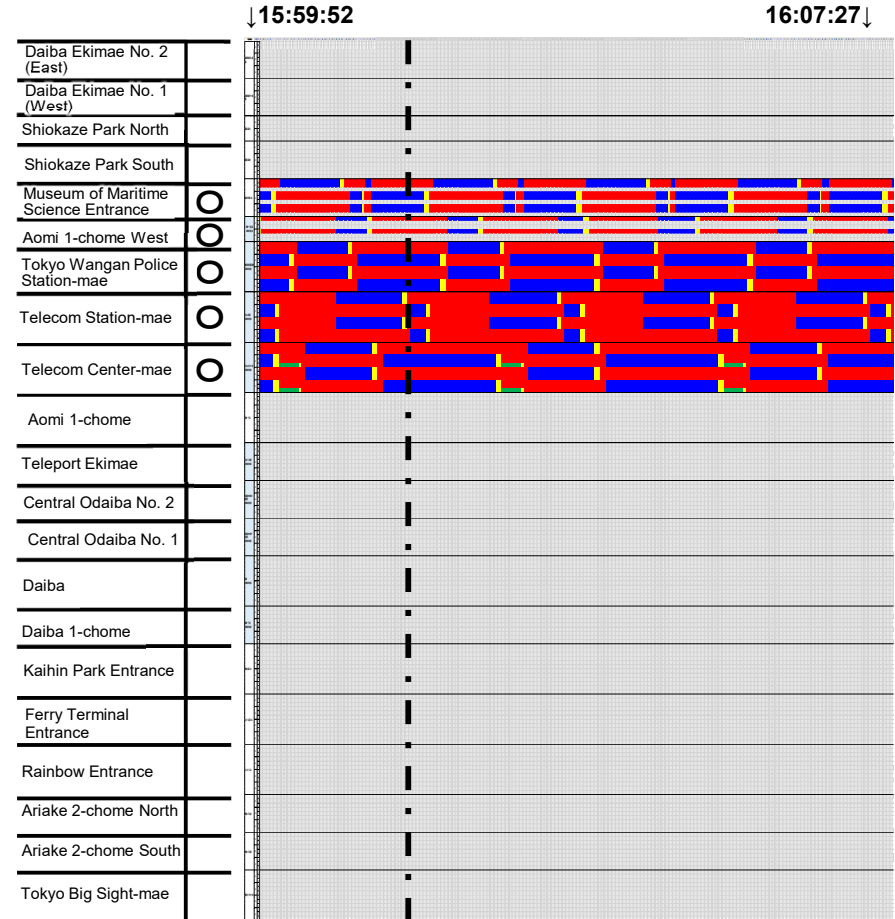
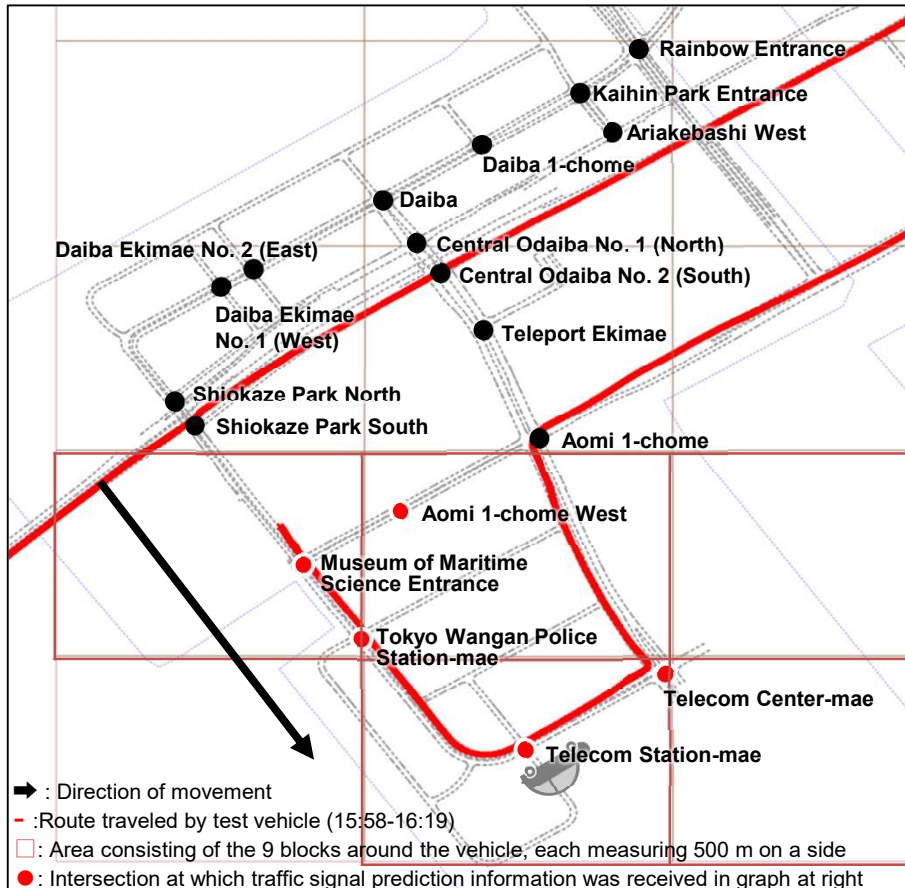


# 6. Results of traffic signal prediction information testing

## (1) Equipment-side test results

3) PULL (Telecom Station-mae traversal time: 16:01:40)

- Information was received for 5 surrounding intersections, including the Telecom Station-mae intersection



Vehicle location

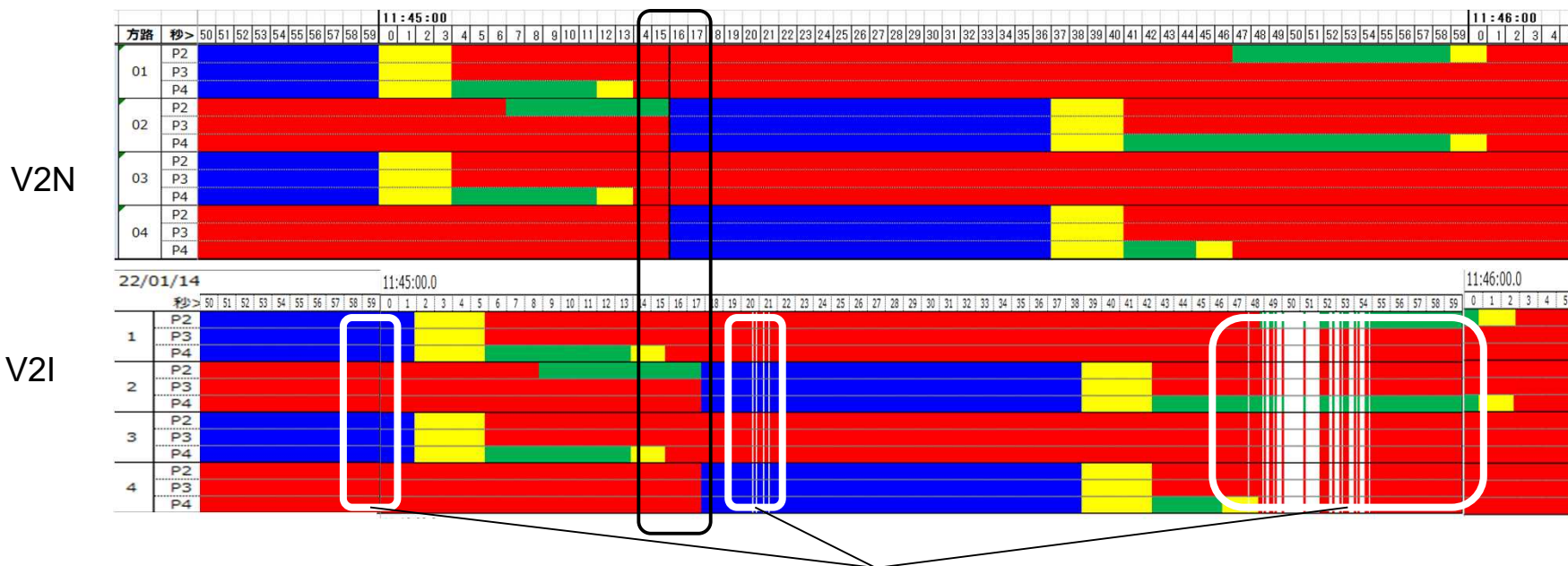
# 6. Results of traffic signal prediction information testing

## (1) Equipment-side test results [Test data: Intersections with confirmed information]

- We confirmed that aspect information identical to the V2I traffic signal information was generated
- We determined that there was a deviation of roughly two seconds between the time in the V2N traffic signal prediction information and the data time of the V2I traffic signal information (roughly equal to the traffic signal time,  $\pm 300$  ms) (the cause will need to be investigated in the future, and countermeasures will need to be deliberated on)

Daiba intersection (1/14 11:44:50 to 11:46:05)

There was a deviation of roughly two seconds at the start of the cycle



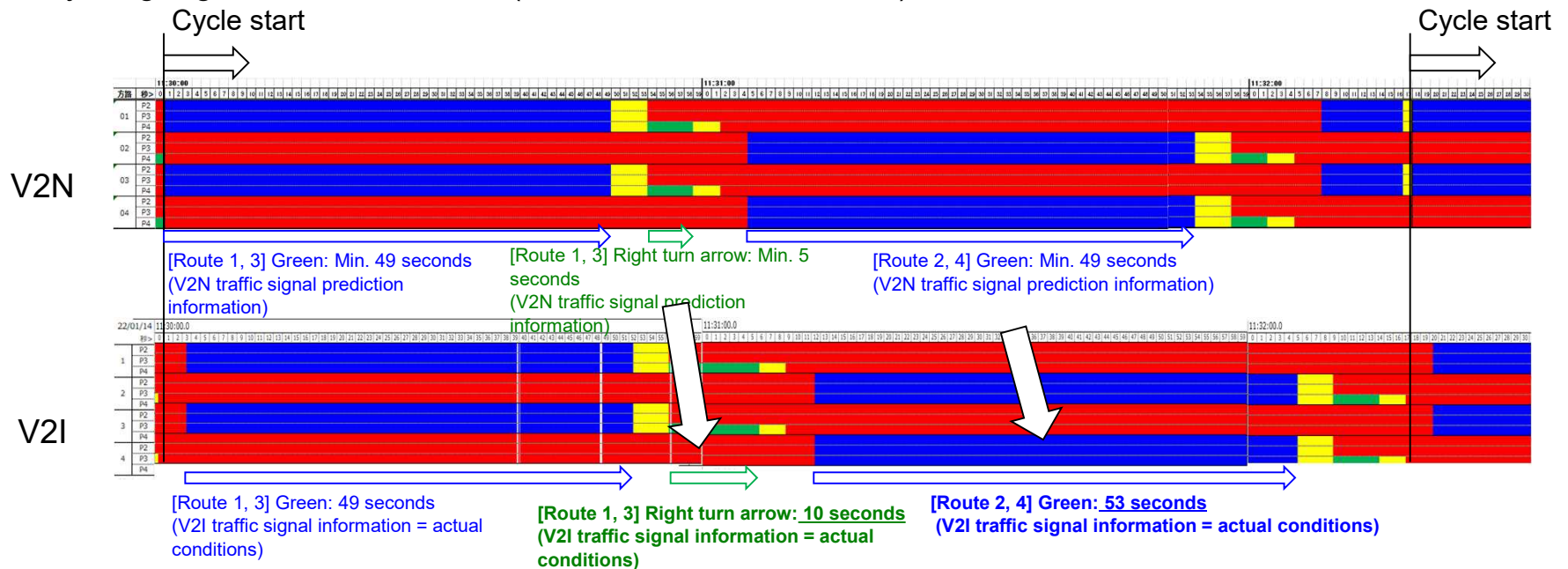
There is data loss during road-to-vehicle communication via V2I (due to multipath transmission), but with V2N, at the start of the cycle, two cycle's worth of traffic signal color information is provided, so there is no data loss

# 6. Results of traffic signal prediction information testing

## (1) Equipment-side test results [Test data: Intersections with margins]

- At the start time of each cycle (when the major road's traffic light turns green), the FOTs system sends two cycle's worth of traffic signal color information, so for intersections with margins, changes in the number of remaining seconds cannot be reflected in the traffic signal prediction information and it is not possible to predict the timing of traffic signal changes

### Tokyo Big Sight-mae intersection (1/14 11:30:00 to 11:32:30)



Extensions to traffic signal aspects at intersections with margins are not reflected in V2N traffic signal prediction information

## 6. Results of traffic signal prediction information testing

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### (2) Analysis of test participant driving data

- Traffic signal prediction information was organized using driving data from test participants (V2N)
- Test participant driving data related to the traffic signal prediction information was organized for each route defined for the mock emergency vehicle location information tests (A, B, and E)

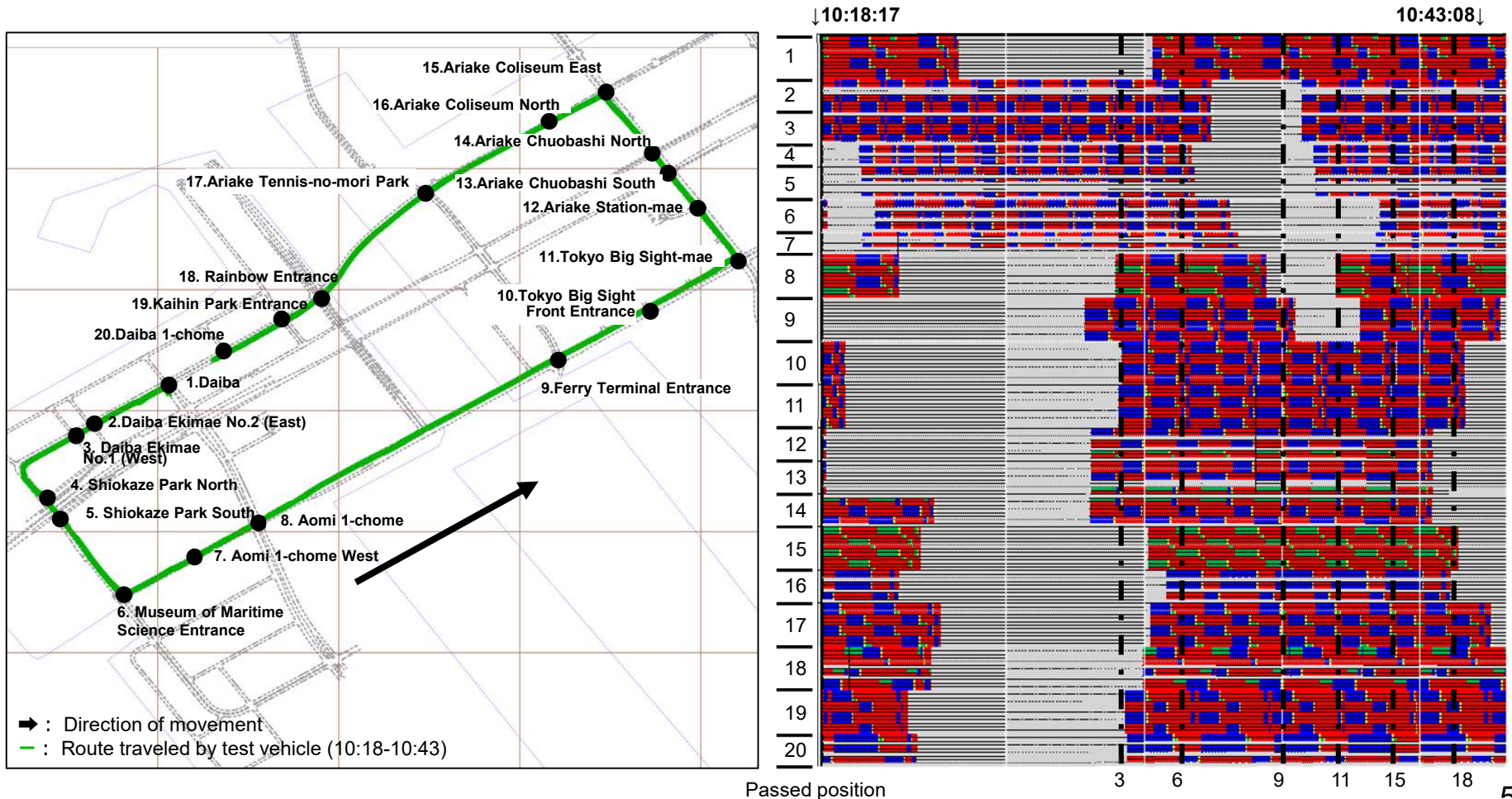
<b>Reception environment</b>	<b>Date/time</b>
Route A	1) Jan. 20, 2022 10:18-10:43
Route B	2) Jan. 20, 2022 13:36-13:44
Route E	Jan. 19, 2022 15:13-15:22

# 6. Results of traffic signal prediction information testing

## (2) Analysis of test participant driving data

### 1) Route A

- Vehicles drove counterclockwise along the route, starting from Daiba, and we confirmed that traffic signal prediction information was received as shown in the figure at bottom right

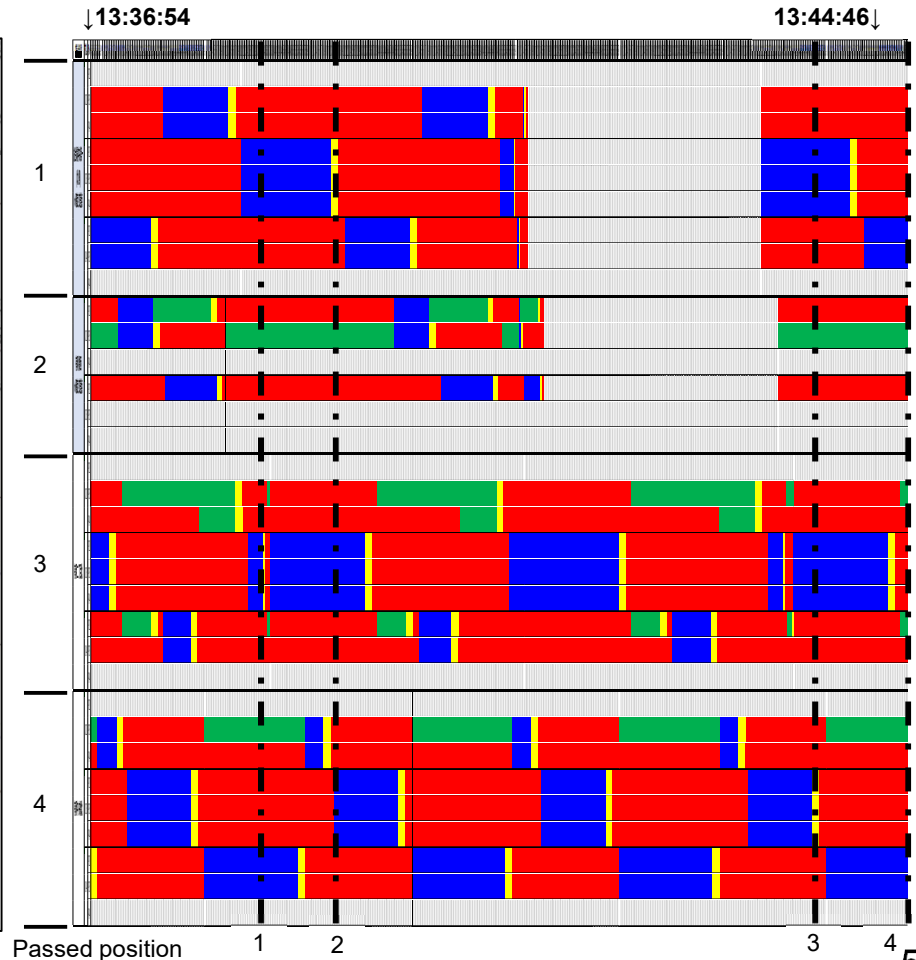
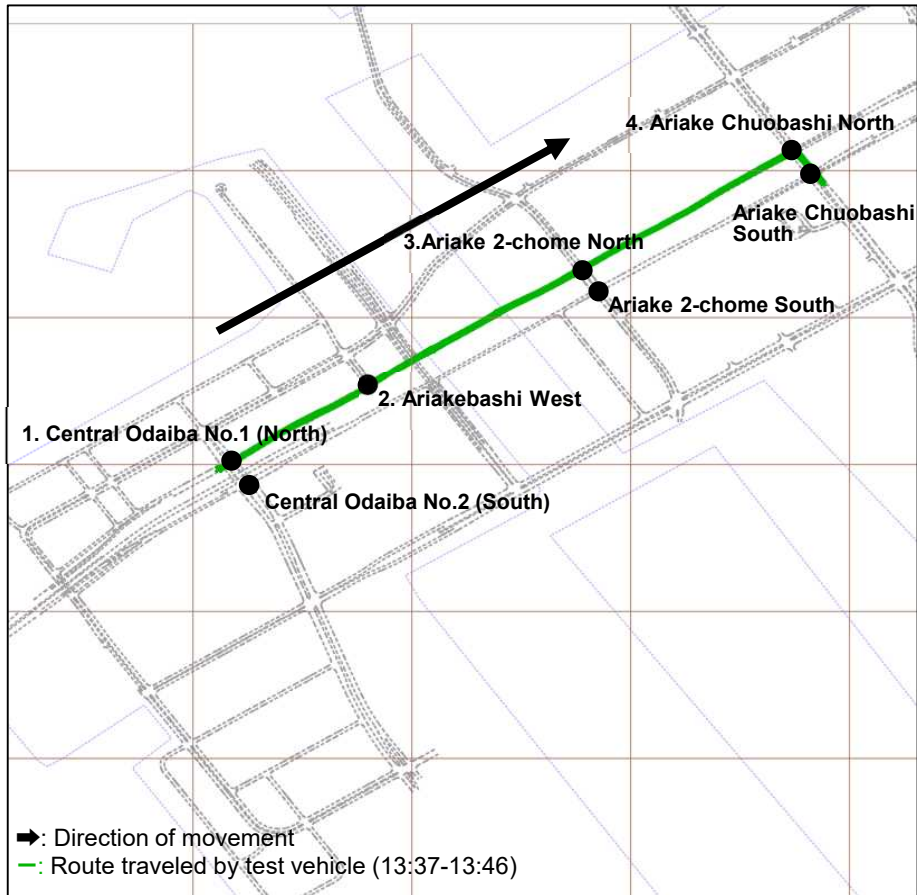


# 6. Results of traffic signal prediction information testing

## (2) Analysis of test participant driving data

### 2) Route B

- Vehicles drove east from Central Odaiba No. 1 (North) and we confirmed that traffic signal prediction information was received as shown in the figure at bottom right

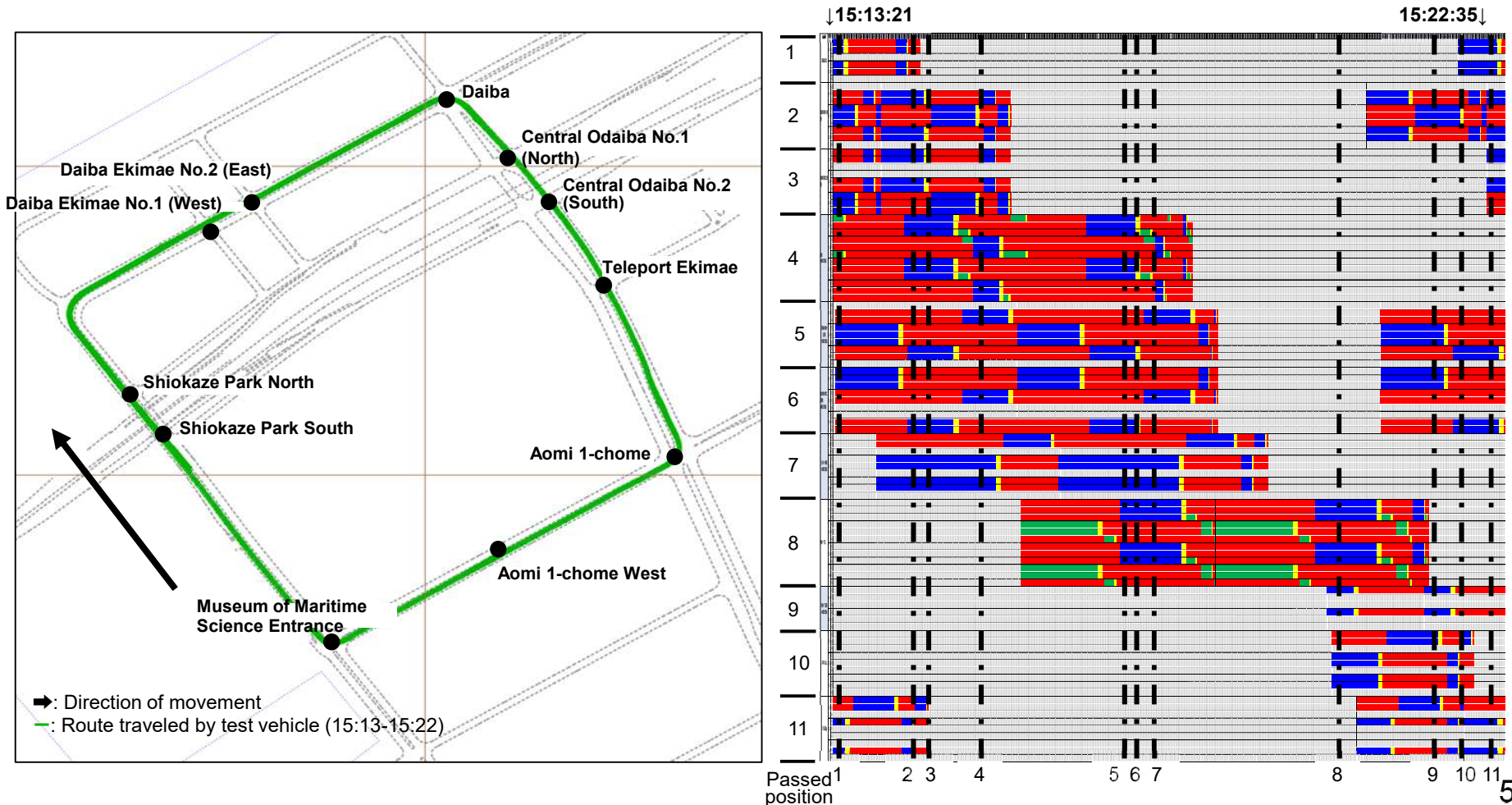


# 6. Results of traffic signal prediction information testing

## (2) Analysis of test participant driving data

### 3) Route E

- Vehicles drove clockwise along the route, starting from Shiokaze Park North, and we confirmed that traffic signal prediction information was received as shown in the figure at bottom right



This report documents the results of Cross-ministerial Strategic Innovation Promotion Program (SIP) 2nd Phase, Automated Driving for Universal Services (SIP-adus, NEDO management number: JPNP18012) that was implemented by the Cabinet Office and was served by the New Energy and Industrial Technology Development Organization (NEDO) as a secretariat.