MINISTRY OF TRANSPORT, VIETNAM

SPECIAL ASSISTANCE FOR PROJECT IMPLEMENTATION (SAPI) FOR ITS INTEGRATION PROJECT ON NEW NATIONAL HIGHWAY NO.3 & NORTHERN AREA OF VIETNAM

APPENDIX 2

SYSTEM OPERATION/MANAGEMENT PLAN

AUGUST 2012

JAPAN INTERNATIONAL COOPERATION AGENCY

ORIENTAL CONSULTANTS CO., LTD.
NEXCO EAST ENGINEERING CO., LTD.
NIPPON KOEI CO., LTD
TRANSPORTATION RESEARCH INSTITUTE CO., LTD
LANDTEC JAPAN INC.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
MINISTRY OF TRANSPORT, VIETNAM

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FINAL REPORT IN AUGUST 2012

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TABLE OF CONTENTS

1. Introduction 1

2. Frameworks and Role Sharing for Expressway Operation 2
2.1 General 2
2.2 Total Framework of Expressway Operation 3
2.3 Framework for Service Level Control 5
2.4 Framework for Traffic Control 6
2.4.1 Key Framework 6
2.4.2 Framework for Police Car Dispatch 8
2.4.3 Framework for Ambulance Dispatch 9
2.4.4 Framework for Incident Notification to Road Operator 10
2.4.5 Framework for Traffic Restriction 11
2.4.6 Framework for Road/Traffic Monitoring 12
2.4.7 Framework for Traffic Event Data Management 13
2.4.8 Framework for Traffic Information Dissemination 14
2.5 Framework for Toll Management 15
2.5.1 Key Framework 15
2.5.2 Framework for Toll Settlement 16
2.5.3 Framework for IC-Card Issuance/Operation 17
2.5.4 Framework for OBU Registration/Management 18
2.5.5 Framework for Toll Enforcement 19
2.6 Framework for Overloading Regulation 20
2.7 Framework for Integrated Data Management 22
2.8 Framework for Communication Network Management 23
2.8.1 Key Framework 23
2.8.2 Framework for Radio Frequency Allocation 23
2.9 Framework for System Maintenance 25
2.10 Role Sharing 26
2.10.1 Roles of Expressway Management Organization in MOT 27
2.10 2 Roles of Road Owner 28
2.10.3 Roles of Road Operator 29
2.10.4 Roles of Telecommunication Company 30
2.10.5 Roles of Other Organization 31

3. Outline of Tasks for Expressway Operation 32

4. Event Trace Diagrams of Tasks for Expressway Operation 42
4.1 General 42
4.2 Routine Patrol 44
4.3 Traffic Condition Monitoring 45
4.4 Incident Reporting by Mobile Phone (113 Call) 46
4.5 Incident Reporting by Mobile Phone (115 Call) 47
4.6 Incident Reporting by Mobile Phone (to Private Hospital) 48
4.7 Incident Reporting by Mobile Phone (to Regional Main Center) 49
4.8 Incident Reporting from Patrol 50
4.9 Incident Identification by Camera 51

4.10 Ascertainment of Incident Situation 52
4.11 Heavy Rain Identification 53
4.12 High Wind Identification 54
4.13 Dense Fog Identification 55
4.14 High Temperature Identification 56
4.15 Flood Identification 57
4.16 Stopped Vehicle Identification 58
4.17 Reverse Driving Identification 59
4.18 Left Obstacle Reporting 60
4.19 Vandalism Identification 61
4.20 Road Damage Identification 62
4.21 Construction Work Information Handling 63
4.22 Road Traffic Supervision 64
4.23 Decision of Traffic restriction 65
4.24 Entrance Closure 66
4.25 Closure 67
4.26 Exit Closure 68
4.27 Lane Closure 69
4.28 Speed Restriction 70
4.29 Incident Handling 71
4.30 Incident Clearance Reporting 72
4.31 Restriction removal 73
4.32 Restiriction Removal Reporting 74
4.33 Traffic Event Management in Regional Main Center 75
4.34 Traffic Event Management in Road Management Office 76
4.35 Traffic Event Management in by Patrol Crew 77
4.36 Traffic Information by VMS 78
4.37 Traffic Information by Internet 79
4.38 Traffic Information by Broadcast 80
4.39 Traffic Information Cancellation 81
4.40 Traffic Data Management 82
4.41 Integrated Data Management 83
4.42 Routine Data Check in Regional Main Center 84
4.43 Toll Collection by Manual 85
4.44 Toll Collection by Touch&Go 86
4.45 Toll Collection by ETC 87
4.46 Handling of Vehicle with Balance Shortage....88
4.47 Handling of Vehicle without OBU into ETC Lane 89
4.48 Handling of OBU Reinstalled Illegally 90
4.49 Toll Data Management 91
4.50 Toll Settlement 92
4.51 IC-card Insurance/Management 93
4.52 Recharge of Prepaid Balance 94
4.53 IC-card Data Management 95
4.54 IC-card Invalidation Management 96

4.55 OBU Registration/Management 97
4.56 OBU Invalidation Management 98
4.57 Toll enforcement Assistance 99
4.58 Axle Load Measurement 100
4.59 Axle Load Data Management 101
4.60 Overloading regulation 102

5. System Architecture and Location 103
5.1 Concept of Implementation Package 103
5.2 System Architecture 104
5.3 Installation Location of Subsystems 105

6. Operation/Management Plan for Traffic Information/Control System 107
6.1 General 107
6.2 System Architecture 107
6.3 Screen Transition Diagram 114
6.4 Comment Indication 152
6.5 Data Sets for Indication/Input 156

7. Operation/Management Plan for Automated Toll Collection/Management System 162
7.1 General 162
7.2 System Architecture 162
7.3 Screen Transition Diagram 167
7.4 Comment Indication 181
7.5 Data Sets for Indication/Input 183

8. Operation/Management Plan for Vehicle Weighing System 190
8.1 General 190
8.2 System Architecture 190
8.3 Screen Transition Diagram 192
8.4 Comment Indication 197
8.5 Data Sets for Indication/Input 198

9. Operation/Management for Communication System 200
9.1 General 200
9.2 System Architecture 200
9.3 Network Management 202
9.4 Comment Indication 206
9.5 Output Log 206

10. Basic Policy on Training System Operation/Management 207
10.1 Objectives of Training 208
10.2 Training Program 208
10.3 Implementation Schedule of Training 213

11. Basic Policy for System Maintenance 213

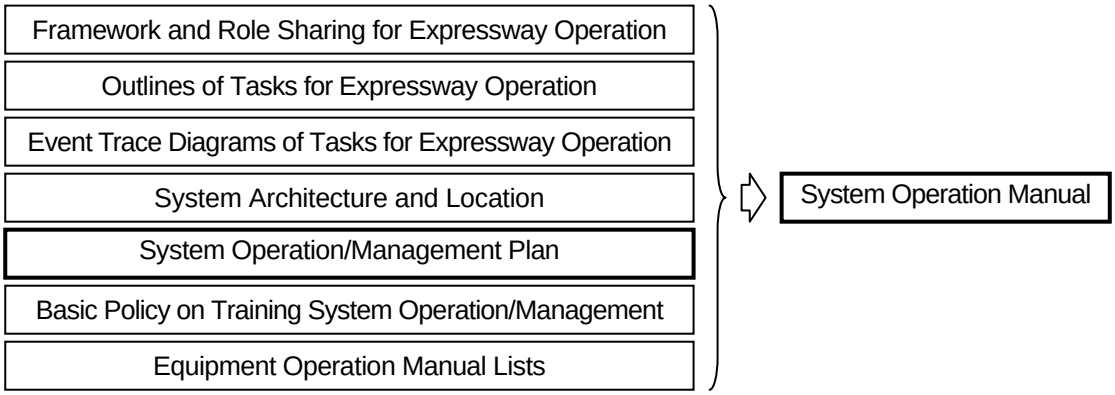
12. Equipment Operation Manual Lists 214
12.1 Essential Points of Equipment Operation Manual 214
12.2 Manual List for Traffic Information/Control System 214

12.3 Manual List for Automated Toll Collection/Management System 215
12.4 Manual List for Vehicle Weighing System 216
12.5 Manual List for Communication System 216

1. Introduction

The System Operation Manual is to be organized, adding the System Operation/Management Training Plan and needed equipment operation manual lists to the System Operation/ Management Plan; however, specific contents of the equipment operation manuals are to be prepared by suppliers, who provide equipment/software component components.

Figure 1.1 Organization of the Plan



Source: ITS Integration Project (SAPI) Study Team

The System Operation/Management Plan will be developed using screen transition diagrams based on the event tracing diagrams shown in the Total Operation Plan for ITS.

2. Frameworks and Role Sharing for Expressway Operation

2.1 General

The frameworks below closely related with system operation are to be mentioned for clarifying appropriate role sharing for system operation of ITS.

- Total Framework of Expressway Operation
- Framework for Service Level Control
- Framework for Traffic Information/Control
- Framework for Police Car Dispatch
- Framework for Ambulance Dispatch
- Framework for Incident Notification to Road Operator
- Framework for Traffic Restriction
- Framework for Traffic Event Data Management
- Framework for Traffic Information Dissemination
- Framework for Toll Management
- Framework for Toll Settlement
- Framework for IC-Card Issuance/Operation
- Framework for OBU Registration/Management
- Framework for Toll Enforcement
- Framework for Overloading Regulation
- Framework for Integrated Data Management
- Framework for Communication Network Management
- Framework for System Maintenance

From the discussion on frameworks, roles of the organizations below are to be clarified in matrix tables:

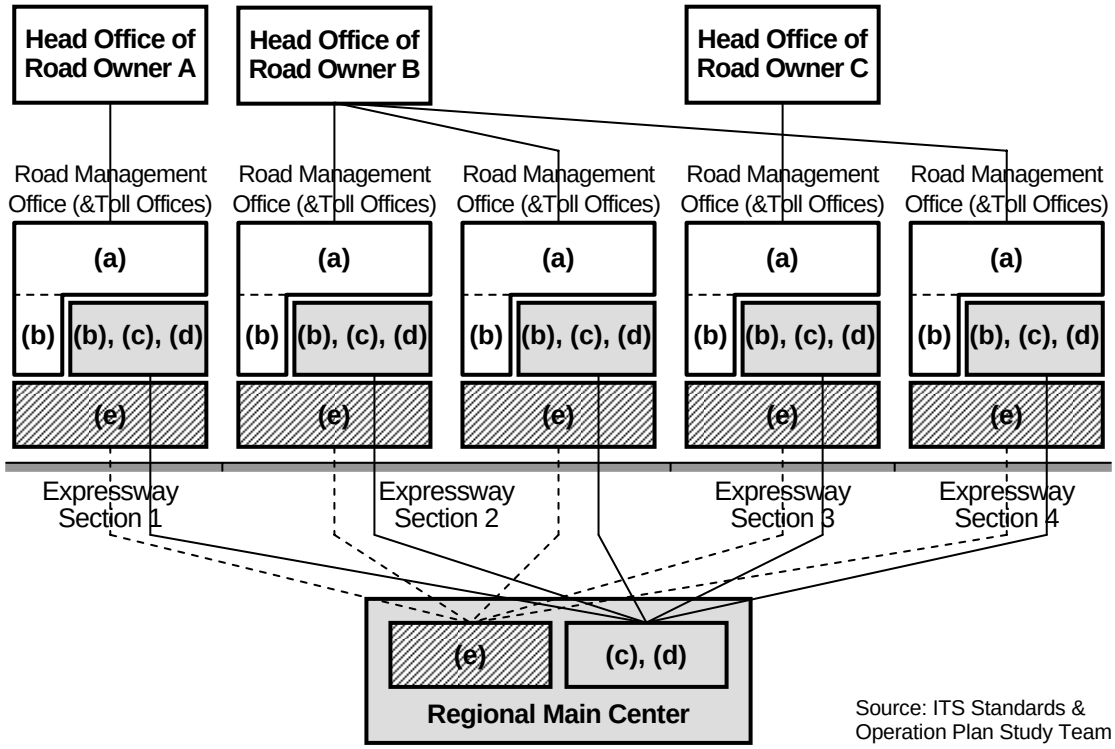
- Expressway Management Organization in MOT
- Road Owner
- Road Operator
- Telecommunication Service Company
- Other Organizations

2.2 Total Framework of Expressway Operation

An expressway network will be constructed/operated by section. Hence, road structure/facility management and toll collection/management are to be integrated by the head offices of the road owners, and proper expressway operation and communication network management are to be integrated by the Regional Main Center as shown in the framework below.

- Head office of road owner
  - (a) Road structure/facility management
  - (b) Toll collection/management
- Regional Main Center
  - (c) Traffic information/control
  - (d) Overloading regulation
  - (e) Communication network management

Figure 2.1 Total Framework or Expressway Operation



(1) Roles of Expressway Management Organization in MOT

- Ownership/funding/management of the Regional Main Center
- Regulation on hardware/software in compliance with the ITS Standards

(2) Roles of Road Owner

- Ownership/funding/maintenance of road structure/facilities of an expressway section other than ITS
- Ownership/funding of facilities of ITS of an expressway section
- Toll collection/management of an expressway section

(3) Roles of Road Operator (in Regional Main Center)

- Member dispatch for operation of the Regional Main Center
- Maintenance of hardware/software of ITS

(4) Roles of Road Operator (in Each Expressway Section)

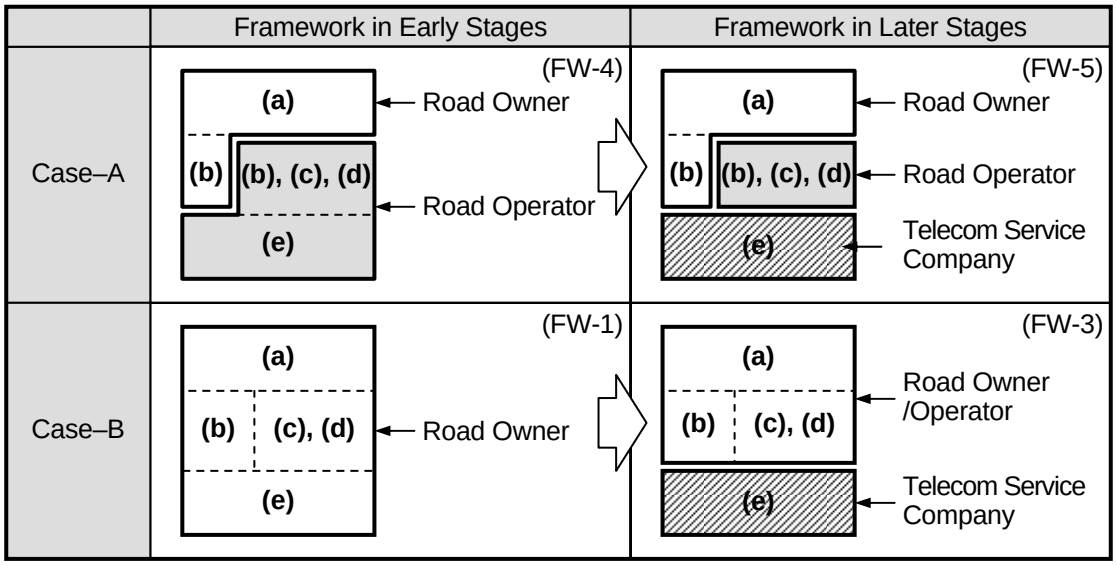
- Assistance of toll collection of an expressway section
- Traffic information/control of an expressway section
- Overloading regulation of an expressway section
- Operation/maintenance of hardware/software of ITS

(5) Roles of Telecom Service Company

- Ownership/funding/maintenance of facilities of communication system of ITS
- Operation of communication system of ITS

In the early stageof ITS installation role sharing among organizations will not be minutely; however, it will be broken into parts minutely for covering extensive expressway network in later stages. Total frame work can shift accordingly as shown in the figure below.

Figure 2.2 Expected Shift on Total Framework



Source: ITS Integration Project (SAPI) Study Team

2.3 Framework for Service Level Control

A set of Minimal Service Requirements shall be shown by MOT to the road operator and the road owner in the process of making a concession of expressway operation. The road operator is to be obliged to meet the Minimal Service Requirements. And on the occasion when the concession is renewed, rises in the specific toll amount of the road owner and in the operation fee paid by the road owner to the road operator are to be permitted by MOF based on an evaluation on the degree of the road operator's achievement by MOT in reference to the requirements. The roles are to be shared as follows:

(1) Roles of Expressway Management Organization in MOT

- Evaluation of road operator's achievement in the expressway operation
- Check of the validity of toll revenue in comparison with the data of traffic

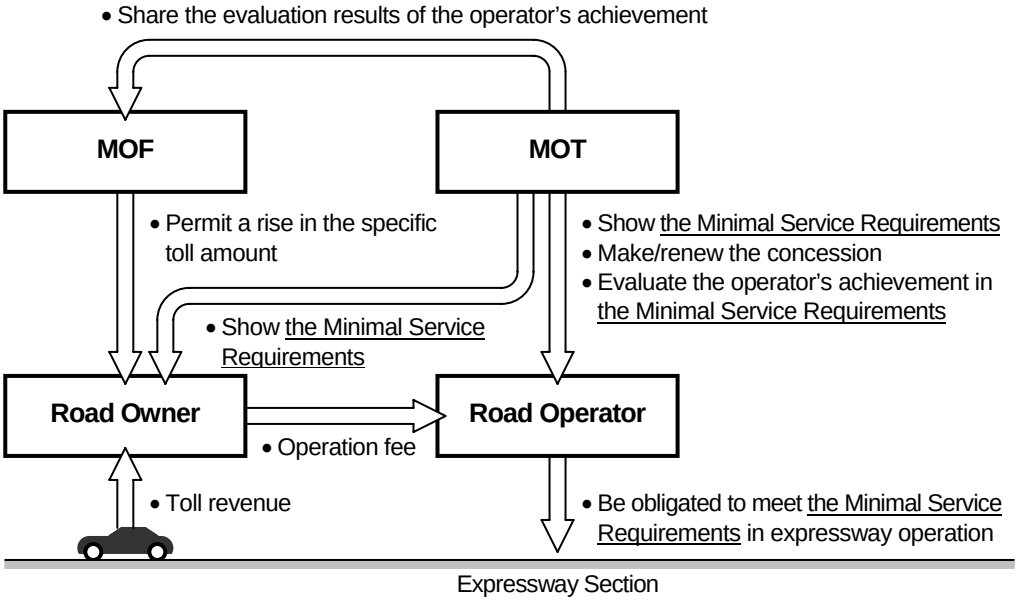
(2) Roles of Road Owner

- Ownership/funding/maintenance of road structure/facilities of an expressway section other than ITS
- Ownership/funding of facilities of ITS of an expressway section
- Toll collection/management of an expressway section

(3) Roles of Road Operator (in Each Expressway Section)

- Assistance of toll collection of an expressway section
- Traffic information/control of an expressway section
- Overloading regulation of an expressway section

Figure 2.3 Framework for Service Level Control



Source: ITS Integration Project (SAPI) Study Team

2.4 Framework for Traffic Control

2.4.1 Key Framework

The framework for traffic control is shown in the following figure. In this framework, expressway police offices are to be organized respectively for the expressway sections, which are the jurisdictions of road management offices. The roles are to be shared as follows:

(1) Roles of Expressway Management Organization in MOT

- Ownership/funding/management of the Regional Main Center
- Regulation on hardware/software in compliance with the ITS Standards
- Issue of permission for enforcing serious traffic restrictions such as road closure

(2) Roles of Road Owner

- Ownership/funding/maintenance of road structure/facilities of an expressway section other than ITS
- Ownership/funding of facilities of ITS of an expressway section

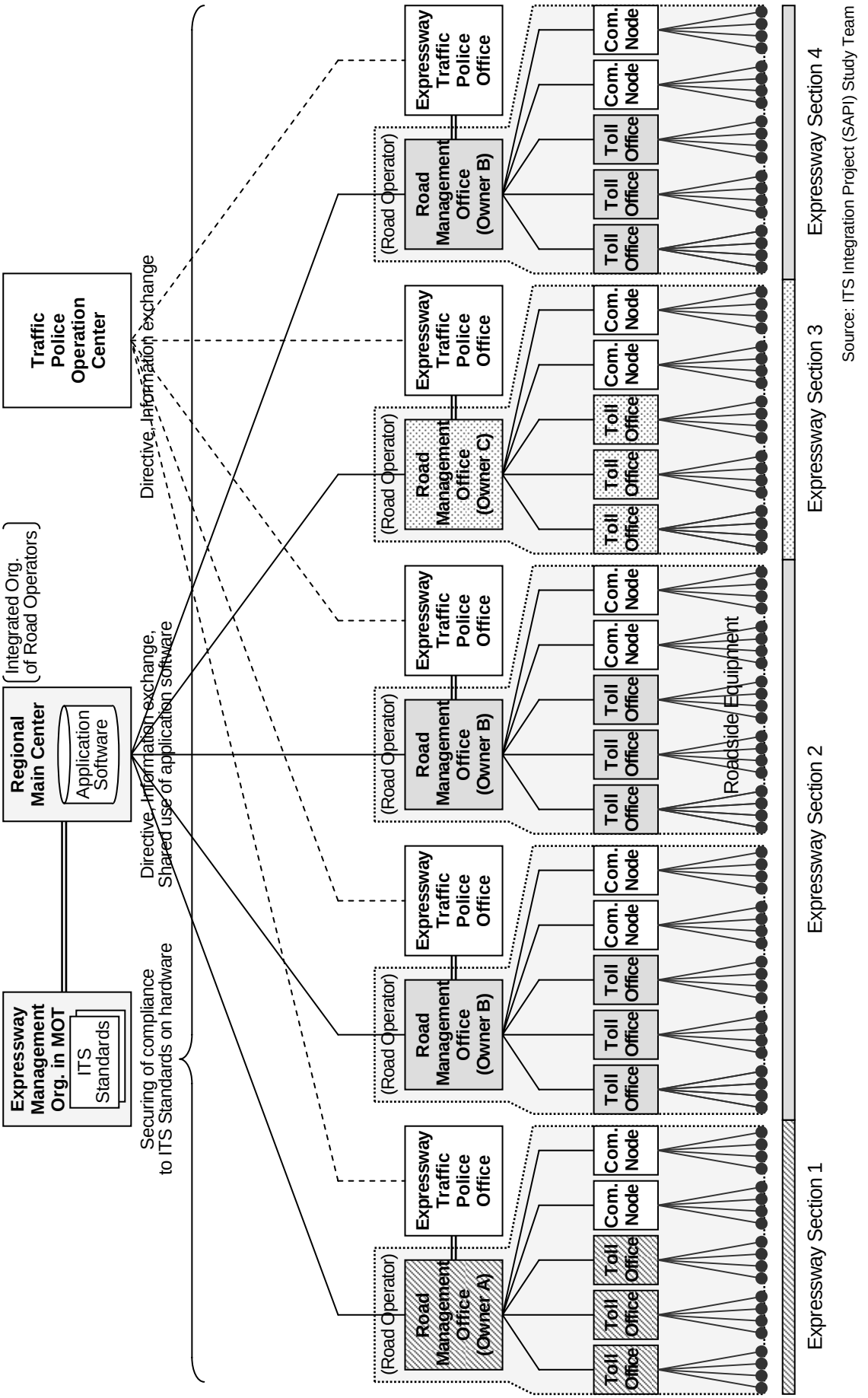
(3) Roles of Road Operator (in Regional Main Center)

- Member dispatch for operation of the Regional Main Center
- Maintenance of hardware/software of ITS

(4) Roles of Road Operator (in Each Expressway Section)

- Traffic information/control of an expressway section
- Operation/maintenance of hardware/software of ITS

Figure 2.4 Framework for Traffic Control



Source: ITS Integration Project (SAPI) Study Team

2.4.2 Framework for Police Car Dispatch

A team of expressway police is to be assigned to each road management office with teams of the road operator and the ambulance service with an identical jurisdiction. In this framework, the three teams are to cooperate responding to 113 calls in case of traffic accidents, and roles are to be shared as follows:

(1) Roles of Expressway Management Organization in MOT

- Ownership/funding/management of the Regional Main Center
- Issue of permission for enforcing serious traffic restrictions such as road closure

(2) Roles of Road Operator (in Regional Main Center)

- Member dispatch for operation of the Regional Main Center

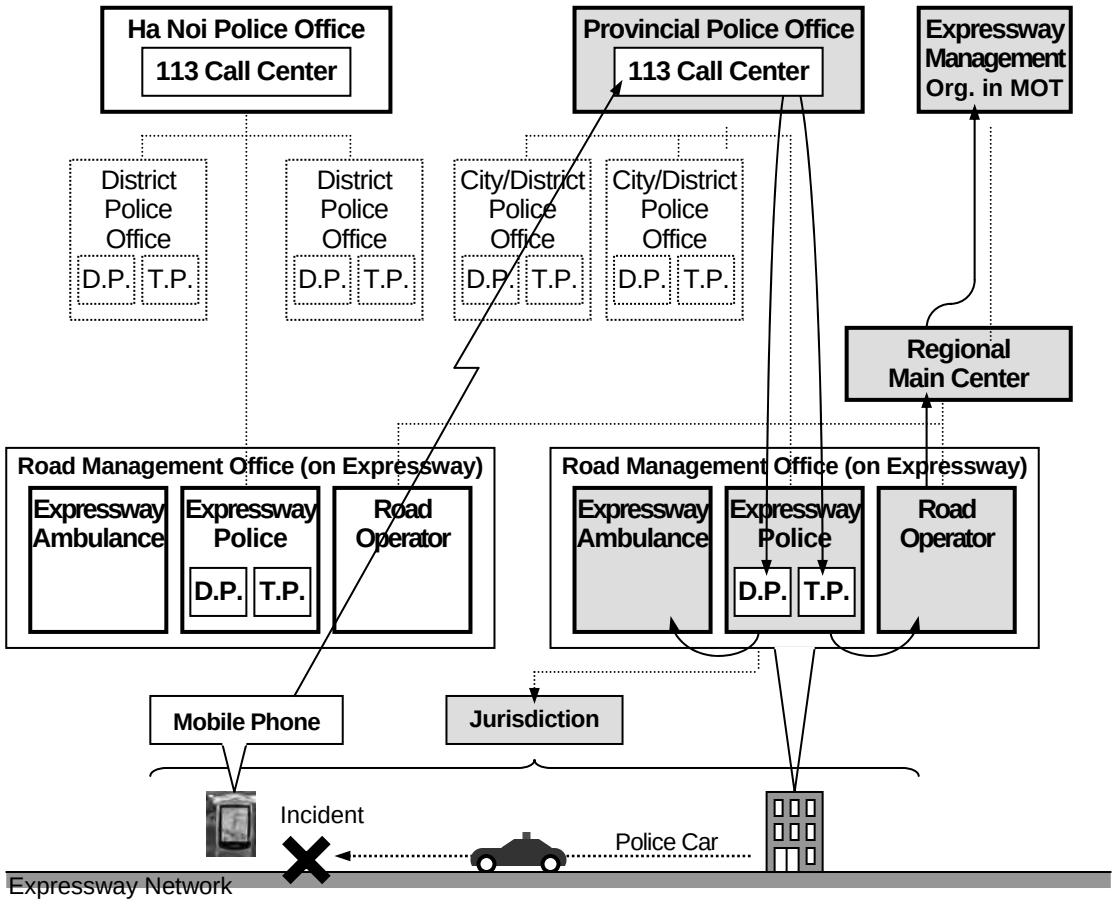
(3) Roles of Road Operator (in Each Expressway Section)

- Dispatch of a patrol crew to the incident site

(4) Roles of Police Office (and Expressway Police)

- Reception of a 113 call and notification to the expressway police, the road operator and the expressway ambulance
- Dispatch of a police car to the incident site

Figure 2.5 Framework for Police Car Dispatch



Note: D.P. : Detective police to be dispatched for traffic accidents with fatalities.
T.P. : Traffic police to be dispatched for traffic accidents without fatalities.

Source: ITS Integration Project (SAPI) Study Team

2.4.3 Framework for Ambulance Dispatch

A team of expressway ambulance is to be assigned to each road management office with teams of the road operator and the police with an identical jurisdiction. In this framework, the three teams are to cooperate responding to 115 calls in case of incidents, and roles are to be shared as follows:

(1) Roles of Expressway Management Organization in MOT

- Ownership/funding/management of the Regional Main Center
- Issue of permission for enforcing serious traffic restrictions such as road closure

(2) Roles of Road Operator (in Regional Main Center)

- Member dispatch for operation of the Regional Main Center

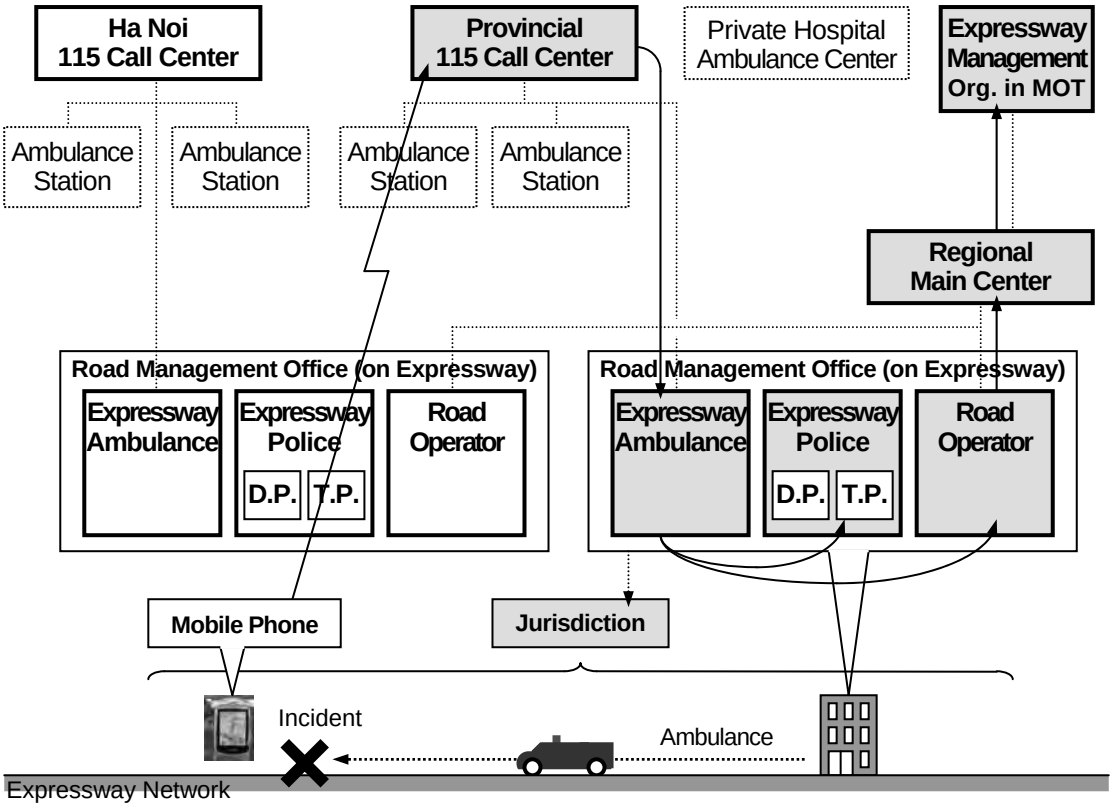
(3) Roles of Road Operator (in Each Expressway Section)

- Dispatch of a patrol crew to the incident site

(4) Roles of Ambulance Service (and Expressway Ambulance)

- Reception of a 115 call and notification to the expressway ambulance, the road operator and the expressway police
- Dispatch of an ambulance to the incident site

Figure 2.6 Framework for Ambulance Dispatch



Note: D.P. : Detective police to be dispatched for traffic accidents with fatalities
T.P. : Traffic police to be dispatched for traffic accidents without fatalities

Source: ITS Integration Project (SAPI) Study Team

2.4.4 Framework for Incident Notification to Road Operator

The framework below is recommended for the road operator to receive notification at the occurrence of incident on the expressway network:

- Main part is to be formed by the expressway management organization in MOT, the Regional Main Center and road management offices
- A special call number is to be prepared for the road operator to receive incident notification
- The Regional Main Center is to cooperate with the Police offices including 113 Call Center
- The Regional Main Center is to cooperate with the Ambulance Centers
- A team consist of the expressway police, the expressway ambulance and road operator is to be assigned to each road management office

(1) Roles of Expressway Management Organization in MOT

- Ownership/funding/management of the Regional Main Center
- Issue of permission for enforcing serious traffic restrictions such as road closure

(2) Roles of Road Operator (in Regional Main Center)

- Member dispatch for operation of the Regional Main Center
- Acquisition of incident information through the special call number or sensors of ITS

(3) Roles of Road Operator (in Each Expressway Section)

- Dispatch of a patrol crew to the incident site

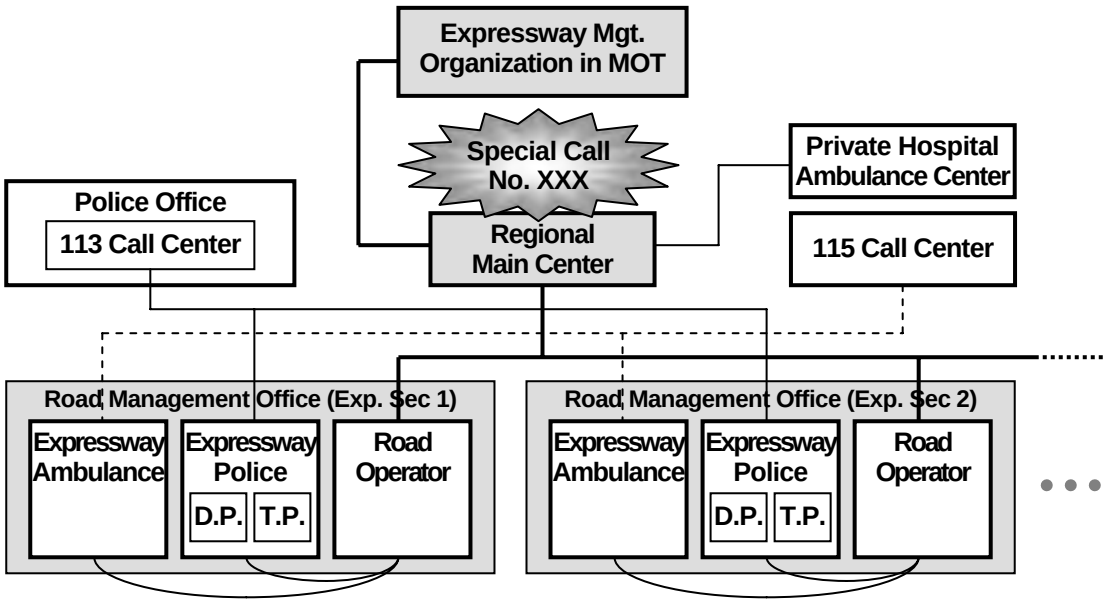
(4) Roles of Police Office (and Expressway Police)

- Reception of a 113 call and notification to the expressway police, the road operator

(5) Ambulance Service (and Expressway Ambulance)

- Reception of a 115 call and notification to the expressway ambulance, the road operator

Figure 2.7 Framework for Incident Notification to Road Operator



Note: D.P. : Detective police to be dispatched for traffic accidents with fatalities
T.P. : Traffic police to be dispatched for traffic accidents without fatalities

Source: ITS Integration Project (SAPI) Study Team

2.4.5 Framework for Traffic Restriction

The road operator is to acquire the information for deciding the traffic restrictions through the special call number or sensors of ITS and to make decisions to enforce the traffic restrictions on the expressway as well as the police in the framework organized under the Expressway Management Office. The roles are to be shared as follows:

(1) Roles of Expressway Management Organization in MOT

- Ownership/funding/management of the Regional Main Center
- Issue of permission for enforcing serious traffic restrictions such as road closure

(2) Roles of Road Operator (in Regional Main Center)

- Member dispatch for operation of the Regional Main Center
- Acquisition of incident information through the special call number or sensors of ITS

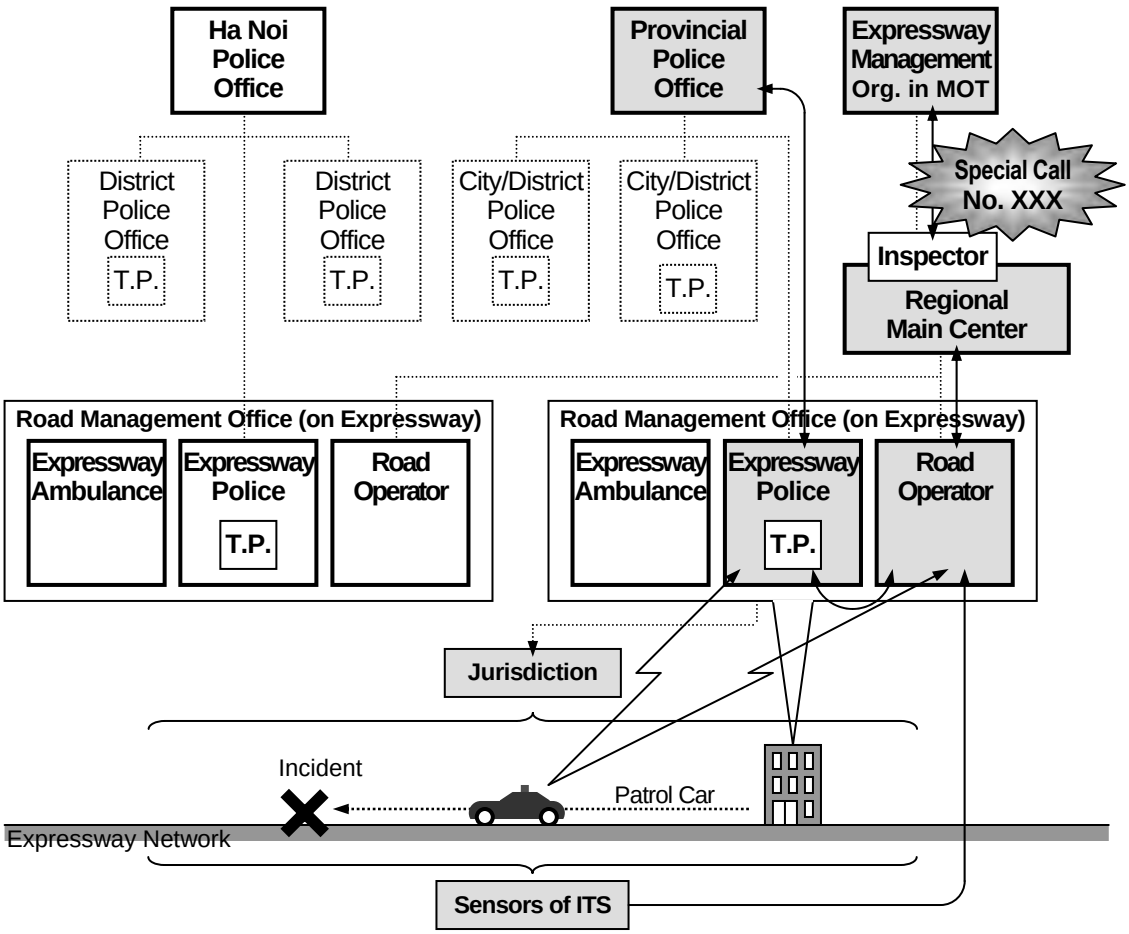
(3) Roles of Road Operator (in Each Expressway Section)

- Dispatch of a patrol crew to the incident site
- Judgement on the gravity of incident and enforcement of the traffic restrictions

(4) Roles of Police Office (and Expressway Police)

- Dispatch of a police car to the incident site

Figure 2.8 Framework for Traffic Restriction



Note: D.P. : Detective police to be dispatched for traffic accidents with fatalities
T.P. : Traffic police to be dispatched for traffic accidents without fatalities.

Source: ITS Integration Project (SAPI) Study Team

2.4.6 Framework for Road/Traffic Monitoring

On the other hand, the Regional Main Center is recommended to exchange information/ data of traffic conditions/events on the national highways or the arteries around the exits of expressways with the Traffic Police Station or the VOV Center in the framework below. The roles are to be shared as follows:

(1) Roles of Expressway Management Organization in MOT

- Exchange monitored information/data of traffic conditions/events

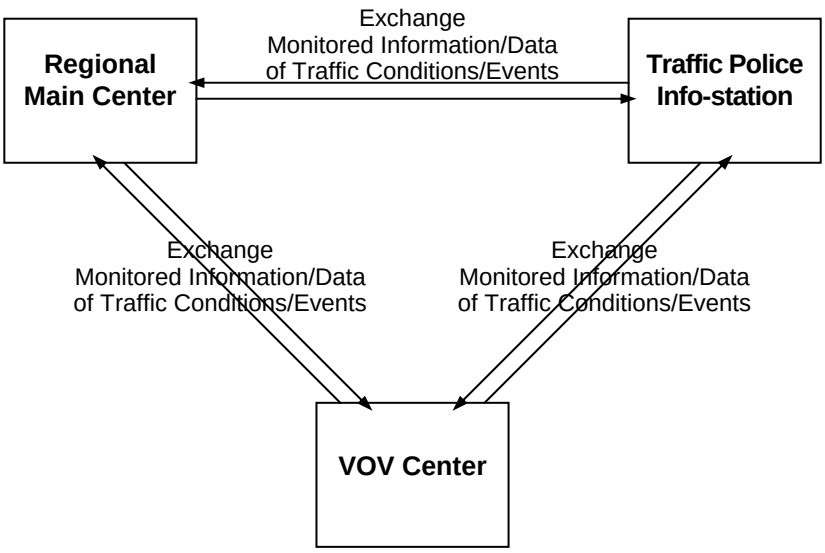
(2) Roles of Police Office (and Expressway Police)

- Exchange monitored information/data of traffic conditions/events

(3) Roles of VOV Center

- Exchange monitored information/data of traffic conditions/events.

Figure 2.9 Framework for Road/Traffic Monitoring



Source: ITS Integration Project (SAPI) Study Team

2.4.7 Framework for Traffic Event Data Management

A traffic event data can be input at a road management office or roadside as well as the Regional Main Center. The validity of the data needs to be checked at both the Regional Main Center and the road management office. Especially in case of a closure of expressway, the check is to be done for getting permission by the inspector under the Expressway Management Office assigned in the Regional Main Center.

(1) Roles of Expressway Management Organization in MOT

- Ownership/funding/management of the Regional Main Center
- Regulation on hardware/software in compliance with the ITS Standards
- Issue of permission for enforcing serious traffic restrictions such as road closure

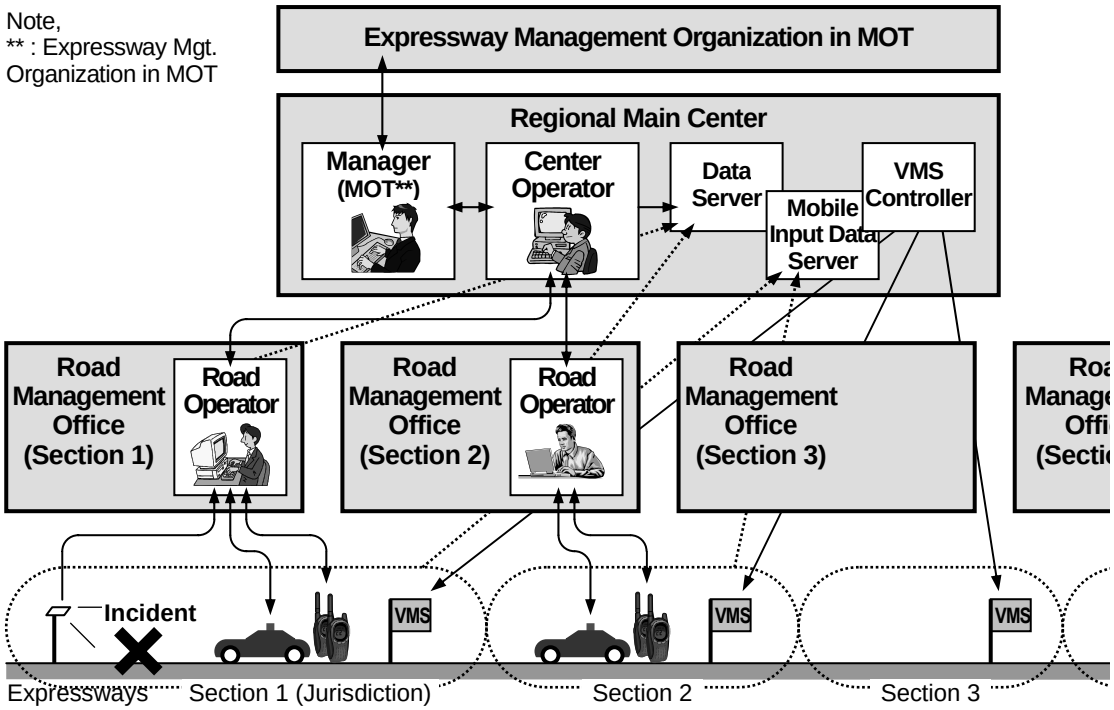
(2) Roles of Road Operator (in Regional Main Center)

- Member dispatch for operation of the Regional Main Center
- Acquisition of incident information through the special call number or sensors of ITS

(3) Roles of Road Operator (in Each Expressway Section)

- Dispatch of a patrol crew to the incident site
- Judgement on the gravity of incident and enforcement of the traffic restrictions
- Input a traffic event data at the road management office or roadside and checking of them

Figure 2.10 Framework for Traffic Event Data Management



Source: ITS Integration Project (SAPI) Study Team

2.4.8 Framework for Traffic Information Dissemination

Traffic Information, which consists of standardised messages and standardised data elements, is to be disseminated to organizations concerned through the Internet. The roles are to be shared as follows:

(1) Roles of Expressway Management Organization in MOT

- Ownership/funding/management of the Regional Main Center
- Regulation on hardware/software in compliance with the ITS Standards

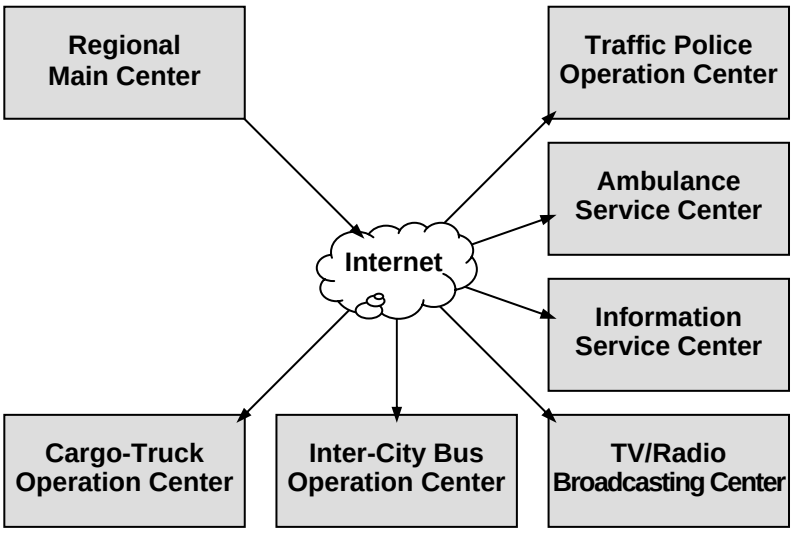
(2) Roles of Road Operator (in Regional Main Center)

- Member dispatch for operation of the Regional Main Center
- Acquisition of information through the special call number or sensors of ITS

(3) Roles of Road Operator (in Each Expressway Section)

- Judgement on the gravity of incident
- Input a traffic event data at the road management office or roadside and checking of them

Figure 2.11 Framework for Traffic Information Dissemination



Source: ITS Standards & Operation Plan Study Team

2.5 Framework for Toll Management

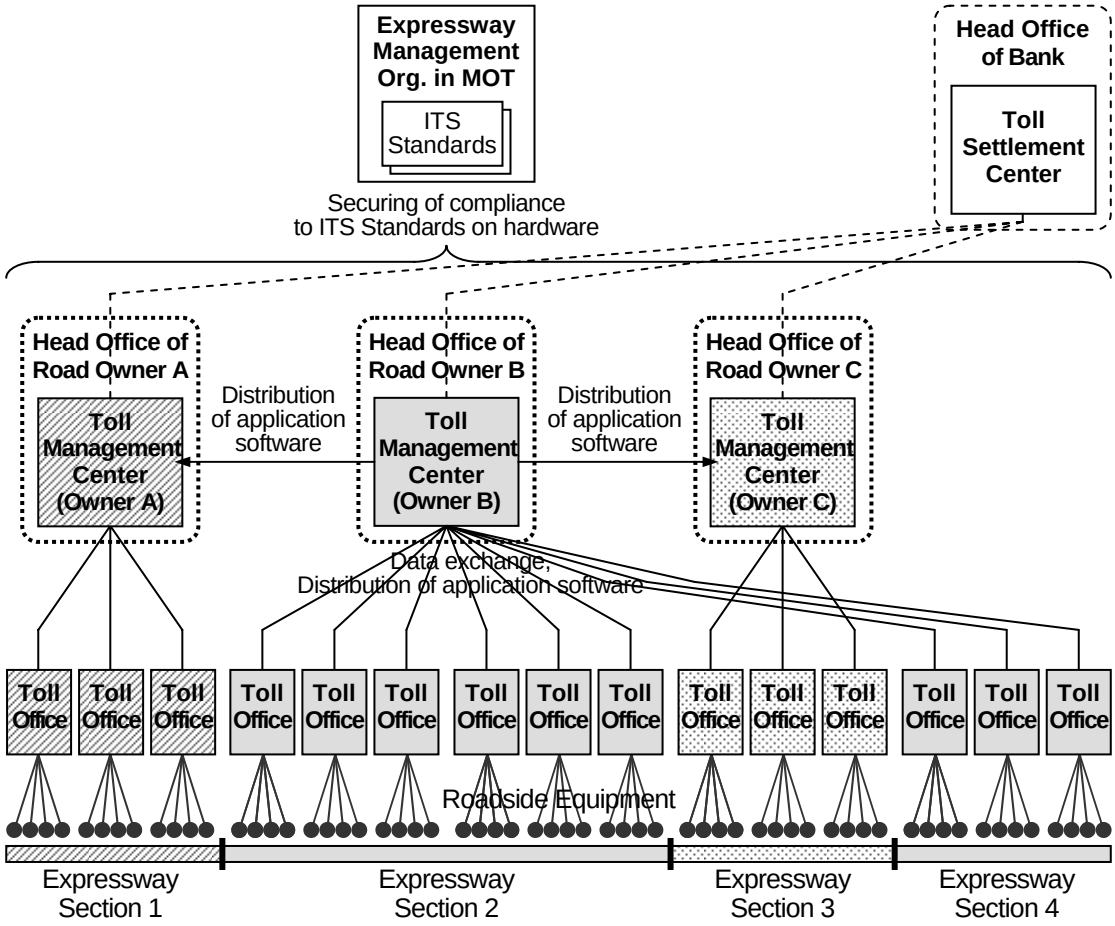
2.5.1 Key Framework

The framework for toll management in the following figure, which includes many different road owners and a bank, is to be defined as a premise for discussion in the Study. The processes at the tollgate including vehicle identification and validity check are to be executed directly by the road owner, and the processes of cash storage and toll settlement is to be transferred to a bank. The Standards on hardware is to be managed by the Expressway Management Office and the application software is to be managed/distributed by the Regional Main Center.

(1) Roles of Expressway Management Organization in MOT

- Regulation on hardware/software in compliance with the ITS Standards
- Integrated management on the data from toll collection/management, traffic information/ control and heavy truck control (including overloading regulation)
- Check of the validity of toll revenue in comparison with the data of traffic

Figure 2.12 Framework for Toll Management



Note: ▌: Barrier tollgates between the expressway sections of different road operators

Source: ITS Integration Project (SAPI) Study Team

(2) Roles of Road Owner

- Ownership/funding/maintenance of road structure/facilities of an expressway section other than ITS
- Ownership/funding of facilities of ITS of an expressway section
- Toll collection/management of an expressway section

(3) Roles of Road Operator (in Each Expressway Section)

- Operation/maintenance of hardware/software of ITS
- Assistance of toll collection of an expressway section

(4) Roles of Bank

- Prepayment management and toll settlement

2.5.2 Framework for Toll Settlement

Issue/recharge service for IC-cards is provided by a single bank in the 1st stage and by several different banks in later stages. These frameworks for toll settlement are based on utilization of a single kind of IC-card shared by different road owners. The roles are to be shared as follows:

(1) Roles of Road Owner

- Toll collection/management of an expressway section

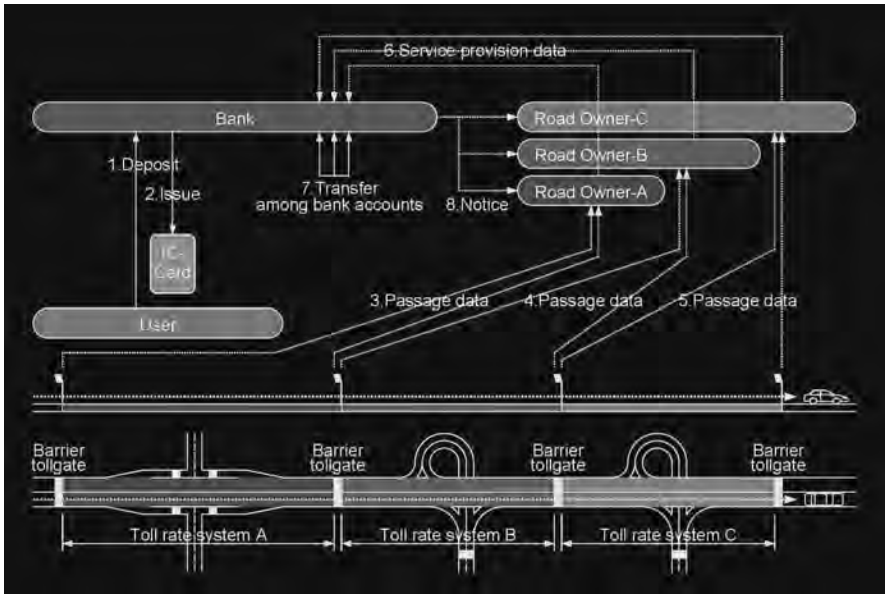
(2) Roles of Road Operator (in Each Expressway Section)

- Assistance of toll collection of an expressway section

(3) Roles of Bank

- Prepayment management and toll settlement

Figure 2.13 Framework for Toll Settlement



Source: VITRANSS2 Study Team

2.5.3 Framework for IC-Card Issuance/Operation

The framework below needs to be established for IC-card issuance/operation in both use of Touch&Go and ETC. Issue/recharge service is provided by a single bank in the 1st stage and by several banks in later stages. In this framework, the roles are to be shared as follows:

(1) Roles of Road Owner

- Toll collection/management of an expressway section
- Transfer of transaction data/status
- Charge for toll fare

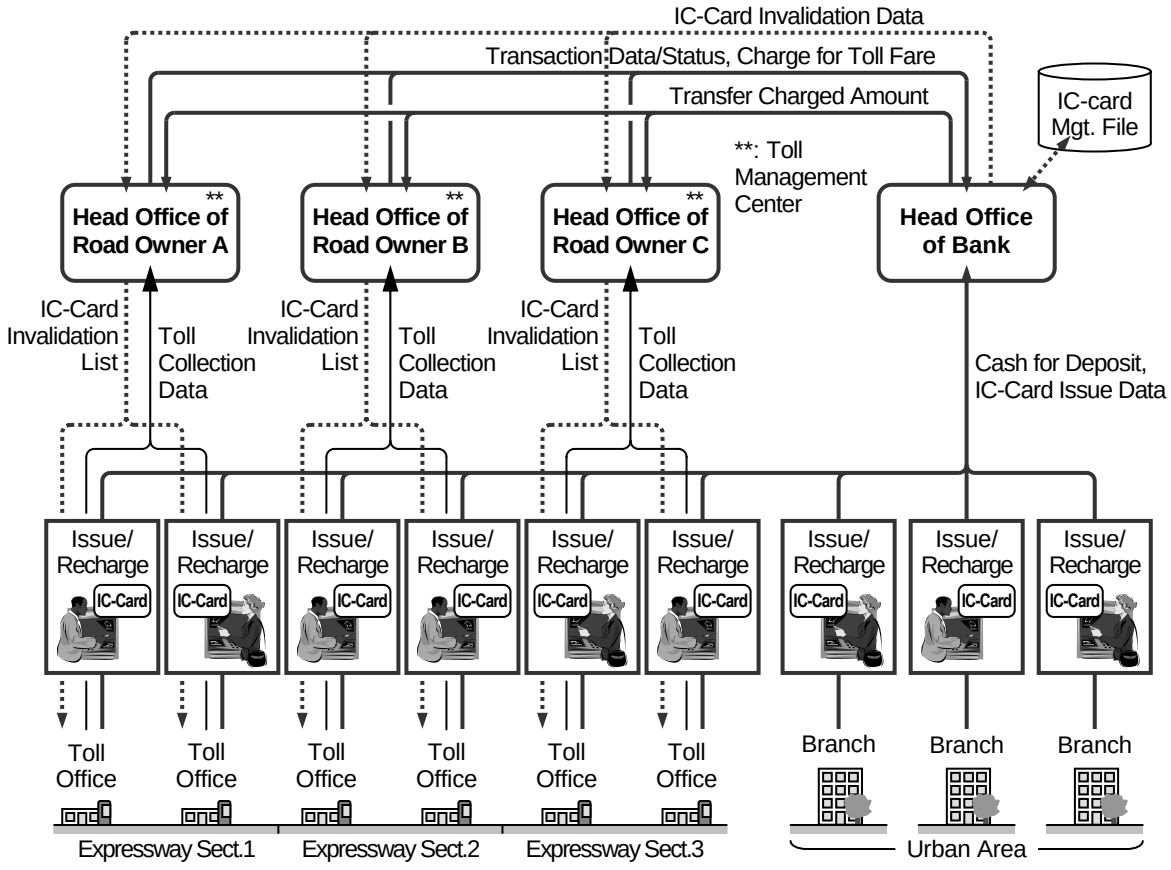
(2) Roles of Bank

- IC-card issue/recharge/management service
- Transfer of charge amount to the road owner
- Generation/distribution of IC-card validation list and assistance for toll enforcement

Required Condition:

The Bank is to be selected for IC-card issuance/operation.

Figure 2.14 Framework for IC-Card Issuance/Operation



Source: ITS Standards & Operation Plan Study Team

2.5.4 Framework for OBU Registration/Management

The framework below needs to be prepared for OBU registration/management, in which an OBU management center is operated by a unified organization for many different road owners and banks, because several banks will make a toll settlement by ETC in later stage. The roles are to be shared as follows:

(1) Roles of Road Owner

- Toll collection/management of an expressway section

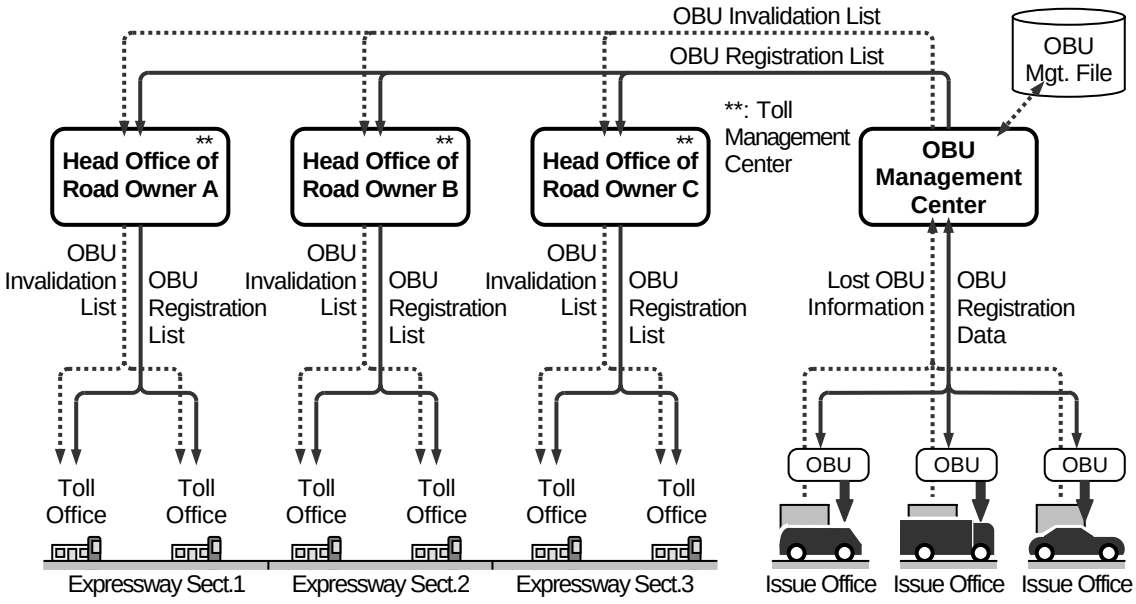
(2) Roles of OBU Management Center

- OBU registration/management service
- Generation/distribution of OBU registration/invalidation list and assistance for toll enforcement

Required Condition:

The OBU Management Center is to be set up (in the Vietnam Register) for OBU Registration/Management.

Figure 2.15 Framework for OBU Registration/Management



Source: ITS Standards & Operation Plan Study Team

2.5.5 Framework for Toll Enforcement

The framework for toll enforcement and invalidation is shown in the figure below. In the framework, invalidation of IC-card or OBU is to be claimed by the user and the enforcement process is to be performed in cooperation between the road owner and the detective police through the bank and OBU management center. The roles are to be shared as follows:

(1) Roles of Road Owner

- Toll collection/management of an expressway section
- Transfer of transaction data/status and assistance for toll enforcement

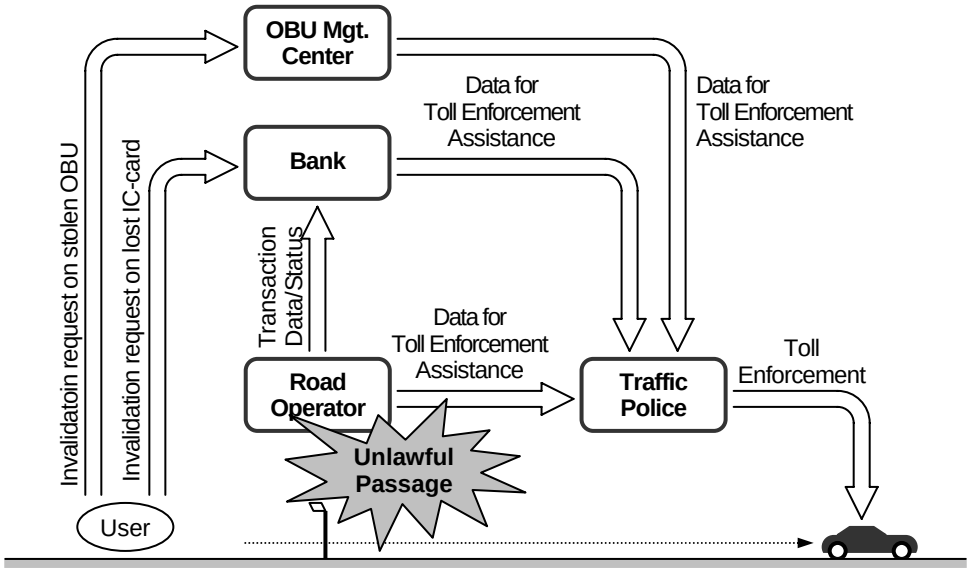
(2) Roles of Bank

- IC-card issue/recharge/management service
- Reception of claim for invalidation of an IC-card from a user
- Generation/distribution of IC-card validation list and assistance for toll enforcement

(3) Roles of OBU Management Center

- OBU registration/management service
- Reception of claim for invalidation of an OBU from a user
- Generation/distribution of OBU registration/invalidation list and assistance for toll enforcement

Figure 2.16 Framework for Toll Enforcement (including Invalidation)

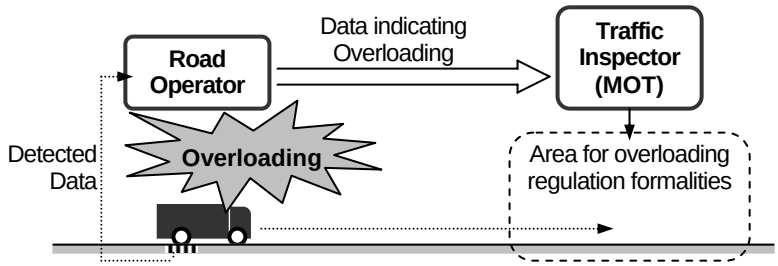


Source: ITS Standards & Operation Plan Study Team

2.6 Framework for Overloading Regulation

The procedure for overloading regulation is shown in the figure below. The role of road operator is to handover the inspector the information on the overloaded vehicle and the data from vehicle weighing system which indicates the fact of overloading.

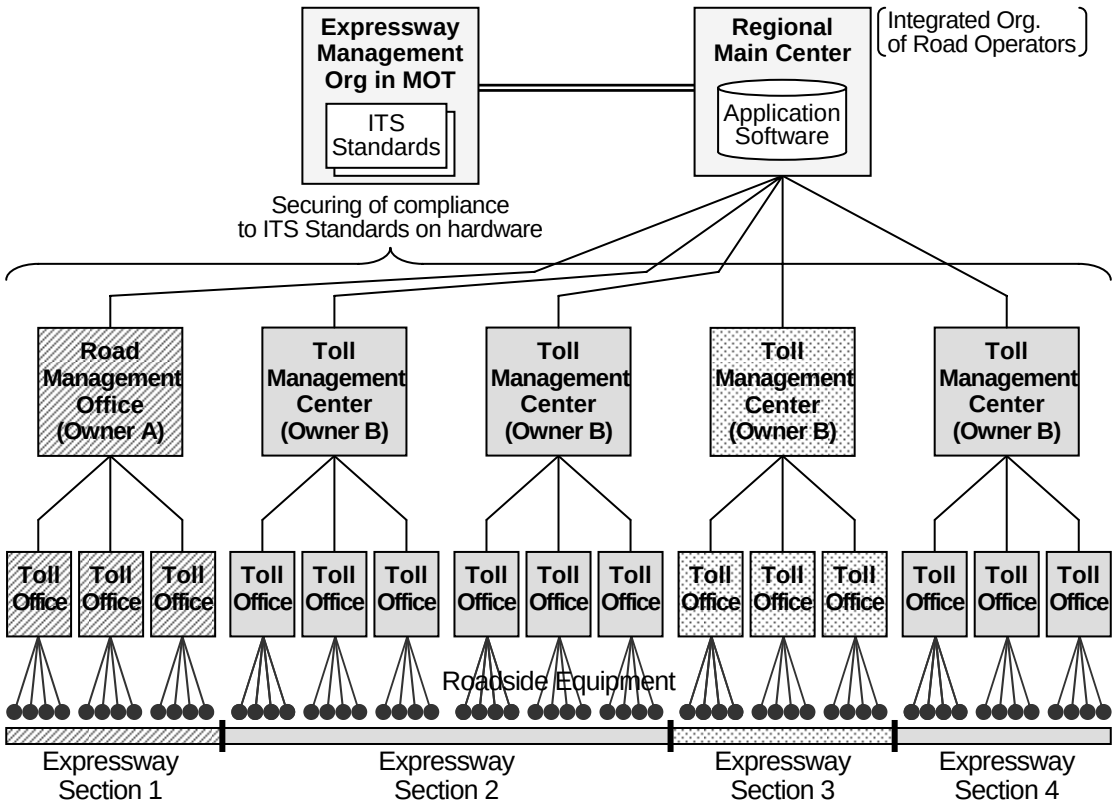
Figure 2.17 Procedure for Overloading Regulation



Source: ITS Standards & Operation Plan Study Team

The framework for overloading regulation shown in the figure below includes many different road owners, who own the expressway section and the vehicle weighing system, and the Regional Main Center. The Standards on hardware is to be managed by the Expressway Management Office and the application software is to be managed/distributed by the Regional Main Center.

Figure 2.18 Framework for Overloading Regulation



Note: ▌: Barrier tollgates between the expressway sections of different road operators

Source: ITS Integration Project (SAPI) Study Team

(1) Roles of Expressway Management Organization in MOT

- Regulation on hardware/software in compliance with the ITS Standards

(2) Roles of Road Owner

- Ownership/funding/maintenance of road structure/facilities of an expressway section other than ITS
- Ownership/funding of facilities of ITS of an expressway section

(3) Roles of Road Operator (in Each Expressway Section)

- Operation/maintenance of hardware/software of ITS
- Overloading regulation of an expressway section

2.7 Framework for Integrated Data Management

The framework shown below needs to be prepared for integrated data management. Traffic data, axle load data and toll revenue data are to be acquired and stored at the same place, and to be utilized for developing plans of inspection and budget for road maintenance and checking the validity of required toll revenue. The roles are to be shared as follows:

(1) Roles of Expressway Management Organization in MOT

- Ownership/funding/management of the Regional Main Center
- Regulation on hardware/software in compliance with the ITS Standards
- Integrated management on the data from toll collection/management, traffic information/ control and heavy truck control (including overloading regulation)
- Development of inspection and budget plan of road improvement/maintenance
- Check of the validity of toll revenue in comparison with the data of traffic
- Evaluation of road operator's achievement in the expressway operation

(2) Roles of Road Owner

- Ownership/funding/maintenance of road structure/facilities of an expressway section other than ITS
- Ownership/funding of facilities of ITS of an expressway section
- Toll collection/management of an expressway section

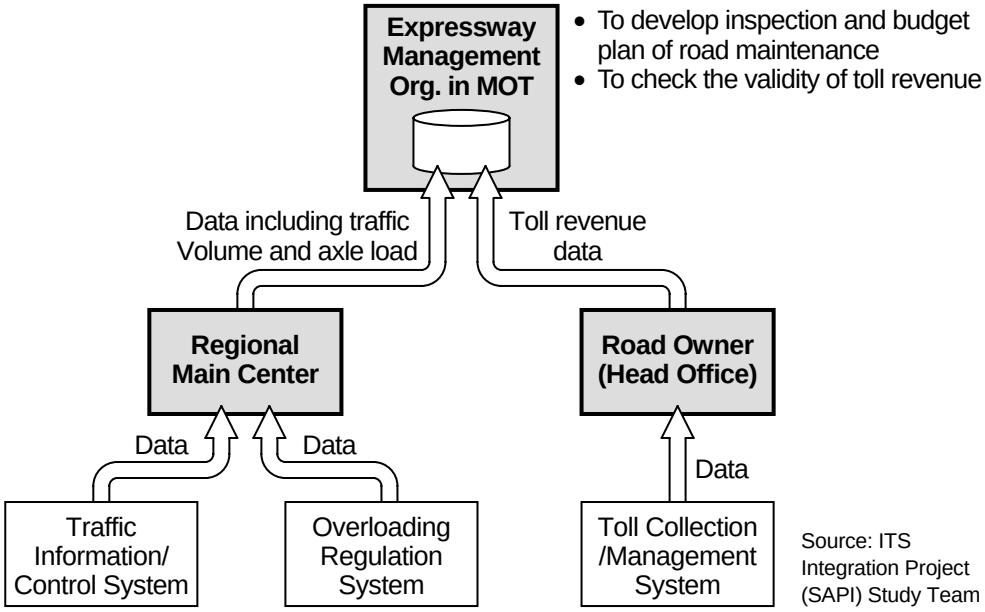
(3) Roles of Road Operator (in Regional Main Center)

- Member dispatch for operation of the Regional Main Center
- Maintenance of hardware/software of ITS

(4) Roles of Road Operator (in Each Expressway Section)

- Assistance of toll collection of an expressway section
- Traffic information/control of an expressway section
- Overloading regulation of an expressway section
- Operation/maintenance of hardware/software of ITS

Figure 2.19 Framework for Integrated Data Management



Source: ITS Integration Project (SAPI) Study Team

2.8 Framework for Communication Network Management

2.8.1 Key Framework

It is recommended for road owners/operators to outsource the communication network management to a telecom service company, because telecom service companies have higher skills. Introduction of communication system/equipment also is to be outsourced to the telecom service companies in the future, as proposed in the Decision No.3569/VPCP-KTN VNPT, because they can select appropriate system, which will not be the hindrance of the operation and maintenance.

(1) Roles of Road Owner

- Ownership/funding of facilities of ITS of an expressway section

(2) Roles of Road Operator (in Regioanl Main Center)

- Member dispatch for operation of the Regional Main Center
- Maintenance of hardware/software of ITS

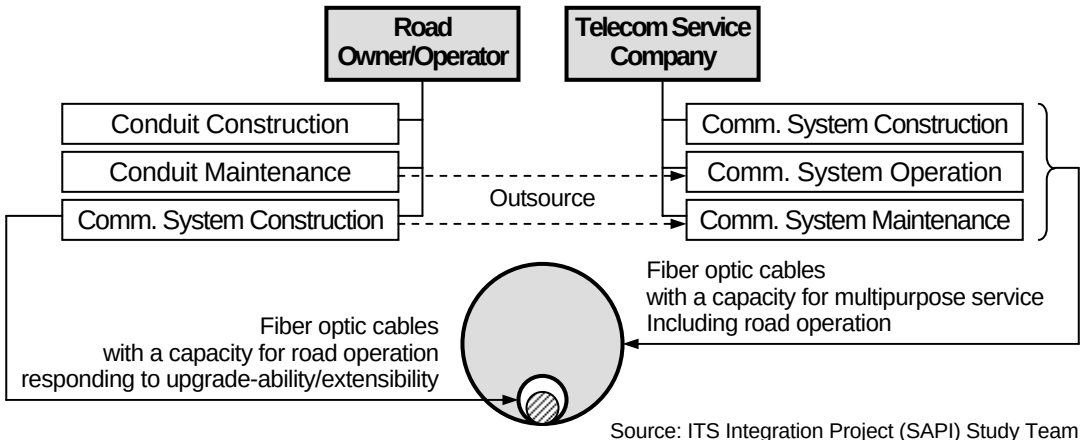
(3) Roles of Road Operator (in Each Expressway Section)

- Operation/maintenance of hardware/software of ITS

(4) Roles of Telecom Service Company

- Ownership/funding/maintenance of facilities of communication system of ITS
- Operation of communication system of ITS

Figure 2.20 Framework for Communication Network Management



Source: ITS Integration Project (SAPI) Study Team

2.8.2 Framework for Radio Frequency Allocation

Upon the utilization of radio frequency, there is a band necessary to obtain the license. The necessity of the license should be checked to Radio Frequency Directorate, if the frequency to be used is required to be licensed, the road operator in road management office should submit the application to Radio Frequency Directorate, and before installing the radio transmitter, the license shall be obtained. The roles are to be shared as follows:

(1) Roles of Radio Frequency Directorate

- Issuance of the license for utilization of radio frequency

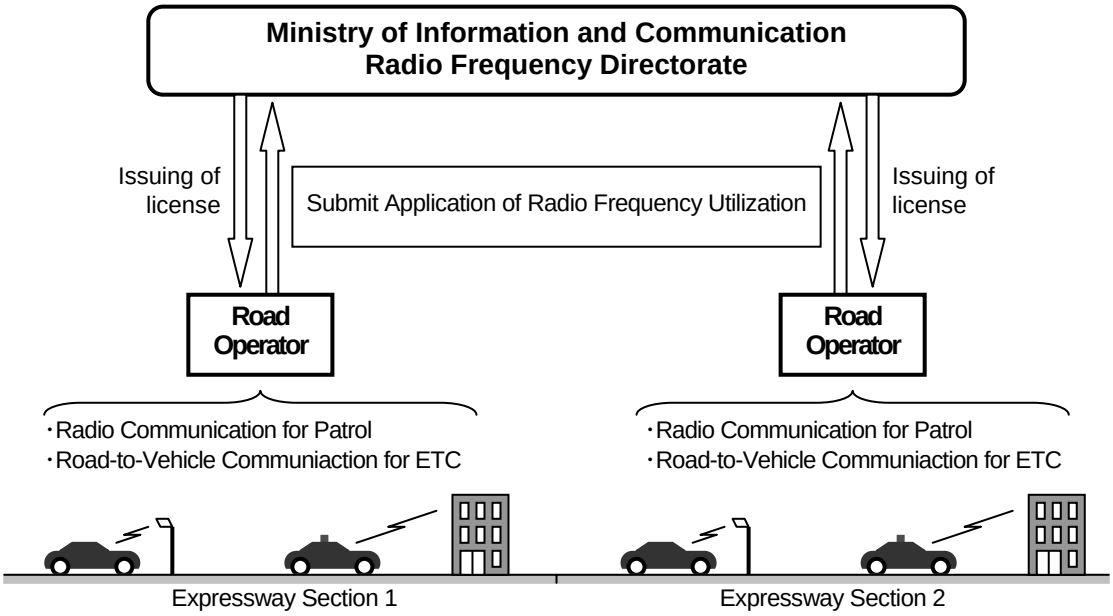
(2) Roles of Road Owner

- Submission of the application for utilization of radio frequency

(3) Roles of Road Operator (in Each Expressway Section)

- Operation of mobile radio communication for patrol and road-to-vehicle communication for ETC

Figure 2.21 Framework for Radio Frequency Allocation



Source: ITS Integration Project (SAPI) Study Team

2.9 Framework for System Maintenance

Maintenance of structures/facilities in the Regional Main Center, road management offices, toll offices and at roadside are to be shared by MOT, the road owners and the road operators. In addition, facilities for communication system, IC-cards and OBUs are to be maintained respectively by the telecom service company, the bank and the OBU management center.

(1) Roles of Expressway Management Organization in MOT

- Ownership/funding/management of the Regional Main Center
- Regulation on hardware/software in compliance with the ITS Standards

(2) Roles of Road Owner

- Ownership/funding of facilities of ITS of an expressway section

(3) Roles of Road Operator (in Regional Main Center)

- Member dispatch for operation of the Regional Main Center
- Maintenance of hardware/software of ITS

(4) Roles of Road Operator (in Each Expressway Section)

- Operation/maintenance of hardware/software of ITS

(5) Roles of Telecom Service Company (in the Future)

- Ownership/funding/maintenance of facilities of communication system of ITS
- Operation of communication system of ITS

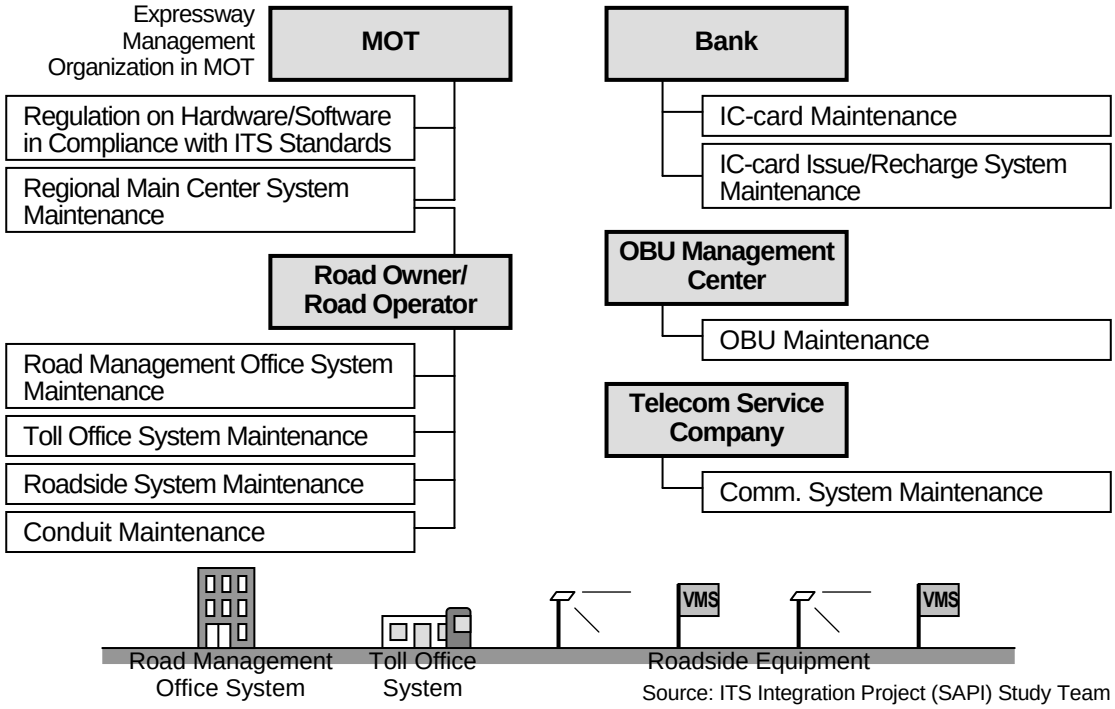
(6) Roles of Bank

- IC-card issue/recharge/management service

(7) Roles of OBU Management Center

- OBU registration/management service

Figure 2.22 Framework for System Maintenance

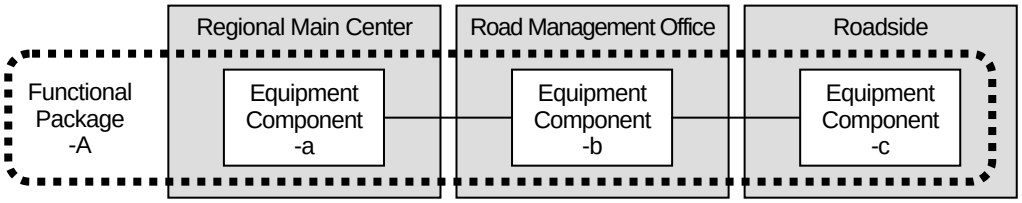


Source: ITS Integration Project (SAPI) Study Team

2.10 Role Sharing

ITS cosists of many functional packages and each functional package consists of several equipment components which can be installed separately in different locations as shown in the figure below. However, the centers and roadside are operated respectively by the different organizations. Accordingly, for discussing the sytem operation, the roles are to be detailed responding to the functional packages and the offices where equipment packages are installed.

Figure 2.23 Functional Package Consists of Equipment Components in Different Locations



Source: ITS Integration Project (SAPI) Study Team

In the following, the roles of exressway operation for the major organizations: the expressway management organization in MOT, the road owner, the road operator, the telecommunication service company, the OBU management center and the bank are shown in the form of matrix, which corresponds to the functional packages and the locations. These organizations shall share the roles and cooperate for operating and maintaining each functional package.

2.10.1 Roles of Expressway Management Organization in MOT

From the discussion on frameworks foregoing, roles of the expressway management organization in MOT are to be sort out as shown in the table below.

The Expressway Management Office is set up as the expressway management organization in MOT in 1st April 2011, is transferred to DRVN in 26th April 2012 and will be change into the Expressway Management Agency.

Table 2.1 Roles of Expressway Management Organization in MOT

Items		Center Subsystem			Roadside Subsystem	Onboard Subsystem	Mobile Subsystem	In-door Subsystem
		Regional Main Center	Road Management Office	Toll Office				
Functional Packages								
1	Voice Communication	O/F/Mgt						
2	CCTV Monitoring	O/F/Mgt						
3	Event Detection (by Image)	O/F/Mgt						
4	Vehicle Detection	O/F/Mgt						
5	Traffic Analysis	O/F/Mgt						
6	Weather Monitoring	O/F/Mgt						
7	Traffic Event Data Management	O/F/Mgt						
8	Traffic Supervision	O/F/Mgt						
9	VMS Indication	O/F/Mgt						
10	Mobile Radio Communication							
11	Traffic Information	O/F/Mgt						
12	Integrated Data Management	O/F/Mgt						
13	Tollgate Lane Monitoring							
14	Vehicle/Class Identification							
15	Lane Control							
16	Road-to-Vehicle Communication							
17	IC-card Recording							
18	Toll Data Management							
19	OBU Management							
20	Axle Load Measurement							
21	Measurement Lane Monitoring							
Communication System		O/F/Mgt						
Communication Ducts		O/F/Mgt						
Base Structures		O/F/Mgt						
Electric Power Supply		O/F/Mgt						

Note: O: Ownership, F: Funding, Mgt: Management.

Source: ITS Integration Project (SAPI) Study Team

2.10.2 Roles of Road Owner

From the discussion on frameworks foregoing, roles of the road owner are to be sort out as shown in the table below.

The road owners has been assigned respectively to the road sections in the Project Scope:

- VEC: Phap Van – Cau Gie – Ninh Binh
- RMU-2: Mai Dich – Thanh Tri, Ha Noi – Bac Ninh and Noi Bai – Bac Ninh
- HPC: Lang – Hoa Lac.

Table 2.2 Roles of Road Owner

Items		Center Subsystem			Roadside Subsystem	Onboard Subsystem	Mobile Subsystem	In-door Subsystem
		Regional Main Center	Road Management Office	Toll Office				
Functional Packages								
1	Voice Communication		O/F/Mgt	O/F/Mgt	O/F/Mgt			
2	CCTV Monitoring		O/F/Mgt		O/F/Mgt			
3	Event Detection (by Image)		O/F/Mgt		O/F/Mgt			
4	Vehicle Detection		O/F/Mgt		O/F/Mgt			
5	Traffic Analysis							
6	Weather Monitoring				O/F/Mgt			
7	Traffic Event Data Management		O/F/Mgt					
8	Traffic Supervision							
9	VMS Indication				O/F/Mgt			
10	Mobile Radio Communication		O/F/Mgt			O/F/Mgt	O/F/Mgt	
11	Traffic Information							
12	Integrated Data Management							
13	Tollgate Lane Monitoring			O/F/Mgt	O/F/Mgt			
14	Vehicle/Class Identification				O/F/Mgt			
15	Lane Control				O/F/Mgt			
16	Road-to-Vehicle Communication				O/F/Mgt			
17	IC-card Recording				O/F/Mgt			
18	Toll Data Management			O/F/Mgt				
19	OBU Management		O/F/Mgt					
20	Axle Load Measurement				O/F/Mgt			
21	Measurement Lane Monitoring			O/F/Mgt				
Communication System			O/F/Mgt	O/F/Mgt	O/F/Mgt			
Communication Ducts			O/F/Mgt	O/F/Mgt	O/F/Mgt			
Base Structures			O/F/Mgt	O/F/Mgt	O/F/Mgt			
Electric Power Supply			O/F/Mgt	O/F/Mgt	O/F/Mgt			

Note: O: Ownership, F: Funding, Mgt: Management.

Source: ITS Integration Project (SAPI) Study Team

2.10.3 Roles of Road Operator

From the discussion on frameworks foregoing, roles of the road operator are to be sort out as shown in the table below.

Road operators under road owners assigned to the road sections in the Project Scope:

- VEC O&M Company (under VEC): Phap Van – Cau Gie – Ninh Binh
- Road O&M company 248 (under RMU-2): Mai Dich – Thanh Tri, Ha Noi – Bac Ninh and Noi Bai – Bac Ninh
- Infrastructure Maintenance Project Management Unit (under HPC): Lang – Hoa Lac.

Table 2.3 Roles of Road Operator

Items		Center Subsystem			Roadside Subsystem	Onboard Subsystem	Mobile Subsystem	In-door Subsystem
		Regional Main Center	Road Management Office	Toll Office				
Functional Packages								
1	Voice Communication	Op/M *	Op/M	Op/M	Op/M			
2	CCTV Monitoring	Op/M *	Op/M		Op/M			
3	Event Detection (by Image)	Op/M *	Op/M		Op/M			
4	Vehicle Detection	Op/M *	Op/M		Op/M			
5	Traffic Analysis	Op/M *						
6	Weather Monitoring	Op/M *			Op/M			
7	Traffic Event Data Management	Op/M *	Op/M					
8	Traffic Supervision	Op/M *						
9	VMS Indication	Op/M *			Op/M			
10	Mobile Radio Communication		Op/M			Op/M	Op/M	
11	Traffic Information	Op/M *						
12	Integrated Data Management	Op/M *						
13	Tollgate Lane Monitoring			Op/M	Op/M			
14	Vehicle/Class Identification				Op/M			
15	Lane Control				Op/M			
16	Road-to-Vehicle Communication				Op/M			
17	IC-card Recording				Op/M			
18	Toll Data Management			Op/M				
19	OBU Management		Op/M					
20	Axle Load Measurement				Op/M			
21	Measurement Lane Monitoring			Op/M				
Communication System		Op/M *	Op/M	Op/M	Op/M			
Communication Ducts		Op/M *	Op/M	Op/M	Op/M			
Base Structures		Op/M *	Op/M	Op/M	Op/M			
Electric Power Supply		Op/M *	Op/M	Op/M	Op/M			

Note: Op: Operation, M: Maintenance, * : Operation by member dispatch to the Regional Main Center.

Source: ITS Integration Project (SAPI) Study Team

2.10.4 Roles of Telecommunication Service Company

From the discussion on frameworks foregoing, roles of the telecommunication service company are to be sort out as shown in the table below.

Introduction and O&M of communication system is to be outsourced to the telecom service companies for manpower saving in the later stage after the ITS Integration Project, that is proposed by the Decision No.3569/ VPCP-KTN VNPT.

Table 2.4 Roles of Telecommunication Service Company

Items		Center Subsystem			Roadside Subsystem	Onboard Subsystem	Mobile Subsystem	In-door Subsystem
		Regional Main Center	Road Management Office	Toll Office				
Functional Packages								
1	Voice Communication	(O/F) M	(O/F) M	(O/F) M	(O/F) M			
2	CCTV Monitoring							
3	Event Detection (by Image)							
4	Vehicle Detection							
5	Traffic Analysis							
6	Weather Monitoring							
7	Traffic Event Data Management							
8	Traffic Supervision							
9	VMS Indication							
10	Mobile Radio Communication		(O/F) M			(O/F) M	(O/F) M	
11	Traffic Information							
12	Integrated Data Management							
13	Tollgate Lane Monitoring							
14	Vehicle/Class Identification							
15	Lane Control							
16	Road-to-Vehicle Communication							
17	IC-card Recording							
18	Toll Data Management							
19	OBU Management							
20	Axle Load Measurement							
21	Measurement Lane Monitoring							
Communication System		(O/F) Op/M	(O/F) Op/M	(O/F) Op/M	(O/F) Op/M			
Communication Ducts								
Base Structures								
Electric Power Supply								

Note: O: Ownership, F: Funding, Op: Operation, M: Maintenance.

Source: ITS Integration Project (SAPI) Study Team

2.10.5 Roles of Other Organization

From the discussion on frameworks foregoing, roles of the bank and the OBU management center are to be sort out as shown in the table below.

IC-card recording, which is included prepayment strongly related to toll settlement among several different road owners, is to be operated a bank or an organization permitted by the State Bank (as the case of Decision No.5190/NHNN-TT). OBU Management is to be carried out independently by the Vietnam Register using the deposit and service charge for OBU.

Table 2.5 Roles of Other Organizations

Items		Center Subsystem			Roadside Subsystem	Onboard Subsystem	Mobile Subsystem	In-door Subsystem
		Regional Main Center	Road Management Office	Toll Office				
Functional Packages								
1	Voice Communication							
2	CCTV Monitoring							
3	Event Detection (by Image)							
4	Vehicle Detection							
5	Traffic Analysis							
6	Weather Monitoring							
7	Traffic Event Data Management							
8	Traffic Supervision							
9	VMS Indication							
10	Mobile Radio Communication							
11	Traffic Information							
12	Integrated Data Management							
13	Tollgate Lane Monitoring							
14	Vehicle/Class Identification							
15	Lane Control							
16	Road-to-Vehicle Communication						Bank	
17	IC-card Recording						(O/F) Op/M	O/F Op/M
18	Toll Data Management							
19	OBU Management					(O/F) Op/M		O/F Op/M
20	Axle Load Measurement					OBU Management Center		
21	Measurement Lane Monitoring							
Communication System								
Communication Ducts								
Base Structures								
Electric Power Supply								

Note: O: Ownership, F: Funding, Op: Operation, M: Maintenance.

Source: ITS Integration Project (SAPI) Study Team

3. Outlines of Tasks for Expressway Operation

1) Triggers of Traffic Information/Control

(1) Receiving Notification by Document

The following traffic events are to be notified by document from the road works contractors and other organizations:

- Construction works
- Special event

(2) Telephone Call

The following traffic events are to be notified by telephone call from the drivers:

- Incidentt

(3) Administrative Telephone or Radio Communication

The following traffic events are to be notified by administrative telephone or radio communication:

- Incident
- Special event
- Construction work
- Bad weather
- Traffic congestion
- Traffic restriction

(4) Monitoring by CCTV Camera

The following traffic events are to be identified through monitoring by CCTV camera:

- Incident
- Bad weather
- Traffic congestion

(5) Identification by Detectors/Sensors

The following traffic events are to be identified by detectors and sensors:

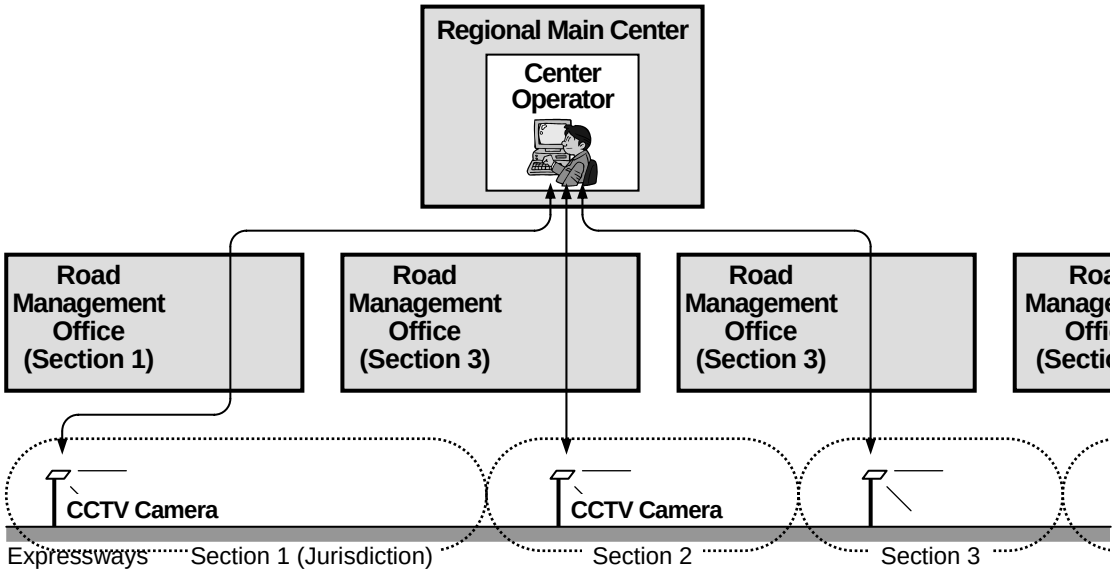
- Incident
- Bad weather
- Traffic congestion
- Traffic restriction

2) Cooperation on Camera Control among Regional Main Center and Road Management Offices

(1) Case-1: Routine Monitoring

Routine road/traffic monitoring is to be delegated to the Regional Main Center for integrating traffic information/control with a wider view on the expressway network. CCTV cameras are to be controlled directly from the Regional Main Center.

Figure 3.1 Routine Monitoring

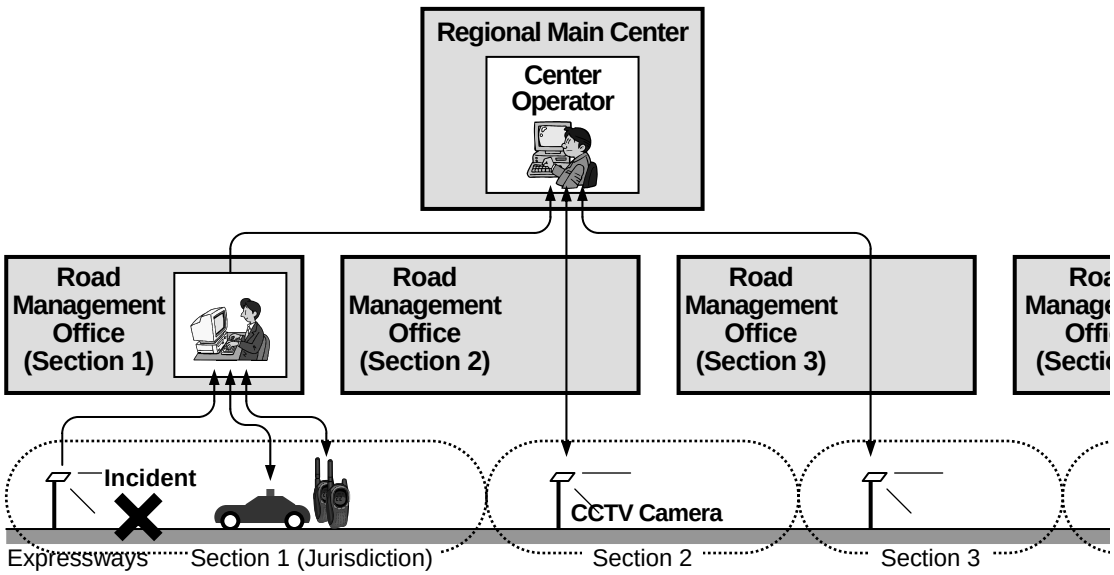


Source: ITS Integration Project (SAPI) Study Team

(2) Case-2: Monitoring at Occurrence of Incident

Road/traffic monitoring at incident site is to be conducted by the road management office in charge to appropriately address/clear the incident. CCTV cameras at incident site are to be controlled from the road management office in charge, and other CCTV cameras and VMS are to be controlled from the Regional Main Center.

Figure 3.2 Monitoring at Occurrence of Incident



Source: ITS Integration Project (SAPI) Study Team

3) Measures of Expressway Operation responding to Incident

The following measures are to be taken for expressway operation responding to incidents:

- Information provision to organization concerned
- Incident handling/clearance by manpower
- Traffic restriction by manpower
- Speed limitation by CSS
- Traffic restriction information by VMS
- Information by VMS

(1) Information Provision to Organization Concerned

Information is to be provided to the traffic police, the fire section, ambulance services, towing services and other offices of road operators concurrently with instruction to the patrol crews. Negotiations with traffic police is necessary for enforcing/removing traffic restrictions.

(2) Incident Handling/Clearance by Manpower

Incident handling and clearance is to be conducted mainly by manpower as shown in the picture below.

Figure 3.3 Incident Handling/Clearance by Manpower

Source: ITS Integration Project (SAPI) Study Team

(3) Traffic Restriction by Manpower

Traffic restriction is to be conducted mainly by manpower as shown in the picture below.

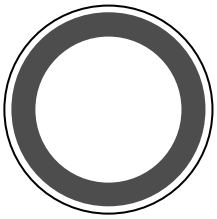
Figure 3.4 Traffic Restriction by Manpower

Source: ITS Integration Project (SAPI) Study Team

(4) Speed Limitation by CSS

Speed limitation is to be disseminated by indication using CSS.

Table 3.1 Speed Limitation by CSS

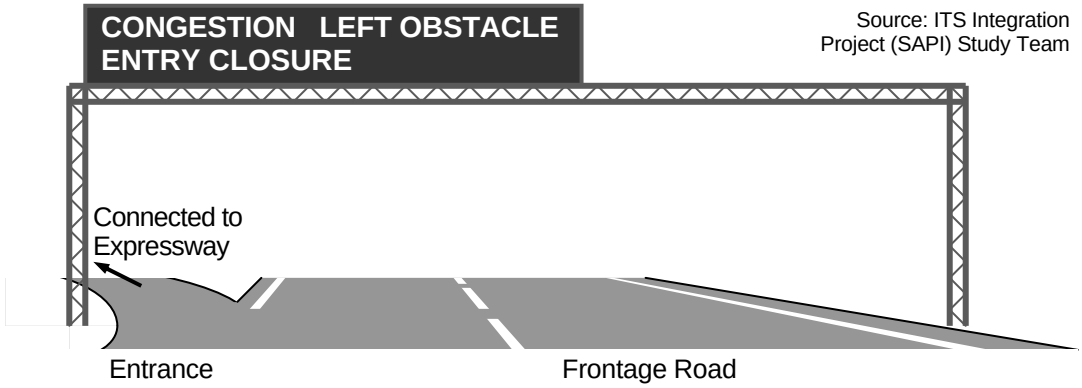
CSS Indication	Closure 	Speed limit at 50 km/h 	Speed limit at 80 km/h 
Heavy Rain	More than 40 mm/h	More than 20 mm/h	More than 15 mm/h
High Wind	More than 20 m/sec	More than 15 m/sec	More than 10 m/sec
Dense Fog	Visibility less than 50 m	Visibility less than 50 m	Visibility less than 50 m

Source: ITS Integration Project (SAPI) Study Team

(5) Traffic Restriction Information by VMS

Traffic restriction information is to be disseminated by indication using VMS. Entry closure shown in the figure below is a typical example of it.

Figure 3.5 VMS Indication for Entry Closure



(6) Guidance Information by VMS

Guidance information is to be disseminated by indication using VMS. Instruction of going out at the exit as shown in the figure below is a typical example of it.

Figure 3.6 VMS Indication for Closure

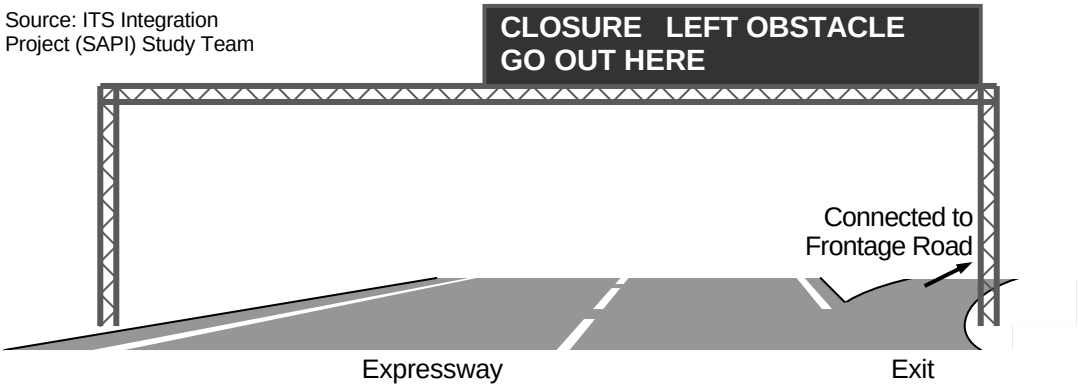


Table 3.2 Definition of Traffic Events including Correlations

Category	Traffic Event		Definition	Traffic Event to be Correlated												
Special Event	Special Event		Special event which may prevent vehicle traffic	X	X	X	X	X	X	X	X	X	X	X	X	X
Incident	Traffic Accident		Serious traffic accident	X	X	X	X	X	X	X	X	X	X	X	X	X
	Incident in Tunnel		Incident in tunnel including fire	X	X	X	X	X	X	X	X	X	X	X	X	X
	Reverse Driving		Vehicle driven in the reverse direction	X	X	X	X	X	X	X	X	X	X	X	X	X
	Broken-down Vehicle		Vehicle stopping on the road	X	X	X	X	X	X	X	X	X	X	X	X	X
	Left Obstacle		Object* on the road which may prevents vehicle traffic	X	X	X	X	X	X	X	X	X	X	X	X	X
	Natural Disaster		Natural disaster which may prevent vehicle traffic	X	X	X	X	X	X	X	X	X	X	X	X	X
	Vandalism		Wilful destruction of facilities or obstruction to traffic on the road	X	X	X	X	X	X	X	X	X	X	X	X	X
Construction Work	Construction Work		Construction work which may prevent vehicle traffic	X	X	X	X	X	X	X	X	X	X	X	X	X
Bad Weather	Heavy Rain	1	Heavy rain more than 40 mm/h**	X	X	X	X	X	X	X	X	X				
		2	Heavy rain more than 20 mm/h**	X	X	X	X	X	X	X					X	
		3	Heavy rain more than 10 mm/h**	X	X	X	X	X	X	X						X
	High Wind	1	High wind more than 25 m/sec** on average	X	X	X	X	X	X	X	X	X				
		2	High wind more than 20 m/sec** on average	X	X	X	X	X	X	X					X	
		3	High wind more than 10 m/sec** on average	X	X	X	X	X	X	X						X
	Dense Fog	1	Dense fog with visibility less than 50 m**	X	X	X	X	X	X	X	X	X				
		2	Dense fog with visibility less than 100 m**	X	X	X	X	X	X	X					X	
		3	Dense fog with visibility less than 200 m**	X	X	X	X	X	X	X						X
	High Temperature		High temperature more than 40 degrees C**													
Traffic Congestion	Congestion on Trough Lanes	1	VS continuously slower than 40 km/h*** on av. with VQ longer than 4 km													
		2	VS continuously slower than 40 km/h*** on av. with VQ longer than 2 km													
		3	VS continuously slower than 40 km/h*** on av. with VQ longer than 1 km													
	Crowdedness on Trough Lanes		VS slower than 50 km/h*** on av. with no or short VQ													
	Congestion at Exit	1	VS continuously slower than 40 km/h*** on av. with VQ longer than 4 km at exit													
		2	VS continuously slower than 40 km/h*** on av. with VQ longer than 2 km at exit													
		3	VS continuously slower than 40 km/h*** on av. with VQ longer than 1 km at exit													
Traffic Restriction	Entry Closure		Restriction to stop inflow traffic at entrance													
	Closure		Restriction to stop traffic on through lanes													
	Exit Closure		Restriction to stop traffic at exit													
	Lane Closure		Restriction to stop through traffic partially on some lanes													
	Speed Limitation	1	Restriction to limit the fastest vehicle speed less than 50 km/h													
		2	Restriction to limit the fastest vehicle speed less than 80 km/h													

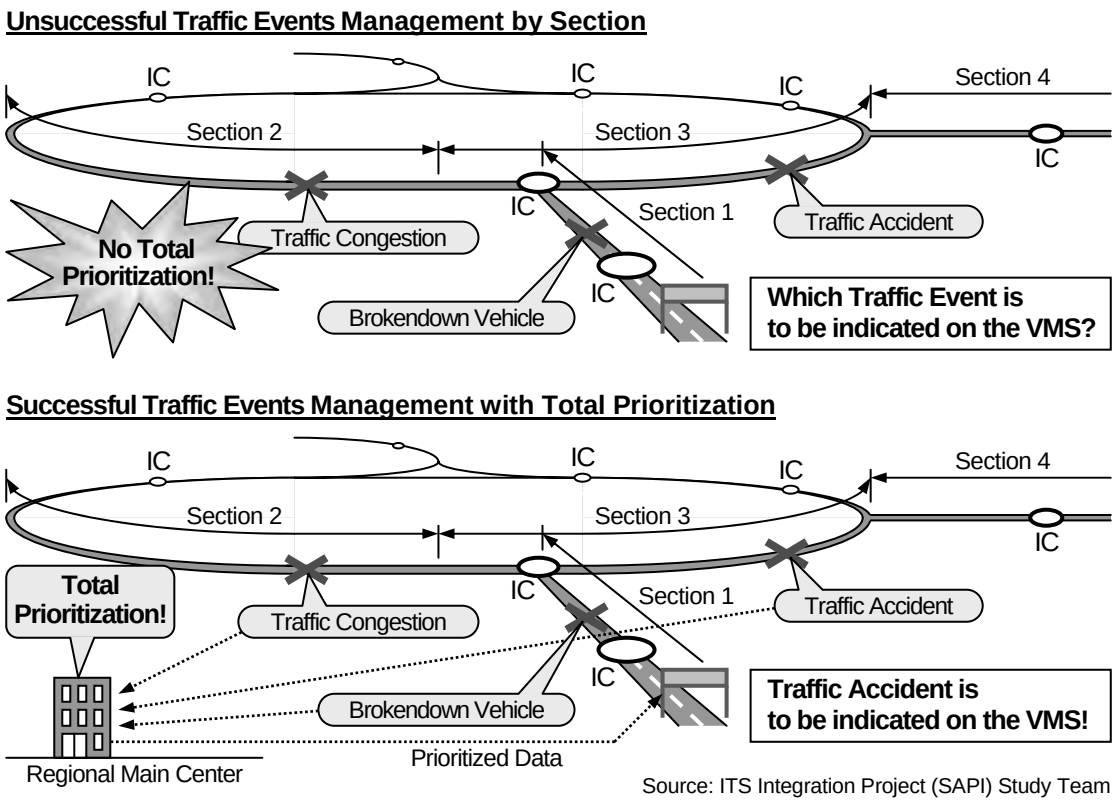
Note: VS: Vehicle speed, VQ : Vehicle queuing, * : Excluding vehicles, ** : Specific definition is shown Appendix 4, *** : Specific definition is shown Appendix 4.

Source: ITS Integration Project (SAPI) Study Team

4) Prioritisation of Traffic Events

Total prioritisation at the Regional Main Center is necessary for traffic events management.

Figure 3.7 Necessity of Prioritisation of Traffic Events

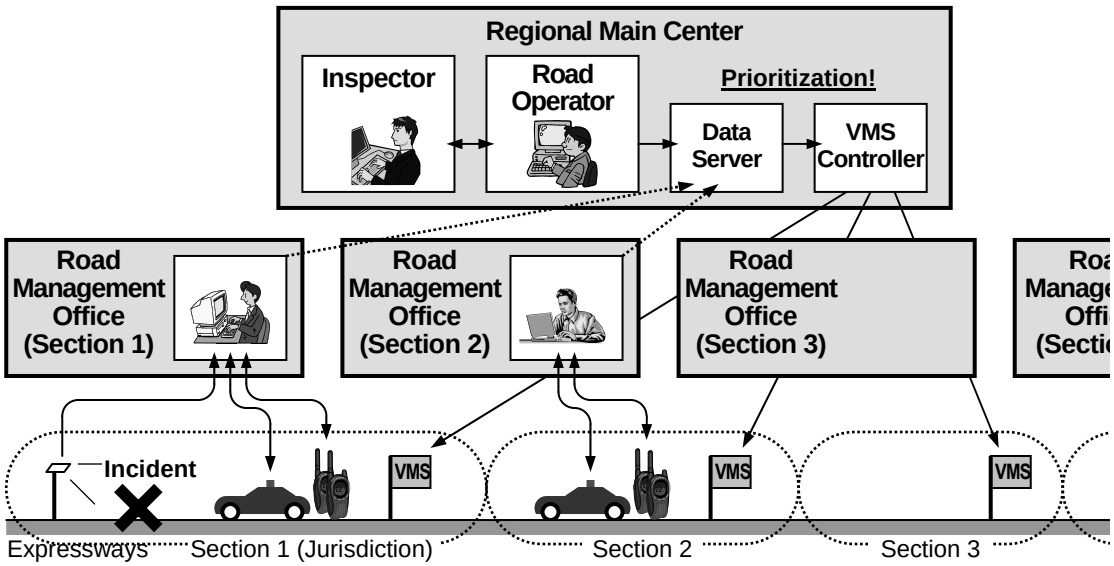


Source: ITS Integration Project (SAPI) Study Team

5) Cooperation on VMS Control among Regional Main Center and Road Management Offices

Cooperation of the Regional Main Center and road management office is necessary for VMS control.

Figure 3.8 Cooperation for VMS Control

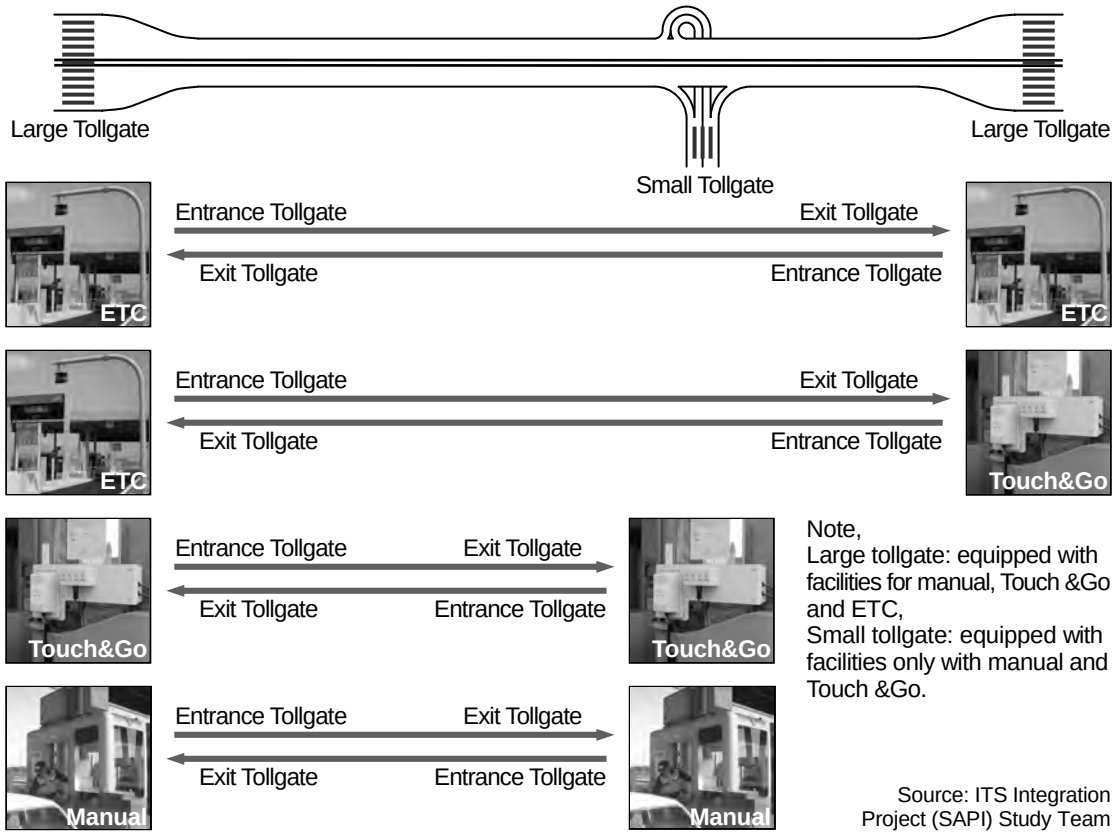


Source: ITS Integration Project (SAPI) Study Team

6) Combined Use of ETC and Touch&Go

Available combination of toll collection methods at entrance and exit is shown in the figure below. For reducing the cost of roadside equipment implementation, combination use of ETC and Touch&Go is available.

Figure 3.9 Available Combination of Toll Collection Methods at Entrance/Exit

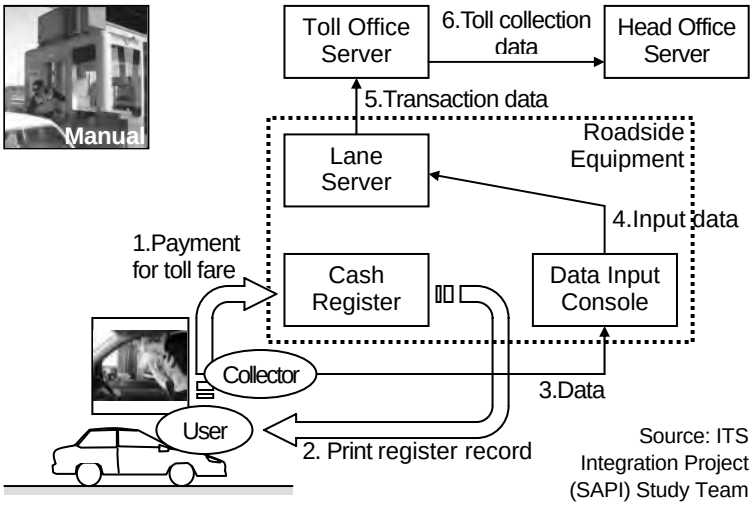


Source: ITS Integration Project (SAPI) Study Team

7) Procedure of Toll Collection

Procedure of manual toll collection is shown in the figure below.

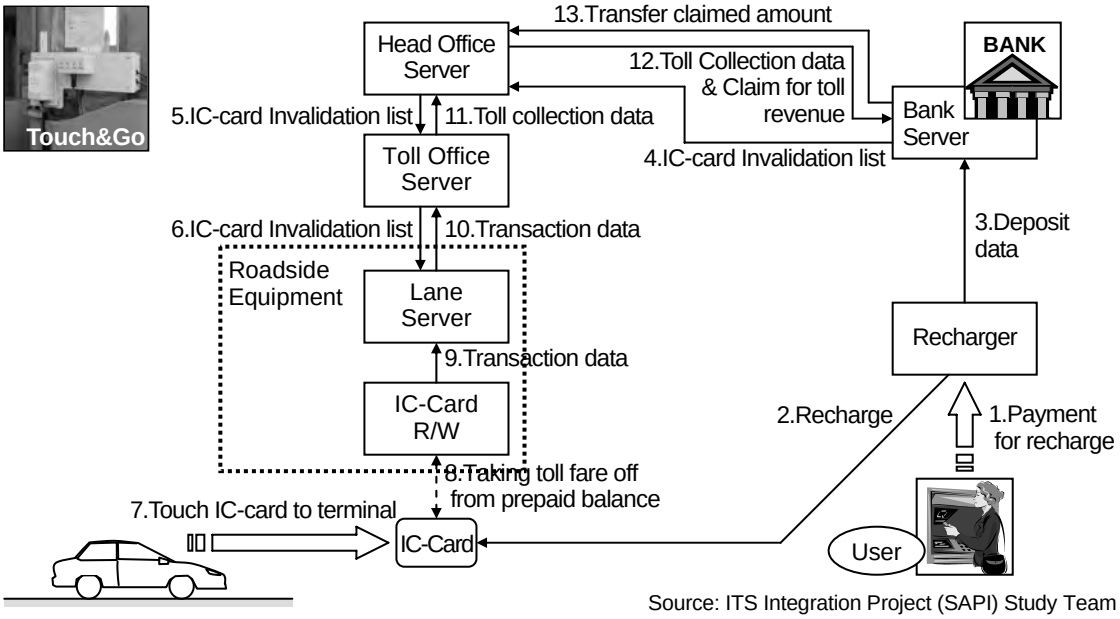
Figure 3.10 Procedure and System Outline of Manual Toll Collection



Source: ITS Integration Project (SAPI) Study Team

Toll collection by Touch-and-Go is to be actualised by servers, roadside equipment and IC-card as shown in the figure below.

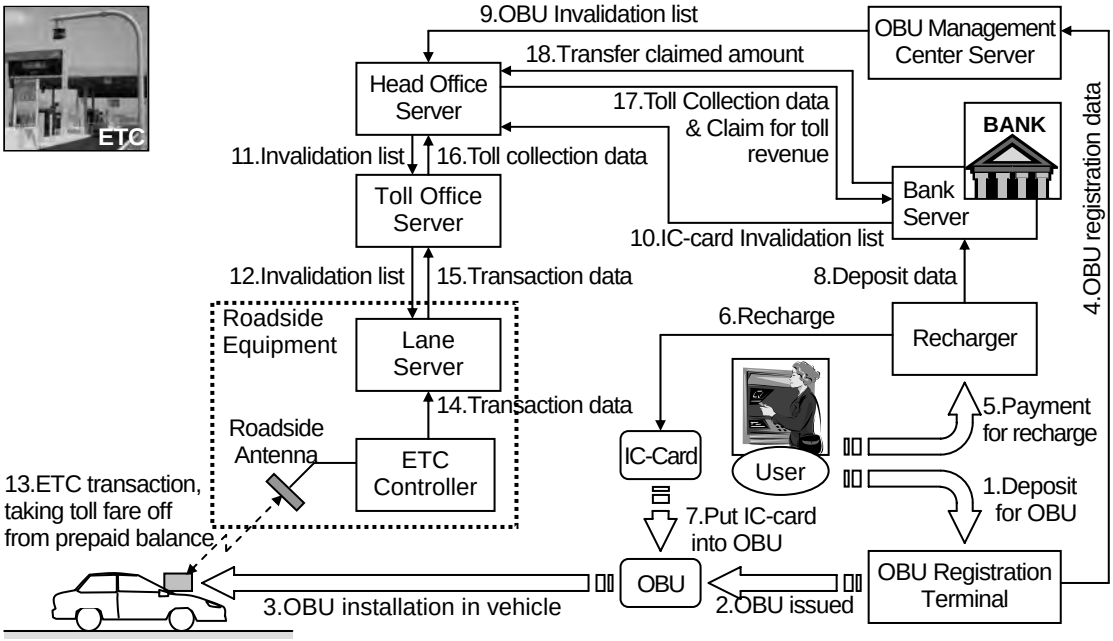
Figure 3.11 Procedure and System Outline of Touch-and-go



Source: ITS Integration Project (SAPI) Study Team

Toll collection by ETC is to be actualised by servers, roadside equipment, OBU and IC-card as shown in the figure below.

Figure 3.12 Procedure and System Outline of ETC



Source: ITS Integration Project (SAPI) Study Team

8) Procedure of Toll Management

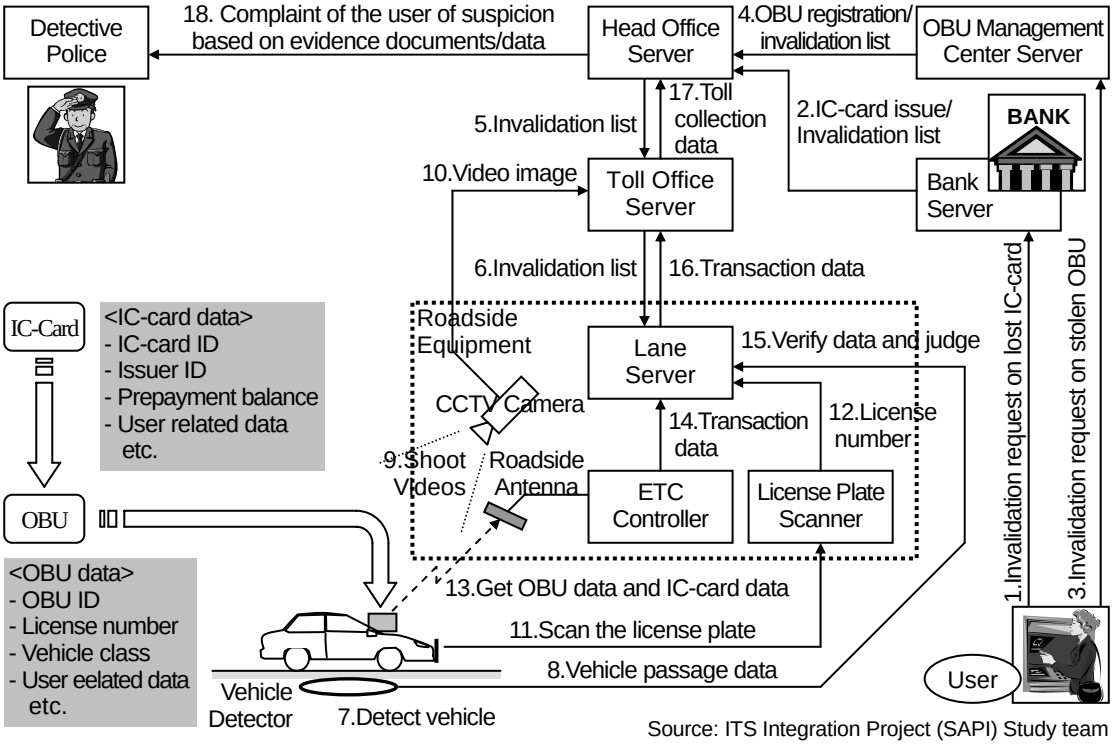
Monitoring by video image: The CCTV system in the toll offce is to provide the staffs with the video image shot by the camera at the tollgate continuously for keeping track of the vehicle

passage and to allow for appropriate toll management.

Enforcement Support: The toll office server is to receive transaction data from the lane server and to send it to the bank server. That allows a search of suspicious vehicles corresponding to the license number obtained by the scanner or the CCTV camera.

Enforcement Support procedure for ETC is to be actualised by servers and roadside equipment as shown in the figure below.

Figure 3.13 Procedure and System Outline of Enforcement Support



Source: ITS Integration Project (SAPI) Study team

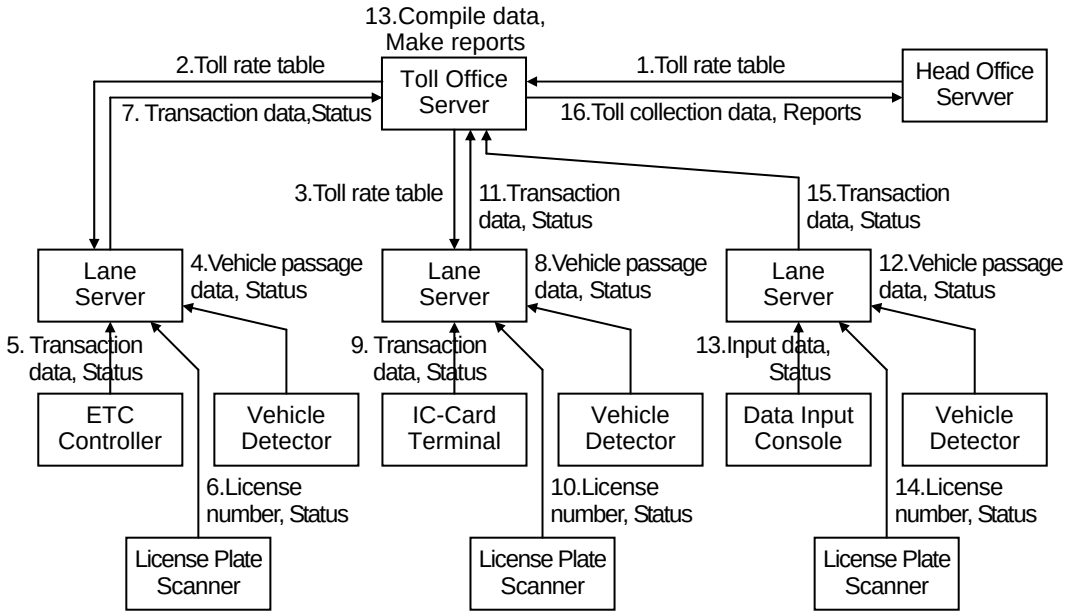
Download of toll management data: The toll office server is to download the latest toll rate table to every lane servers in advance of the revision of tariff system in order to put new tariff system into operation. The toll office server is to invalidation list , as well, which may include ID of stolen OBU or IC-card with shortage in balance.

Gathering/transferring transaction data: The toll office server is to gather all transaction data periodically from the lane servers and transfer them to the bank server to find unlawful passages.

Compiling/uploading toll collection data: The toll office server is to compile the data statistically and make any kind of toll collection reports such as a daily report, a weekly report, a monthly report, and a yearly report. The toll office server is to upload them to the head office server to claim for toll revenue to the bank. All the data in toll office server is to be printed out for audit purposes.

Monitoring equipment operation status: The toll office server is to monitor the operation status of all toll related equipment to support maintenance action. If abnormal status is detected, the toll office server is to alert on maintenance terminal.

Figure 3.14 Procedure and System Outline of Toll Management

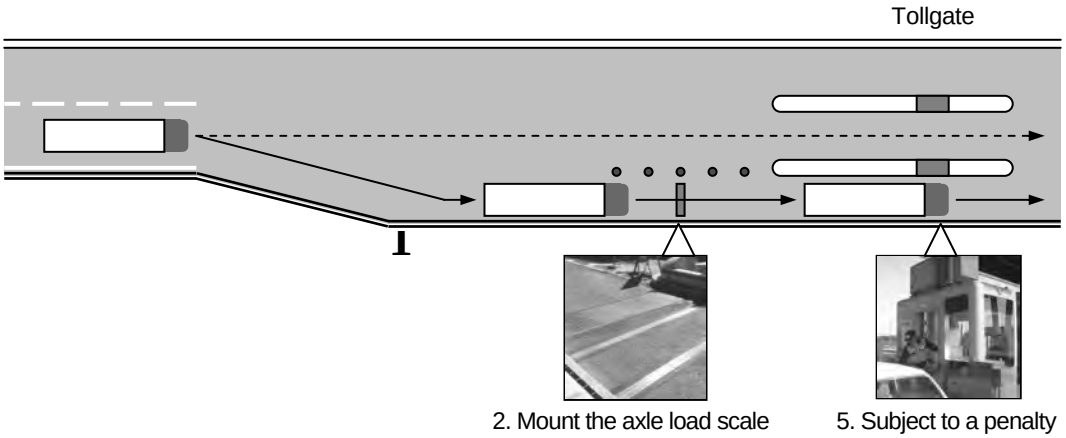


Source: ITS Integration Project (SAPI) Study Team

9) Procedure of Overloading Regulation

Overloading regulation is actualised by the procedure shown in the figure below.

Figure 3.15 Procedure of Overloading Regulation



2. Mount the axle load scale
3. Be judged to be over loading
4. Receive invalidity ticket

5. Subject to a penalty by manual

Source: ITS Integration Project (SAPI) Study Team

4. Event Trace Diagrams of Tasks for Expressway Operation

4.1 General

The tasks for expressway operation are listed in the table below. The discussion results on the event trace diagrams for these tasks are shown in the following pages.

Table 4.1 Task List of Event Trace Diagrams

Name of System	No.	Task Procedures
Traffic Information/Control System	4.2	Routine Patrol
	4.3	Traffic Condition Monitoring
	4.4	Incident Reporting by Mobile Phone (113 Call)
	4.5	Incident Reporting by Mobile Phone (115 Call)
	4.6	Incident Reporting by Mobile Phone (to Private Hospital)
	4.7	Incident Reporting by Mobile Phone (to Regional Main Center)
	4.8	Incident Reporting from Patrol
	4.9	Incident Identification by Camera
	4.10	Ascertainment of Incident Situation
	4.11	Heavy Rain Identification
	4.12	High Wind Identification
	4.13	Dense Fog Identification
	4.14	High Temperature Identification
	4.15	Flood Identification
	4.16	Stopped Vehicle Identification
	4.17	Reverse Driving Identification
	4.18	Left Obstacle Reporting
	4.19	Vandalism Identification
	4.20	Road Damage Identification
	4.21	Construction Work Information Handling
	4.22	Road Traffic Supervision
	4.23	Decision of Traffic Restriction
	4.24	Entrance Closure
	4.25	Closure
	4.26	Exit Closure
	4.27	Lane Closure
	4.28	Speed Restriction
	4.29	Incident Handling
	4.30	Incident Clearance Reporting
	4.31	Restriction Removal
	4.32	Restriction Removal Reporting
	4.33	Traffic Event Management in Regional Main Center
	4.34	Traffic Event Management in Road Management Office
	4.35	Traffic Event Management by Patrol Crew
	4.36	Traffic Information by VMS
	4.37	Traffic Information by Internet
	4.38	Traffic Information by Broadcast
	4.39	Traffic Information Cancellation
	4.40	Traffic Data Management
	4.41	Integrated Data Management
	4.42	Routine Data Check in Regional Main Centre

Source: ITS Integration Project (SAPI) Study Team

Table 4.2 Task List of Event Trace Diagrams (2)

Name of System	No.	Task Procedures
Automated Toll Collection /Management System	4.43	Toll Collection by Manual
	4.44	Toll Collection by Touch & Go
	4.45	Toll Collection by ETC
	4.46	Handling of Vehicle without OBU into ETC Lane
	4.47	Handling of Balance Shortage Vehicle
	4.48	Handling of OBU Reinstalled Illegally
	4.49	Toll Data Management
	4.50	Toll Settlement
	4.51	IC-card Issuance/Management
	4.52	Recharge of Prepaid Balance
	4.53	IC-card Data Management
	4.54	IC-card Invalidation Management
	4.55	OBU Registration/Management
	4.56	OBU Invalidation Management
	4.57	Toll Enforcement Assistance
Vehicle Weighing System	4.58	Axle Load Measurement
	4.59	Axle Load Data Management
	4.60	Overloading Regulation

Source: ITS Integration Project (SAPI) Study Team

4.2 Routine Patrol

Preconditions: - Any traffic event does not occur. Routine patrol is carried out by the patrol crews.

Events:

The patrol crews patrol along the expressway in their jurisdiction.	
V	
Patrol crews come back to the road management office.	
V	
A patrol crew reports the patrol results to the road operator in the road management office.	
V	
The road operator put traffic event data into the system to share it with the Regional Main Center.	
V	
V	
V	
V	
V	

References for Underlined Words: - Road operator→ Figure2.2, 2.4, 3.1
- Road management office→ Figures 2.1, 2.4, 3.1
- Regional Main Center→ Figures 2.1, 2.4, 3.1
- Traffic Event→ Table 3.2

4.3 Traffic Condition Monitoring

Preconditions: - Traffic condition on the expressway is to be monitored by a road operator. The operator finds out traffic congestion section on the expressway through traffic event data monitor.

Events:

Traffic congestion occurs on the expressway.	
V	
The road operator identifies congestion section by CCTV monitoring.	
V	
The road operator put traffic event data of the traffic congestion into the system.	
V	
The operator in the Regional Main Center checks validity of the traffic event data based on the results of traffic analysis.	
V	
The operator and a manager in the Regional Main Center decide the class of needed traffic restriction based on the pre-defined standard.	
V	
The operator informs the class of the traffic restriction to the road management office.	
V	
The road operator takes necessary actions such as entrance closure.	
V	
V	

References for Underlined Words:
- Severity of the traffic congestion→ Table3.2
- Traffic restriction→ Table3.2
- Road operator→ Figures 2.2, 2.4, 3.1
- Road management office→ Figures 2.1, 2.4, 3.1
- Regional Main Center→ Figures 2.1, 2.4, 3.1

4.4 Incident Reporting by Mobile Phone (113 Call)

Preconditions: - A road user finds out an incident on the expressway at the site. Mobile phones are to be utilized as a method of incident reporting to the emergency number (113 Call), but emergency telephones are not installed on the expressways.

Events:

A road user finds out an incident on an expressway.

V

The road user makes a 113 call by mobile phone.

V

The road user reports the situation and the place of the incident to an operator of the 113 call center.

V

The operator of the113 call center informs the incident occurrence to the expressway police in the road management office of incident site.

V

The expressway police go into action at the incident site.

V

The expressway police share the incident occurrence with the expressway ambulance in the road management office In case with injured persons.

V

The expressway police share the incident occurrence with the road operator in the road management office.

V

The road operator puts the situation of incident to the system to share it with the Regional Main Center.

V

The road operator takes necessary actions for incident handling.

References for Underlined Words:
- Incident→ Chapter 2.7
- 113 call center→ Figures 2.5
- Expressway police→ Figures 2.4, 2.5, 2.6
- Expressway ambulance→ Figure 2.4, 2.5, 2.6
- Road operator→ Figures 2.1, 2.4, 2.5
- Road management office→ Figures 2.1, 2.4, 2.5
- Regional Main Center→ Figures 2.1, 2.4, 2.5

4.5 Incident Reporting by Mobile Phone (115 Call)

Preconditions: - A road user finds out an incident with injured persons on the expressway at the site. The road user calls a provincial call center (115 Call) by mobile phones.

Events:

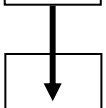
A road user finds out an incident with injured persons on the expressway.	
V	
The road user makes a 115 call by mobile phone and reports the place and the severity of injured persons.	
V	
The operator of the115 call center informs the incident occurrence to the expressway ambulance in the road management office of incident site.	
V	
The expressway ambulance goes into action at the incident site.	
V	
The expressway ambulance crew shares the incident occurrence with the expressway police and the road operator in the road management office.	
V	
The road operator puts the situation of incident to the system to share it with the Regional Main Center.	
V	
The road operator takes necessary actions for incident handling.	
V	
V	

References for Underlined Words:
- Incident→ Chapter 2.7
- 115 call center→ Figures 2.6
- Expressway police→ Figures 2.4, 2.5, 2.6
- Expressway ambulance→ Figure 2.4, 2.5, 2.6
- Road operator→ Figures 2.1, 2.4, 2.6
- Road management office→ Figures 2.1, 2.4, 2.6
- Regional Main Center→ Figures2.1, 2.4, 2.6

4.6 Incident Reporting by Mobile Phone (to Private Hospital)

Preconditions: - A road user finds out an incident with injured persons on the expressway at the site. The road user calls a private hospital ambulance center by mobile phones.

Events:

A road user finds out an incident with injured persons on an expressway.	
V	
The road user makes an emergency call to a private hospital ambulance center.	
V	
The private hospital ambulance center dispatches an ambulance to the incident site.	
V	
The private hospital ambulance center sends a call (without area code) to an operator in the Regional Main Center.	
V	
The operator puts the incident occurrence to the system to share it with the Road Operator in the road management office of incident site.	
V	
The road operator shares of the incident occurrence with the expressway police and the expressway ambulance if necessary.	
V	
The road operator takes necessary actions for incident handling.	
V	
V	

References for Underlined Words:
- Incident→ Chapter 2.7
- Private hospital ambulance center→ Figure 2.7
- Expressway police→ Figures 2.1, 2.4, 2.7
- Expressway ambulance→ Figures 2.1, 2.4, 2.7
- Road operator→ Figures 2.1, 2.4, 2.7
- Road management office→ Figures 2.1, 2.4, 2.7
- Regional Main Center→ Figures 2.1, 2.4, 2.7

4.7 Incident Reporting by Mobile Phone (to Regional Main Center)

Preconditions: - A road user finds out an incident on the expressway at the site. Mobile phones are to be utilized as a method of incident reporting, but emergency telephones are not installed on expressways.

Events:

A road user finds out an incident on the expressway.	
V	
The road user makes an emergency call (without area code) to an operator in the Regional Main Center.	
V	
The operator informs the incident occurrence to the road operator in the road management office of incident site .	
V	
The road operator shares the incident occurrence with the expressway police and the expressway ambulance if necessary.	
V	
The road operator takes necessary actions for incident handling.	
V	
V	
V	
V	

References for Underlined Words:
- Incident→ Chapter 2.7
- Provincial 115 Call Center→ Figure2.6
- Expressway police→ Figures 2.1, 2.4, 2.6
- Expressway ambulance→ Figures 2.1, 2.4, 2.6
- Road operator→ Figures 2.1, 2.4, 2.6
- Road management office→ Figures 2.1, 2.4, 2.6
- Regional Main Center→ Figures 2.1, 2.4, 2.6

4.8 Incident Reporting from Patrol

Preconditions: - A patrol crew finds out an incident on the expressway during patrol work. The crews report an incident to related organizations, but emergency telephones are not installed on expressways.

Events:

A patrol crew finds out an incident on the expressway.	
V	
The patrol crews identify the severity of the incident.	
V	
The patrol crew informs location and severity of the incident to the road management office of incident site.	
V	
The road operator shares the incident situation with the expressway police and the expressway ambulance if necessary.	
V	
The road operator takes necessary actions for incident handling.	
V	
V	
V	
V	

References for Underlined Words:
- Incident→ Table2.7
- Expressway police→ Figure2.1, 2.4, 2.6
- Expressway ambulance→ Figures 2.1, 2.4, 2.6
- Road operator→ Figures 2.1, 2.4, 2.6
- Road management office→ Figures 2.1, 2.4, 2.6, 3.2

4.9 Incident Identification by Camera

Preconditions: - Incident identification is made by the road operator in road management office by utilizing the CCTV cameras, but emergency telephones are not installed on expressways.

Events:

An incident occurs on the expressway.	
V	
An operator in the Regional Main Center recognizes the incident occurrence by alarm from image recognition using a CCTV camera.	
V	
The road operator recognizes the incident occurrence by alarm from image recognition using a CCTV camera.	
V	
The road operator shares the incident situation with the expressway police and the expressway ambulance if necessary.	
V	
The patrol crew informs location and severity of the incident to the road management office of incident site.	
V	
The road operator takes necessary actions for incident handling.	
V	
V	
V	

References for Underlined Words:
- Incident→ Chapter 2.7
- Expressway police→ Figure2.1, 2.4, 2.7
- Expressway ambulance→ Figure 2.1, 2.4, 2.7
- Road management office→ Figures 2.1, 2.4, 2.7, 3.2
- Regional Main Center→ Figures 2.1, 2.4, 2.7, 3.2
- Road operator→ Figures 2.1, 2.4, 2.7

4.10 Ascertainment of Incident Situation

Preconditions: - CCTV cameras are installed continuously along an expressway. An operator in road management office ascertains the incident situation by CCTV camera image.

Events:

The road operator at a road management office gets alarm or receives information of an incident.	
V	
The road operator ascertains the incident situation by CCTV monitoring.	
V	
The road operator gets report on the incident situation from patrol crews.	
V	
The road operator puts the situation of incident to the system to share it with the Regional Main Center.	
V	
The operator in the Regional Main Center checks validity of the traffic event data by CCTV monitoring.	
V	
V	
V	
V	

References for Underlined Words:
- Incident→ Table2.7
- Expressway police→ Figure2.1, 2.4, 2.7
- Expressway ambulance→ Figure 2.1, 2.4, 2.7
- Road management office→ Figures 2.1, 2.4, 2.7, 3.2
- Road operator→ Figures 2.1, 2.4, 2.7
- Traffic event→ Table 3.2

4.11 Heavy Rain Identification

Preconditions: - Heavy rain occurs. The alerting signal of heavy rain is automatically generated by the weather monitoring system and showing on the main monitor screen in the Regional Main Center.

Events:

An expressway section is struck by heavy rain.

V

An operator in the Regional Main Center gets alarm of heavy rain from the system based on data detected by weather sensors.

V

The Road Operator in a road management office gets alarm of heavy rain from the system based on data detected by weather sensors.

V

The road operator despatches patrol crews to the heavy rain area.

V

Patrol crews confirm situation of the heavy rain at the site and inform the situation to the road management office.

V

The road operator decides the class of needed traffic restriction from the informed situation, and instructs it to the patrol crews.

V

The road operator put traffic event data of the heavy rain and the traffic restriction into the system to share with the Regional Main Center.

V

The operator in the Regional Main Center checks validity of the traffic event data based on the values detected by weather sensors.

V

The manager in the Regional Main Center permits the enforced traffic restriction.

References for Underlined Words:
- Traffic restriction→ Table3.2
- Road management office→ Figures 2.1, 2.4, 2.8
- Regional Main Center→ Figures 2.1, 2.4, 2.8
- Road operator→ Figures 2.1, 2.4, 2.8
- Traffic event→ Table 3.2

4.12 High Wind Identification

Preconditions: - High wind occurs. The alerting signal of high wind is automatically generated by the weather monitoring system and showing on the main monitor screen in the Regional Main Center.

Events:

An expressway section is struck by high wind.

V

An operator in the Regional Main Center gets alarm of high wind from the system based on data detected by weather sensors.

V

The Road Operator in a road management office gets alarm of high wind from the system based on data detected by weather sensors.

V

The road operator despatches patrol crews to the high wind area.

V

Patrol crews confirm situation of the high wind at the site and inform the situation to the road management office.

V

The road operator decides the class of needed traffic restriction from the informed situation, and instructs it to the patrol crews.

V

The road operator put traffic event data of the high wind and the traffic restriction into the system to share with the Regional Main Center.

V

The operator in the Regional Main Center checks validity of the traffic event data based on the values detected by weather sensors.

V

The manager in the Regional Main Center permits the enforced traffic restriction.

References for Underlined Words: - Traffic restriction→ Table 3.2
- Road management office→ Figures 2.1, 2.4,
- Regional Main Center→ Figures 2.1, 2.4
- Traffic event→ Table 3.2

4.13 Dense Fog Identification

Preconditions: - Dense fog occurs. The alerting signal of dense fog is automatically generated by the weather monitoring system and showing on the main monitor screen in the Regional Main Center.

Events:

An expressway section is veiled in dense fog.

V

An operator in the Regional Main Center gets alarm of dense fog from the system based on data detected by weather sensors.

V

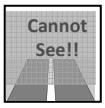
The Road Operator in a road management office gets alarm of dense fog from the system based on data detected by weather sensors.

V

The road operator despatches patrol crews to the dense fog area.

V

Patrol crews confirm the situation of the dense fog at the site and inform the situation to the road management office.



V

The road operator decides the class of needed traffic restriction from the informed situation, and instructs it to the patrol crews.

V

The road operator put traffic event data of the dense fog and the traffic restriction into the system to share with the Regional Main Center.

V

The operator in the Regional Main Center checks validity of the traffic event data based on the values detected by weather sensors.

V

The manager in the Regional Main Center permits the enforced traffic restriction.

References for Underlined Words:
- Traffic restriction→ table3.2
- Road operator→ Figure2.1, 2.4
- Road management office→ Figures 2.1, 2.4
- Regional Main Center→ Figures 2.1, 2.4
- Traffic event→ Table 3.2

4.14 High Temperature Identification

Preconditions: - High temperature occurs. The alerting signal of high temperature is automatically generated by the weather monitoring system and showing on the main monitor screen in the Regional Main Center.

Events:

An expressway section gets hit by high temperature.	
V	
An operator in the Regional Main Center gets alarm of high temperature from the system based on data detected by weather sensors.	
V	
The operator in the Regional Main Center checks the values detected by weather sensors.	
V	
The operator put traffic event data of the high temperature into the system to share it with the road operator in the road management office.	
V	
V	
V	
V	
V	

References for Underlined Words: - Road management office→ Figures 2.1, 2.4
- Regional Main Center→ Figures 2.1, 2.4
- Traffic event→ Table 3.2

4.15 Flood Identification

Preconditions: - Flood occurs. The flooding situation is identified by patrol crews at the site and reported to road management office.

Events:

An expressway section gets hit by floods.	
V	
Patrol crews check situation of the floods at the site.	
V	
Patrol crews inform location and situation of the flood to the road management office.	
V	
The road operator decides the class of needed traffic restriction from the informed situation.	
V	
The road operator put traffic event data of the flood and the traffic restriction into the system to share it with the Regional Main Center.	
V	
The patrol crews take necessary actions for traffic control based on the instruction of the road operator.	
V	
The operator in the Regional Main Center checks validity of the traffic event data based on the values detected by weather sensors.	
V	
The manager in the Regional Main Center permits the enforced traffic restriction.	
V	

References for Underlined Words:
- Traffic restriction→ Table3.2
- Road operator→ Figure2.1, 2.4
- Road management office→ Figures 2.1, 2.4
- Regional Main Center→ Figures 2.1, 2.4
- Traffic event→ Table 3.2

4.16 Stopped Vehicle Identification

Preconditions: - Patrol crews find out a stopped vehicle at the site. The road operator in the road management office doesn't find it from a monitor screen.

Events:

A vehicle stopped by breakdown on the expressway.	
V	
An operator in the Regional Main Center recognizes the stopped vehicle by alarm from image recognition using a CCTV camera.	
V	
The road operator recognizes the stopped vehicle by alarm from image recognition using a CCTV camera.	
V	
The road operator despatches patrol crews to the place of stopped vehicle.	
V	
Patrol crews inform location and situation of the stopped vehicle by breakdown to the road management office.	
V	
The road operator decides the class of needed traffic restriction from the informed situation.	
V	
The road operator put traffic event data of the broken-down vehicle and the traffic restriction into the system to share it with the Regional Main Center.	
V	
The patrol crews take necessary actions for traffic control based on the instruction of the road operator.	
V	

References for Underlined Words:
- Severity of the broken-down vehicle → Table 3.2
- Road operator→ Figure2.1, 2.4, 2.7
- Expressway police→ Figure2.1, 2.4, 2.7
- Road management office→ Figures 2.1, 2.4, 2.7, 3.2
- Traffic restriction→ Table3.2

4.17 Reverse Driving Identification

Preconditions: - Patrol crews find out a reverse driving vehicle at the site. The road operator in the road management office doesn't find it from a monitor screen.

Events:

A vehicle makes reverse driving on the expressway.	
V	
An operator in the Regional Main Center recognizes the reverse driving by alarm from image recognition using a CCTV camera.	
V	
The road operator recognizes the reverse driving by alarm from image recognition using a CCTV camera.	
V	
The road operator put traffic event data of the the reverse driving into the system to share it with the Regional Main Center.	
V	
The road operator shares the location and situation of the reverse driving with the expressway police.	
V	
The expressway police take a necessary action.	
V	
The patrol crews take necessary actions for traffic control based on the instruction of the road operator and the expressway police.	
V	
V	

References for Underlined Words:
- Road operator→ Figure2.1, 2.4, 2.7
- Expressway police→ Figure2.1, 2.4, 2.7
- Road management office→ Figures 2.1, 2.4, 2.7, 3.2
- Severity of the reverse driving → Table 3.2
- Traffic event → Table 3.2

4.18 Left Obstacle Identification

Preconditions: - Patrol crews find an obstacle at the site. The road operator in the road management office doesn't find it from a monitor screen.

Events:

An obstacle is left on the expressway.	
V	
An operator in the Regional Main Center recognizes the left obstacle by alarm from image recognition using a CCTV camera.	
V	
The road operator recognizes the left obstacle by alarm from image recognition using a CCTV camera.	
V	
The road operator despatches patrol crews to the place of left obstacle.	
V	
Patrol crews inform location and situation of the left obstacle to the road management office.	
V	
The road operator decides the class of needed traffic restriction from the informed situation.	
V	
The road operator put traffic event data of the left obstacle and the traffic restriction into the system to share it with the Regional Main Center.	
V	
The patrol crews take necessary actions for traffic control based on the instruction of the road operator.	
V	

References for Underlined Words:
- Tow car→ Figure3.3
- Road operator→ Figure2.1, 2.4, 2.7
- Road management office→ Figures 2.1, 2.4, 2.7, 3.2
- Severity of the left obstacle → Table 3.2
- Traffic event → Table 3.2
- Traffic restriction→ Table3.2

4.19 Vandalism Identification

Preconditions: - Patrol crews find out any kind of vandalism at the site. The road operator in the road management office doesn't find it from a monitor screen.

Events:

Patrol crews find out vandalism on the expressway.	
V	
Patrol crews inform situation of the vandalism and its location to the road management office.	
V	
The road operator put traffic event data of the the vandalism into the system to share it with the Regional Main Center.	
V	
The road operator shares the situation of vandalism to the expressway police.	
V	
The expressway police take a necessary action.	
V	
The patrol crews take necessary actions for traffic control based on the instruction of the road operator and the expressway police.	
V	
V	
V	

References for Underlined Words: -Road operator→ Figure2.1, 2.4, 2.7, Figure 3.4
- Road management office→ Figures 2.1, 2.4, 2.7, 3.2
- Traffic event → Table 3.2
- Expressway police→ Figure2.1, 2.4, 2.7

4.20 Road Damage Identification

Preconditions: - Patrol crews find out road damage at the site. The road operator in the road management office doesn't find it from a monitor screen. Road damage is quite severe.

Events:

Patrol crews find road damage on an expressway.	
V	
The patrol crews inform situation of the road damage to the road management office.	
V	
The road operator decides the class of needed traffic restriction from the informed situation.	
V	
The road operator put traffic event data of the road damage and the traffic restriction into the system to share it with the Regional Main Center.	
V	
The patrol crews take necessary actions for traffic control based on the instruction of the road operator.	
V	
V	
V	
V	

References for Underlined Words:
- Traffic restriction→ Table3.2, Figure 3.4
- Road operator→ Figure2.1, 2.4, 2.7
- Road management office→ Figures 2.1, 2.4, 2.7, 3.2
- Regional Main Center→ Figures 2.1, 2.4, 2.7, 3.2

4.21 Construction Work Information Handling

Preconditions: - Construction work has been already planned, and the class of traffic restriction have been decided.

Events:

A company submit a report of construction work on the expressway to a road operator of a road management office.	
V	
The road operator shares the fact of construction work to the expressway police.	
V	
The road operator checks validity of the construction work decides the class of needed traffic restriction.	
V	
The road operator gives permission for the construction work with instruction of traffic restriction to the company.	
V	
The road operator put traffic event data of the construction work into the system to share it with the Regional Main Center.	
V	
The road operator despatches patrol crews to the place of construction work.	
V	
The patrol crews take necessary actions for traffic control based on the instruction of the road operator and the expressway police.	
V	
V	

References for Underlined Words:
- Traffic restriction → Table3.2, Figure 3.4
- Road operator→ Figure2.1, 2.4, 2.7
- Road management office→ Figures 2.1, 2.4, 2.7
- Regional Main Center→ Figures 2.1, 2.4, 2.7
- Expressway police→ Figure2.1, 2.4, 2.7

4.22 Road Traffic Supervision

Preconditions: - Traffic supervision on the expressway is to be carried out by a road operator. An operator is to find out a traffic event occurrence through traffic event data monitor.

Events:

A road operator in a road management office supervises the traffic conditions on hourly basis shown on the main monitor screen.	
V	
The road operator finds out an incident on an expressway through the monitor and details of incident are confirmed by CCTV monitoring.	
V	
The road operator shares the incident site location with the expressway police and the expressway ambulance in the road management office.	
V	
The road operator despatches patrol crews to the incident site.	
V	
Patrol crews arrive at an incident site with expressway police and/or expressway ambulance.	
V	
Patrol crews inform situation of the incident to the road management office.	
V	
The road operator puts the situation of incident to the system to share it with the Regional Main Center.	
V	
The patrol crews take necessary actions for traffic control based on the instruction of the road operator.	
V	

References for Underlined Words:
- Incident→ Table 3.2
- Expressway police→ Figures 2.1, 2.4, 2.7
- Expressway ambulance→ Figures 2.1, 2.4, 2.7
- Road operator→ Figures 2.1, 2.4, 2.7
- Road management office→ Figures 2.1, 2.4, 2.7
- Regional Main Center→ Figures 2.1, 2.4, 2.7

4.23 Decision Traffic Restriction

Preconditions: - Traffic event occurs on the expressway. The severity of incident is identified by the road operator.

Events:

An operator in the Regional Main Center checks traffic conditions and events on the expressway network shown on the main monitor screen.	
V	
The operator in the Regional Main Center checks the traffic event data input by a road operator in a road management office.	
V	
The operator checks the values detected by sensors.	
V	
The operator ascertains the situation the traffic event by CCTV monitoring.	
V	
The operator and a manager in the Regional Main Center discuss the class of needed traffic restriction based on the pre-defined standard.	
V	
The manager in the Regional Main Center decides the appropriate traffic restriction.	
V	
The operator instructs (or permits) the class of the traffic restriction to the road management office.	
V	
V	

References for Underlined Words:
- Incident→ Table3.2
- Traffic restriction→ Table3.2
- Road operator→ Figure2.1, 2.4, 2.8
- Road management office→ Figures 2.1, 2.4, 2.8
- Regional Main Center→ Figures 2.1, 2.4, 2.8

4.24 Entrance Closure

Preconditions: - Traffic event occurs on the expressway. The severity of incident are identified by the road operator and reported to the Regional Main Center. The operator in the Regional Main Center is making decision on the entrance closure.

Events:

The road operator receives instruction (or permission) of an entrance closure from the operator in the Regional Main Center.	
V	
The road operator despatches patrol crews to the place of entrance.	
V	
The patrol crews take necessary actions for the entrance closure.	
V	
The patrol crews take necessary actions for traffic control.	
V	
V	
V	
V	
V	

References for Underlined Words: - Incident → Table3.2
- Traffic restriction→ Table3.2
- Road operator→ Figure2.1, 2.4, 2.8
- Regional Main Center→ Figures 2.1, 2.4, 2.8

4.25 Closure

Preconditions: - Traffic event occurs on the expressway. The severity of incident are identified by the road operator and reported to the Regional Main Center. The operator in the Regional Main Center is making decision on the expressway closure.

Events:

The road operator receives instruction (or permission) of an closure from the operator in the Regional Main Center.	
V	
The road operator despatches patrol crews to the place of the closure on expressway.	
V	
The patrol crews take necessary actions for the closure.	
V	
The patrol crews take necessary actions for traffic control	
V	
V	
V	
V	
V	

References for Underlined Words: - Incident → Table3.2
- Traffic restriction→ Table3.2
- Road operator→ Figure2.1, 2.4, 2.8
- Regional Main Center→ Figures2.1, 2.4, 2.8

4.26 Exit Closure

Preconditions: - Traffic event occurs on the off-ramp. The severity of incident are identified by the road operator and reported to the Regional Main Center. The operator in the Regional Main Center is making decision on the exit closure.

Events:

The road operator receives instruction (or permission) of an exit closure from the operator in the Regional Main Center.	
V	
The road operator despatches patrol crews to the place of entrance.	
V	
The patrol crews take necessary actions for the exit closure.	
V	
The patrol crews take necessary actions for traffic control.	
V	
V	
V	
V	
V	

References for Underlined Words: - Incident → Table3.2
- Traffic restriction→ Table3.2
- Road operator→ Figure2.1, 2.4, 2.8
- Regional Main Center→ Figures 2.1, 2.4, 2.8

4.27 Lane Closure

Preconditions: - Traffic event occurs on the expressway. The severity of incident are identified by the road operator and reported to the Regional Main Center. The operator in the Regional Main Center is making decision on the lane closure.

Events:

The patrol crews inform the necessity of lane closure to the road management office.	
V	
The road operator put traffic event data of the lane closure into the system to share it with the Regional Main Center.	
V	
The patrol crews take necessary actions for the lane closure control based on the instruction of the road operator.	
V	
The patrol crews take necessary actions for traffic control.	
V	
V	
V	
V	
V	

References for Underlined Words:
- Traffic restriction → Table3.2
- Road operator→ Figure2.1, 2.4, 2.8
- Road management office→ Figures 2.1, 2.4, 2.8
- Regional Main Center→ Figures 2.1, 2.4, 2.8
- Traffic event → Table 3.2

4.28 Speed Restriction

Preconditions: - Traffic event occurs on the expressway. The severity of incident are identified by the road operator and reported to the Regional Main Center. The operator in the Regional Main Center is making decision on the speed limit restriction.

Events:

The operator in the Regional Main Center sends indication of speed restriction on CSS and guidance on VMS.	
V	
The road operator receives information of the speed restriction from the operator in the Regional Main Center	
V	
V	
V	
V	
V	
V	
V	

References for Underlined Words: - Traffic restriction→ Table3.2
- Road operator→ Figure2.1, 2.4, 2.8
- Regional Main Center→ Figures 2.1, 2.4, 2.8

4.29 Incident Handling

Preconditions: - A police officer at an expressway police and patrol crews have already arrived at incident site.
- Accident vehicles cannot move.

Events:

Patrol crews inform the start of incident handling to the road operator in the road management office.	
V	
The patrol crews control traffic at the incident site with the expressway police.	
V	
The patrol crews with expressway police remove the accident vehicle.	
V	
The patrol crews clean up the lanes at the incident site and open them for traffic.	
V	
The patrol crews inform the end of incident handling to the road operator.	
V	
V	
V	
V	

References for Underlined Words: - Incident→ Chapter 3
- Expressway police→ Figure2.1, 2.4, 2.8
- Road operator→ Figure2.1, 2.4, 2.8
- Road management office→ Figures 2.1, 2.4, 2.8

4.30 Incident Clearance Reporting

Preconditions: - Incident clearance is completed and traffic condition is recovering in normal.

Events:

The patrol crews inform the clearance of incident to The road operator in the road management office.	
V	
The road operator put the clearance of incident into the system to share it with the Regional Main Center.	
V	
The operator in the Regional Main Center ascertains the situation the incident site by CCTV monitoring.	
V	
The operator in the Regional Main Center checks the clearance of incident in the system.	
V	
V	
V	
V	
V	

References for Underlined Words: - Road operator→ Figure2.1, 2.4, 2.8
- Incident → Table3.2
- Regional Main Center→ Figures 2.1, 2.4, 2.8
- Road management office→ Figures 2.1, 2.4, 2.8

4.31 Restriction Removal

Preconditions: - Traffic event is finished and traffic condition is recovering in normal. The operator of the road management office receives the instruction of deregulation from the Regional Main Center.

Events:

The patrol crews inform the situation of traffic event which requires the traffic restriction to the road management office.	
V	
The road operator put the situation of traffic event into the system to share it with the Regional Main Center.	
V	
The operator in the Regional Main Center ascertains the situation the traffic event by CCTV monitoring.	
V	
The operator and a manager in the Regional Main Center discuss and decide the removal of the traffic restriction.	
V	
The operator instructs the removal of the traffic restriction to the road management office.	
V	
The road operator instructs the removal of the traffic restriction to the patrol crews.	
V	
The patrol crews take necessary actions for the removal of the traffic restriction.	
V	
V	

References for Underlined Words:
- Traffic restriction → Table3.2
- Road operator→ Figure2.1, 2.4, 2.8
- Road management office→ Figures 2.1, 2.4, 2.8
- Regional Main Center→ Figures 2.1, 2.4, 2.8
- Traffic event → Table 3.2

4.32 Restiriction Removal Reporting

Preconditions: - Traffic event is finished and traffic condition is recovering in normal. The traffic restriction removal at the site has been made by the road operator.

Events:

The patrol crews inform the removal of traffic restriction to the road operator in the road management office.	
V	
The road operator put the removal of traffic restriction into the system to share it with the Regional Main Center.	
V	
The operator in the Regional Main Center ascertains the situation the traffic conditions by CCTV monitoring.	
V	
The operator in the Regional Main Center checks the removal of traffic restriction in the system.	
V	
V	
V	
V	
V	

References for Underlined Words:
- Traffic restriction → Table3.2
- Road operator→ Figure2.1, 2.4, 2.8
- Road management office→ Figures 2.1, 2.4, 2.8
- Regional Main Center→ Figures 2.1, 2.4, 2.8

4.33 Traffic Event Management by Regional Main Center

Preconditions: - A traffic event occurs on the expressway and the operator in the Regional Main Center obtains the traffic event information.

Events:

The operator in the Regional Main Center inputs a date/time and location of a traffic event into the system.	
V	
The operator inputs the category/class of the traffic event into the system.	
V	
The road operator inputs the detail data and relationship of the traffic event into the system.	
V	
The system indicate the traffic event data on the screen in the Road Management Office.	
V	
The road operator checks the validity of the data and input the check flag for the data	
V	
V	
V	
V	

References for Underlined Words: - Regional Main Center→ Figures 2.1, 2.4, 2.9
- Category of traffic event→ Table3.2
- Class of traffic event→ Table3.2
- Road management office→ Figures 2.1, 2.4, 2.9

4.34 Traffic Event Management by Road Management Office

Preconditions: - A traffic event occurs on the expressway and the road operator in the road management office obtains the traffic event information.

Events:

The road operator in the road management office inputs a date/time and location of a traffic event into the system.	
V	
The road operator inputs the category/class of the traffic event into the system.	
V	
The road operator inputs the detail data and relationship of the traffic event into the system.	
V	
The system indicate the traffic event data on the screen in the Regional Main Center.	
V	
The operator checks the validity of the data and input the check flag for the data	
V	
V	
V	
V	

References for Underlined Words:
- Road operator→ Figure2.1, 2.4, 2.9
- Category of traffic event→ Table3.2
- Class of traffic event→ Table3.2
- Road management office→ Figures 2.1, 2.4, 2.9
- Regional Main Center→ Figures 2.1, 2.4, 2.9

4.35 Traffic Event Management by Patrol Crew

Preconditions: - A traffic event occurs on the expressway and the patrol crew obtains the traffic event information at the site. The patrol crew has mobile input terminal.

Events:

A patrol crew inputs a date/time and location of a traffic event into the system by a mobile terminal.	
V	
The patrol crew inputs the category/class of the traffic event into the system.	
V	
The road operator in the road management office checks the traffic event data by the system.	
V	
The road operator inputs the detail data and relationship of the traffic event into the system.	
V	
The road operator checks the validity of the data and input the check flag for the data.	
V	
The operator in the Regional Main Center checks the traffic event data by the system.	
V	
The operator checks the validity of the data and input the check flag for the data	
V	
V	

References for Underlined Words:
- Category of traffic event→ Table3.2
- Class of traffic event→ Table3.2
- Patrol crew→ Chapter 2.9
- Road management office→ Figures 2.1, 2.4, 2.9
- Regional Main Center→ Figures 2.1, 2.4, 2.9

4.36 Traffic Information by VMS

Preconditions: - The operator in the Regional Main Center has already input traffic event data into traffic event data management system.

Events:

An operator in the Regional Main Center recognizes a message candidate to be indicated on VMS shown by the system on a VMS monitor screen.	
V	
The operator checks traffic conditions and events on expressway network shown on the main monitor screen.	
V	
The operator selects (or inputs) the appropriate message for a VMS in each location.	
V	
The message is indicated on VMS.	
V	
V	
V	
V	
V	

References for Underlined Words: - Regional Main Center→ Figures 2.1, 2.4, 2.10, 3.8
- Traffic event→ Table3.2

4.37 Traffic Information by Internet

Preconditions: - The operator in the Regional Main Center has already input traffic event data into traffic event data management system.

Events:

The operator in the Regional Main Center recognizes a traffic event shown by the system on a traffic event monitor screen.	
V	
The operator put an acceptance check on the traffic event to be disseminated through the Internet.	
V	
The operator put the traffic event data on the server for dissemination.	
V	
The information is disseminated to the public through the Internet.	
V	
V	
V	
V	
V	

References for Underlined Words: - Regional Main Center→ Figures 2.1, 2.4, 2.10
- Internet→ Figure2.10
- Traffic event→ Table3.2

4.38 Traffic Information by Broadcast

Preconditions: - The operator in the Regional Main Center has already input traffic event data into traffic event data management system.

Events:

The operator in the Regional Main Center recognizes a traffic event shown by the system on a traffic event monitor screen.	
V	
The operator put an acceptance check on the traffic event to be disseminated through TV/Radio Broadcasting.	
V	
The operator put the traffic event data on the server for dissemination.	
V	
The information is disseminated to the public through TV/Radio Broadcasting.	
V	
V	
V	
V	
V	

References for Underlined Words: - Traffic event→Table3.2
- TV/Radio Broadcasting center → Figure2.10
- Regional Main Center→ Figures 2.1, 2.4, 2.10

4.39 Traffic Information Cancellation

Preconditions: - Patrol crews have already checked the end of traffic event and restriction at the site and reported it to the Regional Main Center through road management office.

Events:

The operator in the Regional Main Center receives information about the end of a traffic event through the system or telephone.	
V	
The operator in the Regional Main Center recognizes a traffic event shown by the system on a traffic event monitor screen.	
V	
The operator put a remove check on the traffic event to be disseminated through TV/Radio Broadcasting.	
V	
The operator saves traffic event data in the system.	
V	
The message on VMS is removed.	
V	
The information about the end of traffic event is disseminated to the public through the Internet.	
V	
The information about the end of traffic event is disseminated to the public through TV/Radio Broadcasting.	
V	
V	

References for Underlined Words:
- Traffic information → Figure2.10
- TV/Radio Broadcasting center → Figure2.10
- Internet→ Figure2.10
- Regional Main Center→ Figures 2.1, 2.4, 2.10
- Road management office→ Figures 2.1, 2.4, 2.10

4.40 Traffic Data Management

Preconditions: - Any traffic event does not occur on the expressway.

Events:

Traffic volume data are automatically collected from vehicle detection roadside equipment on the expressway.	
V	
Traffic volume data are stored into traffic data server.	
V	
The operator in the Regional Main Center checks traffic data.	
V	
V	
V	
V	
V	
V	

References for Underlined Words: - Traffic data→ Figure3.1
- Regional Main Center→ Figures 2.1, 2.4, 3.1

4.41 Integrated Data Management

Preconditions: - The required data are stored into each server.

Events:

The road owner sends toll collection data to the Regional Main Center.

V

The road operator sends vehicle weighing data to the Regional Main Center.

V

The operator in the Regional Main Center saves the toll collection data and the vehicle weighing data in the system.

V

A manager in the Regional Main Center analyse the toll collection data and the vehicle weighing data together with the traffic data in the system.

V

The manager in the Regional Main Center acquires data for inspection and budget plan of road improvement/maintenance.

V

The manager in the Regional Main Center acquires data for evaluation of road operator's achievement in the expressway operation.

V

The manager in the Regional Main Center checks the validity of toll revenues of the road operators in comparison with the data of traffic.

V

V

References for Underlined Words:
- Toll collection data→Figure 2.11, 2.18
- Vehicle weighing data→Figure 2.17, 2.18
- Traffic data→ Figure 2.9, 2.18
- Toll Settlement data→ figure2.12, 2.18
- Regional Main Center→ Figures 2.1, 2.4, 2.18
- Road owner→ 2.18

4.42 Routine Data Check in Regional Main Center

Preconditions: - Any traffic event does not occur on the expressway. Routine monitoring of the expressways is carried out by the operator in the Regional Main Center.

Events:

The operator in the Regional Main Center checks the traffic data.

V

The operator checks weather data.

V

The operator checks the CCTV.

V

The operator checks the message displayed on VMS.

V

The operator checks the axle load scale data.

V

The operator checks the traffic event data.

V

The operator checks the patrol report that is submitted from the road management office.

V

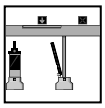
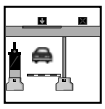
V

References for Underlined Words: - Traffic data→ Figure2.9, 2.18
- Traffic event→ Table 3.2
- Road management office→ Figures 2.1, 2.4, 2.9
- Regional Main Center→ Figures 2.1, 2.4, 2.9

4.43 Toll Collection by Manual

Preconditions: - A road user does not have IC-card. Toll collection is made by cash.

Events:

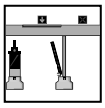
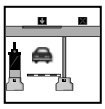
The road user stops vehicle at the tollgate.	
V	
The license number (and vehicle class) is identified capturing license number.	
V	
The road user pays the toll to a collector by cash or a monthly ticket.	
V	
The collector at the tollgate inputs transaction data.	
V	
The tollgate barrier is opened when the transaction is completed.	
V	
The road user passes the tollgate.	
V	
V	
V	

References for Underlined Words: - Transaction data→ Figure3.10
- IC-card→ Figure 2.13, 3.11, 3.12
- Tollgate → Figure 3.10

4.44 Toll Collection by Touch & Go

Preconditions: - A road user has IC-card without OBU. Toll collection is made by Touch&Go.
- The type of IC-card is prepayment and not a credit and debit.

Events:

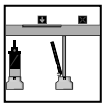
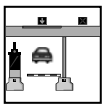
The road user stops vehicle at the tollgate.	
V	
The road user touches IC-card reader with IC-card.	
V	
The license number (and vehicle class) is identified capturing license number.	
V	
Toll amount is deducted from prepaid balance in the IC-card.	
V	
The tollgate barrier is opened in the case toll collection is successfully completed.	
V	
The road user passes a tollgate.	
V	
All transaction data are stored into a server at roadside.	
V	
V	

References for Underlined Words: - IC-card→ Figure2.13, 3.11, 3.12
- Transaction data→ Figure3.12
- Touch&Go → Figure 3.11

4.45 Toll Collection by ETC

Preconditions: - A road user has OBU with IC-card. Toll collection is made by ETC.
- The type of IC-card is prepayment and not a credit and debit.

Events:

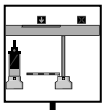
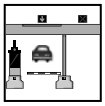
A road user approaches a tollgate while slowing down.	
V	
The ETC roadside equipment obtains the information of IC-card.	
V	
The license number (and vehicle class) is identified capturing license number.	
V	
Toll amount is deducted from prepaid balance in the IC-card.	
V	
The tollgate barrier is opened in the case toll collection is successfully completed (including the case prepaid balance is results in a negative value).	
V	
The road user can pass the tollgate without stopping.	
V	
The transaction data are stored into a server at roadside.	
V	
V	

References for Underlined Words: - Toll collection→ figure3.12
- Transaction data→ Figure3.12
- IC-card→ Figure3.12
- ETC → Figure 3.12

4.46 Handling of Vehicle with Balance Shortage

Preconditions: - The prepaid balance is stored in the IC-card, and the balance is checked by roadside equipment through road-to-vehicle communication.
- A road user passes the tollgate with IC-card balance shortage.

Events:

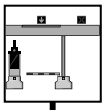
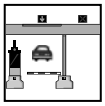
A road user approaches a tollgate while slowing down.	
V	
The ETC roadside equipment obtains the information of IC-card.	
V	
The server at roadside identified a negative value of prepaid balance of the IC-card and toll due/paid sign indicates the error of balance shortage.	
V	
The tollgate barrier is not opened.	
V	
The road user stops the vehicle.	
V	
A toll collector requires the road user to pay toll by manual.	
V	
The road user pays the toll to a collector by cash or a monthly ticket.	
V	
The collector at the tollgate inputs transaction data.	
V	
The road user passes the tollgate.	

References for Underlined Words: - IC-card→ Figure3.11, 3.12
- Transaction data→ Figure3.12
- ETC roadside equipment → Figure 3.13

4.47 Handling of Vehicle without OBU in ETC Lane

Preconditions: - A road user go into ETC lane without OBU.

Events:

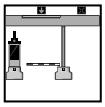
A road user approaches a tollgate while slowing down.	
V	
The server at roadside identified vehicle without OBU is going to pass the ETC lane.	
V	
The tollgate barrier is not opened.	
V	
The road user stops the vehicle.	
V	
A toll collector requires the road user to pay toll by manual.	
V	
The road user pays the toll to a collector by cash or a monthly ticket.	
V	
The collector at the tollgate inputs transaction data.	
V	
The road user passes the tollgate.	
V	

References for Underlined Words: - Transaction data→ Figure3.12
- ETC → Figure 3.12
- Tollgate barrier → Figure 2.13

4.48 Handling of OBU Re-installed Illegally

Preconditions: - A road user passes the tollgate with wrong information in OBU.

Events:

A road user approaches a tollgate while slowing down.	
V	
The ETC roadside equipment obtains the information in OBU	
V	
The system indicates OBU information on screen for the toll collector	
V	
The toll collector identifies vehicle with wrong information in OBU	
V	
The toll collector shut the tollgate barrier	
V	
The toll collector input OBU invalidation information to the server	
V	
The toll collector reject the vehicle to the toll office	
V	
V	

References for Underlined Words: - OBU→ Figure 3.13
- ETC roadside equipment → Figure 3.13
- OBU invalidation information → Figure 2.15, 3.13

4.49 Toll Data Management

Preconditions: - The toll data are stored into toll management server at the toll office.

Events:

The road owner obtains the toll transaction data of each toll booth.	
V	
The road owner checks the transaction data.	
V	
The road owner checks the toll collection data.	
V	
The road owner checks total amount of toll settlement of each toll office in his jurisdiction.	
V	
The road owner registers the toll collection data.	
V	
The road owner registers total amount of toll settlement to a settlement server in toll settlement center.	
V	
V	
V	

References for Underlined Words: - Toll collection data→ Figure2.11, 3.14
- Transaction data→ Figure3.10, 3.11, 3.12
- Road owner→ Figure2.11

4.50 Toll Settlement

Preconditions: - Toll settlement service is to be provided by a single bank. The crosscheck organization is set up.

Events:

The road owner claims toll fare to a bank.	
V	
The bank staff requests toll/traffic data crosscheck to the crosscheck organization.	
V	
The crosscheck organization obtains the toll collection data from the road owner.	
V	
The crosscheck organization obtains the traffic volume data from the Regional Main Center.	
V	
The crosscheck organization checks the toll collection data and traffic volume data.	
V	
The crosscheck organization informs the validity of results of crosscheck to the bank.	
V	
The bank distributes the charged amount to each road owner based on the crosscheck results.	
V	
V	

References for Underlined Words: - Road owner→ Figure2.11
- Regional Main Center→ Figures 2.12
- Toll collection data→ Figure2.11, 3.14
- Bank → Figure 3.11, 3.12, 3.13

4.51 IC-card Issuance/Management

Preconditions: - The bank issues IC-card for the road user.

Events:

A road user applies for IC-card issue in a bank.	
V	
The bank staff inputs the road user data into server.	
V	
The bank staff issues IC-card to the road user.	
V	
The IC-card issue data is sent to the server.	
V	
V	
V	
V	
V	

References for Underlined Words: - IC-card→ Figure2.13, 3.11, 3.12
- Bank → Figure 2.14, 2.22

4.52 Recharge of Prepaid Balance

Preconditions: - Prepaid balance is stored in the IC-card.
- Recharging place is in a bank. There is no recharging place on the expressway.

Events:

A road user goes to a bank for recharging the prepaid balance.	
V	
The road user inserts the IC-card in the terminal of the bank.	
V	
The road user makes payment for recharging the prepaid balance.	
V	
The road user receives the recharged IC-card.	
V	
V	
V	
V	
V	

References for Underlined Words: - IC-card→ Figure2.13, 3.11, 3.12
- Bank → Figure 2.14, 2.22

4.53 IC-Card Data Management

Preconditions: -All the IC-Card registered.

Events:

IC-card reader obtains IC-card data.

V

IC-card data are sent to toll office server.

V

IC-card data are stored into IC-card management server.

V

V

V

V

V

References for Underlined Words: - IC-card→ Figure2.13, 3.11, 3.12
- Toll office server → Figure 3.10, 3.11, 3.12, 3.13

4.54 IC-card Invalidation Management

Preconditions: - A road user passes the tollgate with IC-card balance shortage. The road user does not charge in the bank.

Events:

A road owner picks up data of the IC-card which prepaid balance is repeatedly negative value from the transaction data at the tollgate.	
V	
The road owner sends the data of the IC-card with negative balance to the bank.	
V	
The bank manages data of the IC-card invalidation list.	
V	
An road user notify the OBU management center that his IC-card is lost or stolen.	
V	
The bank manages data of the IC-card invalidation list.	
V	
The bank distributes the data of IC-card invalidation list to all road Owners.	
V	
The road owners send the data of IC-card invalidation list to roadside equipment of all toll offices.	
V	
V	

References for Underlined Words:
- Road owner→ Figure2.13, 2.15
- IC-card→ Figure2.13, 3.11, 3.12
- OBU management center → Figure 3.13
- Bank → Figure 3.13

4.55 OBU Registration/Management

Preconditions: - A road user can obtain the OBU from OBU management center.
- A road user has IC-card.

Events:

A road user applies for the OBU use to the OBU management center.	
V	
The operator at the OBU management center inputs the registration data of road user with OBU registration terminal.	
V	
The operator at the OBU management center issues the OBU to the road user.	
V	
The OBU registration data in the OBU registration terminal are sent to the OBU management server.	
V	
The OBU management server transfers the OBU registration data to the road owners.	
V	
The road user installs OBU in his vehicle and puts IC-card into OBU.	
V	
The road user can pass the ETC toll lane.	
V	
V	

References for Underlined Words: - OBU management center→ chapter2.14, 2.15
- Road owner→ Figure2.14, 2.15
- OBU registration data → Figure 3.13
- OBU management server → Figure 3.13

4.56 OBU Invalidation Management

Preconditions: - The violation information is stored into the system automatically.

Events:

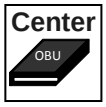
A road owner picks up data of the vehicle which OBU is replaced from the transaction data at the tollgate.	
V	
The road owner sends the data of replaced OBU to the OBU management Canter.	
V	
The OBU management center manages data of the OBU invalidation list.	
V	
A road user notifies the OBU management center that his OBU is lost or stolen.	
V	
The operator at the OBU management center input information into the OBU invalidation list.	
V	
The OBU management center manages data of the OBU invalidation list.	
V	
The OBU management center distributes the data of OBU invalidation list to all road Owners.	
V	
The road owners send the data of OBU invalidation list to roadside equipment of all toll offices.	
V	

References for Underlined Words:
- Road owner→ Figure2.14, 2.15
- OBU management center→ chapter2.14, 2.15
- Transaction Data→ Figure 3.13
- OBU invalidation list → Figure 3.13

4.57 Toll Enforcement Assistance

Preconditions: - Legal system for penalty charge is developed.

Events:

A road owner picks up data of the IC-card which prepaid balance is repeatedly negative value from the transaction data at the tollgate.	
V	
The road owner identifies the IC-card user of suspicion getting documents from the OBU management center.	
V	
The road owner picks up data of the vehicle which OBU is replaced from the transaction data at the tollgate.	
V	
The road owner identifies the OBU user of suspicion getting information from the bank.	
V	
The road owner complains the users of suspicion to the police office based on the evidence which includes data and documents.	
V	
The police enforce a legal system.	
V	
V	
V	

References for Underlined Words: - Legal system→ figure2.15
- Road owner→ Figure2.15
- OBU management center→ chapter2.14, 2.15
- Transaction Data→ Figure 3.13

4.58 Axle Load Measurement

Preconditions: - The vehicle passes the exit tollgate.

Events:

The crew of tollgate identifies a suspicious truck approaching to the exit tollgate.	
V	
The crew leads the truck to the lane equipment with axle load scale.	
V	
The vehicle passes the axle load scale.	
V	
The axle load scale measures/indicates the weight of the vehicle to the crew of the road operator.	
V	
The axle load scale sends the measurement weight to a heavy truck control server.	
V	
The traffic inspector collects a penalty from the road user.	
V	
The axle load scale sends the measurement data with CCTV captured image of license plate to the heavy truck control data server.	
V	
V	

References for Underlined Words: - Road operator→ Figure2.16
- Traffic inspector→ Figure2.16

4.59 Axle Load Data Management

Preconditions: - The axle load scale measures axle loads of all vehicles. The axle load data is stored into lane server.

Events:

The heavy truck data is sent to server.	
V	
The measurement data are compared with allowable measuring range.	
V	
In case the measurement data are out of range, the data are stored as violation information.	
V	
The traffic inspector checks the violation user information.	
V	
The traffic inspector sends data to the Regional Main Center.	
V	
V	
V	
V	

References for Underlined Words: - Allowable measuring range→ table7.16
- Traffic inspector→ Figure2.16
- Regional Main Center→ Figures 2.1, 2.4, 2.17

4.60 Overloading Regulation

Preconditions: - The violation data are stored into the heavy truck control data server.

Events:

The operator in the Regional Main Center searches the violation information from heavy truck control system.	
V	
The operator checks details of violation vehicle information.	
V	
The operator reports the violation vehicle information to the road management office, the road owner and the expressway police.	
V	
V	
V	
V	
V	
V	

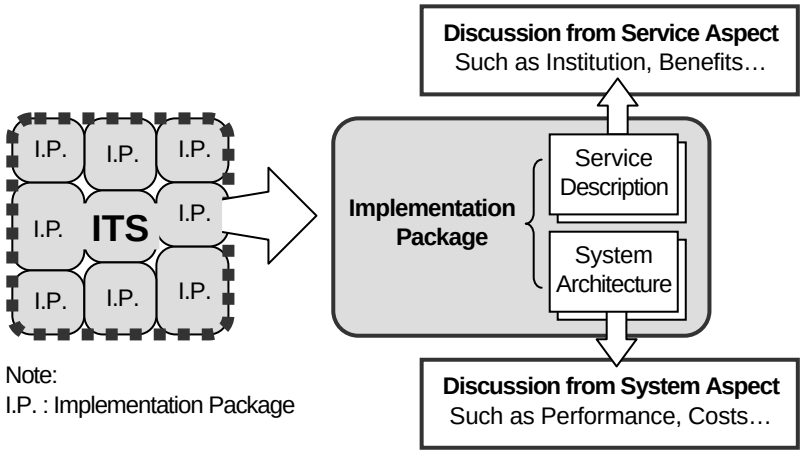
References for Underlined Words:
- Road owner→ Figure2.17
- Expressway police→ Figure 2.17
- Road management office→ Figures 2.1, 2.4, 2.17
- Regional main center → Figure 2.1, 2.4, 2.17

5. System Architecture and Location

5.1 Concept of Implementation Package

The ITS user services aforementioned are to be implemented stepwise based on the selection suited to regional properties and are to be divided into smaller packages accordingly. For this purpose, discussions are to be made based on implementation packages are in the System Operation/Management Plan. The implementation packages provide a common ground for the discussion of two aspects as shown below.

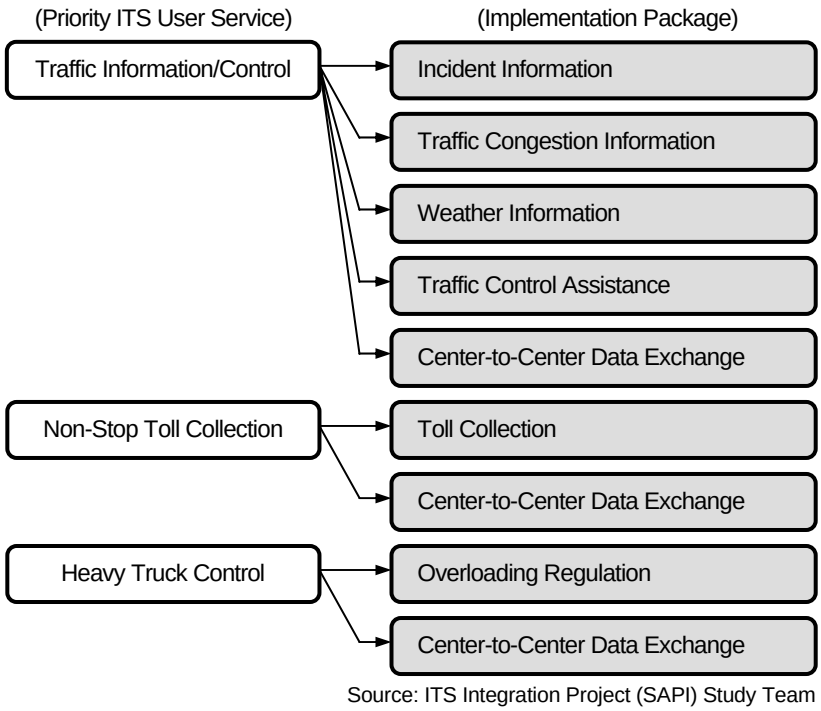
Figure 5.1 Concept of Implementation Package



Source: ITS Integration Project (SAPI) Study Team

The three priority ITS user services can be broken down into the implementation packages as shown below.

Figure 5.2 Implementation Packages for Priority ITS User Services

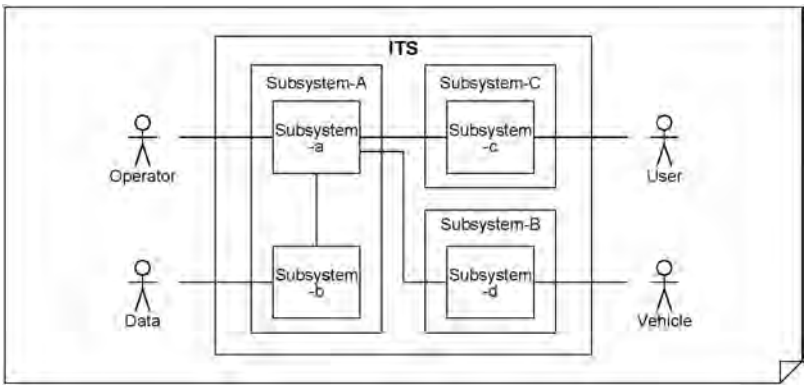


Source: ITS Integration Project (SAPI) Study Team

5.2 System Architecture

The implementation packages are described using the system architecture in the Plan, which consist of collaboration diagrams and message sequence diagrams described by using the notification of UML (Unified Modelling Language).

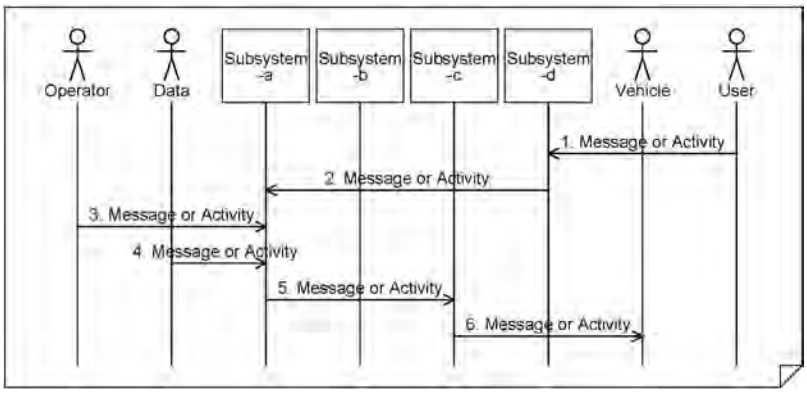
Figure 5.3 Collaboration Diagram



Note: This diagram shows configuration of a system using subsystems and interfaces between them in order to assist to share the most basic understanding of the system.

Source: VITRANSS2 Study Team

Figure 5.4 Message Sequence Diagram



Note: This diagram shows a procedure of exchanging messages/activities among subsystems for realizing a system and their contents in order to assist to discuss interoperability of data.

Source: VITRANSS2 Study Team

Figure 5.5 Classification of Subsystem

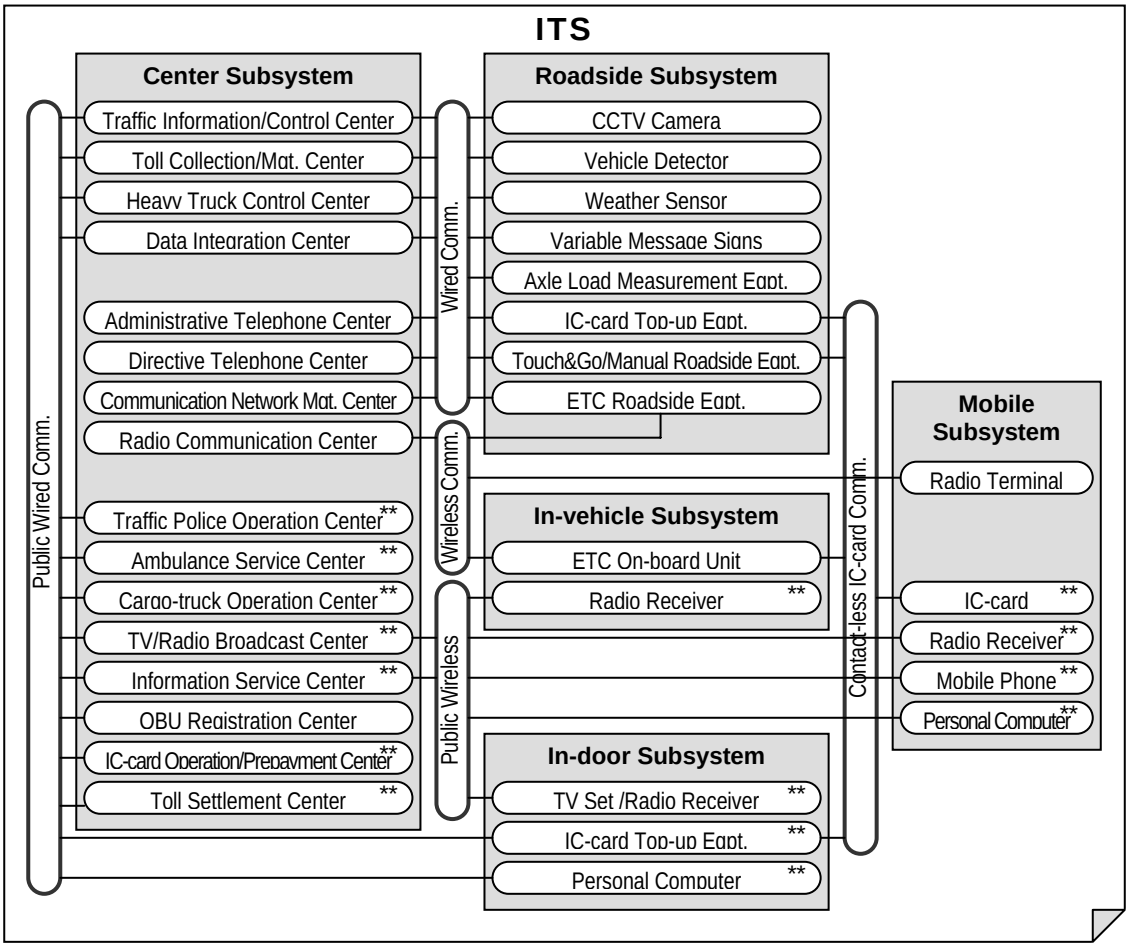
Subsystem	Elements of a system defined by considering differences in function, location and envisioned operating body, which can be broken down to the lower-levels; the high-end subsystem is to respond to the total framework for ITS operation
Functional Package	In-between Subsystem; a group of equipment components that collaborate for realizing a function of a system; unit for the ITS standards and system introduction
Equipment Component	Low-end subsystem; minimum units considered for describing the system architecture of ITS

Note: an equipment component that does not include any hardware is to be called software component as distinguished from others.

Source: ITS Integration Project (SAPI) Study Team

The total system architecture for the priority ITS user services can be illustrated as shown in the figure below with reference to the ITS Master Plan.

Figure 5.6 Total System Architecture for Priority ITS User Services



Note: ** : Only protocols and messages are defined, being operated by the entity other than the road operators.

Source: ITS Integration Project (SAPI) Study Team

5.3 Installation Location of Subsystems

The logical center subsystems in the total system architecture are to be installed in each road owner's offices as shown in the table below.

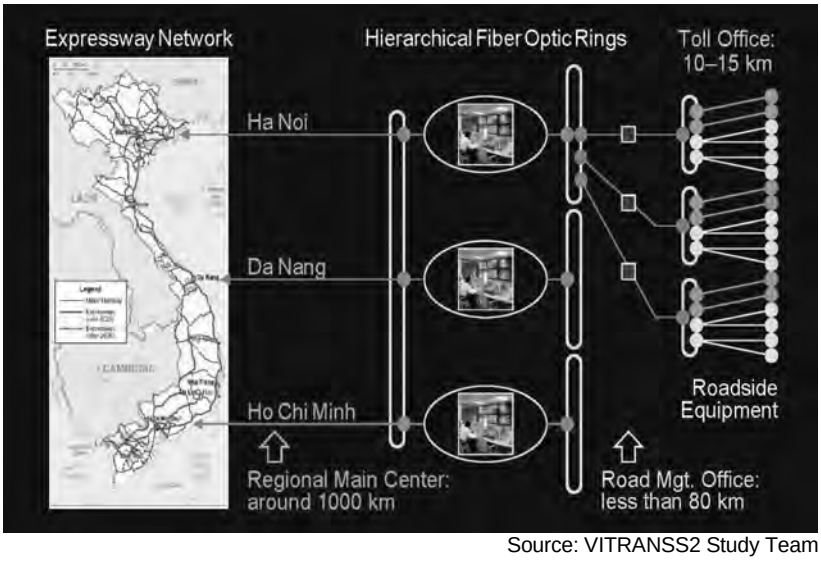
Table 5.1 Center Subsystems to be Installed in Each Road Owner's Office

Center Subsystems	Regional Main Center	Road Management Office	Toll Office	Road Owner's Head Office	OBU Registration Office
Traffic Information/Control Center	XXX	X			
Toll Collection/Mgt. Center			XXX	X	
Heavy Truck Control Center			XXX		
Data Integration Center	XXX				
Administrative Telephone Center	XXX	X			
Directive Telephone Center	XXX				
Communication Network Mgt. Center	XXX	X			
Radio Communication Center		XXX			
OBU Registration Center					XXX

Note: XXX : Necessity of the whole function, X : Necessity of partial function.

The structure/location outline of road owner's offices is illustrated in the ITS Master Plan as below. The Regional Main Centers are to be located in Ha Noi, Da Nang and Ho Chi Minh.

Figure 5.7 Structure/Location Outline of Road Owner's Offices



Source: VITRANSS2 Study Team

The functional packages in the system architecture developed in the ITS Master Plan are to be installed in the locations as shown in the table below.

Table5.2 Installation Location of Functional Packages

	Functional Packages	Center Subsystem					Roadside Subsystem	Onboard Subsystem	Mobile Subsystem	In-door Subsystem
		Regional Main Center	Road Management Office	Toll Office	Road Owner's Head Office	OBU Registration Office				
1	Voice Communication	XX	XX	XX			XX			
2	CCTV Monitoring	XX	XX				XX			
3	Event Detection (by Image)						XX			
4	Vehicle Detection						XX			
5	Traffic Analysis	XX								
6	Weather Monitoring	XX					XX			
7	Traffic Event Management	XX	XX							
8	Traffic Supervision	XX								
9	VMS Indication	XX					XX			
10	Mobile Radio Communication		XX				XX		XX	
11	Traffic Information	XX								XX
12	Integrated Data Management	XX		XX	XX					
13	Tollgate Lane Monitoring			XX			XX			
14	Vehicle/Class Identification						XX			
15	Lane Control						XX			
16	Road-to-Vehicle Communication						XX	XX		
17	IC-card Recording						XX		XX	XX
18	Toll Data Management			XX	XX					
19	OBU Management					XX				XX
20	Axle Load Measurement						XX			
21	Measurement Lane Monitoring			XX						

6. Operation/Management Plan for Traffic Information/Control System

6.1 General

This system achieves traffic information/control on the expressway. The system provides functions for the following purposes.

- Supervision of the traffic condition through monitoring
- Management of traffic events
- Management of patrol
- Report of traffic events from roadside
- Dissemination of traffic information.

6.2 System Architecture

The system is to be composed as shown in the following system architecture.

Figure 6.1 System Architecture for Voice Communication

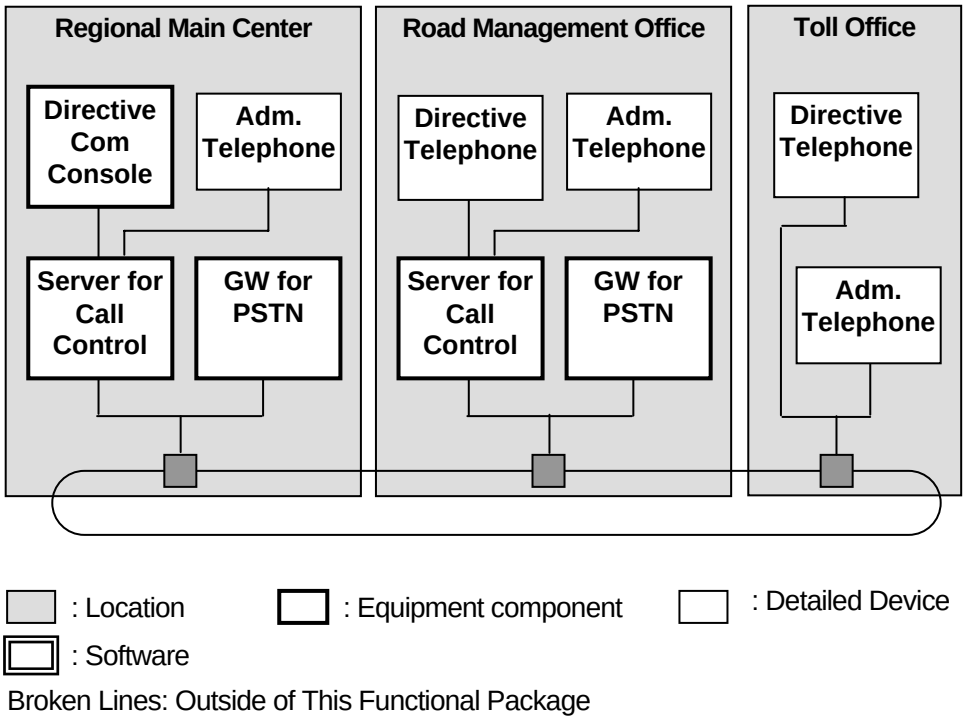


Figure 6.2 System Architecture for CCTV Monitoring

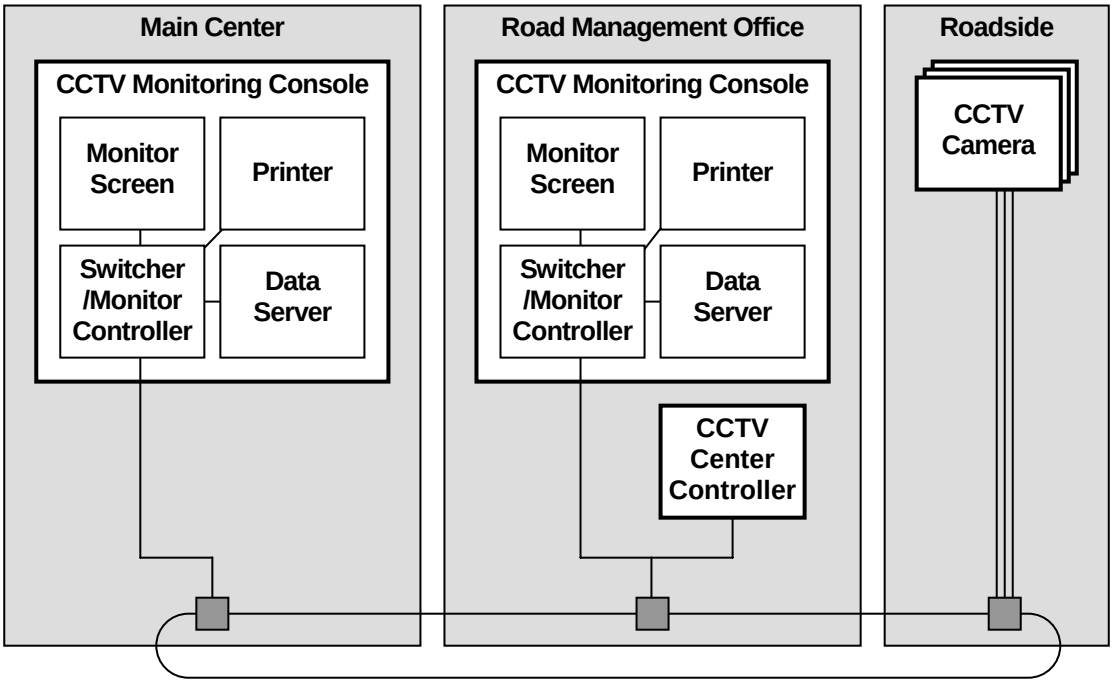


Figure 6.3 System Architecture for Event Detection

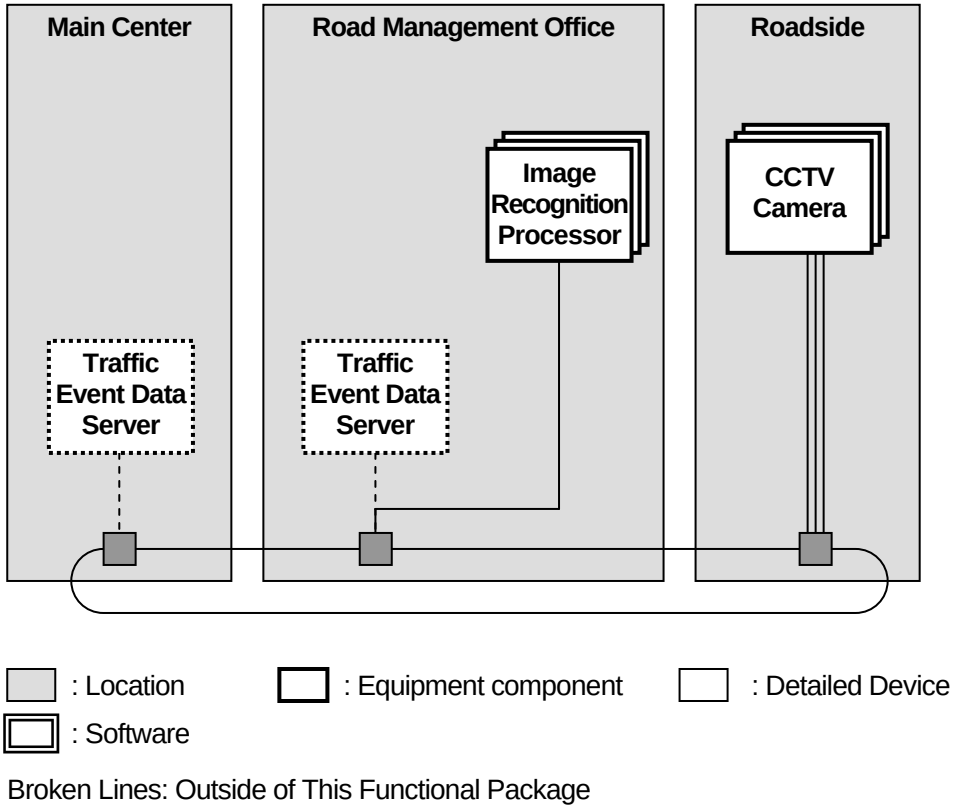


Figure 6.4 System Architecture for Vehicle Detection

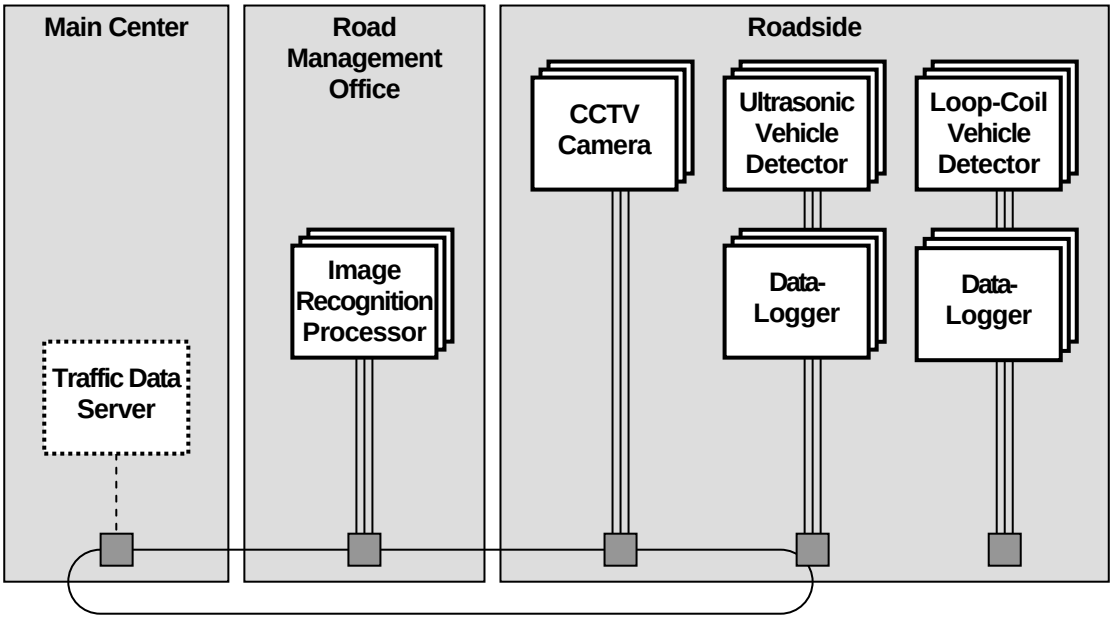


Figure 6.5 System Architecture for Traffic Analysis

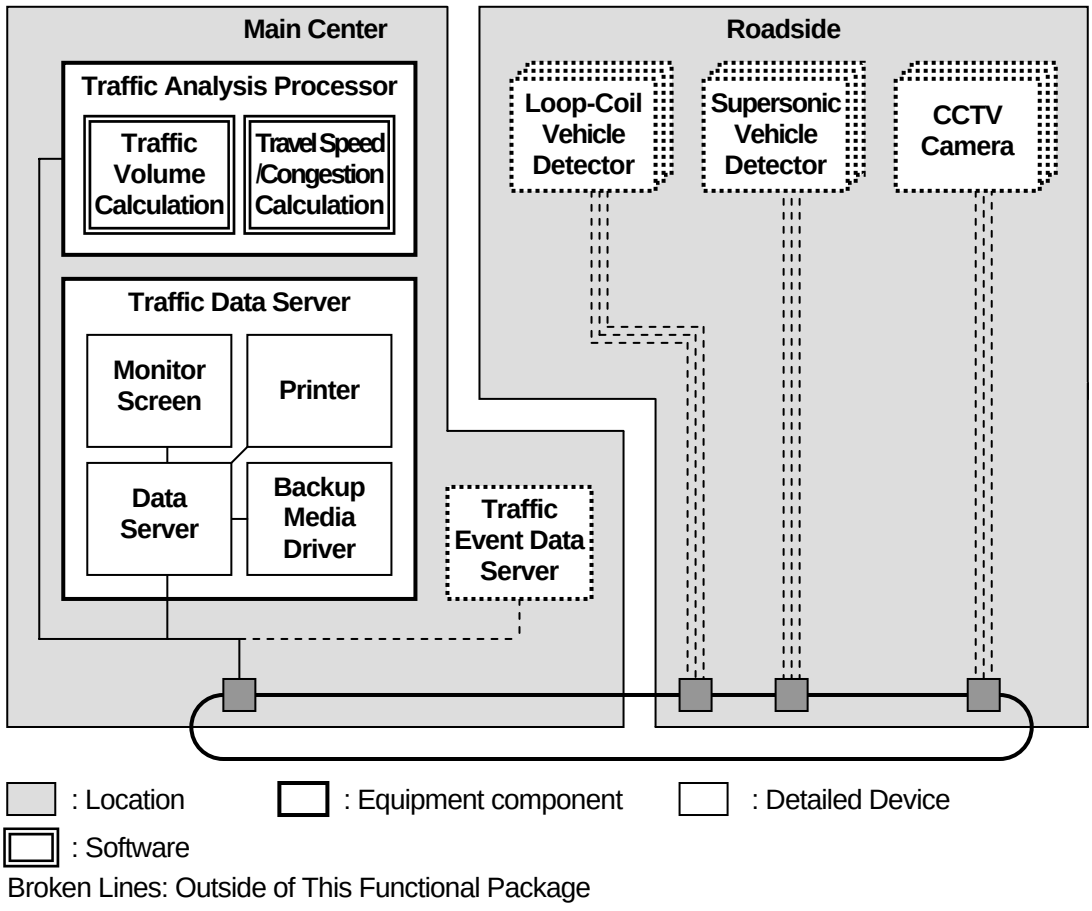


Figure 6.6 System Architecture for Weather Monitoring

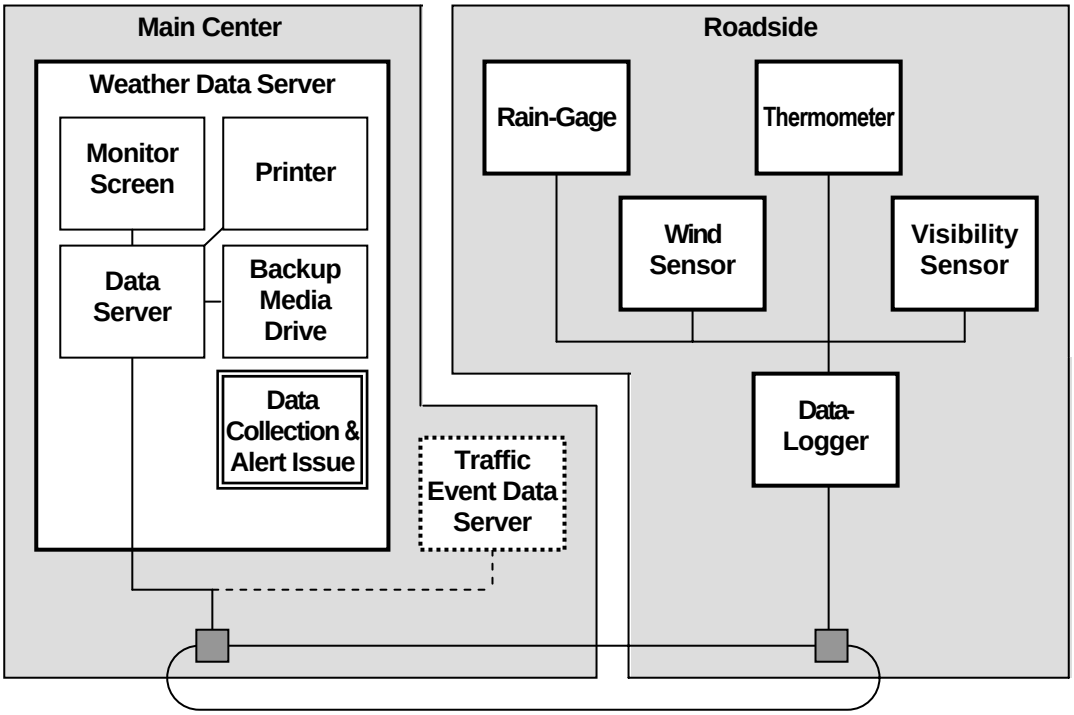


Figure 6.7 System Architecture for Traffic Event Management

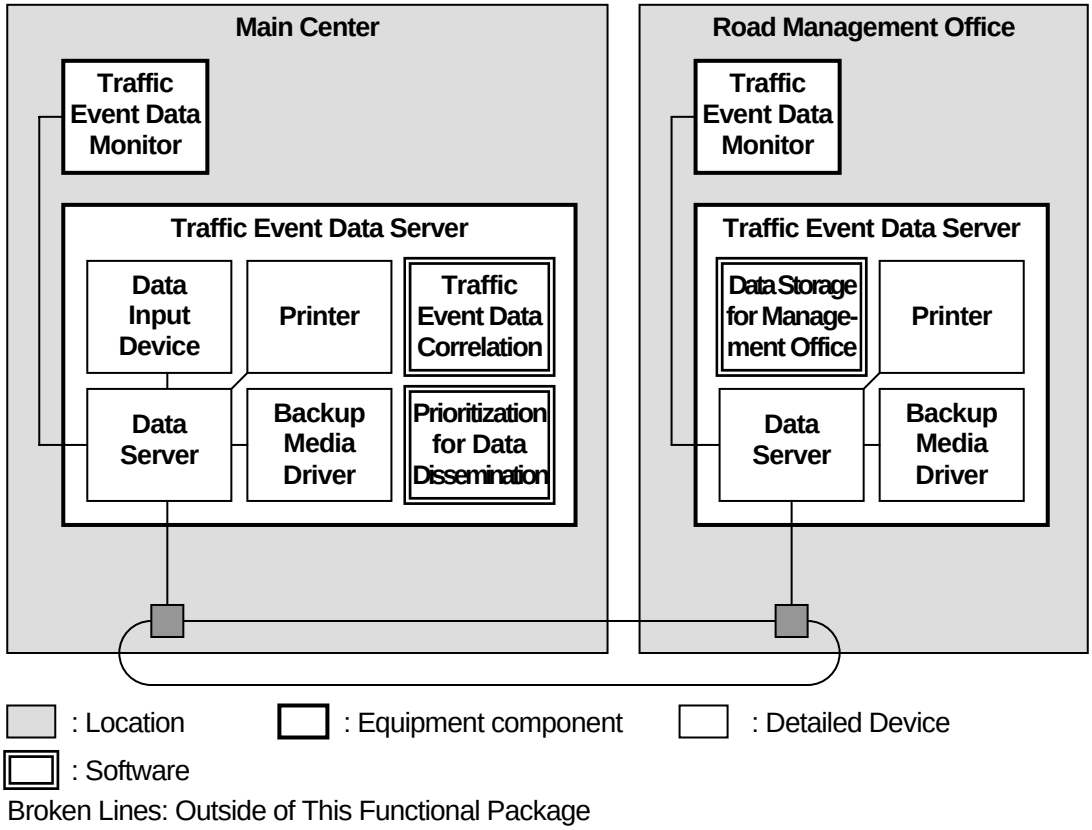
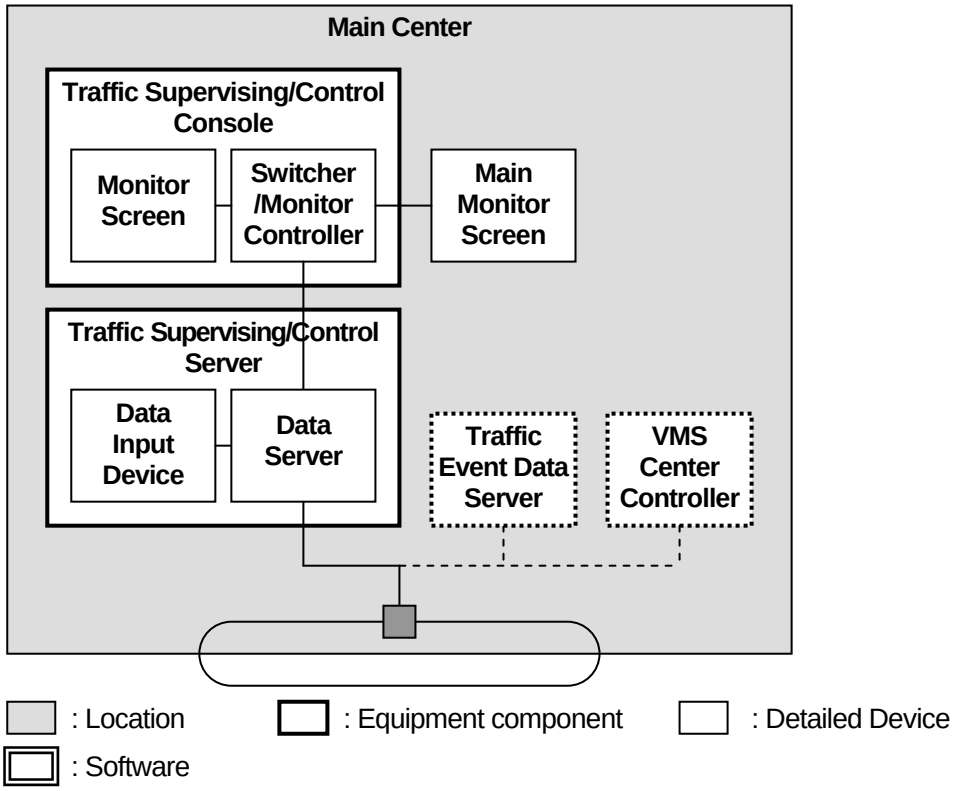
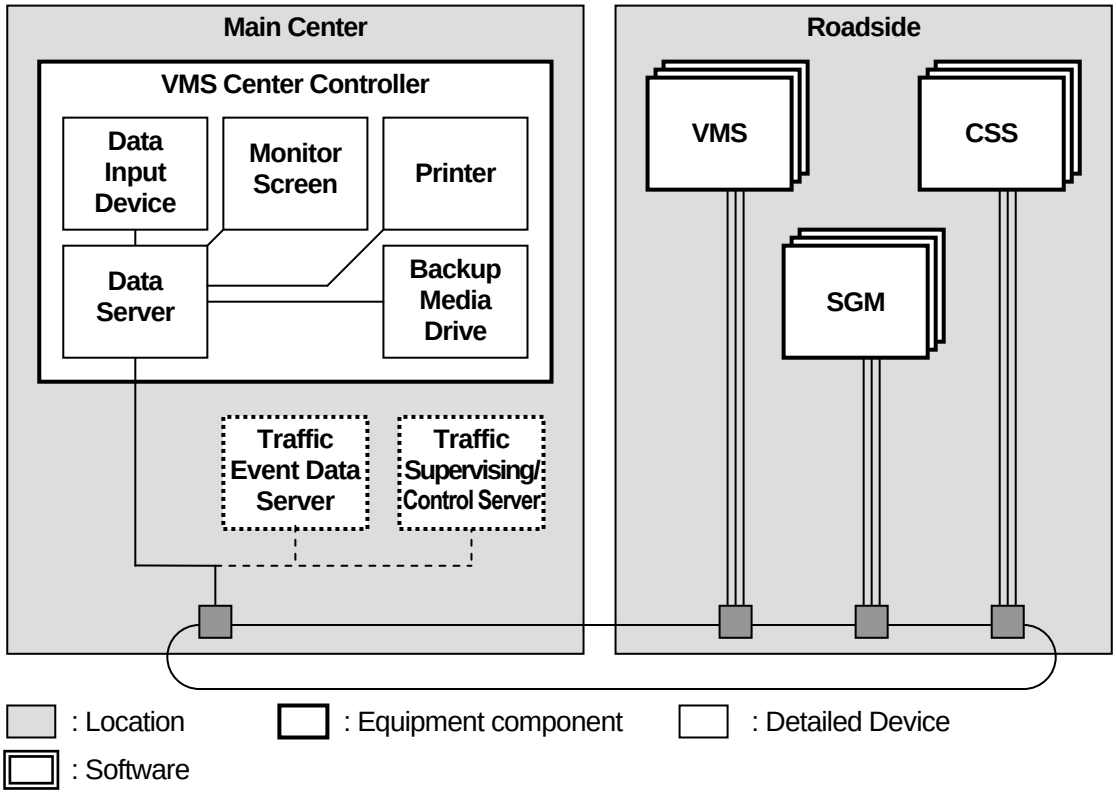


Figure 6.8 System Architecture for Traffic Supervision



Broken Lines: Outside of This Functional Package

Figure 6.9 System Architecture for VMS Indication



Broken Lines: Outside of This Functional Package

Figure 6.10 System Architecture for Mobile Radio Communication

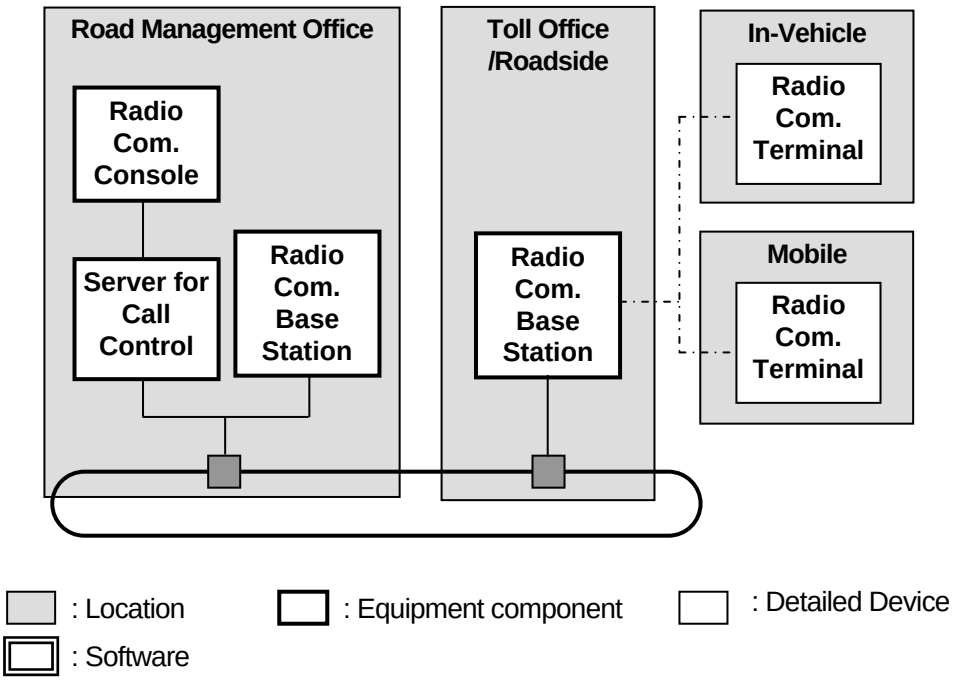


Figure 6.11 System Architecture for Traffic Information

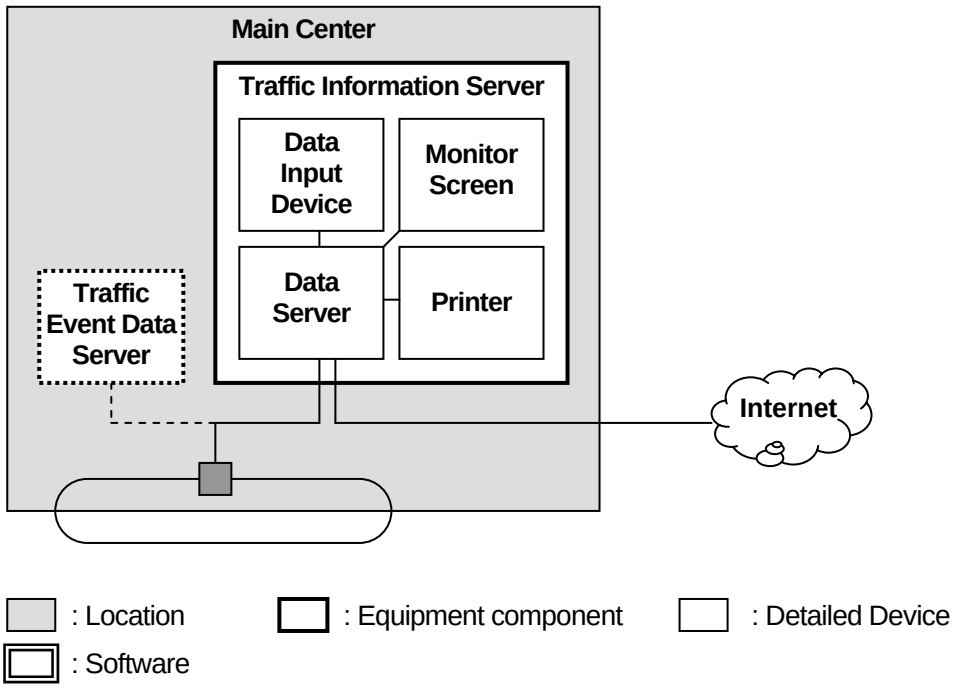
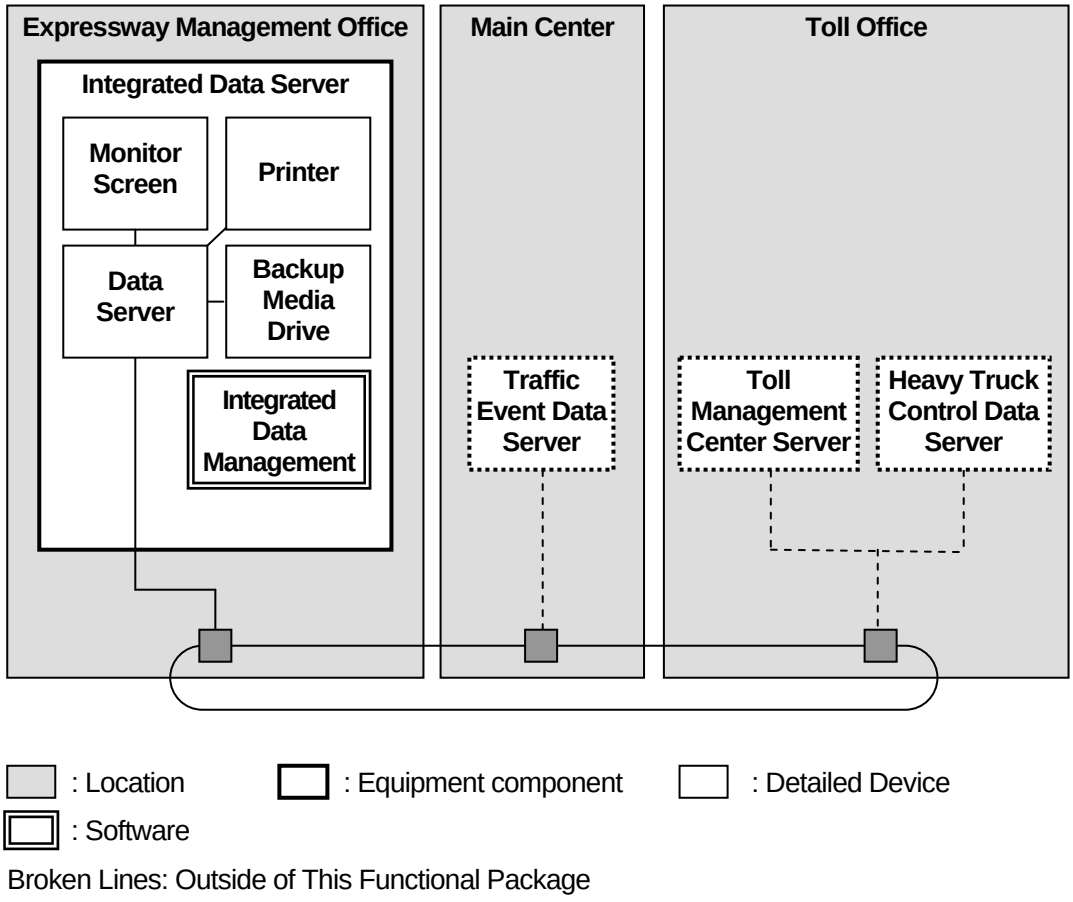


Figure 6.12 System Architecture for Integrated Data Management

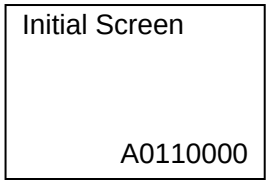


6.3 Screen Transition Diagram

1) Regional Main Center

(1) Traffic Event Data Server Console

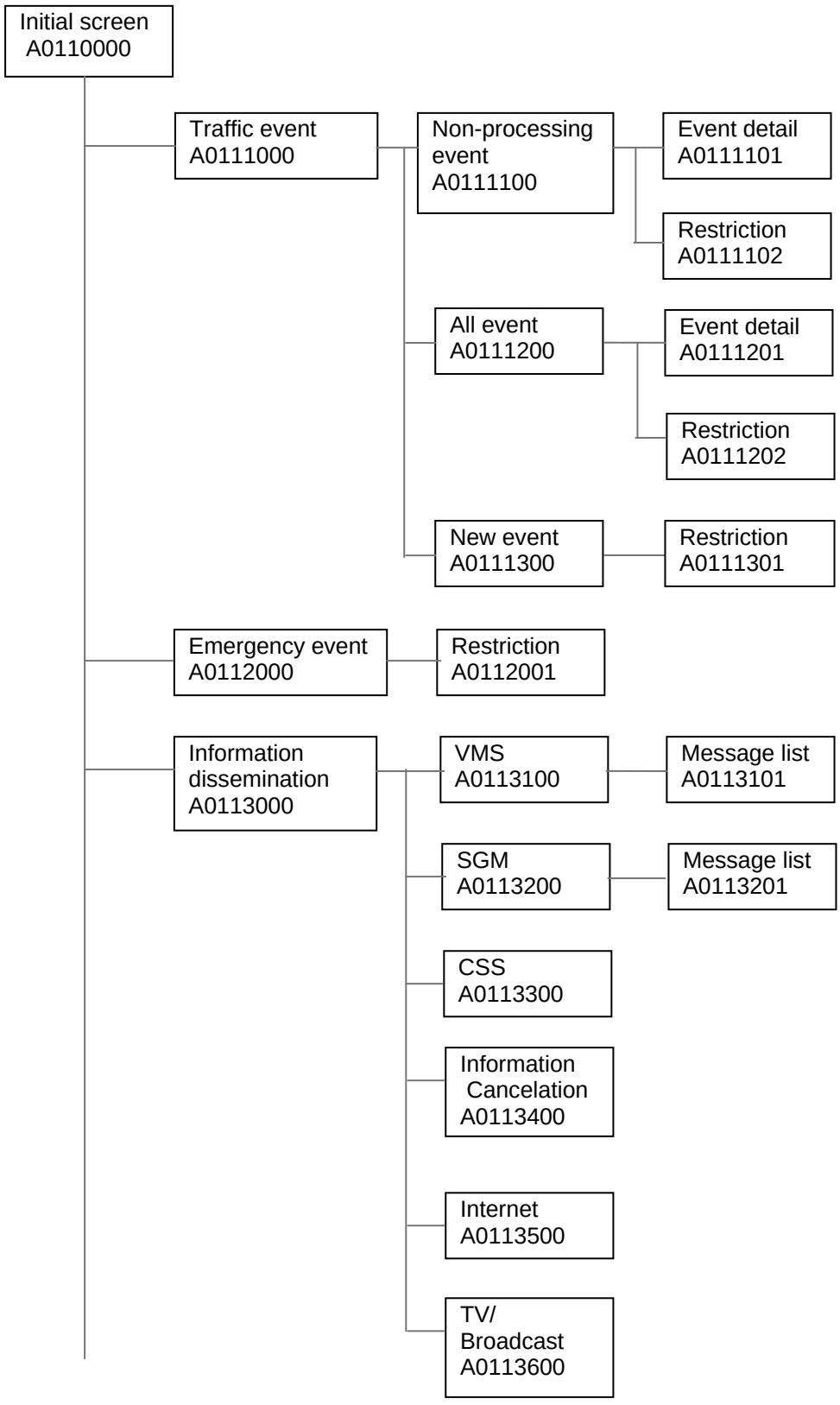
Initial screen is to indicates the Main Menu of the traffic event control and information.

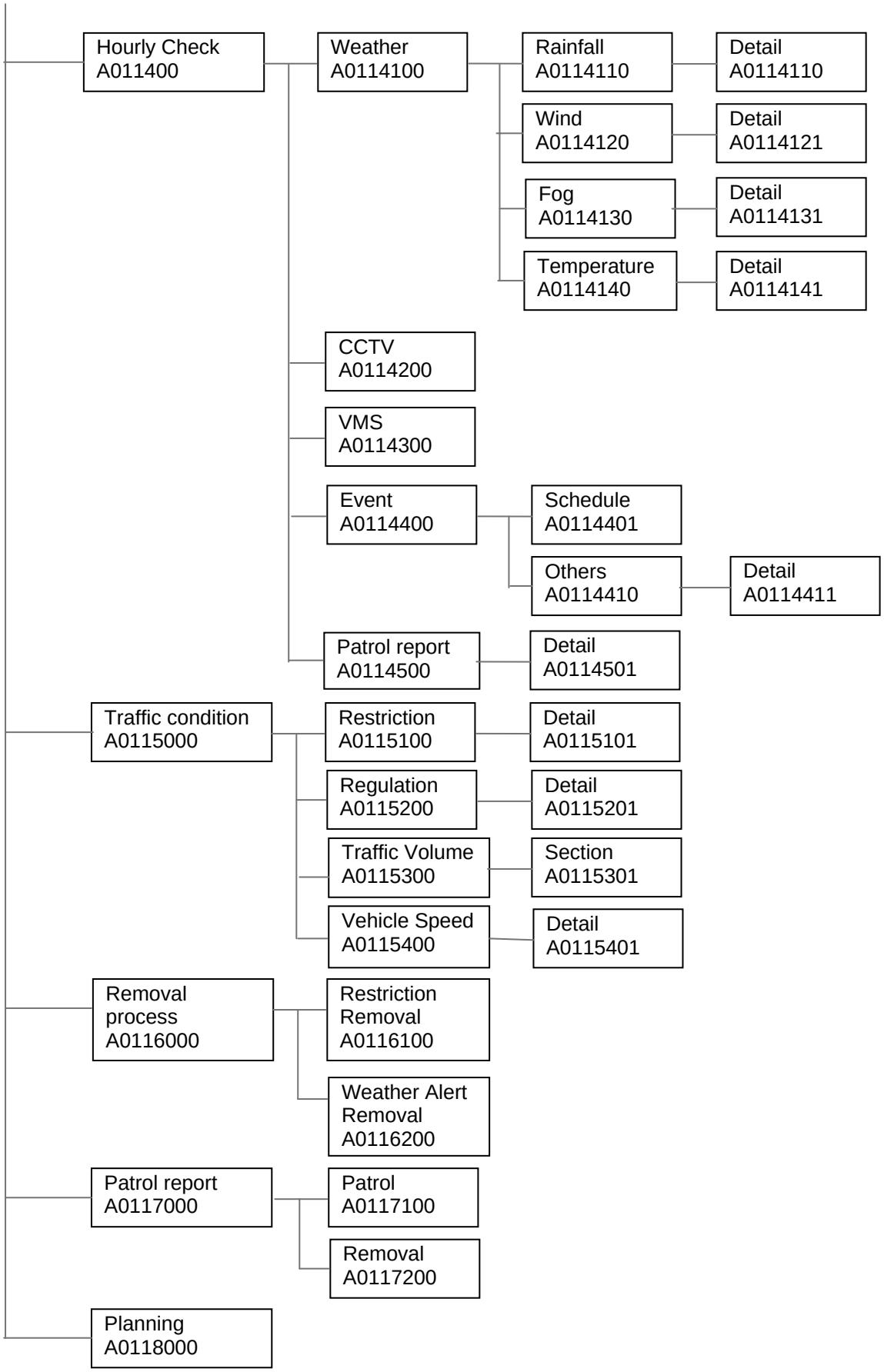


Initial screen
- Traffic event list
- Emergency
- Information dissemination
- Hourly check
- Traffic condition
- Removal process
- Patrol Report
- Planning

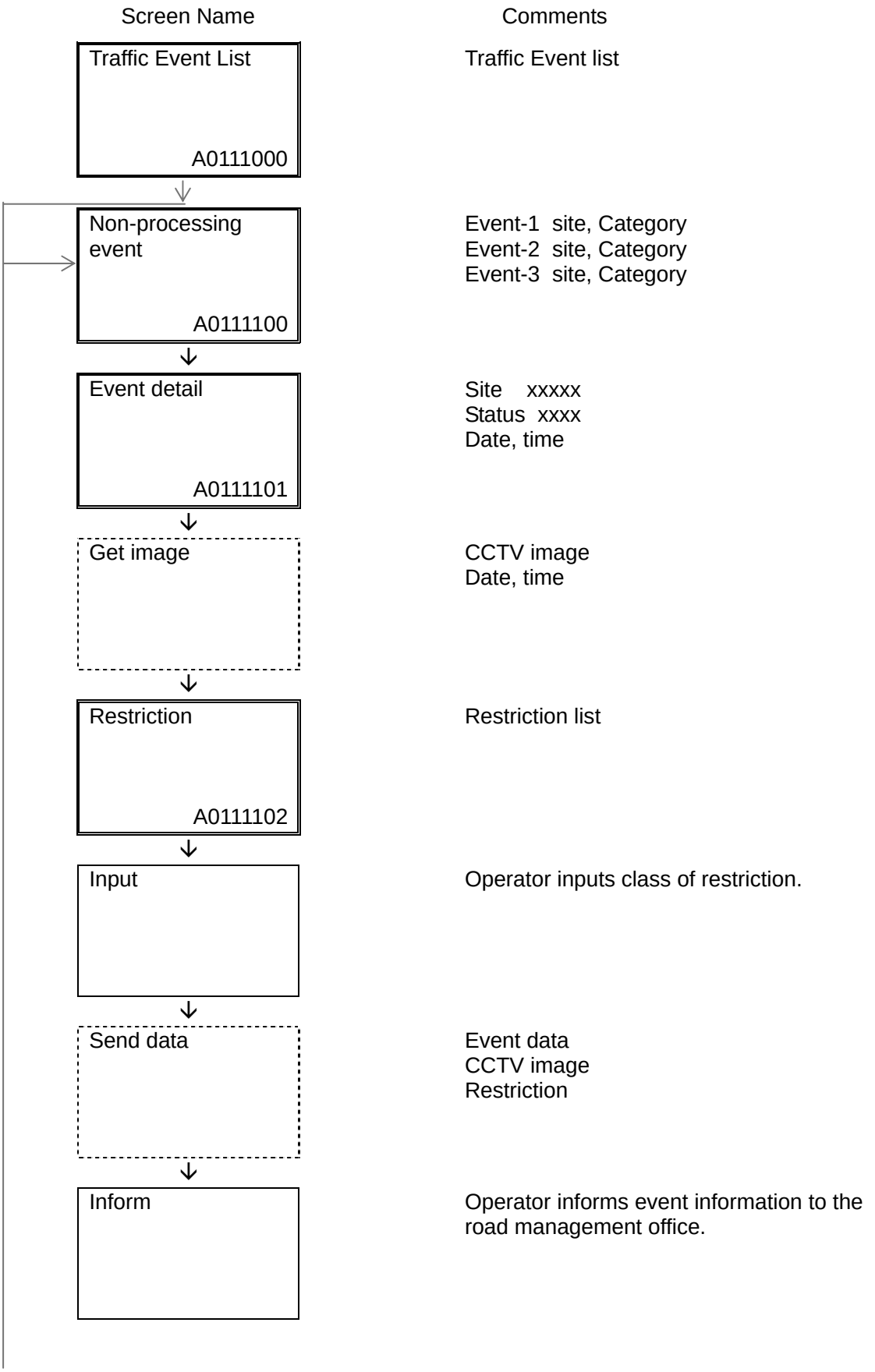
a. Event list
   This screen displays the list of event and inputs new event.
b. Emergency
   This screen displays emergency information and inputs emergency message.
c. Information dissemination
   This screen displays information of VMS, SGM, CSS, broadcast and internet. Moreover, this screen inputs a message to indicate.
d. Hourly check
   This screen displays the CCTV video streaming, weather information, all VMSs message, event information and patrol report.
e. Traffic condition
   This screen displays list of restriction, list of regulation, traffic volume of section and vehicle speed of section.
f. Removal process
   This screen displays list of restriction and list of weather alert.
g. Patrol report
   This screen displays patrol report written by patrol crew.
h. Planning
   This screen displays the plan of roadwork and exclusive use of the road. In addition, this screen inputs new schedule of roadwork or exclusive use of the road.

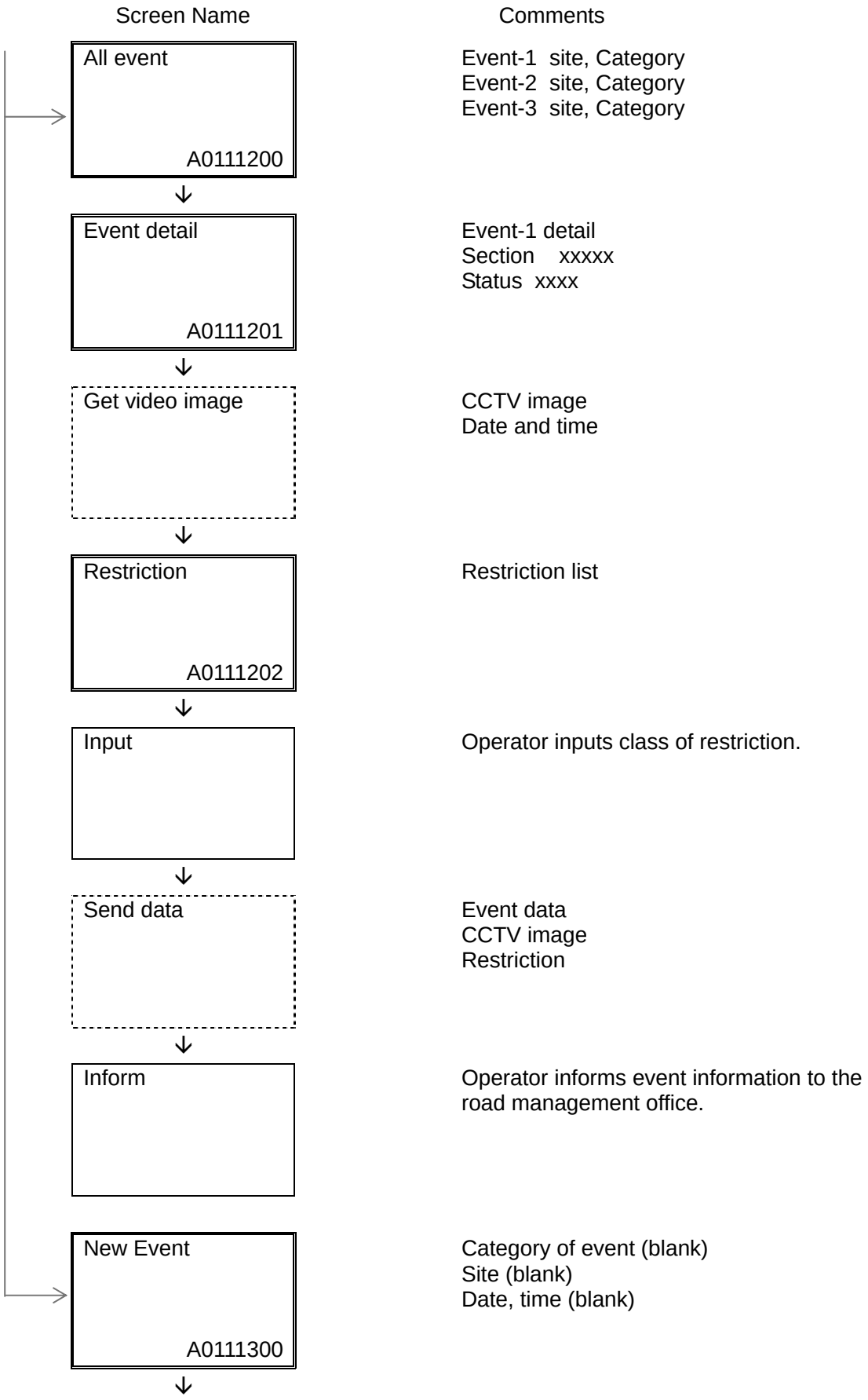
Figure 6.13 Screen Transition Diagram of Traffic Event Data Server Console

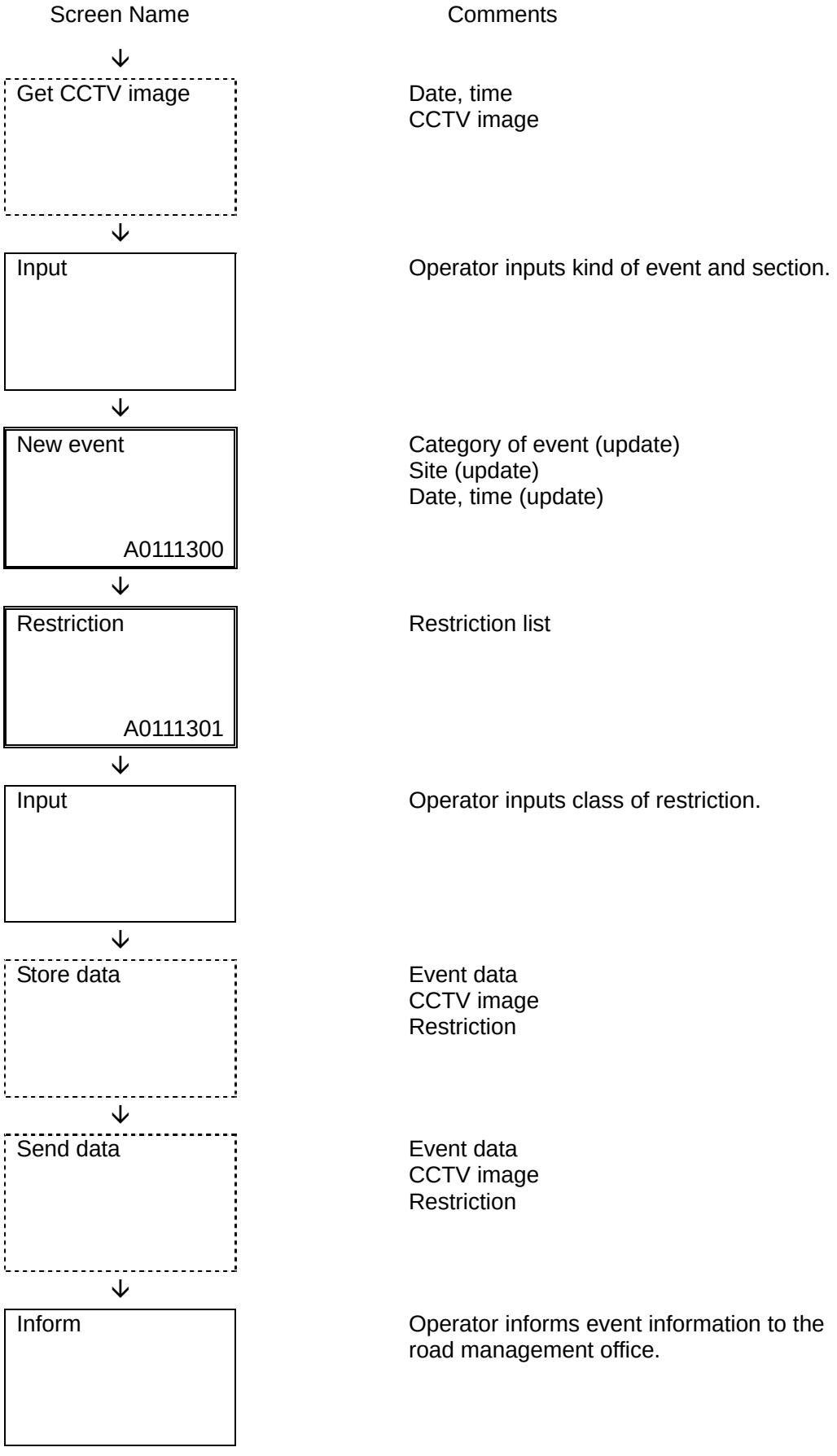



Hourly Check A011400
Weather A0114100
Rainfall A0114110
Detail A0114110
Wind A0114120
Detail A0114121
Fog A0114130
Detail A0114131
Temperature A0114140
Detail A0114141
CCTV A0114200
VMS A0114300
Event A0114400
Schedule A0114401
Others A0114410
Detail A0114411
Patrol report A0114500
Detail A0114501
Traffic condition A0115000
Restriction A0115100
Detail A0115101
Regulation A0115200
Detail A0115201
Traffic Volume A0115300
Section A0115301
Vehicle Speed A0115400
Detail A0115401
Removal process A0116000
Restriction Removal A0116100
Weather Alert Removal A0116200
Patrol report A0117000
Patrol A0117100
Removal A0117200
Planning A0118000

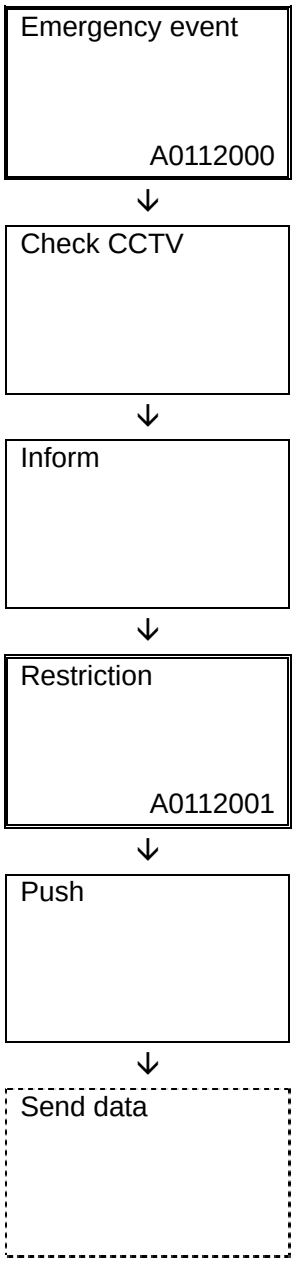
a. Event list


Screen Name
Comments
Traffic Event List
A0111000
Traffic Event list
Non-processing event
A0111100
Event-1 site, Category
Event-2 site, Category
Event-3 site, Category
Event detail
A0111101
Site xxxxx
Status xxxx
Date, time
Get image
CCTV image
Date, time
Restriction
A0111102
Restriction list
Input
Operator inputs class of restriction.
Send data
Event data
CCTV image
Restriction
Inform
Operator informs event information to the road management office.

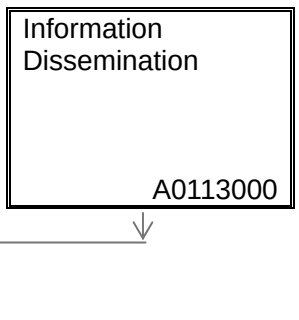

Screen Name
Comments
All event
A0111200
Event-1 site, Category
Event-2 site, Category
Event-3 site, Category
Event detail
A0111201
Event-1 detail
Section xxxxx
Status xxxx
Get video image
CCTV image
Date and time
Restriction
A0111202
Restriction list
Input
Operator inputs class of restriction.
Send data
Event data
CCTV image
Restriction
Inform
Operator informs event information to the road management office.
New Event
A0111300
Category of event (blank)
Site (blank)
Date, time (blank)

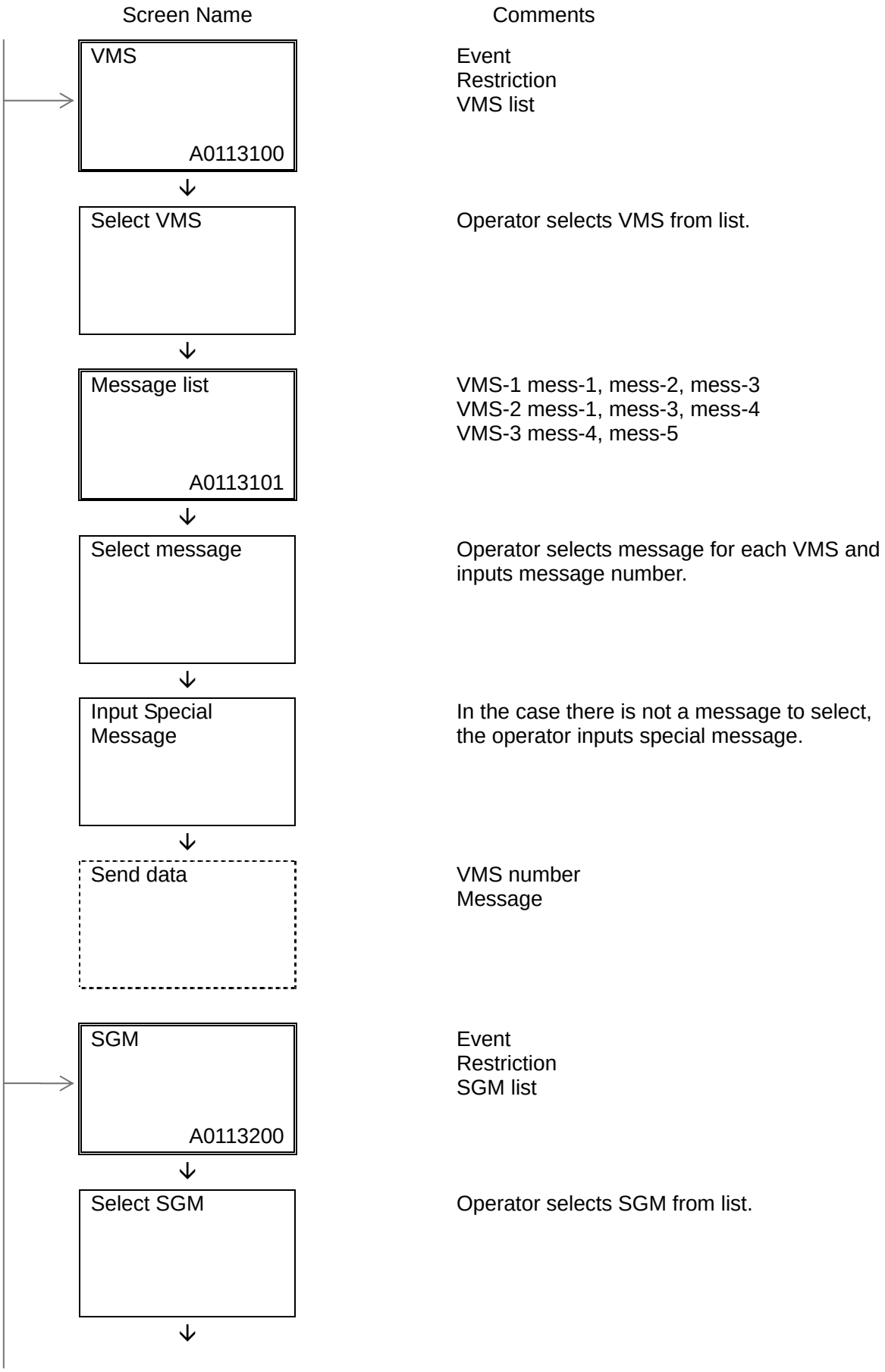

Screen Name
Comments
Get CCTV image
Date, time
CCTV image
Input
Operator inputs kind of event and section.
New event
A0111300
Category of event (update)
Site (update)
Date, time (update)
Restriction
A0111301
Restriction list
Input
Operator inputs class of restriction.
Store data
Event data
CCTV image
Restriction
Send data
Event data
CCTV image
Restriction
Inform
Operator informs event information to the road management office.

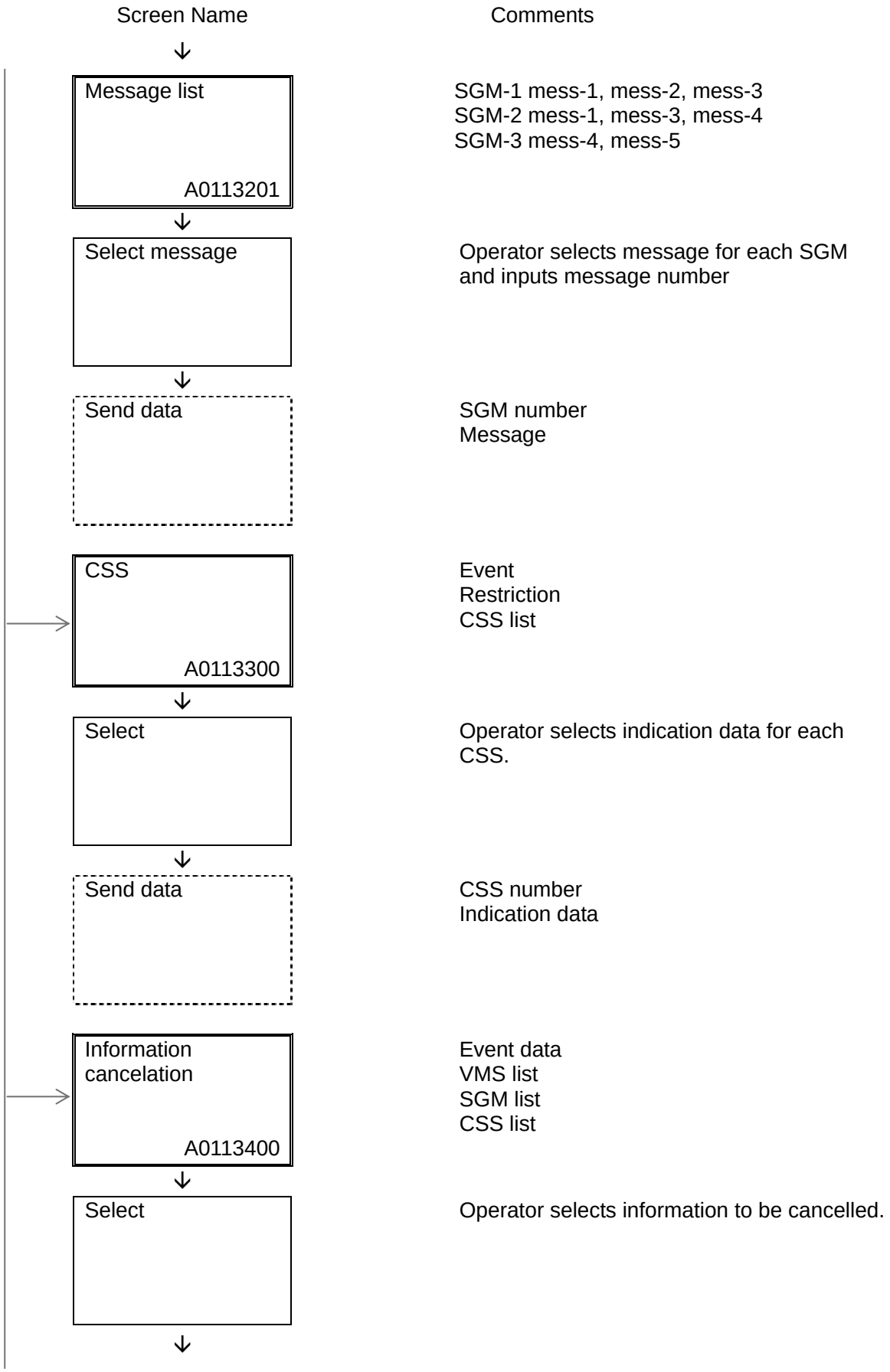
b. Emergency

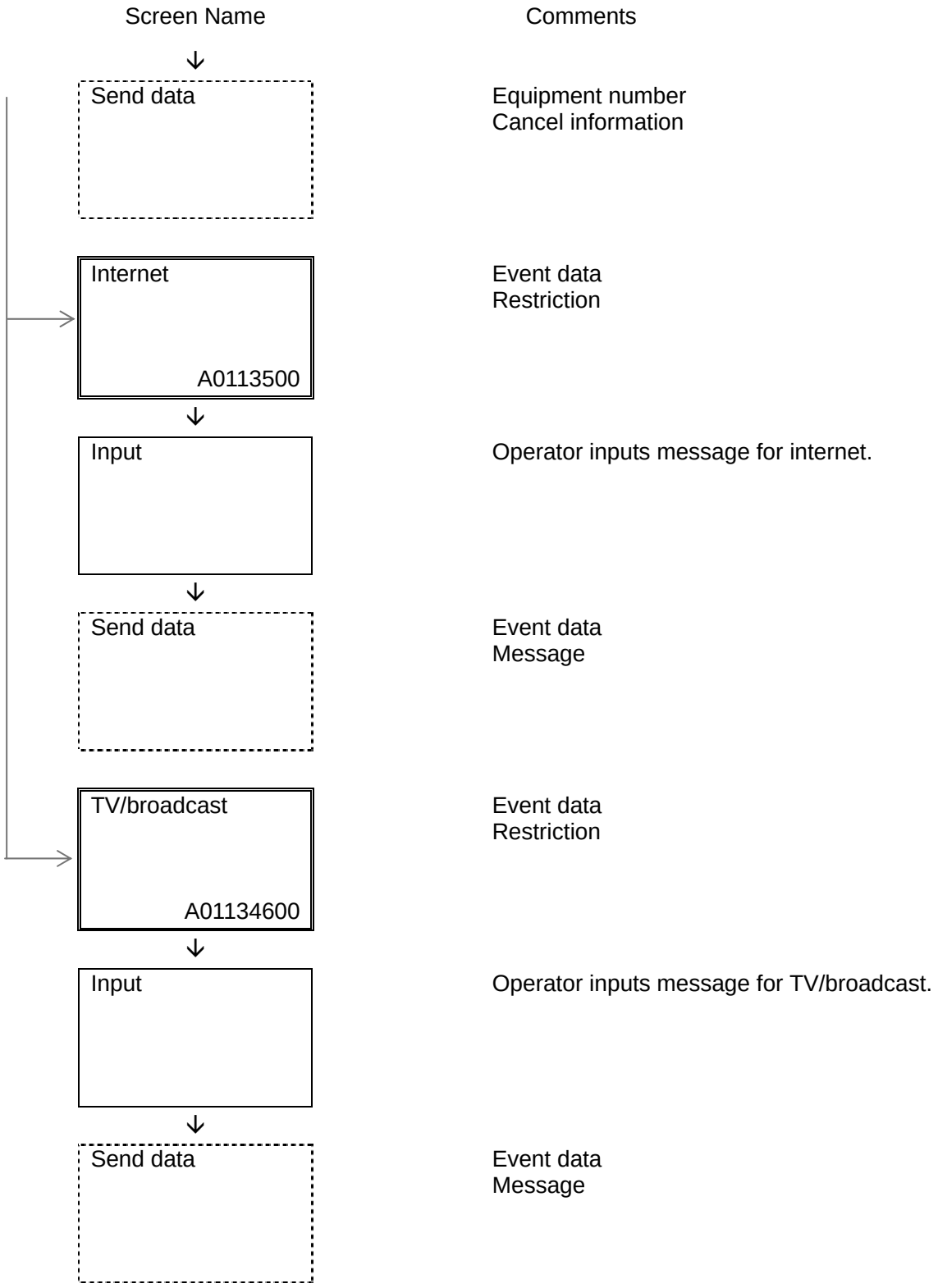


c. Information dissemination

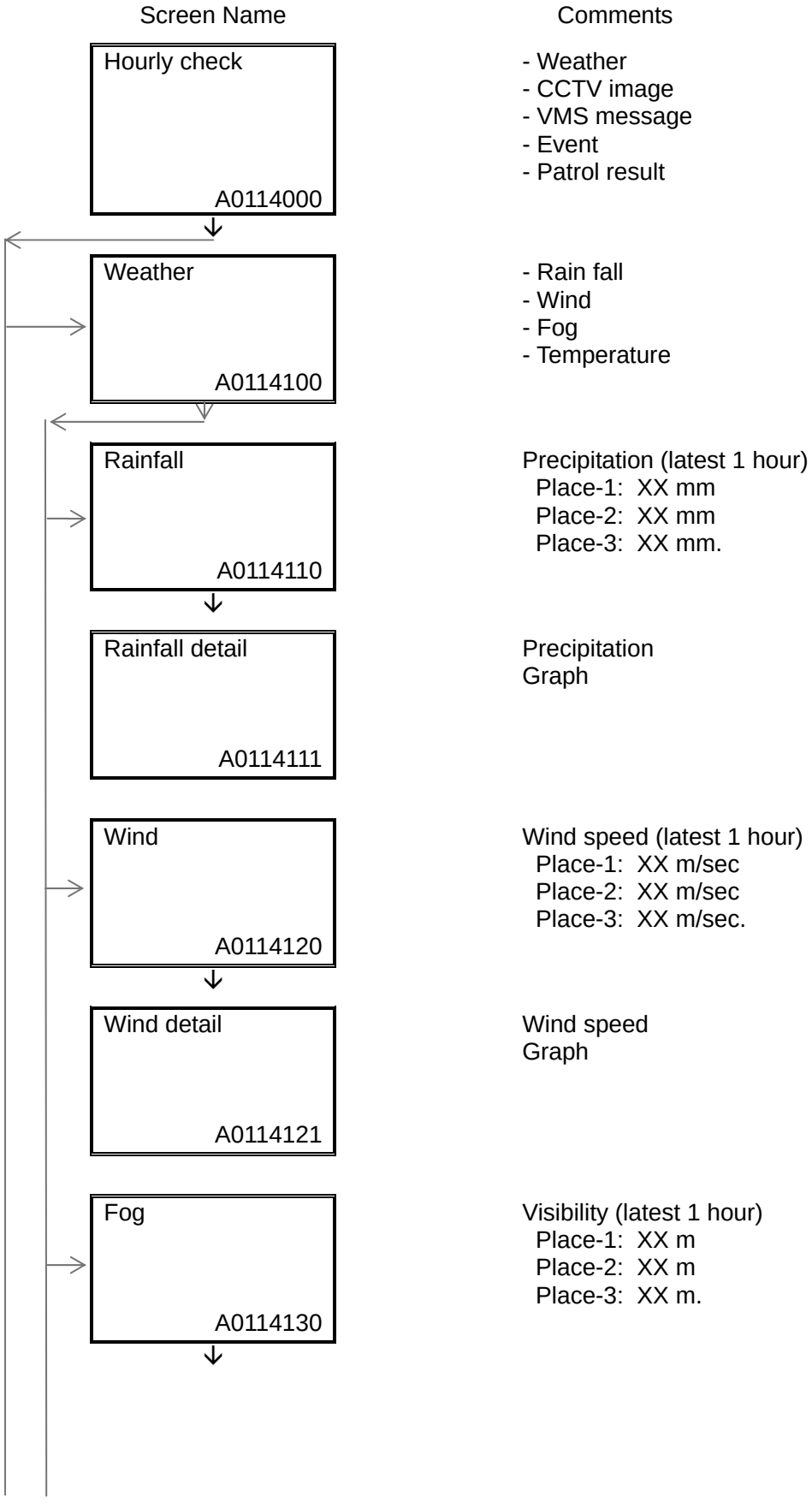


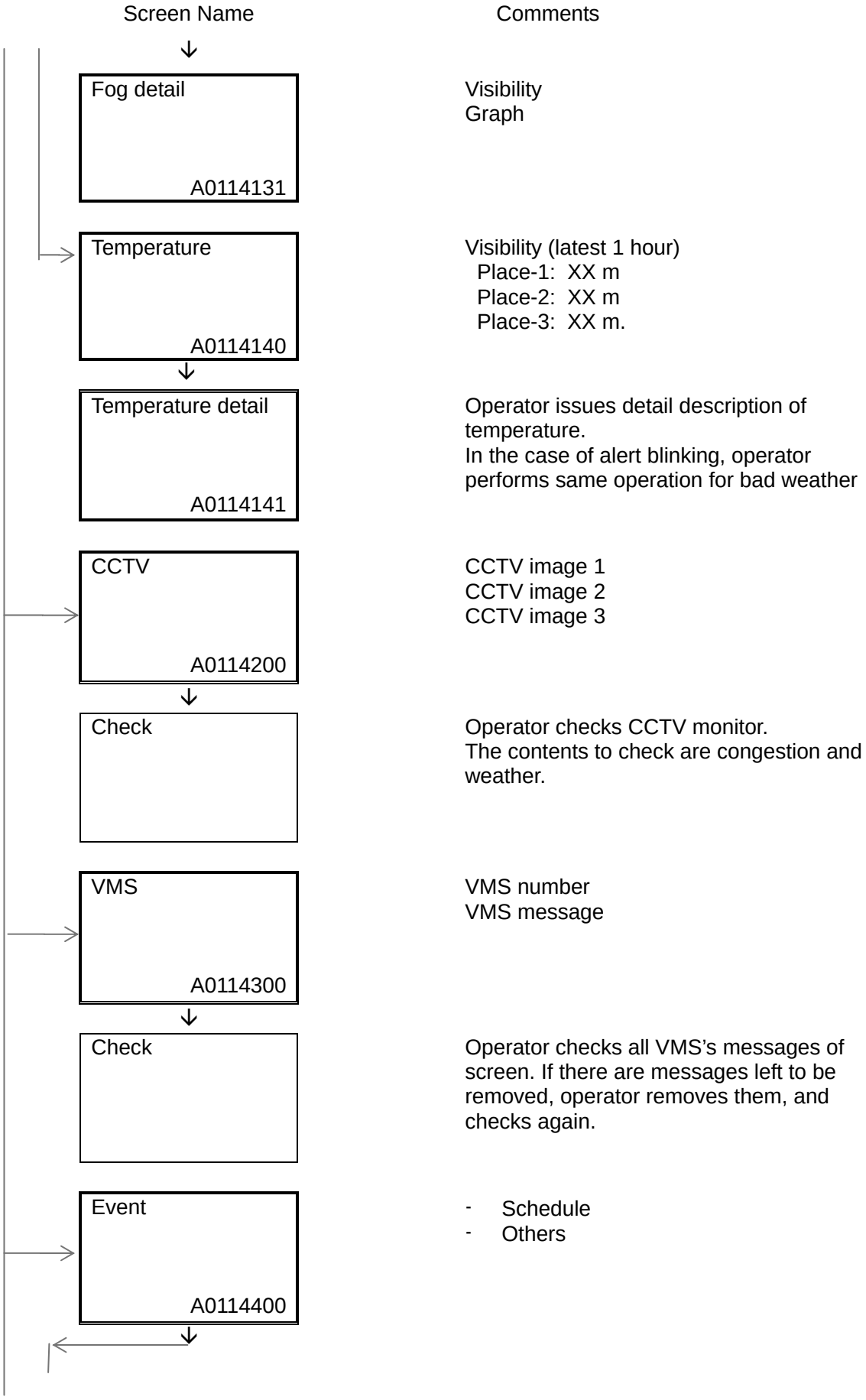

Screen Name
Comments
VMS
A0113100
Event
Restriction
VMS list
Select VMS
Operator selects VMS from list.
Message list
A0113101
VMS-1 mess-1, mess-2, mess-3
VMS-2 mess-1, mess-3, mess-4
VMS-3 mess-4, mess-5
Select message
Operator selects message for each VMS and inputs message number.
Input Special Message
In the case there is not a message to select, the operator inputs special message.
Send data
VMS number
Message
SGM
A0113200
Event
Restriction
SGM list
Select SGM
Operator selects SGM from list.

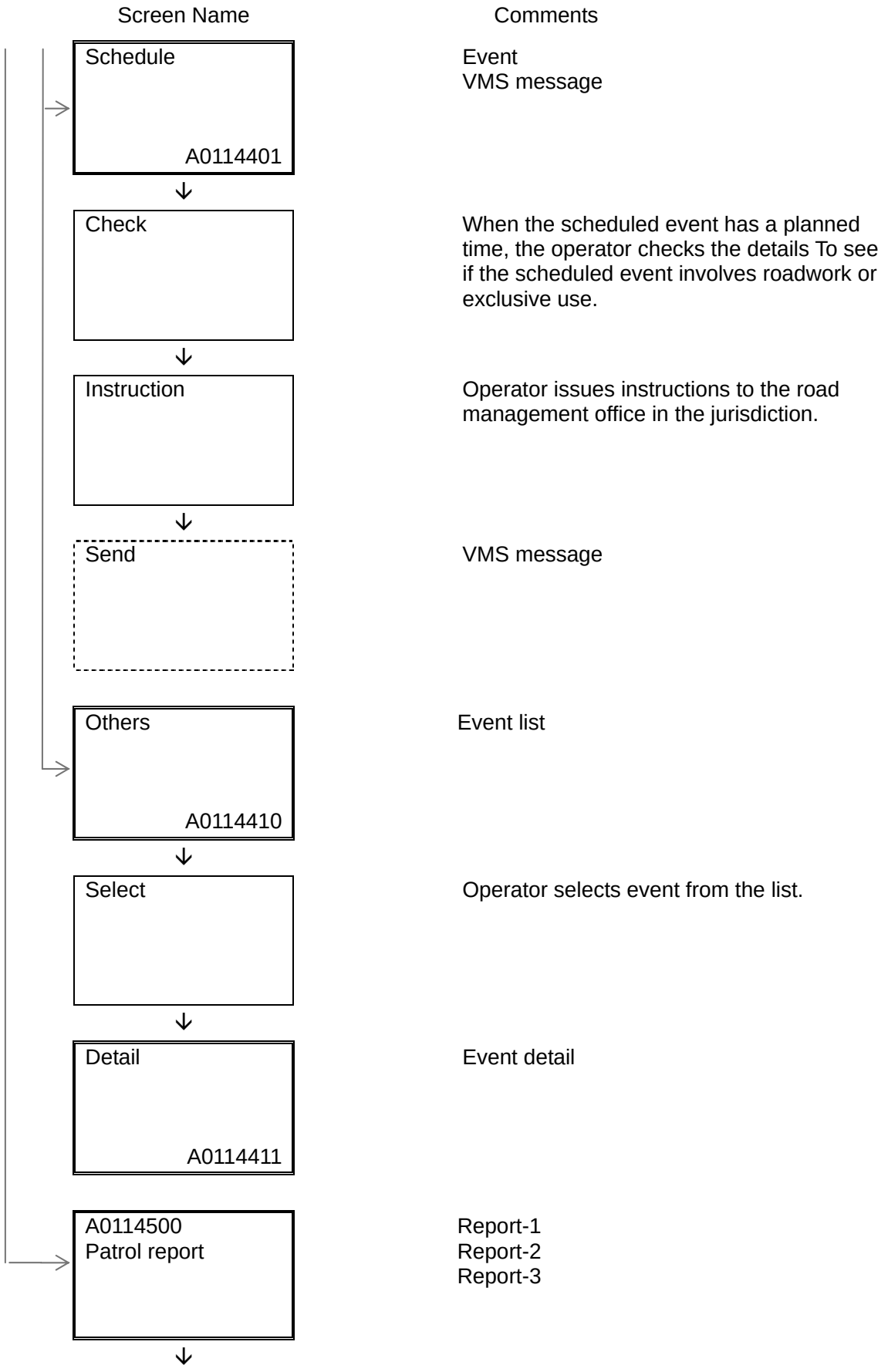

Screen Name
Comments
Message list
A0113201
SGM-1 mess-1, mess-2, mess-3
SGM-2 mess-1, mess-3, mess-4
SGM-3 mess-4, mess-5
Select message
Operator selects message for each SGM and inputs message number
Send data
SGM number
Message
CSS
A0113300
Event
Restriction
CSS list
Select
Operator selects indication data for each CSS.
Send data
CSS number
Indication data
Information cancelation
A0113400
Event data
VMS list
SGM list
CSS list
Select
Operator selects information to be cancelled.

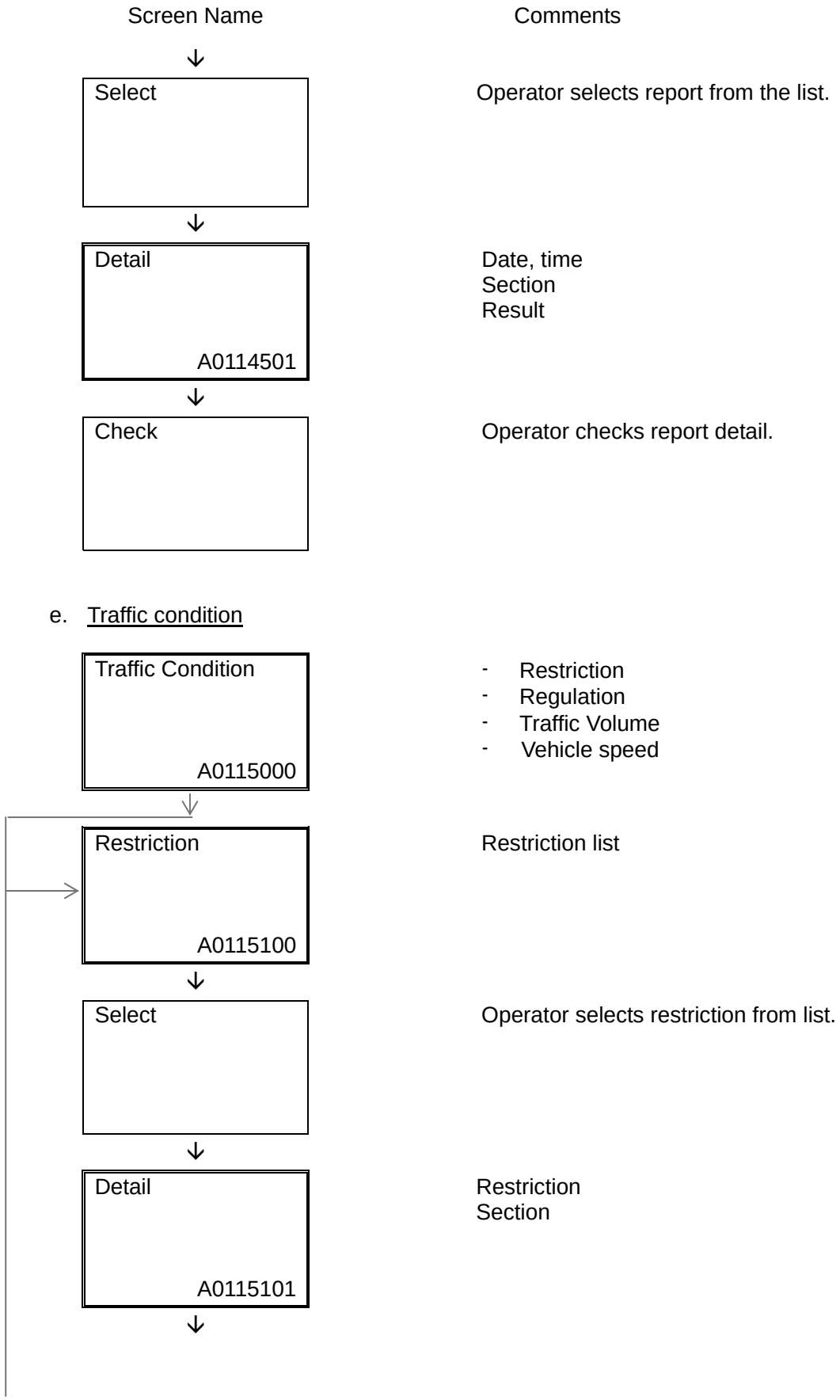

Screen Name
Comments
Send data
Equipment number
Cancel information
Internet
A0113500
Event data
Restriction
Input
Operator inputs message for internet.
Send data
Event data
Message
TV/broadcast
A01134600
Event data
Restriction
Input
Operator inputs message for TV/broadcast.
Send data
Event data
Message

d. Hourly check

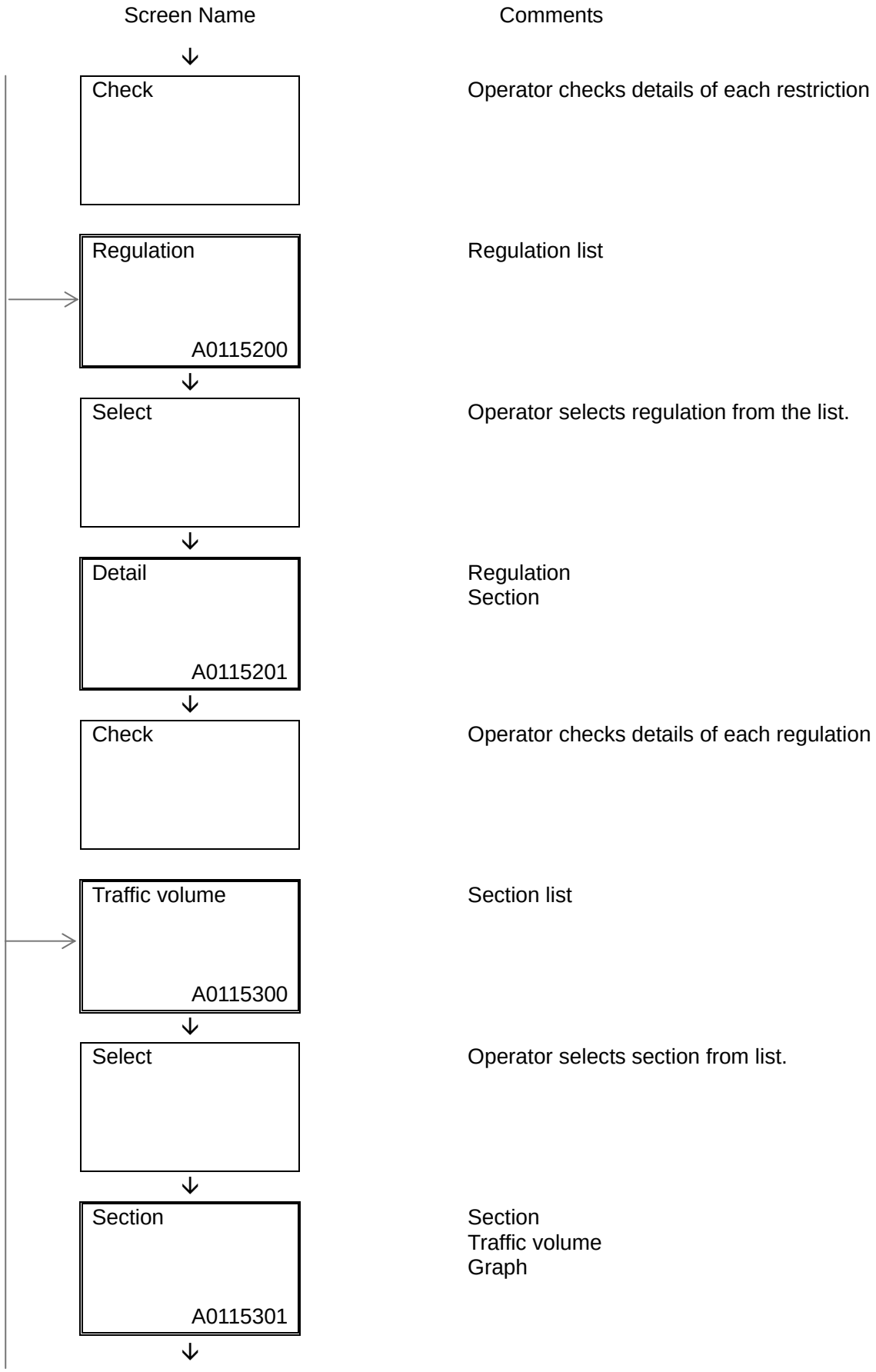


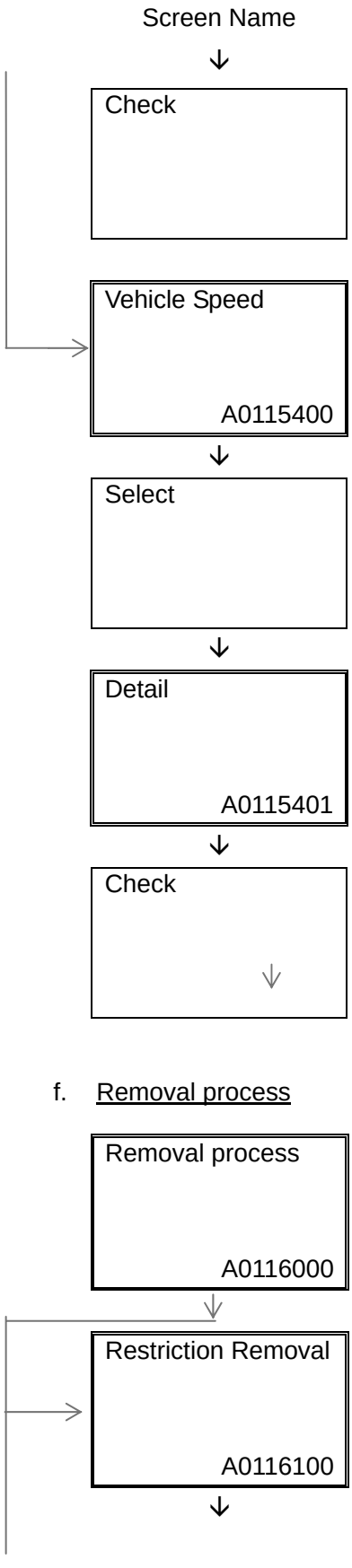

Screen Name
Comments
Fog detail
A0114131
Visibility
Graph
Temperature
A0114140
Visibility (latest 1 hour)
Place-1: XX m
Place-2: XX m
Place-3: XX m.
Temperature detail
A0114141
Operator issues detail description of temperature.
In the case of alert blinking, operator performs same operation for bad weather
CCTV
A0114200
CCTV image 1
CCTV image 2
CCTV image 3
Check
Operator checks CCTV monitor.
The contents to check are congestion and weather.
VMS
A0114300
VMS number
VMS message
Check
Operator checks all VMS's messages of screen. If there are messages left to be removed, operator removes them, and checks again.
Event
A0114400
- Schedule
- Others


Screen Name
Comments
Schedule
A0114401
Event
VMS message
Check
When the scheduled event has a planned time, the operator checks the details To see if the scheduled event involves roadwork or exclusive use.
Instruction
Operator issues instructions to the road management office in the jurisdiction.
Send
VMS message
Others
A0114410
Event list
Select
Operator selects event from the list.
Detail
A0114411
Event detail
A0114500
Patrol report
Report-1
Report-2
Report-3

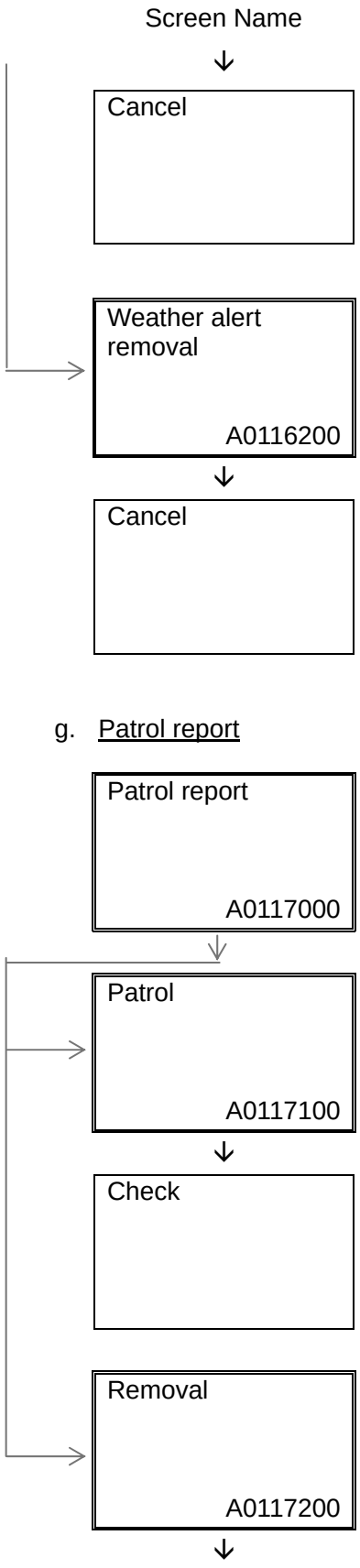


e. Traffic condition


Screen Name
Comments
Check
Operator checks details of each restriction
Regulation
A0115200
Regulation list
Select
Operator selects regulation from the list.
Detail
A0115201
Regulation
Section
Check
Operator checks details of each regulation
Traffic volume
A0115300
Section list
Select
Operator selects section from list.
Section
A0115301
Section
Traffic volume
Graph



f. Removal process



g. Patrol report

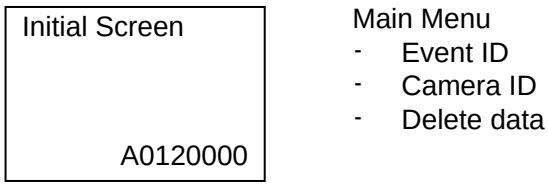
Screen Name	Comments
↓	
Check	Operator receives removal information and checks if cancelation needs to be issued.

h. Planning

Planning A0118000	Schedule date, time (blank) Event information (blank) Restriction (blank) VMS massage (blank)
↓	
Input	Operator inputs event information and time to indicate on VMS.
↓	
Planning A0118100	Schedule date, time (update) Event information (update) Restriction (update) VMS massage (update)
↓	
Send	Schedule date, time Event information Restriction VMS massage

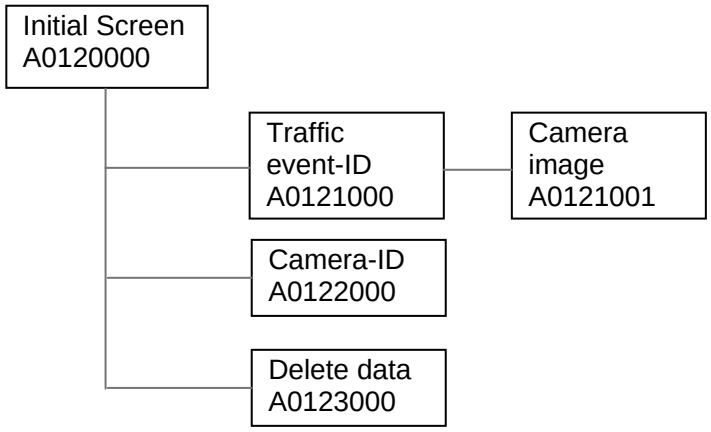
(2) Traffic Supervising/Control Server Console

Initial screen is to indicates the Main Menu of the traffic event control and information.

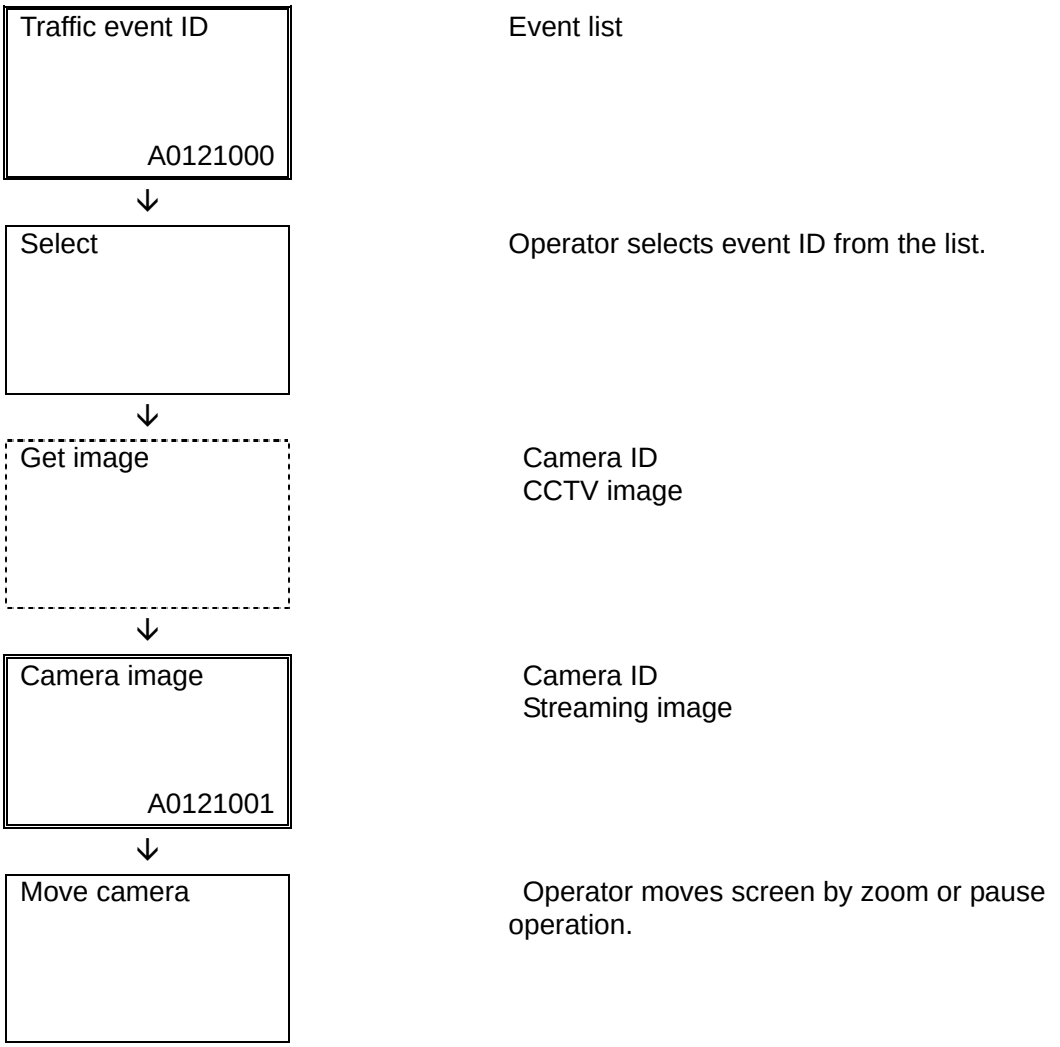


a. Event ID
This screen displays CCTV video streaming with relation to the event.
b. Camera ID
This screen displays CCTV video streaming of a selected camera.
c. Delete data
This screen displays the list of recording data. Moreover, this screen deletes old record data.

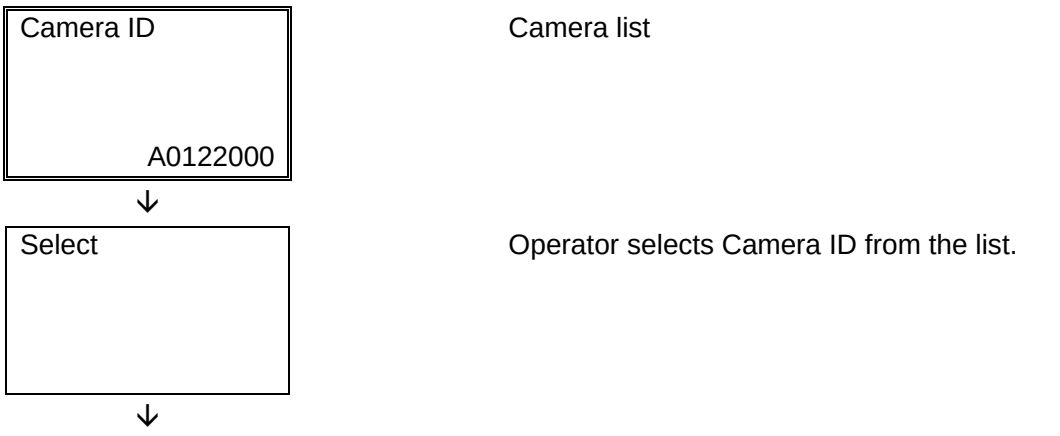
Figure 6.14 Screen Transition Diagram of Supervising/Control Server Console



a. Event ID



b. Camera ID



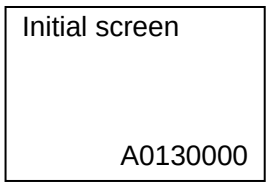
Screen Name	Comments
↓	
Get image	Camera ID CCTV image
↓	
Move image	Operator moves screen by zoom or pause operation.

c. Delete data

Delete data A0123000	Camera ID Record length
↓	
Delete	Operator selects and deletes camera data.

(3) CCTV Center Controller Console

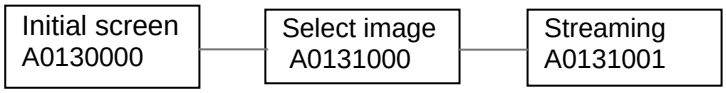
Initial screen is to indicates the Main Menu of the traffic event control and information.



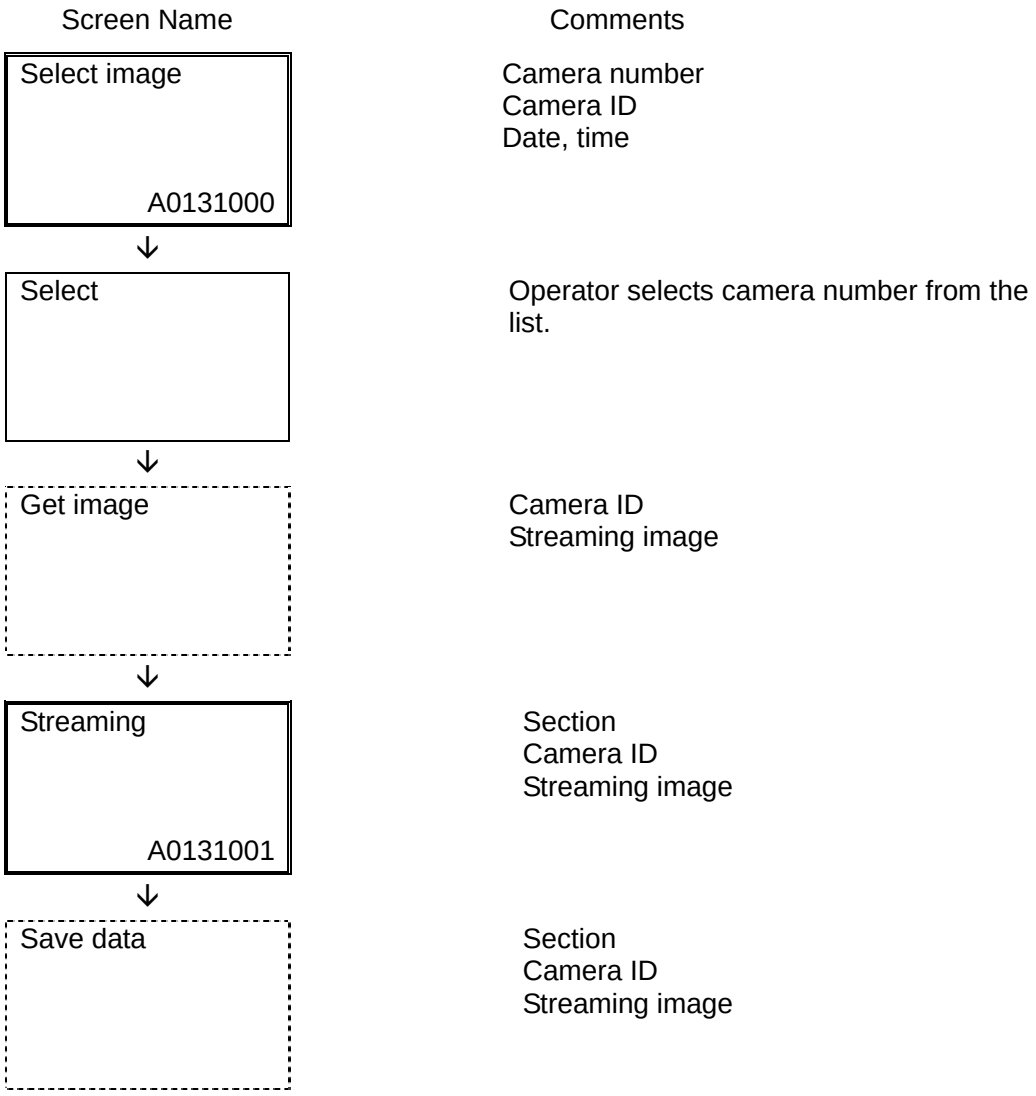
Main Menu
- Select image

a. Select image
This screen displays CCTV video streaming of a selected camera.

Figure 6.15 Screen Transition Diagram of Supervising/Control Server Console



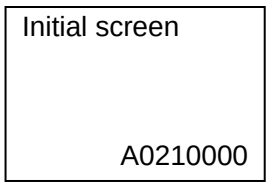
a. Select image



2) Road Management Office

(1) Traffic Event Server Console

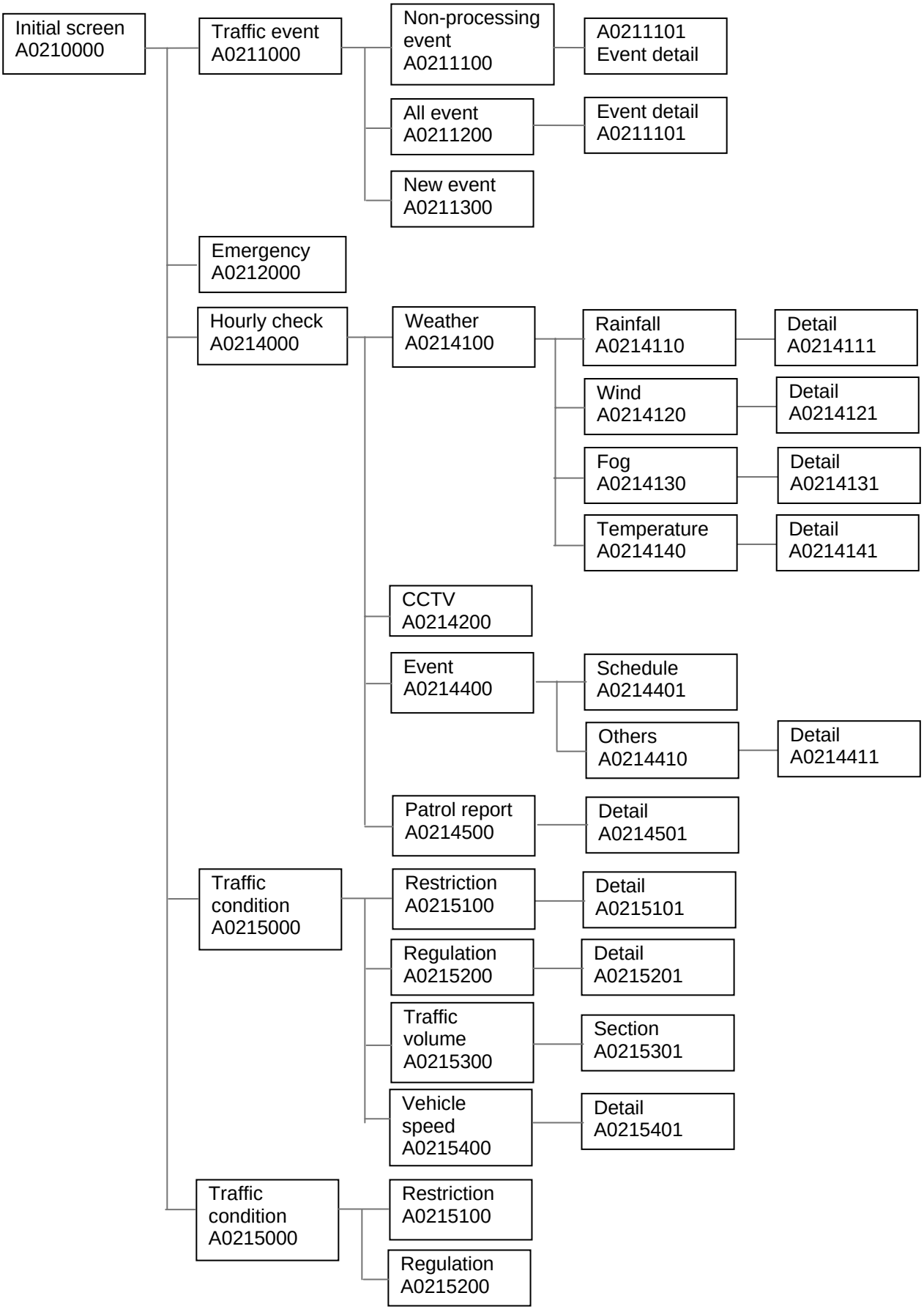
Initial screen is to indicates the Main Menu of the traffic event control and information.



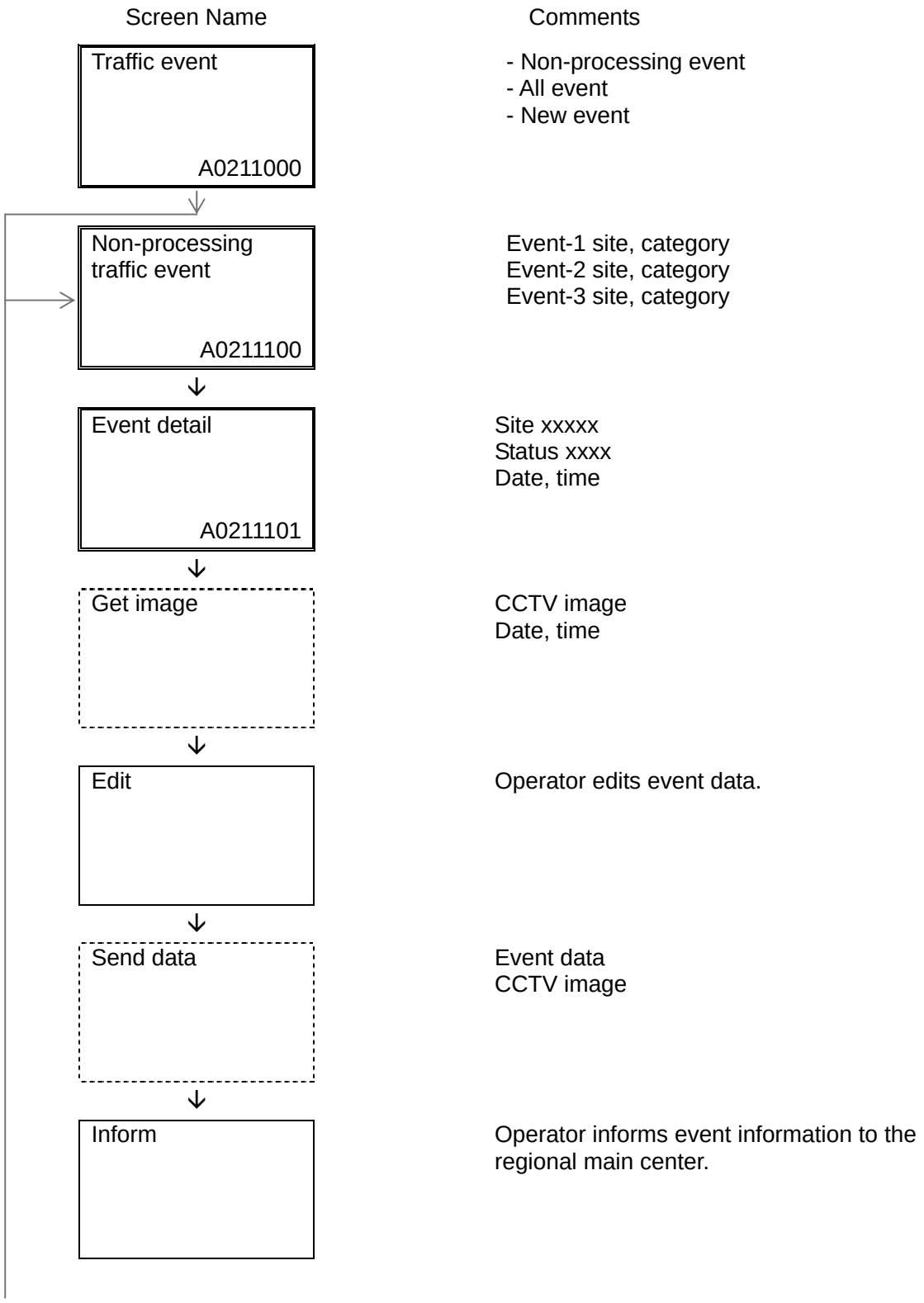
Main Menu
- Event
- Emergency
- Hourly check
- Traffic condition
- Patrol report

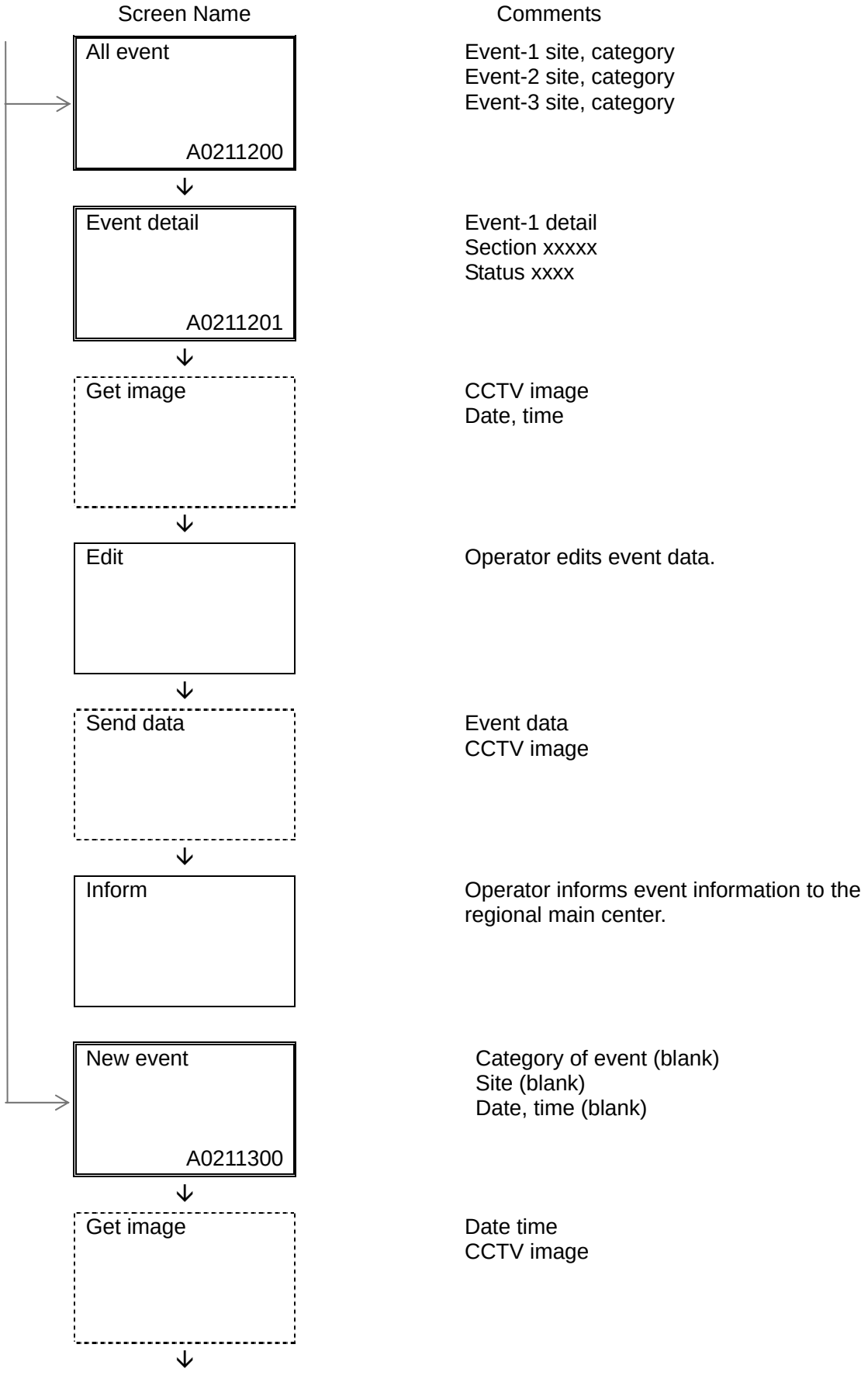
a. Event
This screen displays the list of event and inputs new event.
b. Emergency
This screen displays emergency information and inputs emergency message.
c. Hourly check
This screen displays the CCTV video streaming, weather information, event information and patrol report.
d. Traffic condition
This screen displays list of restriction, list of regulation, traffic volume of section and vehicle speed of section.
e. Patrol report
This screen displays patrol report written by patrol crew.

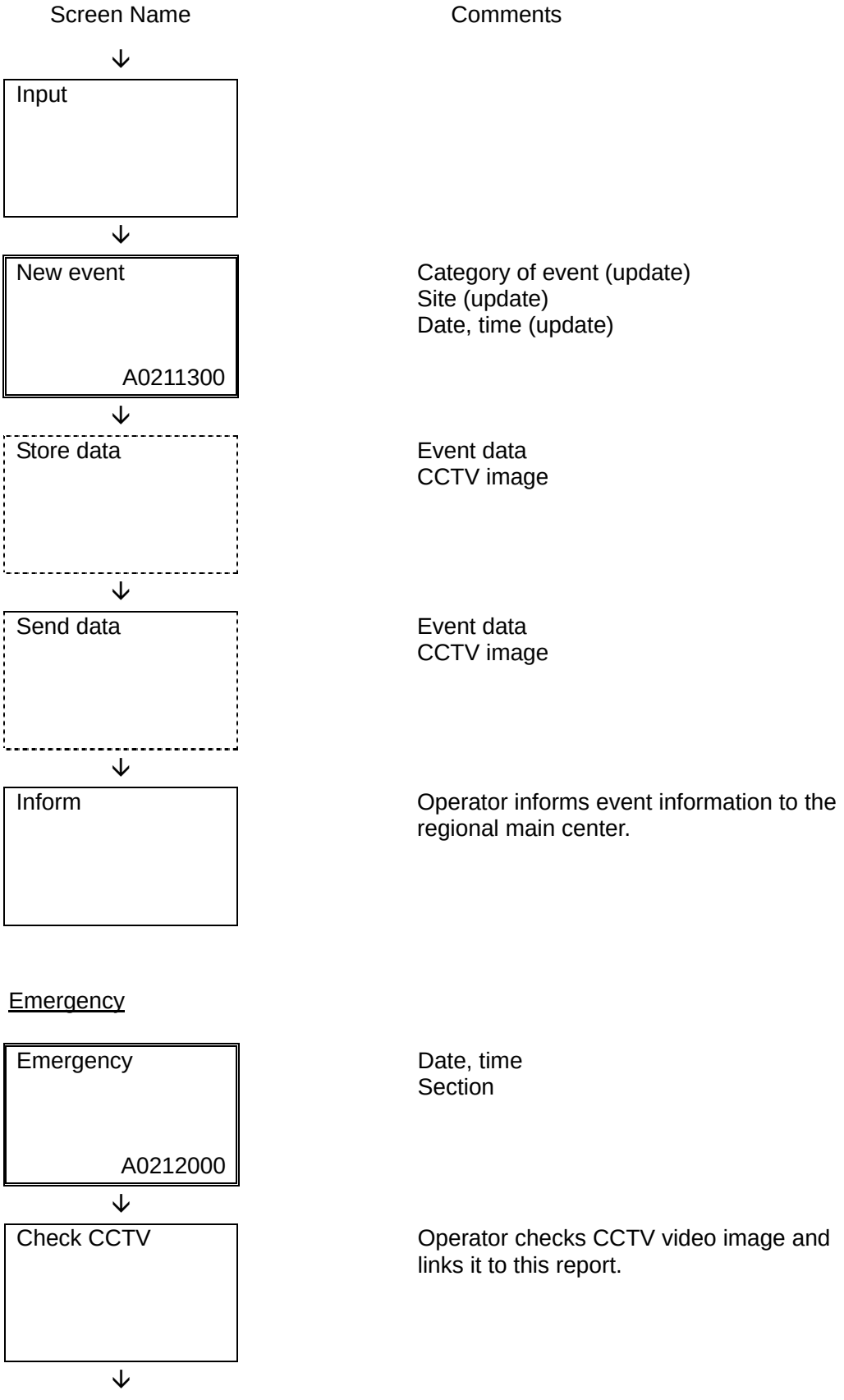
Figure 6.16 Screen Transition Diagram of Traffic Event Server Console



a. Event

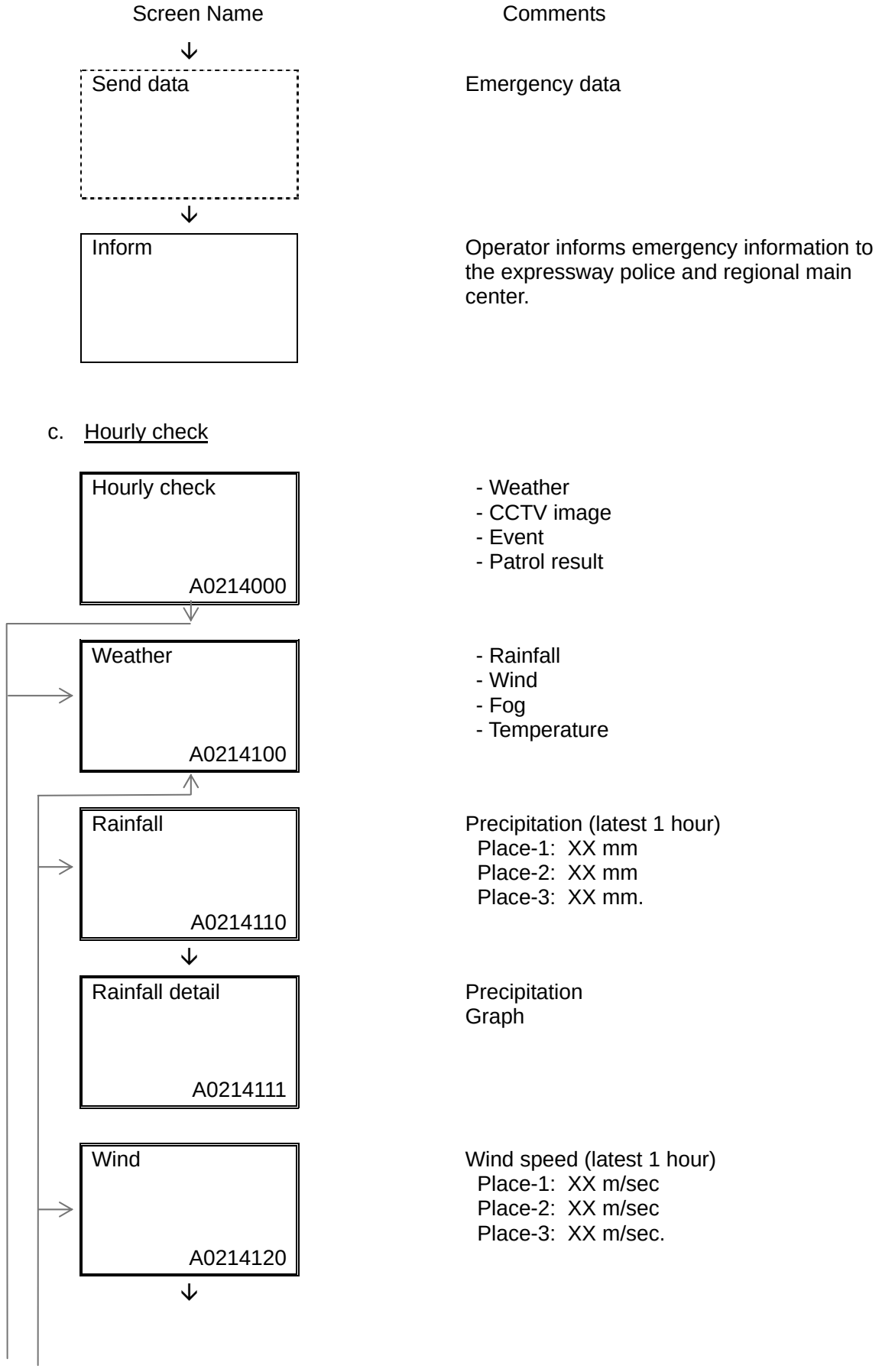

Screen Name
Comments
Traffic event
A0211000
- Non-processing event
- All event
- New event
Non-processing traffic event
A0211100
Event-1 site, category
Event-2 site, category
Event-3 site, category
Event detail
A0211101
Site xxxxx
Status xxxx
Date, time
Get image
CCTV image
Date, time
Edit
Operator edits event data.
Send data
Event data
CCTV image
Inform
Operator informs event information to the regional main center.

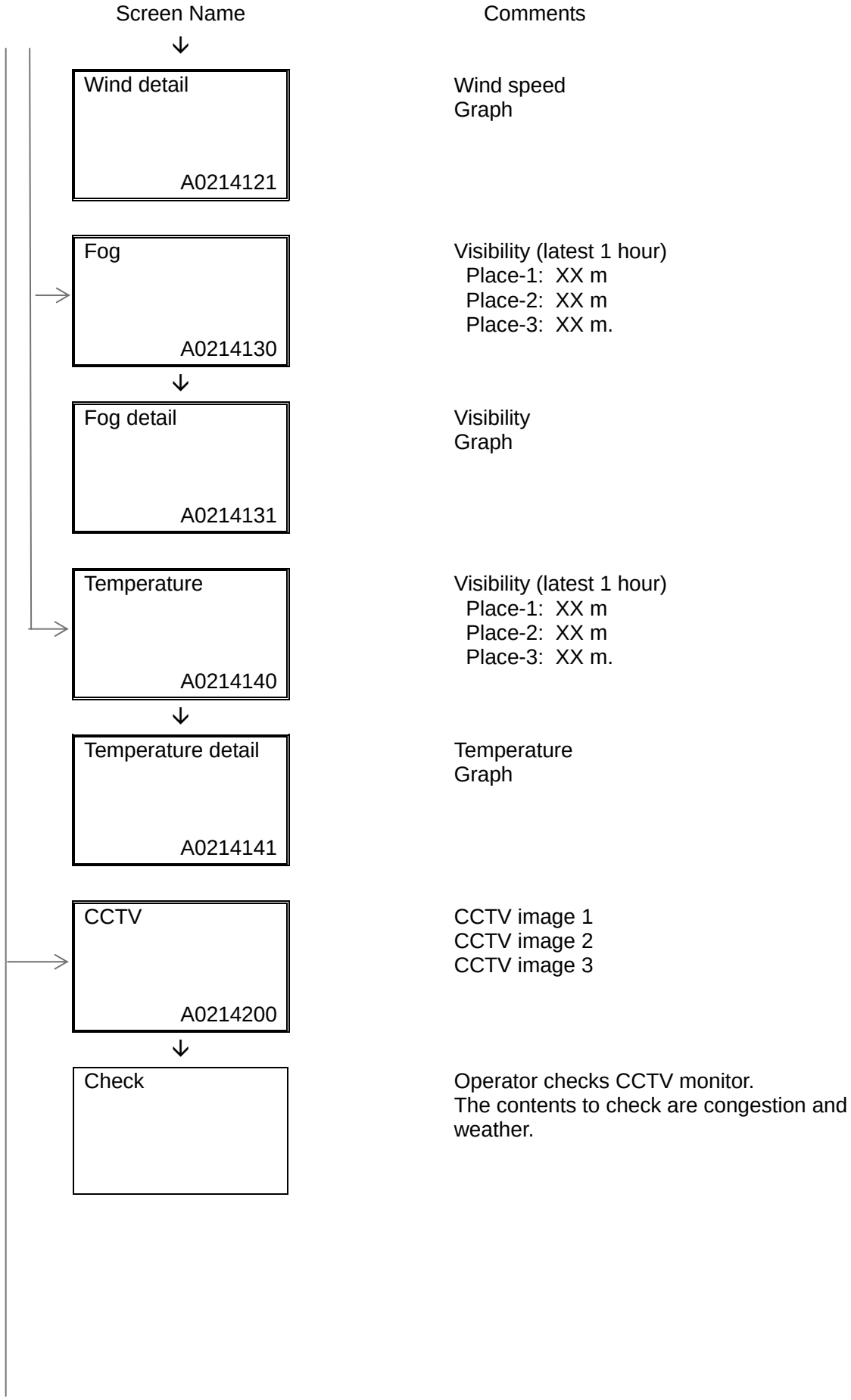

Screen Name
Comments
All event
A0211200
Event-1 site, category
Event-2 site, category
Event-3 site, category
Event detail
A0211201
Event-1 detail
Section xxxxx
Status xxxx
Get image
CCTV image
Date, time
Edit
Operator edits event data.
Send data
Event data
CCTV image
Inform
Operator informs event information to the regional main center.
New event
A0211300
Category of event (blank)
Site (blank)
Date, time (blank)
Get image
Date time
CCTV image

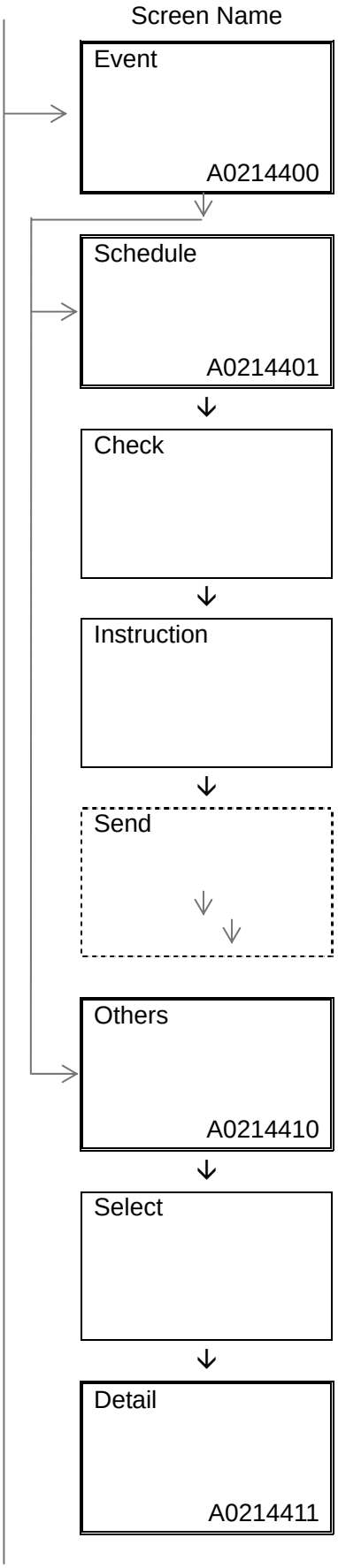

Screen Name
Comments
Input
New event
A0211300
Category of event (update)
Site (update)
Date, time (update)
Store data
Event data
CCTV image
Send data
Event data
CCTV image
Inform
Operator informs event information to the regional main center.

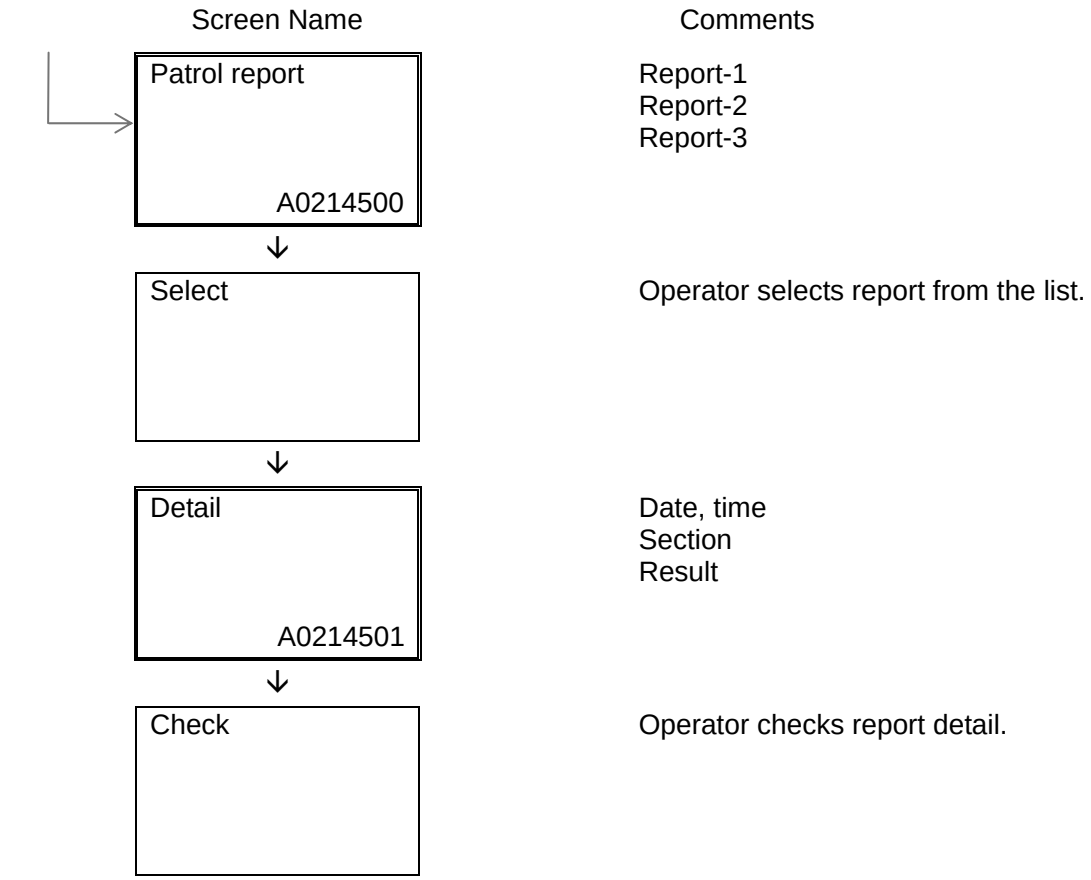
b. Emergency

Emergency
A0212000
Date, time
Section
Check CCTV
Operator checks CCTV video image and links it to this report.

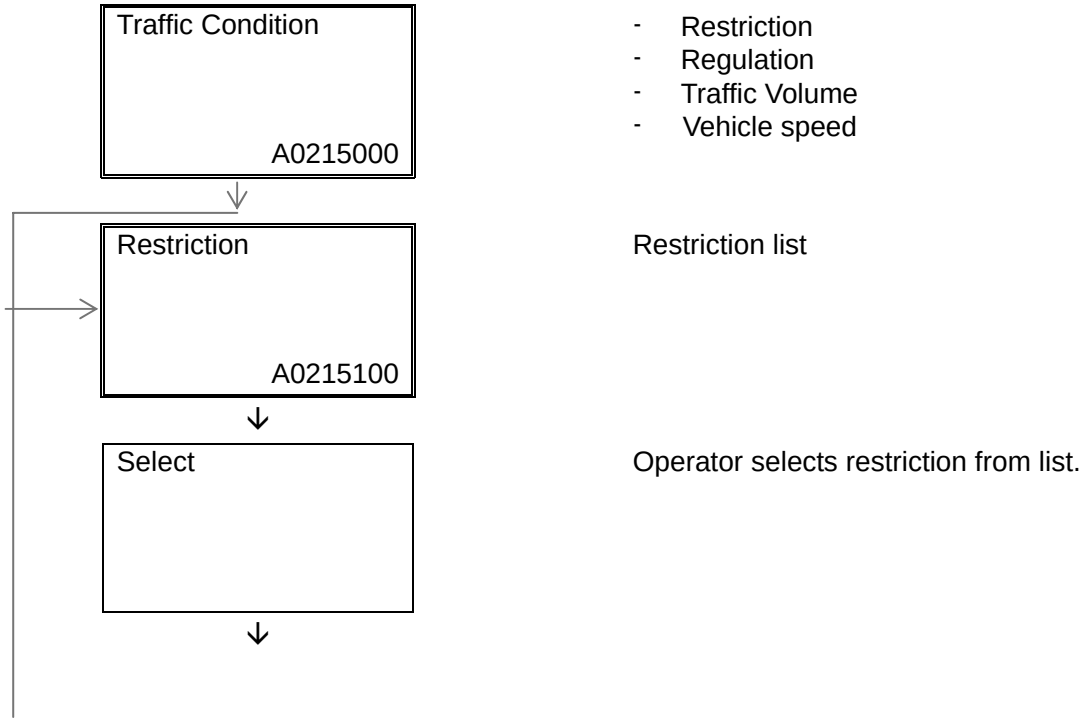

Screen Name
Comments
Send data
Emergency data
Inform
Operator informs emergency information to the expressway police and regional main center.
c. Hourly check
Hourly check
A0214000
- Weather
- CCTV image
- Event
- Patrol result
Weather
A0214100
- Rainfall
- Wind
- Fog
- Temperature
Rainfall
A0214110
Precipitation (latest 1 hour)
Place-1: XX mm
Place-2: XX mm
Place-3: XX mm.
Rainfall detail
A0214111
Precipitation
Graph
Wind
A0214120
Wind speed (latest 1 hour)
Place-1: XX m/sec
Place-2: XX m/sec
Place-3: XX m/sec.

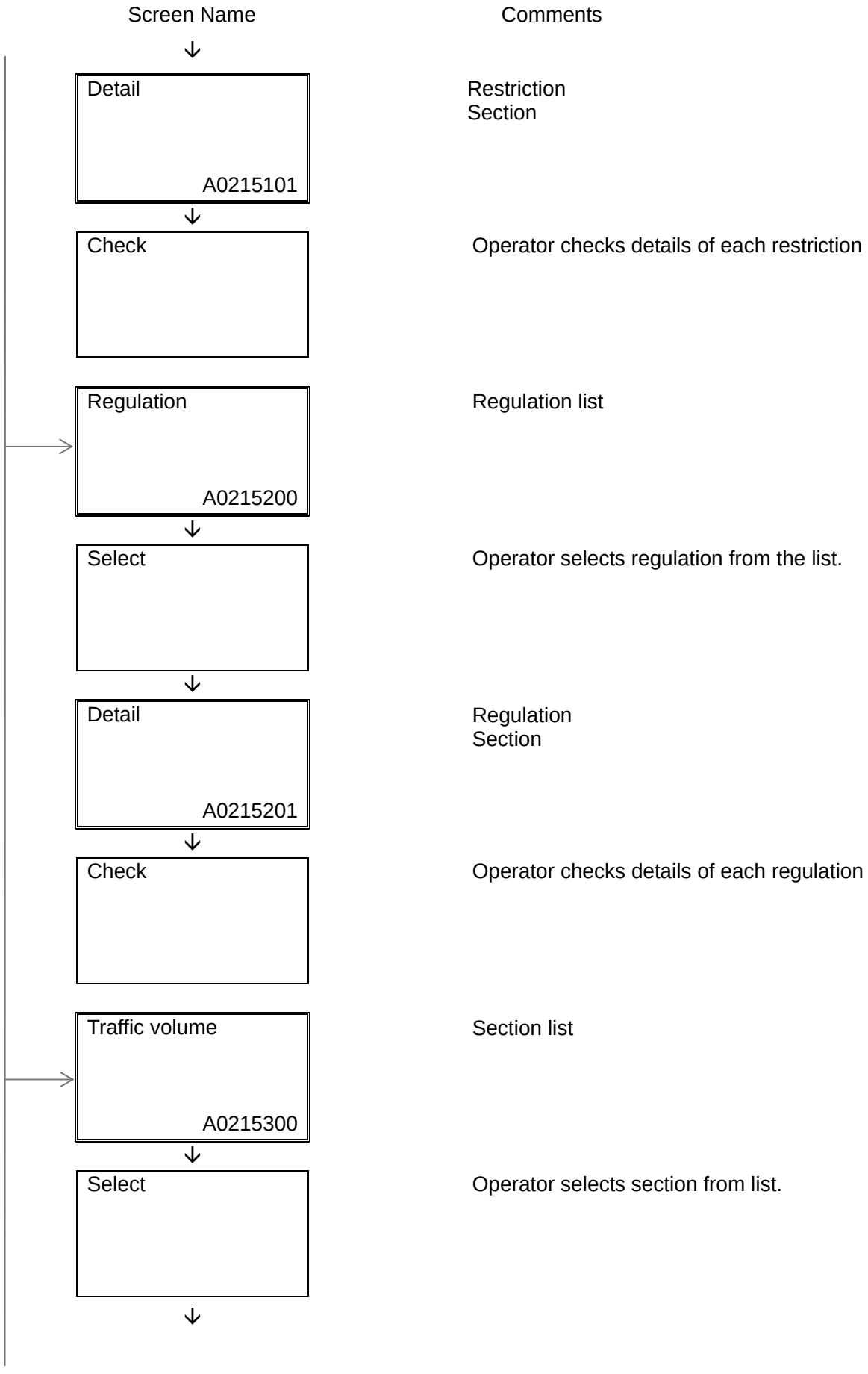

Screen Name
Comments
Wind detail
A0214121
Wind speed
Graph
Fog
A0214130
Visibility (latest 1 hour)
Place-1: XX m
Place-2: XX m
Place-3: XX m.
Fog detail
A0214131
Visibility
Graph
Temperature
A0214140
Visibility (latest 1 hour)
Place-1: XX m
Place-2: XX m
Place-3: XX m.
Temperature detail
A0214141
Temperature
Graph
CCTV
A0214200
CCTV image 1
CCTV image 2
CCTV image 3
Check
Operator checks CCTV monitor.
The contents to check are congestion and weather.

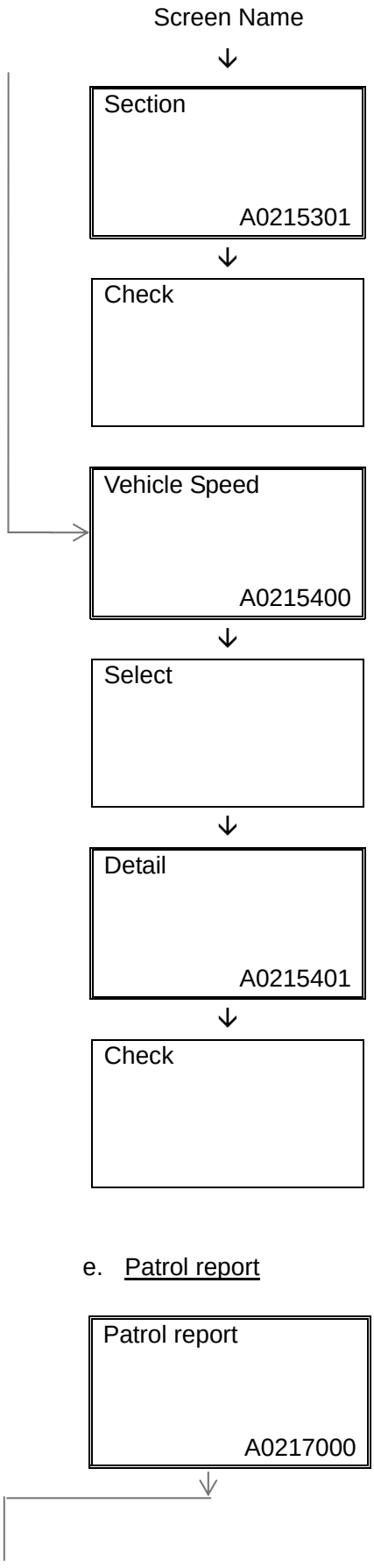

Screen Name
Comments
Event
A0214400
- Schedule
- Others
Schedule
A0214401
Event
Check
When the schedule event has a planned time, the operator checks the details to see if the scheduled event involves roadwork or exclusive use.
Instruction
Operator issues instructions to the regional main center in the jurisdiction.
Send
Event
Others
A0214410
Event list
Select
Operator selects event from the list
Detail
A0214411
Event detail



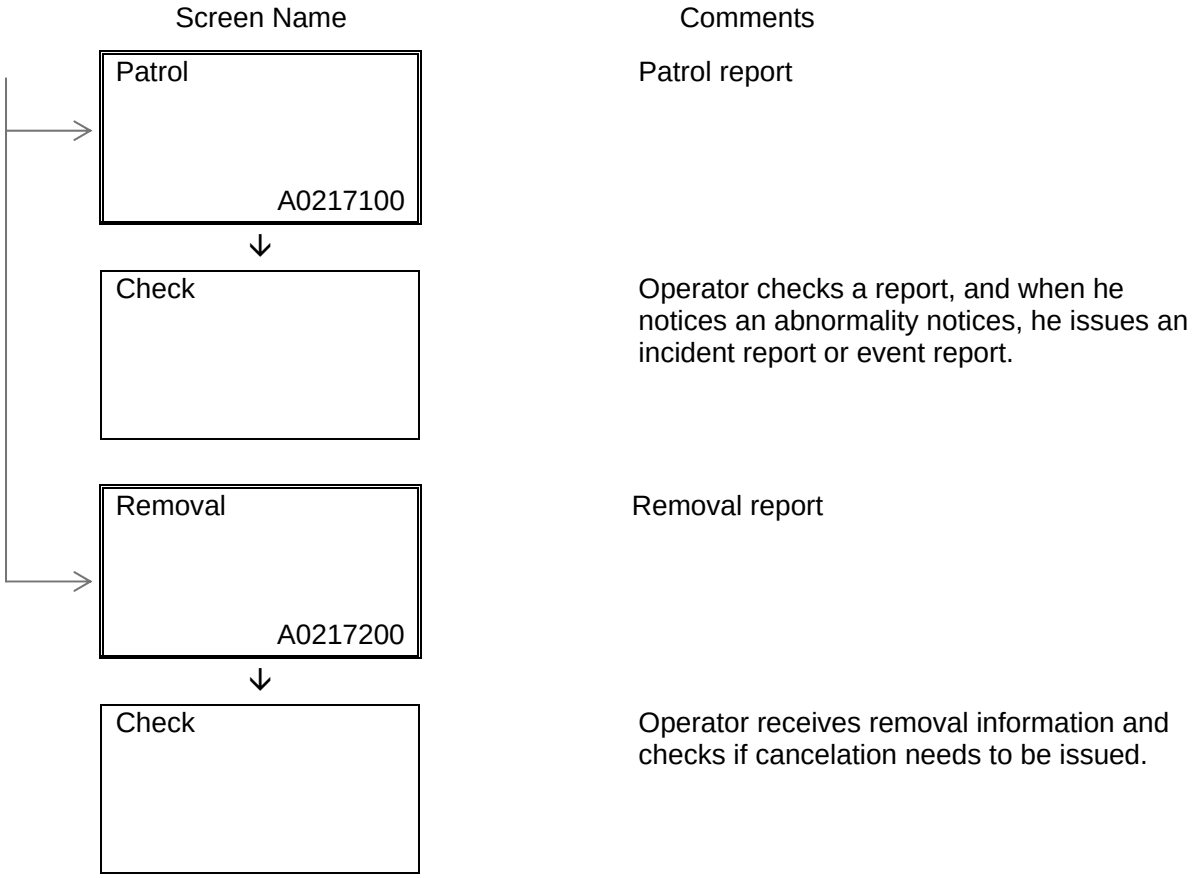
d. Traffic condition




Screen Name
Comments
Detail
A0215101
Restriction Section
Check
Operator checks details of each restriction
Regulation
A0215200
Regulation list
Select
Operator selects regulation from the list.
Detail
A0215201
Regulation Section
Check
Operator checks details of each regulation
Traffic volume
A0215300
Section list
Select
Operator selects section from list.

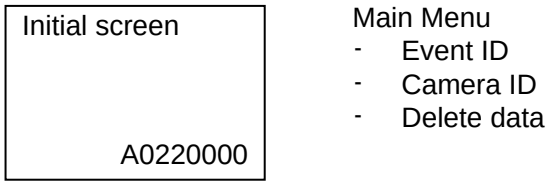


e. Patrol report



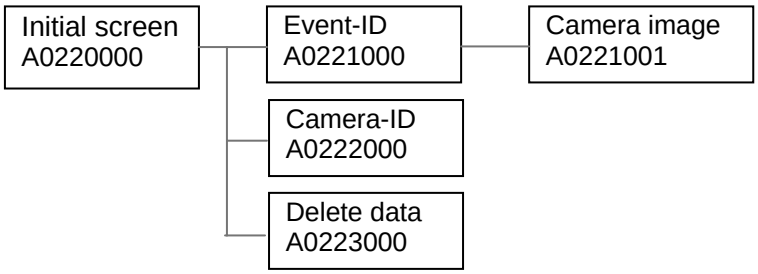
(2) Traffic Supervising/Control Server Console

Initial screen is to indicates the Main Menu of the traffic event control and information.

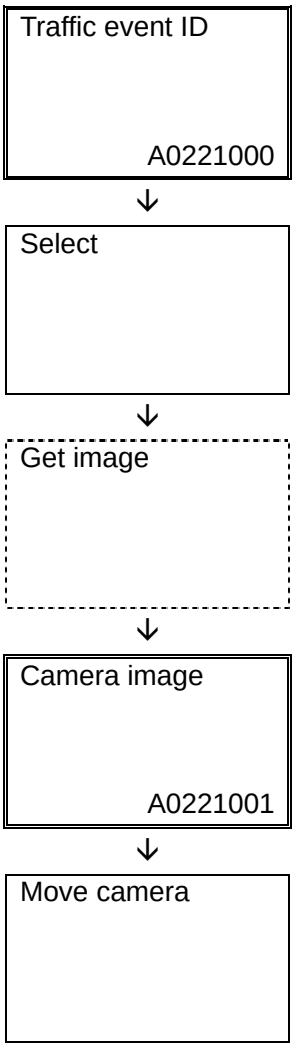


a. Event ID
This screen displays CCTV video streaming with relation to the event.
b. Camera ID
This screen displays CCTV video streaming of a selected camera.
c. Delete data
This screen displays the list of recording data. Moreover, this screen deletes old record data.

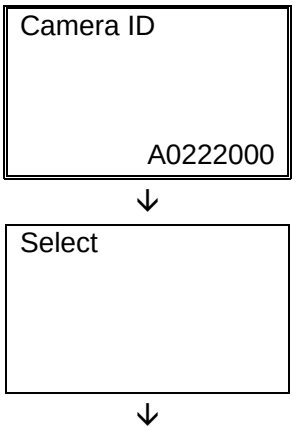
Figure 6.17 Screen Transition Diagram of Traffic Supervising/Control Server Console

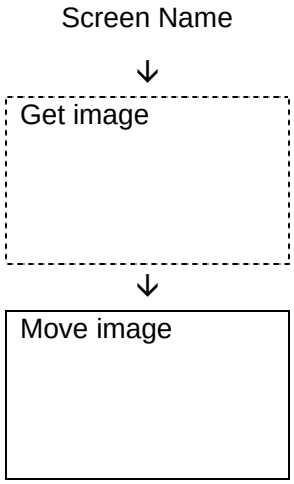


a. Event ID

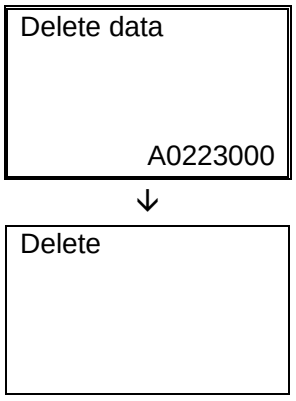


b. Camera ID



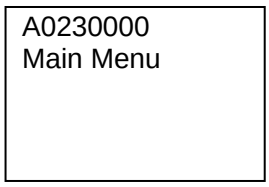


c. Delete data



(3) CCTV Center Controller Console

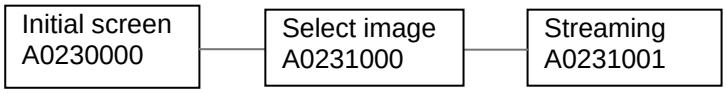
Initial screen is to indicates the Main Menu of the traffic event control and information.



Main Menu
- Select image

a. Select image
This screen displays the streaming video of the CCTV camera. The operator switches a camera with the screen.

Figure 6.18 Screen Transition Diagram of CCTV Center Controller Console

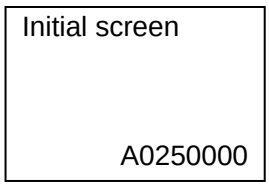


a. Select image

Screen Name	Comments
Initial screen A0230000	Camera number Camera ID Date, time
↓	
Select	Operator selects camera number from the list.
↓	
Get image	Camera ID Streaming image
↓	
Streaming A0231001	Section Camera ID Streaming image
↓	
Save data	Section Camera ID Streaming image

(4) Patrol Crew Terminal

Initial screen is to indicates the Main Menu of the traffic event control and information.

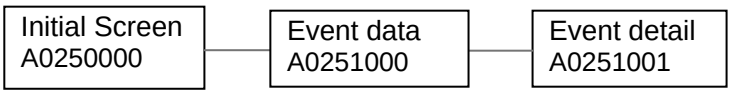


Main Menu
- Event data

a. Event data

This screen displays input form of event data. The patrol crew inputs event information on the site using mobile communication terminal.

Figure 6.19 Screen Transition Diagram of CCTV Center Controller Console



a. Event data

Screen Name	Comments
Event data A0251000	Event data List
↓	
Select	Operator selects event data from the list.
↓	
Event detail A0251001	Category of event Section Date, time
↓	
Input	Patrol crew inputs event information.
↓	
Save data	Category of event Section Date, time

6.4 Comment Indication

The traffic information/control system displays a message on screen at every processing. A list of comments to be indicated on each screen is shown in table below.

1) Regional Main Center

(1) Traffic Event Data Server

Table 6.1 Comment Indication for Traffic Event Data Server (Regional Main Center)

Screen Number	Comment Indication
A0110000	Logon failure: unknown user name or bad password.
	Logon failure: user not allowed to log on to this computer.
	An unexpected error occurred.
A0111100	The event list cannot be collected by the system.
	There is not non-processing event.
A0111101	This event information is locked.
	The detail information cannot be collected by the system.
A0111102	Restriction information was registered successfully.
	The register operation could not be completed. A retry should be performed.
A0111200	The event list cannot be collected by the system.
A0111201	This event information is locked.
	The detail information cannot be collected by the system.
A0111202	Restriction information was registered successfully.
	The register operation could not be completed. A retry should be performed.
A0111300	The new event information was saved successfully.
	The save operation could not be completed. A retry should be performed.
A0111301	Restriction information was registered successfully.
	The register operation could not be completed. A retry should be performed.
A0112000	Emergency occurred. Identify the situation quickly.
A0112001	Emergency restriction was registered successfully.
	The register operation could not be completed. A retry should be performed.
A0113100	The VMS list cannot be collected by the system.
A0113101	The message list cannot be collected by the system.
	The special message was inputted successfully.
	The input operation could not be completed. A retry should be performed.
A0113200	The SGM list cannot be collected by the system.
A0113201	The message list cannot be collected by the system.
	The special message was inputted successfully.
	The input operation could not be completed. A retry should be performed.
A0113300	The CSS list cannot be collected by the system.
	The select operation could not be completed. A retry should be performed.
A0113400	The list cannot be collected by the system.
	The cancel operation could not be completed. A retry should be performed.
A0113500	The event information cannot be collected by the system.
	The message for internet was inputted successfully.
	The input operation could not be completed. A retry should be performed.
	Cannot connect the traffic information server.
A01134600	The event information cannot be collected by the system.
	The message for TV/Broadcast was inputted successfully.
	The input operation could not be completed. A retry should be performed.
	Cannot connect the traffic information server.
A0114110	The rainfall data cannot be collected by the system.
A0114111	The rainfall detail cannot be collected by the system.

Screen Number	Comment Indication
A0114120	The wind data cannot be collected by the system.
A0114121	The wind detail cannot be collected by the system.
A0114130	The fog data cannot be collected by the system.
A0114131	The fog detail cannot be collected by the system.
A0114140	The temperature data cannot be collected by the system.
A0114141	The temperature detail cannot be collected by the system.
A0114200	The CCTV image cannot be collected by the system.
A0114300	The VMS information cannot be collected by the system.
A0114401	The event information cannot be collected by the system.
A0114410	The event information cannot be collected by the system.
A0114411	The event detail cannot be collected by the system.
A0114500	The report information cannot be collected by the system.
A0114501	The report detail cannot be collected by the system.
A0115101	The restriction detail cannot be collected by the system.
A0115201	The regulation detail cannot be collected by the system.
A0115301	The traffic volume information cannot be collected by the system.
A0115401	The vehicle speed information cannot be collected by the system.
A0116100	The restriction list cannot be collected by the system.
	The message was cancelled successfully.
	The cancel operation could not be completed. A retry should be performed.
A0116200	The weather alert information cannot be collected by the system.
	The weather alert was cancelled successfully.
	The cancel operation could not be completed. A retry should be performed.
A0117100	The patrol report cannot be collected by the system.
A0117200	The removal report cannot be collected by the system.
A0118000	The plan information was inputted successfully.
	The input operation could not be completed. A retry should be performed.

(2) Traffic Supervising/Control Server Console

Table 6.2 Comment Indication for Traffic Supervising/Control Server (Regional Main Center)

Screen Number	Comment Indication
A0120000	Logon failure: unknown user name or bad password.
	Logon failure: user not allowed to log on to this computer.
	An unexpected error occurred.
A0121000	The event list cannot be collected by the system.
A0121001	Cannot display a streaming image.
	An operations error occurred.
A0122000	The camera list cannot be collected by the system.
	An operations error occurred.
A0123000	The camera data was deleted successfully.
	The delete operation could not be completed. A retry should be performed.

(3) CCTV Center Controller Console

Table 6.3 Comment Indication for CCTV Center Controller Console (Regional Main Center)

Screen Number	Comment Indication
A0130000	Logon failure: unknown user name or bad password.
	Logon failure: user not allowed to log on to this computer.
	An unexpected error occurred.
A0131000	The camera list cannot be collected by the system.
A0131001	Cannot display a streaming image.
	An operations error occurred.

2) Road Management Office

(1) Traffic Event Server

Table 6.4 Comment Indication for Traffic Event Server (Road Management Office)

Screen Number	Comment Indication
A0210000	Logon failure: unknown user name or bad password.
	Logon failure: user not allowed to log on to this computer.
	An unexpected error occurred.
A0211100	The event list cannot be collected by the system.
	There is not non-processing event.
A0211101	This event information is locked.
	The detail information cannot be collected by the system.
	The event data was updated successfully.
	The update operation could not be completed. A retry should be performed.
A0211200	The event list cannot be collected by the system.
A0211201	This event information is locked.
	The detail information cannot be collected by the system.
	The event data was updated successfully.
	The update operation could not be completed. A retry should be performed.
A0211300	The new event information was saved successfully.
	The save operation could not be completed. A retry should be performed.
A0212000	Emergency occurred. Identify the situation quickly.
A0214110	The rainfall data cannot be collected by the system.
A0214110	The rainfall detail cannot be collected by the system.
A0214120	The wind data cannot be collected by the system.
A0214121	The wind detail cannot be collected by the system.
A0214130	The fog data cannot be collected by the system.
A0214131	The fog detail cannot be collected by the system.
A0214140	The temperature data cannot be collected by the system.
A0214141	The temperature detail cannot be collected by the system.
A0214200	The CCTV image cannot be collected by the system.
A0214401	The event information cannot be collected by the system.
A0214410	The event information cannot be collected by the system.
A0214411	The event detail cannot be collected by the system.
A0214500	The report information cannot be collected by the system.
A0214501	The report detail cannot be collected by the system.
A0215101	The restriction detail cannot be collected by the system.
A0215201	The regulation detail cannot be collected by the system.
A0215301	The traffic volume information cannot be collected by the system.
A0215401	The vehicle speed information cannot be collected by the system.

Screen Number	Comment Indication
A0217100	The patrol report cannot be collected by the system.
A0217200	The removal report cannot be collected by the system.

(2) Traffic Supervising/Control Server Console

Table 6.5 Comment Indication for Traffic Supervising/Control Server (Road Management Office)

Screen Number	Comment Indication
A0220000	Logon failure: unknown user name or bad password.
	Logon failure: user not allowed to log on to this computer.
	An unexpected error occurred.
A0221000	The event list cannot be collected by the system.
A0221001	Cannot display a streaming image.
	An operations error occurred.
A0222000	The camera list cannot be collected by the system.
	An operations error occurred.
A0223000	The camera data was deleted successfully.
	The delete operation could not be completed. A retry should be performed.

(3) CCTV Center Controller Console

Table 6.6 Comment Indication for CCTV Center Controller Console (Road Management Office)

Screen Number	Comment Indication
A0230000	Logon failure: unknown user name or bad password.
	Logon failure: user not allowed to log on to this computer.
	An unexpected error occurred.
A0231000	The camera list cannot be collected by the system.
A0231001	Cannot display a streaming image.
	An operations error occurred.

(4) Patrol Crew Terminal

Table 6.7 Comment Indication for CCTV Center Controller Console (Road Management Office)

Screen Number	Comment Indication
A0250000	Logon failure: unknown user name or bad password.
	Logon failure: user not allowed to log on to this computer.
	An unexpected error occurred.
A0251000	The event list cannot be collected by the system.
A0251001	This event information is locked.
	The detail information cannot be collected by the system.
	The event data was updated successfully.

6.5 Data Sets for Indication/Input

The traffic information/control system stores data in several dataset. The stored data are to be structure as shown in table below.

1) Regional Main Center

(1) Traffic Event Data Server

Table 6.8 Data Set of Traffic Event Data Server (Regional Main Center)

Data Set <Screen No.>	Data Elements	Type	Digit	Set
Incident Data Set < A0111100>	Road Management Office ID	INT*	4	1
	Road Section ID	INT*	4	1
	Lane ID	INT*	2	1
	Place ID	INT*	4	1
	Beginning Kilometer Post	TXT	6	1
	Ending Kilometer Post	TXT	6	1
	Roadside Equipment ID	INT*	4	1
	Incident Status	INT*	2	1
	Date/Time	Datetime	≥14	1
Image Recognition Result Data Set < A0111101>	Road Management Office ID	INT*	4	1
	Roadside Equipment ID	INT*	4	1
	Image Recognition Result Status	INT*	2	1
	Video Image Address	TXT	60	1
	Date/Time	Datetime	≥14	1
Vehicle Detection Data Set < A0115000>	Road Management Office ID	INT*	4	1
	Roadside Equipment ID	INT*	4	1
	Cumulative Number of Vehicles	INT*	4	1
	Vehicle Speed	FLOAT	5	N
	Vehicle Length	FLOAT	4	
	Date/Time	Datetime	≥14	1
Traffic Volume Data Set < A0115300>	Road Management Office ID	INT*	4	1
	Roadside Equipment ID	INT*	4	1
	Total Traffic Volume per Day	INT	5	1
	Large Vehicle Ratio	FLOAT	5	1
	Traffic Volume per Day of vehicle class 1	INT	5	1
	Traffic Volume per Day of vehicle class 2	INT	5	1
	Traffic Volume per Day of vehicle class 3	INT	5	1
	Traffic Volume per Day of vehicle class 4	INT	5	1
	Traffic Volume per Day of vehicle class 5	INT	5	1
	Total Traffic Volume per Hour	INT*	4	1
	Large Vehicle Ratio	FLOAT	5	1
	Traffic Volume per Hour of vehicle class 1	INT*	4	1
	Traffic Volume per Hour of vehicle class 2	INT*	4	1
	Traffic Volume per Hour of vehicle class 3	INT*	4	1
	Traffic Volume per Hour of vehicle class 4	INT*	4	1
	Traffic Volume per Hour of vehicle class 5	INT*	4	1
	Total Traffic Volume per 15 minutes	INT*	3	1
	Traffic Volume per 15 minutes of vehicle class 1	INT*	3	1
	Traffic Volume per 15 minutes of vehicle class 2	INT*	3	1
	Traffic Volume per 15 minutes of vehicle class 3	INT*	3	1
	Traffic Volume per 15 minutes of vehicle class 4	INT*	3	1
	Traffic Volume per 15 minutes of vehicle class 5	INT*	3	1

	Date/Time	Datetime	≥14	1
Traffic Congestion Data Set < A0115000>	Road Management Office ID	INT*	4	1
	Roadside Equipment ID	INT*	4	1
	Cumulative Number of Vehicles	INT*	4	1
	Average Vehicle Speed	INT*	4	1
	Traffic Congestion Status	INT*	2	1
	Beginning Kilometer Post	TXT	6	1
	Ending Kilometer Post	TXT	6	1
	Date/Time	Datetime	≥14	1
Weather Monitoring Data Set < A0114100>	Road Management Office ID	INT*	4	1
	Roadside Equipment ID	INT*	4	1
	Precipitation	FLOAT	2	1
	Wind Speed	FLOAT	2	1
	Visibility	FLOAT	2	1
	Temperature	FLOAT	2	1
	Alarm Status of Precipitation	INT*	2	1
	Alarm Status of Wind Speed	INT*	2	1
	Alarm Status of Visibility	INT*	2	1
	Alarm Status of Temperature	INT*	2	1
	Date/Time	Datetime	≥14	1
Bad Weather Data Set < A0114100>	Road Management Office ID	INT*	4	1
	Roadside Equipment ID	INT*	4	1
	Precipitation	FLOAT	2	1
	Wind Speed	FLOAT	2	1
	Visibility	FLOAT	2	1
	Temperature	FLOAT	2	1
	Heavy Rain Status	INT*	2	1
	High Wind Status	INT*	2	1
	Low Visibility Status	INT*	2	1
	High Temperature Status	INT*	2	1
	Date/Time	Datetime	≥14	1
Construction Work Data Set < A0111000>	Road Management Office ID	INT*	4	1
	Road Section ID	INT*	4	1
	Lane ID	INT*	2	1
	Place ID	INT*	4	1
	Beginning Kilometer Post	TXT	6	1
	Ending Kilometer Post	TXT	6	1
	Construction Work Status	INT*	2	1
	Number of document	TXT	20	1
	Permission Date	TXT	8	1
	Date/Time Begin	TXT	≥14	1
	Date/Time End	TXT	≥14	1
	Date/Time	Datetime	≥14	1
Traffic Restriction Data Set < A0111301; A0116100; A0115100>	Road Management Office ID	INT*	4	1
	Road Section ID	INT*	4	1
	Lane ID	INT*	2	1
	Place ID	INT*	4	1
	Beginning Kilometer Post	TXT	6	1
	Ending Kilometer Post	TXT	6	1
	Construction Work Status	INT*	2	1
	Permission Date	TXT	8	1
	Date/Time Begin	TXT	≥14	1
	Date/Time End	TXT	≥14	1
	Date/Time	Datetime	≥14	1
Traffic Event	Traffic Event Data ID	INT	8	1

Data Set < A0111000>	Road Management Office ID	INT*	4	1
	Road Section ID	INT*	4	1
	Road Link ID	INT*	4	1
	Lane ID	INT*	2	1
	Place ID	INT*	4	1
	Traffic Event Category ID	INT*	4	1
	Traffic Event Class ID	INT*	4	1
	Causal Traffic Event Data ID	INT	8	1
	Beginning Kilometer Post	TXT	6	1
	Ending Kilometer Post	TXT	6	1
	Input Person	TXT	32	1
	Event Status	TXT	4	1
	Video Image address	TXT	60	1
	Main Center Check Status	INT*	4	1
	Road Management Office Check Status	INT*	4	1
	Status of Traffic Event	INT*	2	1
	Date/Time End	TXT	≥14	1
	Date/Time	Datetime	≥14	1
Event Image Data Set < A0111101; A0111201>	Road Management Office ID	INT*	4	1
	Roadside Equipment ID	INT*	4	1
	Place ID	INT*	4	1
	Video Image ID	INT	8	1
	Event Video Image	IMG	var	1
	Traffic Event Data ID	INT	8	1
	Date/Time	Datetime	≥14	1
VMS Check /Indication Data Set < A0113100>	Road Management Office ID	INT*	4	1
	Roadside Equipment ID	INT*	4	1
	Traffic Event Class ID	INT*	4	1
	Place ID	INT*	4	1
	Place Name	TXT	28	1
	Traffic Event ID	INT	8	1
	Traffic Event Name	TXT	20	1
	Causal Place ID	INT*	4	1
	Causal Place Name	TXT	28	1
	Date/Time	Datetime	≥14	1
VMS Input/Indication Data Set < A0113100>	Road Management Office ID	INT*	4	1
	Roadside Equipment ID	INT*	4	1
	Traffic Event Class ID	INT*	4	1
	Place ID	INT*	4	1
	Place Name	TXT	28	1
	Traffic Event ID	INT	8	1
	Traffic Event Name	TXT	20	1
	Causal Place ID	INT*	4	1
	Causal Place Name	TXT	28	1
	Free Text	TXT	var	1
	Date/Time	Datetime	≥14	1
CSS Indication Data Set < A0113300>	Road Management Office ID	INT*	4	1
	Roadside Equipment ID	INT*	4	1
	Speed Limit	INT*	3	1
	Date/Time	Datetime	≥14	1

(2) Traffic Supervising/Control Server Console

Table 6.9 Data Set of Traffic Supervising/Control Server (Regional Main Center)

Data Set <Screen No.>	Data Elements	Type	Digit	Set
Event Image Data Set <A0121001>	Road Management Office ID	INT*	4	1
	Roadside Equipment ID	INT*	4	1
	Place ID	INT*	4	1
	Video Image ID	INT	8	1
	Event Video Image	IMG	var	1
	Traffic Event Data ID	INT	8	1
	Date/Time	Datetime	≥14	1

(3) CCTV Center Controller Console

Table 6.10 Data Set of CCTV Center Controller Console (Regional Main Center)

Data Set <Screen No.>	Data Elements	Type	Digit	Set
Event Image Data Set < A0131000>	Road Management Office ID	INT*	4	1
	Roadside Equipment ID	INT*	4	1
	Place ID	INT*	4	1
	Video Image ID	INT	8	1
	Event Video Image	IMG	var	1
	Traffic Event Data ID	INT	8	1
	Date/Time	Datetime	≥14	1

2) Road Management Office

(1) Traffic Event Server

Table 6.11 Data Set of Traffic Event Server (Road Management Office)

Data Set <Screen No.>	Data Elements	Type	Digit	Set
Incident Data Set < A0211100>	Road Management Office ID	INT*	4	1
	Road Section ID	INT*	4	1
	Lane ID	INT*	2	1
	Place ID	INT*	4	1
	Beginning Kilometer Post	TXT	6	1
	Ending Kilometer Post	TXT	6	1
	Roadside Equipment ID	INT*	4	1
	Incident Status	INT*	2	1
	Date/Time	Datetime	≥14	1
Traffic Event Data Set < A0211000>	Traffic Event Data ID	INT	8	1
	Road Management Office ID	INT*	4	1
	Road Section ID	INT*	4	1
	Road Link ID	INT*	4	1
	Lane ID	INT*	2	1
	Place ID	INT*	4	1
	Traffic Event Category ID	INT*	4	1
	Traffic Event Class ID	INT*	4	1
	Causal Traffic Event Data ID	INT	8	1
	Beginning Kilometer Post	TXT	6	1
	Ending Kilometer Post	TXT	6	1
	Input Person	TXT	32	1
	Event Status	TXT	4	1
	Video Image address	TXT	60	1
	Main Center Check Status	INT*	4	1
	Road Management Office Check Status	INT*	4	1
	Status of Traffic Event	INT*	2	1
	Date/Time End	TXT	≥14	1
	Date/Time	Datetime	≥14	1

(2) Traffic Supervising/Control Server Console

Table 6.12 Data Set of Traffic Supervising/Control Server (Road Management Office)

Data Set <Screen No.>	Data Elements	Type	Digit	Set
Event Image Data Set < A0221001>	Road Management Office ID	INT*	4	1
	Roadside Equipment ID	INT*	4	1
	Place ID	INT*	4	1
	Video Image ID	INT	8	1
	Event Video Image	IMG	var	1
	Traffic Event Data ID	INT	8	1
	Date/Time	Datetime	≥14	1

(3) CCTV Center Controller Console

Table 6.13 Data Set of CCTV Center Controller Console (Road Management Office)

Data Set <Screen No.>	Data Elements	Type	Digit	Set
Event Image Data Set < A0231000>	Road Management Office ID	INT*	4	1
	Roadside Equipment ID	INT*	4	1
	Place ID	INT*	4	1
	Video Image ID	INT	8	1
	Event Video Image	IMG	var	1
	Traffic Event Data ID	INT	8	1
	Date/Time	Datetime	≥14	1

(4) Patrol Crew Terminal

Table 6.14 Data Set of CCTV Center Controller Console (Road Management Office)

Data Set <Screen No.>	Data Elements	Type	Digit	Set
Incident Data Set < A0251001>	Road Management Office ID	INT*	4	1
	Road Section ID	INT*	4	1
	Lane ID	INT*	2	1
	Place ID	INT*	4	1
	Beginning Kilometer Post	TXT	6	1
	Ending Kilometer Post	TXT	6	1
	Roadside Equipment ID	INT*	4	1
	Incident Status	INT*	2	1
	Date/Time	Datetime	≥14	1

7. Operation/Management Plan for Automated Toll Collection System

7.1 General

The system manages toll collection of toll management center, toll office and toll booth. The system provides functions for the following purposes.

- Support work of toll collection for operator
- Browsing and updating of toll
- Charge for toll fare to the bank
- Management of invalidation list
- Output of toll revenue statistics.

7.2 System Architecture

The system is to be composed as shown in the following system architecture.

Figure 7.1 System Architecture for Toll Gate Lane Monitoring

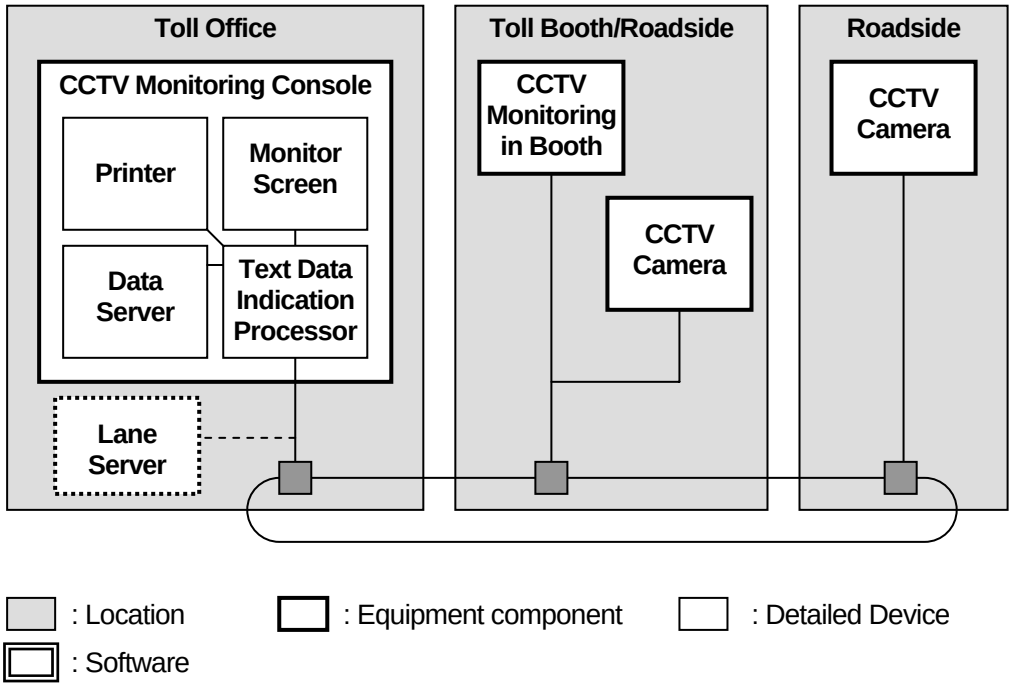
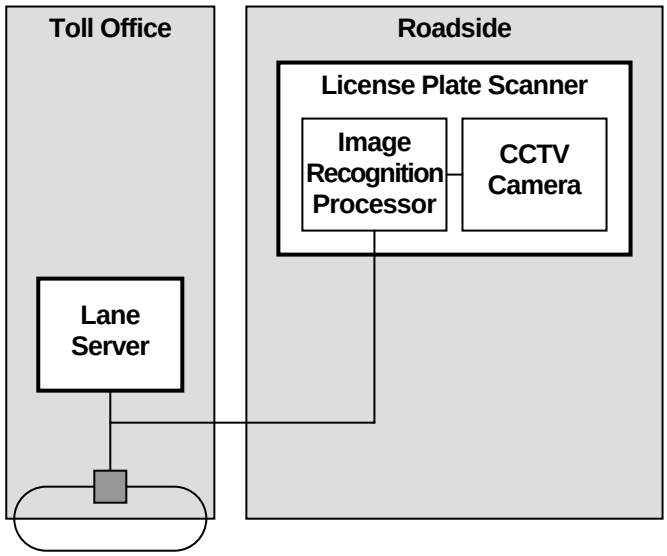


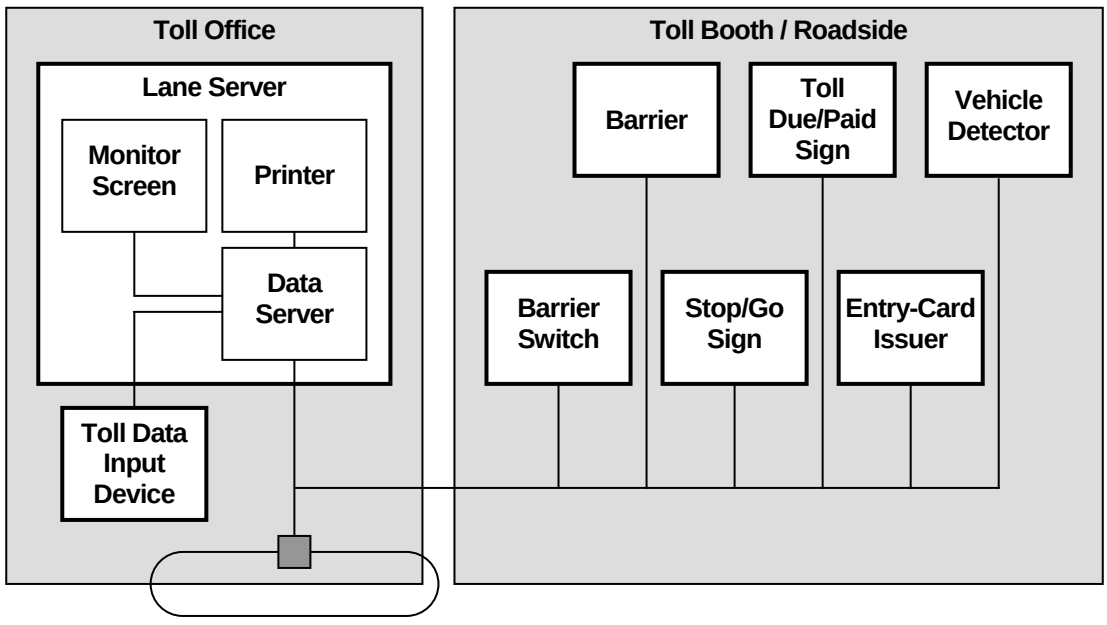
Figure 7.2 System Architecture for Vehicle/Class Identification



: Location : Equipment component : Detailed Device
: Software

Broken Lines: Outside of This Functional Package

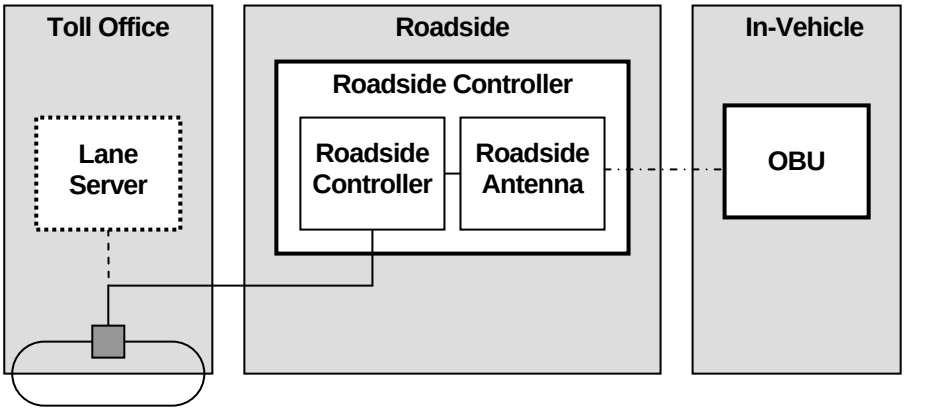
Figure 7.3 System Architecture for Lane Control



: Location : Equipment component : Detailed Device
: Software

Broken Lines: Outside of This Functional Package

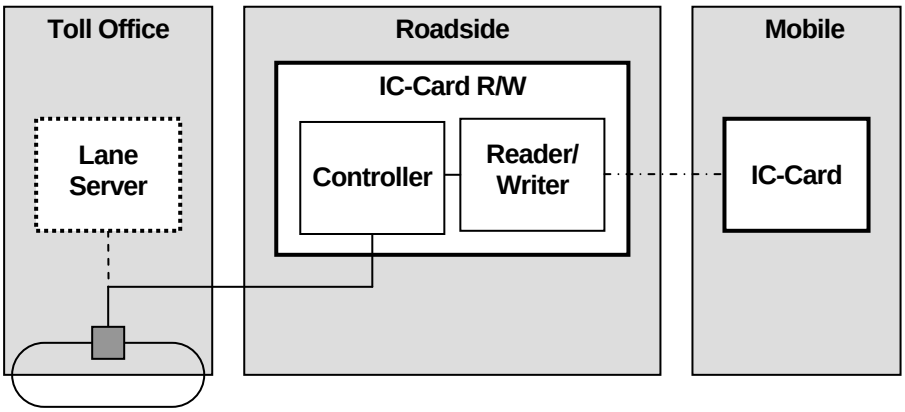
Figure 7.4 System Architecture for Road-to-Vehicle Communication



: Location : Equipment component : Detailed Device

Broken Lines: Outside of This Functional Package

Figure 7.5 System Architecture for IC-card Recording



: Location : Equipment component : Detailed Device

Broken Lines: Outside of This Functional Package

Figure 7.6 System Architecture for Toll Data Management

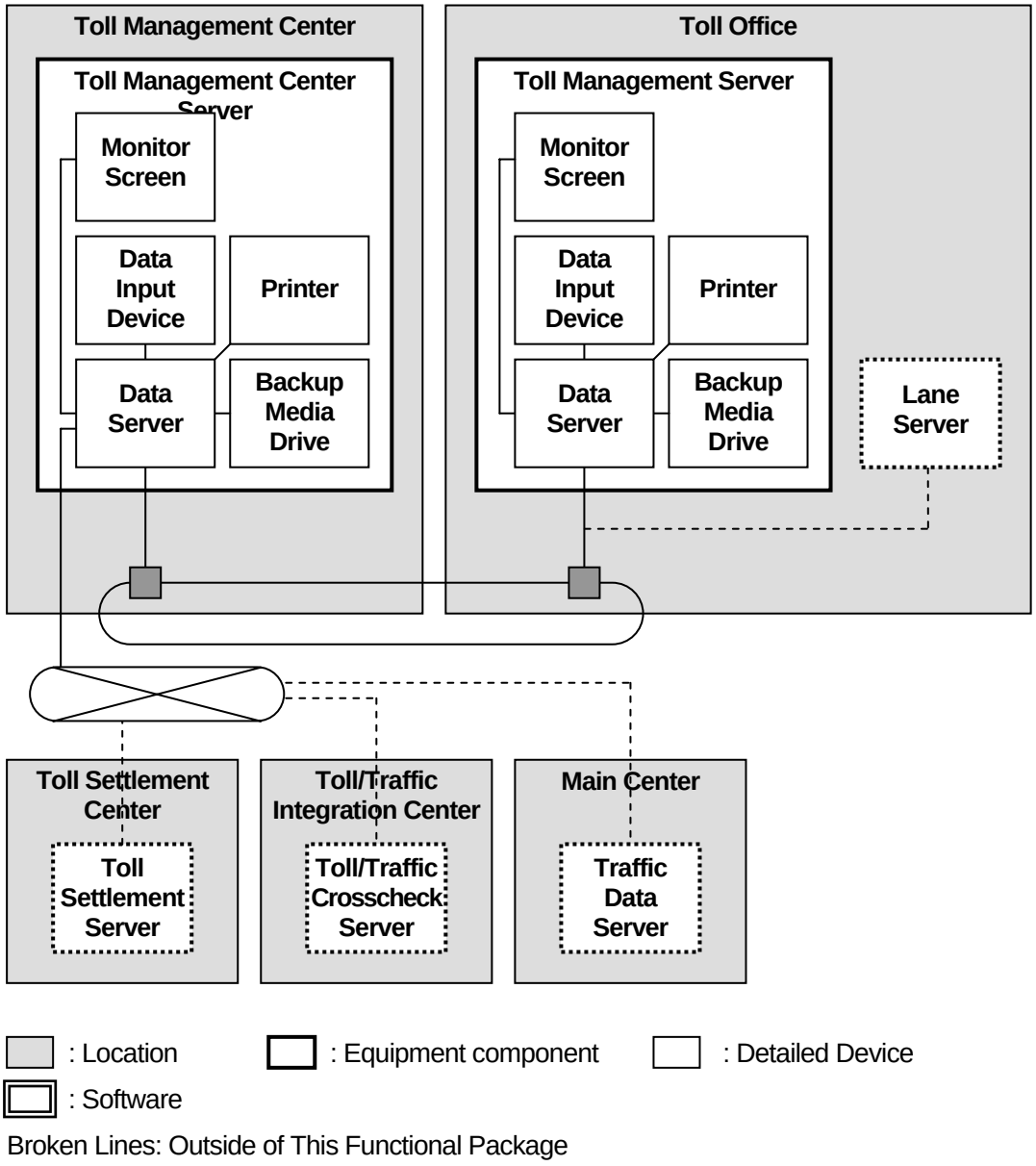
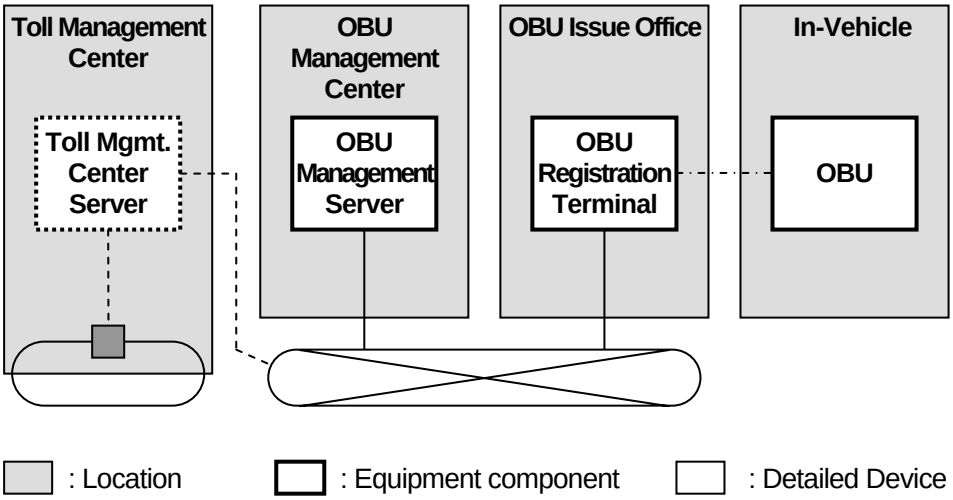


Figure 7.7 System Architecture for OBU Management



7.3 Screen Transition Diagram

1) Toll Management Center

Initial screen is to indicates the Main Menu of the traffic event control and information.

Initial screen
A0310000

Main Menu
- Toll request
- Toll rate table
- Total amount
- Invalidation list

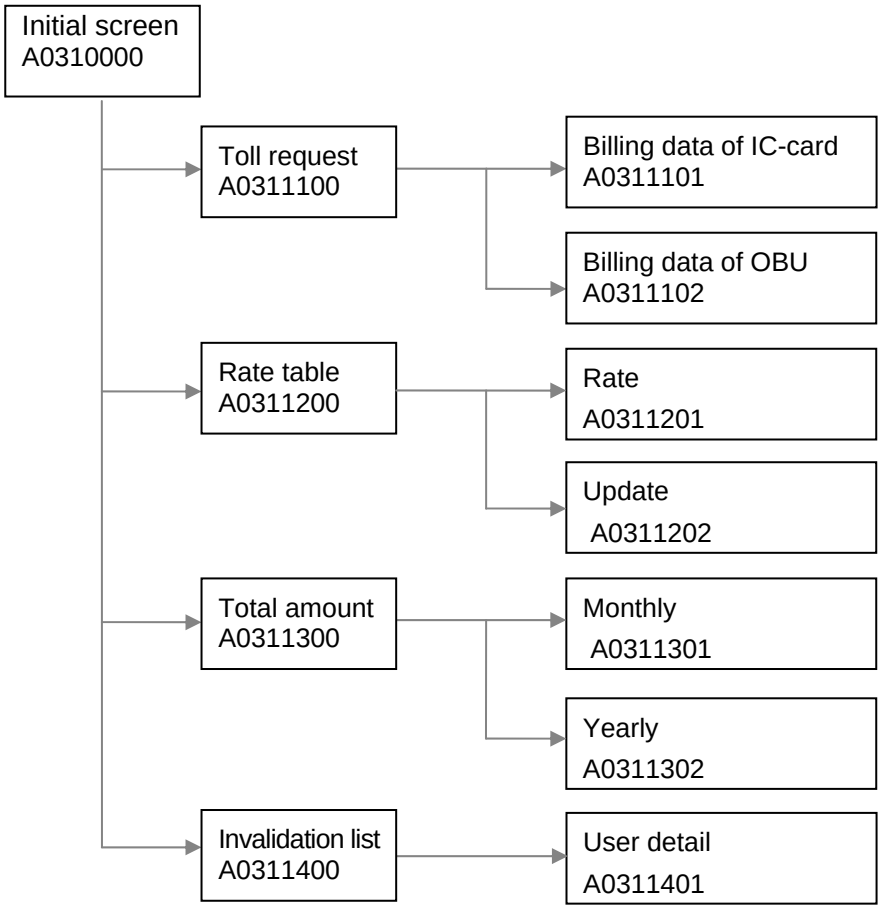
a. Toll request
This screen displays bill data of IC-card and OBU. The operator requests the toll revenue to the bank from this screen.

b. Toll rate table
This screen displays the toll rate table for the whole expressway network. Moreover, this screen can update the expressway toll rate table.

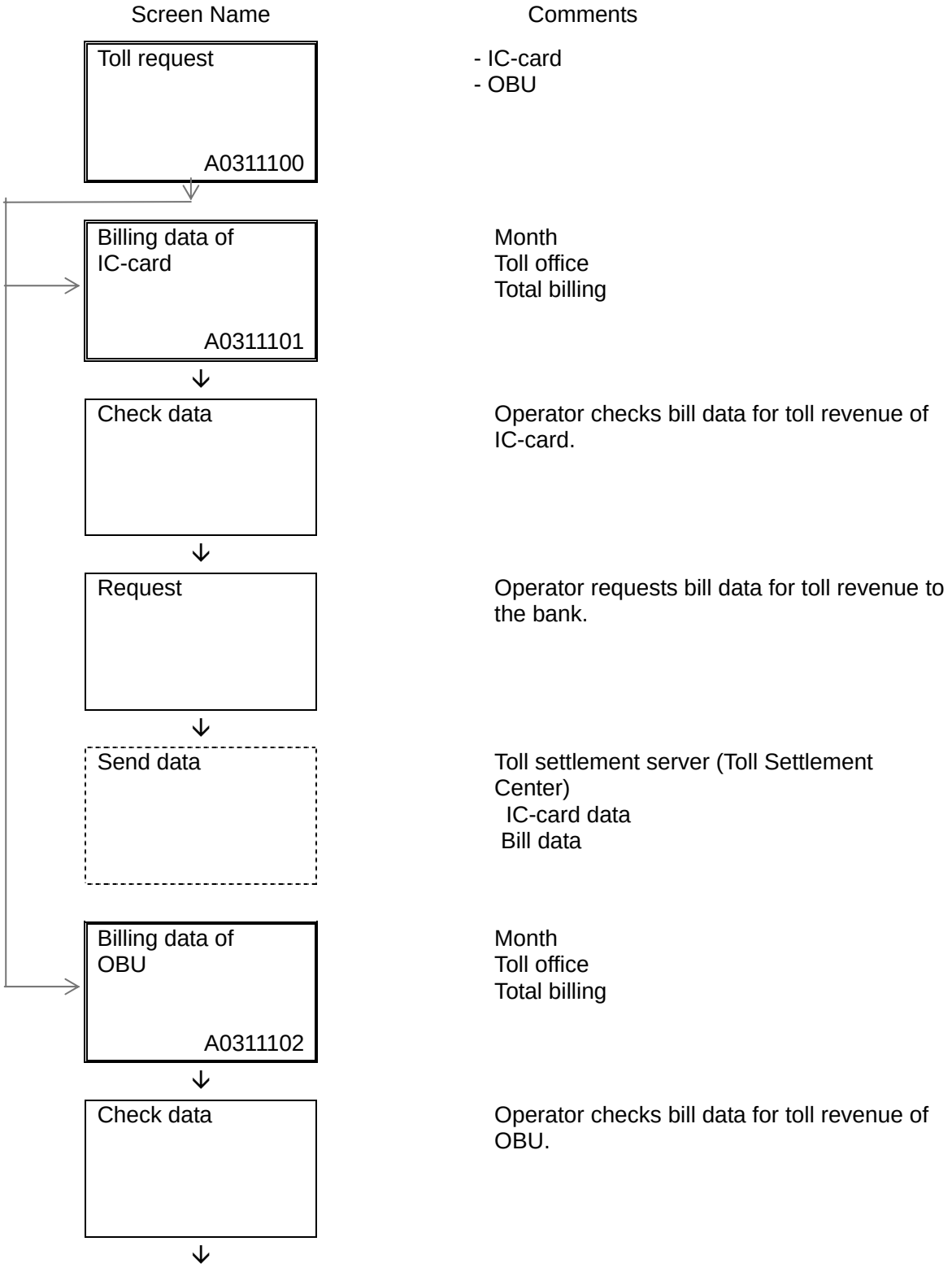
c. Total amount
This screen displays the total amount of the toll revenue for every month or every year.

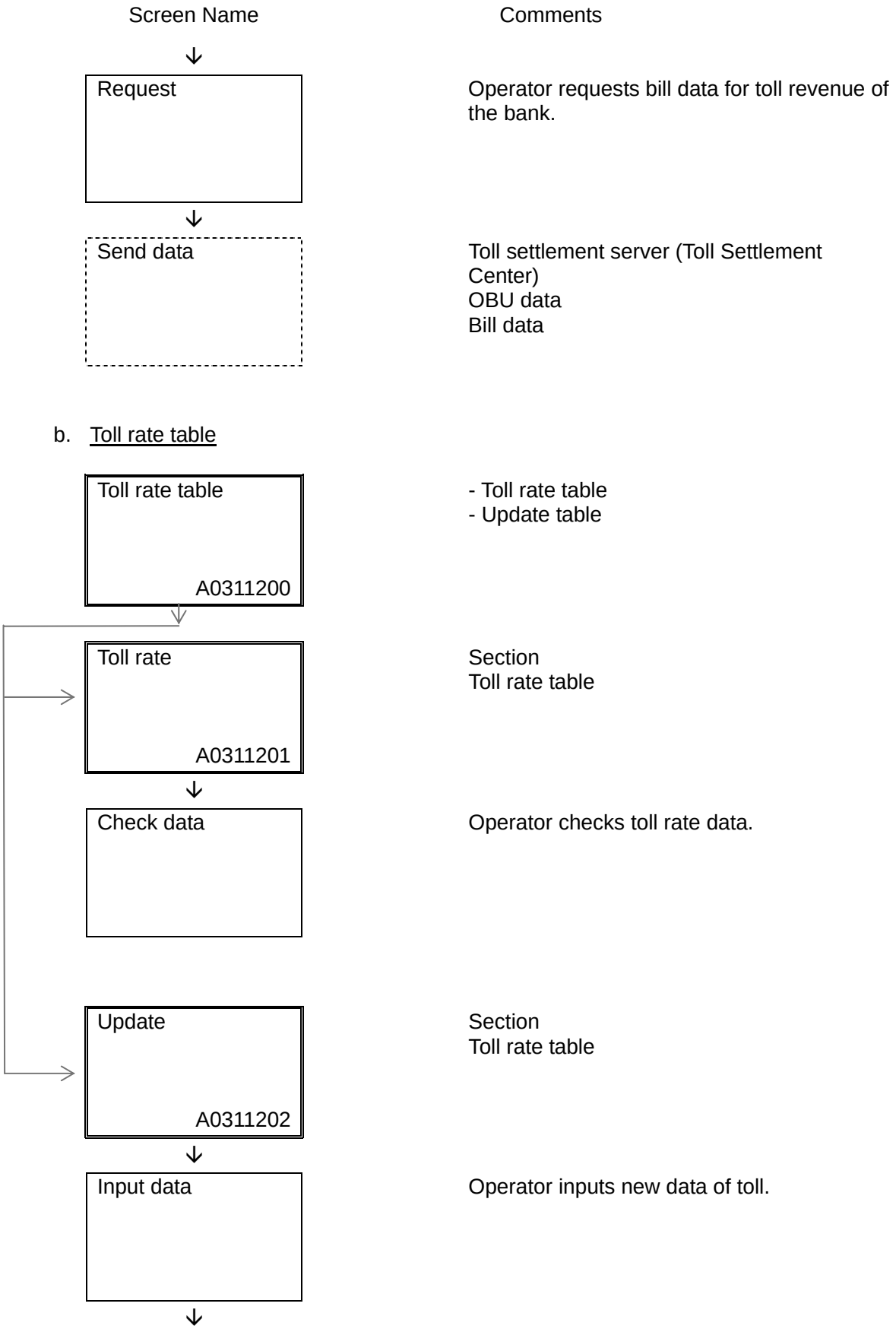
d. Invalidation list
This screen displays the list of invalid OBUs and IC-cards.

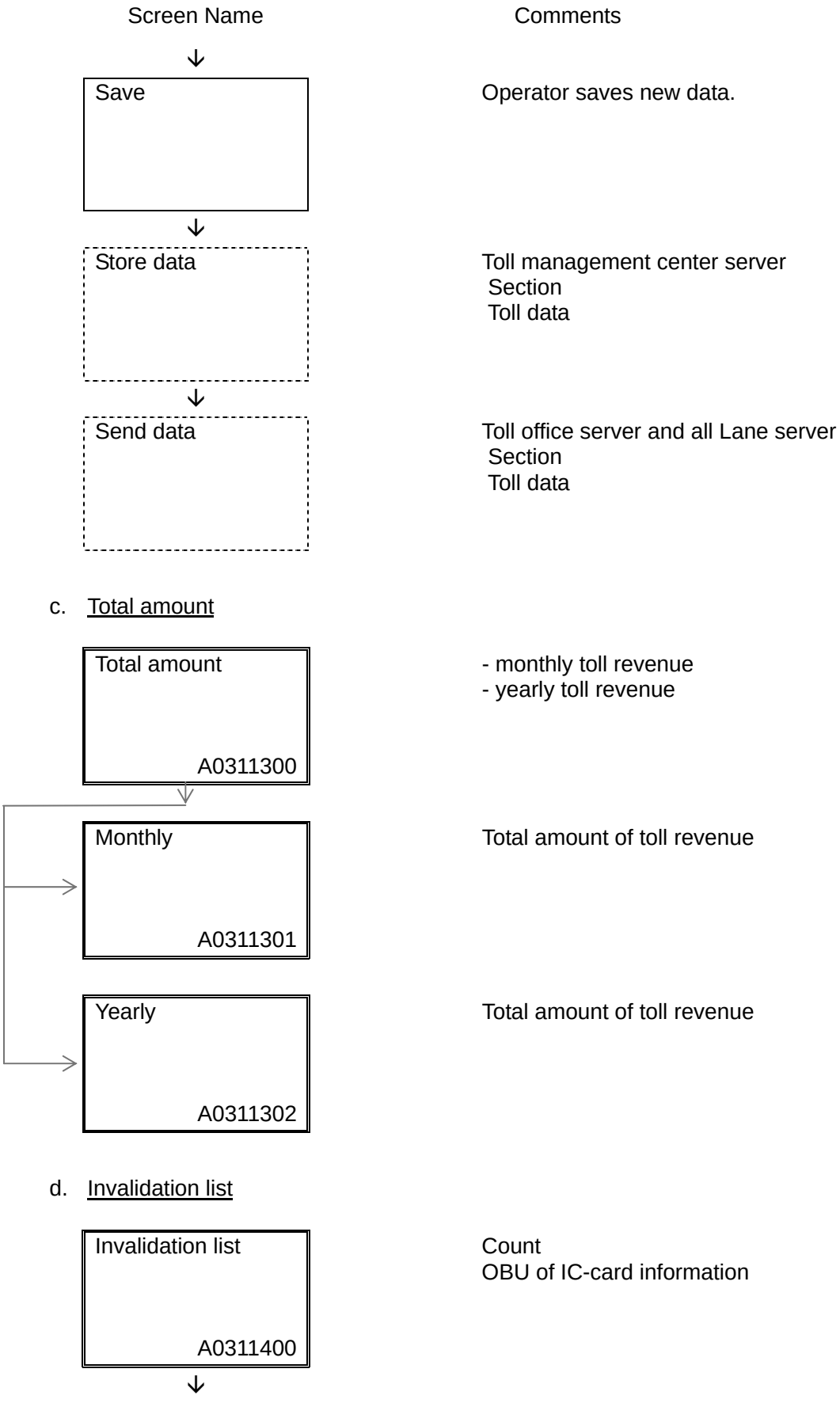
Figure 7.2 Screen Transition Diagram of Toll Management Center Console



a. Toll request

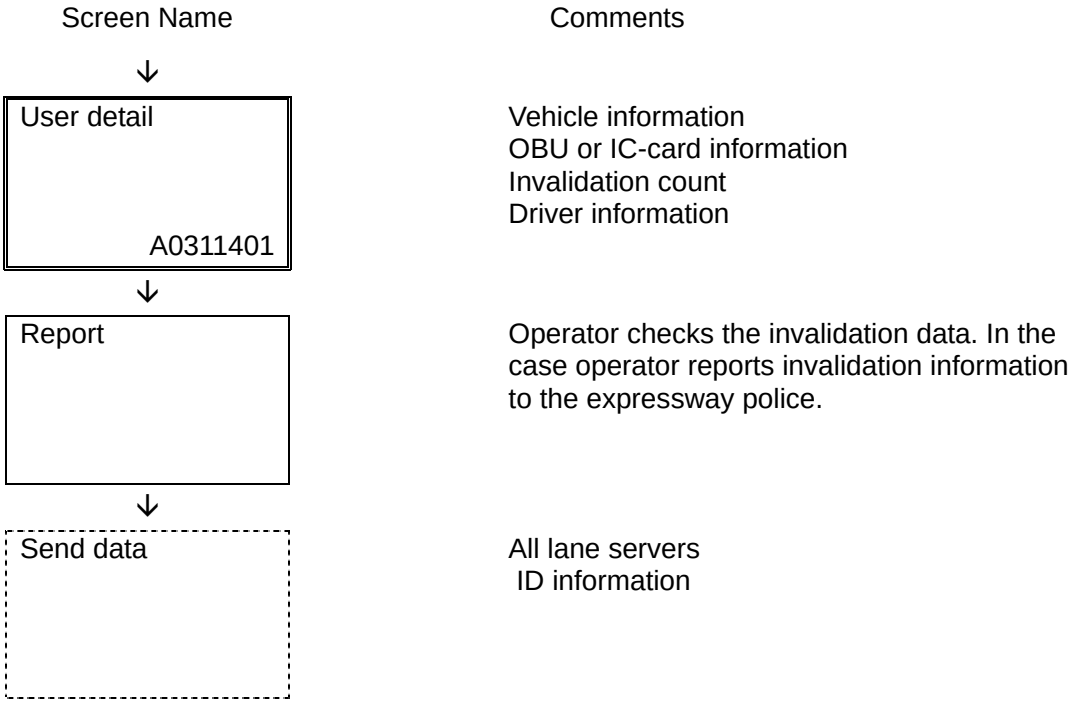



Screen Name
Comments
Request
Operator requests bill data for toll revenue of the bank.
Send data
Toll settlement server (Toll Settlement Center)
OBU data
Bill data
b. Toll rate table
Toll rate table
A0311200
- Toll rate table
- Update table
Toll rate
A0311201
Section
Toll rate table
Check data
Operator checks toll rate data.
Update
A0311202
Section
Toll rate table
Input data
Operator inputs new data of toll.



c. Total amount

d. Invalidation list


Screen Name
Comments
User detail
A0311401
Vehicle information
OBU or IC-card information
Invalidation count
Driver information
Report
Operator checks the invalidation data. In the case operator reports invalidation information to the expressway police.
Send data
All lane servers
ID information

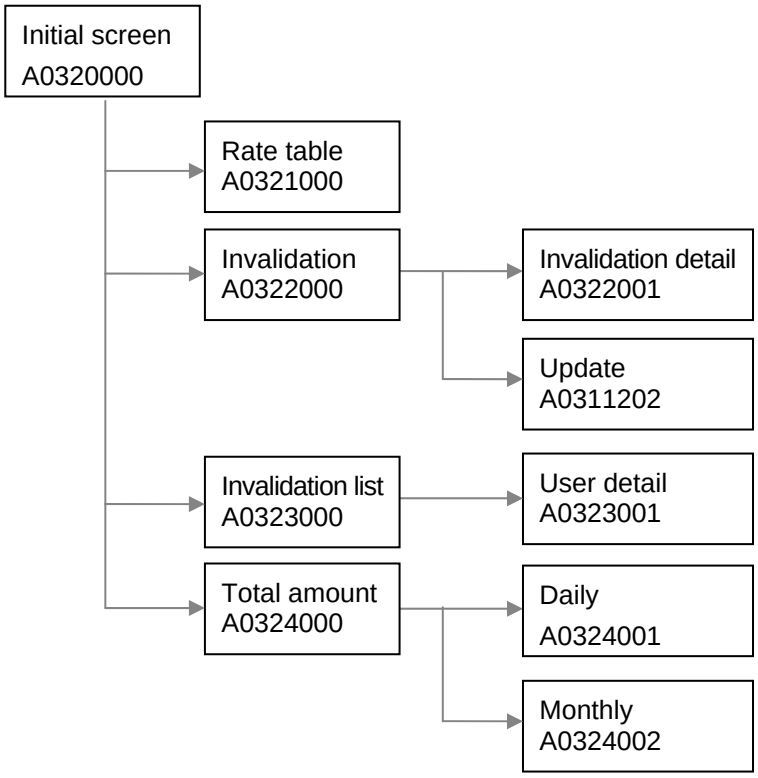
2) Toll Office

Initial screen is to indicates the Main Menu of the traffic event control and information.

Initial screen A0320000	Main Menu - Toll rate table - Invalidation - Invalidation list - Total amount

a. Rate table
This screen displays the toll rate table for the whole expressway network.
b. Invalidation
This screen displays the short balanced ID data.
c. Invalidation list
This screen displays the list of invalid OBUs and IC-cards.
d. Total amount
This screen displays the total amount of toll revenue for every day.

Figure 7.3 Screen Transition Diagram of Toll Office Console



a. Toll rate table

Screen Name	Comments
Toll rate table A0321000	Section Toll rate table
↓	
Check data	Operator checks toll rate data.

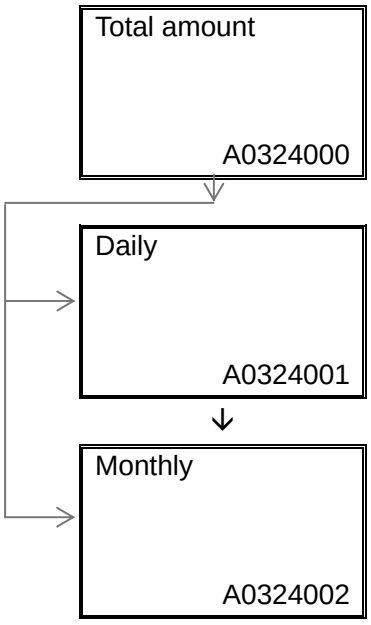
b. Invalidation

Invalidation A0322000	Date, time Invalidation ID (OBU or IC-card)
↓	
Get data	Vehicle license number Picture of vehicle ID information
↓	
Invalidation detail A0322001	Date, time Invalidation ID (OBU or IC-card) Vehicle information Driver information
↓	
Registration	Operator registers invalidation information to the invalidation list.
↓	
Send data	Toll management center server and All lane server Invalidation list

c. User list of Invalidation

Screen Name	Comments
User list A0323000	Count IC-card or OBU information
↓	
User Detail A0323001	Vehicle information ID information Invalidation count Driver information

d. Total amount



- Daily toll revenue
- Monthly toll revenue

Total amount of toll revenue

Total amount of toll revenue

3) Toll Booth

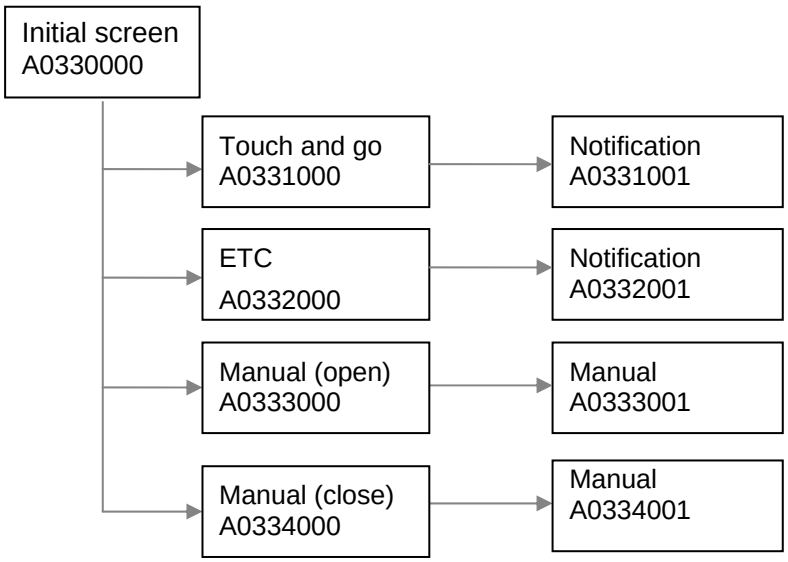
Initial screen is to indicates the Main Menu of the traffic event control and information.

Initial screen
A0330000

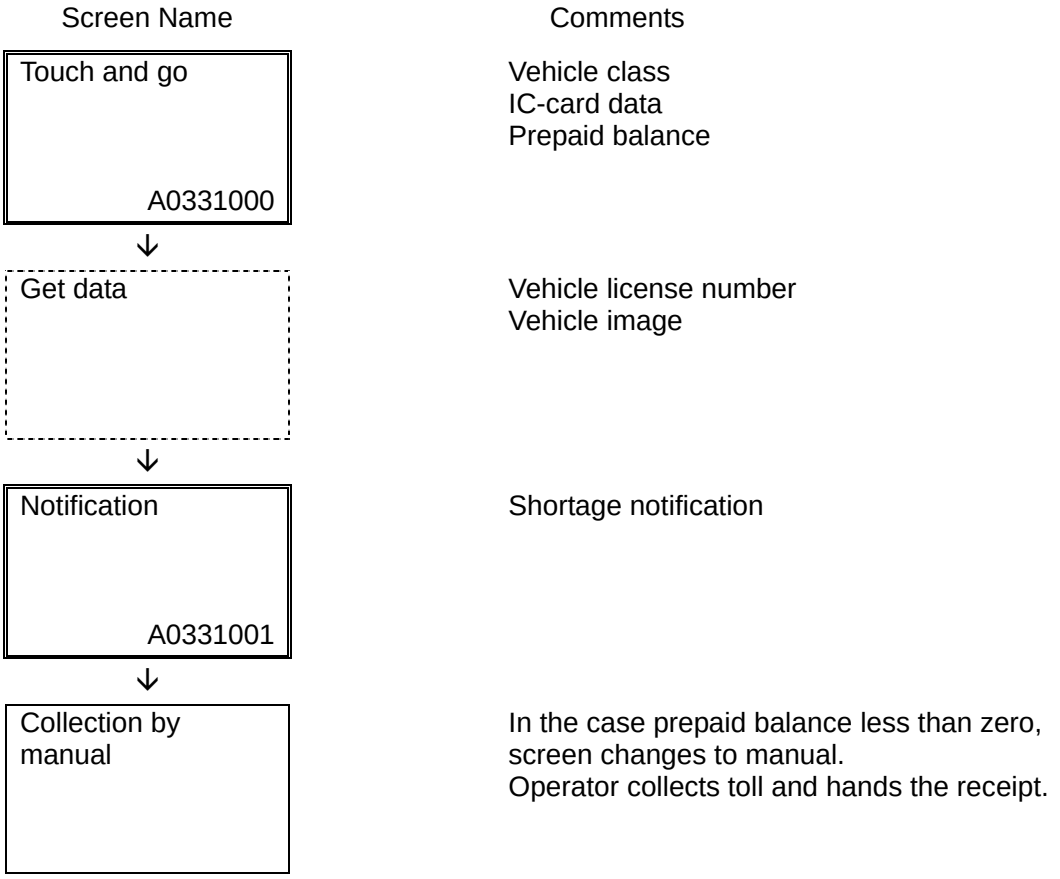
Main Menu
- Touch and go
- ETC
- Manual (open toll system)
- Manual (closed toll system)

a. Touch and go
This screen displays the vehicle information that passed in touch and go.
b. ETC
This screen displays the vehicle information that passed in ETC.
c. Manual (open toll system)
This screen displays the toll information.
d. Manual (closed toll system)
This screen displays the toll information.

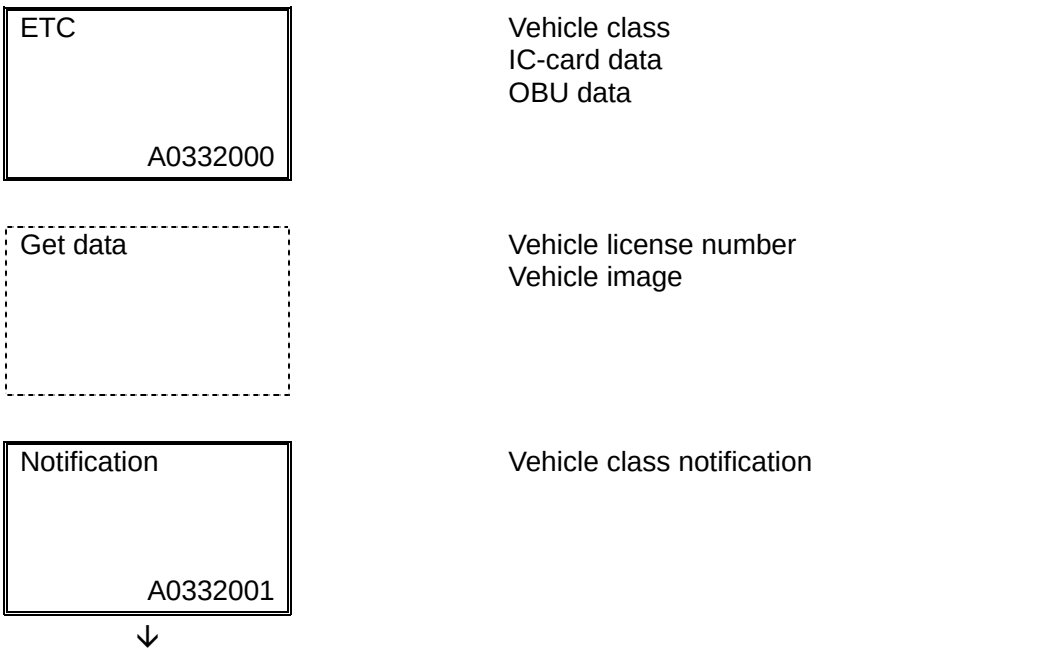
Figure 7.4 Screen Transition Diagram of Toll Booth Console



a. Touch and go



b. ETC



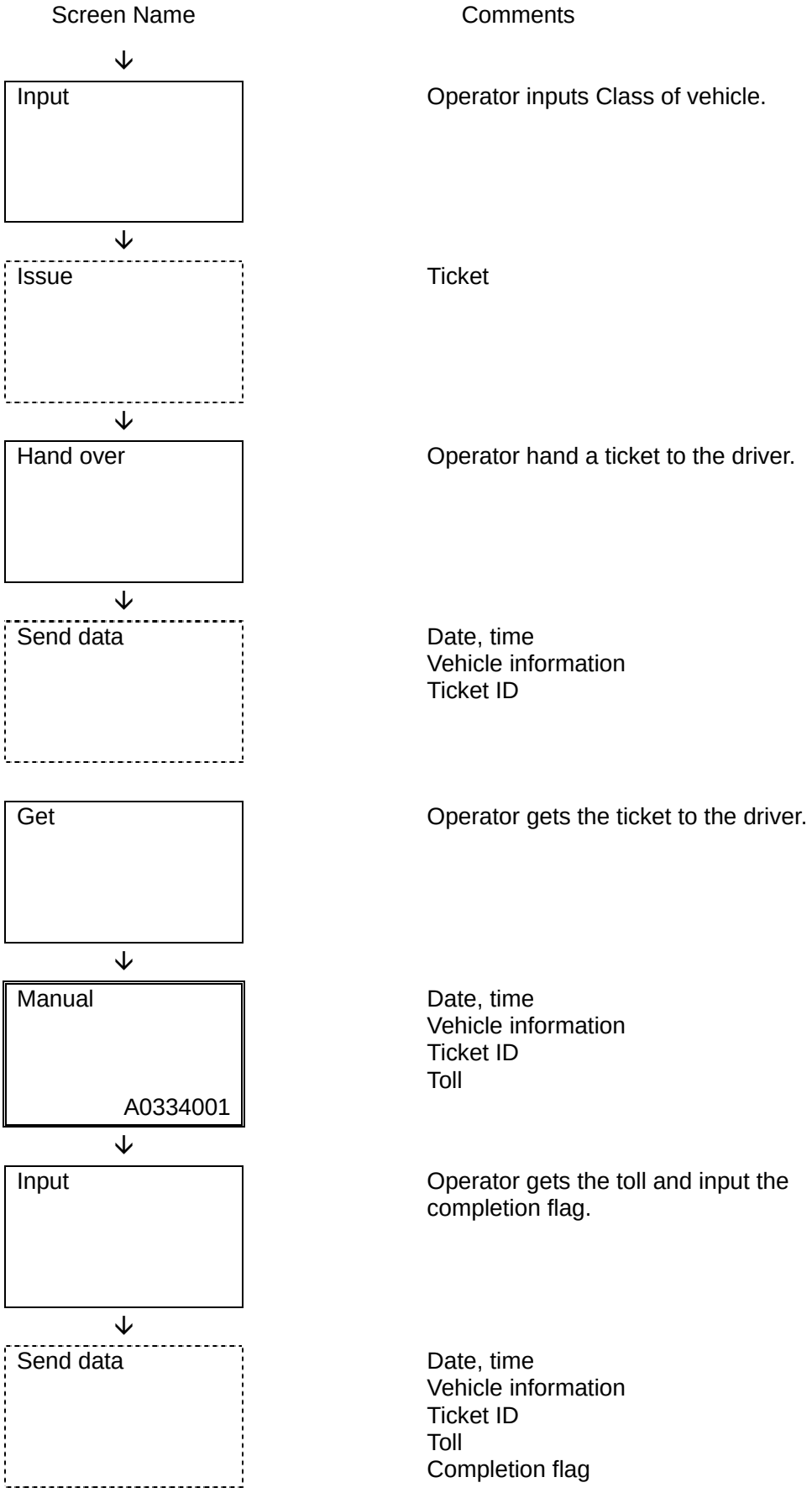
Screen Name	Comments
↓	
Send data	Toll management server IC-card data Vehicle information

c. Manual (open toll system)

Manual A0333000	Date, time Class of vehicle (blank)
↓	
Input	Operator inputs Class of vehicle.
↓	
Manual A0333000	Date, time Class of vehicle Toll
↓	
Toll collection	Operator collects toll and hands the receipt.
↓	
Send data	Date, time Vehicle information Toll

d. Manual (closed toll system)

Manual A0334000	Date, time Class of vehicle (blank)


Screen Name
Comments
Input
Operator inputs Class of vehicle.
Issue
Ticket
Hand over
Operator hand a ticket to the driver.
Send data
Date, time
Vehicle information
Ticket ID
Get
Operator gets the ticket to the driver.
Manual
A0334001
Date, time
Vehicle information
Ticket ID
Toll
Input
Operator gets the toll and input the completion flag.
Send data
Date, time
Vehicle information
Ticket ID
Toll
Completion flag

4) OBU Management Center

Initial screen is to indicates the Main Menu of the traffic event control and information.

Initial screen

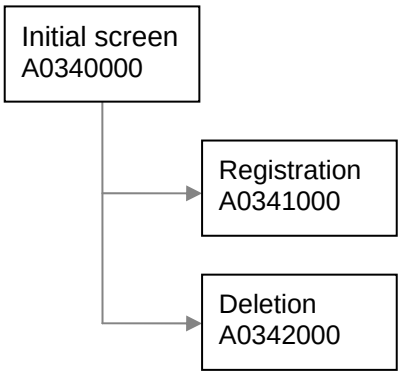
A0340000

Main Menu
- Registration
- Deletion

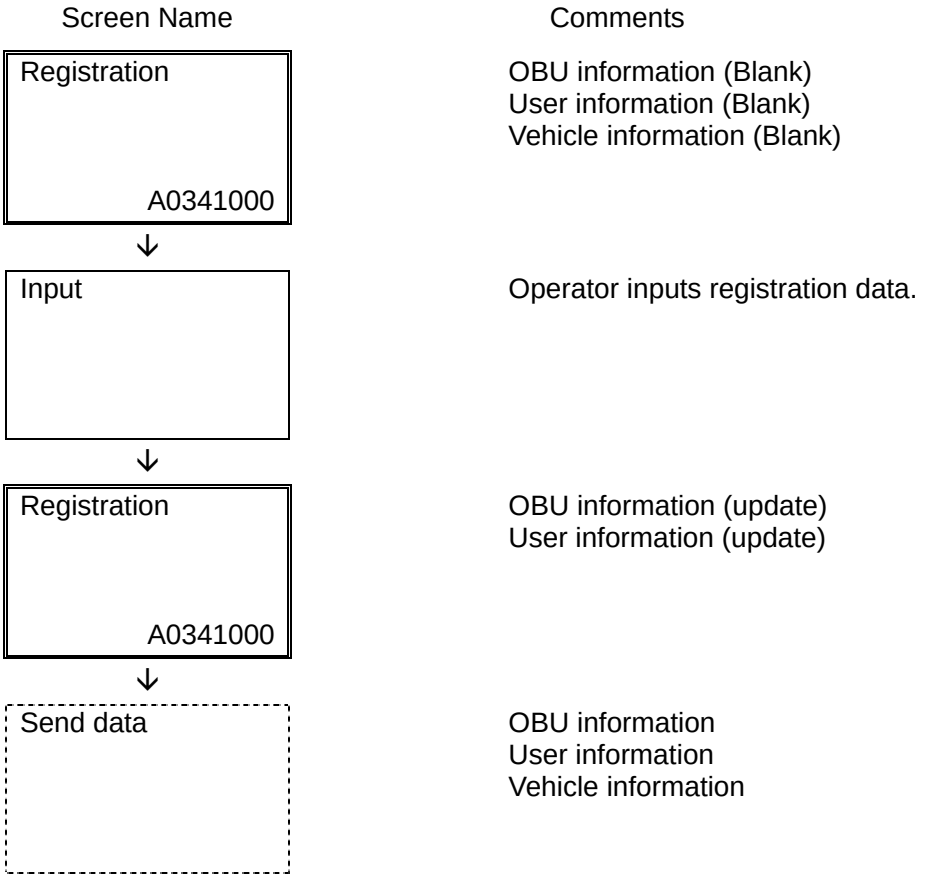
a. Registration
This screen displays registration of OBU.

b. Deletion
This screen displays deletion in registration OBU.

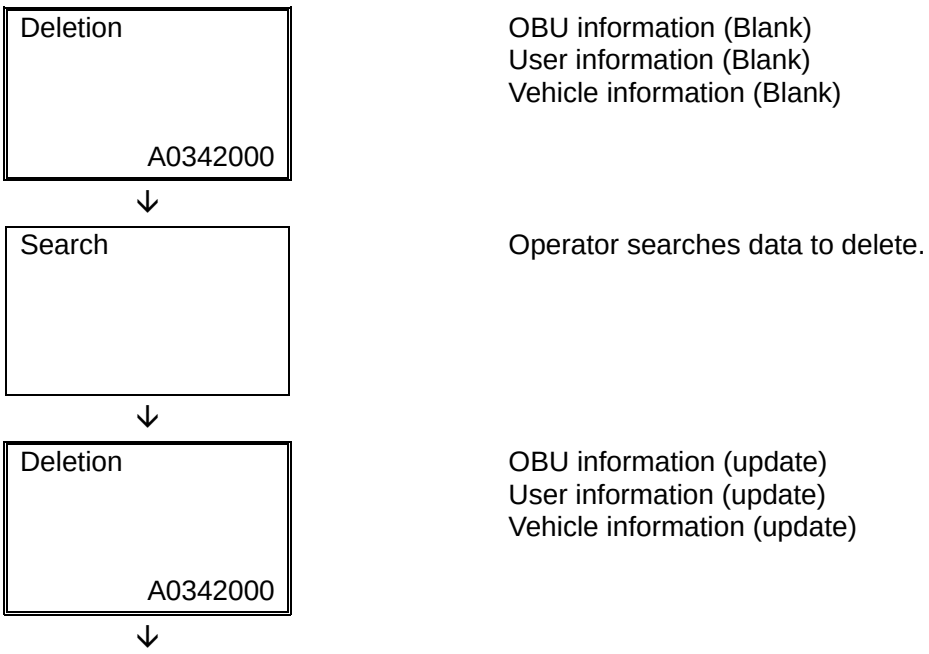
Figure 7.5 Screen Transition Diagram of OBU Management Center Console

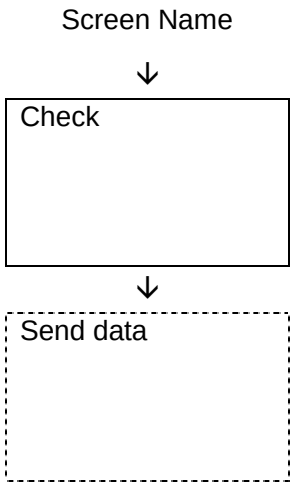


a. Registration



b. Deletion





7.4 Comment Indication

The automated toll collection/management system displays a message on screen at every processing. A list of comments to be indicated on each screen is shown in table below.

1) Toll Management Center

Table 7.1 Comment Indication for Automated Toll Collection/Management System (Toll Management Center)

Screen Number	Comment Indication
A0310000	Logon failure: unknown user name or bad password.
	Logon failure: user not allowed to log on to this computer.
	An unexpected error occurred.
A0311101	The billing data of IC-card cannot be collected by the system.
	The billing data were sent successfully.
	The request operation could not be completed. A retry should be performed.
A0311102	The billing data of OBU cannot be collected by the system.
	The billing data were sent successfully.
	The request operation could not be completed. A retry should be performed.
A0311201	The toll rate table cannot be collected by the system.
A0311202	The toll rate table cannot be collected by the system.
	The toll rate table were update successfully.
	The update operation could not be completed. A retry should be performed.
A0311301	The monthly data cannot be collected by the system.
A0311302	The yearly data cannot be collected by the system.
A0311400	The invalidation list cannot be collected by the system.
A0311401	There is not the detailed information.

2) Toll Office

Table 7.2 Comment Indication for Automated Toll Collection/Management System (Toll Office)

Screen Number	Comment Indication
A0320000	Logon failure: unknown user name or bad password.
	Logon failure: user not allowed to log on to this computer.
	An unexpected error occurred.
A0321000	The toll rate table cannot be collected by the system.
A0322000	There is not the invalidation data.
	The invalidation data cannot be collected by the system.
	The system cannot read a license number from a camera.
A0322001	The invalidation data were registered successfully.
	The register operation could not be completed. A retry should be performed.
	The detail information cannot be collected by the system.
A0323000	The Invalidation list cannot be collected by the system.
A0323001	The detail information cannot be collected by the system.
A0324001	The daily data cannot be collected by the system.
A0324002	The monthly data cannot be collected by the system.

3) Toll Booth

Table 7.3 Comment Indication for Automated Toll Collection/Management System (Toll Booth)

Screen Number	Comment Indication
A0330000	Logon failure: unknown user name or bad password.
	Logon failure: user not allowed to log on to this computer.
	An unexpected error occurred.
A0331000	The system cannot read IC-card information from IC-card reader.
A0331001	The system cannot read a license number from a camera.
A0332000	The system cannot read IC-card information from IC-card reader.
	The system cannot read OBU information.
A0332001	The system cannot read a license number from a camera.

4) OBU Management Center

Table 7.4 Comment Indication for Automated Toll Collection/Management System (OBU Management Center)

Screen Number	Comment Indication
A0340000	Logon failure: unknown user name or bad password.
	Logon failure: user not allowed to log on to this computer.
	An unexpected error occurred.
A0341000	The OBU data were registered successfully.
	The register operation could not be completed. A retry should be performed.
A0342000	The OBU data were deleted successfully.
	The OBU list cannot be collected by the system.
	The system cannot delete OBU information.

7.5 Data Sets for Indication/Input

The automated toll collection/management system stores data in several dataset. The stored data are to be structure as shown in table below.

1) Toll Management Center

Table 7.5 Data Set of Automated Toll Collection/Management System (Toll Management Office)

Data Set <Screen No.>	Data Elements	Type	Digit	Set
IC-card Passage Data Set < A0311101>	Toll Office ID	INT*	4	N
	Tollgate ID	INT	8	
	Lane ID	INT	12	
	Toll Amount	FLOAT	8	
	Prepaid Balance	FLOAT	8	
	Date/Time	Datetime	≥14	
IC-card Invalidation List Data Set < A0311400>	Issuer ID	INT*	4	1
	Issue Terminal ID	INT	12	N
	IC-card ID for Invalidation	INT	12	
	IC-card Owner ID	INT	18	
	Amount of Deposit	FLOAT	8	
	Date/Time of Issue	TXT	≥14	
	Date/Time of Expiry	TXT	≥14	
	Date/Time	Datetime	≥14	1
OBU Passage Data Set < A0311102>	Toll Office ID	INT*	4	3
	Tollgate ID	INT*	4	
	Lane ID	INT*	4	
	IC-card ID	INT	12	
	Toll Amount	FLOAT	4	
	Prepaid Balance	INT	8	
	Date/Time	Datetime	≥14	
OBU Invalidation List Data Set < A0311400>	Management Organization ID	INT	12	1
	OBU ID for Invalidation	INT	12	N
	OBU Owner ID	INT	18	
	License Plate Number	TXT	12	
	Vehicle Class	TXT	2	
	Date of Issue	TXT	8	
	Date of Expiry	TXT	8	
	Date/Time	Datetime	≥14	1
Transaction Data Set < A0311100>	Toll Office ID	INT*	4	1
	Tollgate ID	INT	8	1
	Lane ID	INT*	4	1
	OBU ID	INT	12	1
	Vehicle Class in OBU	INT*	2	1
	License number in OBU	TXT	12	1
	IC-card ID	INT	12	1
	Toll Amount	INT	8	1
	Prepaid Balance	FLOAT	8	1
	Termination Status	INT*	2	1
	Serial Number of Vehicle	INT	5	1
	Date/Time	Datetime	≥14	1
Toll Collection Data Set	Road Owner ID	INT*	4	1
	Toll Office ID	INT*	4	1

< A0311100>	Date of Toll Amount	TXT	8	1
	Sum of Toll Amount	INT*	12	1
	Number of Vehicle Passage	INT	8	1
	Transaction Data Set	Set	var	N
	Enforcement Status	TXT	2	
	Date/Time	Datetime	≥14	1
Hourly Toll Collection Data Set < A0311300>	Road Owner ID	INT*	4	1
	Toll Office ID	INT*	4	1
	Date/Hour of Record	TXT	10	1
	Sum of Toll Amount	FLOAT	12	1
	Number of Vehicle Passage	INT	8	1
	Sum of Toll of Vehicle Class 1	FLOAT	12	1
	Number of Vehicle of Class 1	INT	8	1
	Sum of Toll of Vehicle Class 2	FLOAT	12	1
	Number of Vehicle of Class 2	INT	8	1
	Sum of Toll of Vehicle Class 3	FLOAT	12	1
	Number of Vehicle of Class 3	INT	8	1
	Sum of Toll of Vehicle Class 4	FLOAT	12	1
	Number of Vehicle of Class 4	INT	8	1
	Sum of Toll of Vehicle Class 5	FLOAT	12	1
	Number of Vehicle of Class 5	INT	8	1
	Sum of Toll of Vehicle Class 6	FLOAT	12	1
	Number of Vehicle of Class 6	INT	8	1
	Sum of Toll of Vehicle Class 7	FLOAT	12	1
	Number of Vehicle of Class 7	INT	8	1
	Sum of Toll of Vehicle Class 8	FLOAT	12	1
	Number of Vehicle of Class 8	INT	8	1
	Sum of Toll of Vehicle Class 9	FLOAT	12	1
	Number of Vehicle of Class 9	INT	8	1
	Sum of Toll of Vehicle Class 10	FLOAT	12	1
	Number of Vehicle of Class 10	INT	8	1
	Sum of Toll of Vehicle Class 11	FLOAT	12	1
	Number of Vehicle of Class 11	INT	8	1
	Sum of Toll of Vehicle Class 12	FLOAT	12	1
	Number of Vehicle of Class 12	INT	8	1
	Sum of Toll of Vehicle Class 13	FLOAT	12	1
	Number of Vehicle of Class 13	INT	8	1
	Sum of Toll of Vehicle Class 14	FLOAT	12	1
	Number of Vehicle of Class 14	INT	8	1
	Sum of Toll of Vehicle Class 15	FLOAT	12	1
	Number of Vehicle of Class 15	INT	8	1
	Sum of Toll of Vehicle Class 16	FLOAT	12	1
	Number of Vehicle of Class 16	INT	8	1
	Sum of Toll of Vehicle Class 17	FLOAT	12	1
	Number of Vehicle of Class 17	INT	8	1
	Sum of Toll of Vehicle Class 18	FLOAT	12	1
	Number of Vehicle of Class 18	INT	8	1
	Sum of Toll of Vehicle Class 19	FLOAT	12	1
	Number of Vehicle of Class 19	INT	8	1
	Sum of Toll of Vehicle Class 20	FLOAT	12	1
	Number of Vehicle of Class 20	INT	8	1
	Date/Time	Datetime	≥14	1
Toll Revenue Data Set < A0311300>	Road Owner ID	INT*	4	1
	Fiscal Month	TXT	6	1
	Toll Revenue of The Month/Week	FLOAT	16	1

	Number of Vehicle Passage	INT	8	1
	Sum of Toll of Vehicle Class 1	FLOAT	12	1
	Number of Vehicle of Class 1	INT	8	1
	Sum of Toll of Vehicle Class 2	FLOAT	12	1
	Number of Vehicle of Class 2	INT	8	1
	Sum of Toll of Vehicle Class 3	FLOAT	12	1
	Number of Vehicle of Class 3	INT	8	1
	Sum of Toll of Vehicle Class 4	FLOAT	12	1
	Number of Vehicle of Class 4	INT	8	1
	Sum of Toll of Vehicle Class 5	FLOAT	12	1
	Number of Vehicle of Class 5	INT	8	1
	Sum of Toll of Vehicle Class 6	FLOAT	12	1
	Number of Vehicle of Class 6	INT	8	1
	Sum of Toll of Vehicle Class 7	FLOAT	12	1
	Number of Vehicle of Class 7	INT	8	1
	Sum of Toll of Vehicle Class 8	FLOAT	12	1
	Number of Vehicle of Class 8	INT	8	1
	Sum of Toll of Vehicle Class 9	FLOAT	12	1
	Number of Vehicle of Class 9	INT	8	1
	Sum of Toll of Vehicle Class 10	FLOAT	12	1
	Number of Vehicle of Class 10	INT	8	1
	Sum of Toll of Vehicle Class 11	FLOAT	12	1
	Number of Vehicle of Class 11	INT	8	1
	Sum of Toll of Vehicle Class 12	FLOAT	12	1
	Number of Vehicle of Class 12	INT	8	1
	Sum of Toll of Vehicle Class 13	FLOAT	12	1
	Number of Vehicle of Class 13	INT	8	1
	Sum of Toll of Vehicle Class 14	FLOAT	12	1
	Number of Vehicle of Class 14	INT	8	1
	Sum of Toll of Vehicle Class 15	FLOAT	x	1
	Number of Vehicle of Class 15	INT	8	1
	Sum of Toll of Vehicle Class 16	FLOAT	12	1
	Number of Vehicle of Class 16	INT	8	1
	Sum of Toll of Vehicle Class 17	FLOAT	12	1
	Number of Vehicle of Class 17	INT	8	1
	Sum of Toll of Vehicle Class 18	FLOAT	12	1
	Number of Vehicle of Class 18	INT	8	1
	Sum of Toll of Vehicle Class 19	FLOAT	12	1
	Number of Vehicle of Class 19	INT	8	1
	Sum of Toll of Vehicle Class 20	FLOAT	12	1
	Number of Vehicle of Class 20	INT	8	1
	Date/Time	Datetime	≥14	1

2) Toll Office

Table 7.6 Data Set of Automated Toll Collection/Management System (Toll Office)

Data Set < Screen No.>	Data Elements	Type	Digit	Set
Toll Rate Information Data Set < A0321000>	Number of tollgate pair	INT	8	1
	Tollgate Pair ID	INT	8	N
	Entrance Tollgate ID	INT*	4	
	Exit Tollgate ID	INT*	4	
	Toll Rate of Vehicle Class 1	FLOAT	12	
	Toll Rate of Vehicle Class 2	FLOAT	12	

	Toll Rate of Vehicle Class 3	FLOAT	12	
	Toll Rate of Vehicle Class 4	FLOAT	12	
	Toll Rate of Vehicle Class 5	FLOAT	12	
	Toll Rate of Vehicle Class 6	FLOAT	12	
	Toll Rate of Vehicle Class 7	FLOAT	12	
	Toll Rate of Vehicle Class 8	FLOAT	12	
	Toll Rate of Vehicle Class 9	FLOAT	12	
	Toll Rate of Vehicle Class 10	FLOAT	12	
	Toll Rate of Vehicle Class 11	FLOAT	12	
	Toll Rate of Vehicle Class 12	FLOAT	12	
	Toll Rate of Vehicle Class 13	FLOAT	12	
	Toll Rate of Vehicle Class 14	FLOAT	12	
	Toll Rate of Vehicle Class 15	FLOAT	12	
	Toll Rate of Vehicle Class 16	FLOAT	12	
	Toll Rate of Vehicle Class 17	FLOAT	12	
	Toll Rate of Vehicle Class 18	FLOAT	12	
	Toll Rate of Vehicle Class 19	FLOAT	12	
	Toll Rate of Vehicle Class 20	FLOAT	12	
	Number of document	TXT	20	
	Date of Toll Rate Table	TXT	8	
	Date of Expiry	Date	8	1
	Tollgate ID	INT	8	
	Lane ID	INT	12	
	Toll Amount	FLOAT	8	
	Prepaid Balance	FLOAT	8	
	Date/Time	Datetime	≥14	
IC-card Invalidation List Data Set < A0323000>	Issuer ID	INT*	4	1
	Issue Terminal ID	INT	12	N
	IC-card ID for Invalidation	INT	12	
	IC-card Owner ID	INT	18	
	Amount of Deposit	FLOAT	8	
	Date/Time of Issue	TXT	≥14	
	Date/Time of Expiry	TXT	≥14	
	Date/Time	Datetime	≥14	1
OBU Invalidation List Data Set < A0323000>	Management Organization ID	INT	12	1
	OBU ID for Invalidation	INT	12	N
	OBU Owner ID	INT	18	
	License Plate Number	TXT	12	
	Vehicle Class	TXT	2	
	Date of Issue	TXT	8	
	Date of Expiry	TXT	8	
	Date/Time	Datetime	≥14	1
Hourly Toll Collection Data Set < A0324000>	Road Owner ID	INT*	4	1
	Toll Office ID	INT*	4	1
	Date/Hour of Record	TXT	10	1
	Sum of Toll Amount	FLOAT	12	1
	Number of Vehicle Passage	INT	8	1
	Sum of Toll of Vehicle Class 1	FLOAT	12	1
	Number of Vehicle of Class 1	INT	8	1
	Sum of Toll of Vehicle Class 2	FLOAT	12	1
	Number of Vehicle of Class 2	INT	8	1
	Sum of Toll of Vehicle Class 3	FLOAT	12	1
	Number of Vehicle of Class 3	INT	8	1
	Sum of Toll of Vehicle Class 4	FLOAT	12	1
	Number of Vehicle of Class 4	INT	8	1

	Sum of Toll of Vehicle Class 5	FLOAT	12	1
	Number of Vehicle of Class 5	INT	8	1
	Sum of Toll of Vehicle Class 6	FLOAT	12	1
	Number of Vehicle of Class 6	INT	8	1
	Sum of Toll of Vehicle Class 7	FLOAT	12	1
	Number of Vehicle of Class 7	INT	8	1
	Sum of Toll of Vehicle Class 8	FLOAT	12	1
	Number of Vehicle of Class 8	INT	8	1
	Sum of Toll of Vehicle Class 9	FLOAT	12	1
	Number of Vehicle of Class 9	INT	8	1
	Sum of Toll of Vehicle Class 10	FLOAT	12	1
	Number of Vehicle of Class 10	INT	8	1
	Sum of Toll of Vehicle Class 11	FLOAT	12	1
	Number of Vehicle of Class 11	INT	8	1
	Sum of Toll of Vehicle Class 12	FLOAT	12	1
	Number of Vehicle of Class 12	INT	8	1
	Sum of Toll of Vehicle Class 13	FLOAT	12	1
	Number of Vehicle of Class 13	INT	8	1
	Sum of Toll of Vehicle Class 14	FLOAT	12	1
	Number of Vehicle of Class 14	INT	8	1
	Sum of Toll of Vehicle Class 15	FLOAT	12	1
	Number of Vehicle of Class 15	INT	8	1
	Sum of Toll of Vehicle Class 16	FLOAT	12	1
	Number of Vehicle of Class 16	INT	8	1
	Sum of Toll of Vehicle Class 17	FLOAT	12	1
	Number of Vehicle of Class 17	INT	8	1
	Sum of Toll of Vehicle Class 18	FLOAT	12	1
	Number of Vehicle of Class 18	INT	8	1
	Sum of Toll of Vehicle Class 19	FLOAT	12	1
	Number of Vehicle of Class 19	INT	8	1
	Sum of Toll of Vehicle Class 20	FLOAT	12	1
	Number of Vehicle of Class 20	INT	8	1
	Date/Time	Datetime	≥14	1
Toll Revenue Data Set < A0324000>	Road Owner ID	INT*	4	1
	Fiscal Month	TXT	6	1
	Toll Revenue of The Month/Week	FLOAT	16	1
	Number of Vehicle Passage	INT	8	1
	Sum of Toll of Vehicle Class 1	FLOAT	12	1
	Number of Vehicle of Class 1	INT	8	1
	Sum of Toll of Vehicle Class 2	FLOAT	12	1
	Number of Vehicle of Class 2	INT	8	1
	Sum of Toll of Vehicle Class 3	FLOAT	12	1
	Number of Vehicle of Class 3	INT	8	1
	Sum of Toll of Vehicle Class 4	FLOAT	12	1
	Number of Vehicle of Class 4	INT	8	1
	Sum of Toll of Vehicle Class 5	FLOAT	12	1
	Number of Vehicle of Class 5	INT	8	1
	Sum of Toll of Vehicle Class 6	FLOAT	12	1
	Number of Vehicle of Class 6	INT	8	1
	Sum of Toll of Vehicle Class 7	FLOAT	12	1
	Number of Vehicle of Class 7	INT	8	1
	Sum of Toll of Vehicle Class 8	FLOAT	12	1
	Number of Vehicle of Class 8	INT	8	1
	Sum of Toll of Vehicle Class 9	FLOAT	12	1
	Number of Vehicle of Class 9	INT	8	1

	Sum of Toll of Vehicle Class 10	FLOAT	12	1
	Number of Vehicle of Class 10	INT	8	1
	Sum of Toll of Vehicle Class 11	FLOAT	12	1
	Number of Vehicle of Class 11	INT	8	1
	Sum of Toll of Vehicle Class 12	FLOAT	12	1
	Number of Vehicle of Class 12	INT	8	1
	Sum of Toll of Vehicle Class 13	FLOAT	12	1
	Number of Vehicle of Class 13	INT	8	1
	Sum of Toll of Vehicle Class 14	FLOAT	12	1
	Number of Vehicle of Class 14	INT	8	1
	Sum of Toll of Vehicle Class 15	FLOAT	x	1
	Number of Vehicle of Class 15	INT	8	1
	Sum of Toll of Vehicle Class 16	FLOAT	12	1
	Number of Vehicle of Class 16	INT	8	1
	Sum of Toll of Vehicle Class 17	FLOAT	12	1
	Number of Vehicle of Class 17	INT	8	1
	Sum of Toll of Vehicle Class 18	FLOAT	12	1
	Number of Vehicle of Class 18	INT	8	1
	Sum of Toll of Vehicle Class 19	FLOAT	12	1
	Number of Vehicle of Class 19	INT	8	1
	Sum of Toll of Vehicle Class 20	FLOAT	12	1
	Number of Vehicle of Class 20	INT	8	1
	Date/Time	Datetime	≥14	1

3) Toll Booth

Table 7.7 Data Set of Automated Toll Collection/Management System (Toll Booth)

Data Set <Screen No.>	Data Elements	Type	Digit	Set
Bar-code Data Set < A0333000>	Toll Office ID	INT*	4	1
	Tollgate ID	INT*	4	1
	Lane ID	INT*	2	1
	Deposit Terminal ID	INT*	4	1
	Ticket Type	INT*	4	1
	Vehicle Class	INT*	2	1
	Serial Number	INT	12	1
	Date Issue	Date	8	1
	Date of Expiry	Date	8	1
IC-card Passage Data Set < A0331000; A0332000>	Toll Office ID	INT*	4	N
	Tollgate ID	INT	8	
	Lane ID	INT	12	
	Toll Amount	FLOAT	8	
	Prepaid Balance	FLOAT	8	
	Date/Time	Datetime	≥14	
Toll Collection License Plate Data Set < A0331001; A0332001>	Toll Office ID	INT*	4	1
	Tollgate ID	INT*	4	1
	Lane ID	INT*	4	1
	Roadside Equipment ID	INT*	4	1
	Captured License Plate Number	TXT	12	1
	Captured License Plate Image	IMG	var	1
	Serial Number of Vehicle	INT*	5	1
	Date/Time	Datetime	≥14	1

4) OBU Management Center

Table 7.8 Data Set of Automated Toll Collection/Management System (OBU Management Center)

Data Set <Screen No.>	Data Elements	Type	Digit	Set
OBU Registration Data Set < A0341000>	Management Organization ID	INT	12	1
	OBU ID	INT	12	1
	OBU Owner ID	INT	18	1
	License Plate Number	TXT	12	1
	Vehicle Class	TXT	2	1
	Date of Issue	TXT	8	1
	Date of Expiry	TXT	8	1

8. Operation/Management Plan for Vehicle Weighing System

8.1 General

This system measures overloading of heavy trucks by automatic execution of vehicle weighing at interchanges. The measurement data is diagnostic, and its result is transmitted to the server immediately.

8.2 System Architecture

The system is to be composed as shown in the following system architecture.

Figure 8.1 System Architecture for Axle Load Measurement

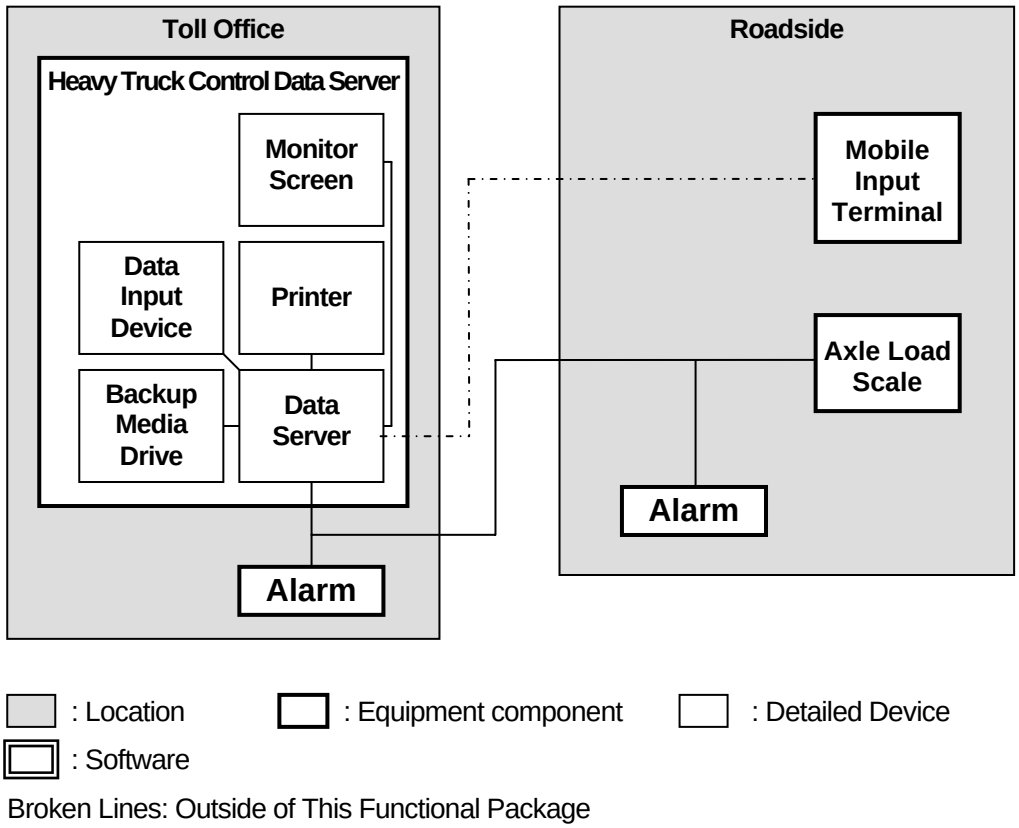
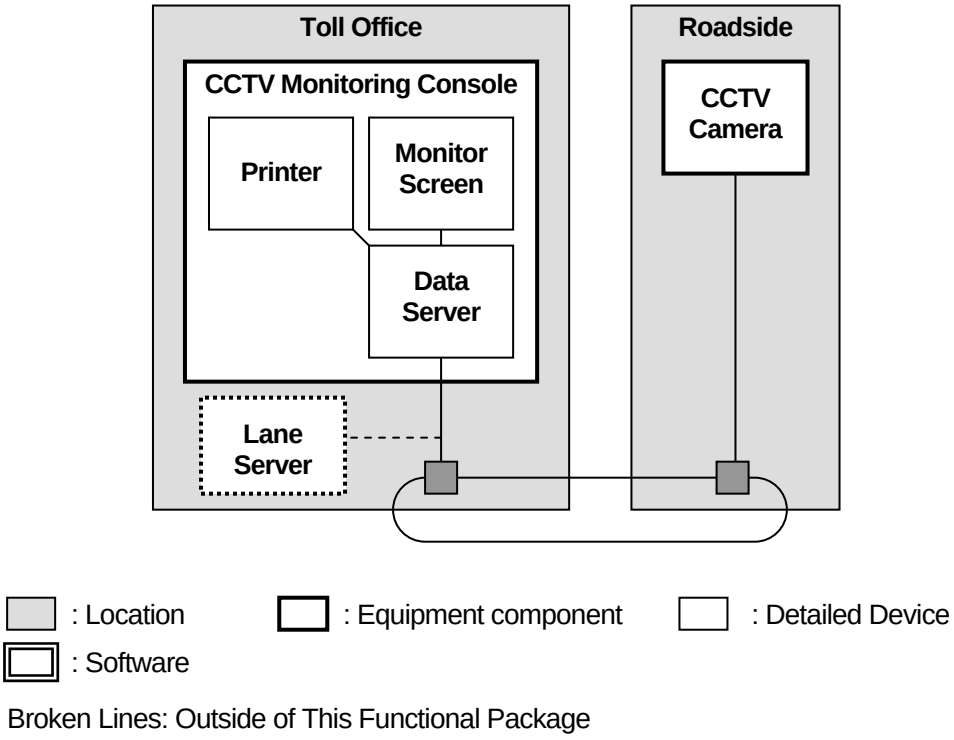


Figure 8.2 System Architecture for Measurement Lane Monitoring



8.3 Screen Transition Diagram

1) Toll Office

Initial screen is to indicates the Main Menu of the traffic event control and information.

Initial Screen

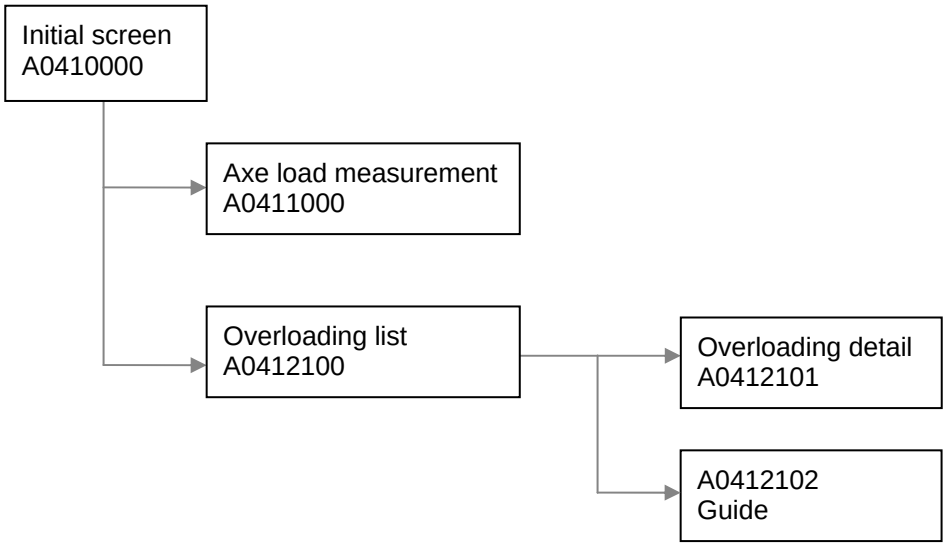
A0410000

Main Menu
- Axle load measurement
- Overloading list

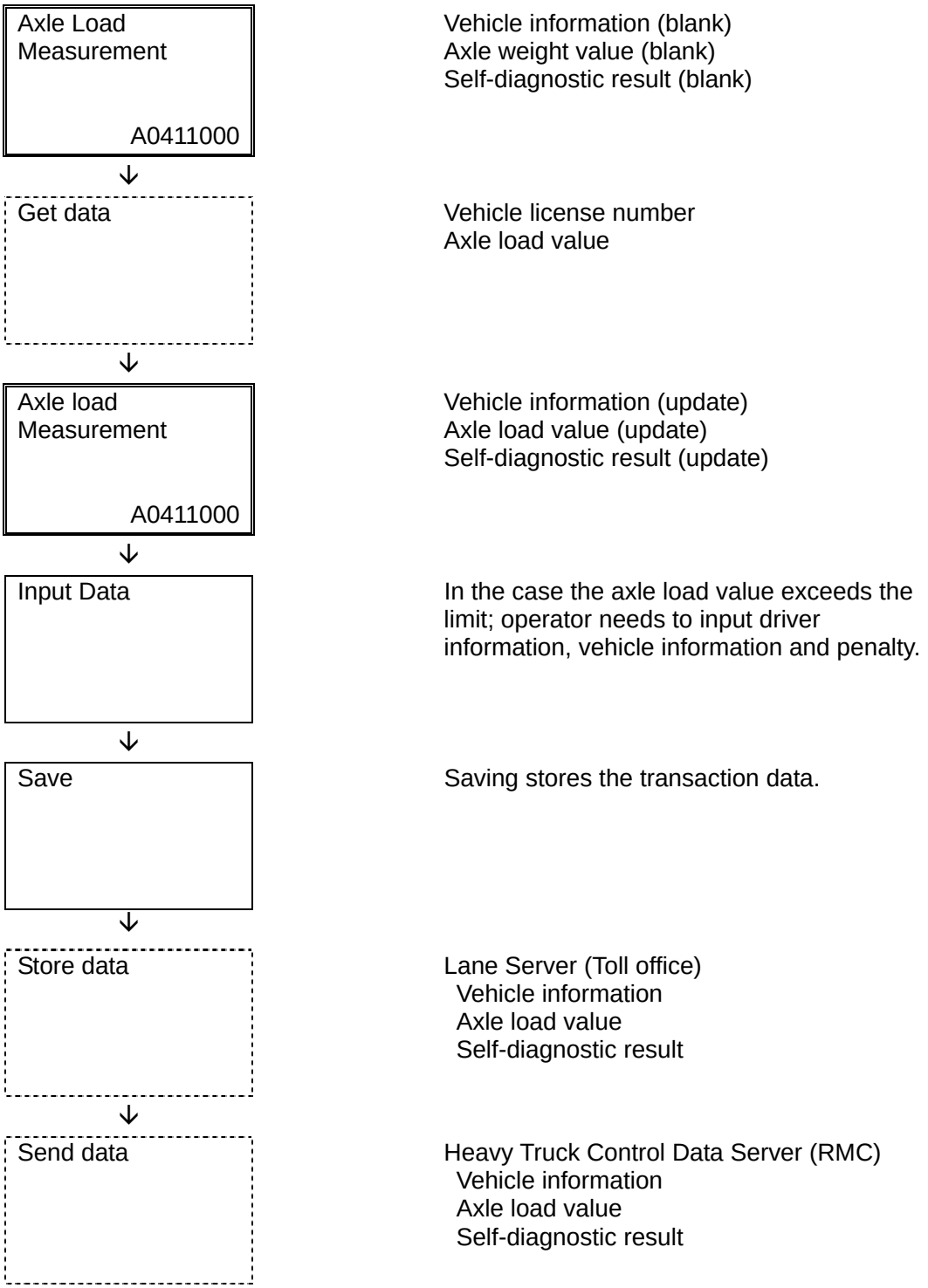
a. Axle load measurement
This screen displays a measurement result of axle load. Moreover, this screen can show driver and vehicle information.

b. Overloading list
This screen displays the list of overloading measurements and saves the data. Information for dissemination is displayed as additional screen.

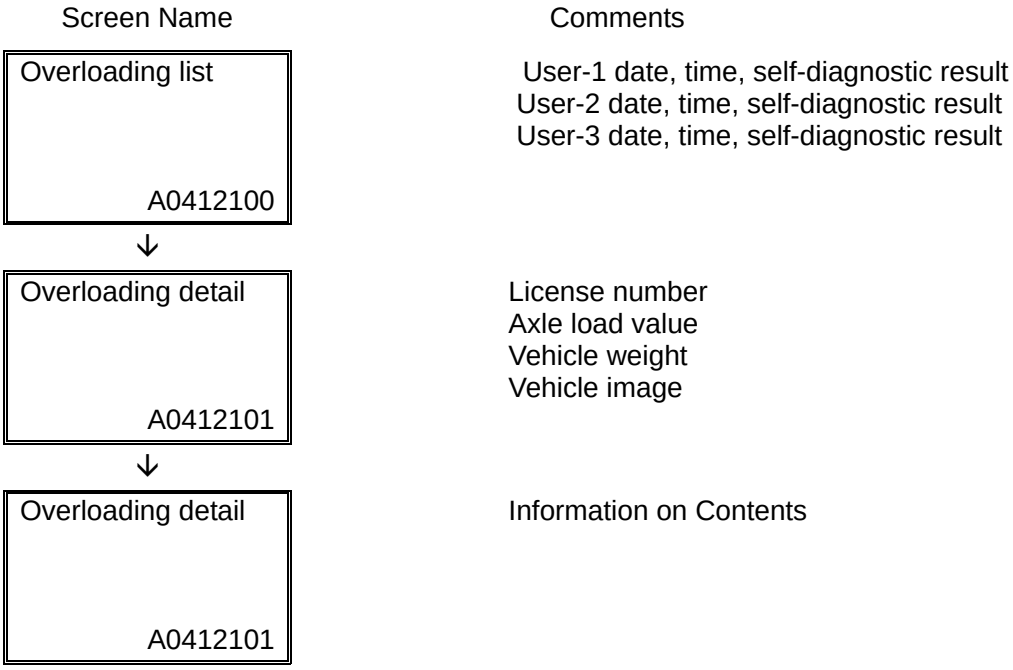
Figure 8.2 Screen Transition Diagram of Toll Office Console



a. Axle load measurement



b. Overloading list



2) Regional Main Center

Initial screen is to indicates the Main Menu of the traffic event control and information.

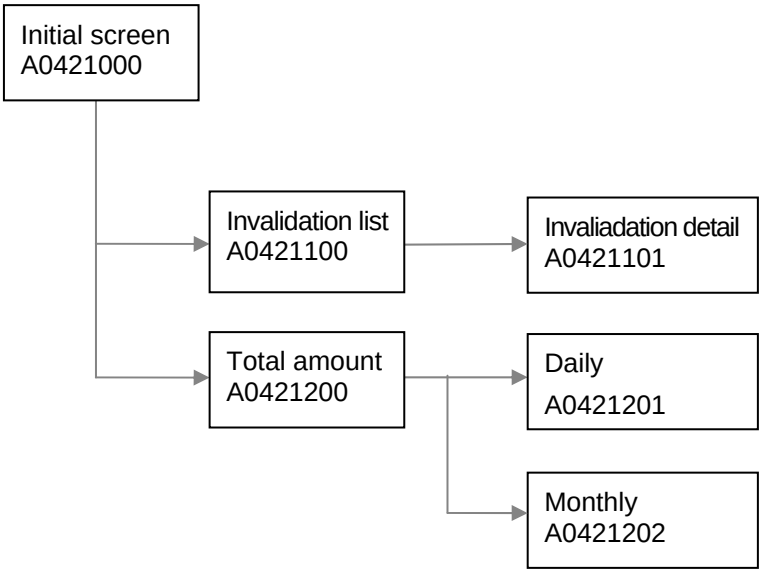
Initial screen
A0420000

Main Menu
- Invalidation list
- Total amount

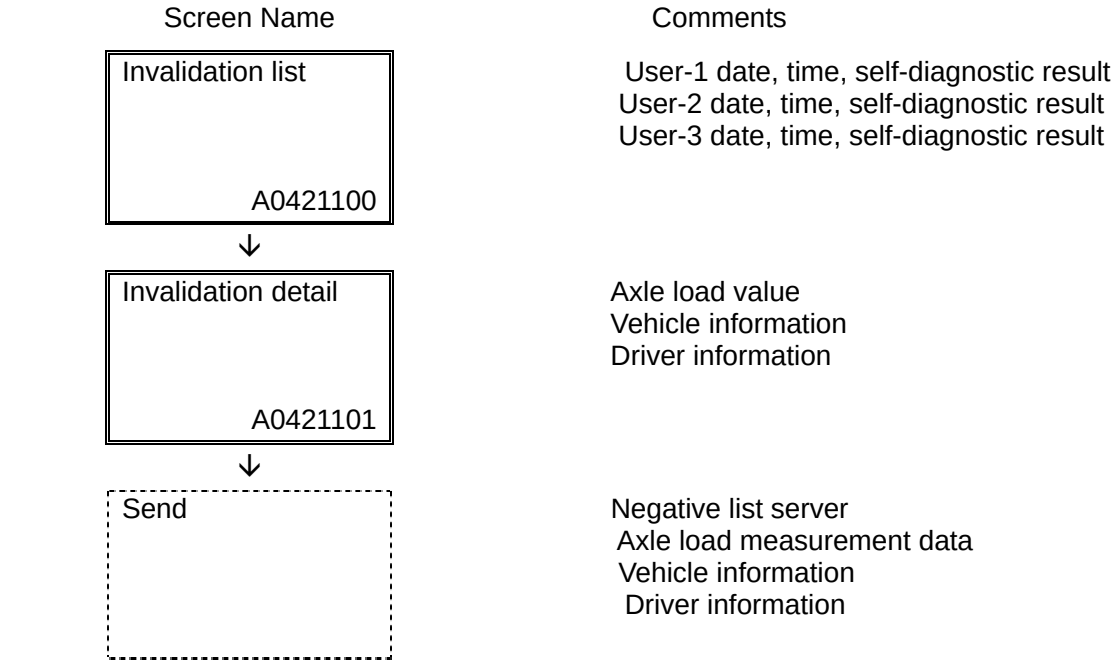
a. Invalidation list
This screen displays a list of invalidation information that has been received from all toll offices. After selecting a single invalidation record, the display will show the invalidation information details.

b. Total amount
This screen displays the total amount of the invalidation data on a day or in the month.

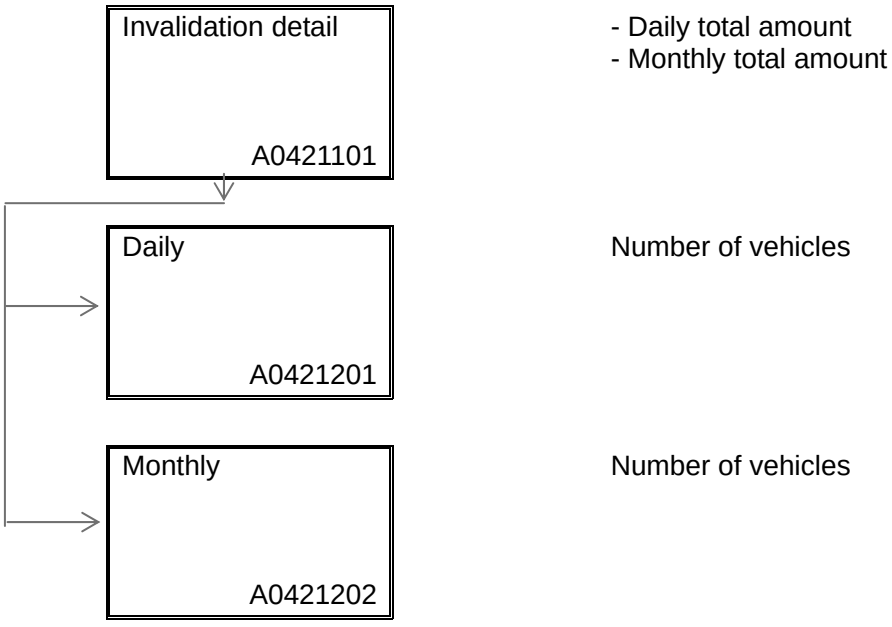
Figure 8.3 Screen Transition Diagram of Regional Main Center Console



a. Invalidation list



b. Total amount



8.4 Comment Indication

The vehicle weighing system displays a message on screen at every processing. A list of comments to be indicated on each screen is shown in table below.

1) Toll Office

Table 8.1 Comment Indication for Vehicle Weighing System (Toll Office)

Screen Number	Comment Indication
A0410000	Logon failure: unknown user name or bad password.
	Logon failure: user not allowed to log on to this computer.
	An unexpected error occurred.
A0411000	The input data were saved successfully.
	The operation could not be completed. A retry should be performed.
	The system cannot read a license number from a camera.
	The axle load data cannot be collected by the system.
A0412100	The overloading list cannot be collected by the system.
A0412101	The detail information cannot be collected by the system.

2) Regional Main Center

Table 8.2 Comment Indication for Vehicle Weighing System (Regional Main Center)

Screen Number	Comment Indication
A0420000	Logon failure: unknown user name or bad password.
	Logon failure: user not allowed to log on to this computer.
	An unexpected error occurred.
A0421100	The invalidation list cannot be collected by the system.
A0421101	The detail information cannot be collected by the system.
A0421201	Please select the date.
	There are not the data of the day.
A0421202	Please select the month.
	There are not the data of the month.

8.5 Data Sets for Indication/Input

The vehicle weighing system stores data in several dataset. The stored data are to be structure as shown in table below.

1) Toll Office

Table 8.3 Data Set of Vehicle Weighing System (Toll Office)

Data Set <Screen No.>	Data Elements	Type	Digit	Set
Axle Load Measurement Data Set <A0411000>	Road Section ID	INT*	4	1
	Axle Load Scale Location ID	INT*	4	1
	Lane ID	INT*	2	1
	Vehicle Class	INT*	2	1
	Number of Axles	INT*	2	1
	Axle Load	INT*	2	10
	Maximum Axle Load	INT*	2	1
	Axle Load Status	INT*	2	1
	Serial Number of Vehicle	INT	5	1
	Date/Time	Datetime	≥14	1
Axle Load License Plate Data Set < A0411000>	Road Section ID	INT*	4	1
	Axle Load Scale Location ID	INT*	4	1
	Lane ID	INT*	2	1
	Roadside Equipment ID	INT*	4	1
	Captured License Plate Number	TXT	12	1
	Captured License Plate Image	IMG	var	1
	Serial Number of Vehicle	INT	5	1
	Date/Time	Datetime	≥14	1
Axle Load Management Data Set < A0412100>	Road Owner ID	INT*	4	1
	Road Section ID	INT*	4	1
	Axle Load Scale Location ID	INT*	4	1
	Lane ID	INT*	2	1
	Date/Hour of Record	TXT	10	1
	Number of Heavy Trucks	INT	5	1
	Number of Suspicious Trucks	INT	5	1
	Number of Overloaded Trucks	INT	5	1
	Axle Load Measurement Data Set	Set	var	N
	Axle Load Status	INT*	2	
	Serial Number of Vehicle	INT	5	
	Date/Time	Datetime	≥14	1

2) Regional Main Center

Table 6.4 Data Set of Vehicle Weighing System (Regional Main Center)

Data Set <Screen No.>	Data Elements	Type	Digit	Set
Axle Load Measurement Data Set < A0421101>	Road Section ID	INT*	4	1
	Axle Load Scale Location ID	INT*	4	1
	Lane ID	INT*	2	1
	Vehicle Class	INT*	2	1
	Number of Axles	INT*	2	1
	Axle Load	INT*	2	10
	Maximum Axle Load	INT*	2	1
	Axle Load Status	INT*	2	1
	Serial Number of Vehicle	INT	5	1
	Date/Time	Datetime	≥14	1
Axle Load License Plate Data Set < A0421101>	Road Section ID	INT*	4	1
	Axle Load Scale Location ID	INT*	4	1
	Lane ID	INT*	2	1
	Roadside Equipment ID	INT*	4	1
	Captured License Plate Number	TXT	12	1
	Captured License Plate Image	IMG	var	1
	Serial Number of Vehicle	INT	5	1
	Date/Time	Datetime	≥14	1
Axle Load Management Data Set < A0421100>	Road Owner ID	INT*	4	1
	Road Section ID	INT*	4	1
	Axle Load Scale Location ID	INT*	4	1
	Lane ID	INT*	2	1
	Date/Hour of Record	TXT	10	1
	Number of Heavy Trucks	INT	5	1
	Number of Suspicious Trucks	INT	5	1
	Number of Overloaded Trucks	INT	5	1
	Axle Load Measurement Data Set	Set	var	N
	Axle Load Status	INT*	2	
	Serial Number of Vehicle	INT	5	
	Date/Time	Datetime	≥14	1

9. Operation/Management Plan for Communication System

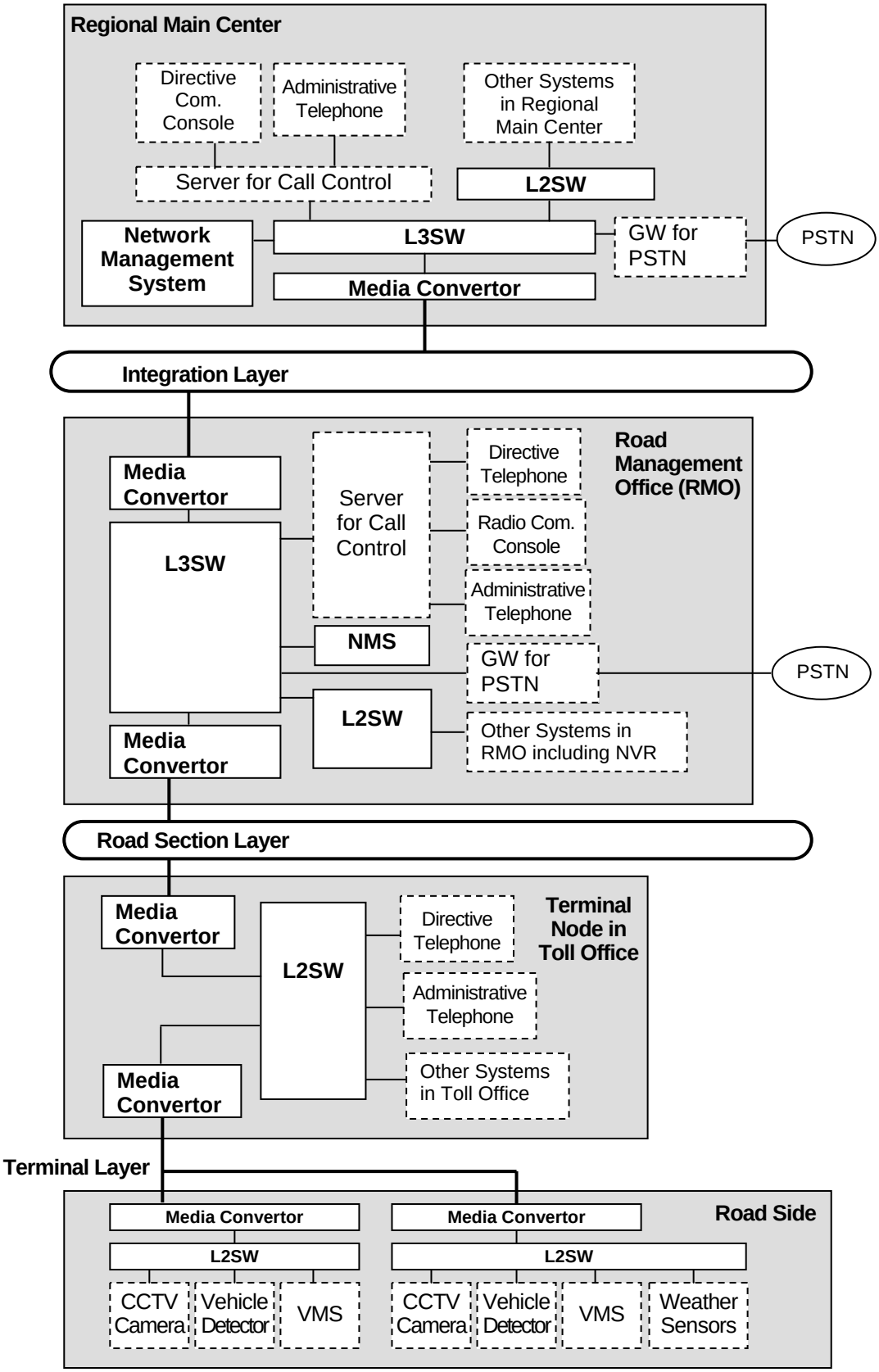
9.1 General

This system monitors a condition and resource and performance of communication network. In addition, this system switch network to redundant component automatically, and it tests communication line.

9.2 System Architecture

The system is to be composed as shown in the following system architecture.

Figure 9.1 System Architecture for Communication System



9.3 Screen Transition Diagram

1) Regional Main Center

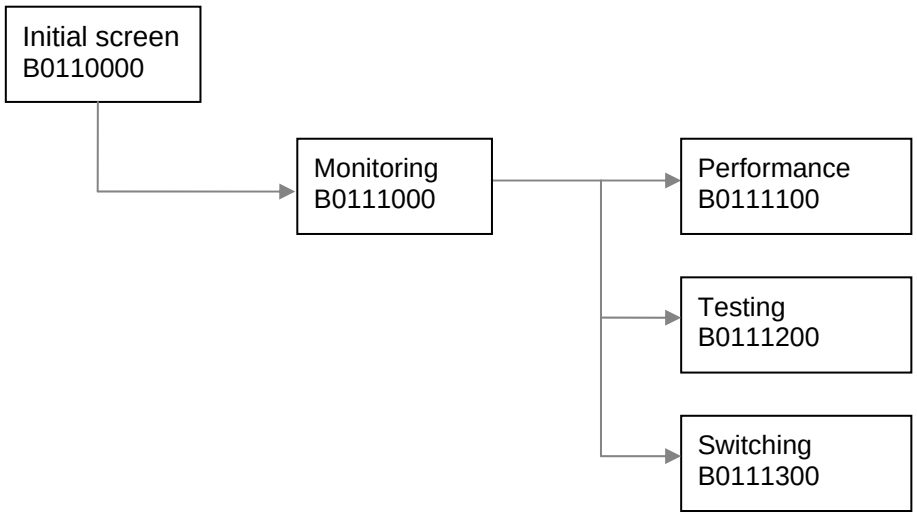
Initial screen is to indicates the Main Menu of the traffic event control and information.

Initial screen
B0110000

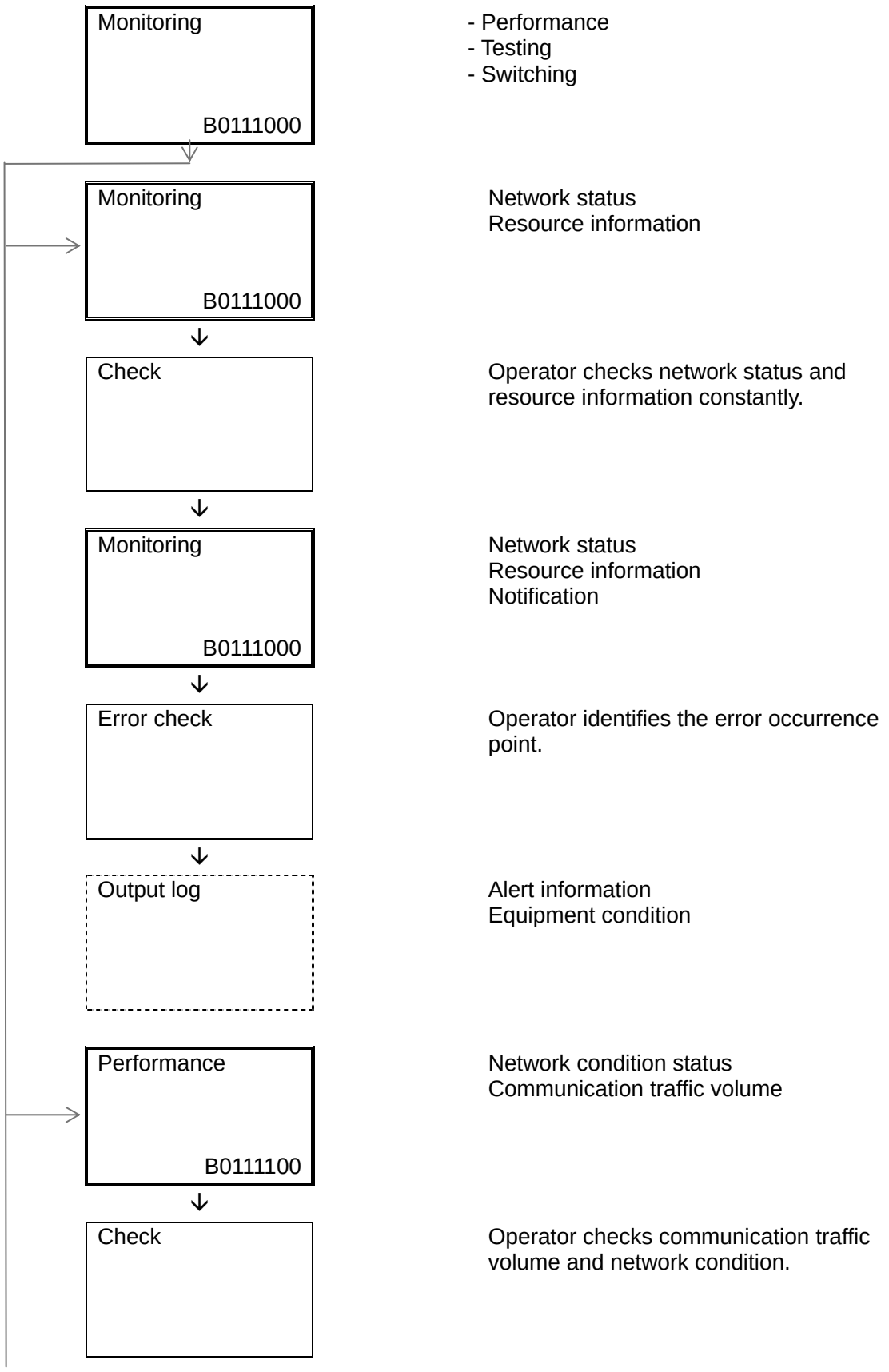
Main Menu
- Network monitoring

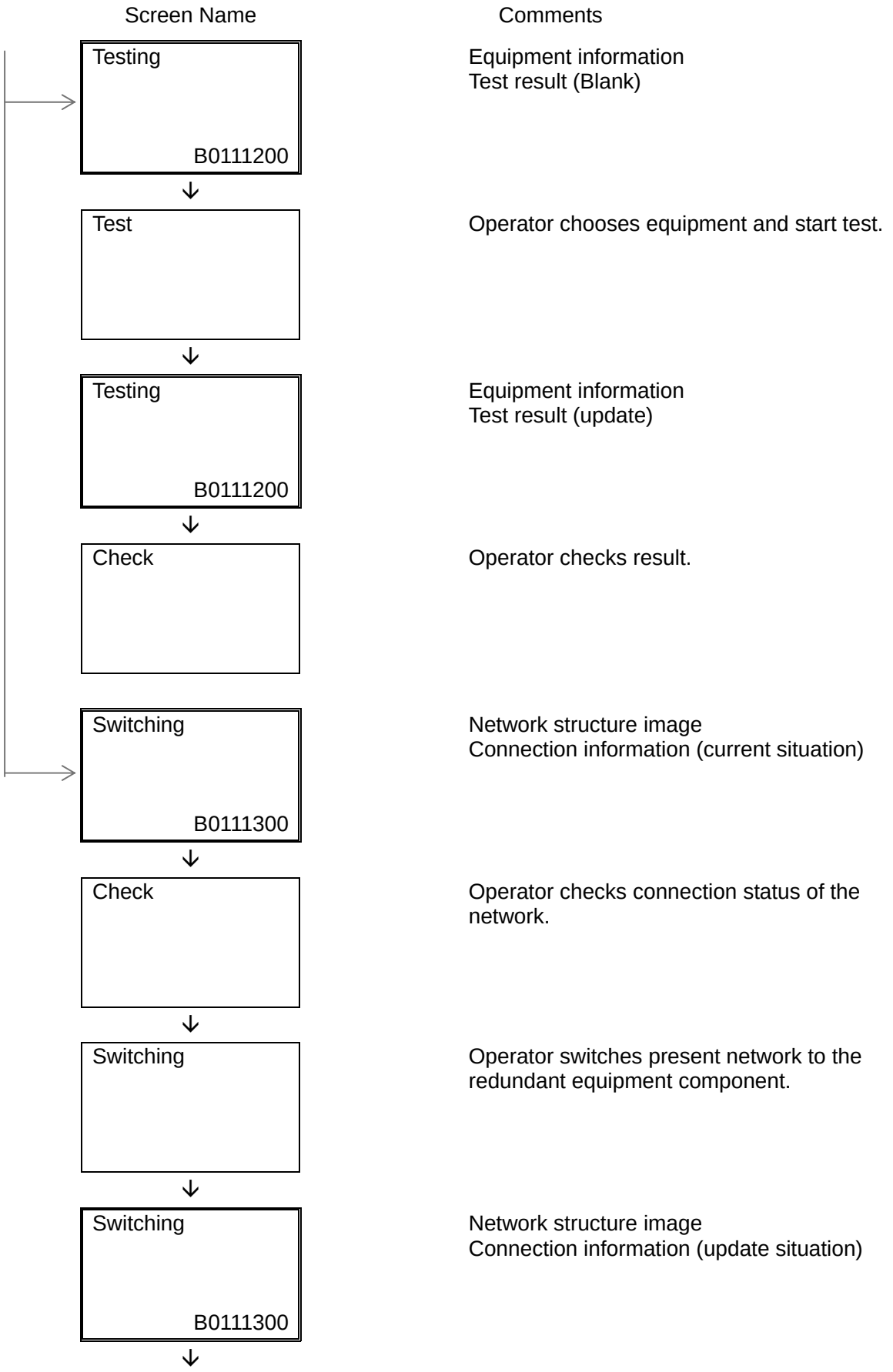
a. Network monitoring
This screen displays status of the network connection and resource. About performance and testing and switching, is displayed as additional screen.

Figure 9.2 Screen Transition Diagram of Regional Main Center Console



a. Network monitoring




Screen Name
Comments
Testing
B0111200
Equipment information
Test result (Blank)
Test
Operator chooses equipment and start test.
Testing
B0111200
Equipment information
Test result (update)
Check
Operator checks result.
Switching
B0111300
Network structure image
Connection information (current situation)
Check
Operator checks connection status of the network.
Switching
Operator switches present network to the redundant equipment component.
Switching
B0111300
Network structure image
Connection information (update situation)

Screen Name	Comments
↓	
Check	Operator checks the network switched.

9.4 Comment Indication

The network management system displays a message on screen at every processing. A list of comments to be indicated on each screen is shown in table below.

Table 9.1 Comments Indication for Network Management System

Screen Number	Comment Indication
B0110000	Getting network information.
	The network information cannot be collected by the system.
	Logon failure: unknown user name or bad password.
	Logon failure: user not allowed to log on to this computer.
	An unexpected error occurred.
B0111000	The network is operating successfully.
	The error on the network occurred.
	Access is denied.
B0111100	The network is operating successfully.
	There is heavy load on the network.
	A network was disconnected.
B0111200	The system is sending test data to all equipment components.
	The test was completed successfully.
	Access is denied.
B0111300	The network is switched.
	The network switched redundant equipment component successfully.
	Access is denied.

9.5 Output Log

The network management system outputs several log. The format of the log file is output by a file name called "***.log" with a text format. Contents of each log file are to be output as shown in table below.

Table 9.2 Output Log of Network Management System

Log Name	Contents of Log	Type
Event Log	The system outputs normal information in this log file when the processing of the event is exactly finished.	TXT
Error Log	The system outputs the information in this log file when it detects an error in a network.	TXT
Test Log	The system outputs the result of the test function that an operator executed in this log file.	TXT
Performance Log	The system outputs performance information in this log file at regular interval	TXT
Security Log	The system outputs security information in this log file at regular interval in monitoring information of the outside connect.	TXT

10. Basic Policy on Training System Operation/Management

10.1 Objectives of Training

1) Background

The systems to be introduced under ITS Integration Project are Traffic Information/Control, Automated Toll Collection, and Axle Load Measurement which is considered high priority as ITS user services.

In order to start up smooth operation of those system and to ensure the sustainability of the cooperation outcome of the ITS Integration Project, the following training is required.

1) Training for instructor of expressway traffic control operator

2) Training for system operation and maintenance focusing on Traffic Information/Control

3) Training of lane control related to automated toll collection and axle road measurement

Although the traffic control system will be developed under the grant aid project by the government of Japan titled “The Project for Development of Traffic Control System for Expressway in Hanoi”, the Traffic Information/Control System to be introduced in the Northern Regional Main Center under the ITS Integration Project, is the first and not familiar system for the person who operates it as expressway traffic control operator basically. Upon the introduction of the traffic Information/Control System, operation guidance for each equipment component is required to implement by the contractor or manufacturer of the equipment component. However, in order to control expressway traffic timely and properly by the expressway traffic control operator, it is required to disseminate necessary information to the VMS or CSS based on the operator’s judgement on the basis of guidance provided by the Traffic Information/Control System which is processed by the collected information from the roadside equipment components.

For realizing such conditions, the following training is required to implement for smooth operation start-up, and ensuring sustainability of cooperation result to be achieved under the ITS Integration Project. The training is recommended to implement for the following two stages.

a) The first Stage: Basic program for expressway traffic control operator, system maintenance staff, and other related organizations staff

b) The Second Stage: advanced program of on the job training basis for expressway traffic control operator to be advised by the expert of expressway traffic control

The expressway traffic control operator will enhance his capability through actual traffic control experience using the Traffic Information/Control System. However, it is necessary to get the advice from the traffic control expert during actual operation for more precise traffic control capability. In fact in Japan, the expressway traffic control operator is trained through such process. Furthermore such advice becomes more important during rainy season since traffic accident increases during such season. In order to ensure the sustainability of

the cooperation outcome of the ITS Integration Project, the cooperation on advice by the expert during traffic control operation is required.

As for the training for operation and maintenance, it is necessary for operator who faces failure of the system or who find extraordinary data to be able to operate the system properly. It is different from the initial operation guidance to be provided by the manufacturer of the equipment components.

For the training of lane control, it is necessary for the driver who is not familiar to pass toll gate or axle load scale to guide the lane, or in order to prevent to pass the fraudulence driver.

2) Objectives

The objectives of the training are shown below, which are to be specified for individual training items based on the manuals. The list of manuals to be provided by the contractor are shown in the following chapter.

(1) Training on Traffic Control of Expressway

The objective of this training is basic knowledge transfer for the operator of traffic information/ control system responding to the occurrences of incidents for first stage, and enhancement of capability of traffic control for second stage through the process of obtaining advice from traffic control expert during actual traffic control operation in rainy season.

(2) Training on System Operation/Maintenance

The objective of this training is basic knowledge transfer for the responsible staff of system operation and maintenance. The targets are the traffic information/control system, the automated toll collection system and the vehicle weighing system.

(3) Training on Lane Operation

The objective of this training is basic knowledge transfer for the responsible staff on the lane operation for toll collection and vehicle weighing. The target includes the drivers who are not familiar to pass the toll gate and how to prevent the passage of fraudulence driver.

10.2 Training Program

1) Training Items/Contents

The training program is shown below. As for the program (1) to (4), it is planned mainly for the subjects for traffic control staff, and for the program (5) to (9), it is planned mainly for lane operation staff. As for the program (10) to (11), it is planned for the system maintenance staff.

The second stage training is planned for further skill enhancement for traffic control staff. The training will be implemented on the job training basis with obtaining advice from traffic control expert. This stage trainee should master the program (1) to (3) shown in the following table in advance at least.

Table 10.1 Training Items/Contents

Training Items	Contents of Program
(1) Proper monitoring and judging gravity of incident using roadside equipment of Traffic Information/ Control System	- Explanation on Expressway Operation Framework using ITS - Instruction by manual on the basic knowledge of Traffic Control System such as information/data collection, information/data processing, information dissemination, and implementation of related exercise - Instruction by manual on the method of event judgement, event recording, and record management, and implementation of related exercise - Instruction on utilization method of data generated by image recognition function using CCTV camera, and implementation of related exercise - Review of manuals or related format according to the training above if necessary - Guidance for technology transfer from trained staff to other staffs
(2) Proper operation of data management and exchange among expressway operators using Traffic Information/ Control System	- Explanation on Expressway Operation Framework using ITS - Instruction by manual on traffic event data management and exchange, and implementation of related exercise - Instruction by manual on event category, event class, criteria of enforcing traffic regulation, and how to make data correlation, and implementation of related exercise - Review of manuals or related format according to the training above if necessary - Guidance for technology transfer from trained staff to other staffs
(3) Proper operation of incident clearance in cooperation with related organizations using Traffic Information/ Control System	- Explanation on Expressway Operation Framework using ITS - Instruction by manual on information distributing procedure and method among related organizations based on the event category which is generated by Traffic Information/Control System, and implementation of related exercise - Instruction on operation of information dissemination equipment components such as VMS controller based on the confirmation result among related organization, and implementation of related exercise - Instruction by manual on record of communication between related organization, record of operation of information dissemination equipments, and implementation of related exercise - Review of manuals or related format according to the training above if necessary - Guidance for technology transfer from trained staff to other staffs

Training Items	Contents of Program
(4) Proper operation of information dissemination in cooperation with related expressway sections using Traffic Information/ Control System	- Explanation on Expressway Operation Framework using ITS - Instruction by manual on information distributing procedure and method among related organizations based on the event category which is generated by Traffic Information/Control System, and implementation of related exercise - Instruction on operation of information dissemination equipment components such as VMS controller based on the confirmation result among related organization, and implementation of related exercise - Instruction by manual on record of communication between related organization, record of operation of information dissemination equipments, and implementation of related exercise - Review of manuals or related format according to the training above if necessary - Guidance for technology transfer from trained staff to other staffs
(5) Proper tollgate lane operation for toll collection under usage of ETC and Touch&Go System	- Instruction of skill on vehicle guidance to the lane of ETC, Touch&Go, and manual at toll gates. - Instruction of skill on proper handling for fraudulence vehicle - Review of manuals or related format according to the training above if necessary - Guidance for technology transfer from trained staff to other staffs
(6) Proper operation of handling the vehicle with balance shortage or without OBU under usage of ETC System	- Instruction of skill on identifying and stopping vehicle with balance shortage or without OBU under usage of ETC System going into lane. - Instruction of skill on futher processing of fraudulence vehicle - Review of manuals or related format according to the training above if necessary - Guidance for technology transfer from trained staff to other staffs
(7) Proper operation of IC-card issuance/ invalidation and toll settlement in cooperation with a bank	- Instruction of skill on managing IC-card issuance information in cooperation with a bank. - Instruction of skill on managing IC-card invalidation information in cooperation with a bank. - Instruction of skill on toll settlement in cooperation with a bank - Review of manuals or related format according to the training above if necessary - Guidance for technology transfer from trained staff to other staffs

Training Items	Contents of Program
(8) Proper operation of OBU registration/ invalidation in cooperation with related organizations	- Instruction of skill on managing OBU registration information in cooperation with related organization. - Instruction of skill on managing OBU invalidation information in cooperation with related organization. - Review of manuals or related format according to the training above if necessary - Guidance for technology transfer from trained staff to other staffs
(9) Proper lane operation for overloading regulation under usage of Axle Load Scale	- Instruction of skill on heavy truck guidance to the axle load scale lane at toll gates. - Instruction of skill on proper handling for fraudulence vehicle - Review of manuals or related format according to the training above if necessary - Guidance for technology transfer from trained staff to other staffs
(10) Proper integrated management on data from Traffic Information/Control, Toll Collection and Vehicle Weighing	- Instruction on data formation, data storage and implementation of related exercise - Instruction on utilization method of data from Traffic Information/Control, Toll Collection and Vehicle Weighing and implementation of related exercise - Review of manuals or related format according to the training above if necessary - Guidance for technology transfer from trained staff to other staffs
(11) Proper/prompt recovery work of the system by identifying fault location on the communication network of ITS	- Confirmation of maintenance manual and various types of forms handed over by the contractor or manufacturer of each delivered equipment component - Instruction by manual on monitoring various types of equipment components, maintenance work in normal operation time, periodical check & cleaning work, and preparation of record of maintenance activities, and implementation of related exercise using installed equipment components - Instruction on trouble shooting method such as recovery method, and deletion method of outlier data when system failure or fault occurs during normal operation and monitoring conditions of the system, and implementation of related exercise using installed equipment components - Instruction on trouble shooting method such as fault location and investigation method, recovery method of failure when IP network system failure or fault is detected, and implementation of related exercise using installed equipment components - Review of manuals or related format according to the training above if necessary - Guidance for technology transfer from trained staff to other staffs

2) Target Trainees

The trainees and related training item of each trainee is shown below.

Table 10.2 Trainees for Training Items

Training Items	Trainee	
(1) Proper monitoring and judging gravity of incident using roadside equipment of Traffic Information/Control System	Regional Main Center	- Manager - Operator
	Road management office	- Manager - Operator - Patrol crews
(2) Proper operation of data management and exchange among expressway operators using Traffic Information/ Control System	Regional Main Center	- Manager - Operator
	Road management office	- Manager - Operator - Patrol crews
(3) Proper operation of incident clearance in cooperation with related organizations using Traffic Information/Control System	Regional Main Center	- Manager - Operator
	Road management office	- Manager - Operator - Patrol crews
(4) Proper operation of information dissemination by VMS in cooperation with related expressway sections using Traffic Information/Control System	Regional Main Center	- Manager - Operator
(5) Proper tollgate lane operation for toll collection under usage of ETC and Touch&Go System	Toll office	- Toll manager - Toll collector
(6) Proper operation of handling the vehicle with balance shortage or without OBU in ETC Lane	Toll office	- Toll manager - Toll collector
(7) Proper operation of IC-card issuance/ invalidation and toll settlement in cooperation with a bank	Toll office	- Toll manager - Toll operator
	Bank	- Operator
(8) Proper operation of OBU registration/ invalidation in cooperation with related organizations	Toll office	- Toll manager - Toll operator
	OBU Management Center	- Operator
(9) Proper lane operation for overloading regulation under usage of Axle Load Scale	Toll office	- Traffic inspector - Measurement operator
(10) Proper integrated management on data from Traffic Information/Control, Toll Collection and Vehicle Weighing	Regional Main Center	- Manager
(11) Proper/prompt recovery work of the system by identifying fault location on the communication network of ITS	Regional Main Center	- Operator - Maintenance crews
	Road management office	- Operator - Maintenance crews
	Toll office	- Toll operator - Measurement operator

3) Instruction Method

The instruction is made by lecture and exercise using Traffic Information/Control System to be installed under the ITS Integration Project basically. The reference is made to the manuals or forms to be prepared for this training program, the framework of expressway operation described in the Study Report, and other necessary documents prepared by the lecturer for system maintenance and lane control.

The manuals or forms to be used for the training shall be translated into Vietnamese. The English/Vietnamese interpreter shall be present during training time.

10.3 Implementation Schedule of Training

It is recommended to implement 1 to 2 months for the first stage after completion of ITS Integration Project. For the second stage, it is recommended to implement approximately 1.5 month during incident prone period such as rainy season.

11. Basic Policy for System Maintenance

The policy for system maintenance is to be described as follows:

- To prepare the Maintenance Schedule and the Maintenance Manual for all equipment components and devices included in the Traffic Information/Management System, the Automated Toll Collection/Management, the Vehicle Weighing System and the Communication System, and to perform the maintenance base on them.
- To perform periodic maintenance on the server system in the Regional Main Center, the road management offices and the toll offices to ascertain the good condition without abnormalities.
- To make a backup of all the data stored in the server system using suitable recording media. Additionally, to check missing of detected data, to restore the lost data and to maintain the availability of the data.
- To store needed quantity of consumables to ensure continuous operation of the system.
- To perform visual observation of roadside equipment included in the Traffic Information/ Management System, the Automated Toll Collection/Management and the Vehicle Weighing System by routine patrol to ascertain the good condition without any damage/ abnormalities on the roadside equipment proper or the base structure.
- To perform visual observation of the Communication System by routine patrol, as well as detection by NMS (Network Management System), to ascertain the good condition without any damage/abnormalities on the cable, the communication node or the duct.
- To make contact/inquiry from the Regional Main Center to the road management offices, in the case that an abnormality is identified remotely in the Regional Main Center including the case of detection by NMS, to confirm the existence of reason on the road section layer.
- To make report from the road management office to the Regional Main Center in the case that an abnormality is identified in the road management office including the case of detection by NMS.

12. Equipment Operation Manual List

12.1 Essential Points of Equipment Operation Manual

The following decision is provided as the manual for essential points of equipment operation:

- Decision No.2452/QD-BGTVT “Approving Alternatives for Management and Temporary Exploitation of Cau Gie – NH 21 Section, the Expressway Cau Gie – Ninh Binh

12.2 Manual List for Traffic Information/Control System

The manuals for the following equipment components are to be provided by the contractor at the commissioning of the system.

- CCTV Camera PTZ type
- CCTV Camera FIX type
- Media Converter
- Network Video Recorder
- Monitor Screen
- Data Server
- Monitor Controller
- Video Management Software
- Image Recognition Boad
- Image Recognition Software
- Loop-Coil Vehicle Detector
- Loop-Coil Controller
- Data Logger for Vehicle Detection
- Media Converter for Loop-Coil Vehicle Detector
- Traffic Volume Calcuration Software
- Travel Speed / Congestion Calculation Software
- Collection / Accumulation Software for Traffic Analysis
- Backup Media Drive
- Rain-Gauge
- Wind Sensor
- Visibility Sensor
- Thermometer
- Data Logger for Weather Monitoring
- Data Collection / Accumulation & Alert Isssue
- UPS
- Compiling of Traffic Event Data Software
- Printer
- Collection / Accumulation Software for Traffic Event Data Management
- Generation of Data for Dissemination Software
- Multi Display Control Software
- Multi Display Graphic Board

- Monitor Controller for Traffic Supervision
- Collection / Accumulation Software for Traffic Supervision
- Mobile Data Input Terminal
- Collection / Accumulation Software for VMS Identification
- VMS / CSS Controller Software
- Web Server for Traffic Information
- Collection / Accumulation / Dissemination Software for Traffic Information

12.3 Manual List for Automated Toll Collection/Management System

The manuals for the following equipment components are to be provided by the contractor at the commissioning of the system.

- CCTV Camera for Image recognition
- Barcode Reader
- Text Data Indication Processor
- Monitor Screen
- Printer
- Data Server
- CCTV Camera
- Image Recognition Board
- Image Recognition Software
- Management of Vehicle Identification Software
- Entry-Card Issuer
- Toll Due / Paid Sign
- Stop / Go Sign
- Barrier
- Barrier Switch
- Lane Control / Management Software
- OBU
- Roadside Antena
- Roadside Controller
- IC-Card Reader / Writer
- IC-Card Controller
- Management Software for Toll
- Backup Media Drive
- UPS
- OBU Registration Terminal
- OBU Registration Software
- OBU Management Software

12.4 Manual List for Vehicle Weighing System

The manuals for the following equipment components are to be provided by the contractor at the commissioning of the system.

- Barrier Switch
- Data Server
- Measure and Calculation Software for Vehicle Load
- Overloading Determination & Management Software
- Alert for Overliading Management

12.5 Manual List for Communication System

The manuals for the following equipment components are to be provided by the contractor at the commissioning of the system.

- Switching HUB
- Administrative Telephone
- Server for Call Control
- GW for PSTN
- Terminal for Directive Communication
- Layer 3 SW
- Layer 2 SW
- Network Management System for Integration Layer
- Radio Communication Console
- Base Station for Radio Communication
- Radio Communication Terminal