Cross-ministerial Strategic Innovation Promotion Program (SIP)
Automated Driving System / Large-Scale Field Operational Test

Next Generation Transportation

ART operational data aggregation and storage of operation, construction of mechanism for providing information to ART users, and implementation and management of large-scale field operational test

FY 2018 Annual Report (Summary)

Hitachi, Ltd., Pacific Consultants Co., Ltd.
and The Institute of Behavioral Sciences

1．Backgrounds, Goals and Intents

【Goal】Next Generation Transportation

We realized followings by appealing effectiveness of PTPS (Public Transportation Priority System) that improves speediness of ART (Advanced Rapid Transit) and the pedestrian support system in their field operational test.

- Promoting of social receptivity towards social implementation of Next step ART technologies
- Improving convenience and accessibility (physical and information) for realizing public transportation for wide range of users including the elderly and people with disabilities, and promoting the conversion from other transportations

【Achievements】

a. ART operational data aggregation and storage, and construction of mechanism for providing information to ART users

① Development on ART information center and its verification test
② Field operational test of improving the speediness of ART with Advanced PTPS
③ Investigation of measures of traffic congestion forecasting and guiding to avoid congestion, Demonstrative experiment
④ Pedestrian transfer support system

c. Management of large-scale field operational test

① Organizing large-scale field operational test
② Organizing the achievement experience session for stakeholders
③ Development and feasibility study on ART Information Center
④ Field operational test of improving the speediness of ART with Advanced PTPS
⑤ Pedestrian transfer support system

2． Milestones and Goals

「a. ART operational data aggregation and storage, and construction of mechanism for providing information to ART users 」

Item	Goal
①Development on ART Information Center and its Verification Test	＜Milestones＞ Complete the optimization of the priority mediation information (adjustment of the priority mediation parameter) providing from the ART information center to the PTPS on-board equipment and verification of the service function (API and application) provided for large-scale field operational test (in FY2018)
	＜Goals＞ Perform the following effectiveness evaluation on the PTPS priority mediation support function and service functions (API and application) provided for large-scale feasibility study, and show the usefulness of data collected and provided by the ART information center • ART speediness improvement by Advanced PTPS • Promotion of bus (ART) by providing connection guidance service • Provide user information such as bus crowdedness and getting on / off
②Field Operational Test of Improving the Speediness of ART with Advanced PTPS	＜Milestones＞ • Complete the development of the Advanced PTPS on-board equipment • Verify its performance from the technical point of view by a preliminary test • Complete planning of the field operational test of FY2018
	＜Goals＞ • Confirm effectiveness and technical feasibility of Advanced PTPS through the field operational test. • Extract technical and practical issues in implementing Advanced PTPS in a bus route.

2． Milestones and Goals

「a. ART operational data aggregation and storage, and construction of mechanism for providing information to ART users 」

Item	Goal
③Investigation of Measures of Traffic Congestion Forecasting and Guiding to Avoid Congestion, Demonstration Experiment	＜Milestones＞ ・Considering case examples of measures of traffic congestion forecasting and guiding to avoid traffic congestion, experimental survey will be conducted to estimate effects of measures to avoid congestion. ・Based on the results, traffic condition during a large event will be simulated. ・Based on these knowledge, draft plan of demonstrative experiment will be drawn up.
	＜Goals＞ Based on the results of demonstrative experiment, effective measures guiding to avoid traffic congestion will be developed.
④Pedestrian Transfer Support System	＜Milestones＞ For large-scale field operational test , we prototype walking route collection application and information posting application, and collected GPS track information and barrier free information. Based on these information and on-site survey, we develop walking network data.
	＜Goals＞ Through the large-scale field operational test, we evaluate the effectiveness and acceptability (easy to understanding delivery method and information presentation to users' smartphone) of pedestrian transfer support system.

2． Milestones and Goals

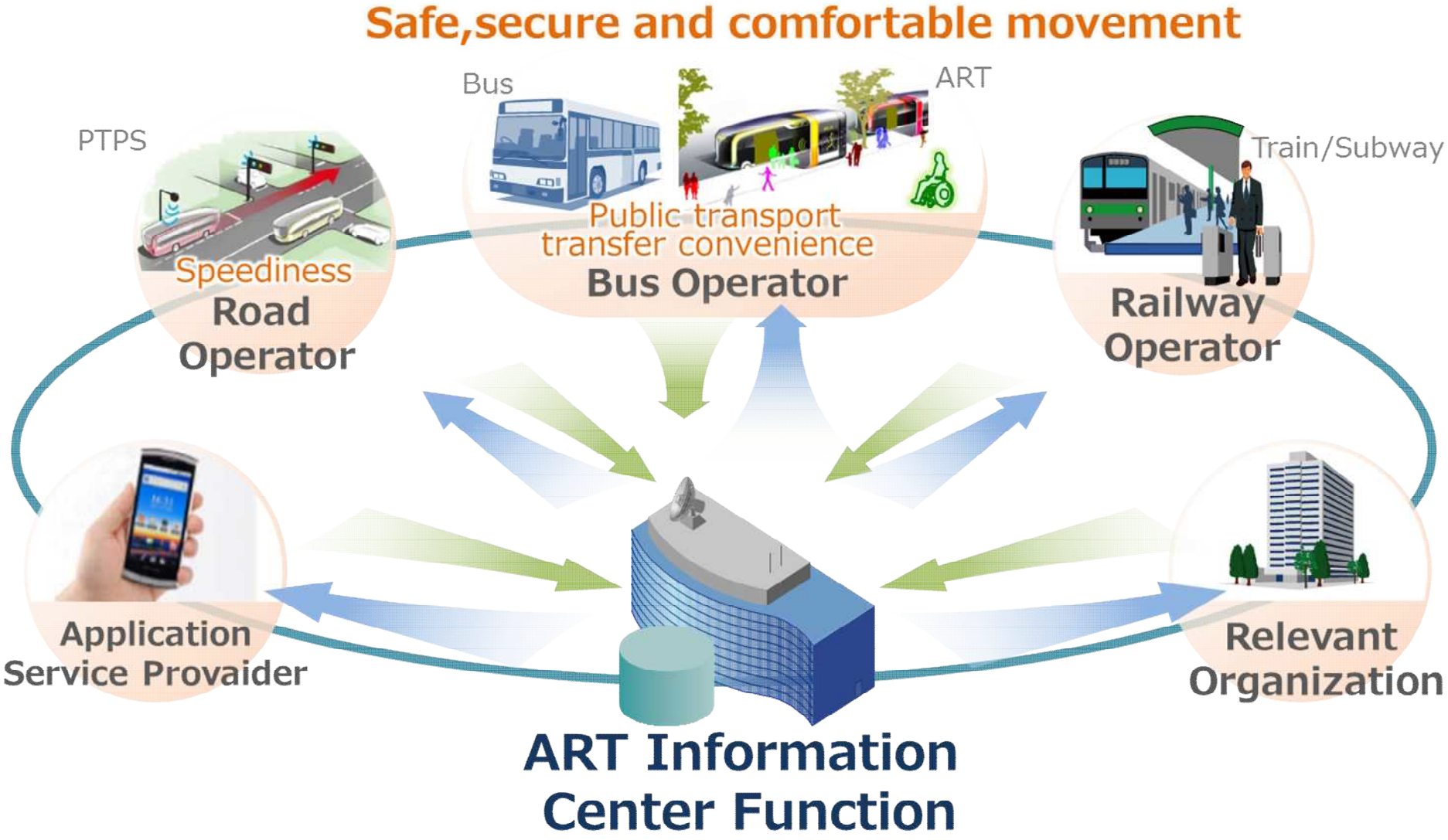
「c. Management of Field Operational Test」

Goals
＜Milestones＞ ・Support various arrangements including equipment procurement, planning, and stakeholder arrangement to conduct the field operational test and the demonstration event in FY 2018.
＜Goals＞ ・Complete the field operational test and the demonstration event at the Tokyo bay area without traffic accident. ・Raise people’s awareness of ART for fostering social acceptability through the test and the demonstration.

3． Achievement

Item a① Development on ART Information Center and its Verification Test

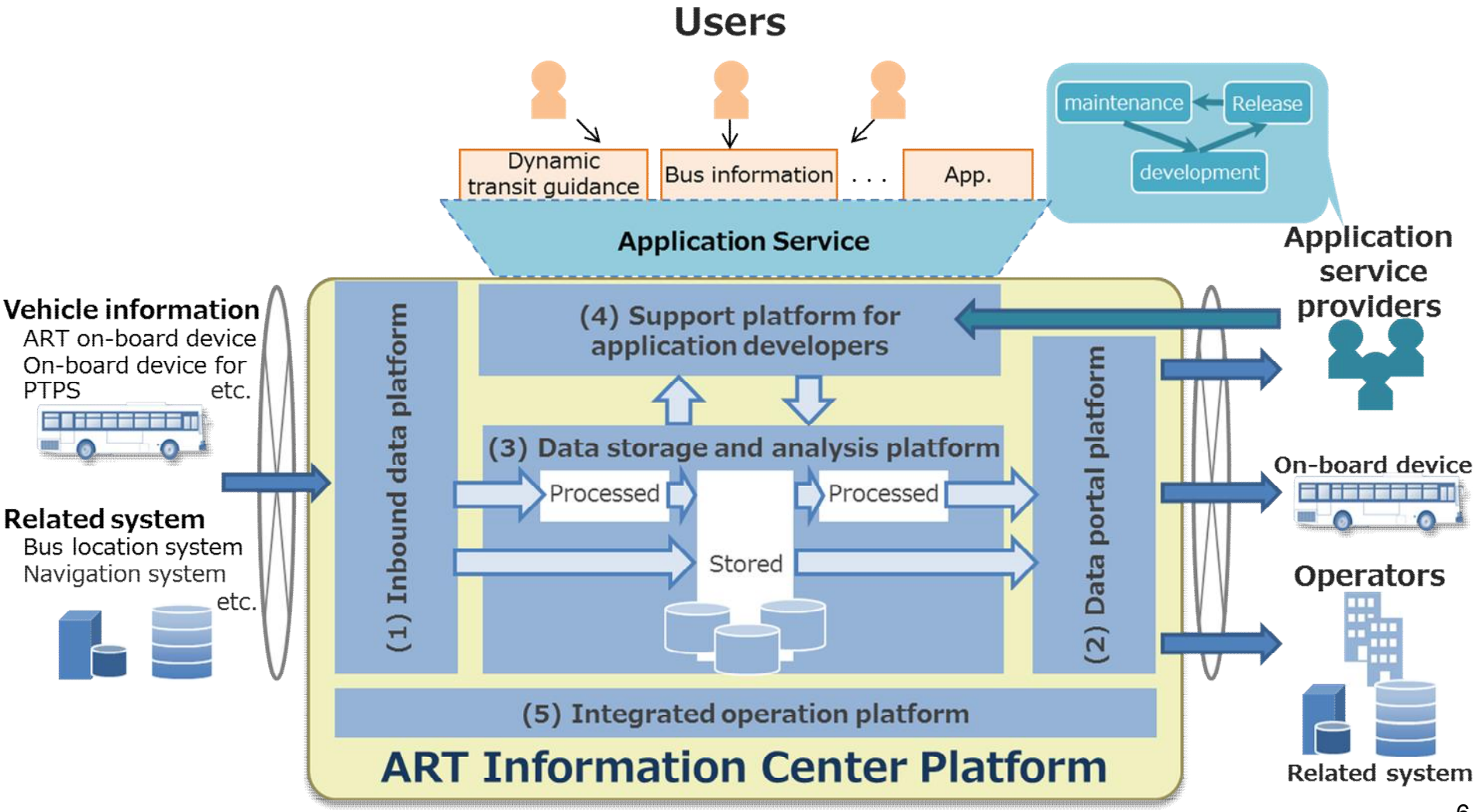
- An Advanced Rapid Transit (ART) information center is an open platform for the collection and utilization of information related to public transportation.



3． Achievement

Item a① Development on ART Information Center and its Verification Test

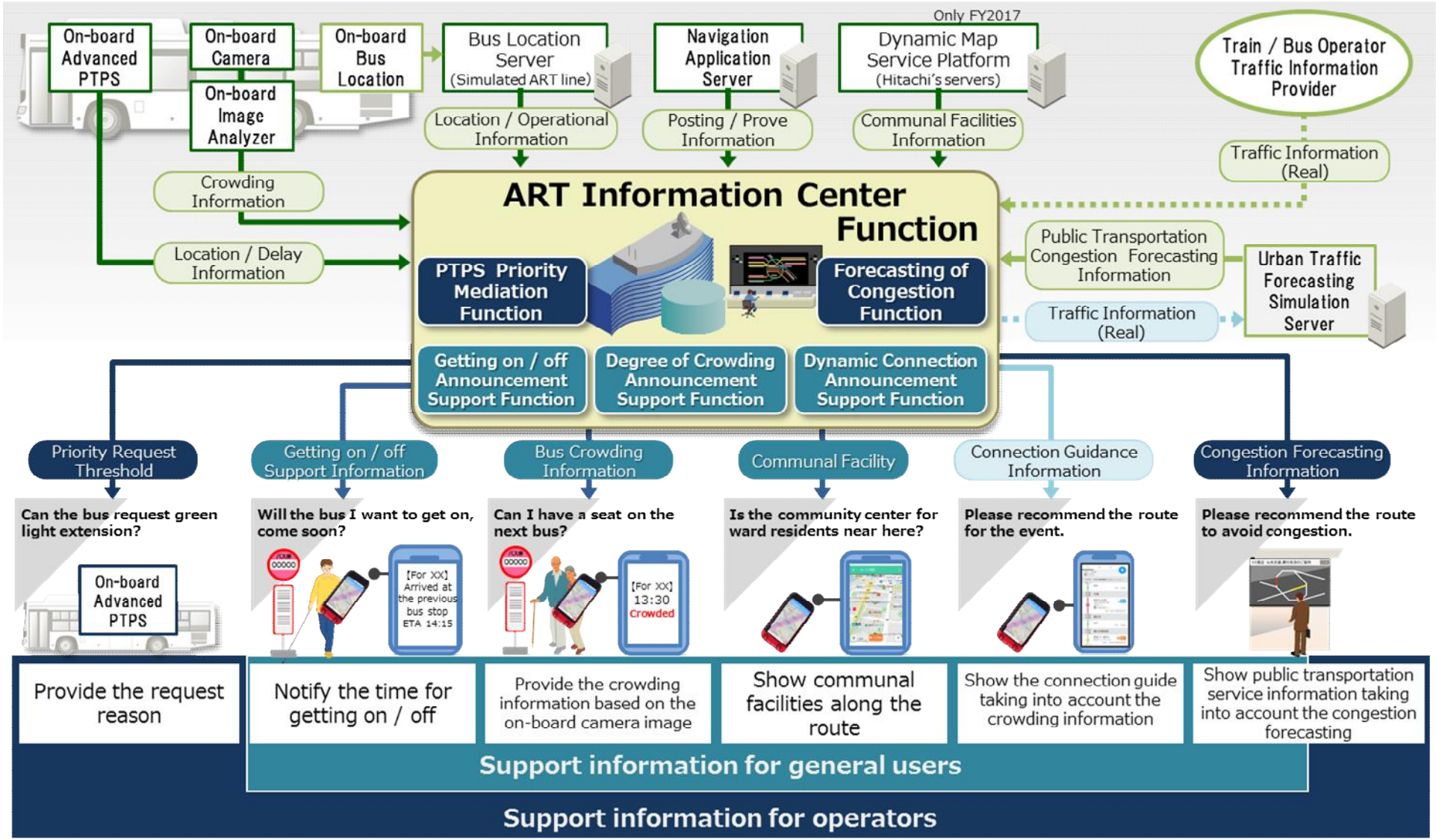
- The ART information center works as an open platform for collecting, refreshing, and sharing the traffic-related by the following five platforms.



3． Achievement

Item a① Development on ART Information Center and its Verification Test

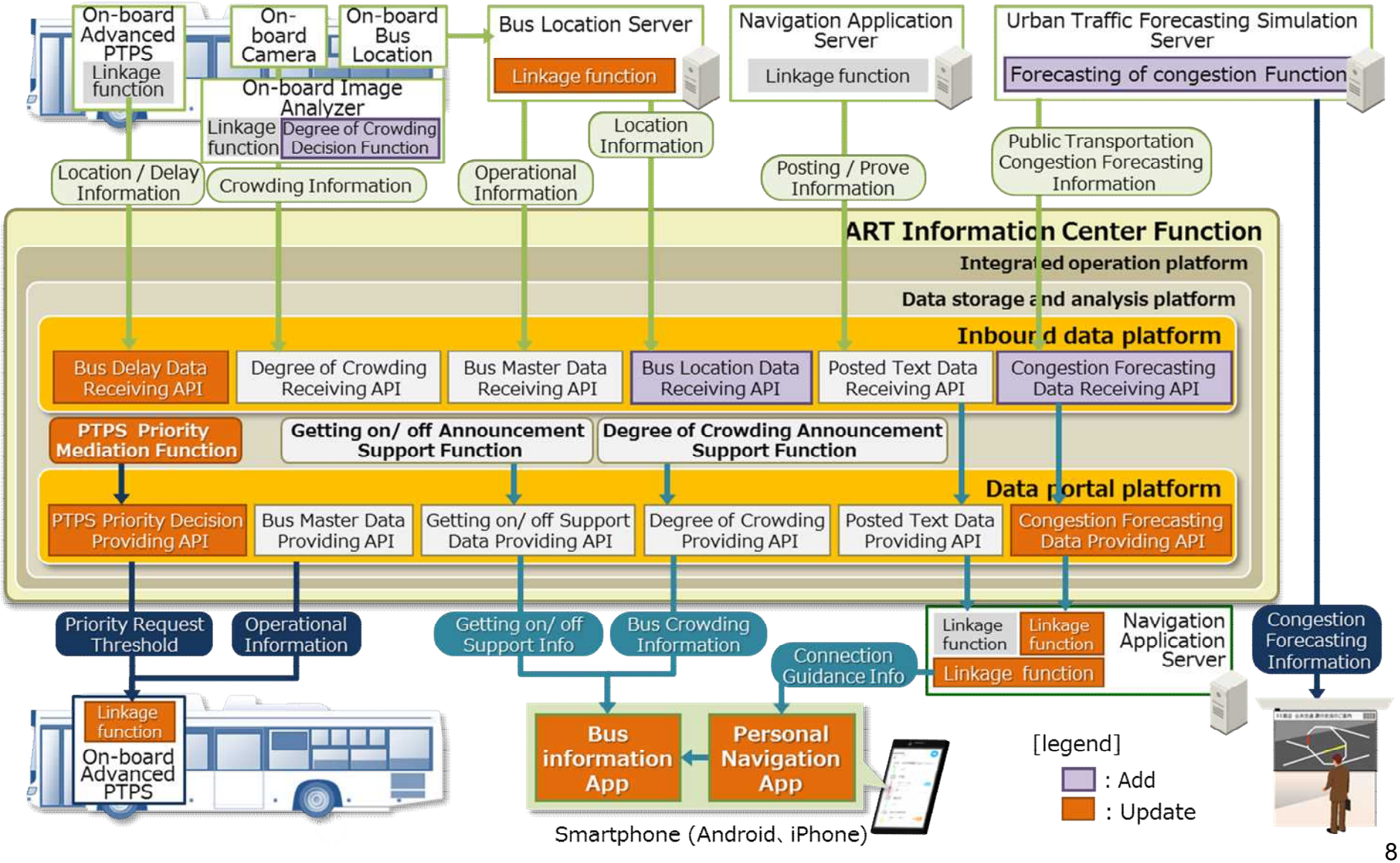
➢ Functions of the ART information center and information sharing services



3． Achievement

Item a① Development on ART Information Center and its Verification Test

➢ Functions evaluated in verification experiment



3． Achievement

Item a① Development on ART Information Center and its Verification Test

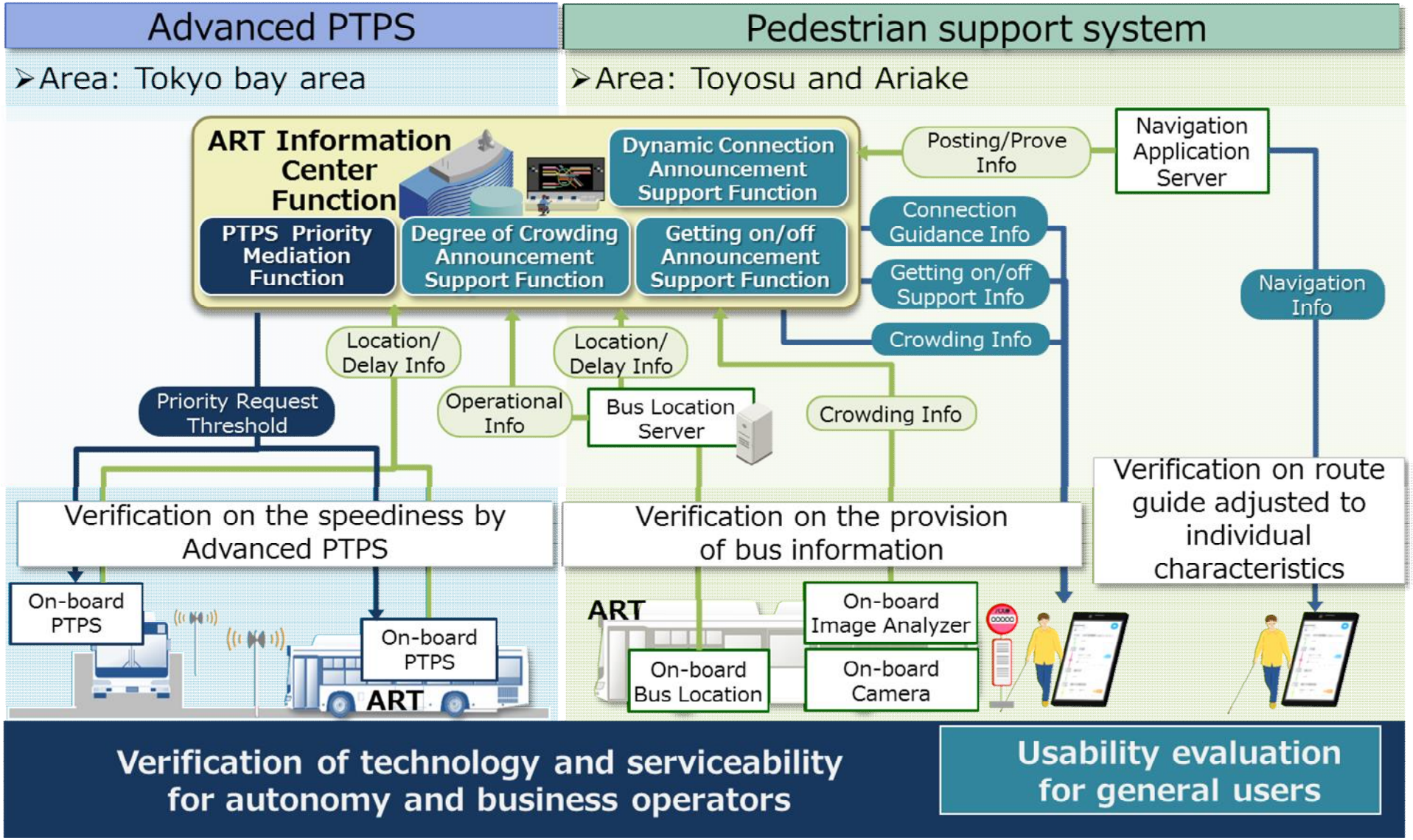
➢ Prototype API

Type	Prototype API	Information	Target Drvices and Systems
Inbound Data	Bus Master Data Receiving API	Bus Master Information (Timetable, Bus Stop, Vehicle Info)	Bus Location Server
	Bus Location Data Receiving API	Bus Location, Delay Information	Bus Location Server
	Bus Delay Data Receiving API	Bus Location, Delay Information	On-board Advanced PTPS
	Degree of Crowding Receiving API	Bus Crowding Information (Degree of Crowding etc.)	Bus inner Camera Image Analysis On-board Device
	Posted Text Data Receiving API	Collecting Application Posting Information	Navigation Application Server
	Congestion Forecasting Data Receiving API	Public Transportation Congestion Forecasting Information	Urban Traffic Forecasting Simulation Server
Data Portal	Bus Master Data Providing API	Management Info, Bus Stop , Timetable	On-board Advanced PTPS
	PTPS Priority Decision Providing API	Bus Crowding Information (Degree of Crowding) PTPS Control Information (Priority Request Threshold, Direction Info)	On-board Advanced PTPS
	Getting on/ off Support Data Providing API	Getting on/ off Support Information (Bus Stop, Delay)	Bus Information Application (Sample)
	Degree of Crowding Providing API	Crowdedness Information (Crowdedness Level)	Bus Information Application (Sample)
	Congestion Forecasting Data Providing API	Traffic Simulation Frediction Result Information	Navigation Application Server
	Posted Text Data Providing API	Information Collecting Application Posting Information	Navigation Application Server

3． Achievement

Item a① Development on ART Information Center and its Verification Test

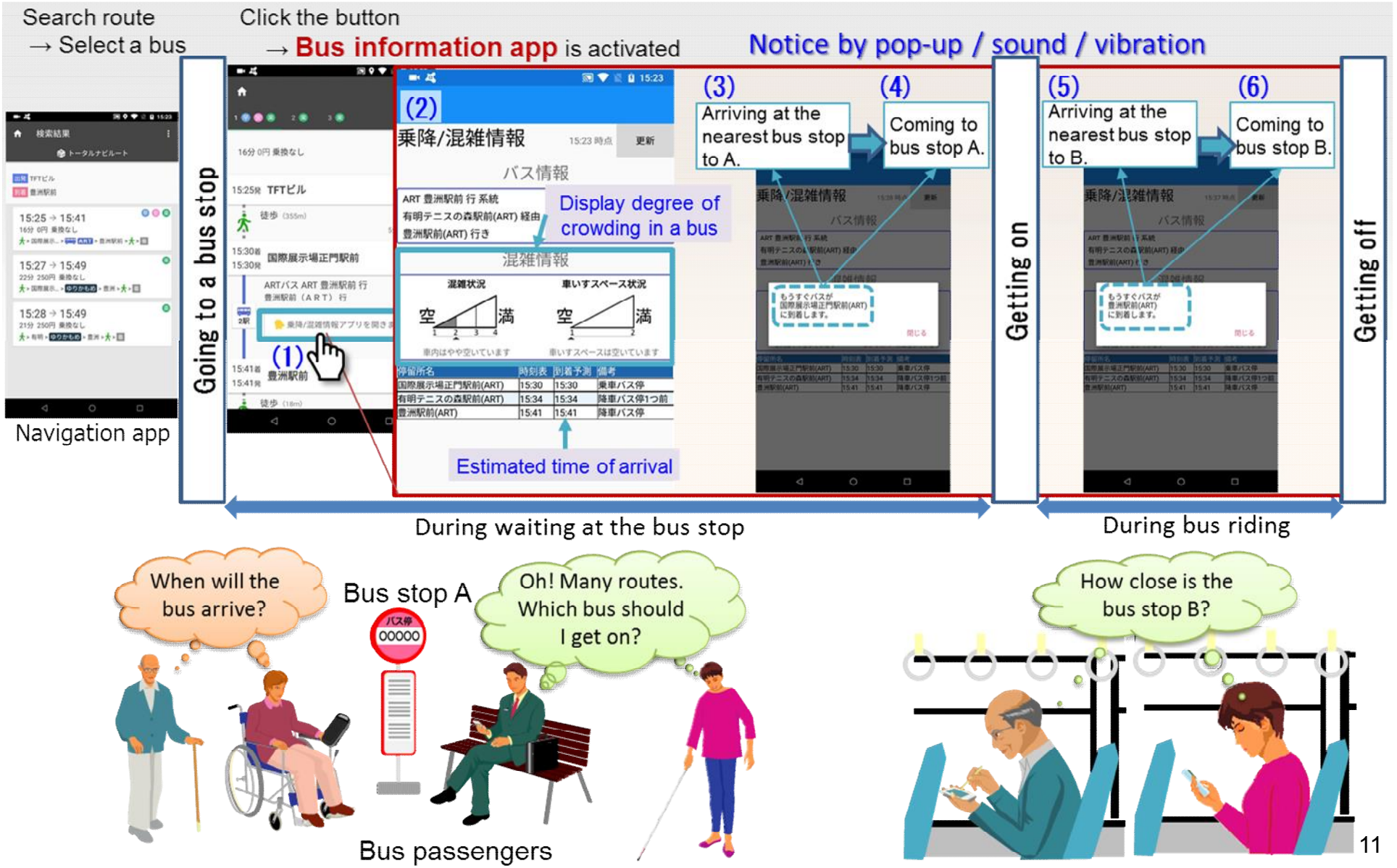
- Operation of the ART information center function in large-scale field operational test



3． Achievement

Item a① Development on ART Information Center and its Verification Test

- Outline and use scenarios of bus information provision service



3．Achievement

Item a① Development on ART Information Center and its Verification Test

■Conclusion

- The ART information center function provided “Advanced PTPS” and “Pedestrian transfer support system” with the following items in the large-scale field operational test.
  - For “Advanced PTPS”
    - PTPS priority mediation function was enhanced and verified.
  - For “Pedestrian transfer support system“
    - The getting on/off announcement support function and the degree of crowding announcement support function were enhanced and verified.
    - Transit guidance support function was developed and verified using the result of traffic forecast

■Action items toward social implementation (Technology)

- Establish the organization to operate ART information center
- Cooperate with related institutions and companies (data provided by transport operator, etc.)
- Discuss how to cooperate with related services such as MaaS

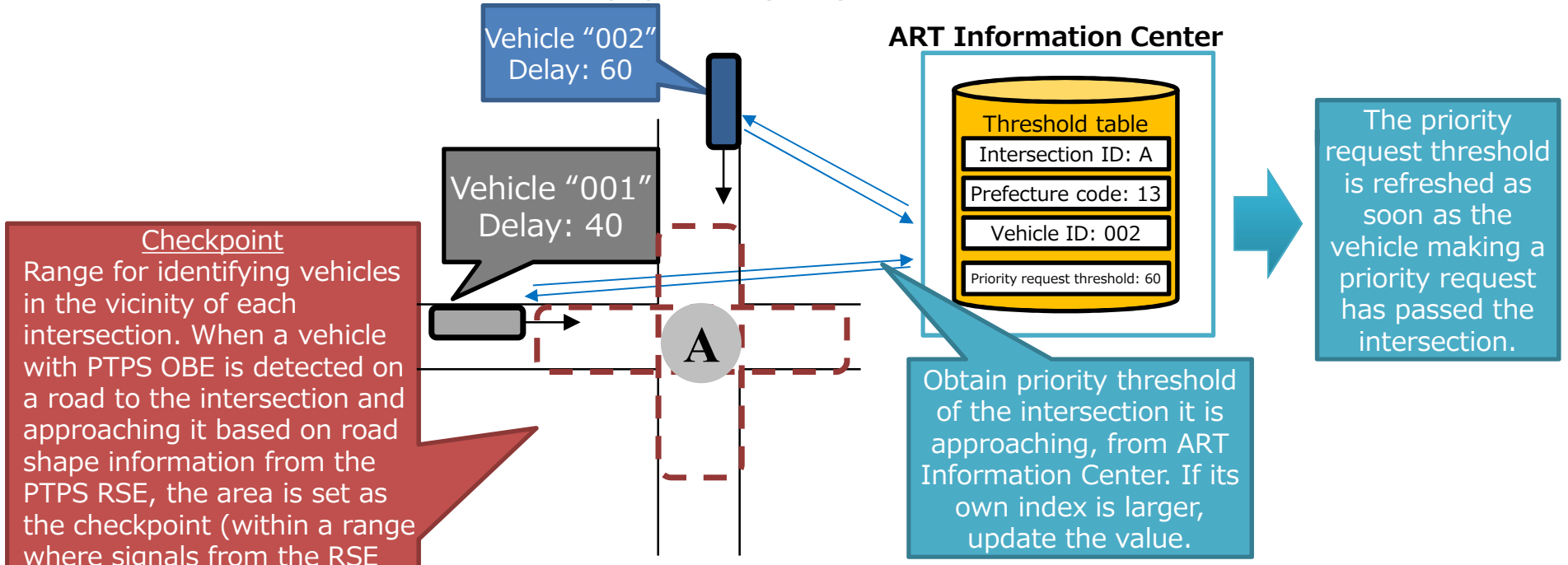
3． Achievement

Item a② Field Operational Test of Improving the Speediness of ART with Advanced PTPS

➢ Improvement in prioritization function

● **Improvement in the prioritization criteria of buses approaching an intersection simultaneously**

- Up to last fiscal year: The threshold for prioritization was calculated from data of all the buses on the network. Buses not in the vicinity could be included in prioritization.
- Improved method: The priority request threshold is calculated from data of the buses within an area 760 MHz band signals reach (checkpoint) using road shape information sent from the ITS wireless roadside equipment (RSE).



▲ **Overview of improved prioritization**

3． Achievement

Item a② Field Operational Test of Improving the Speediness of ART with Advanced PTPS

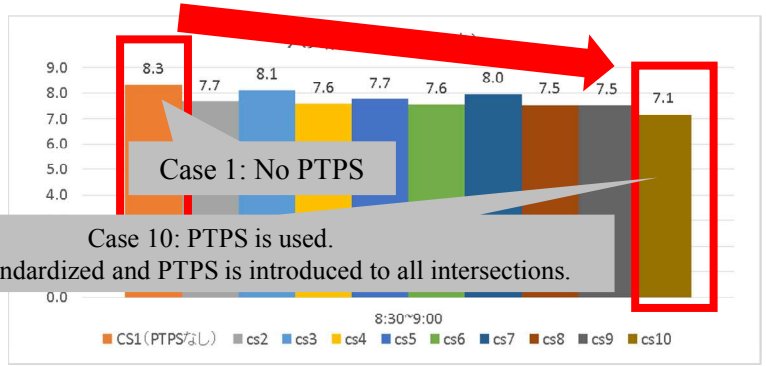
➢ Verifying the effect of introduction to Ring Road No. 2 (simulation)

● Effect verification on Ring Road No. 2 using Vissim, microscopic traffic simulation software

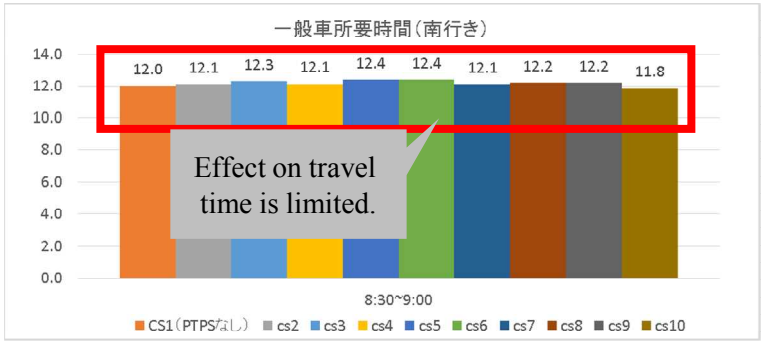
- Evaluated the effect using the PTPS settings used in the demonstration project and changing PTPS settings, signal cycle lengths and other conditions.
- Reduction in bus travel time can be improved (approx. 15%) from the demonstration project by finding conditions that allow network-wise prioritization, such as changing part of PTPS settings and standardizing signal cycle lengths.
- Under the conditions of this simulation, improvement in the travel time of general vehicles on Ring Road No. 2 will be limited. Further studies including other networks around Ring Road No. 2 is needed.

▼ Simulation case

No	PTPS settings				Signal cycle
	Beacon location	Green time extension / red time shortening	PTPS logic	Priority index	
1	No PTPS control				
2	Almost the same as the demonstration project		Conventional performance	None	No particular changes
3			All the vehicles are subject to prioritization (the same as last fiscal year)	Delay	
4			Improved prioritization (Only the buses in the vicinity of the intersection are subject to prioritization)	Delay	
5	Changed the virtual beacon locations in south-north direction at Toyosu Shijo guchi	Red time is shortened at Toyosu Shijo mae. PTPS control is introduced to Ariake Chuo-bashi Kita & Minami (green extended by 10 s).		Delay	
6				Congestion	
7				Delay x congestion	
8	Similar to Case 4	Red time is shortened at Toyosu Shijo mae.	Similar to Case 4		
9					
10		Similar to Cases 6 and 7			Standardize signal cycle lengths



▲ Changes in bus travel time (Northbound, 8:30-9:00)



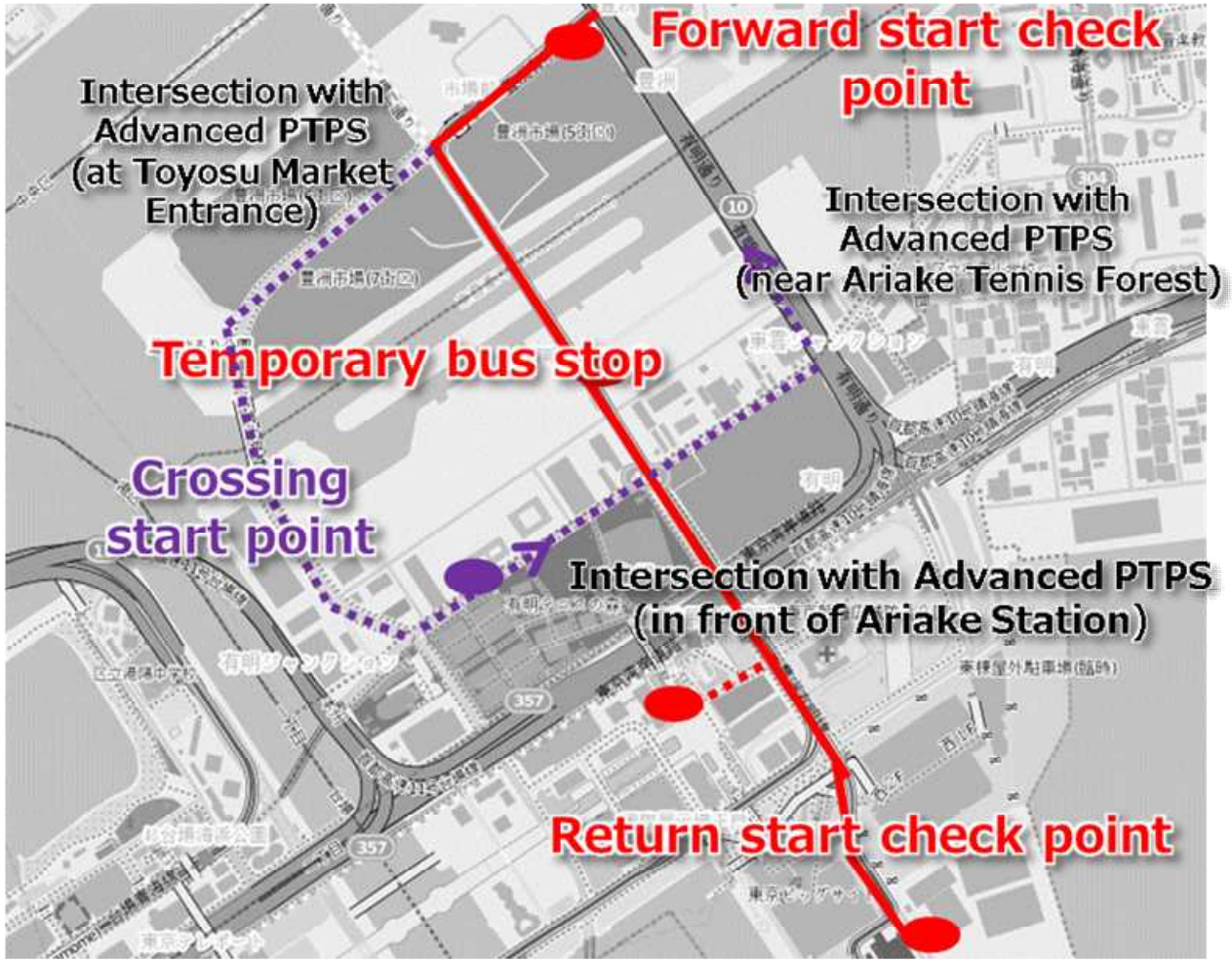
▲ Changes in general vehicle travel time (Southbound, 8:30-9:00)

3． Achievement

Item a② Field Operational Test of Improving the Speediness of ART with Advanced PTPS

➢ Effect verification

- Carried out effect verification for three days from November 27 to 29, 2018.
- Drove several times the route below passing 3 units of ITS wireless RSE on Ring Road No. 2 and acquired data.



▲ Driving route for effect verification

3． Achievement

Item a② Field Operational Test of Improving the Speediness of ART with Advanced PTPS

➢ Result of effect verification

● A bus stop is close to an intersection:

- Two types of PTPS OBE were used; those with GPS and map matching only and with GPS, map matching and dead reckoning based on vehicle speed information. About lat-long information at the same point, the former had accuracy of 6 m in radius and the latter had a maximum error of over 30 m between two points.
- Some of the latter OBE detected that the bus passed a virtual beacon while it was stopped at a bus stop. When that is the case, virtual beacon locations have to be chosen carefully, based on the accuracy of OBE's position information.

● Buses approach from cross directions simultaneously:

Confirmed that improved prioritization works properly and adequately in the patterns below.

Pattern	Result
1． Prioritization is not used and buses are close to each other.	Both buses make a priority request and priority is given to one passing the first virtual beacon earlier.
2． Prioritization is used and buses are close to each other.	Priority is given to a bus with more passengers and longer delay.
3． Prioritization is used and buses are not close to each other (this was added as part of this fiscal year's improvement)	As two buses are not close to each other, prioritization is not required and one reaching the intersection is given priority.

● Verification of the effect on bus operation

Confirmed that introduction of PTPS shortens the travel time by about 10%.

	Number of runs	No. of runs with PTPS operated or not		Drive time (sec)		PTPS operation
	-	PTPS not operated	PTPS operated	PTPS not operated	PTPS operated	Mean green time extension (sec)
Outward	36	18	18	566	519	5.6
Return	40	31	9	391	338	6.4

3． Achievement

Item a② Field Operational Test of Improving the Speediness of ART with Advanced PTPS

➢ Result of effect verification

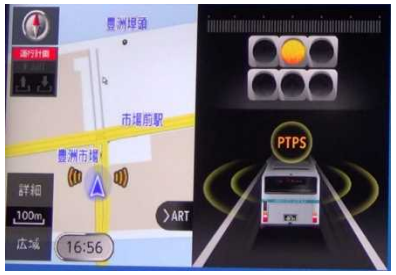
● **Assistance for buses departing and arriving at a terminal and for drivers in passing an intersection**

- Confirmed that providing a bus stopped at a terminal with the color information of the traffic lights at the terminal exit can assist in timing bus departure. It helps a bus depart without being stopped by the signal at the exit.

▲ Assistance for buses departing and arriving at a terminal

● **HMI verification**

- Confirmed that all the display functions, including the assistance in signal passage using the signal information from ITS wireless RSE, work properly.



▲Display of signal phase (yellow)

▲Display of signal phase (red)

▲Display of signal phase (green)

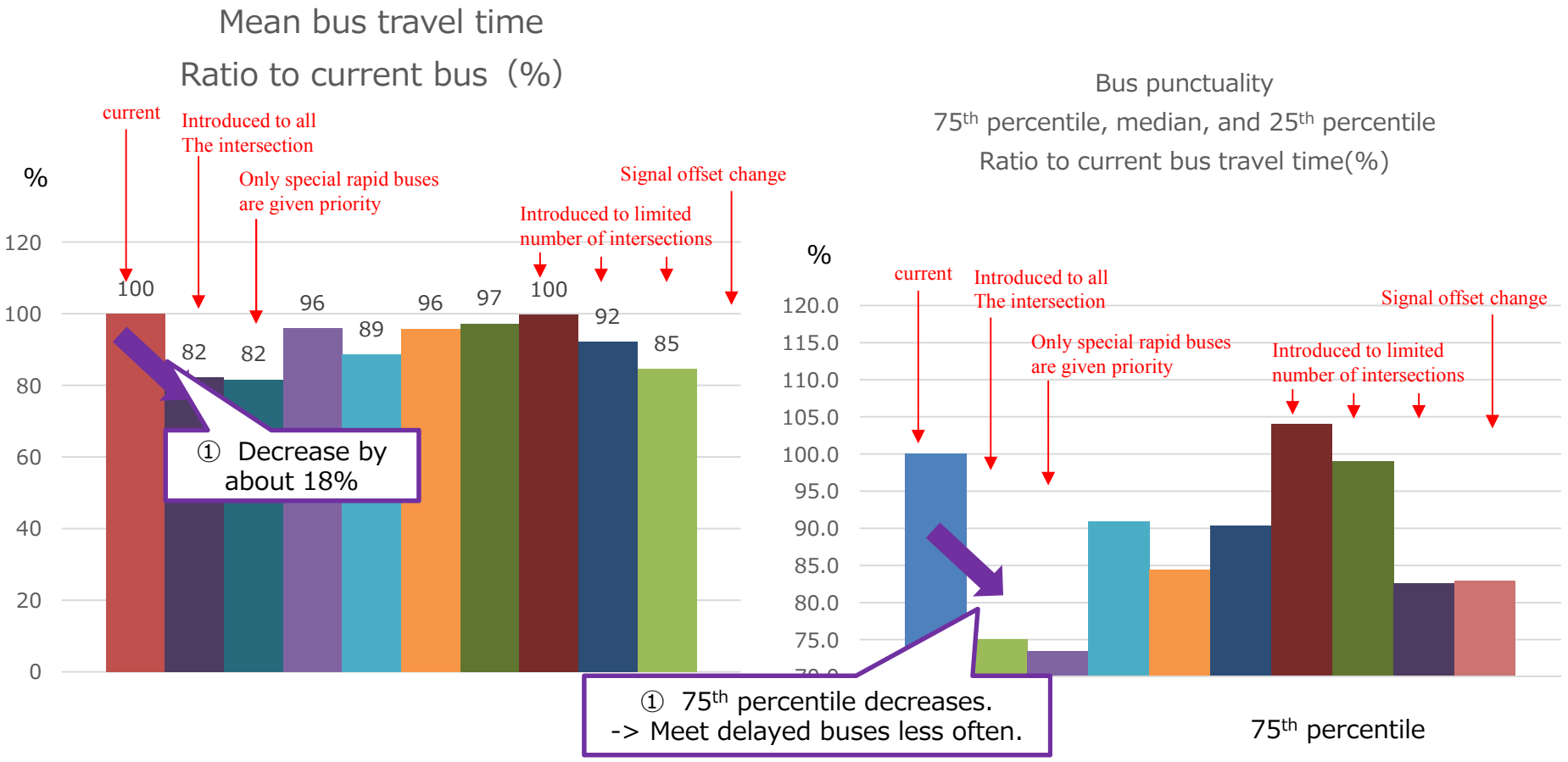
▲Red lights can be avoided by keeping speed

3． Achievement

Item a② Field operational test of improving the speediness of ART with advanced PTPS

➢ Simulation evaluations in other cities

- We chose two cities based on past surveys and evaluated by simulation the effect of the introduction of advanced PTPS to the bus lines in those cities.



▲ Example of evaluation result by simulation

3．Achievement

Item a② Field Operational Test of Improving the Speediness of ART with Advanced PTPS

■Conclusion

- The prioritization function of Advanced PTPS OBE was improved based on the result of preliminary test in FY 2017.
- The effect of introduction of Advanced PTPS through the field experiment on Ring Road No.2 where 3 ITS wireless RSE were introduced was verified, and it was confirmed that Advanced PTPS has possibilities to reduce travel time of public bus.
- The impact assessment of introduction of Advanced PTPS to the bus lines in Ring Road No.2 and 2 cities using microscopic traffic simulation was carried out.
- To introduce Advanced PTPS, it is necessary to grasp the needs and issues of local governments and to quantify the impact of Advanced PTPS using the traffic simulation before its introduction.

■Issues toward Social Implementation (Technology)

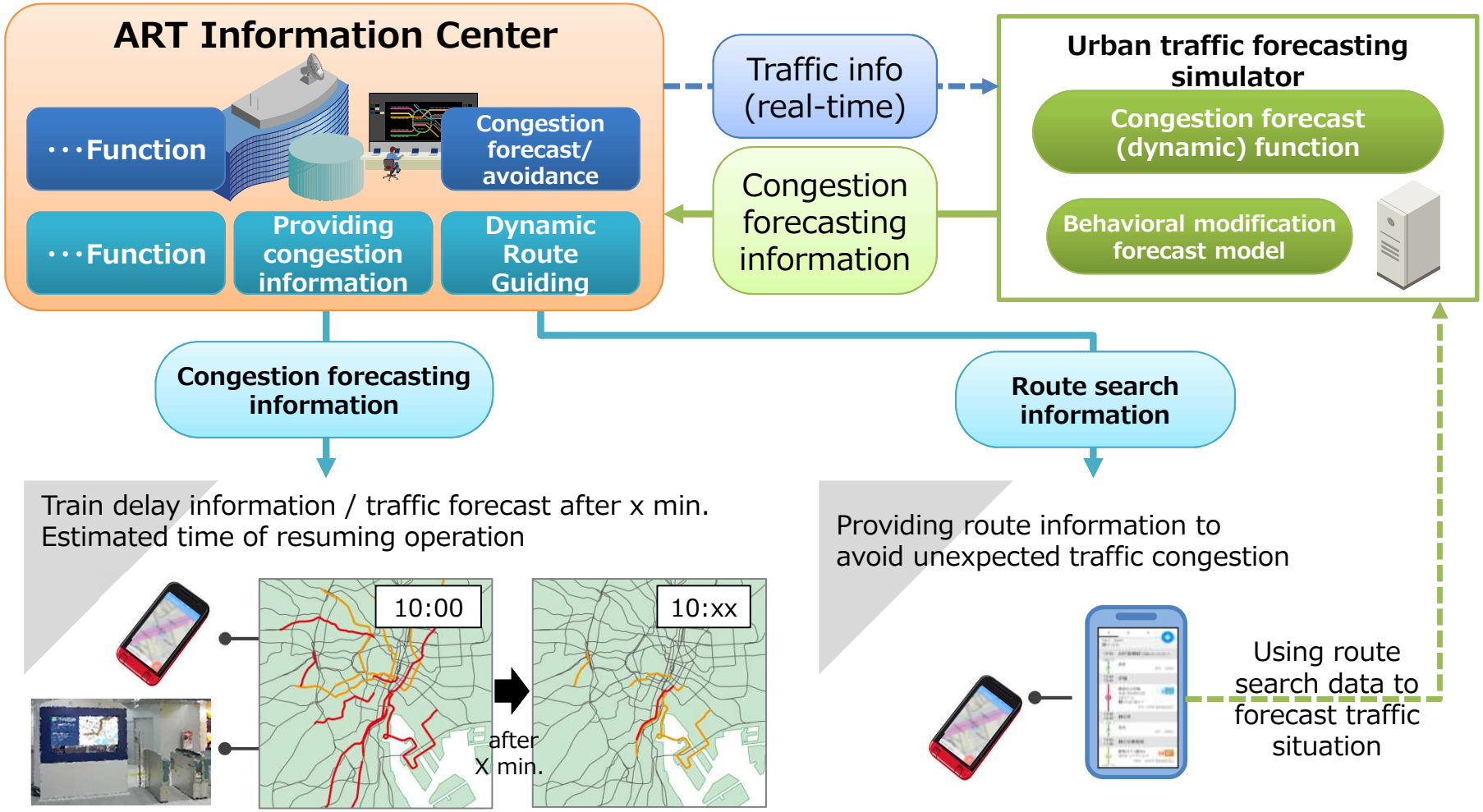
- It is important to consider the bus prioritization measures comprehensively not only introducing Advanced PTPS but also optimizing traffic signal settings (e.g. cycle length or offset) or introducing bus dedicated lane.
- It is also necessary to present the superiority of Advanced PTPS compared with conventional technology from both aspects of service level and cost.

3．Achievement

Item a③ Investigation of Measures of Traffic Congestion Forecasting and Guiding to Avoid Congestion, Demonstration Experiment

■Outline of traffic congestion forecasting and guiding to avoid congestion

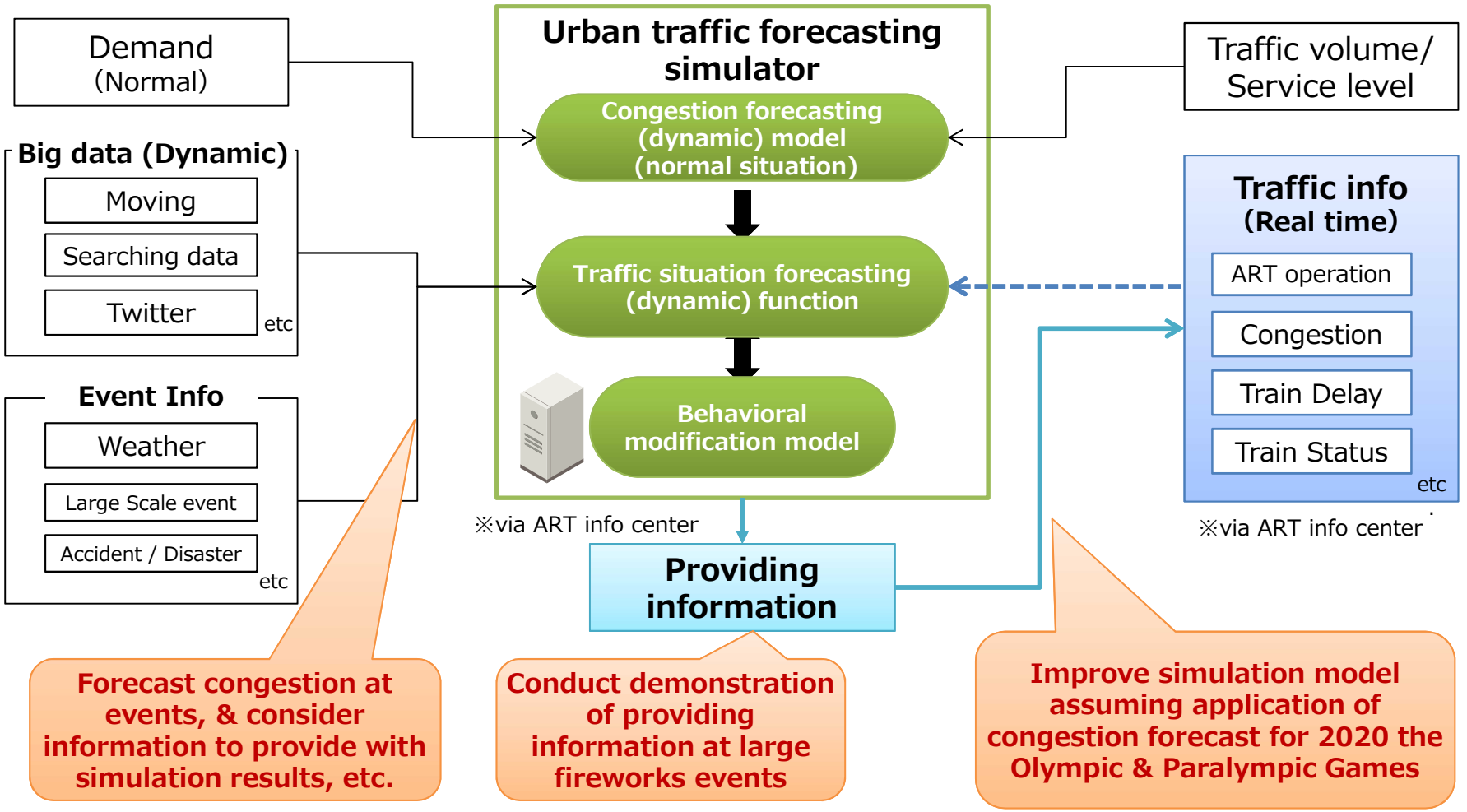
- Guiding to avoid traffic congestion based on the behavioral modification process, providing the appreciate information depending on the individual attribute and situation as well as conducting dynamic congestion forecasting in cooperation with ART Info. Center.



3. Achievement

Item a③ Investigation of Measures of Traffic Congestion Forecasting and Guiding to Avoid Congestion, Demonstration Experiment

- In FY 2018, we planned to conduct a demonstrative experiment.
- Simulated traffic situation using traffic simulator (applying agent modelling), integrated with behavioral modification based on the information provided.



3．Achievement

Item a③ Investigation of Measures of Traffic Congestion Forecasting and Guiding to Avoid Congestion, Demonstration Experiment

■Outline of FY2018 demonstrative experiment

- This FY, demonstrative experiments will be conducted at fireworks events in Sumida River and Jingu Gaien
  - Conducted survey of the smartphone app users

- At the experiments, assuming the demand at the event, forecast congestions mainly for railways. Based on the forecast results, what information to be provided at the demonstrative experiments will be considered.
  - At Sumida River fireworks, preliminary simulation of providing information
  - At Jingu Gaien fireworks, conduct ex-post simulation of validation

■Events for Demonstration Experiment

Event	Date	Navigation Service Providers
Sumida River Fireworks	July 29 (Sun), 2018 19:00～20:30 ※postponed due to rain	NAVITIME JAPAN Co., Ltd. Yahoo Japan Corporation
Jingu Gaien Fireworks	August 11th , 2018 (Sat) 19:30～20:30	Yahoo Japan Corporation

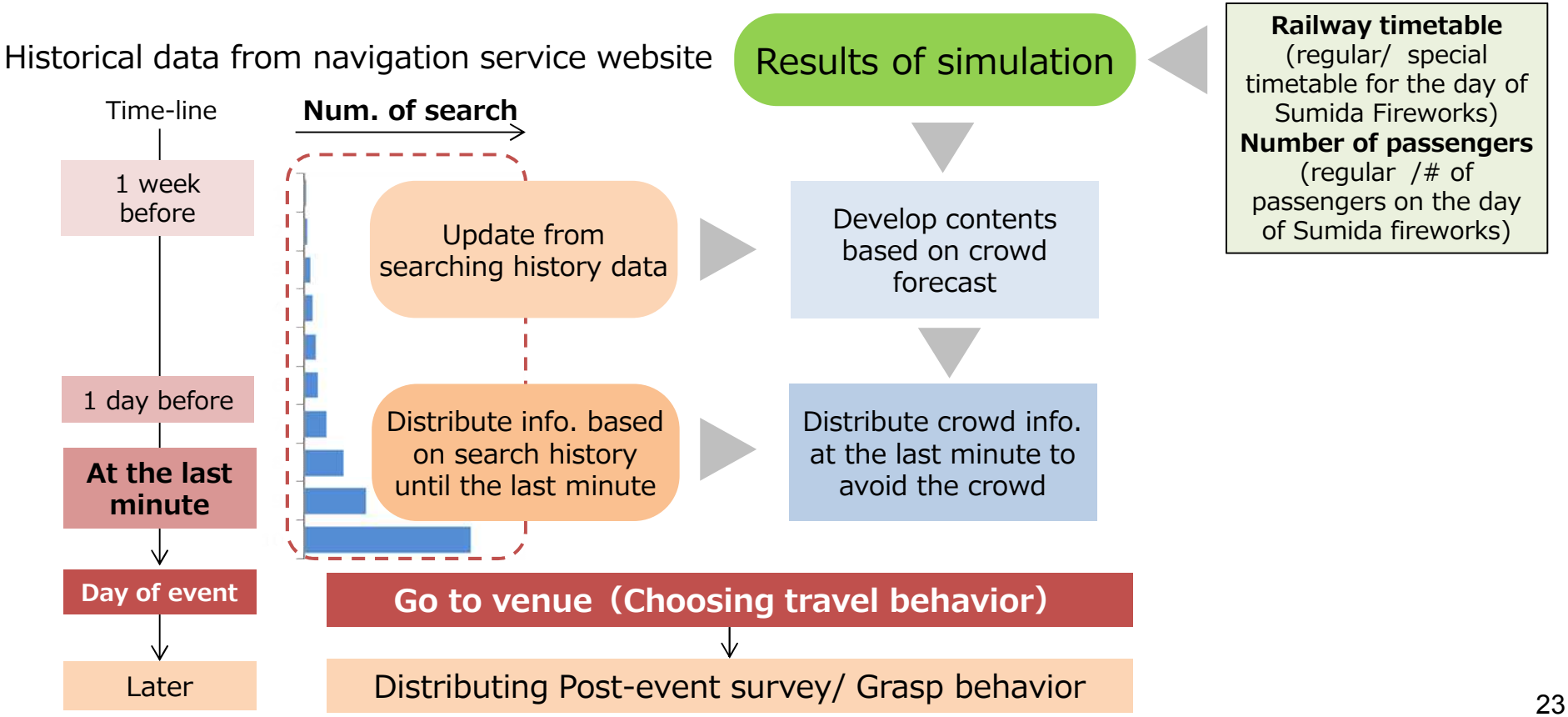
3．Achievement

Item a③ Investigation of Measures of Traffic Congestion Forecasting and Guiding to Avoid Congestion, Demonstration Experiment

■Providing information at the Demonstration Experiment

- Based on simulation results, forecast crowd at train stations with route search data until right before the events, develop contents of information for expected visitors to avoid the crowd
- Provide information (push notification or PN) to expected visitors via smartphone apps in advance, to avoid congestion

  ⇒At Sumida River, sent PN on the day of event, to thousands of expected visitors (20-30% opened), At Jingu Gaien fireworks, sent PN the day before to about 500 expected visitors



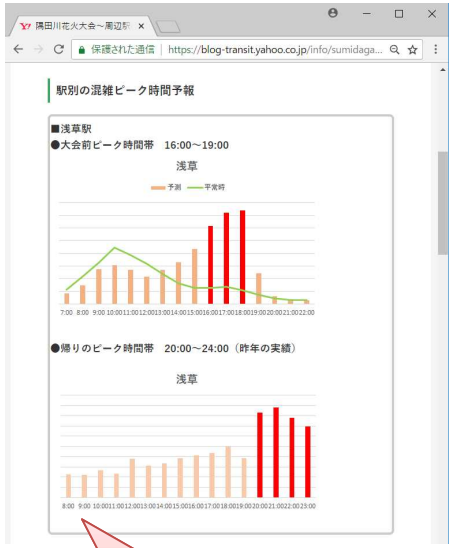
3．Achievement

Item a③ Investigation of Measures of Traffic Congestion Forecasting and Guiding to Avoid Congestion, Demonstration Experiment

■Providing information at the demonstrative experiment

- Congestion forecast: A message that congestion is expected due to the event, provide info. of real-time congestion (by hour/station)
- Congestion avoidance: Advise to avoid congestion such as “Come early,” “Avoid the nearest station and use another one,” “Choose the station with smaller crowd, not the nearest route,” etc.

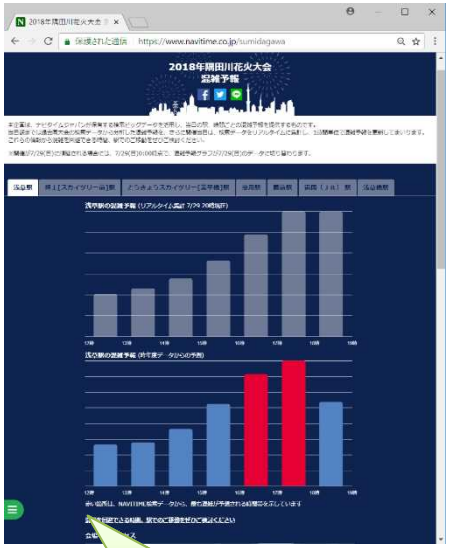
Information from Yahoo Japan

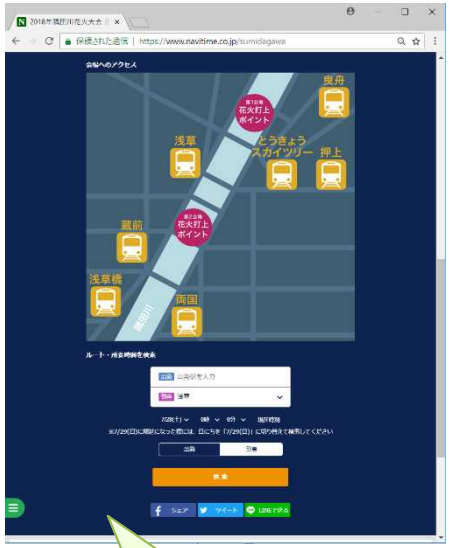


Blog recommending congestion avoidance (congestion forecast)

Real-time congestion forecast based on route search history

Information from NAVITIME





Real-time congestion forecast based on route search history

Re-route format to avoid congestion

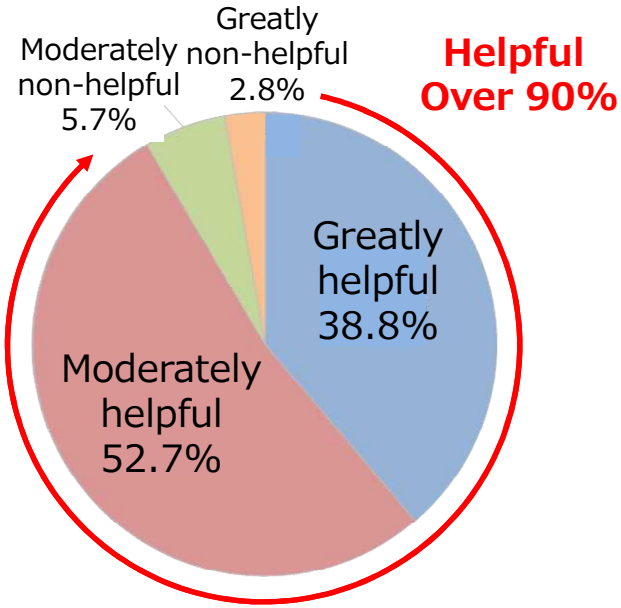
3．Achievement

Item a③ Investigation of Measures of Traffic Congestion Forecasting and Guiding to Avoid Congestion, Demonstration Experiment

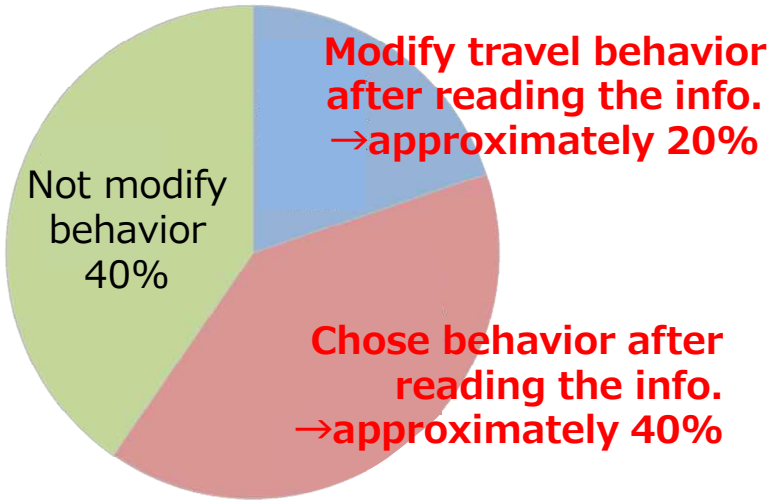
■Results of survey for application users

- Among the respondents who read the information (blog), about 90% found it “useful”
- Among the respondents who read the info. (blog) said, found info. Provided useful since 20% of respondents “re-routed from the original route,” 40% of said, “chose the route after reading it”
- Some of the answers are: “Arrived earlier,” “Changed the station to get off,” “Took a different railway line”

■Was the information you received before firework helpful for you?



■Did the information provided affect how to get the venue? Choose one. (n=344)



(Sample)
Among the survey respondents (N=9,998) through the link on the Yahoo! Transit app after the Sumida River Fireworks, those who viewed the Information site (blog)(N=577, *including those who did not go to Sumida River Fireworks), and those who visited Sumida River Firework and viewed the Information site (blog) (N=344) were calculated.

3．Achievement

Item a③ Investigation of Measures of Traffic Congestion Forecasting and Guiding to Avoid Congestion, Demonstration Experiment

■Results of simulation

- Subway to Shibuya, the number of passengers reached its peak at Gaienmae Station about 3 hrs before the event between 16:00 and 17:00, and after 20:00.
- Case with information provided (30% of visitors who leave between 20:30 and 21:30, left 1hr later), congestion between 20:00 and 21:00 decreased 7%, and increased 2% in 2100, 13% in 2200.

⇒If 30% of visitors change time, peak-time passengers decrease about 10% (congestion reduced)

【CASE1】with visitors' travel demand, without providing information (and visitors' travel change)

(Tokyo Metro Ginza line; bound for Shibuya station)

Bound for Shibuya		Time [hour]																			
		5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Ginza Line	Tameike-sanno	16%	14%	15%	20%	39%	47%	57%	69%	73%	80%	95%	114%	94%	75%	58%	67%				
	Akasaka-mitsuke	16%	12%	12%	16%	30%	38%	48%	58%	65%	71%	88%	110%	90%	74%	55%	65%				
	Aoyama-itchome	17%	12%	10%	14%	24%	33%	43%	52%	60%	69%	91%	114%	96%	81%	55%	65%				
	Gaienmae	17%	11%	10%	14%	23%	35%	45%	54%	63%	71%	94%	125%	102%	83%	57%	70%	4%	54%	46%	3%
	Omote-sando	17%	10%	8%	12%							80%	94%	67%	56%	55%	119%	98%	71%	57%	4%
	Shibuya	16%	12%	8%	15%							91%	114%	96%	78%	74%	147%	134%	86%	84%	12%

Peak at end of firework

Peak 3 hours before fireworks start

【CASE2】with visitors' travel demand, with providing information and 30% visitors' travel change

(Tokyo Metro Ginza line; bound for Shibuya station)

Bound for Shibuya		Time [hour]																			
		5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Ginza Line	Tameike-sanno	16%	14%	15%	20%	39%	47%	57%	69%	73%	80%	95%	114%	94%	75%	58%	67%	59%	55%	43%	2%
	Akasaka-mitsuke	16%	12%	12%	16%	30%	38%	48%	58%	65%	71%	88%	110%	90%	74%	55%	65%				
	Aoyama-itchome	17%	12%	10%	14%	24%	33%	43%	52%	60%	69%	91%	114%	96%	81%	55%	65%				
	Gaienmae	17%	11%	10%	14%	23%	35%	45%	54%	63%	71%	94%	125%	102%	83%	57%	69%	6	55%	46%	3%
	Omote-sando	17%	10%	8%	12%	21%	32%	43%	56%	63%	70%	80%	94%	67%	56%	55%	109%	103%	78%	57%	4%
	Shibuya	16%	12%	8%	15%	25%	35%	43%	60%	68%	76%	91%	114%	96%	78%	74%	136%	136%	97%	84%	12%

Passengers decreased 10%

3．Achievement

Item a③ Investigation of Measures of Traffic Congestion Forecasting and Guiding to Avoid Congestion, Demonstration Experiment

■Conclusion

- Based on simulation results, forecast crowd at train stations with route search data until right before the events, develop contents of information for expected visitors to avoid the crowd

■Toward Full Implementation for the Olympic & Paralympic Games

- The Organizing Committee operates the transport center manages overall transport. With the data from the Tokyo Metro etc., it simulates traffic forecast, develop the heat island map, and geodesic congestion forecast.
- Based on the above, it assumes framework which carries information provision through existing application services.

■Issues toward Social Implementation (Technologies)

- With the improved simulation model (structure, parameters, etc.), measures including inflow control, transport behavior will be appropriately evaluated.
- Establish organization structure for information provision in cooperation with related organizations (data provided by transport operator, etc.),
- Develop better transport environment for applying on daily traffic congestions as a legacy after the Games.

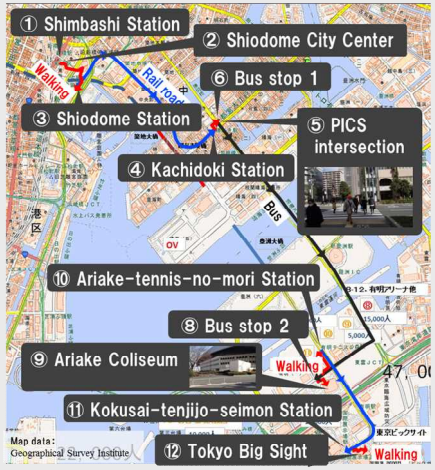
3． Achievement

Item a④ Pedestrian Transfer Support System

➢ Outline of demonstration experiences experiments between 2015 and -2017

FY 2015

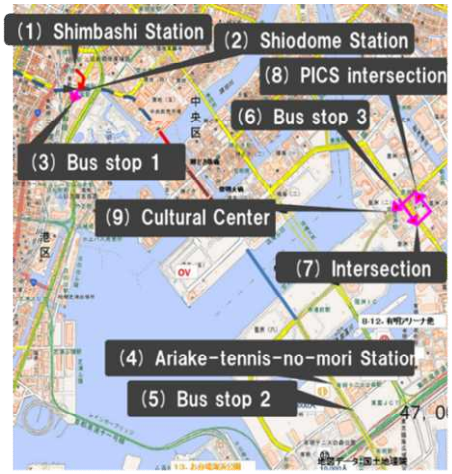
Basic research and study



- Basic research of necessary info for moving (Rail/Bus/Walking, indoor/outdoor/inside facilities)
- Demonstration Experiment of route guidance targeted to lead users with high IT-Literacy

FY 2016

Study and evaluation of necessary info for moving and its use cases



- Study of necessary info for moving and method to collect data
- Evaluation of route guidance adjusted to individual characteristics

FY 2017

Experience to collect necessary info with data collection app

- Experiment to collect necessary info for moving with data collection app
  - Posting of barrier/barrier-free info
  - Collection of GNSS tracking data
- Intersection crossing with cooperation with Advanced PICS

3．Achievement

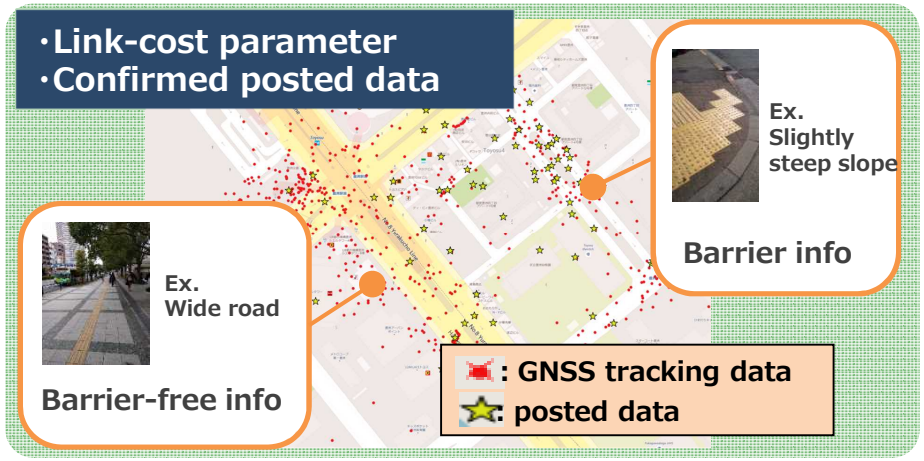
Item a④ Pedestrian Transfer Support System

- Development of personal-navigation app utilizing network(NW) data for pedestrians and link-cost parameter

Implemented in FY 2017

+

Implemented in FY 2018



Implemented in FY 2018

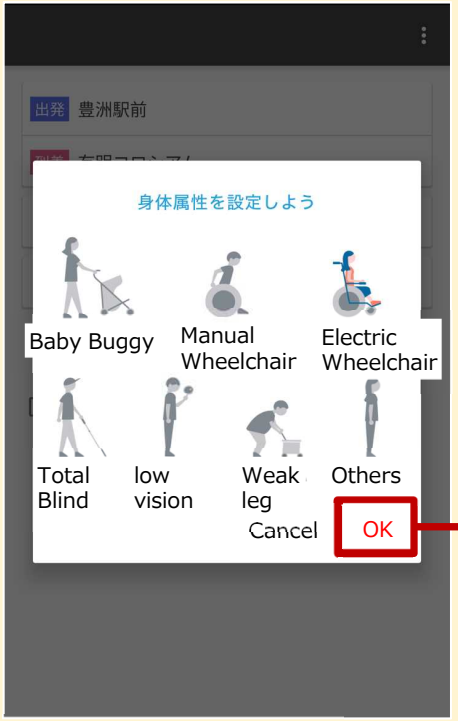
3．Achievement

Item a④ Pedestrian Transfer Support System

➢ Prototyping of personal navigation application

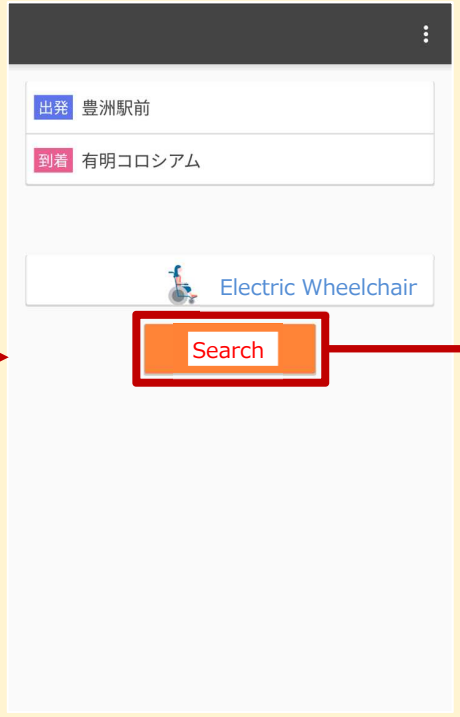
Setting physical attributes and route search

Set physical attributes



・Manual wheelchair
・Electric wheelchair
・Total blind ・Low vision
・Weak leg ・Baby Buggy
・Others

Route search



Enter departure place and destination

Display results of retrieval

3．Achievement

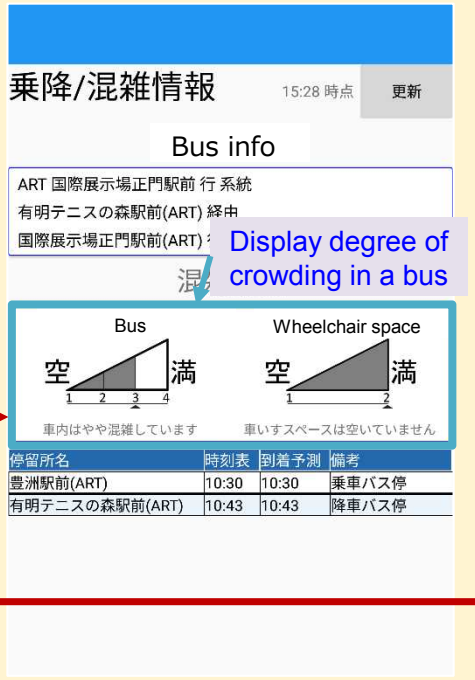
Item a④ Pedestrian Transfer Support System

➢ Prototyping of personal navigation application

Providing bus related info and route guidance corresponding to individual characteristics

Transit guidance info

Providing bus(ART) related info



- Notify “getting on/off time” of ART
- Provide the crowding info
- Notify “arrival time” estimated by the actual ART data

Route guidance corresponding to individual characteristics

3．Achievement

Item a④ Pedestrian Transfer Support System

➢ Prototyping of personal navigation application

Routes corresponding to individual characteristics utilizing link-cost parameters

Conventional navigation route

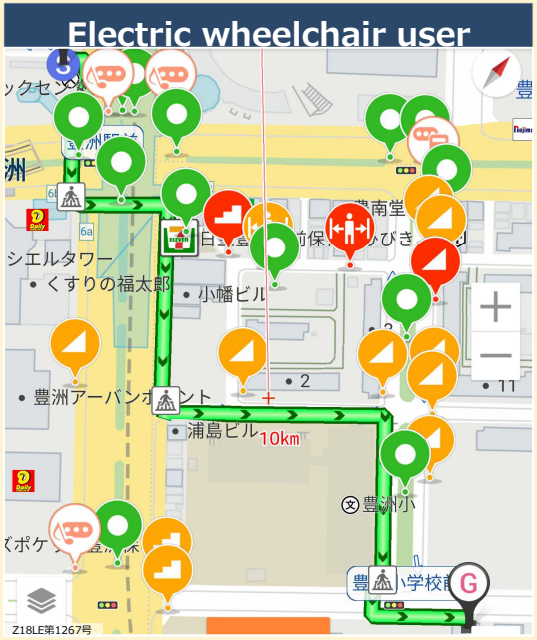
＋

Link-cost parameters reflected

- Barrier/barrier-free info
- GNSS tracking data corresponding to individual characteristics

Personal navigation route

Electric wheelchair user



・Route to avoid steps
・Route with many traffic results

Visually impaired people

・Priority to a acoustic signal/escort zone
・Route with studded paving block
・Straight route

3．Achievement

Item a④ Pedestrian Transfer Support System

➢ Large-scale field operational test

Date : From October 1 to November 7, 2018 (Rehearsal: October 1)

Target area: Toyosu, Ariake

Participants: 21 persons (wheelchair 6, elderly persons 3,total blind 5, low vision 3, Baby buggy 4)

Staffs／ Inspectors (total number of people): 218／26

Usefulness evaluation of bus info provision service providing transit guidance service

Route guidance corresponding to individual characteristics

1 **Toyosu station**

Bus / Rail road / ART

Walking

2 **Ariake coliseum (watching games)**

Bus / Rail road / Walking

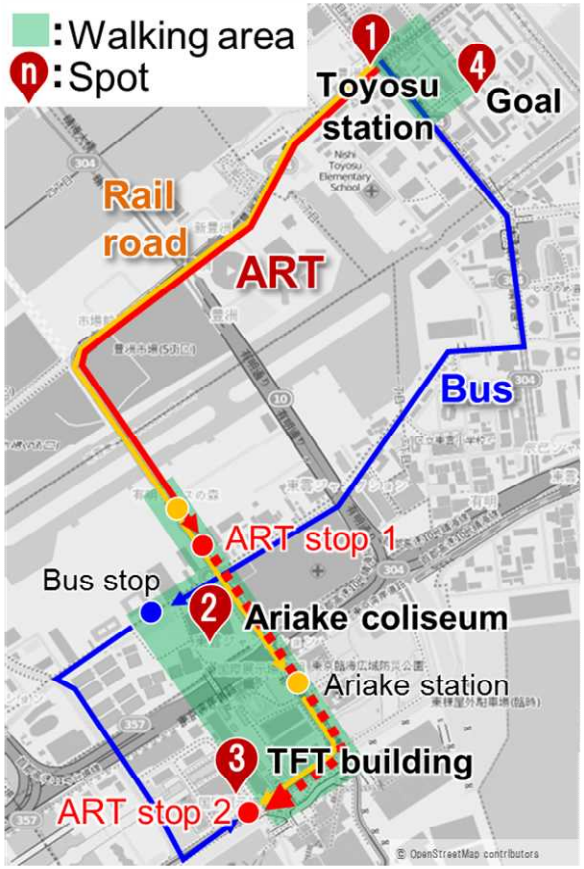
3 **TFT building (break)**

Bus / Rail road / ART

Toyosu station

Walking

4 **Goal**



3． Achievement

Item a④ Pedestrian Transfer Support System

➢ Large-scale field operational test

※ Supported by Keisei Bus Co., Ltd. and Tokyo Metropolitan Bureau

3．Achievement

Item a④ Pedestrian Transfer Support System

➢ Large-scale field operational test

Evaluation and consideration of the usefulness

Qualitative evaluation

◆Route guidance corresponding to individual characteristics

- High reputation: easy-to-use, and easy-to-understand the way of the provision with barrier/ barrier-free info

  ⇒ Can move easily

- A small difference of barrier/barrier-free info affects how well it matches personal feelings.

  ⇒ Should be more personalized

◆ Bus info provision service

- Many opinions: beneficial, useful
- The necessity depends on the individual characteristics.

Quantitative evaluation

◆Questionnaire results

Evaluated by 1 to 5(best) points

Evaluation item	Rating score (average)
Is the notification on the time of getting on/off of ART useful?	4.2
Is the provision of the crowding info useful?	4.0
Is the personal navigation app more useful than a conventional navigation app?	4.2
Do you want to use the personal navigation app for the next?	4.7
Do you recommend the personal navigation app to others?	4.2
Total Average	**4.3**

Route guidance corresponding to individual characteristics and bus info provision service are useful qualitatively and quantitatively.

3．Achievement

Item a④ Pedestrian Transfer Support System

➢ Action toward social implementation

“Personal Navigation Application” (http://corporate.navitime.co.jp/topics/pr/201811/13_4630.html)

TOP

Selecting attribute

Route guidance

Monitor delivery

- Date: from November 13, 2018 to January 31, 2019
- Target area: Toyosu, Ariake

Data collection app “Yasashii Chizu” (http://corporate.navitime.co.jp/topics/pr/201811/30_4634.html)

TOP

Posting

Sharing

Public release

- Date: from November 30, 2018
- Target area: Japan
- Features: simple design

  pursuit of operability
  (Easy to use for various users including visually impaired)

3．Achievement

Item a④ Pedestrian Transfer Support System

➢ Towards a sustainable society

Lack of necessary info for route navigation

Undeveloped NW data for pedestrians

Data collection to create NW for pedestrians

・Barrier/barrier-free info
・GNSS tracking data of pedestrians

Data collection app

Visualization and analysis of collected data

・Posted data
・GNSS tracking data

Personal navigation app

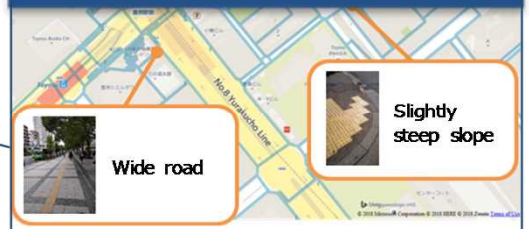
Route guide adjusted to individual characteristics

・Utilizing NW for pedestrians
・Barrier/barrier-free data noticed by screen display and sound

Sustainable process plan

From data collection to route guidance provision

Creating NW for pedestrians



Creating walking network for pedestrians more adjusted to individual characteristics

3．Achievement

Item a④ Pedestrian Transfer Support System

■ Conclusion

- **Personal-navigation app was developed** utilizing network data for pedestrians and **link-cost parameters** in consideration of barrier/barrier-free information and GNSS tracking data.

- **Through the large-scale field operational test**, we evaluated the effectiveness and acceptability of the pedestrian transfer support system.

  The route guidance corresponding to individual characteristics and **the bus info provision service** are **useful qualitatively and quantitatively**.

  Date : From October 1 to November 7, 2018 (25 times in total)
  Participants: 21 persons
  Staffs／ Inspectors （total number of people): 218／26

- **The data collection** application “ Yasashii Chizu” was **opened to the public** and **“Personal Navigation Application”** was **to the limited members**.

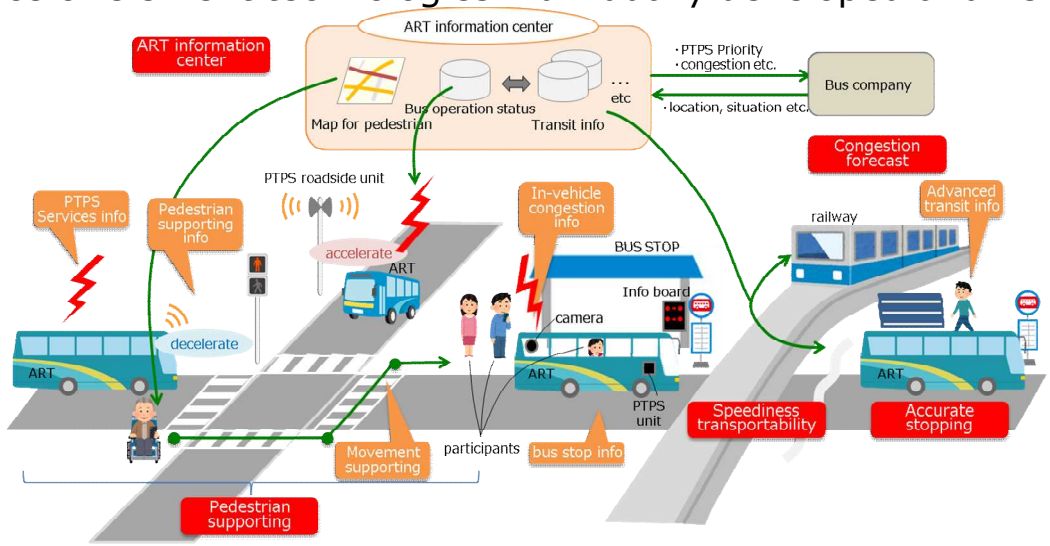
3. Achievement

Item c Management of Field Operational Test

➢ Overview of Next-generation Bus Technology Demonstration Tour

■ **Role**

- The Next-generation Bus Technology Demonstration Tour provides participants with one-stop hands-on experience of element technologies individually developed and verified.



▲ Conceptual image of Next-generation Bus Technology Demonstration Tour

■ **Dates**

- February 6 and 7, 2019 (10:00－17:00)

■ **Location**

- G1 temporary parking lot on the west side of TFT Building – Toyosu Station and its surrounding areas with exhibits in the TFT Building Hall

■ **Outline**

- Participants, while traveling on virtual ART (bus), experienced developed technologies on public roads (for details, see next pages).
- The functions of the ART Information Center and congestion prediction were explained by exhibits, including display boards and videos, in TFT Building.

3．Achievement

Item c Management of Field Operational Test

➢ Details and route of Next-generation Bus Technology Demonstration Tour

■ Details

a) Precision docking and automated driving
b) Advanced PTPS
c) Availability information of wheelchair space on a bus
d) Explanation of the technologies on the onboard display monitor
e) Route guiding with personal navigation app

■Tour route

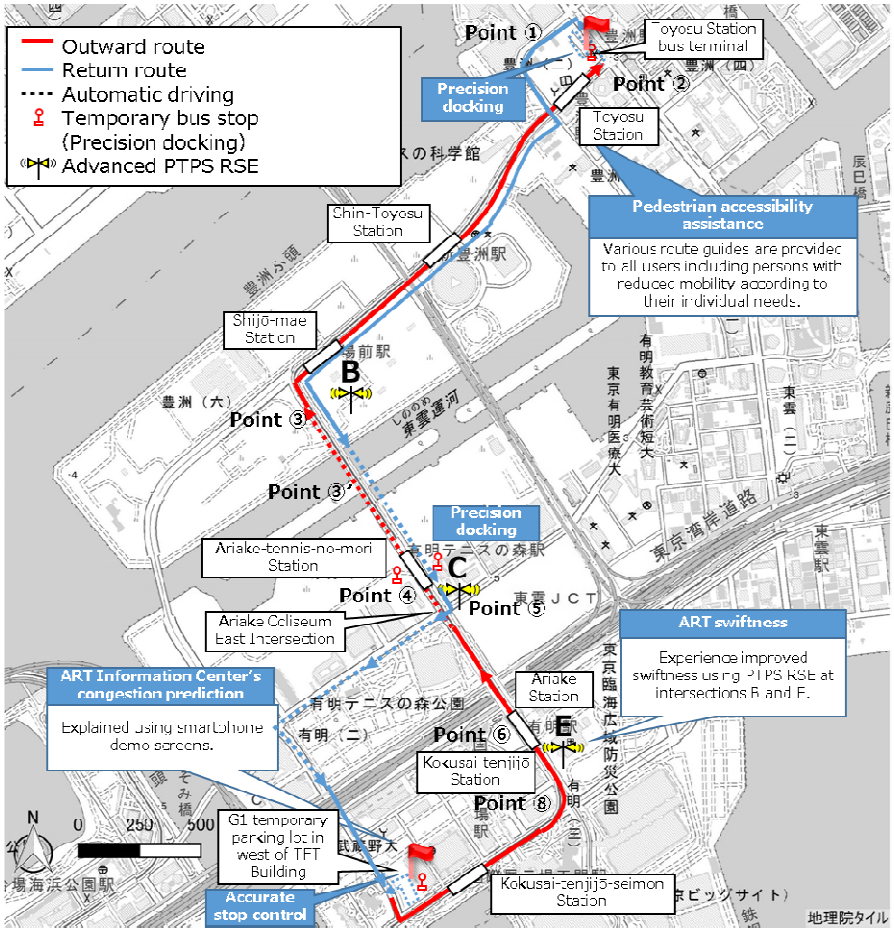
There were two routes below.

(1) Round trip course between TFT west G1 temporary parking lot and Toyosu Station (approx. 10 km)

- a) was experienced at 4 places, Toyosu Station bus terminal, Ariake-tennis-no-mori Station (northbound and southbound) and TFT west G1 temporary parking lot.
- c) at TFT west G1 temporary parking lot
- b) and d) on the route
- e) around Toyosu Station

(2) Route in TFT west G1 temporary parking lot

- a) was experienced in the parking lot.



▲Next-generation Bus Technology Demonstration Tour route

3．Achievement

Item c Management of Field Operational Test

➢ Bus operation for Next-generation Bus Technology Demonstration Tour

■ **Number of buses**

• One JTEKT bus

(1) Round trip course between TFT west G1 temporary parking lot and Toyosu Station

- The bus ran five times a day.
  (10:00, 11:30, 13:00, 14:30 and 16:00)
- About 50 min to run the entire route
- 10:00 bus on 2/6 was for the media.

(2) Route in TFT west G1 temporary parking lot

- The bus ran four times a day.
  (11:15, 12:45, 14:15 and 15:45)
- About 10 min to run the entire route

▲ JTEKT bus used for the Tour

■ **Seating capacity**

(1) Round trip course between TFT west G1 temporary parking lot and Toyosu Station

- Maximum seating capacity per ride is 18 (carrying up to 180 passengers for two days)

(2) Route in TFT west G1 temporary parking lot

- Maximum seating capacity per ride is 18 (carrying up to 144 passengers for two days)

3．Achievement

Item c Management of Field Operational Test

➢ Report from Next-generation Bus Technology Demonstration Tour

■ **Number of participants**

- 282 people participated in total for two days.

■ **Day 1 (February 6, 2019)**

▲ **In TFT west G1 temporary parking lot**

▲ **A wheelchair user getting on the bus**

■ **Day 2 (February 7, 2019)**

▲ **Precision docking at Toyosu Station bus terminal**

▲ **Participants in TFT west G1 temporary parking lot**

3．Achievement

Item c Management of Field Operational Test

➢ Overview of the questionnaire

■ **Purpose**

- Grasp how much the Tour enhances understanding and acceptance of the technologies and what problems are to be solved for their practical application.

■ **Overview**

▼ Overview of the questionnaire

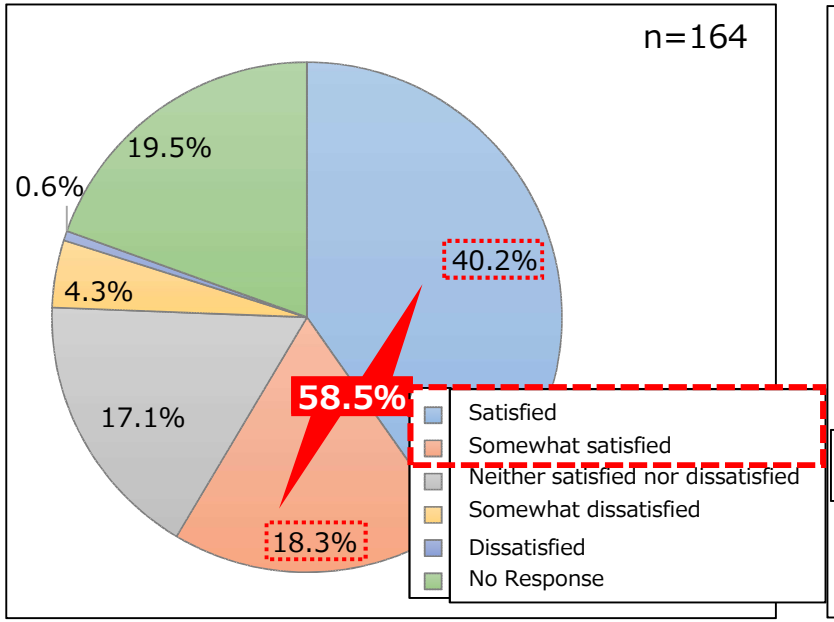
	Overview
Respondent	Participants of the Next-generation Bus Technology Demonstration Tour
Method	The questionnaire was handed to each participant during the check-in and completed on board.
Obtained samples	164 samples

3．Achievement

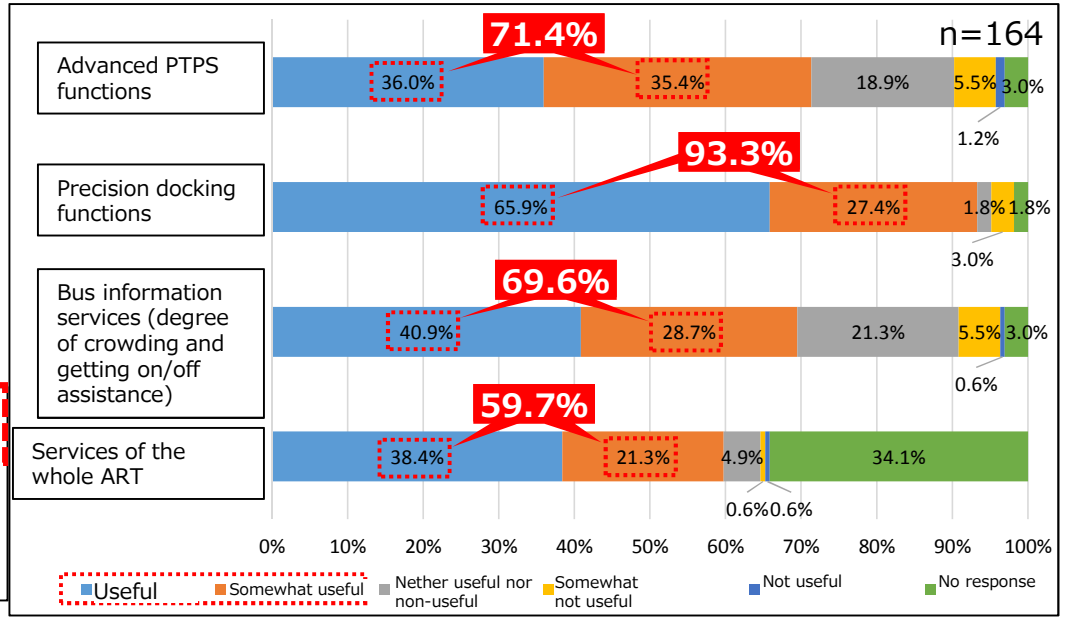
Item c Management of Field Operational Test

➢ Result of the questionnaire

■ **Result**



▲**Satisfaction of the Demonstration Tour**



▲ **Usefulness of the technologies and whole ART services**

- About 60% of the respondents were satisfied or somewhat satisfied with the Next-generation Bus Technology Demonstration Tour.
- About 70% felt the Advanced PTPS functions useful or somewhat useful.
- About 90% felt the precision docking functions useful or somewhat useful.
- About 70% felt the bus information (degree of crowding and getting on/off assistance) services useful or somewhat useful.
- About 60% felt the services of the whole ART useful or somewhat useful.

3．Achievement

Item c Management of Field Operational Test

■Conclusion

- We managed the field operational test and the demonstration tour for Advanced PTPS, Precision Docking, Pedestrian Transfer Support System, Traffic Congestion Forecasting and Guiding to Avoid Congestion, and ART information center.
- On February 6 and 7, 2019, in order to provide the opportunity to experience each developed technology with one-stop service, the Next-generation Bus Technology Demonstration Tour was held in Tokyo and 282 people including central and local governments, bus companies, etc. participated in the demonstration tour.
- Questionnaire survey to the participants of the demonstration tour was conducted and about 60% of the participants responded that the ART services are beneficial.