MITSUBISHI ELECTRIC
Changes for the Better

Status report of Dynamic Map Field Operational Tests

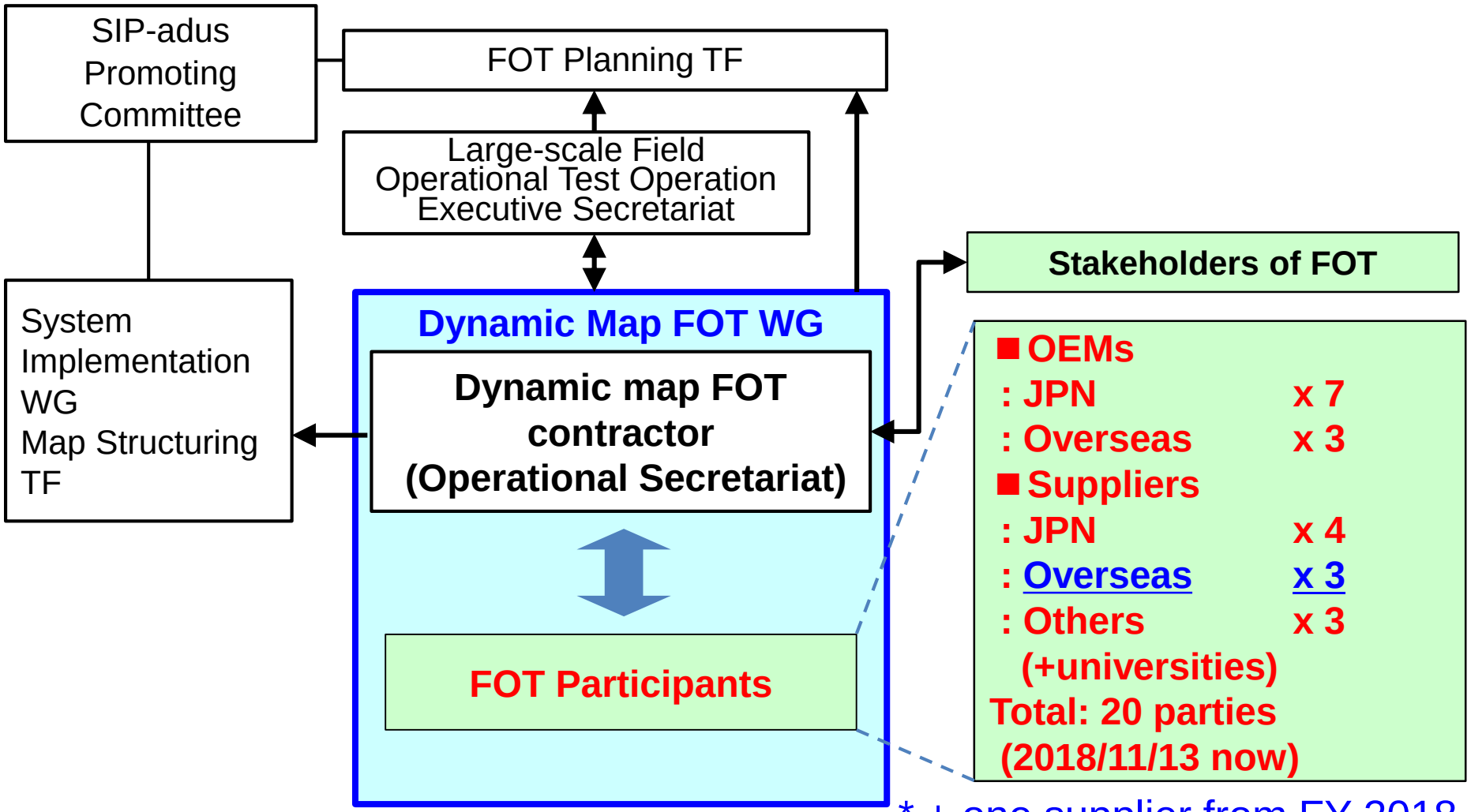
13th, November, 2018

MITSUBISHI ELECTRIC CORPORATION

YOSHIAKI TSUDA

1. Framework of Dynamic Map FOT

The Field Operational Tests (FOT) are implemented using the following framework.



2. FOT Status

The status of FOT is as follows.

Major category	Category	2017				2018												2019		
		9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
Preparation/ Provision/ Evaluation	Static data : 300km																			
	Static data : 758km																			
	Static data : updated data																			
	Semi-dynamic data																			
	Dynamic data																			
Conclusion	Static data																			
	Dynamic data																			
Meetings/ Events	Dynamic Map FOT WG	○			○		○	○		○		○			○	○	○		○	
	SIP-adus WS			★												★				

10 meetings

11/13-15 SIP-adus Workshop

3. Data for Dynamic Map FOT

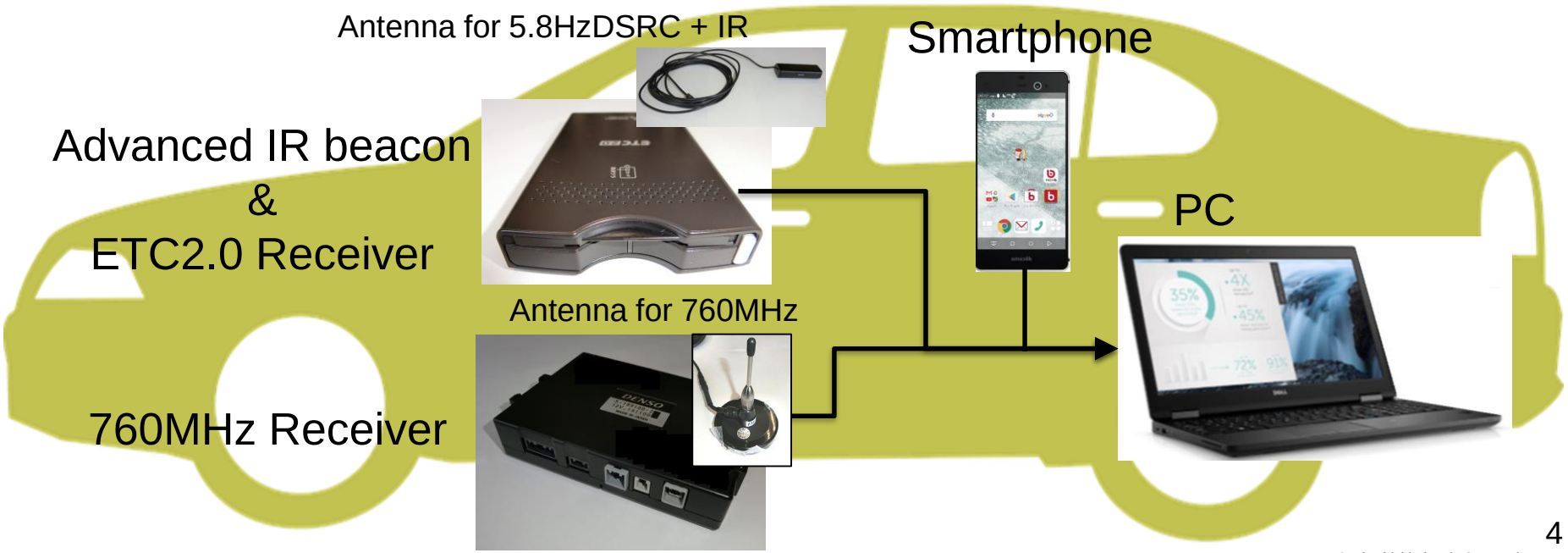
The data and communication media of the FOT is as follows.

Data	Data: detail	Media
(1)Dynamic	Traffic signal information	Advanced infrared beacon & 760MHz
(2)Semi-dynamic	Lane-level traffic flow information (Probe data)	LTE
	Lane-level traffic restriction information	ETC2.0(5.8GHz)
(3)Semi-static	NA	NA
(4)Static	Map data	DVD
	Updated data	DVD+LTE

4. System for Dynamic Map FOT

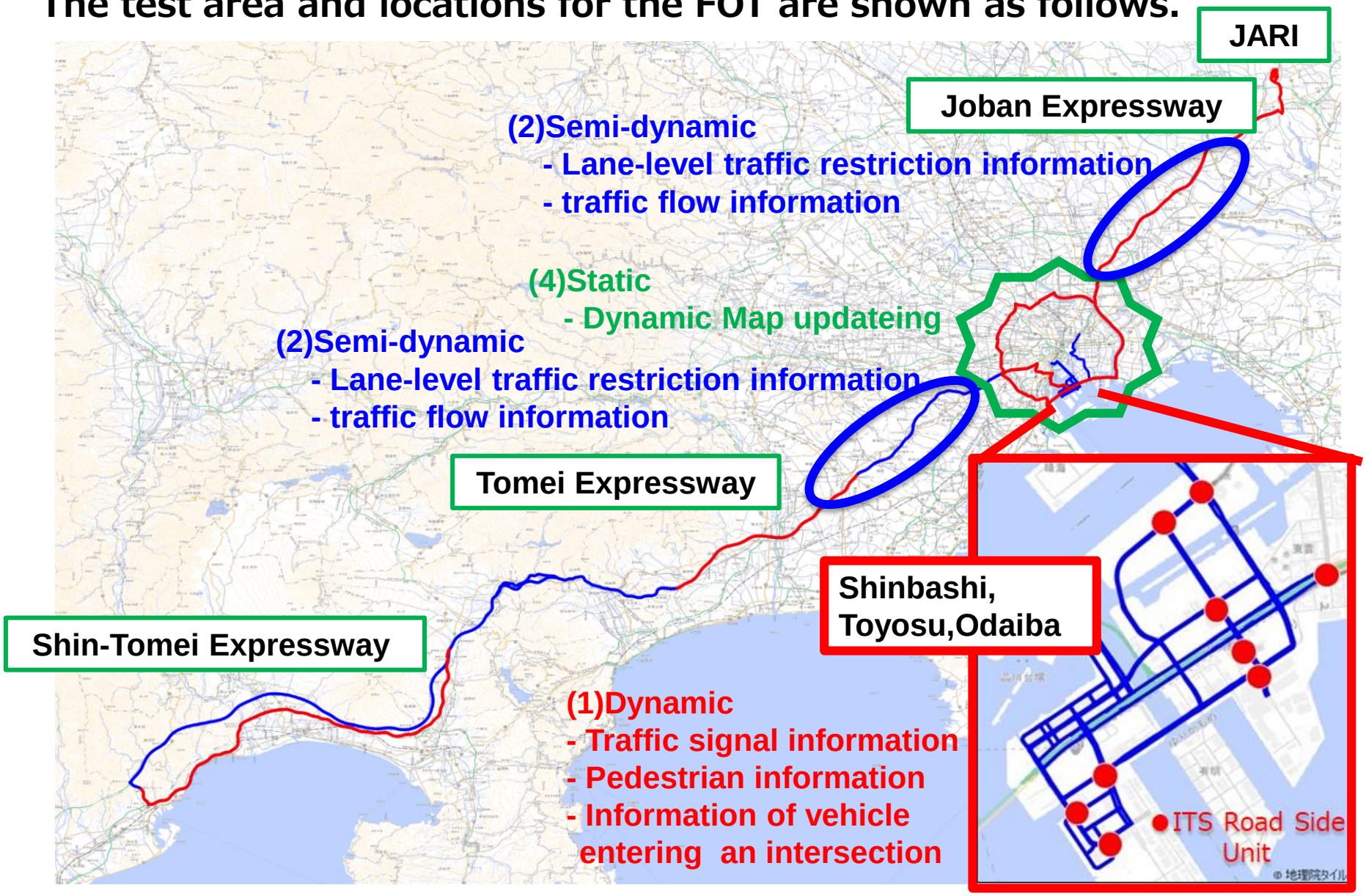
Test system of the FOT is consisted by infrastructures, on-board units, FOT server, smartphone and PC.

ETC2.0 RSU	Advanced infrared beacon & ITS-RSU	FOT server DM & probe data
(2)Lane-level traffic restriction information	(1)Traffic signal information	(2)Lane-level traffic flow information (4)Updated map data



5 . Test area for the Dynamic Map FOT

The test area and locations for the FOT are shown as follows.



5. Evaluation

5.1 Evaluation results of Static data

	FOT Paticipants		
	○	△	-
Stop Line	9	2	7
Pedestrian Crossing	10	1	7
Traffic Signal	11	3	4
Road Shoulder	10	4	4
Road Center Line	12	2	4
Lane Line	11	5	2
Carriageway Edge	11	4	3
Road Marking	7	6	5
Road Signage	8	5	5
Carriageway Link	11	3	4
Lane Link	13	4	1
Intersection Lane Link	8	7	3
Intersection Area	8	3	7
Other Features	8	0	10

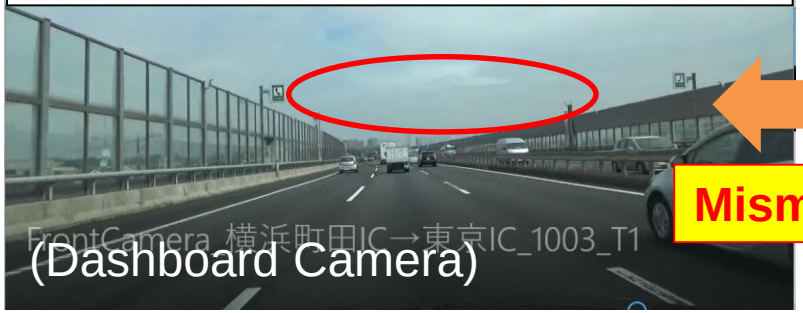
Legend
- Selected “Used the feature” and “Sufficiently usable in current state.”:○
- Selected “Used the feature” and “Acquisition standards and attributes should be reviewed and revised.” : △
- Not evaluated : -

5. Evaluation

5.1 Evaluation results of Static data

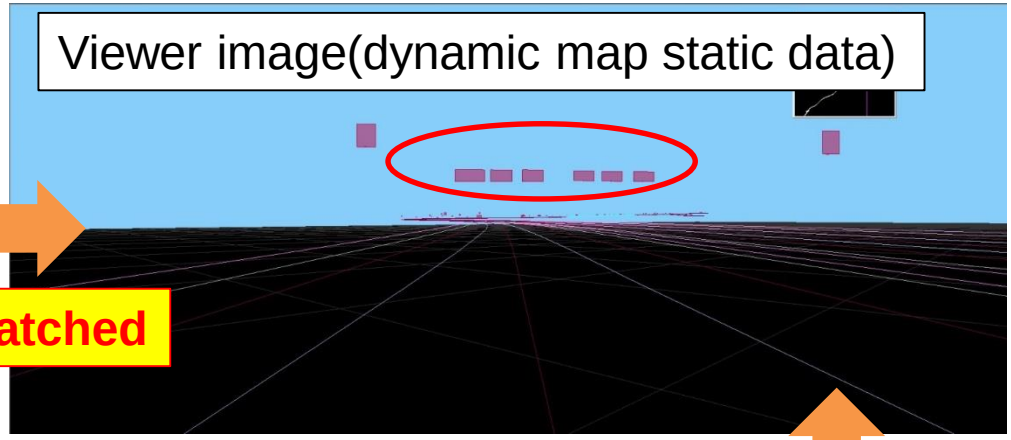
A case of changes in the real world

When the FOT participants evaluated the map.(2017 winter)



Mismatched

Viewer image(dynamic map static data)



Tomei Expressway, Yokohama Machida IC -Tokyo IC; There are no road signages.

same

Check the source data

These road signages are existed in the source data.

>> After the preparing map data, these road signages have been removed.

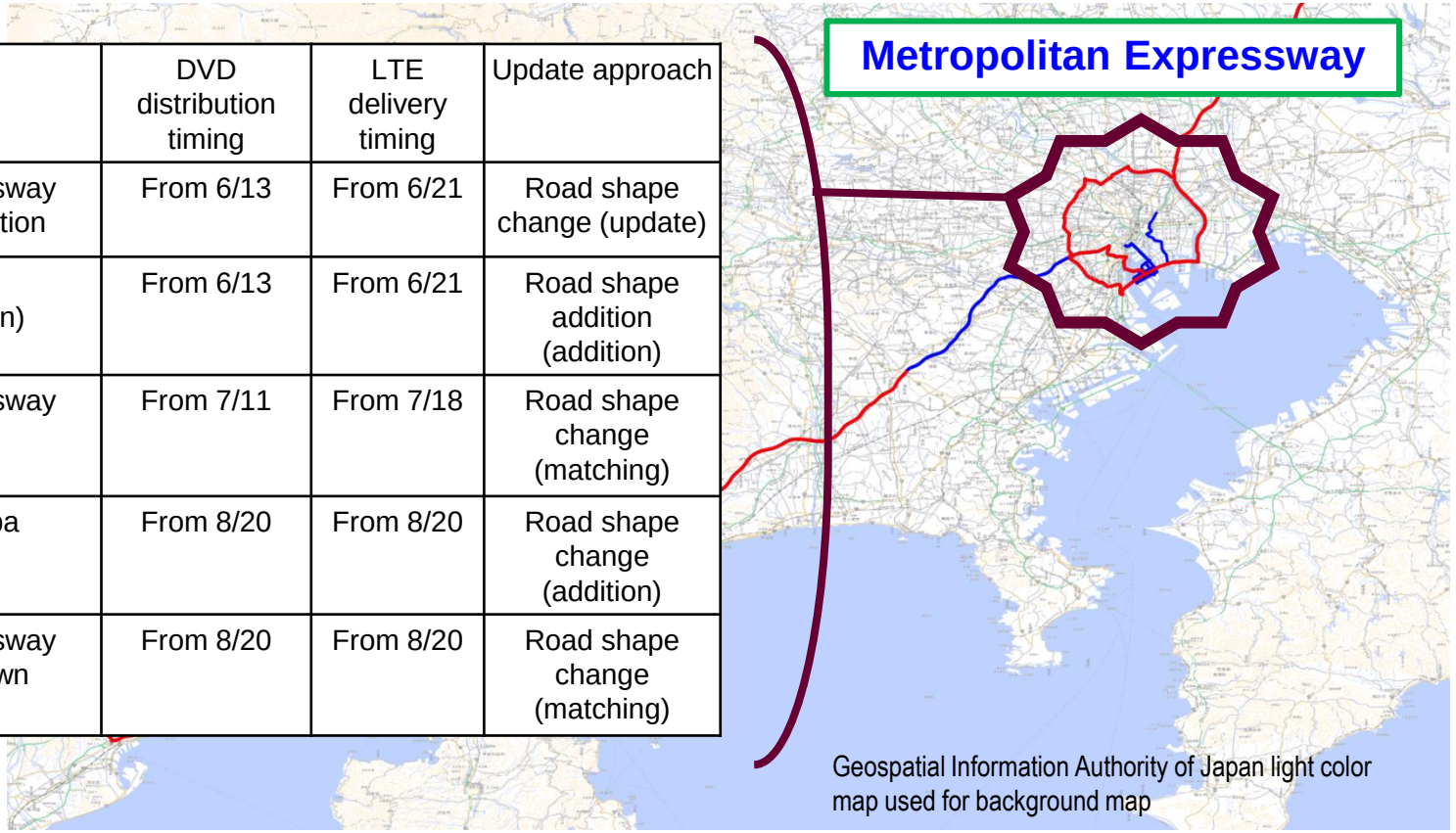
When the map data prepared. (2017 summer)

5. Evaluation

5.1 Evaluation results of Static data

FOT area for ***Map update:5 case***

	Location	DVD distribution timing	LTE delivery timing	Update approach
1	Metropolitan Expressway Horikiri/Kosuge Junction	From 6/13	From 6/21	Road shape change (update)
2	Ordinary road Odaiba (CRP addition)	From 6/13	From 6/21	Road shape addition (addition)
3	Metropolitan Expressway Harumi entry/exit (extension)	From 7/11	From 7/18	Road shape change (matching)
4	Ordinary road: Odaiba (map update)	From 8/20	From 8/20	Road shape change (addition)
5	Metropolitan Expressway Itabashi/Kumano Town Junction	From 8/20	From 8/20	Road shape change (matching)



5. Evaluation

5.1 Evaluation results of Static data

Evaluation results of map update

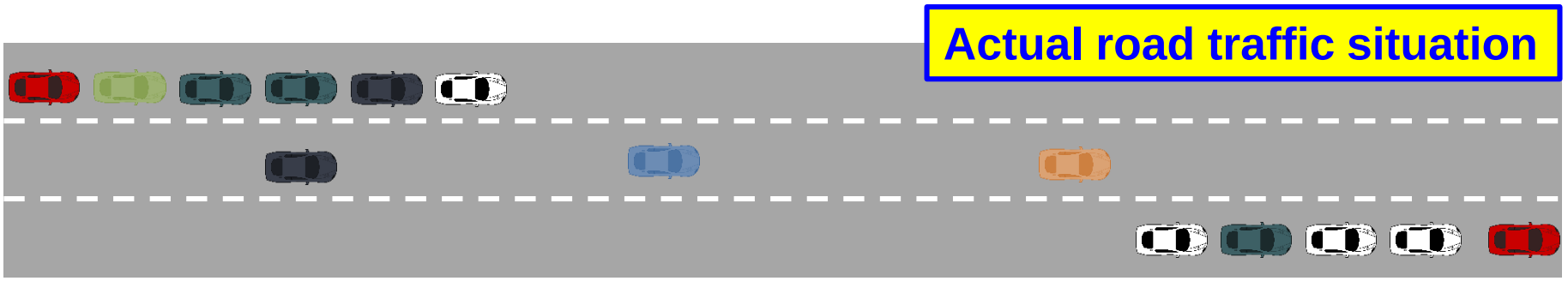
- In level 2 automated driving, map data could be used.
- In level 4 or higher, map data might be used in competitive area.

Automated driving level	Use of high accuracy	Update frequency
Level 1	–	–
Level 2	✓	In case of difference update, data is updated every time. In case of mass update, data is updated or around half a year.
Level 3	✓	
Level 4	✓ (competitive area)	
Level 5	✓ (competitive area)	

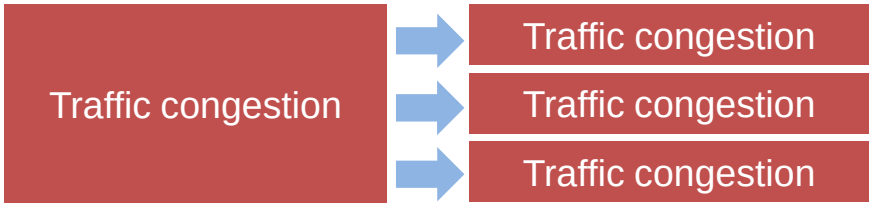
5. Evaluation

5.2 Evaluation: Semi-dynamic data

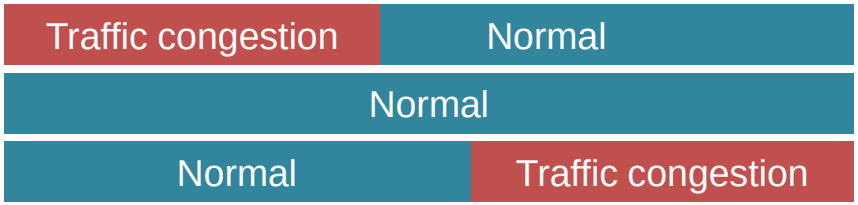
5.2.1 Traffic flow information



Case1:Road-level
Even if only some lanes are traffic congestion, it is shown that all lanes are congested.



Case2:Lane-level
Only traffic congestion lanes are shown. This information shows the real world.



Road-level traffic flow information could be used as reference.
Lane-level traffic flow information could be used for route selection.

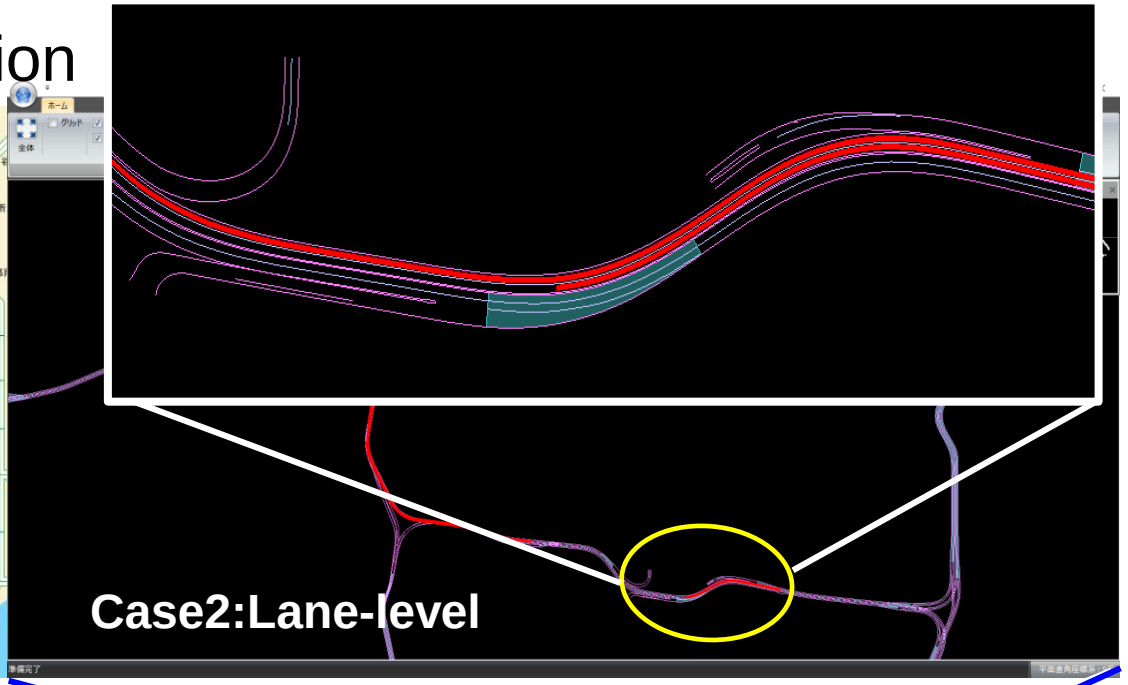
5. Evaluation

5.2 Evaluation: Semi-dynamic data

5.2.1 Traffic flow information

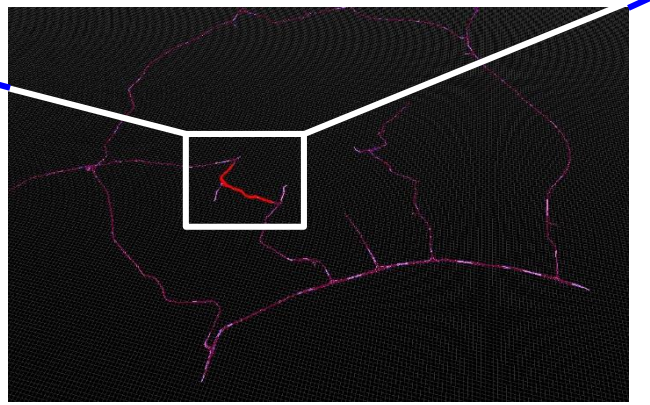
Source: Japan Road Traffic Information Center HP

Viewer image



Before the Ichinohashi JCT

Shiba park exit



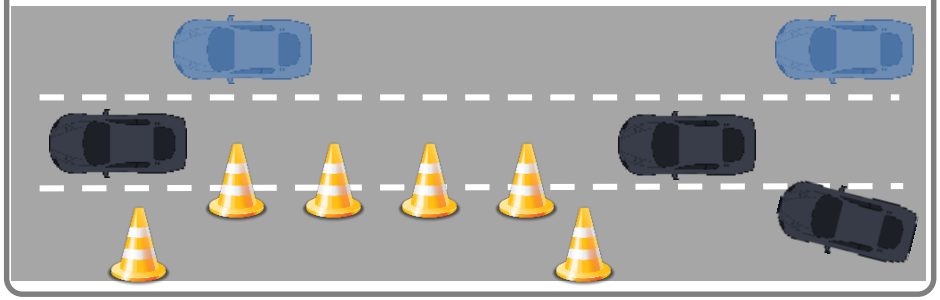
Dashboard Camera

5. Evaluation

5.2 Evaluation: Semi-dynamic data

5.2.2 Lane-level traffic restriction information

Actual road traffic situation

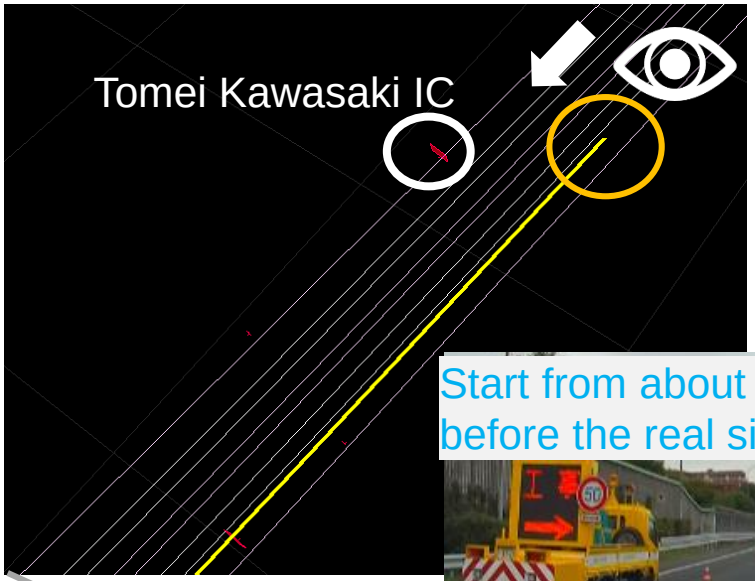


Providing data

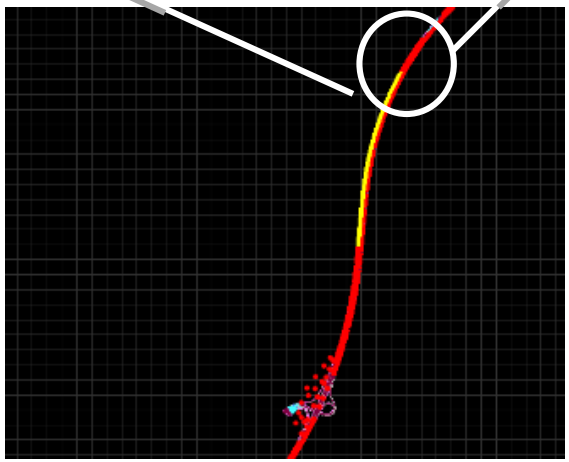
Even if only some lanes are traffic congestion, it is shown that all lanes are congested.

Normal		
Normal		
Normal	Restriction	Normal

Restriction start point

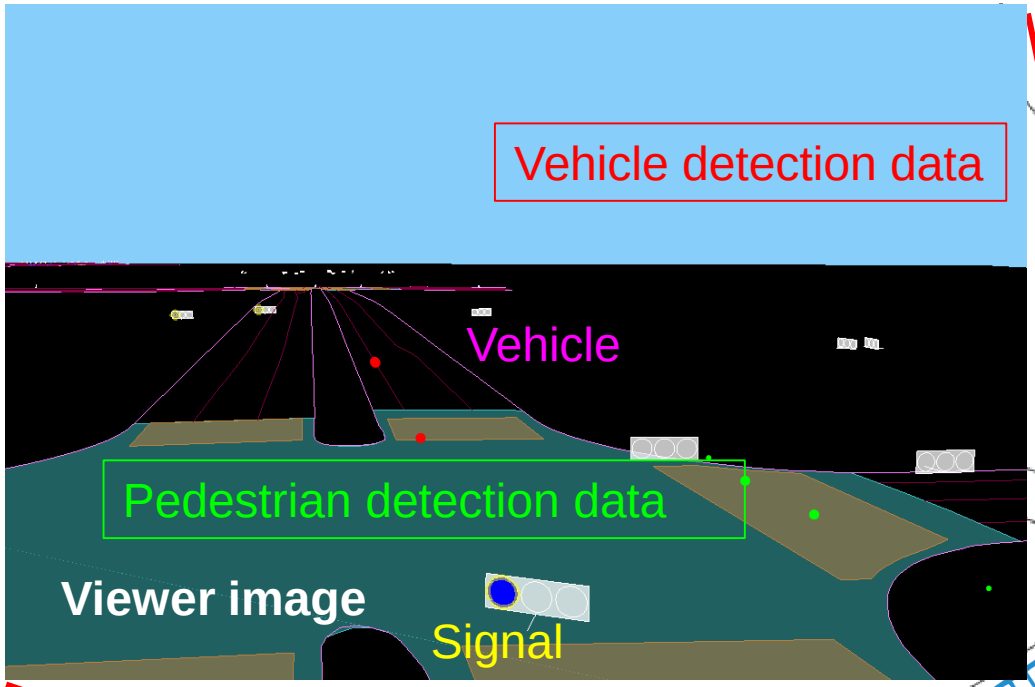


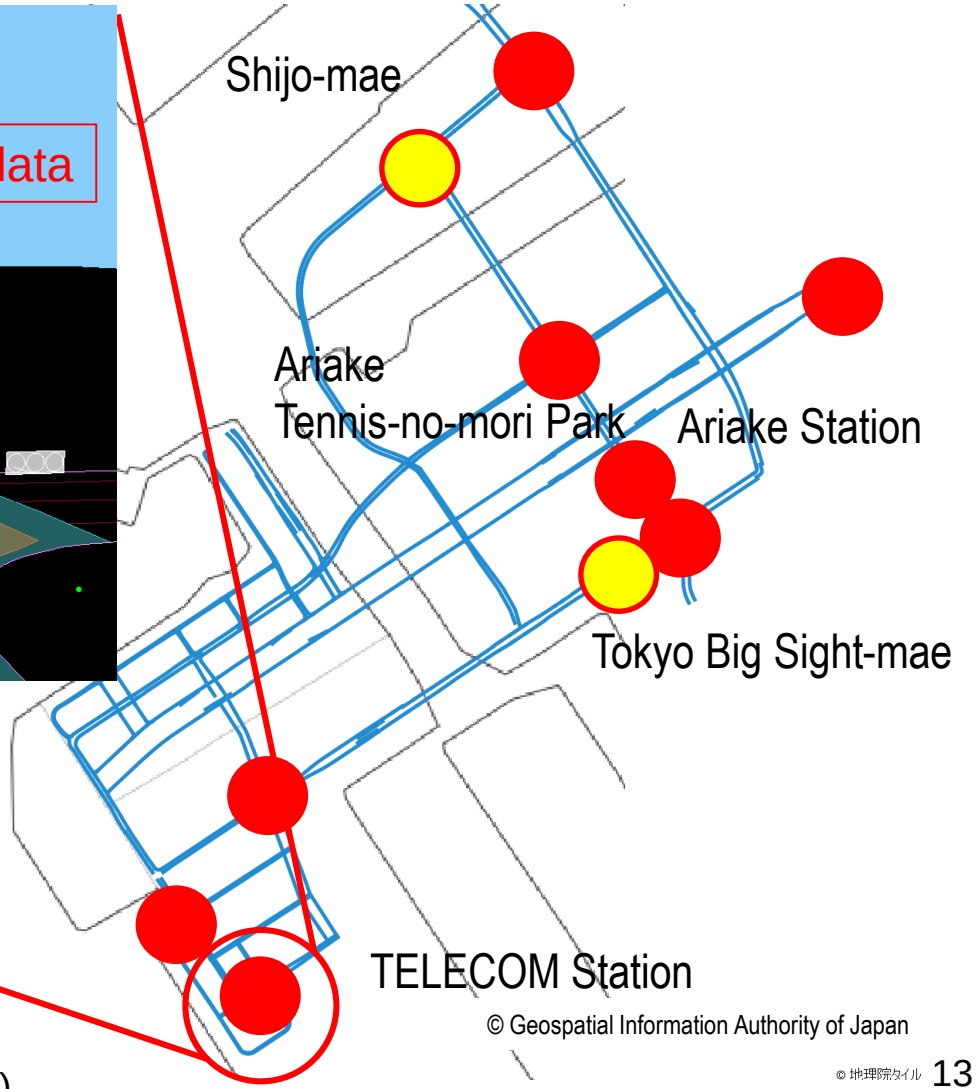
Start from about 400 m before the real situation



5. Evaluation

5.3 Evaluation: Dynamic data





Advanced IR beacon
(TSPS:Traffic Signal Prediction Systems)

ITS Road Side Unit
(DSSS: DSSS(Driving Safety Support Systems)

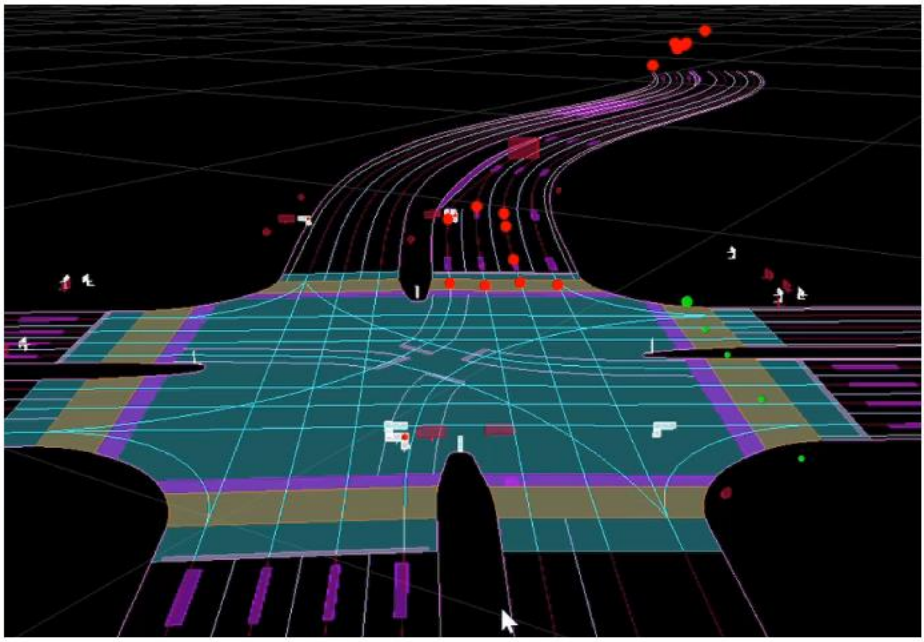
5. Evaluation

5.3 Evaluation: Dynamic data

Dashboard Camera

Viewer image

Signal



5. Evaluation

5.4 Evaluation: Semi-dynamic data & Dynamic data

Evaluation results of Semi-dynamic data & Dynamic data

*Evaluation by the FOT participants has been carrying from October.
We will report it as soon as the evaluation results are complete.

Automated driving level	Traffic signal information	Pedestrian information	Oncoming car information
Level 1			
Level 2			
Level 3			
Level 4			
Level 5			

Semi-dynamic data & Dynamic data has been in under evaluation.

6. Conclusion

- Through the FOT, we demonstrated the theory of dynamic map in real environment.
  >>The practicality and effectiveness of the dynamic map were confirmed.

- We are conducting the FOT until the end of December, and we will brush up this evaluation result.

- As a result of the FOT, it was verified that this map is available for automated driving systems.

Thank you for your kind attention !