

A1.8 Heavy/Hazardous-material Truck Tracking

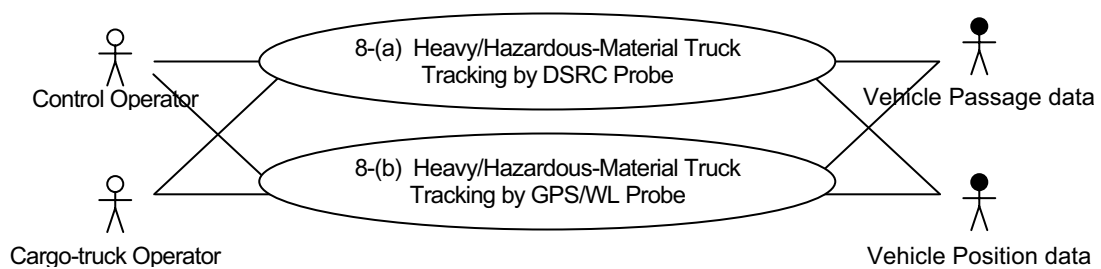
1) Service Requirements and Use Cases

(1) 2nd Stage

- (i) Notification to the road operator at the coming of the heavy/hazardous-material truck into the expressway network,
- (ii) Tracking the actual driving route of the heavy/hazardous-material truck and the section where the truck exists,
- (iii) Identification of the management office in charge of response/clearance of the incident caused by the heavy/hazardous-material truck,
- (iv) Information of the heavy/hazardous-material truck to the management office in case of incident,
- (v) Information of actual position of the truck to the cargo-truck operators,
- (vi) Provision of heavy/hazardous-material truck data to the road operator at the occurrence of the accident.

The following two alternative use cases are to be considered in the discussion.

Figure A1.8.1 Use Case Diagram of Heavy/Hazardous-material Truck Tracking



Source: VITRANSS 2 Study Team

2) Message Sequence Diagram

The message sequence diagram (MSD) of the use cases above are shown in the following pages.

Figure A1.8-(a).MSD Heavy/Hazardous-Material Truck Tracking by DSRC Probe

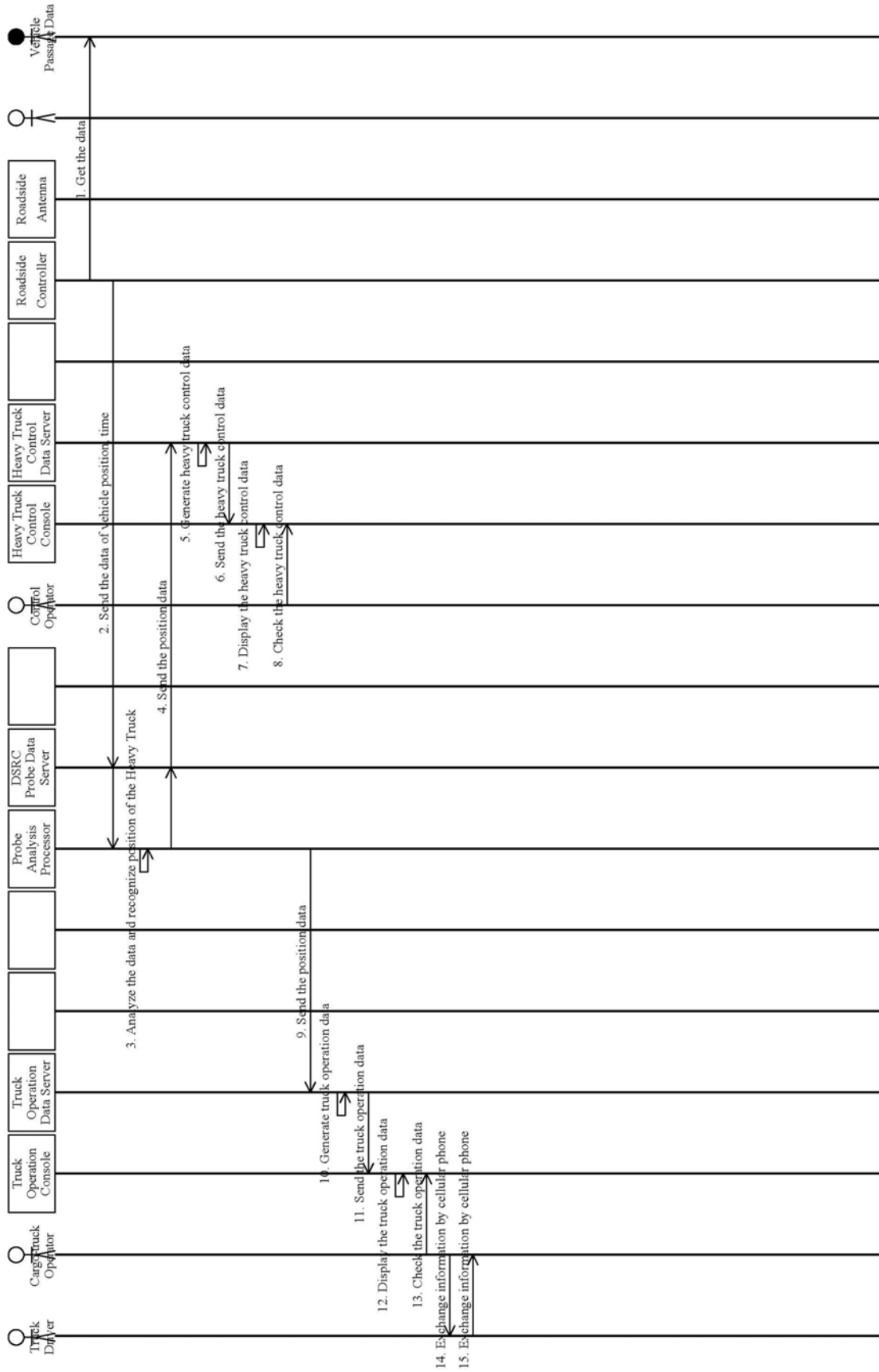
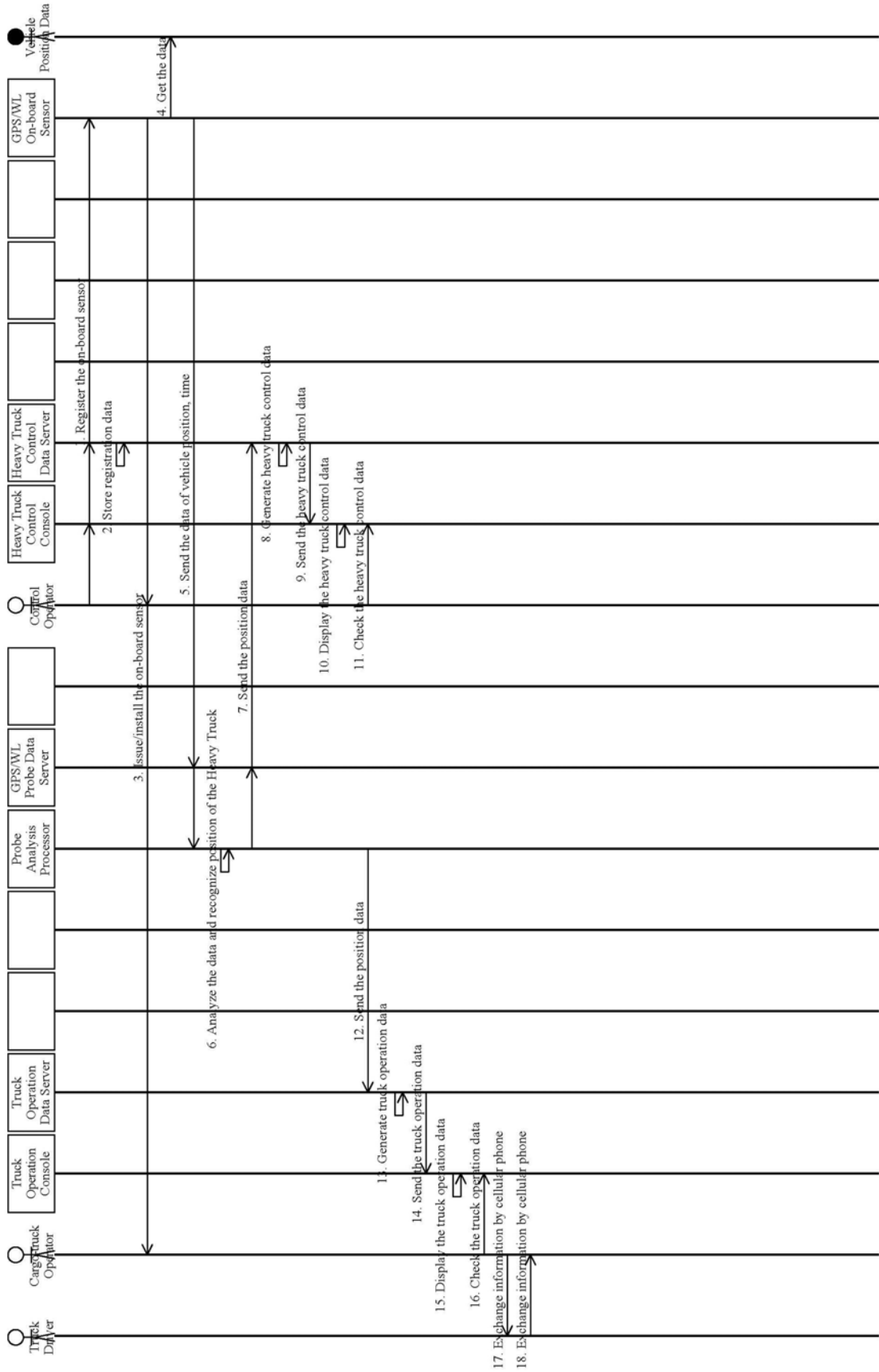


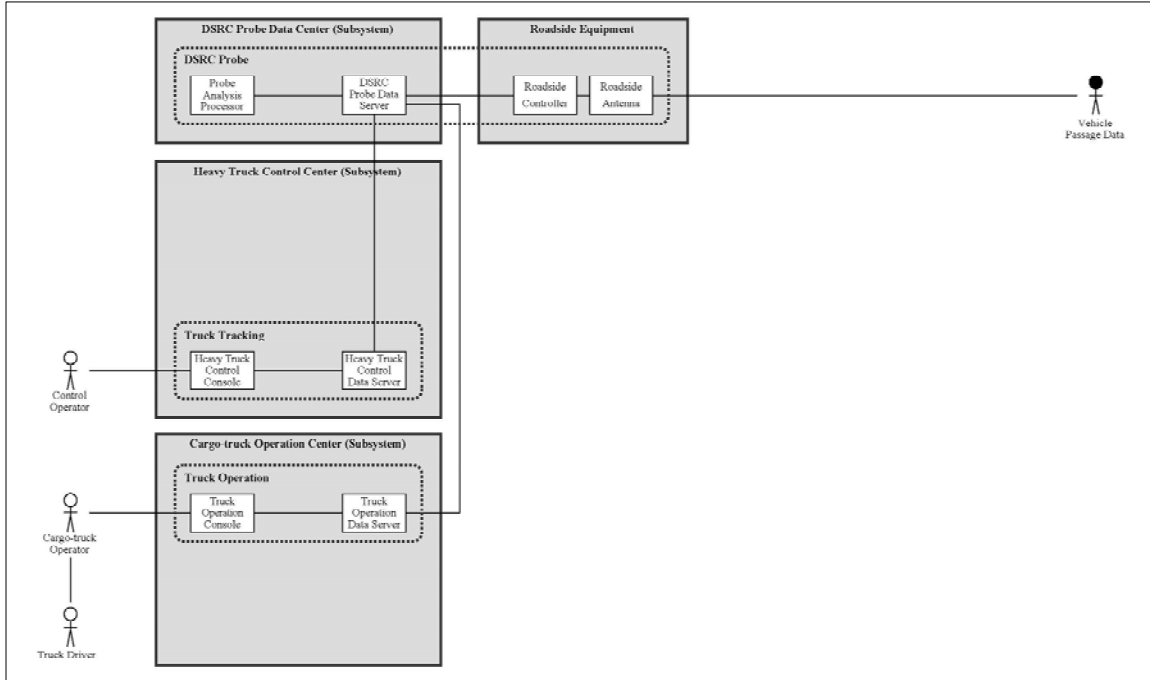
Figure A1.8-(b).MSD Heavy/Hazardous-Material Truck Tracking by GPS/WLC Probe



3) Collaboration Diagram with Functions/Installation

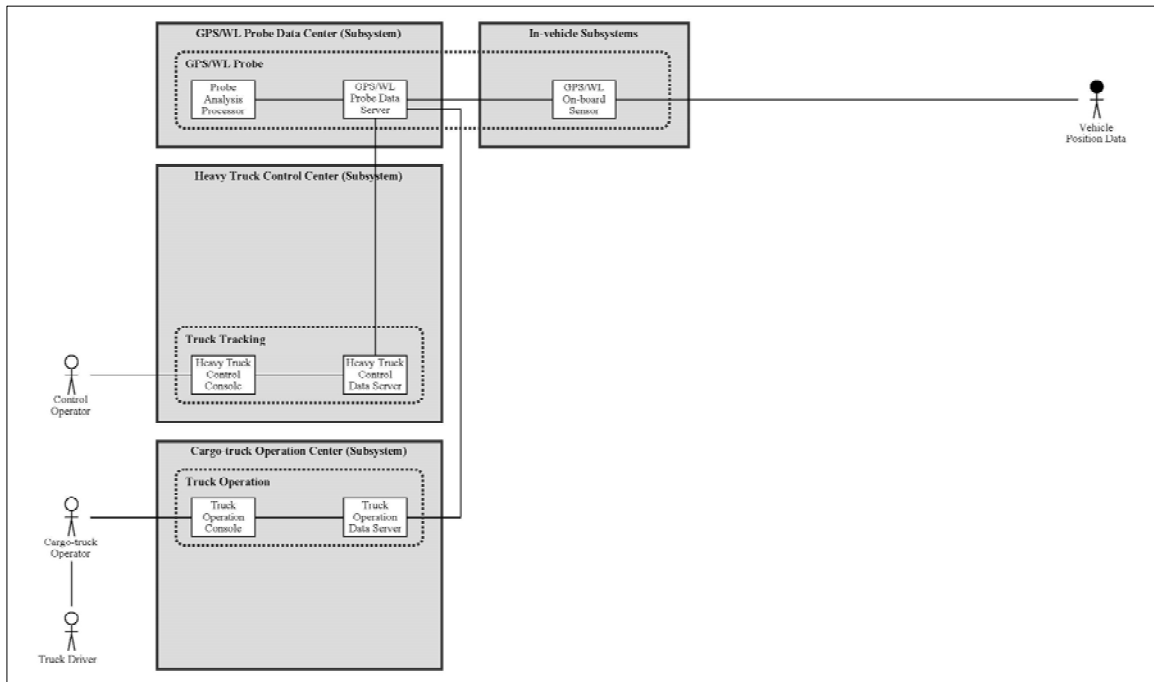
The collaboration diagrams (CD) are derived respectively from the message sequence diagrams aforementioned.

Figure A1.8-(a).CD Heavy/Hazardous-material Truck Tracking by DSRC Probe (Graded as “Recommended”)



Functions & Installation: 8-(a) by DSRC Probe		
Function	Equipment	Installation
DSRC Probe	Computer	DSRC probe data center (2 nd ~)
	Computer	DSRC probe data center (2 nd ~)
	Computer	Roadside (1 st ~ : every tollgate, 2 nd ~ : junction)
	Antenna	Roadside (1 st ~ : every tollgate, 2 nd ~ : junction)
Truck Tracking	Console	Heavy truck control center (1 st ~)
	Computer	Heavy truck control center (1 st ~)
Truck Operation	Console	Cargo-truck operation center (2 nd ~)
	Computer	Cargo-truck operation center (2 nd ~)

Figure A1.8-(b).CD Heavy/Hazardous-material Truck Tracking GPS/WL Probe (Graded as “Useful as a Complement”)



Functions & Installation: 8-(b) by GPS/WL Probe		
Function	Equipment	Installation
GPS/WL Probe	Computer	GPS/WL probe data center (2 nd ~)
	Computer	GPS/WL probe data center (2 nd ~)
	Sensor	In-vehicle (2 nd ~)
Truck Tracking	Console	Heavy truck control center (1 st ~)
	Computer	Heavy truck control center (1 st ~)
Truck Operation	Console	Cargo-truck operation center (2 nd ~)
	Computer	Cargo-truck operation center (2 nd ~)

A1.9 Center-to-center Data Exchange

1) Service Requirements and Use Cases

(1) Center-to-center Data Exchange for Incident Notification

(a) 1st Stage

- (i) Round-the-clock information reception of incident occurrence/situation/place at the traffic information/control center from the traffic police operation center,
- (ii) Round-the-clock prompt information provision of incident occurrence/situation/place from the traffic information/control center to the traffic police operation center and the emergency vehicle operation center.

(b) 2nd Stage

- (i) Provision of weather information from the traffic information/ control center to the traffic police operation center and the emergency vehicle operation center.

(2) Center-to-center Data Exchange for DSRC Probe

(a) 2nd Stage

- (i) Generating DSRC probe data at the DSRC probe data center using data from the toll management center and the road pricing operation center and excluding disturbing factors caused by the measurement,
- (ii) Provision of the generated data to the traffic information center, the cargo-truck operation center and the inter-city bus operation center,
- (iii) Data update every 15 minutes for provision.

(3) Center-to-center Data Exchange for GPS/WL Probe

(a) 2nd Stage

- (i) Generating GPS/WL probe data at the GPS/WL probe data center using data from the cargo-truck operation center and the inter-city bus operation center and excluding disturbing factors caused by the measurement,
- (ii) Provision of the generated data to the traffic information center, the cargo-truck operation center and the inter-city bus operation center,
- (iii) Data update every 15 minutes for provision.

(4) Center-to-center Data Exchange for Travel Information

(a) 1st Stage

- (i) Provision of traffic information (including incident, congestion and restriction) from the traffic information/control center to the traffic police operation center, the information provider center and the TV/Radio broadcasting center.

(b) 3rd Stage

- (i) Provision of congestion forecast information from the traffic information/control center to the traffic police operation center, the information provider center and the TV/Radio broadcasting center.

(5) Center-to-center Data Exchange for OBU Management

(a) 1st Stage

- (i) Storage of the OBU registration data in the center, which is transferred from the OBU shop where OBU is issued to the user and installed in the vehicle,
- (ii) Reception of the notification of lost OBU from the user to the OBU registration center,
- (iii) Transmission of the lost OBU list from the OBU registration center to the toll management centers of the road operators for invalidating the lost OBU over the whole expressways and other toll roads.

(6) Center-to-center Data Exchange for Toll Clearance

(a) 1st Stage

- (i) Toll clearance to be prepared for many different road operators over the whole expressways and other toll roads
- (ii) Toll clearance by using contact-less IC-card for prepayment,
- (iii) Issue/recharge of contact-less IC-card to be utilized conveniently in the city as well as the roadside,
- (iv) Adequate data exchange for toll clearance between the toll management center of the road operator and the prepayment service center such as the center of the bank,
- (v) Appropriate and reliable apportionment of the toll revenue among the road operators preventing unfair billings to the prepayment service center for establishing the sustainable toll clearance system,
- (vi) Stepwise establishment of the toll clearance system for enhancing convenience for the users.

(7) Center-to-center Data Exchange for IC-card Operation

(a) 1st Stage

- (i) Storage of the IC-card issue/recharge data in the prepayment service center for prevention of illegal recharge,
- (ii) Reception of the notification of lost IC-card from the user to the prepayment service center,
- (iii) Transmission of the lost IC-card list from the prepayment service center to the toll management centers of the road operators (through the clearing center) for invalidating the lost IC-card over the whole expressways and other toll roads.

(8) Center-to-center Data Exchange for Toll Enforcement Assistance

(a) 1st Stage

- (i) Framework for the assistance of toll enforcement based on the negative list,
- (ii) Negative list of the license plate numbers of the vehicles of unlawful passage without adequate toll payment responding to the vehicle classification,
- (iii) Negative list updated/stored by the OBU management center,
- (iv) Delivery of the negative list to all road operators and all toll management centers of the whole expressways and other toll roads every two hours.

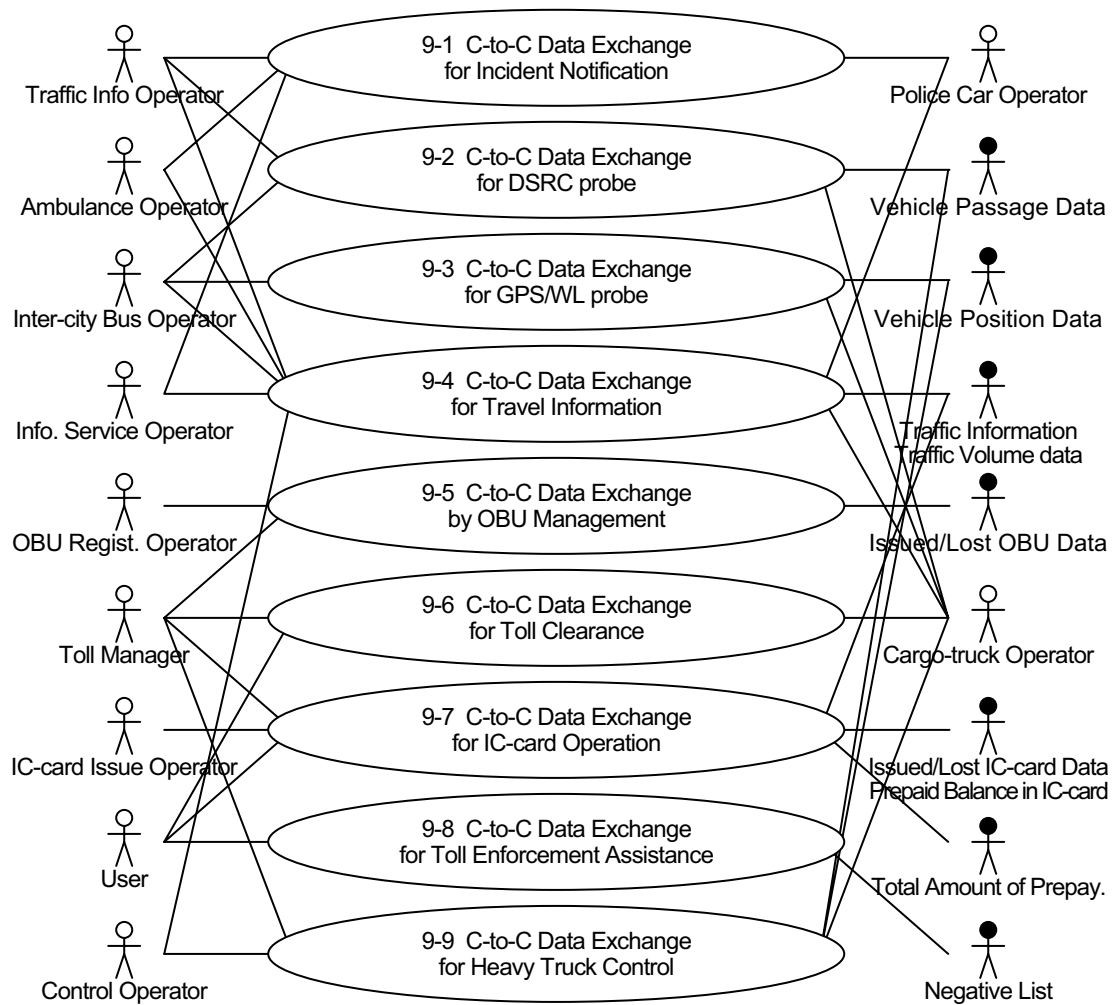
(9) Center-to-center Data Exchange for Heavy Truck Control

(a) 2nd Stage

- (i) Actual positioning data of the heavy/hazardous-material trucks generated in the centers of DSRC probe and GPS/WL probe,
- (ii) Provision of the positioning data to the centers of heavy truck control and cargo-truck operation.

The nine use cases responding to the service requirements above are to be considered in the discussion.

Figure A1.9.1 Use Case Diagram of Center-to-center Data Exchange



Source: VITRANSS 2 Study Team

2) Message Sequence Diagram

The message sequence diagram (MSD) of the use cases above are shown in the following pages.

Figure A1.9-1.MSD C-to-C Data Exchange for Incident Notification

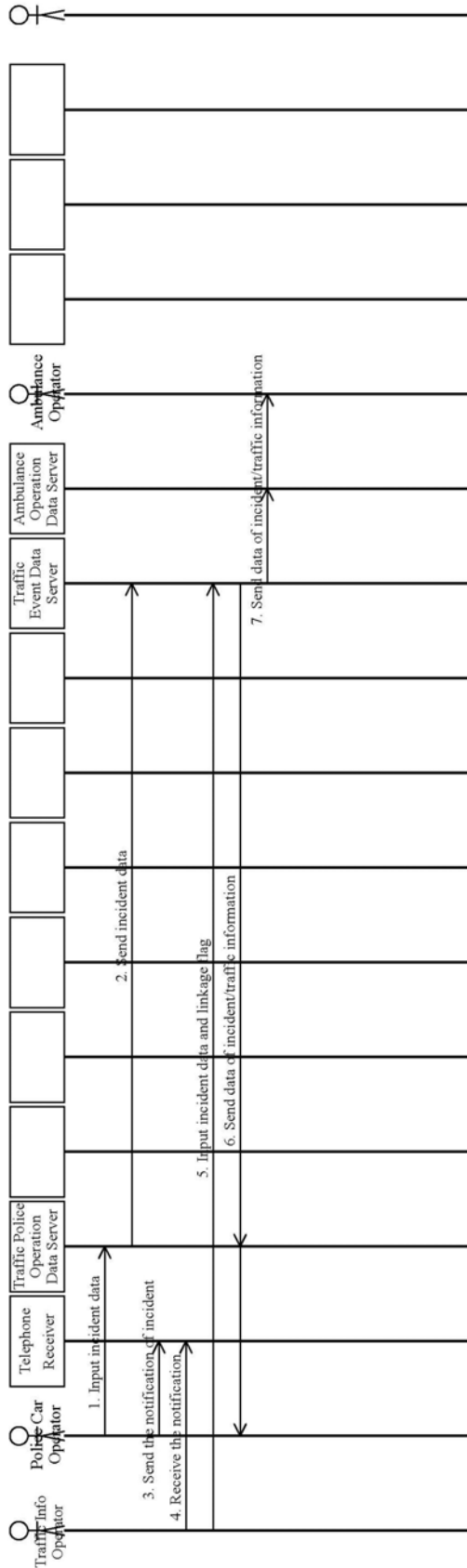


Figure A1.9-2.MSD C-to-C Data Exchange for DSRC Probe

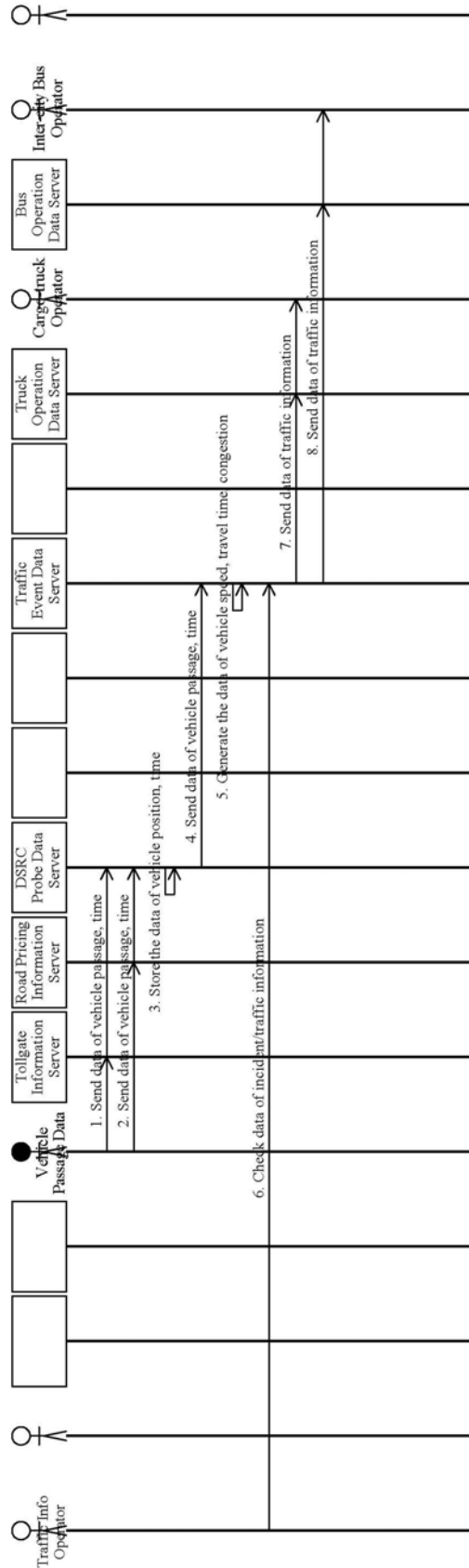


Figure A1.9-3.MSD C-to-C Data Exchange for GPS/WL Probe

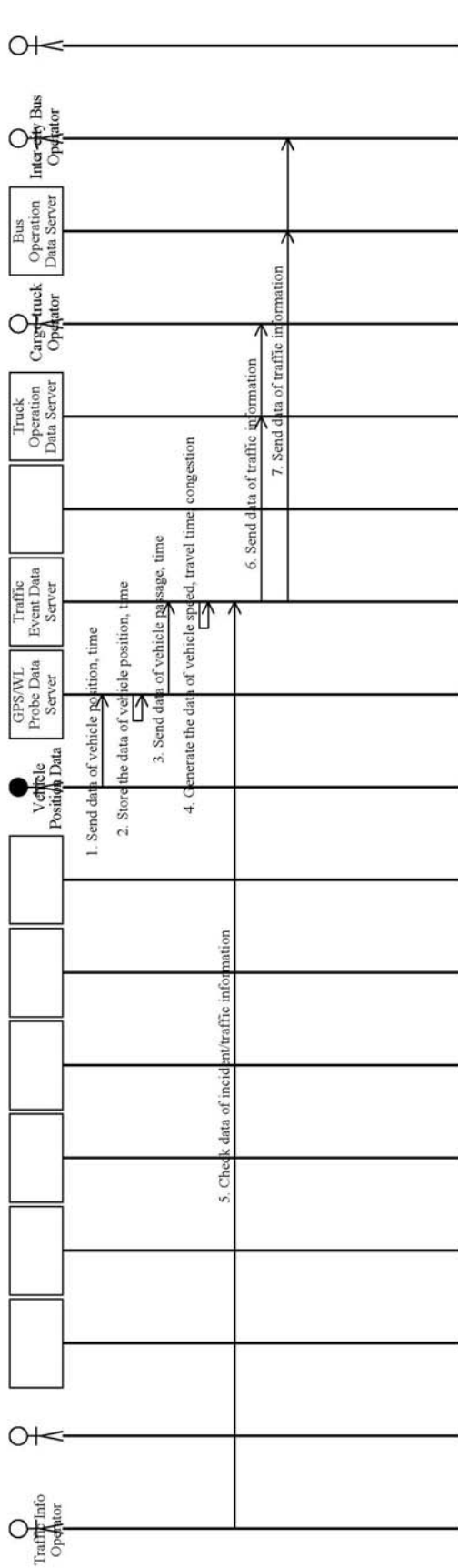


Figure A1.9-4.MSD C-to-C Data Exchange for Traffic Information

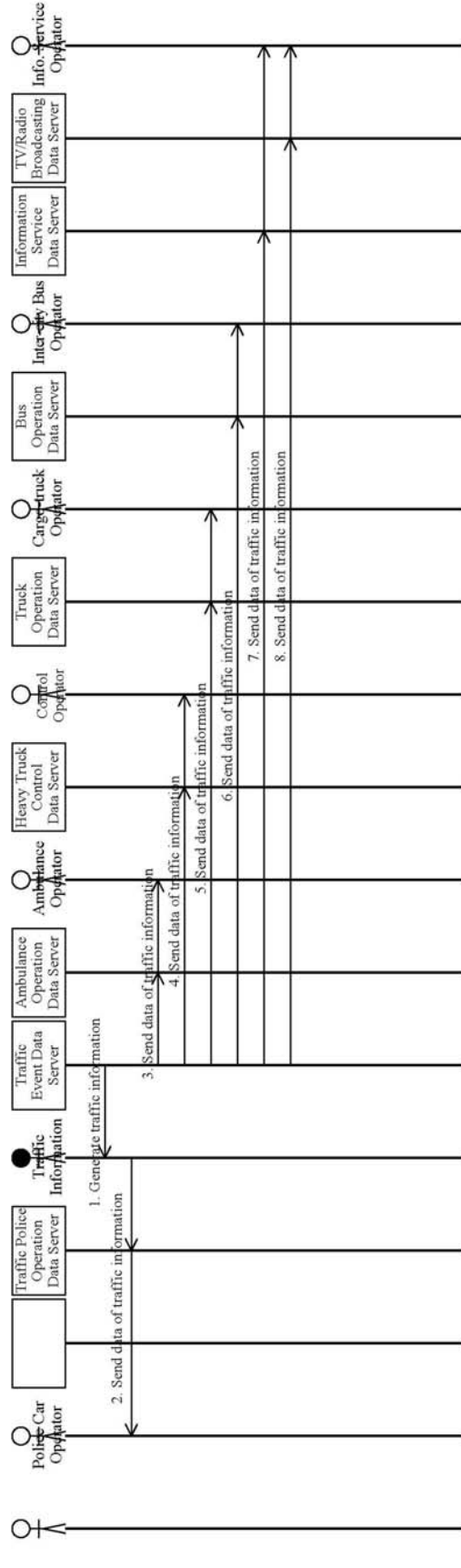


Figure A1.9-5.MSD C-to-C Data Exchange for OBU Management

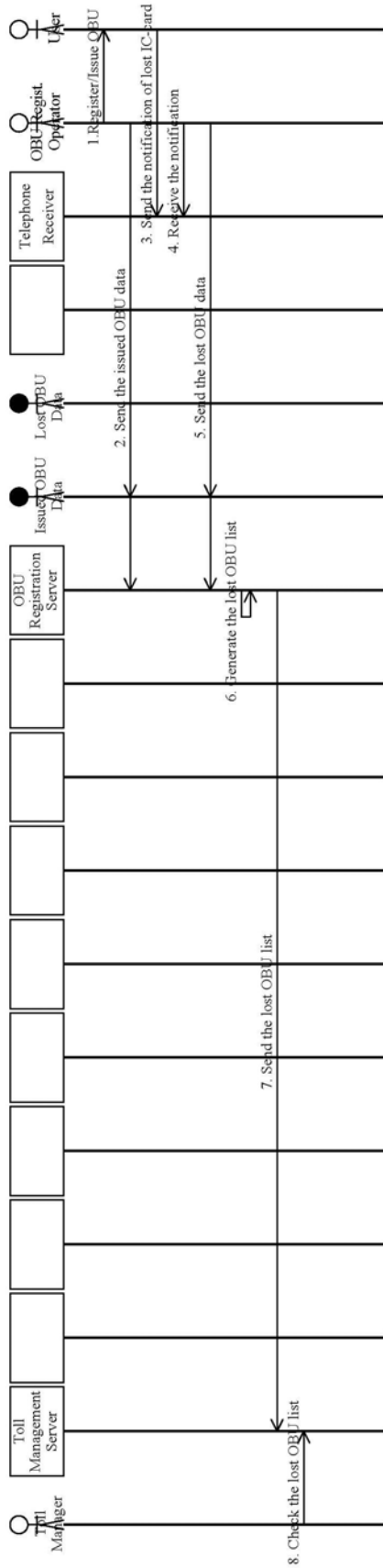


Figure A1.9-6.MSD C-to-C Data Exchange for Toll Clearance

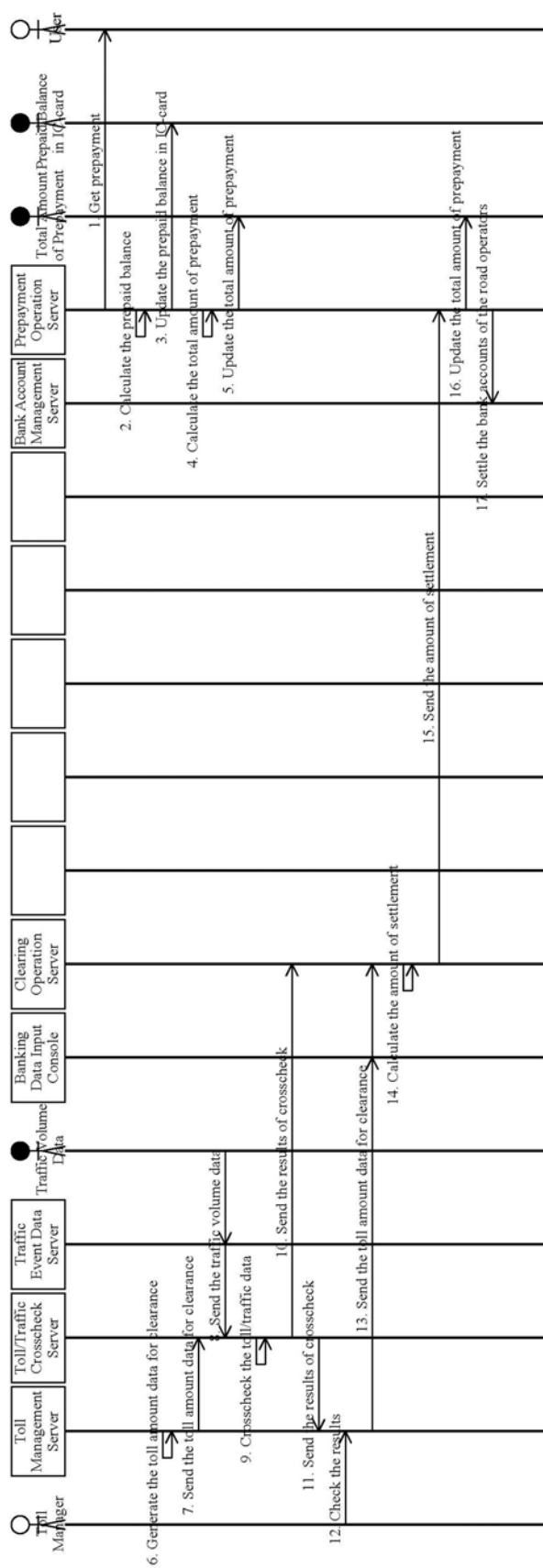


Figure A1.9-7.MSD C-to-C Data Exchange for IC-card Operation

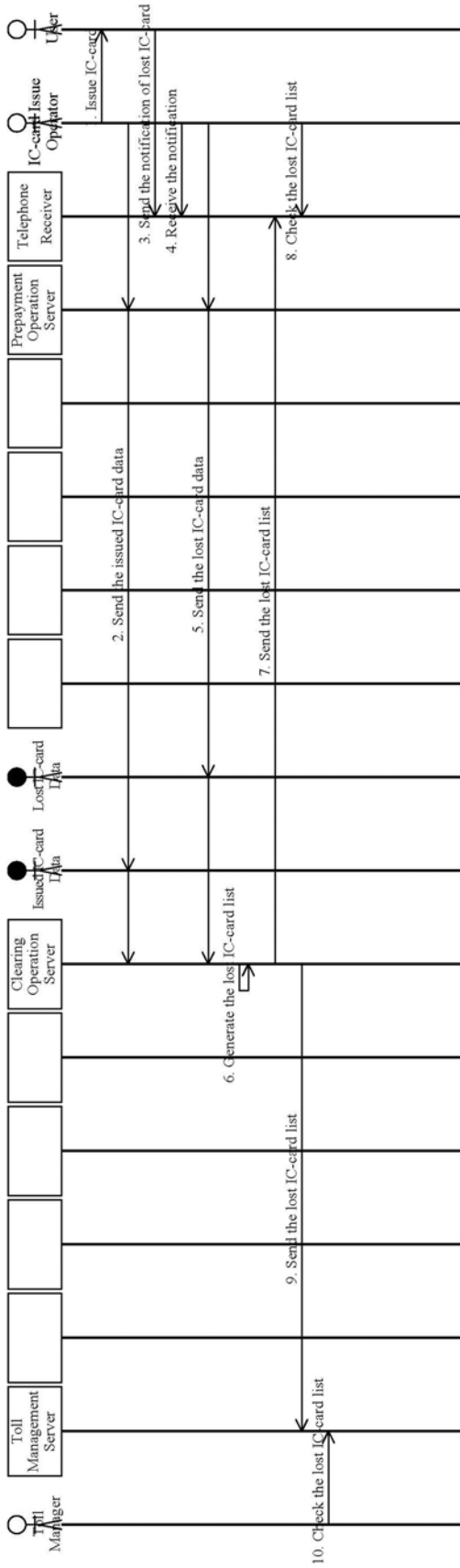


Figure A1.9-8.MSD C-to-C Data Exchange for Toll Enforcement Assistance

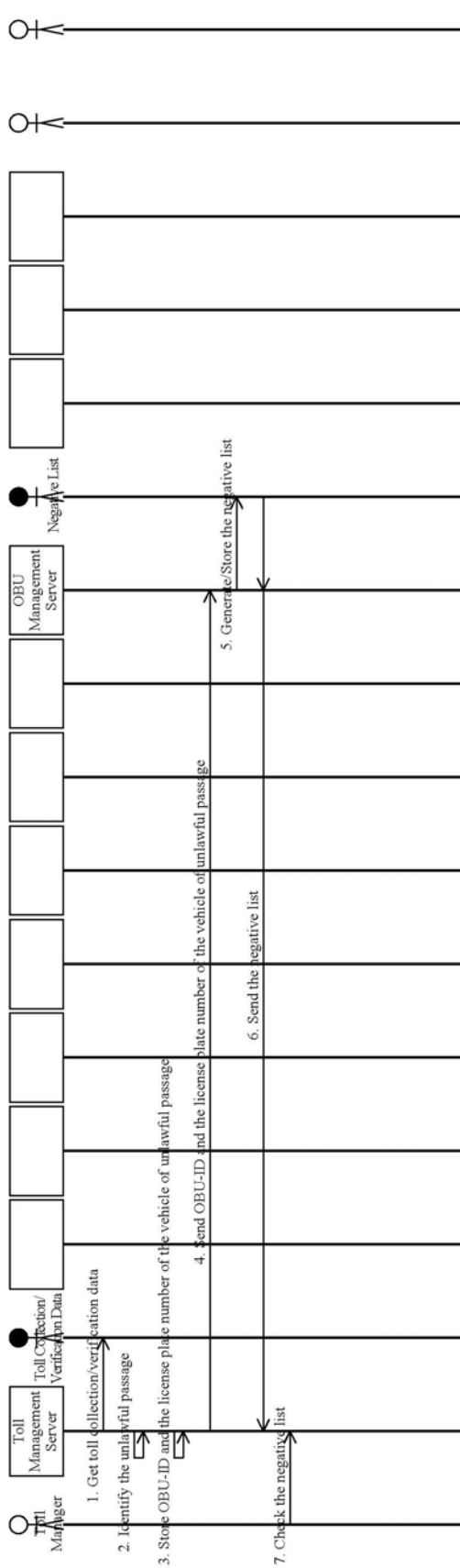
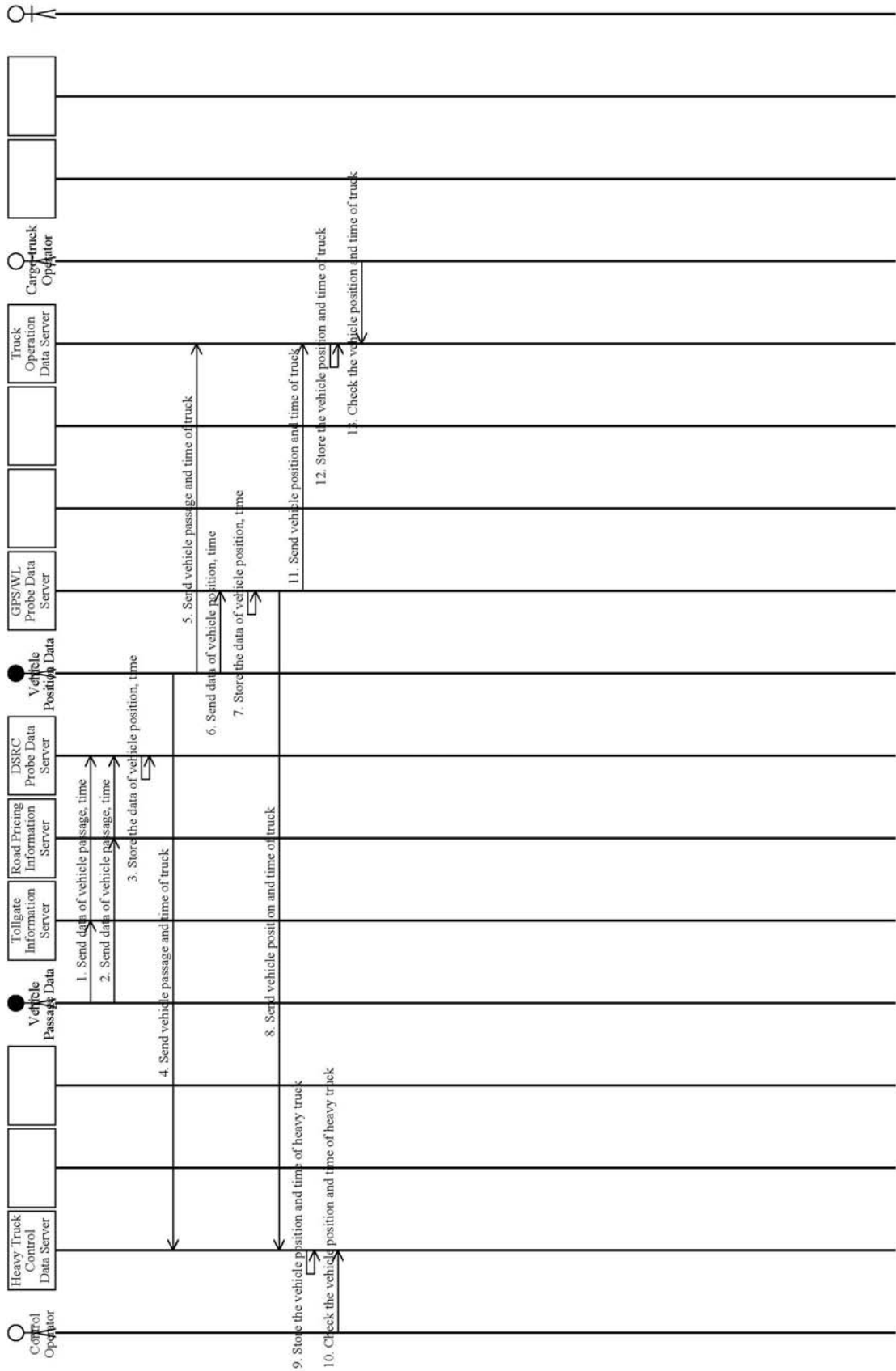


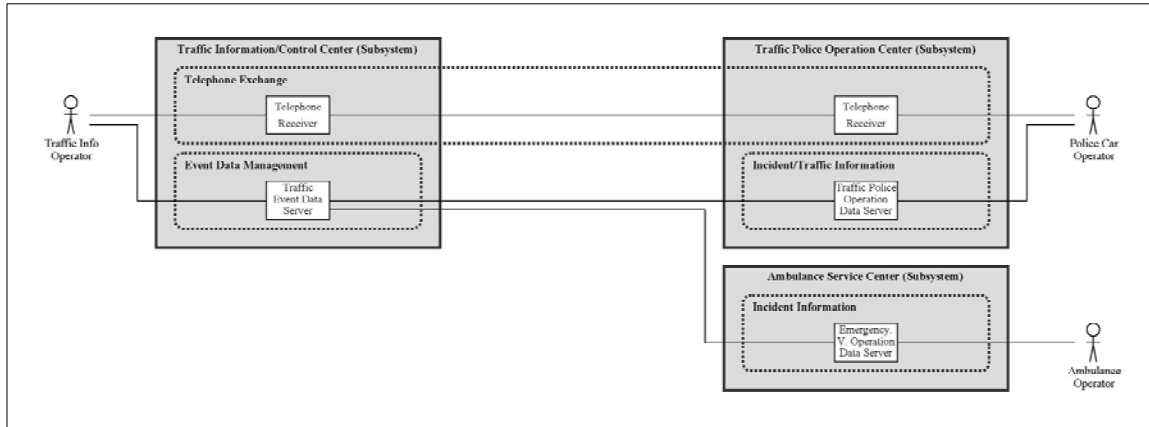
Figure A1.9-9.MSD C-to-C Data Exchange for Heavy Truck Control



3) Collaboration Diagram with Functions/Installation

The collaboration diagrams (CD) are derived respectively from the message sequence diagrams aforementioned.

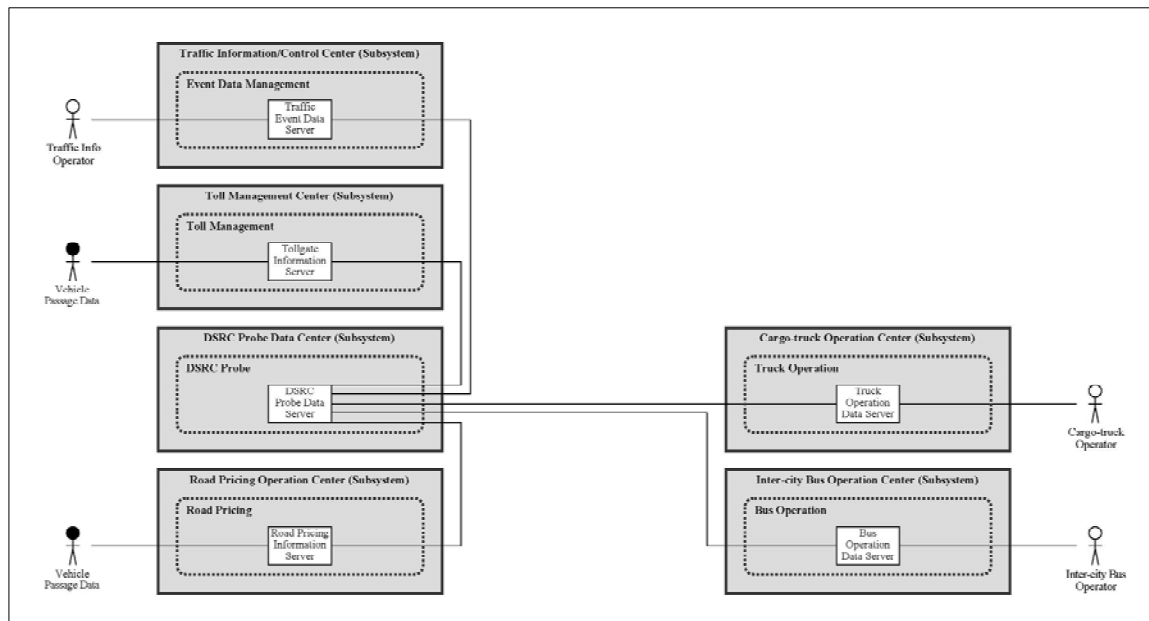
Figure A1.9-1.CD Center-to-center Data Exchange for Incident Notification (Graded as “Necessary”)



Functions & Installation: 9-1 for Incident Notification		
Function	Equipment	Installation
Event data manage.	Computer	Traffic information/control center **
Telephone exchange	Receiver	Traffic information/control center **
	Receiver	Traffic police operation center (1 st ~)
Incident/traffic info.	Computer	Traffic police operation center (1 st ~)
Incident info.	Computer	Ambulance service center (1 st ~)

Note, **: Three main centers shall be constructed in the 1st stage (→ See Section 8.4). Management offices shall be implemented every 50–80 km in the 1st–2nd stages keeping pace with the road construction (→ See Figure 8.3.2).

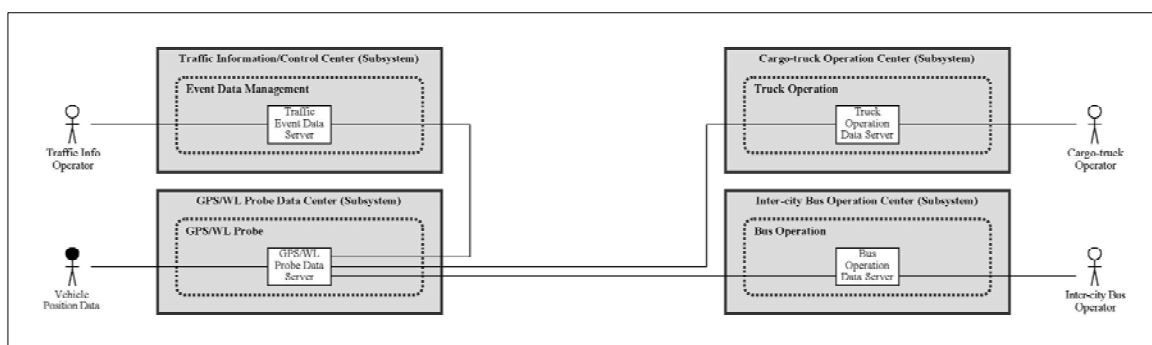
Figure A1.9-2.CD Center-to-center Data Exchange for DSRC probe (Graded as “Necessary”)



Functions & Installation: 9-2 for DSRC Probe		
Function	Equipment	Installation
Event data manage.	Computer	Traffic information/control center **
DSRC probe	Computer	DSRC probe data center (2 nd ~)
Toll management	Computer	Toll management center (1 st ~)
Road pricing	Computer	Road pricing operation center (3 rd ~)
Truck operation	Computer	Cargo-truck operation center (2 nd ~)
Bus operation	Computer	Inter-city bus operation center (2 nd ~)

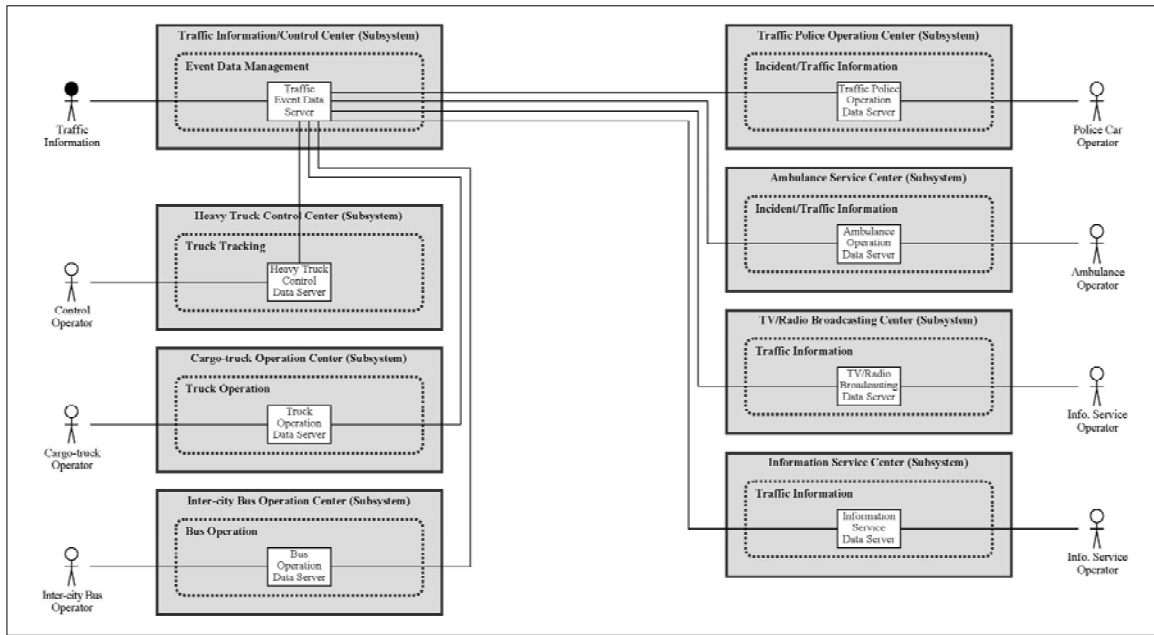
Note, **: Three main centers shall be constructed in the 1st stage (→ See Section 8.4). Management offices shall be implemented every 50–80 km in the 1st–2nd stages keeping pace with the road construction (→ See Figure 8.3.2).

Figure A1.9-3.CD Center-to-center Data Exchange for GPS/WL probe (Graded as “Necessary”)



Functions & Installation: 9-3 for GPS/WL Probe		
Function	Equipment	Installation
Event data manage.	Computer	Traffic information/control center **
GPS/WL probe	Computer	GPS/WL probe data center (2 nd ~)
Truck operation	Computer	Cargo-truck operation center (2 nd ~)
Bus operation	Computer	Inter-city bus operation center (2 nd ~)

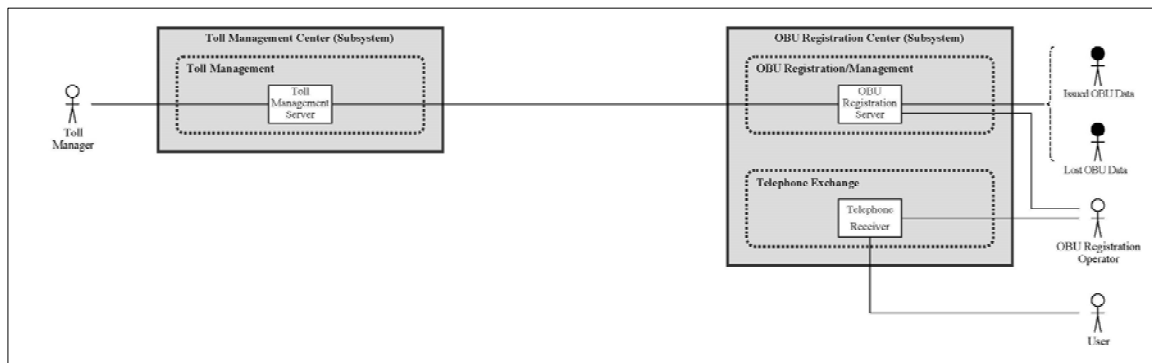
Figure A1.9-4.CD Center-to-center Data Exchange for Traffic Information (Graded as “Necessary”)



Functions & Installation: 9-4 for Traffic Information & Control		
Function	Equipment	Installation
Event data manage.	Computer	Traffic information/control center **
Truck tracking	Computer	Heavy truck control center (1 st ~)
Truck operation	Computer	Cargo-truck operation center (2 nd ~)
Bus operation	Computer	Inter-city bus operation center (2 nd ~)
Incident/traffic info.	Computer	Traffic police operation center (1 st ~)
Incident/traffic info.	Computer	Ambulance service center (1 st ~)
Traffic info.	Computer	TV/Radio broadcasting center (1 st ~)
Traffic info.	Computer	Information service center (1 st ~)

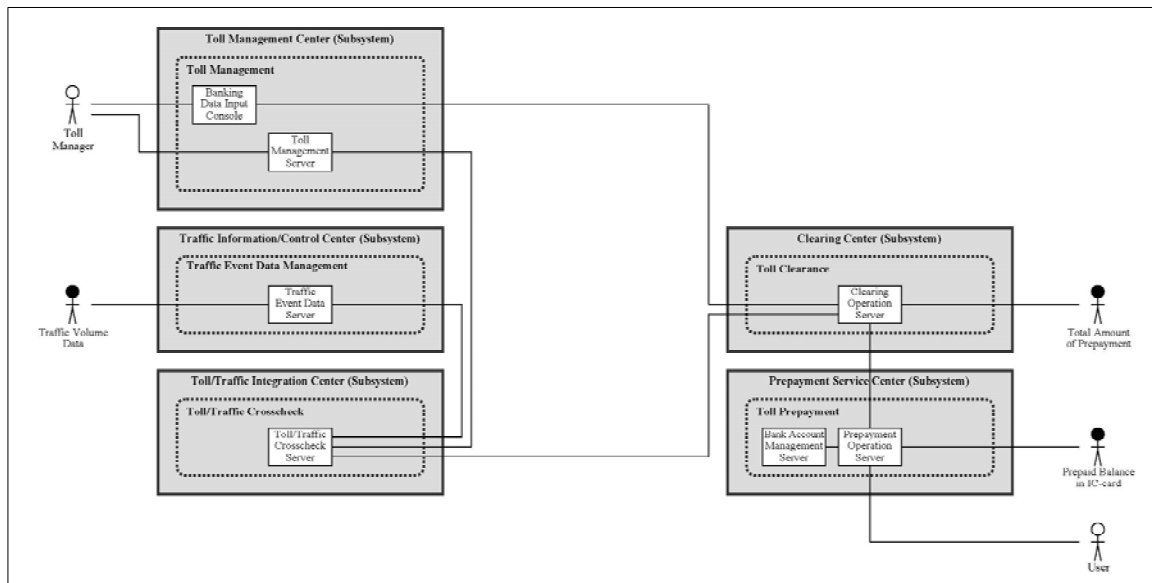
Note, **: Three main centers shall be constructed in the 1st stage (→ See Section 8.4). Management offices shall be implemented every 50–80 km in the 1st–2nd stages keeping pace with the road construction (→ See Figure 8.3.2).

Figure A1.9-5.CD Center-to-center Data Exchange for OBU Management (Graded as “Necessary”)



Functions & Installation: 9-5: for OBU Management		
Function	Equipment	Installation
Toll management	Computer	Toll management center (1 st ~)
OBU regist./Manage.	Computer	OBU registration center (1 st ~)
Telephone exchange	Receiver	OBU registration center (1 st ~)

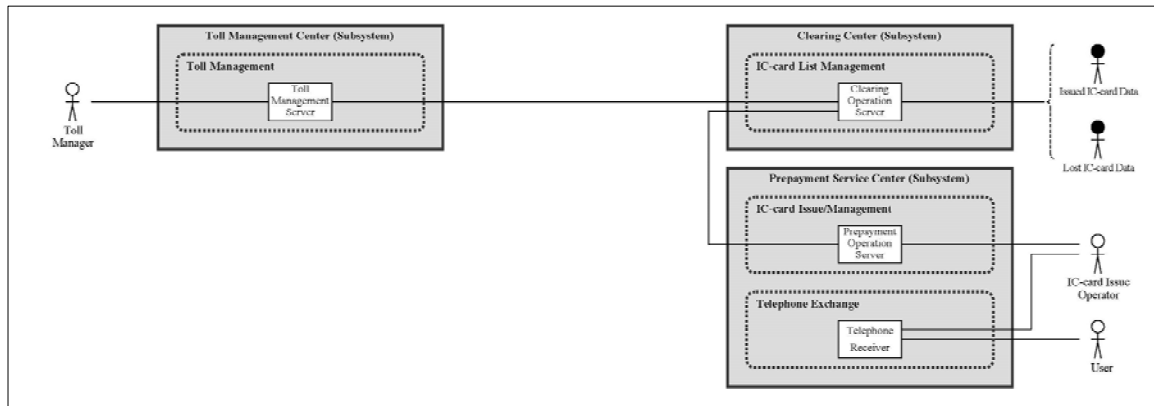
Figure A1.9-6.CD Center-to-center Data Exchange for Toll Clearance (Graded as “Necessary”)



Functions & Installation: 9-6: for Toll Clearance		
Function	Equipment	Installation
Toll management	Console	Toll management center (1 st ~)
	Computer	Toll management center (1 st ~)
Toll/traffic crosscheck	Computer	Toll/traffic integration center (1 st ~)
Event data manage.	Computer	Traffic information/control center **
Toll prepayment	Computer	Prepayment service center (1 st ~)
	Computer	Prepayment service center (1 st ~)
Toll clearance	Computer	Clearing center (2 nd ~)

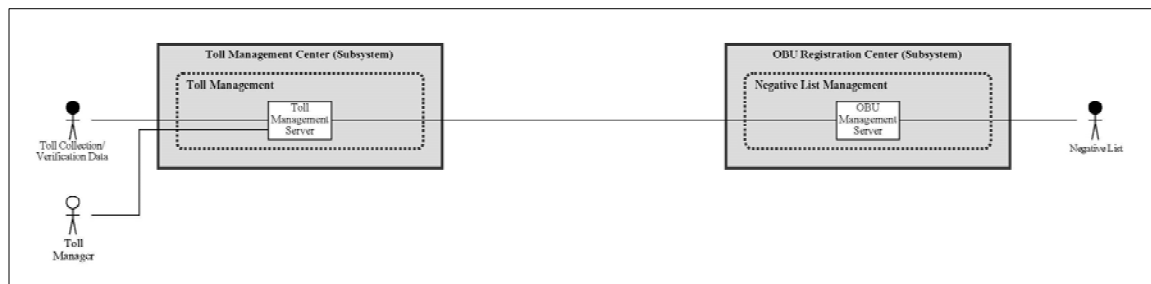
Note, **: Three main centers shall be constructed in the 1st stage (→ See Section 8.4). Management offices shall be implemented every 50–80 km in the 1st–2nd stages keeping pace with the road construction (→ See Figure 8.3.2).

Figure A1.9-7.CD Center-to-center Data Exchange for IC-card Operation (Graded as “Necessary”)



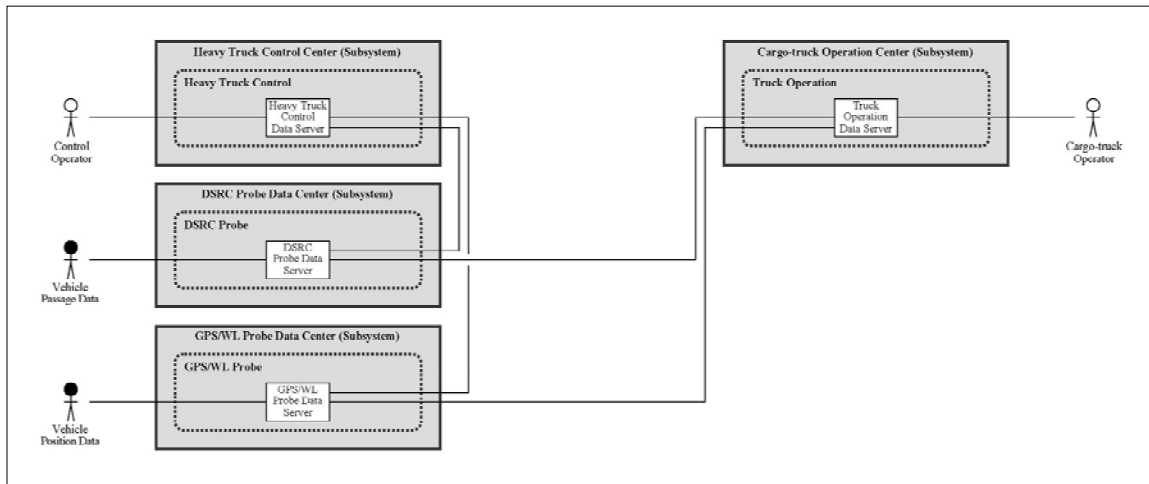
Functions & Installation: 9-7: for IC-card Operation		
Function	Equipment	Installation
Toll management	Computer	Toll management center (1 st ~)
IC-card list manage.	Computer	Clearing center (1 st ~)
IC-card issue/manage.	Computer	Prepayment service center (1 st ~)
Telephone exchange	Receiver	Prepayment service center (1 st ~)

Figure A1.9-8.CD Center-to-center Data Exchange for Toll Enforcement Assistance (Graded as “Necessary”)



Functions & Installation: 9-8: for Enforcement Assistance		
Function	Equipment	Installation
Toll management	Computer	Toll management center (1 st ~)
Negative list manage.	Computer	OBU registration center (1 st ~)

Figure A1.9-9.CD Center-to-center Data Exchange for Heavy Truck Control (Graded as “Necessary”)



Functions & Installation: 9-9 for Heavy Truck Control		
Function	Equipment	Installation
Heavy truck control	Computer	Heavy truck control center (1 st ~)
DSRC probe	Computer	DSRC probe data center (2 nd ~)
GPS/WL probe	Computer	GPS/WL probe data center (2 nd ~)
Truck operation	Computer	Cargo-truck operation center (2 nd ~)