SUMITOMO ELECTRIC
SYSTEM SOLUTIONS

The Cross-ministerial Strategic Innovation Promotion Program (SIP)
Phase 2/Automated Driving for Universal Services/

Constructing the Field Operation Tests environment to provide signal information via the public network

FY2021-FY2022 Final Report(Overview)

Sumitomo Electric System Solutions CO., LTD.
February, 2023

SUMITOMO
ELECTRIC
GROUP

Contents

1. Background and objectives

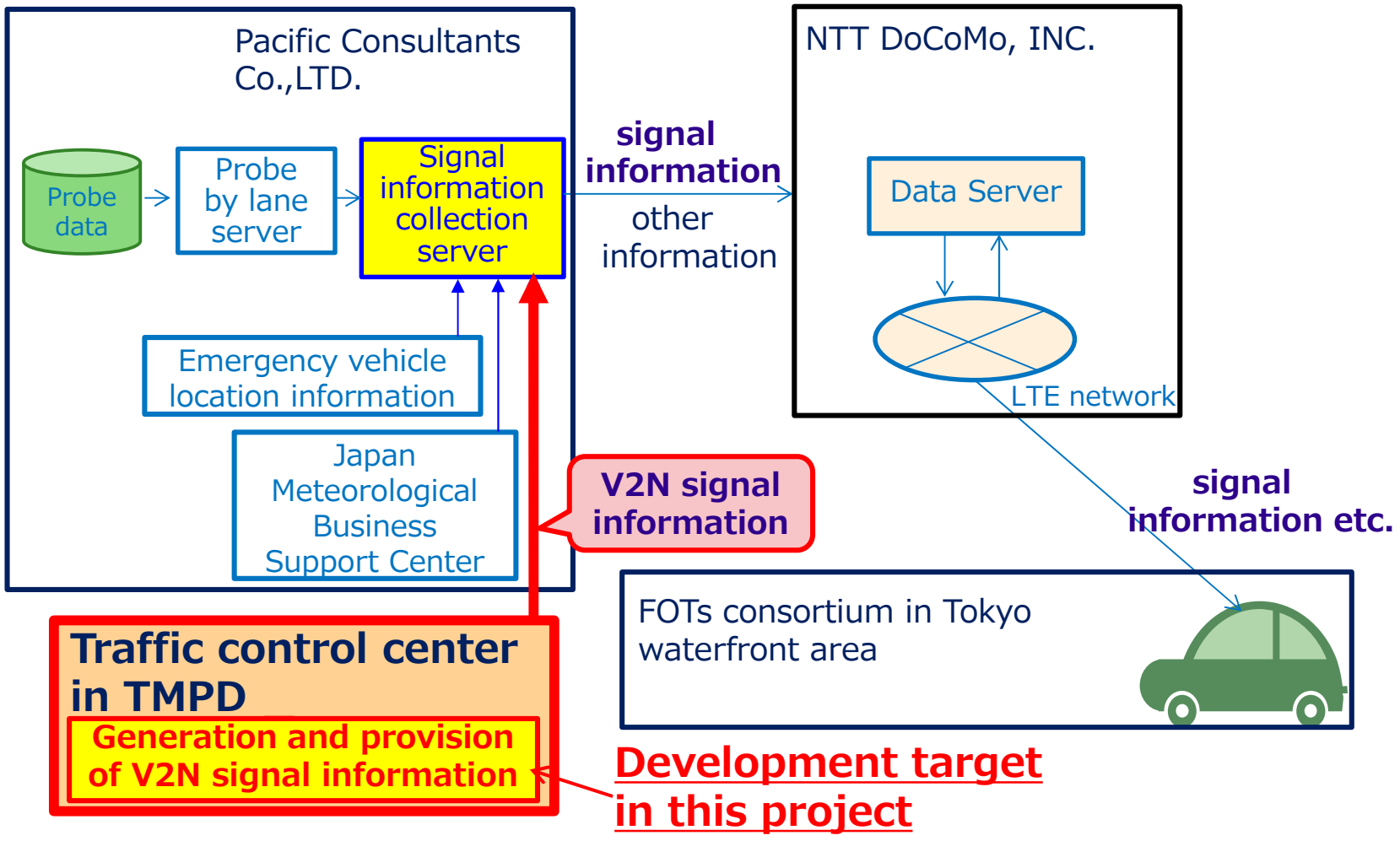
Background

- For realization of infrastructure coordinated automated driving utilizing the traffic environment information by SIP Phase 2 automated driving (expansion of systems and services), infrastructures such as ITS radio roadside units for signal information provision and high-precision three dimensions map on the public way of Tokyo waterfront area and such as sensors for branch confluent support in the Metropolitan expressway have been installed and Field Operation Tests (FOTs) in which domestic and foreign car manufacturers, motor-parts makers, universities and venture companies participated have been conducted since October, 2019.
- In FY2021, FOTs environments were constructed for provision of various traffic environment information via the public network (V2N) in addition to signal information and branch confluent support by infrastructure (V2I).

Objectives

For construction of FOTs environment to provide the signal information via the public network (V2N Signal Information) in Tokyo waterfront area, the signal information generation server and the signal information provision server was introduced into the Traffic Control Center of Tokyo Metropolitan Police Department (TMPD). V2N Signal Information had been provided from the signal information provision server to the signal information collection server outside the Traffic Control Center of TMPD.

2-1. Constitution of FOTs environment



Contribution to FOTs in Tokyo waterfront area by providing V2N signal information

2-2. Project overview

- Contractor: Sumitomo Electric System Solutions Co., Ltd.
- Period: from August, 2021 to February, 2023
- Implementation items

(1) Construction of FOTs environment to provide signal information via the public network (V2N Signal Information) in Tokyo waterfront area

・Development of software to generate and provide signal information and installation of servers with the software in the Traffic Control Center of Tokyo Metropolitan Police Department (TMPD)

(2) Modification of existing server software and connection the server and developed servers

・Review of specification such as interface, protocol and target intersection about signal information provision
・Modification of the existing server software for traffic signal control in the Traffic Control Center of TMPD
・Connection signal information provision server with the signal information collection server and provision of signal information

(3)Maintenance of test system and restoration of TCS in TMPD

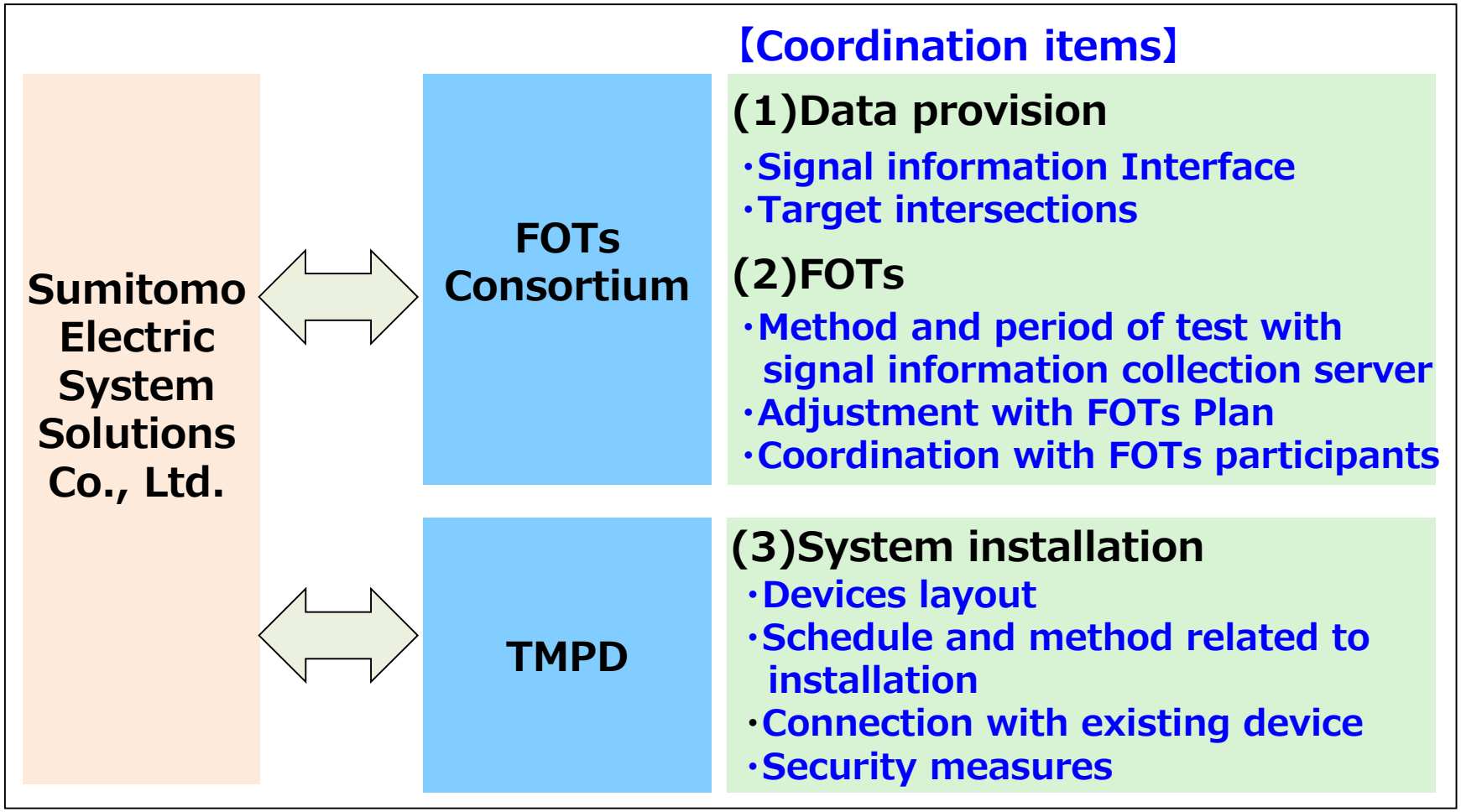
・Confirmation of status of signal information status from the Traffic Control Center of TMPD
・Establishment of the maintenance system to detect abnormalities of test system

(4)Log data accumulation

・Accumulation of provided signal information log for verification and evaluation

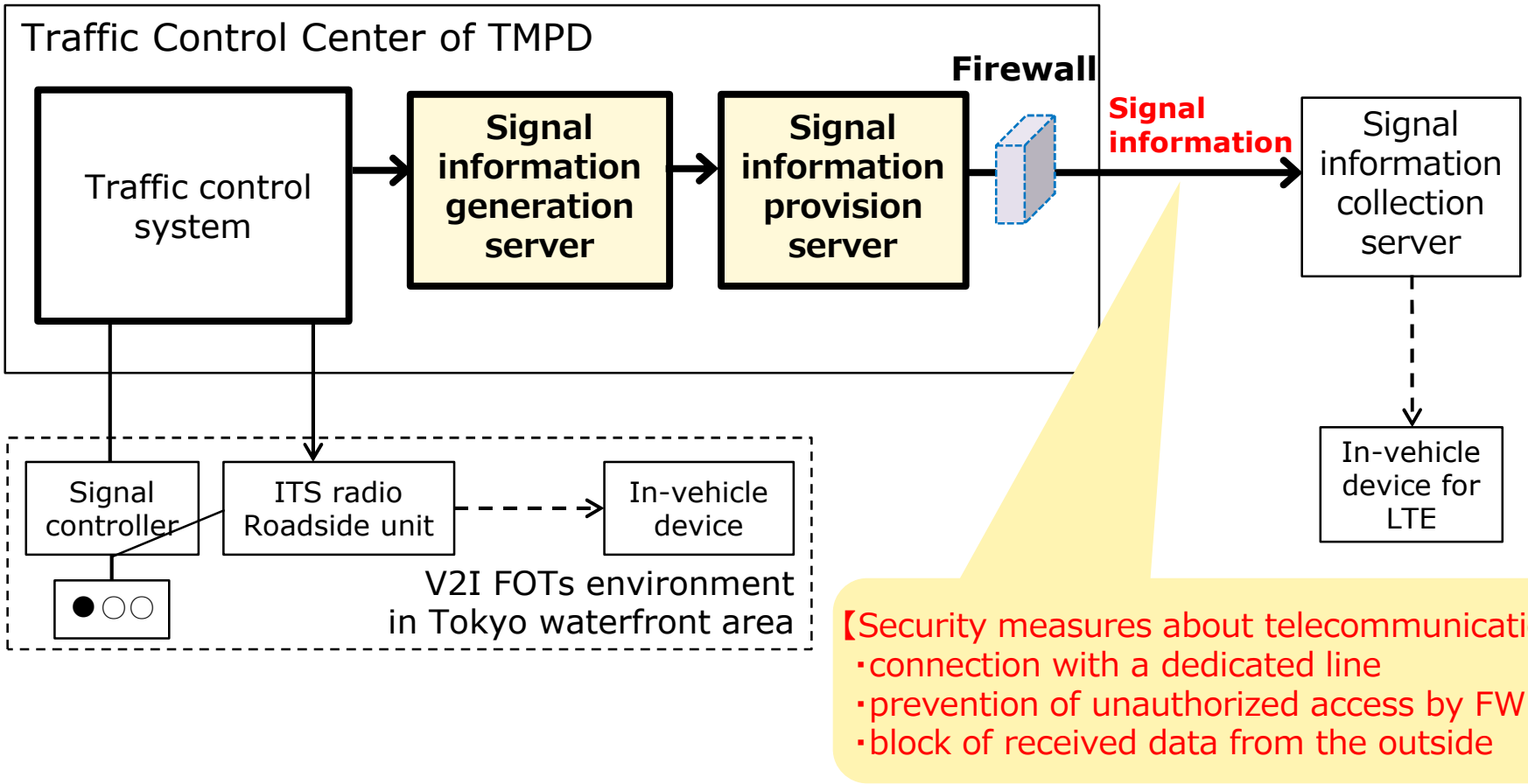
2-3. Implementation system

We designed, developed and constructed test system in collaboration with relevant stakeholders.



3-1. System configuration

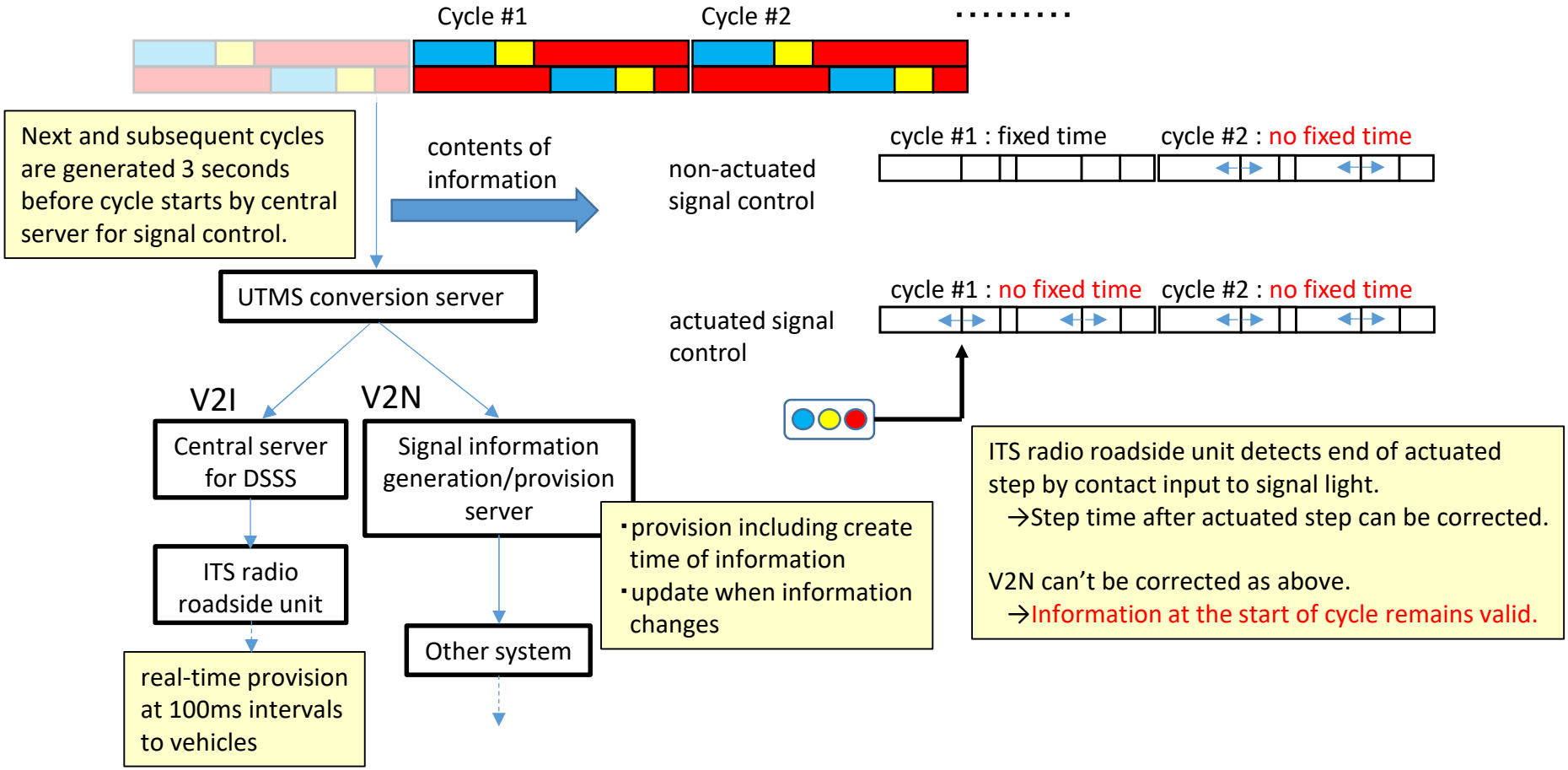
We reviewed system configuration of test system so as to minimize operation impact on the Traffic Control System of TMPD.



3-2. Specification of signal information

We reviewed specification of V2N signal information based on related constraints.

- Provision flow V2N signal information



3-2. Specification of signal information

■ Interface of V2N signal information

Item		Data Size	Code
Provision Point No			
	Prefecture Code	bin(8)	E-1
	Provision Type Code	bin(8)	E-2
	Intersection ID	bin(8)	C-1
	(Reserved)	bin(8)	D-8
	(Reserved)	bin(8)	D-8
	Version(Standard)	bin(8)	C-3
	Version(Definition)	bin(8)	C-4
	(Reserved)	bin(8)	D-8
	(Reserved)	bin(8)	D-8
Create Time			
	Year	bin(8)	A-1
	Month	bin(8)	A-2
	Day	bin(8)	A-3
	Hour	bin(8)	A-4
	Miniute	bin(8)	A-5
	Second	bin(8)	A-6
	Second(10 ms)	bin(8)	A-7
Signal Status		bin(8)	E-1
Specific Control Flag		bin(8)	D-8
System Status		bin(8)	F-1
Event Counter		bin(8)	F-2
Vehicle Light Number		bin(8)	C-5
Pedestrian Light Number		bin(8)	C-6
Connect Direction Number(I)		bin(8)	D-9
Service Direction Number(J)		bin(8)	D-10
Service Direction Singnal Information : 1			
	Direction ID	bin(8)	C-2
	Signal Pass Direction Flag	bin(1)	F-3
	(Reserved)	bin(7)	D-7
	Signal Pass Direction	bin(8)	F-4
	Vehicle Light Pointer : 1	bin(16)	F-5
	:		
	Vehicle Light Pointer : I	bin(16)	F-5
	Pedestrian Light Pointer : 1	bin(16)	F-5
	:		
	Pedestrian Light Pointer : I	bin(16)	F-6
:			
Service Direction Singnal Information : J			

Vehicle Light Information(Per Vehicle Light)

Vehicle Light ID		bin(4)	C-5
Light Color Output Number(K)		bin(4)	F-7
Vehicle Light Information : 1			
	Signal Light Color	bin(8)	F-8
	Arrow Signal Light Direction	bin(8)	F-9
	Countdown Stop Flag	bin(1)	F-10
	Minimum Rest Second	bin(15)	F-11
	Maximum Rest Second	bin(16)	F-12
:			
Vehicle Light Information : K			

Pedestrian Light Information(Per Pedestrian Light)

Pedestrian Light ID		bin(4)	C-6
Light Color Output Number(L)		bin(4)	F-7
Pedestrian Light Information : 1			
	Pedestrian Signal Light Color	bin(8)	F-13
	Countdown Stop Flag	bin(1)	F-10
	Minimum Rest Second	bin(15)	F-11
	Maximum Rest Second	bin(16)	F-12
:			
Pedestrian Light Information : L			

Items in red box do not exist in case of V2I.
->0 fixed or undefined as follows

- Version : 0 fixed
- Create Time : Next cycle start time
  Second(10ms) is undefined.
- Signal Status : 0 fixed
- Specific Control Flag : 0 fixed

4. Construction of test system

We constructed test system environment by conducting the following.

(1) Development of server software for test system
- Production of software based on reviewed specification
- Function test and evaluation of the software

(2) Modification of existing server software for traffic signal control in the Traffic Control System of TMPD
- Addition of following functions
  a. Provision of traffic control information required to generate signal information
  b. Collection of operation status of developed servers

(3) Installation works
- Installation of developed servers in the Traffic Control Center of TMPD
- Connection existing server and developed server
- Generation of correct signal information

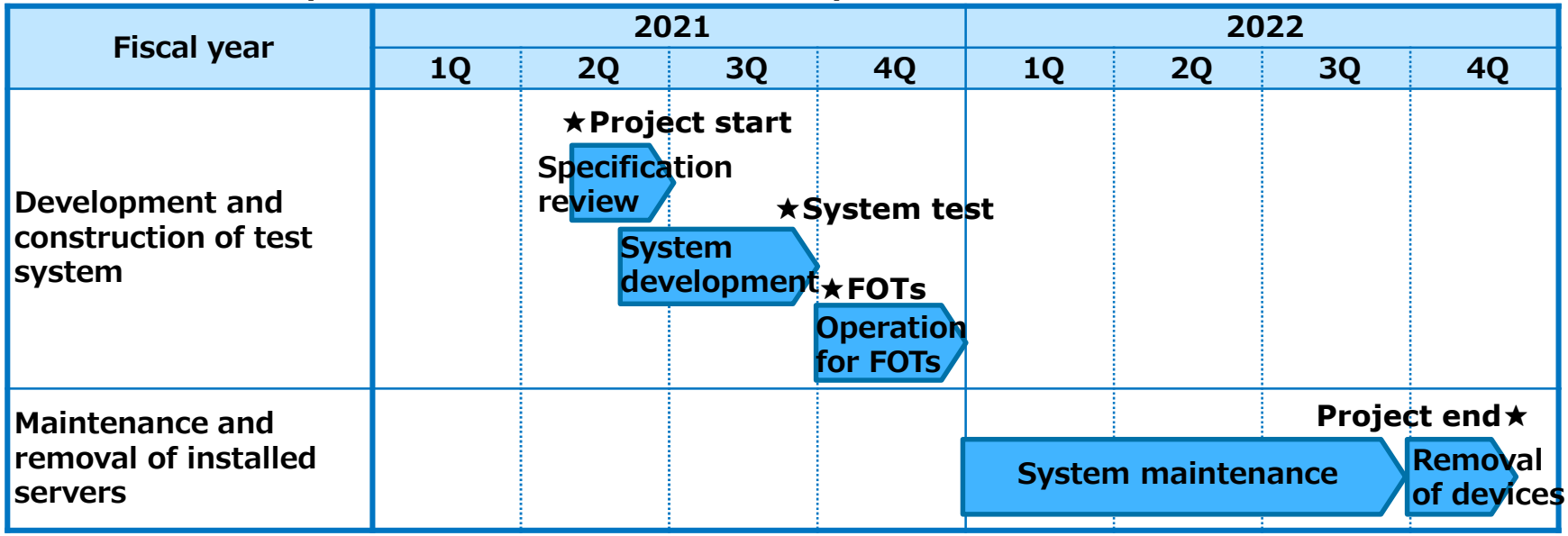
(4) Construction of test system
- Connection signal information provision server and signal information collection server
- Provision of signal information
- Accumulating log data of the provided information

5. Summary

We conducted the following and contributed to the execution of Tokyo waterfront area FOTs(from January 2022 to December 2022) .

- Review of specification such as interface of signal information provision
- Development of software to generate and provide signal information
- Modification of existing server software for traffic signal control
- Installation of developed servers in the Traffic Control Center of TMPD
- Provision of signal information and establishment of maintenance system
- Removal of installed servers and restoration to original condition

■ Schedule (from FY2021 to FY2022)



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.