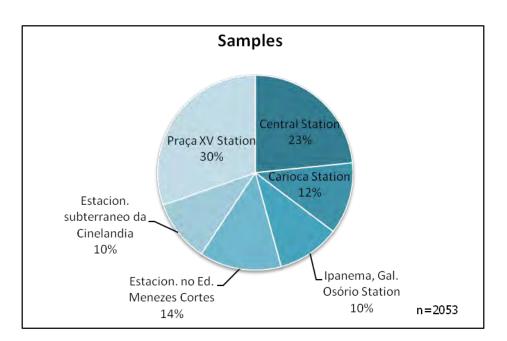
5.1.2 Survey Results

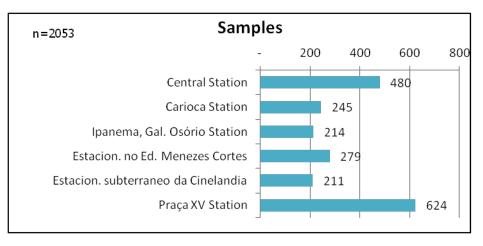
- (1) August 14, 2012 (Tuesday)
- 1) Basic Information of Samples

i) Samples

Total number of samples: 2053

The number of samples from each location is as shown in Figure 5-3.



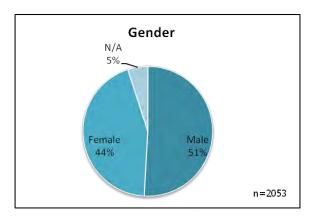


Source: JICA Study Team

Figure 5-3 Samples

ii) Gender

Males have a percentage of 51% while females have 44%.



Source: JICA Study Team

Figure 5-4 Gender

iii) Age

The percentages of samples in their 20s, 30s, and 40s are large, as shown in Figure 5-5. Their combined percentage is 78% of all the samples.

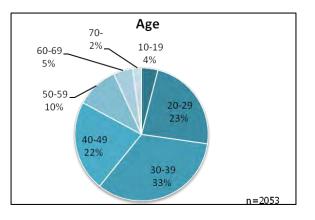
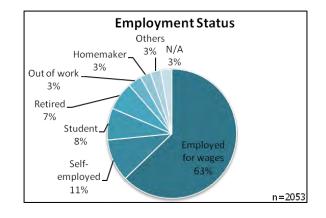


Figure 5-5 Age

iv) Employment Status

The samples that are employed for wages have the top share at 63%, followed by samples that are self-employed at 11%. Of all the samples, 75% are working.



Source: JICA Study Team

Figure 5-6 Employment Status

v) Home Address

Most of the samples live in Rio de Janeiro, Niteroi, or Duque de Caxias. In Rio de Janeiro, the home addresses of samples vary but the percentages of those living in Centro, Barra da Tijuca, Bangu, Campo Grande, Ipanema and Copacabana are relatively high.

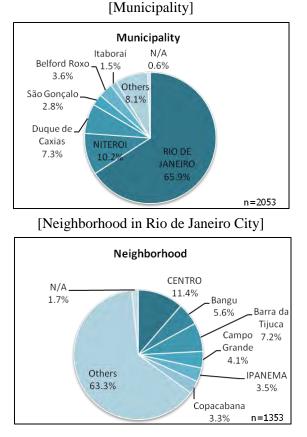
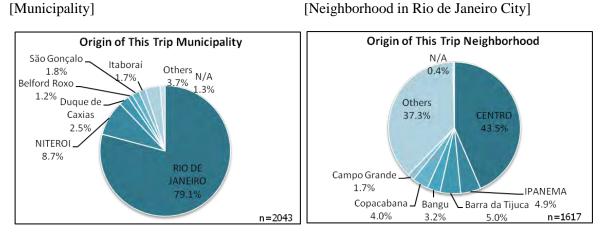


Figure 5-7 Home Address

2) Information of Trip

i) Origin of This Trip

Rio de Janeiro and Niteroi have the highest proportion of origins of trips.



Source: JICA Study Team

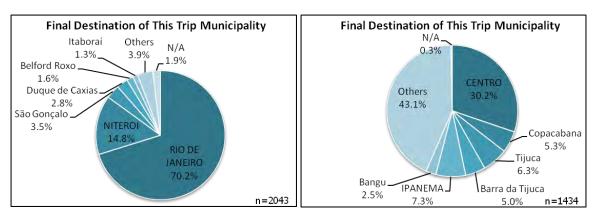
Figure 5-8 Origin of This Trip

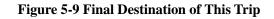
ii) Final Destination of This Trip

The destinations are more or less the same as the origins. This is because the purposes of the trips of the samples consist of "leaving home" and "going home".



[Neighborhood in Rio de Janeiro City]

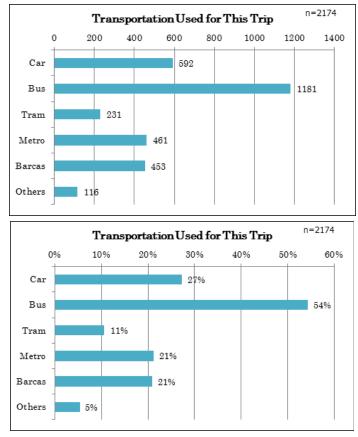




iii) Transportation Used for This Trip

Of all the samples, 27% use cars for their trips. More than half of the samples use buses for their

trips.



Source: JICA Study Team

Figure 5-10 Transportation Used for This Trip

iv) Purpose of This Trip

On a weekday, the main purpose of the trip was commuting, followed by private and school purposes.

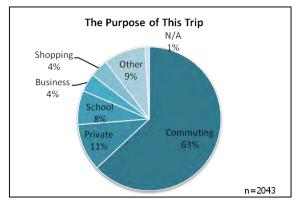


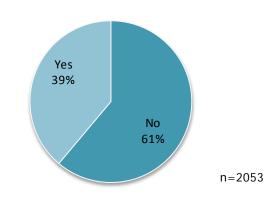
Figure 5-11 Purpose of This Trip

3) ITS Services Needs

i) For Car Users

[Do you usually use a car for work or private purpose?]

About 40% of the samples usually use a car for work or private purposes. Only car users were asked the next question.



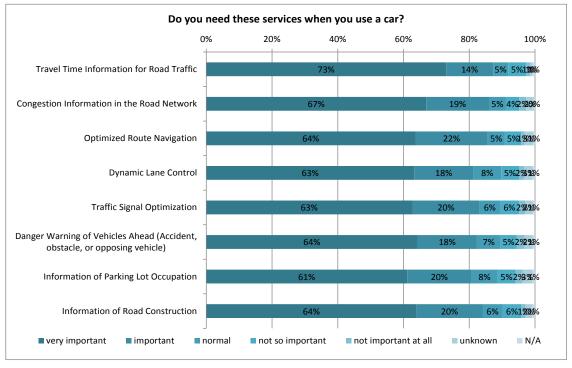
Do you usually use a car for the purpose of Work or Private?

Source: JICA Study Team

Figure 5-12 Car Use

[Do you need these services when you use a car?]

More than 80% of all the samples answered that ITS services are important for their car use. "Travel time information for road traffic" seems to be especially important to them.



Source: JICA Study Team

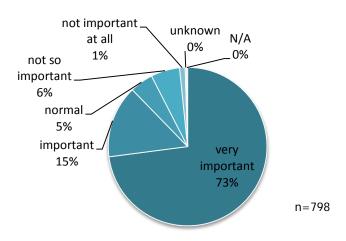
Figure 5-13 ITS Needs of Car Users

[Do you need these services when you use a car?]

The following are the results for each service.

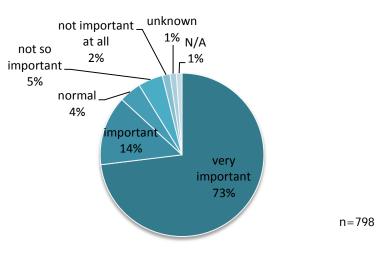
Service A: Travel Time Information for Road Traffic

< For Work Purpose>

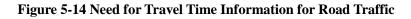


Travel Time Information for Road Traffic

<For Private Purpose>



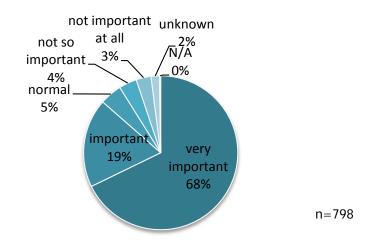
Travel Time Information for Road Traffic



Service B: Congestion Information in the Road Network

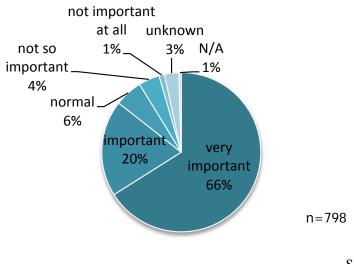
< For Work Purpose>

Congestion Information in the Road Network



<For Private Purpose>

Congestion Information in the Road Network

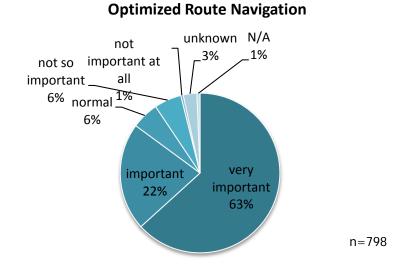


Source: JICA Study Team

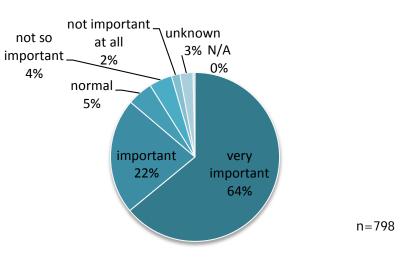
Figure 5-15 Need for Congestion Information in the Road Network

Service C: Optimized Route Navigation

< For Work Purpose>



<For Private Purpose>



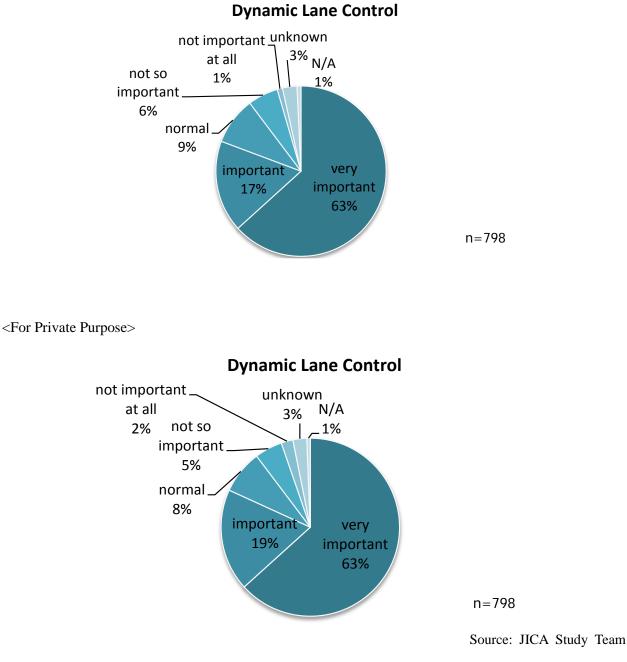
Optimized Route Navigation

Source: JICA Study Team

Figure 5-16 Need for Optimized Route Navigation

Service D: Dynamic Lane Control

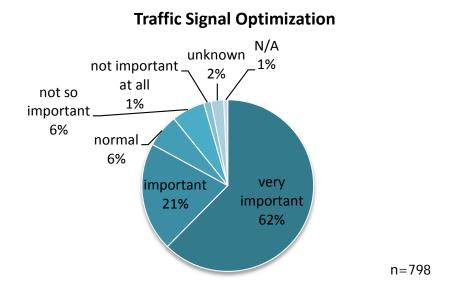
< For Work Purpose>



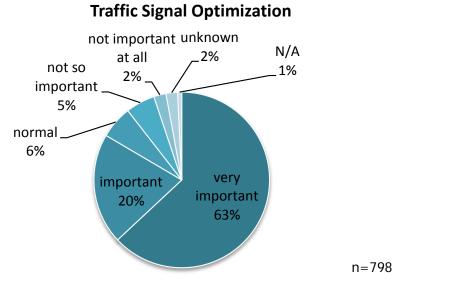


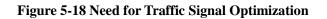
Service E: Traffic Signal Optimization

< For Work Purpose>



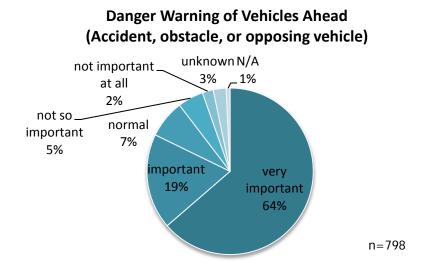
<For Private Purpose>



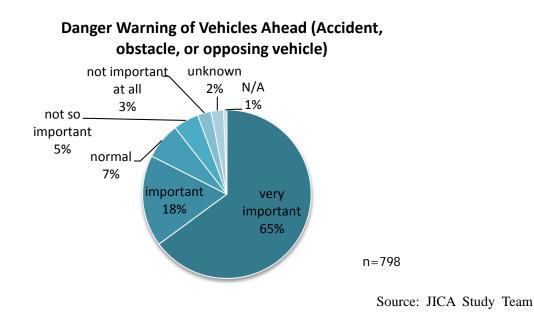


Service F: Danger Warning of Vehicles Ahead (Accident, Obstacle, or Opposing Vehicle)

< For Work Purpose>



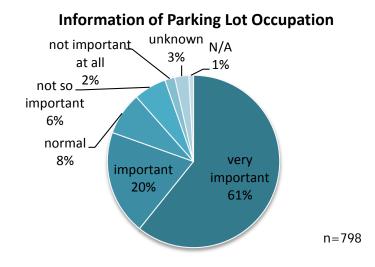
<For Private Purpose>





Service G: Information of Parking Lot Occupation

< For Work Purpose>



<For Private Purpose >

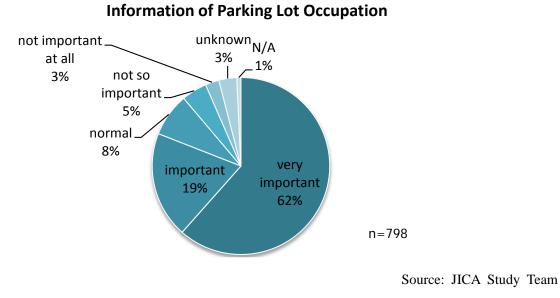
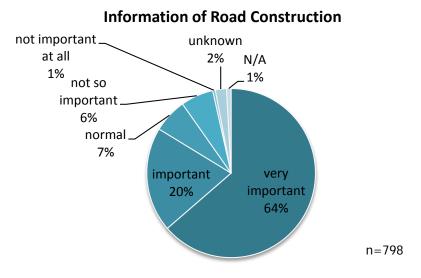


Figure 5-20 Need for Information of Parking Lot Occupation

Service H: Information of Road Construction

< For Work Purpose>



<For Private Purpose>

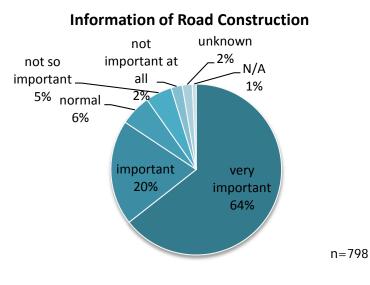
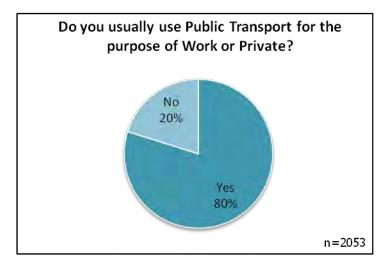


Figure 5-21 Need for Information of Road Construction

ii) For Public Transport Users

[Do you usually use public transport for work or private purposes?]

About 80% of all the samples usually use public transport for work or private purposes. Only public transport users were asked the next question.

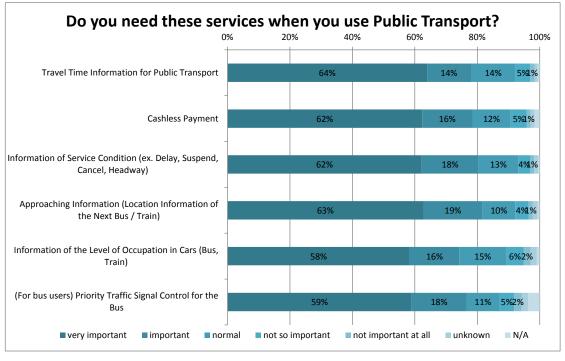


Source: JICA Study Team

Figure 5-22 Public Transport Use

[Do you need these services when you use public transport?]

About 80% of all the samples answered that ITS services are important for their public transport use. "Approaching information" and "Information of service condition" seem to be especially important to them.



Source: JICA Study Team

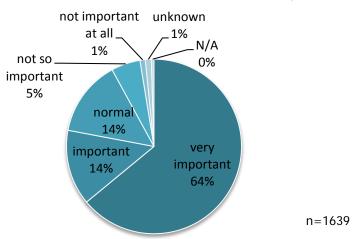
Figure 5-23 ITS Needs of Public Transport Users

[Do you need these services when you use public transport?]

The following are the results for each service.

Service A: Travel Time Information for Public Transport

< For Work Purpose>



Travel Time Information for Public Transport

<For Private Purpose>

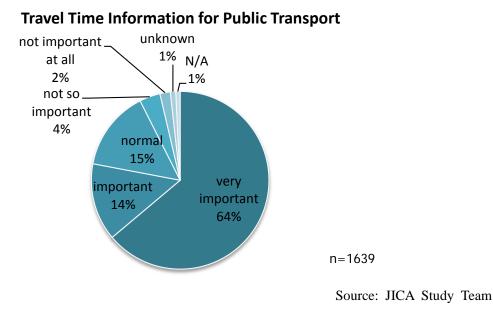
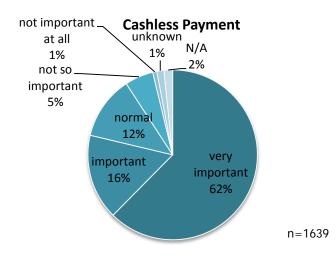


Figure 5-24 Need for Travel Time Information for Public Transport

Service B: Cashless Payment

< For Work Purpose>



<For Private Purpose>

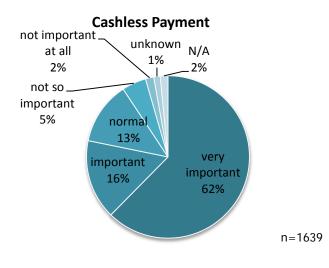
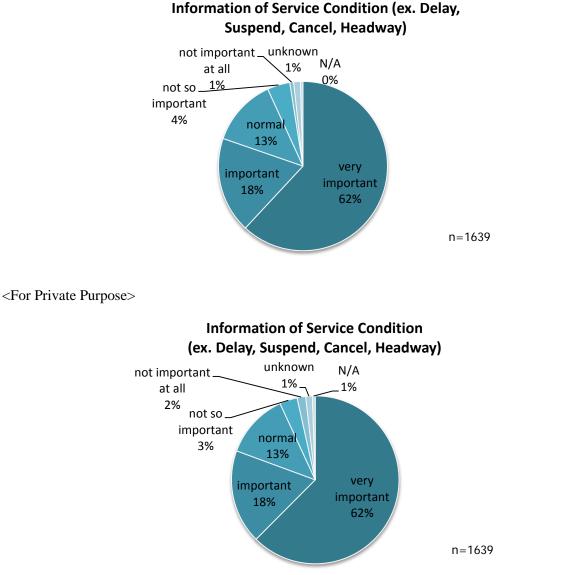
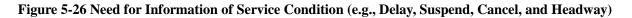


Figure 5-25 Need for Cashless Payment

Service C: Information of Service Condition (e.g., Delay, Suspend, Cancel, and Headway)

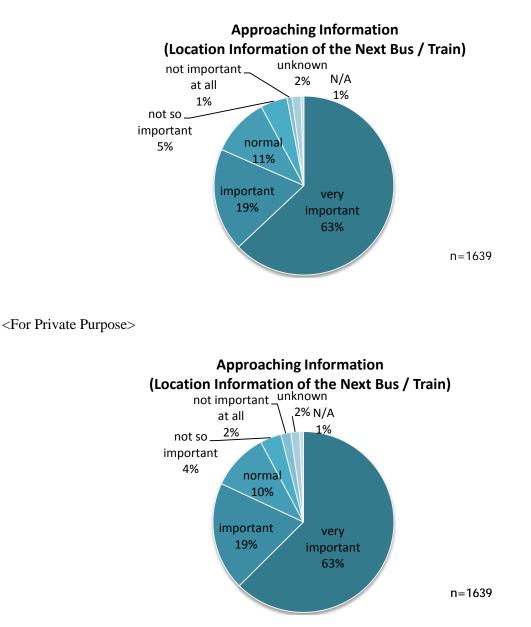






Service D: Approaching Information (Location Information of the Next Bus/Train)

< For Work Purpose>

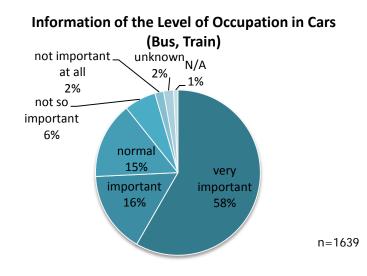


Source: JICA Study Team

Figure 5-27 Need for Approaching Information (Location Information of the Next Bus/Train)

Service E: Information of the Level of Occupation in Cars (Bus, Train)

< For Work Purpose>



<For Private Purpose>

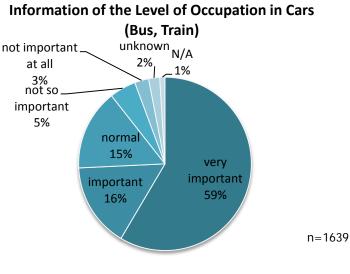
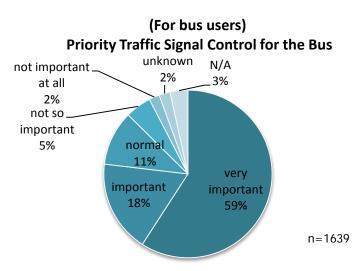


Figure 5-28 Need for Information of the Level of Occupation in Cars (Bus and Train)

Service F: (For Bus Users) Priority Traffic Signal Control for the Bus

< For Work Purpose>



<For Private Purpose>

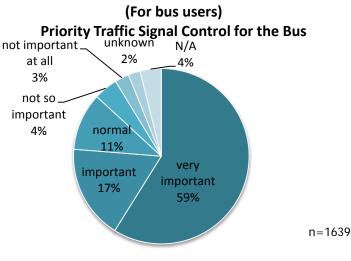
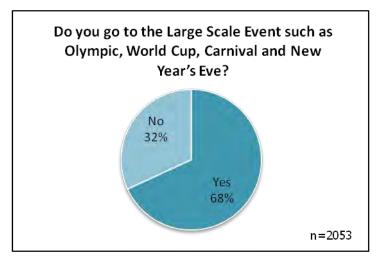


Figure 5-29 Need for Priority Traffic Signal Control for the Bus

iii) Large-scale Events

[Do you go to large-scale events such as the Olympics, World Cup, Carnival, and New Year's Eve?]

About 70% of the samples go to a large-scale event such as the Olympics. Only large-scale event visitors answered the next question.

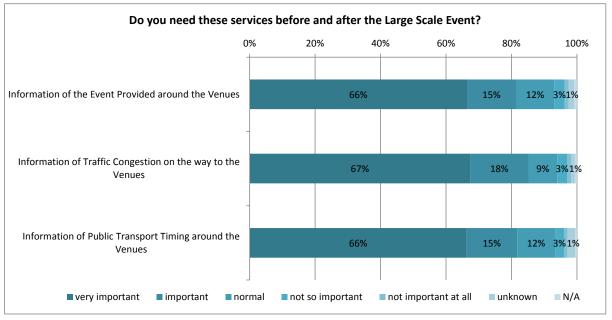


Source: JICA Study Team

Figure 5-30 Event Visitors

[Do you need these services before and after the large-scale event?]

More than 80% of the samples answered that ITS services are important in the case of large-scale events. "Information on traffic congestion on the way to the venues" seems to be especially important to them.



Source: JICA Study Team

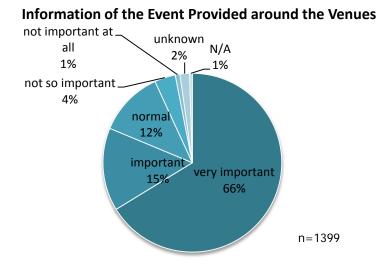
Figure 5-31 ITS Needs for Large-Scale Events

[Do you need these services before and after a large-scale event?]

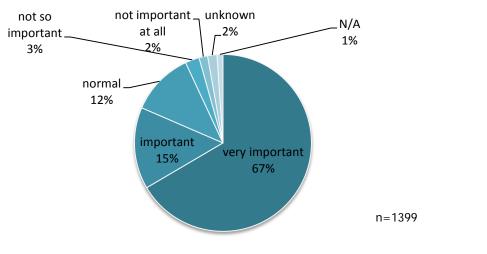
The following are the results for each service.

Service A: Information of the Event Provided around the Venues

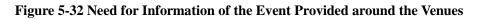
< Before the Event>



<After the Event>

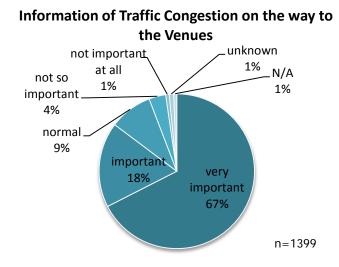


Information of the Event Provided around the Venues



Service B: Information of Traffic Congestion on the way to the Venues

< Before the Event>



<After the Event>

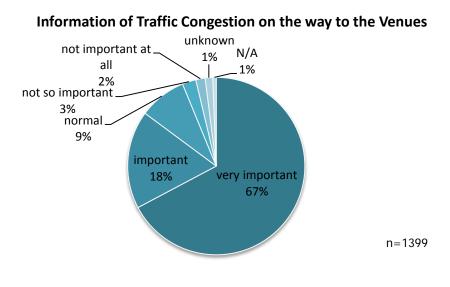
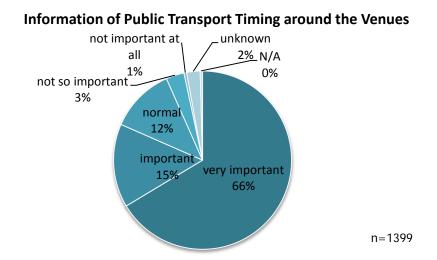


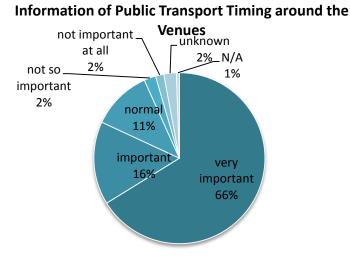
Figure 5-33 Need for Information of Traffic Congestion on the Way to the Venues

Service C: Information of Public Transport Timing around the Venues

< Before the Event>



<After the Event>



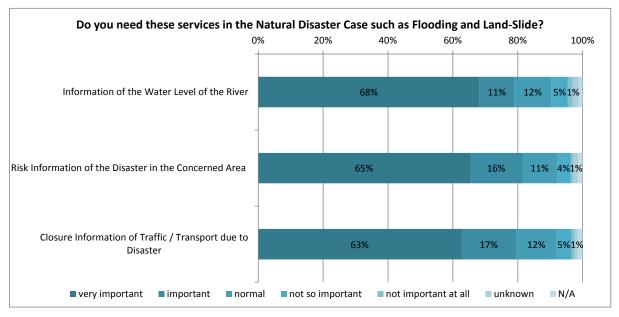
Source: JICA Study Team

Figure 5-34 Need for Information of Public Transport Timing around the Venues

iv) Natural Disaster

[Do you need these services in case of natural disaster such as flooding or landslide?]

About 80% of all the samples answered that ITS services are important in case of natural disasters. "Risk information on the disaster in the concerned area" seems to be especially important to them. This result indicates that disaster monitoring is important to reduce the risk of natural disasters.



Source: JICA Study Team

Figure 5-35 ITS Needs in case of Natural Disaster

[Do you need these services in case of natural disaster such as flooding or landslide?]

normal 12% important

11%

The following are the results for each service.

Service A: Information of the Water Level of the River

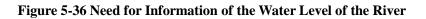
5%

<In case of Natural Disaster>

unknown not important at 2% N/A all 1% not so important

Information of the Water Level of the River





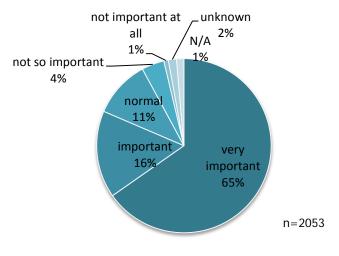
very

important 68%

n=2053

Service B: Risk Information of the Disaster in the Concerned Area

<In case of Natural Disaster>



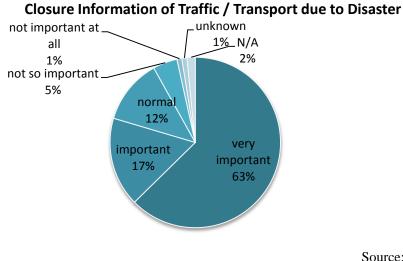
Risk Information of the Disaster in the Concerned Area

Source: JICA Study Team

Figure 5-37 Need for Disaster Risk Information in the Concerned Area

Service C: Traffic/Transport Closure Information due to Disaster

<In case of Natural Disaster>



Source: JICA Study Team

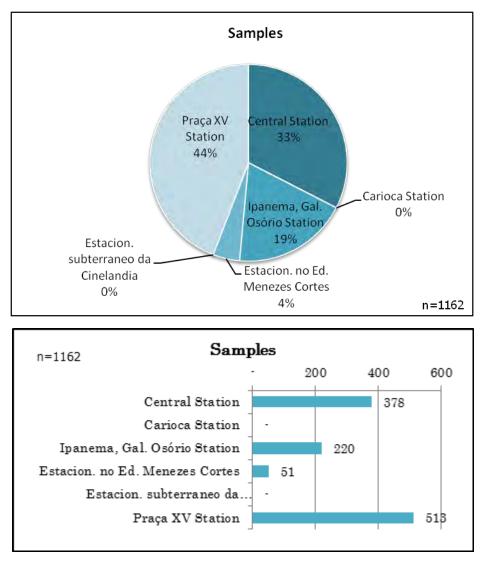
Figure 5-38 Need for Traffic/Transport Closure Information due to Disaster

- (2) August 12, 2012 (Sunday)
- 1) Basic Information of Samples

i) Samples

Total number of samples: 1162

The number of samples from each location is shown in Figure 5-39.

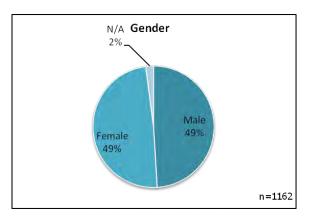


Source: JICA Study Team

Figure 5-39 Samples

ii) Gender

The percentage of male is 49%, and of female is 49%.



Source: JICA Study Team

Figure 5-40 Gender

iii) Age

The percentages of samples in their 20s, 30s, and 40's are large, as shown in Figure 5-41. Their combined percentage is 73% of all the samples.

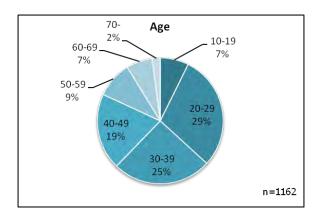
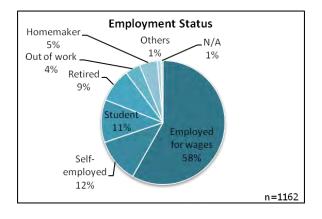


Figure 5-41 Age

iv) Employment Status

The samples that are employed for wages have the top share at 58%, followed by samples that are self-employed. Of all the samples, 70% are working.



Source: JICA Study Team

Figure 5-42 Employment Status

v) Home Address

Most of the samples live in Rio de Janeiro, Niteroi, or Duque de Caxias. In Rio de Janeiro, the home addresses of the samples vary but the percentages of those living in Centro, Barra da Tijuca, Bangu, Campo Grande, Ipanema and Copacabana are relatively high.

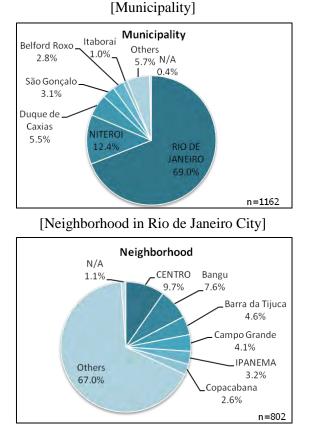
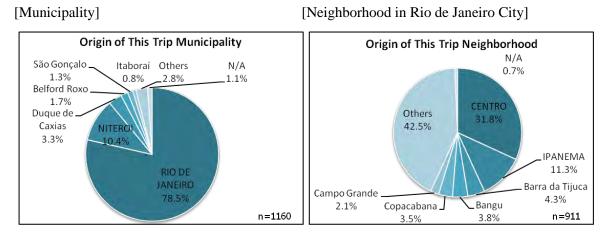


Figure 5-43 Home Address

2) Information of Trip

i) Origin of This Trip

Rio de Janeiro and Niteroi have the highest proportions of origins of the trips.



Source: JICA Study Team

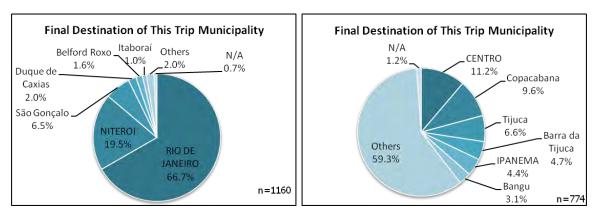
Figure 5-44 Origin of This Trip

ii) Final Destination of This Trip

The characteristics of the destination are almost the same as the origin. This is because the purposes of the trips of the samples consist of "leaving home" and "going home".



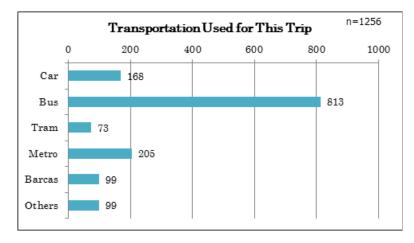
[Neighborhood in Rio de Janeiro City]

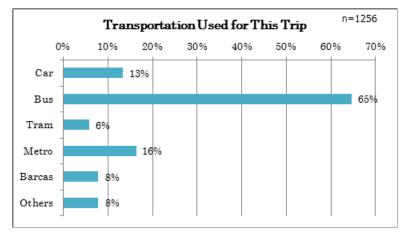




iii) Transportation Used for This Trip

Only 13% of all the samples use cars during the weekend, while 65% of samples use the bus for their trips.





Source: JICA Study Team

Figure 5-46 Transportation Used for This Trip

iv) Purpose of This Trip

In the weekend, the main purposes of the samples were commuting and private.

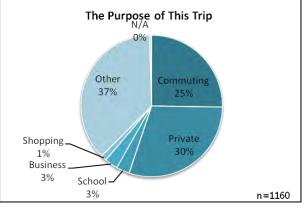


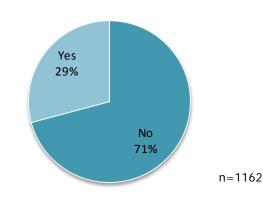
Figure 5-47 Purpose of This Trip

3) ITS Services Needs

i) For Car Users

[Do you usually use a car for work or private purposes?]

About 30% of all the samples usually use a car for work or private purposes. Only car users were asked the next question.



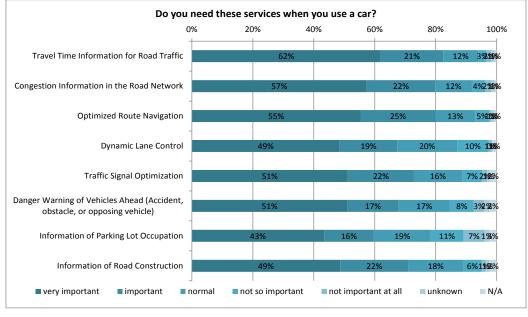
Do you usually use a car for the purpose of Work or Private?

Source: JICA Study Team

Figure 5-48 Car Use

[Need for ITS service for car users]

About 80% of the samples answered that some of the ITS services are important for their car use. "Travel time information for road traffic", "Congestion information in the road network" and "Optimized route navigation" seem to be especially important to them. Other services seem to be less important during the weekend.



Source: JICA Study Team

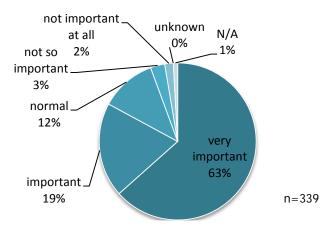
Figure 5-49 ITS Needs of Car Users

[Do you need these services when you use a car?]

The following are the results for each service.

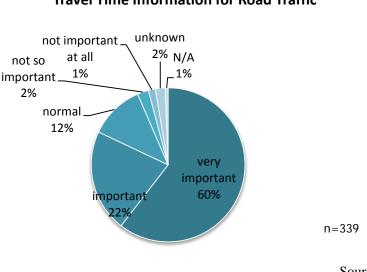
Service A: Travel Time Information for Road Traffic

< For Work Purpose>

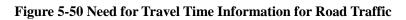


Travel Time Information for Road Traffic

<For Private Purpose>



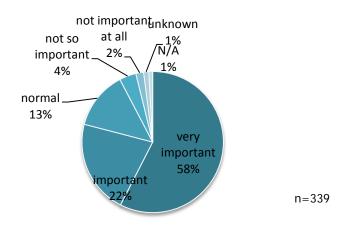
Travel Time Information for Road Traffic



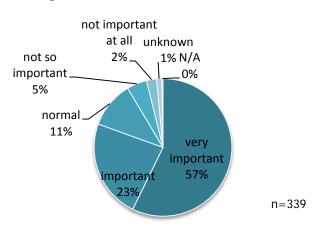
Service B: Congestion Information in the Road Network

< For Work Purpose>

Congestion Information in the Road Network



<For Private Purpose>

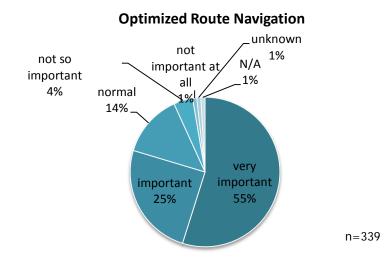


Congestion Information in the Road Network

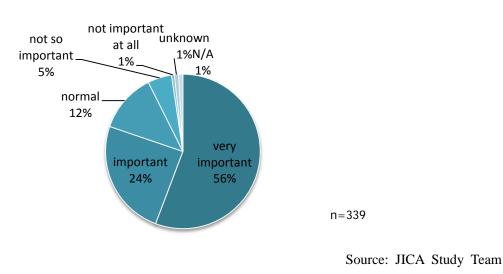
Figure 5-51 Need for Congestion Information in the Road Network

Service C: Optimized Route Navigation

< For Work Purpose>



<For Private Purpose>



Optimized Route Navigation

Figure 5-52 Need for Optimized Route Navigation

Service D: Dynamic Lane Control

< For Work Purpose>

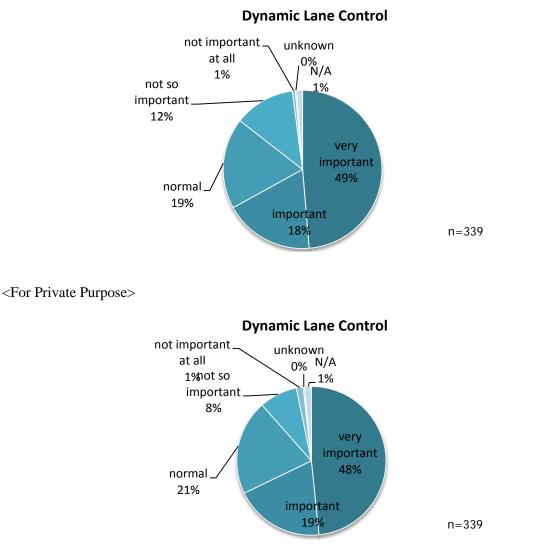
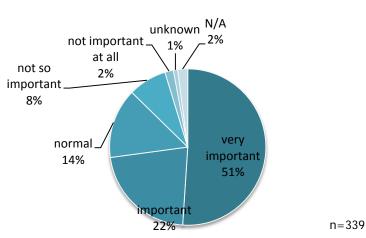


Figure 5-53 Need for Dynamic Lane Control

Service E: Traffic Signal Optimization

< For Work Purpose>



Traffic Signal Optimization

<For Private Purpose>

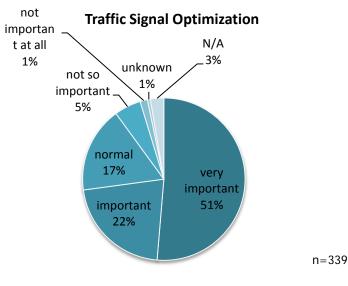
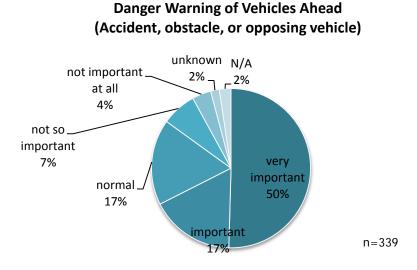


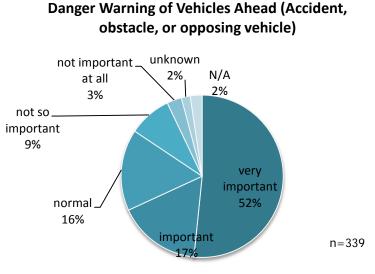
Figure 5-54 Need for Traffic Signal Optimization

Service F: Danger Warning of Vehicles Ahead (Accident, Obstacle, or Opposing Vehicle)

< For Work Purpose>



<For Private Purpose>

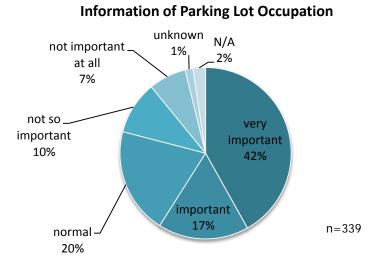


Source: JICA Study Team

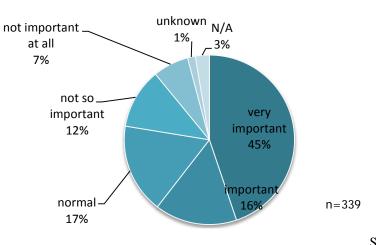
Figure 5-55 Need for Danger Warning of Vehicles Ahead (Accident, Obstacle, or Opposing Vehicle)

Service G: Information of Parking Lot Occupation

< For Work Purpose>



<For Private Purpose>

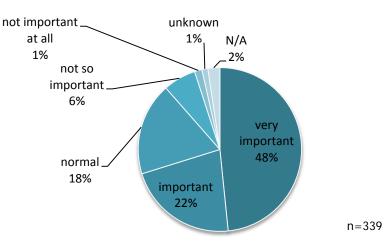


Information of Parking Lot Occupation

Figure 5-56 Need for Information of Parking Lot Occupation

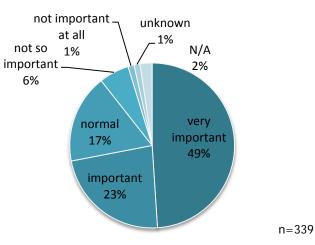
Service H: Information of Road Construction

< For Work Purpose>



Information of Road Construction

<For Private Purpose>



Information of Road Construction

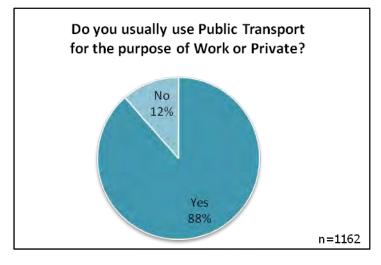
Source: JICA Study Team

Figure 5-57 Need for Information of Road Construction

ii) For Public Transport Users

[Do you usually use public transport for work or private purposes?]

About 90% of all the samples usually use public transport for work or private purposes. Only public transport users were asked the next question.

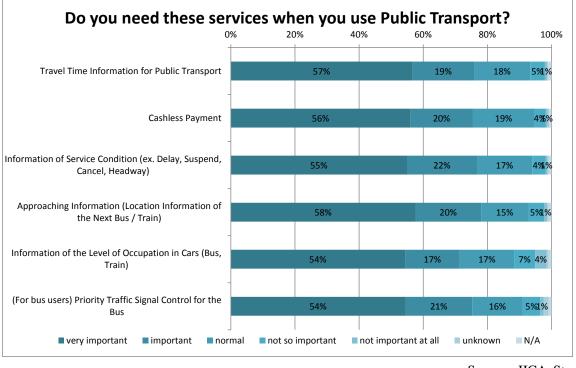


Source: JICA Study Team

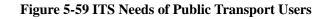
Figure 5-58 Public Transport Use

[Need for ITS service for public transport users]

About 80% of all the samples answered that some of the ITS services are important for their public transport use. "Approaching information" and "Information of service condition" seem to be especially important to them. Others seem to be less important during the weekend.



Source: JICA Study Team

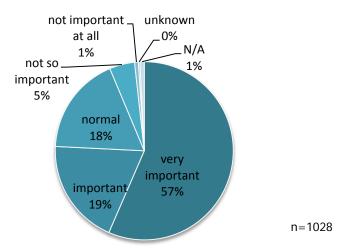


[Do you need these services when you use public transport?]

The following are the results for each service.

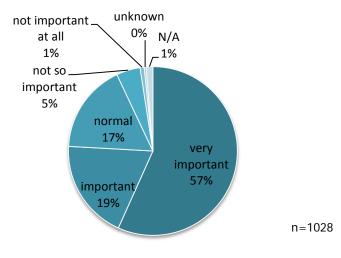
Service A: Travel Time Information for Public Transport

< For Work Purpose>



Travel Time Information for Public Transport

<For Private Purpose>

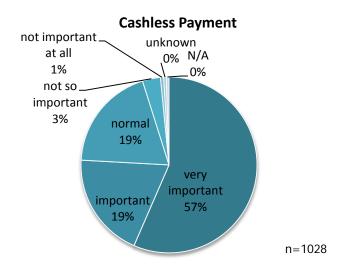


Travel Time Information for Public Transport



Service B: Cashless Payment

< For Work Purpose>



<For Private Purpose>

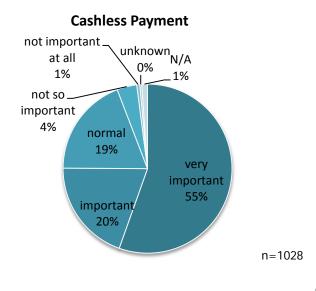
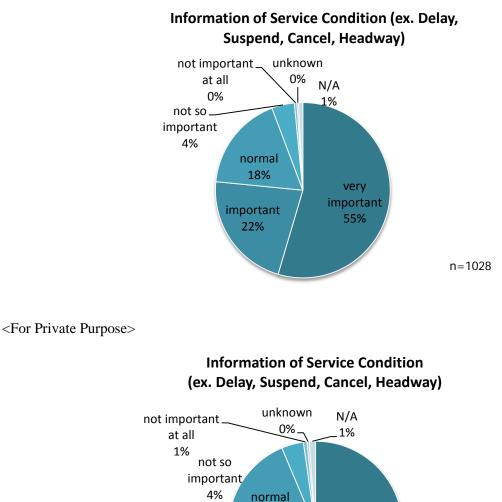


Figure 5-61 Need for Cashless Payment



17%

important

22%

< For Work Purpose>

Source: JICA Study Team

n=1028

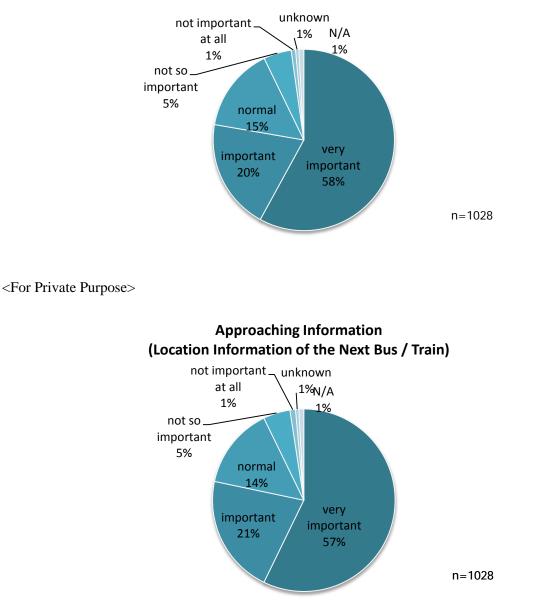
Figure 5-62 Need for Information of Service Condition (e.g., Delay, Suspend, Cancel, and Headway)

very important

55%

Service D: Approaching Information (Location Information of the Next Bus/Train)

< For Work Purpose>



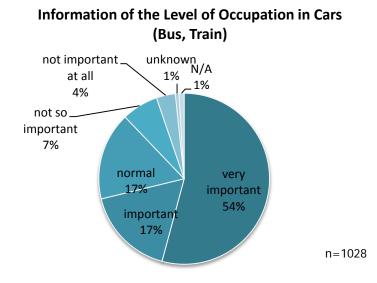
Approaching Information (Location Information of the Next Bus / Train)

Source: JICA Study Team

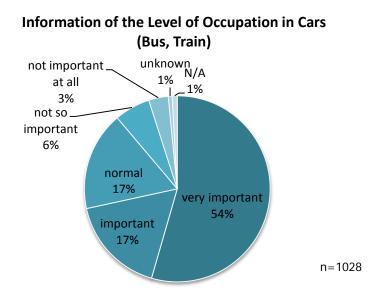
Figure 5-63 Need for Approaching Information (Location Information of the Next Bus/Train)

Service E: Information of the Level of Occupation in Cars (Bus, Train)

< For Work Purpose>



<For Private Purpose >

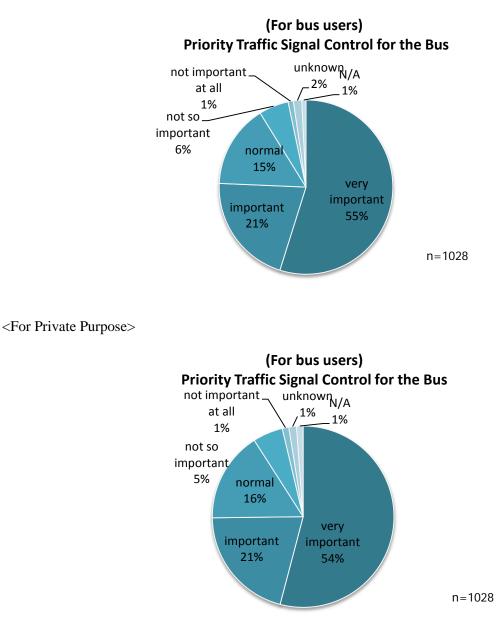


Source: JICA Study Team

Figure 5-64 Need for Information of the Level of Occupation in Cars (Bus, Train)

Service F: (For Bus Users) Priority Traffic Signal Control for the Bus

< For Work Purpose>



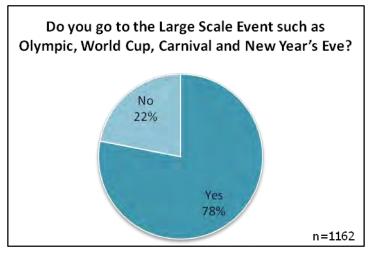
Source: JICA Study Team

Figure 5-65 Need for Priority Traffic Signal Control for the Bus

iii) Large-scale Events

[Do you go to large-sale events, such as the Olympics, World Cup, Carnival, and New Year's Eve?]

About 80% of all the samples go to a large-scale event such as the Olympics. Only large-scale event visitor answered the next question.

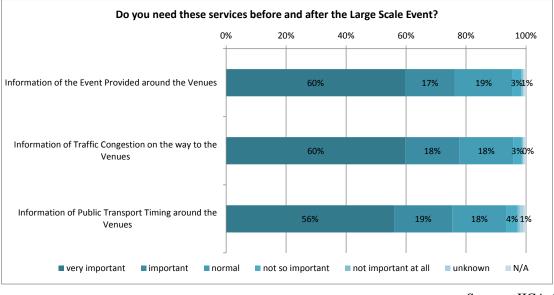


Source: JICA Study Team

Figure 5-66 Event Visitors

[Need for ITS service in a large-scale event]

More than 80% of all the samples answered that ITS services are important in the case of large-scale events. "Information of traffic congestion on the way to the venues" seems to be especially important to them.



Source: JICA Study Team

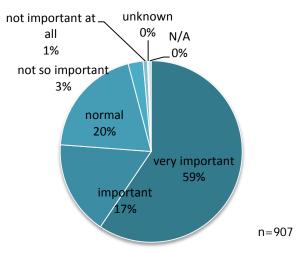
Figure 5-67 ITS Needs for Large-Scale Events

[Do you need these services before and after a large-scale event?]

The following are the results for each service.

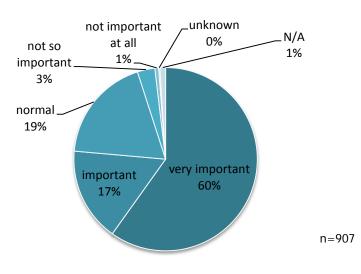
Service A: Information of the Event Provided around the Venues

< Before the Event>



Information of the Event Provided around the Venues

<After the Event>



Information of the Event Provided around the Venues

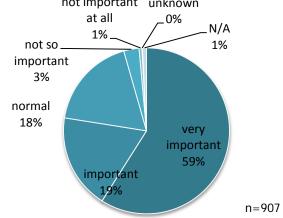
Source: JICA Study Team

Figure 5-68 Need for Information of the Event Provided around the Venues

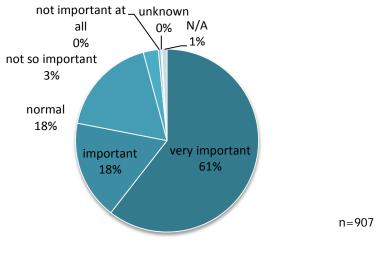
Service B: Information of Traffic Congestion on the Way to the Venues

< Before the Event>





<After the Event>



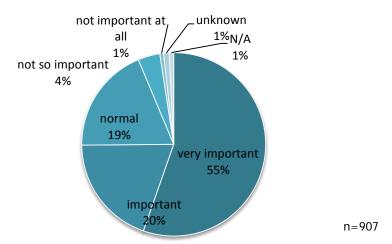
Information of Traffic Congestion on the way to the Venues

Source: JICA Study Team

Figure 5-69 Need for Information of Traffic Congestion on the Way to the Venues

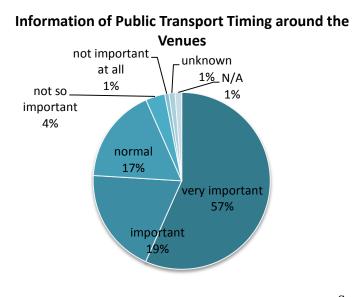
Service C: Information of Public Transport Timing around the Venues

< Before the Event>



Information of Public Transport Timing around the Venues

<After the Event>



Source: JICA Study Team

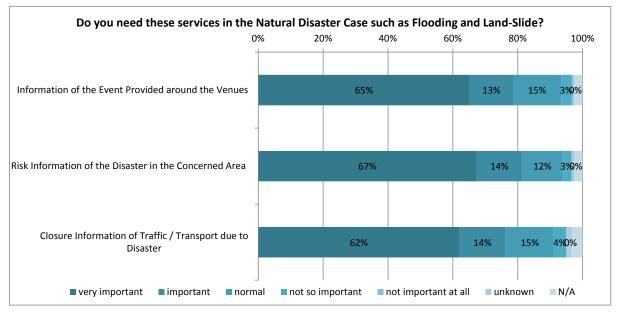
Figure 5-70 Need for Information of Public Transport Timing around the Venues

iv) Natural Disaster

[Do you need these services in case of natural disaster such as flooding or landslide?]

About 80% of all the samples answered that ITS services are important in case of natural disasters. "Risk information of the disaster in the concerned area" seems to be especially important to them. This result indicates that disaster monitoring is important to reduce the risk of natural disasters.

The results are the same during weekday and weekend. This result shows that disaster monitoring and ITS in case of natural disaster would always be important.



Source: JICA Study Team

Figure 5-71 ITS Needs in case of Natural Disaster

[Do you need these services in case of natural disasters such as flooding or landslide?]

The following are the results for each service.

Service A: Information of the Water Level of the River

<In case of Natural Disaster>

unknown 1% not important at. N/A all 2% 0% not so important 3% normal 15% very important important 65% 13% n=1162

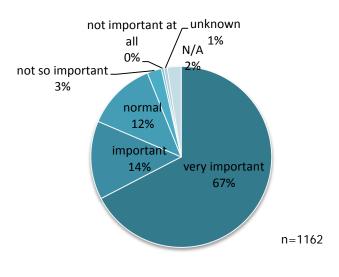
Information of the Water Level of the River

Source: JICA Study Team

Figure 5-72 Need for Information of the Water Level of the River

Service B: Risk Information of the Disaster in the Concerned Area

<In case of Natural Disaster>



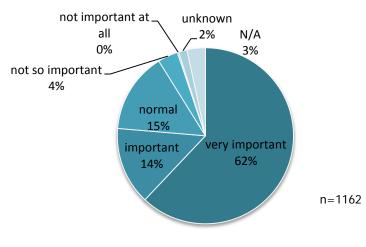
Risk Information of the Disaster in the Concerned Area

Source: JICA Study Team

Figure 5-73 Need for Disaster Risk Information in the Concerned Area

Service C: Traffic/Transport Closure Information due to Disaster

<In case of Natural Disaster>



Closure Information of Traffic / Transport due to Disaster

Source: JICA Study Team

Figure 5-74 Need for Traffic/Transport Closure Information Due to Disaster

5.1.3 Summary

About 2,000 samples on August 14, 2012 (Tuesday) and about 1,000 samples on August 12, 2012 (Sunday) were collected via interviews in the field. The answers of car and public transport users to the questionnaire on ITS needs are summarized as follows:

- > ITS services are very important to about 80% of the samples
- > ITS services for road traffic are more important than for public transport
- > More information is needed in case of disaster.

5.2 INTERVIEWS ON ITS NEEDS OF TRANSPORTATION AGENCIES

5.2.1 Objective and Survey Methodology

(1) Objective

The objective of the survey was to obtain information on the ITS needs of transportation agencies. The target of the survey was all stakeholders related to traffic and transport in Rio de Janeiro, such as public sectors for development and management, and operators.

- (2) Methodology
- 1) Summary

The survey questions were about current problems related to stakeholders' own work, specific plans and future needs related to ITS. The survey was conducted through interview.

2) Survey Schedule

The survey was conducted from July 2012 to October 2012.

3) Survey Coverage

The survey targets, such as stakeholders, are shown in Table 5-3.

Agencies	Name	Remarks	Survey
	rtation Agencies		- /
Public/	ANTT	• Federal Gov.	0
Governmental	 DENATRAN 	• Federal Gov.	0
Company	• DNIT	• Federal Gov.	0
1 5	DETRAN-RJ	• State Gov.	0
	• DER-RJ	• State Gov.	0
	SECONSERVA	Municipal Gov.	X
	CET-RIO	Municipal Gov.	0
Private	CCR PONTE	Road Concessionaire	0
1111000	Autopista Flminense	Road Concessionaire	Õ
	CCR VIA LAGOS	Road Concessionaire	Õ
	• ROTA116	Road Concessionaire	Õ
	LAMSA	Road Concessionaire	ŏ
Transit Agencie	es/Other Transit Providers	- Roud Concessionane	0
Public	CENTRAL-SETRANS	• State	0
i uone	RIO TORIHOS-SETRANS	State	0
	 DETRO-SETRANS 	State	0
		~	0
			-
	AMTU-SETRANS	• State	0
	SETRANS	• State	0
	• SMTR	• Municipality	0
	• COR	Municipality (Control Center)	0
	NITTRANS	Municipality(Other Municipalities)	0
Syndicate/	Rio Onibus	Inner City Bus Company Syndicate	0
Consortium	Central Coop etc.	Taxi Company Cooperative	0
Private	Super VIA	Train and Cable Car O/M Concessionaire	0
	METRO	 Subway O/M Concessionaire 	0
	CCR Barcas	Ferry O/M Concessionaire	0
	• Private Bus Companies (208)	Bus Concessionaire	0
	• Socicam	Bus Terminal O/M Operator	0
	Taxi Companies	Taxi Operator	0
	• Rio Card TI/ Rio Card Cartoes	IC Card Company	Х
Public Safety A			
Public	Civil Defense-SEDEC	• State Gov.	0
	SAMU-CBMERJ	• State Gov Ambulance-	0
	 BOMBEIRO-CBMERJ 	• State GovFire, Rescue-	0
	• SESEG	• State GovCICC- Police	0
	Civil Defense-SMSDC	Municipal Gov.	Ō
Other Agency I			-
Other Agency		National Standardization Agency	0
Department	 Ministry of Communication 	 Federal Ministry 	0
Department	 ANATEL 	 Frequency Management 	0
	ANATEL INEA-SEA	 State Gov. Environmental Monitoring 	0
		 State Gov. Environmental Monitoring State Gov. Weather Monitoring 	0
	SIMERJ-SEDEC		
		Municipal Cov. Air Dallution Monitorian	
	• SMAC	Municipal Gov. Air Pollution Monitoring Concessionaire Monitoring	0
	SMACAGETRANSP	Concessionaire Monitoring	0
Elaat Operator	• SMAC		
Fleet Operators	SMACAGETRANSPFETRANSPOR	 Concessionaire Monitoring Association of Syndicate for Bus Companies 	0 0
Syndicate	 SMAC AGETRANSP FETRANSPOR Syndicargo 	 Concessionaire Monitoring Association of Syndicate for Bus Companies Syndicate of Fleet Operators 	000000000000000000000000000000000000000
Syndicate Private	SMACAGETRANSPFETRANSPOR	 Concessionaire Monitoring Association of Syndicate for Bus Companies Syndicate of Fleet Operators 	0 0
Syndicate Private Travelers	 SMAC AGETRANSP FETRANSPOR Syndicargo Utilissimo Tranportes LTDA etc. 	 Concessionaire Monitoring Association of Syndicate for Bus Companies Syndicate of Fleet Operators Fleet Operator 	0 0 0 0
Syndicate Private Travelers Travelers/Visi	 SMAC AGETRANSP FETRANSPOR Syndicargo Utilissimo Tranportes LTDA etc. Commuters, residents 	 Concessionaire Monitoring Association of Syndicate for Bus Companies Syndicate of Fleet Operators 	0 0 0 0 X
Syndicate Private Travelers Travelers/Visi tors	 SMAC AGETRANSP FETRANSPOR Syndicargo Utilissimo Tranportes LTDA etc. 	 Concessionaire Monitoring Association of Syndicate for Bus Companies Syndicate of Fleet Operators Fleet Operator 	0 0 0 0
Syndicate Private Travelers Travelers/Visi	 SMAC AGETRANSP FETRANSPOR Syndicargo Utilissimo Tranportes LTDA etc. Commuters, residents 	 Concessionaire Monitoring Association of Syndicate for Bus Companies Syndicate of Fleet Operators Fleet Operator 	0 0 0 0 X
Syndicate Private Travelers Travelers/Visi tors	 SMAC AGETRANSP FETRANSPOR Syndicargo Utilissimo Tranportes LTDA etc. Commuters, residents 	 Concessionaire Monitoring Association of Syndicate for Bus Companies Syndicate of Fleet Operators Fleet Operator 	0 0 0 X X X X
Syndicate Private Travelers Travelers/Visi tors Private Sector Other Related	 SMAC AGETRANSP FETRANSPOR Syndicargo Utilissimo Tranportes LTDA etc. Commuters, residents Tourists/Visitors etc. Local TV and Radio Stations 	 Concessionaire Monitoring Association of Syndicate for Bus Companies Syndicate of Fleet Operators Fleet Operator 	0 0 0 X X X
Syndicate Private Travelers Travelers/Visi tors Private Sector Other Related Companies	 SMAC AGETRANSP FETRANSPOR Syndicargo Utilissimo Tranportes LTDA etc. Commuters, residents Tourists/Visitors etc. Local TV and Radio Stations 	 Concessionaire Monitoring Association of Syndicate for Bus Companies Syndicate of Fleet Operators Fleet Operator 	0 0 0 X X X X
Syndicate Private Travelers Travelers/Visi tors Private Sector Other Related	 SMAC AGETRANSP FETRANSPOR Syndicargo Utilissimo Tranportes LTDA etc. Commuters, residents Tourists/Visitors etc. Local TV and Radio Stations 	 Concessionaire Monitoring Association of Syndicate for Bus Companies Syndicate of Fleet Operators Fleet Operator 	0 0 0 X X X X

4) ITS Services

The ITS services which are referred to in the interviews were determined according to the ITS Service Domain from ISO as shown in Figure 5-75 below. In this survey, services are focused on the domains which are related to each organization type as indicated in Table 5-4.



Figure 5-75 ITS Service Domains

c	Service Domain ITS Services Referred to in the Interview					
Traffic/Transport Transit			Public Safety	Other Agency	Fleet Operators	
		Agencies	Agencies/	Agencies	Department	
		3	Other Transit	3 • • • •		
			Providers			
1.	Traveler		0			
	Information					
2.	Traffic	0	0			
	Management					
	and					
	Operations					
3.	Vehicle	Х	Х	Х	Х	Х
	Services					
4.	Freight Transport					0
5.	Transport Public		0			
5.	Transport		0			
6.	Emergency			0		
0. 7.	Transport-	0	0	0		
/.	related	0	0			
	Electronic					
	Payment					
8.	Road		0			
	Transport-					
	related					
	Personal					
	Safety					
9.	Weather and				0	
	Environmenta					
	l Conditions					
	Monitoring			-		
10.	Disaster			0		
	Response					
	Management and					
	and Coordination					
11	National			0		
11.	Security					
12	ITS Data	0	0	0	0	0
12.	Management					Ŭ
L		L	L	I	1	1

5.2.2 Survey Results

The ITS needs of each stakeholder, which were obtained through interviews, are shown in Table

5-5.

Agencies	Name	Needs of Each Stakeholder ITS Needs
	ortation Agencies	115 170045
Public/ Governmental Company	ANTT	 Plan to build CCO in ANTT to monitor concession road operation To make ITS equipment of concessionaires compatible with each other
	DENATRAN DNIT	 Implementation of SINRAV and SINIAV To install weigh-in motion sensors Plan to introduce fines for speed violations via speed monitoring
	DETRAN-RJ	 To implement SINRAV To match OCR data and license registration data
	DER-RJ	 Plan to build a new control center To centralize collected data on the road (CCTV, detector, and OCR)
	CET-RIO	 Plan to install more adaptive signal controls Plan to exchange information between other bodies
Private	CCR PONTE	 To exchange CCTV data between CET and CCR Ponte (tried once in 2007 but failed) Accidents occur almost every day The pavement sensor is not online Toll gate is congested because of the lack of ETC lanes
	Autopista Flminense Road concessionaires CCR VIA LAGOS ROTA116	 None OCR data is collected manually (CCR via Lagos) Infrastructure monitoring is not enough (LAMSA)
Transit Aganci	LAMSA	
Public	es/Other Transit Providers CENTRAL-SETRANS RIO TORIHOS-SETRANS	 None To monitor the condition of construction effectively To encourage people to use rail more (by investing in network development)
	DETRO-SETRANS	 Plan to develop an online data collection system from buses Plan to send CCTV data of buses to CICC
	CODERTE-SETRANS	 To collect data online and in real time from bus terminals To improve the service at bus terminals by changing to a concession contract such as with NOVO Rio
	AMTU-SETRANS	 To integrate operation systems between transportation modes Plan to manage transportation system at the metropolitan region level
	SETRANS	 To integrate operation systems between transportation modes To provide better user services
	SMTR	 To build hub and spoke transport network (rail/metro and bus) To improve traffic conditions in the area of Barra da Tijuca
	COR	 Disaster management Plan to provide information on traffic conditions

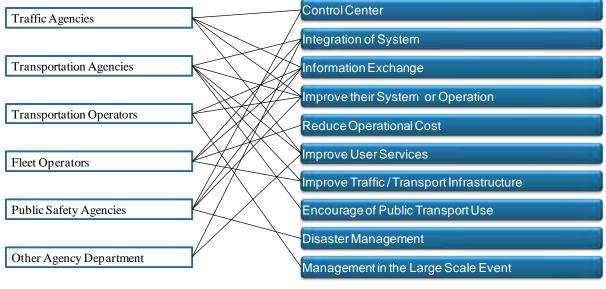
	1	(travel time) by using taxi GPS data
	NITTRANS	 To reduce the demand for automobiles
		 To develop a BRS system
		 To monitor bus locations via GPS in CCO
		> To provide users, especially users between Rio and
		Niteroi, information on traffic and public transport
Syndicate/	Rio Onibus	To share bus line updates between SMTR and bus
Consortium		companies
		GPS data sometimes fail to be transmitted
		Plan to share CCTV data from CET-Rio
		Plan to fine bus companies after bus location
	<u> </u>	monitoring system is validated
	Central Coop	Disconnection between taxi and control center due
		to shadow areas of private mobile services
Delevata	Com on VIA	Plan to install electronic vouchers to reduce costs To another the transmission between other transmission.
Private	Super VIA	To exchange information between other transport
	METRO	agencies None
	CCR Barcas	 To send data to AGETRANSP automatically To share data on traffic/transport conditions in order
		to provide better transportation services
		to provide better transportation services
	Private Bus Companies (208)	-
	Socicam	> Information on arrival time and location of buses are
		not obtained
		Plan to develop the NOVO Rio Terminal as an
		exchange terminal among bus, metro, and LRT
		Plan for operations regarding security and tourism
		matters during large-scale events
	Taxi Companies	Same as Central Coop
Public Safety A		
Public	Civil Defense-SEDEC	Prepare the procedure of operations in CICC
	SAMU-CBMERJ	Plan to establish the SAMU Operation Center and
		the BOMBEIRO Operation Center together in CICC
		Plan to get permission to control CCTV of CET-Rio
		in case of emergency
		Plan to improve ambulance monitoring system (classification of ambulances, and estimation of
		travel times of ambulances)
		 They are testing the introduction of GPS on
		ambulances on the outskirts of Rio de Janeiro City
		 Need for a reliable communications network in case
		of large-scale events
		> To make a procedure for contact between ambulance
		and operations center
	BOMBEIRO-CBMERJ	➢ Same as SAMU
	SESEG	Plan to build CCO for security purposes
		To share CCTV data and OCR data among
		traffic/transport operators
		To use the same protocol for information exchange
	Civil Defense-SMSDC	Plan to be integrated in CICC
Other Agency I		
Other Agency	ABNT Ministry of Communication	Plan to build ITS national standards To survey divited TV broadcasting
Department	Ministry of Communication	 To spread digital TV broadcasting Plan to use analog TV frequency
		Plan to use analog TV frequency
	ANIATEI	> None
	ANATEL	
	ANATEL INEA-SEA	Plan to analyze the relation between traffic data and
		 Plan to analyze the relation between traffic data and air conditions
		 Plan to analyze the relation between traffic data and air conditions Building their own wireless network instead of GMS
	INEA-SEA	 Plan to analyze the relation between traffic data and air conditions Building their own wireless network instead of GMS Plan to increase the number of rain gauges
		 Plan to analyze the relation between traffic data and air conditions Building their own wireless network instead of GMS

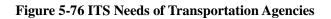
	AGETRANSP	 To install more cameras at stations To process information from concessionaires automatically To integrate the systems used by concessionaires via SITRANS To integrate bus services with other public transportation services To reduce complaints from users
Fleet Operators	FETRANSPOR	The timetable and location data of buses are not provided
Syndicate	Syndicargo	 Integration of port/airport operations and truck operations For trucks to receive weather, roadway, and travel time information and have GPS communications in real time
Private	Utilissimo Tranportes LTDA	 Increase of operating costs due to traffic regulations Plan to install GPS for backup of the current fleet management system
	CUPELLO TRANSPORTES LTDA.	 To realize environmental and economical sustainability Improvement of road network for freight transport They need to change technology based on the contract Freight operating system has not been integrated due to differences among systems Increase of operating costs

Source: JICA Study Team

5.2.3 Summary

Interviews with about 40 stakeholders were conducted. The ITS needs of transportation agencies are summarized in Figure 5-76.





CHAPTER 6 FRAMEWORK SETTING FOR THE INTELLIGENT TRANSPORT SYSTEMS MASTER PLAN OF RIO DE JANEIRO METROPOLITAN AREA

It is important to develop an ITS architecture for the Rio de Janeiro Metropolitan Area considering the following:

- 1. Rising economic activities and urbanization have led to significant congestion on transportation networks;
- 2. Transportation networks are more complex;
- 3. Organizations are more interrelated and information exchange is more essential;
- 4. Systems are more interconnected and interdependent; and
- 5. Travelers expect consistent services.

Against this background of increasing need for "integration" in the Rio de Janeiro Metropolitan Area, the ITS architecture will be prepared to provide an entire framework of ITS and better communication.

In this chapter, the JICA Study Team set an entire framework for developing the ITS architecture of Rio de Janeiro Metropolitan Area by referring to existing ITS architectures around the world. It is a basic concept for formulating an ITS master plan, as shown in Chapter 7.

6.1 REVIEW AND ANALYSIS OF ITS ARCHITECTURES IN MAJOR COUNTRIES

6.1.1 Review and Analysis of ITS Architectures in Major Countries

It is necessary to review the ITS architectures in other countries in order to develop the ITS architecture of Rio de Janeiro in Brazil. The ITS architectures in major developed countries, such as Japan, the United States, and Europe, are reviewed as basic information for reference in the preparation of the ITS architecture plan for the Rio de Janeiro Metropolitan Area. The ITS architectures in major countries are listed in Table 6-1 below.

Name of ITS Architecture	Country	Outline	Year (1st Edition)
System Architecture for ITS	Japan	- Formulated by the five ministries involved	1999
in Japan		- Organized by nine development areas and 21	
		user services	
National ITS Architecture	United States	- Formulated by the Federal Highway	2012
		Administration	
		- Organized by eight development areas and 33	
		user services	
		- More focused on public transportation	
		- Used as framework for regional ITS	
		architecture	
ITS FRAME Architecture	Europe	- Initiated by the European Commission for	2000
		formulation	
		- Organized by ten major functions and 46	
		subfunctions	
		- Prepared as framework architecture commonly	
		used across different countries to secure	
		compatibility	
ITS Architecture for Canada	Canada	- Formulated by Transport Canada	1999
		- Prepared considering the U.S. National ITS	
		Architecture	
Reference Model	ISO/TC204	- Prepared as reference architecture for	1999/2010
Architecture for the ITS	/ABNT	countries/regions to formulate their architectures	
Sector (TS14813 series)		- Reflected by the ITS architectures of major	
		countries including Japan, the United States,	
		Europe, China, Korea, Australia, etc.	

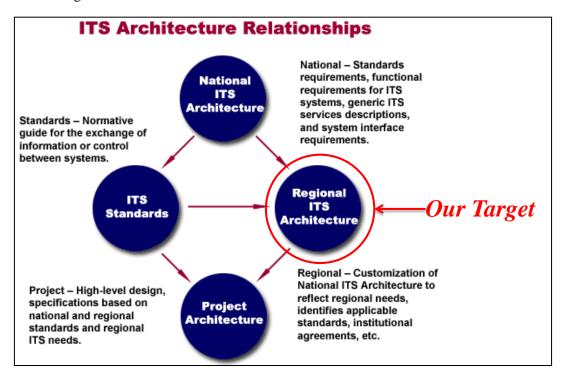
6.1.2 Analysis of the Structure of ITS Architecture

(1) Overall Outline

Based on the review, the ITS architecture can be defined as follows:

- ✓ A framework within which a system can be built;
- \checkmark What the elements of the system do;
- \checkmark What information can be exchanged between them;
- \checkmark "What" must be done, not "how" it will be done; and
- \checkmark The systems and the interconnections and information exchanges between these systems.

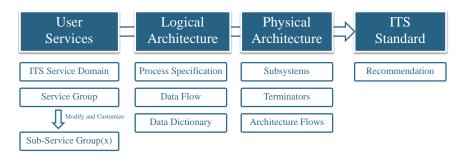
According to the National ITS Architecture of the U.S., the relationships of ITS architectures are summarized in Figure 6-1 below.



Source: Research and Innovative Technology Administration (RITA)

Figure 6-1 ITS Architecture Relationships

The general composition of an ITS architecture includes the following: (i) user services or service domain that shall be defined from several backgrounds like regional issues, transportation issues, etc., (ii) logical architecture, formulated based on (i), which defines the functions or processes needed to deliver the required user services, and (iii) physical architecture, which defines where functions are performed and their interconnections. The following Figures 6-2 to 6-9 show the general composition and roles of ITS architecture, and the definitions of logical and physical architectures.



Source: JICA Study Team

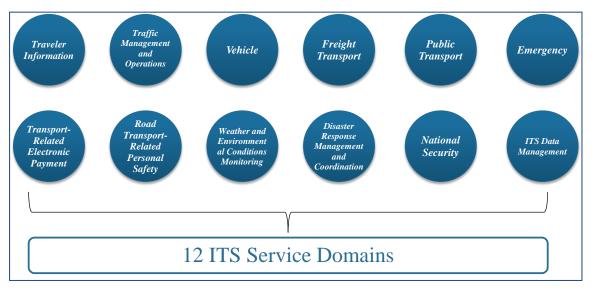
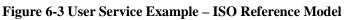
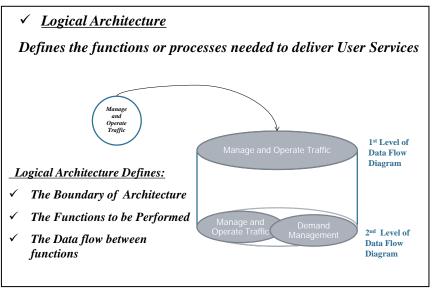


Figure 6-2 General Composition of ITS Architecture

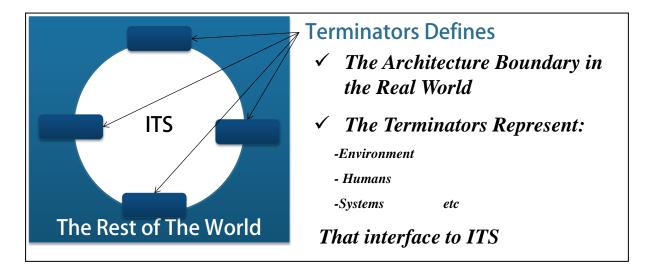
Source: JICA Study Team





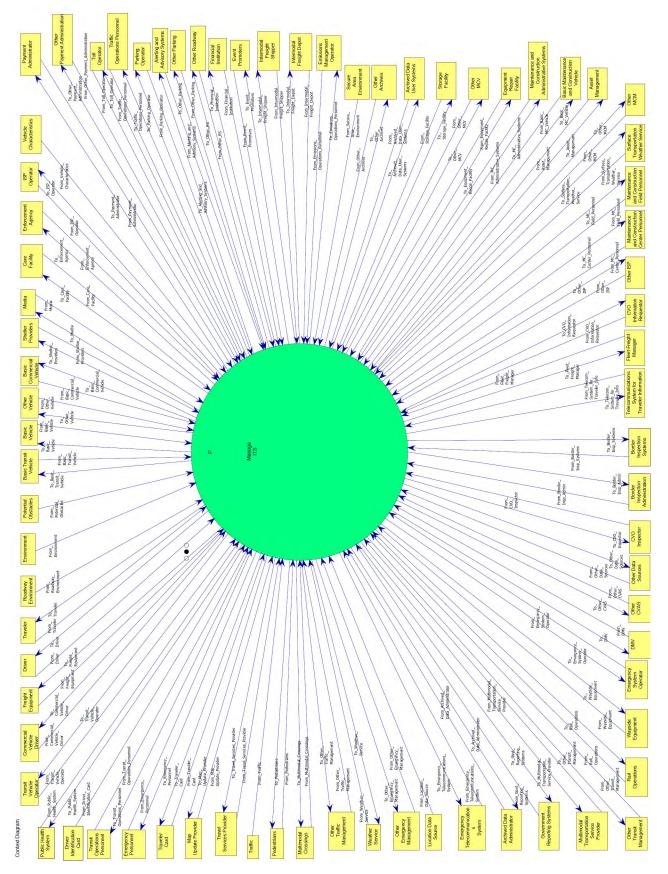
Source: JICA Study Team

Figure 6-4 Definition of Logical Architecture (1/2)



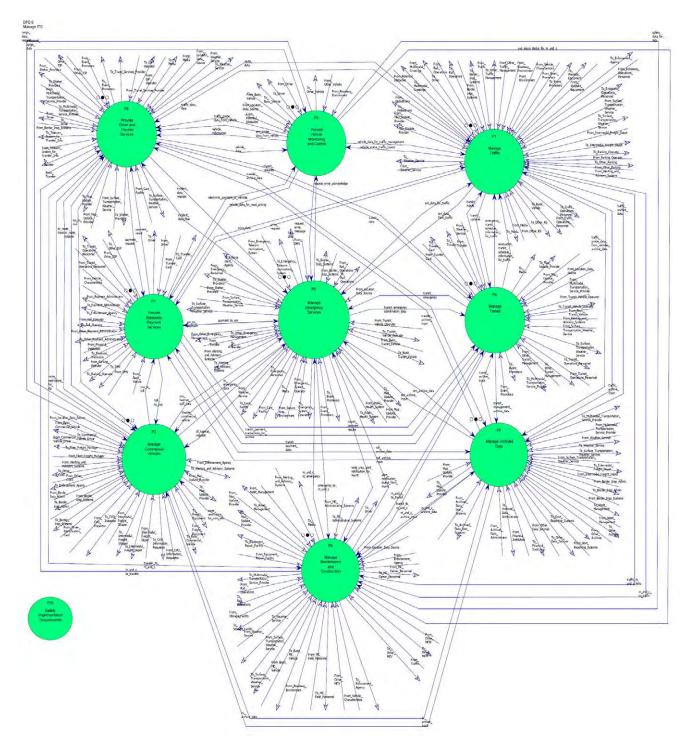
Source: JICA Study Team

Figure 6-5 Definition of Logical Architecture (2/2)



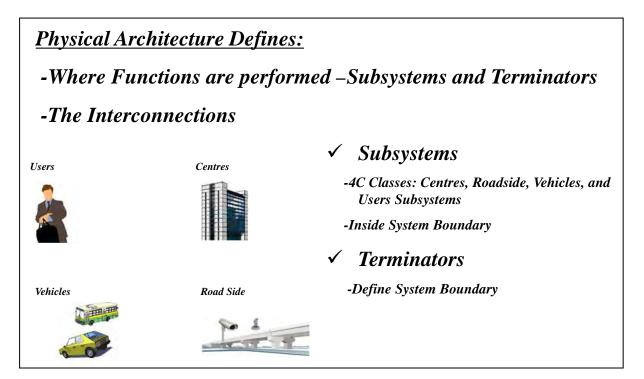
Source: National ITS Architecture of the U.S.

Figure 6-6 Highest-Level Logical Architecture

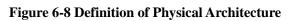


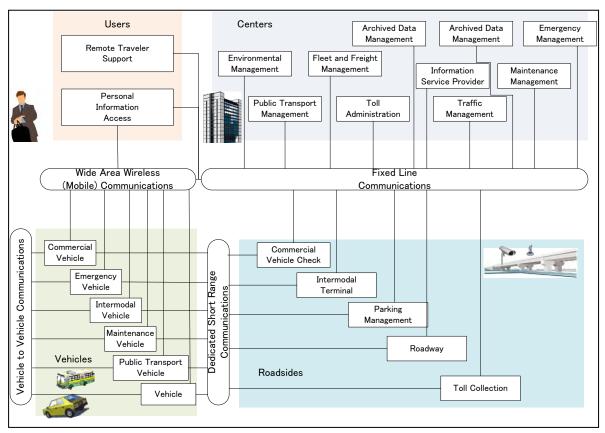
Source: National ITS Architecture of the U.S.

Figure 6-7 High-Level Logical Architecture



Source: JICA Study Team





Source: National ITS Architecture of the U.S. modified by the JICA Study Team

Figure 6-9 High-Level Physical Architecture

Table 6-2 below shows the summary of the results of the review of the ITS architectures of different countries. The National ITS Architecture of the U.S. is comparatively well developed and the world's newest ITS architecture because it is updated frequently. All other architectures except FRAME, which is the E.U. ITS architecture, are not updated. In addition, the user services of the U.S. architecture are aligned with the ISO 14813 reference model. The Canadian ITS architecture is similar to the U.S. architecture because there is an agreement between the U.S. and Canada for the development of ITS architecture. The Japanese ITS architecture was developed in 1999 but it is not updated.

Table 6-2 ITS Architecture Outline

Country	U.S.A.	Canada	Japan	E.U.	ISO 14813
Name/Year	National ITS Architecture/1999- Current Version 7. 2012 January	ITS Architecture for Canada/1999	Japanese National ITS Architecture/1999	The FRAME Architecture /2000- Current Version 4.1 2011	Reference Model Architecture/2007
Structure	3 Layers (Institutional Transportation Communications) Main Architecture===== User Services Logical Architecture Physical Architecture Service Packages Standards	User Services and User Services Requirements Logical Architecture Physical Architecture Equipment Packages Service Packages	User Services Logical Architecture Physical Architecture Standards	User Needs Functional Architecture Physical Architecture Communication Architecture	Service Domain -Service Groups As a Reference to whoever want to develop architecture
No. User Services	8 Service Area 97 Service Package	9 User Service Bundle 37 User Services	9 Development Areas 21 User Services 56 Specific User Services 172 Sub-Services	9 Principal Functional Area 43 Sub Functional Area 187 Sub-Sub Functional Area	12 Service Domains 49 Service Groups 143 Service Example
Summary	The most sophisticated ITS architecture in the world. Old Version of the U.S. Architecture 6.0 was aligned with the ISO 14813. The architecture is well developed, revised frequently and covered wide area.	Similar to the U.S. It's adaptive the U.S. Architecture.	This Architecture has adopted the object-oriented method. This method makes it easier for future alteration and expansion. BUT it is not revised so far.	This is defined by the user needs and functional view point. The "User Needs" of each group was described all aspects of task-wise such as objective, planning, activation and so on.	This is designed to assist the integration of services into cohesive architecture, assist interoperability and with common data definition. The definition of different services varying levels of detail. Because services and the respective domains should be useful for the nation preparing ITS architecture.

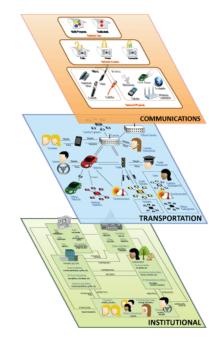
Source: JICA Study Team

This section can be summarized as follows:

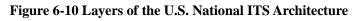
- ✓ The ITS architecture defines the entire framework of ITS;
- ✓ In developing regional architecture, national architecture is necessary;
- \checkmark There is not so much difference in the general composition of ITS architecture;
- ✓ The National ITS Architecture of the U.S. is aligned with the ISO reference model; and
- The Brazilian Technical Standards Association (Associação Brasileira de Normas Técnicas: ABNT) defines the ISO reference model as a standard for the development of ITS architecture in Brazil.

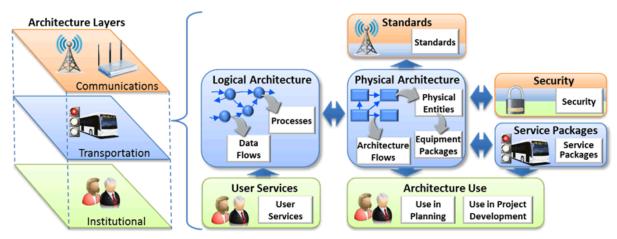
- (2) Analysis of ITS Architecture for Each Country
- 1) The U.S. Architecture

The National ITS Architecture of the U.S. was recently updated and the current version is Version 7.0. It is often updated to catch up with current issues and ITS-related technology. According to the National ITS Architecture website, the latest Version 7.0 provides a framework for planning, programming, and implementing ITS. The architecture framework is comprised of two technical layers, namely, transportation layer and communication layer, which must operate in the context of an institutional layer. Figure 6-10 below shows the layers of the U.S. ITS architecture while Figure 6-11 shows the transportation layer.



Source: National ITS Architecture Website (http://www.iteris.com/itsarch/)





Source: National ITS Architecture Website (http://www.iteris.com/itsarch/)

Figure 6-11 Transportation Layer

The U.S. ITS architecture defines the following:

- ✓ Functions that are required for ITS (e.g., gathering of traffic information or requesting a route);
- ✓ Physical entities or subsystems where these functions reside (e.g., the field or the vehicle); and
- ✓ Information flows and data flows that connect these functions and physical subsystems together into an integrated system.

The user services of the U.S. ITS architecture are comprised of eight user service bundles and 33 user services which are aligned with the ISO14813-1 reference model. Apart from that, the architecture is based on process-oriented methodology, and is extremely detailed and maintained regularly.

2) ITS Architecture of Canada

The Border Information Flow Architecture (BIFA) is a modified version of the U.S. National ITS Architecture developed jointly by the Federal Highway Administration (FHWA) and Transport Canada. Its purpose is to support the planning, development, and implementation of ITS and other technology-based solutions at the U.S.-Canada border (see http://www.iteris.com/itsarch/bifa/).

The ITS Architecture of Canada (http://www.tc.gc.ca/innovation/its/eng/architecture.htm) is based on the U.S. National ITS Architecture, with some modifications to cover the "special" conditions found in Canada. The architecture is due to be updated soon. It has also spawned a joint architecture (BIFA) for use in the implementation of ITS at the Canada-U.S. border crossings (see above).

3) Japanese Architecture

To promote the application of information technologies on roads, traffic, and vehicles, the five related government bodies (National Police Agency, Ministry of International Trade and Industry, Ministry of Transport, Ministry of Posts and Telecommunications, and Ministry of Construction) jointly finalized the Comprehensive Plan for ITS in Japan in July 1996, which is based on the Basic Guidelines for the Promotion of an Advanced Information and Telecommunications Society.

In August 1999, the five government bodies organized a draft copy entitled "System Architecture for ITS". Subsequently, the draft was released so as to collect opinions from a broad range of industrial and academic sectors and to actively address the information overseas.

The composition of the Japanese architecture is quite similar to the architecture of other countries. It has user services, logical, and physical architectures. It also consists of process-oriented methodology, similar to the European and U.S. architectures. However, it is not maintained; therefore, it does not reflect the current condition of ITS in Japan.

The user services of the Japanese architecture consist of 9 development areas, 21 user services, 56 specific user services and 172 subservices.

4) European ITS Frame Architecture

According to its website (http://www.frame-online.net), the FRAME Architecture comprises the top level requirements and functionality, or the Use Cases, for almost all the ITS applications and services that have been considered for implementation in the European Union. It is at such a level that it can be used as a reference by all ITS architects, and is intended to be the foundation for building the other types of architecture that will be necessary. It will enable them to guarantee compliance at the interfaces of other systems so that seamless services can be provided to cross-border travelers, and so that an open European market of compatible components can be established.

User **Data Collection** FRAM Interfaces Interfaces Support for Safety & Manage Public Emergencies Transport Freight & Fleet Operations Manage **Trip Planning &** Traffic **Travel Information** Cooperative Systems Support for Law Road Enforcement Tolling Multi-Modal Transport Other Interfaces (non-Transport) Systems' Interfaces

The coverage area of FRAME is shown in Figure 6-12 below.

Source: FRAME Website (http://www.frame-online.net/)

Figure 6-12 Composition of the FRAME Architecture

The purpose of the FRAME Architecture is to provide a starting point for the development of national and project-based ITS architectures for supporting the increased complexity of ITS implementations across Europe. If used at the start of the ITS implementation process, an ITS architecture based on the FRAME Architecture can reduce the cost and time to completion. This is because the FRAME Architecture enables a large number of different and sometimes complex implementation scenarios to be explored and potential problems to be identified before anything has been purchased or detailed design work has started.

5) ISO 14813-1 Reference Model for ITS Service Domains

The International Standard Organization (ISO) developed a technical committee for intelligent transport systems in 1992 called TC 204. The scope of TC 204 is the standardization of information, communication, and control systems in the field of urban and rural surface transportation. It includes intermodal and multimodal aspects, traveler information, traffic management, public transport, commercial transport, emergency services, and commercial services in the field of ITS.

The ISO 14813-1:2007 provides a definition of the primary services and application areas that can be provided to ITS users. Those with a common purpose can be collected together in ITS service domains, and within these, there can be a number of ITS service groups for particular parts of the domain. The ISO 14813-1:2007 identifies 12 service domains, within which numerous groups are defined. Within this framework, there are varying levels of detail related to the definition of different services. These details differ from nation to nation, depending on whether the specific national architecture building blocks are based directly on services or on groups of functions.

6) ABNT

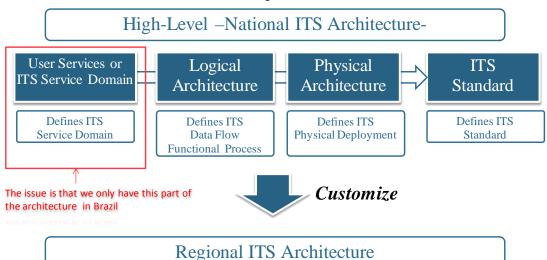
The ABNT was created in 1940 as a non-profit organization engaged in the preparation of national standards. It has set the ISO reference model architecture(s) described above for the ITS sector of Brazil as of August 2010. Therefore, it is necessary to consider ISO 14813-1:2007 as reference to develop the ITS architecture and master plan of Brazil.

6.2 FRAMEWORK SETTING FOR THE ITS MASTER PLAN OF RIO DE JANEIRO METROPOLITAN AREA

6.2.1 Analysis of Current Conditions

According to the ABNT, the Brazilian government has set the reference model architecture(s) for the ITS sector in Brazil as of August 2010. The ABNT defines the standard that must be followed in Brazil. However, this reference model was translated from the ISO reference model, which is an imperfect ITS architecture due to the lack of logical and physical architectures. Therefore, it is important to refer to the U.S. national ITS architecture for developing the regional ITS architecture.

The current situation can be summarized in Figure 6-13 below.



To develop regional architecture future deployment plan should also be developed

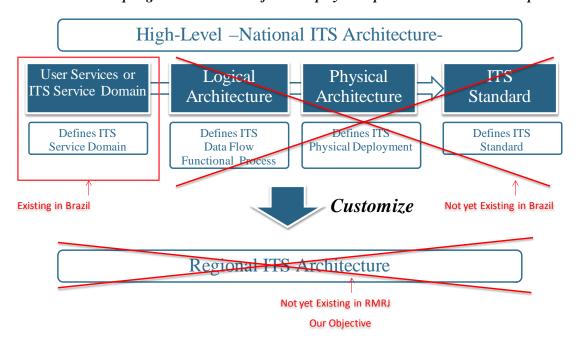


Figure 6-13 Current Condition of ITS Architecture in Brazil

In order to set the framework for an ITS master plan, the ITS architecture of other countries shall be referred to and utilized. Hence, in the next section, the JICA Study Team has conducted a consistency check between the U.S. ITS architecture and the ISO reference model.

6.2.2 Framework Setting for the Development of the ITS Master Plan of Rio de Janeiro Metropolitan Area

As it has been described several times in the preceding sections, the National ITS Architecture of the U.S. is aligned with the ISO reference model. On the other hand, the ABNT, which is the organization supervising the national standards of Brazil, set a standard for ITS user services for developing the ITS in Brazil. This has been translated from the ISO reference model. In accordance with this prerequisite, the JICA Study Team conducted a consistency check between the ISO reference model and the National ITS Architecture of the U.S. in order to utilize and adopt the latter as an entire framework.

U.S.A National ITS Architecture/1999- Current Version 7. 2012 January	ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS ABNT/CEE-127	ISO 14813 Reference Model Architecture/2007
3 Layers (Institutional Transportation Communications) Main Architecture===== User Services Logical Architecture Physical Architecture Service Packages Standards	User Service is adaptable means;	Service Domain=User Services -Service Groups As a Reference to whom want to develop architecture
8 Service Area 97 Service Package The most sophisticated ITS architecture in the world. Old Version of U.S. Architecture 6.0 was aligned with the ISO 14813. Although current version of architecture is revised some points, it can be adaptable for ISO reference model. The architecture is well developed, revised frequently and covered wide area.	User Service is adaptable means, User Services or utilized to define the entire ITS User Service Domain Logical Architecture Physical Architecture Defines ITS Service Domain Defines ITS Data Flow Functional Process	12 Service Domains 49 Service Groups 143 Service Example This is designed to assist the integration of services into cohesive architecture, assist interoperability and with common data definition. The definition of different services varying levels of detail. Because services and the respective domains should be useful for the nation preparing ITS architecture.

Source: JICA Study Team

Figure 6-14 Consistency Check between the ISO Reference Model and the National ITS Architecture of the U.S.

The following Table 6-3 shows the results of the consistency check between the ISO reference model and the National ITS Architecture of the U.S.

The table clearly describes that the user services of the National ITS Architecture of the U.S. and the ISO reference model are completely consistent. Therefore, the National ITS Architecture of the U.S. is set as an entire ITS system framework for developing the ITS master plan of the Metropolitan Region of Rio de Janeiro (*Região Metropolitana do Rio de Janeiro*: RMRJ).

For detailed explanations of both architectures, please refer to their websites.

Table 6-3 Consistency Check between the ISO Reference Model and the National ITS Architecture of

the U.S.

No.	ITS User Services	No.	Service Group Bundles	Adaptive Check to ISO
1	Travel And Traffic Management	1.1	Pre-trip Travel Information	1.1 9.1 9.2
		1.2	En-route Driver Information	1.2
		1.3	Route Guidance	1.3 1.4
		1.4	Ride Matching And Reservation	1.6
		1.5	Traveler Services Information	1.6
		1.6	Traffic Control	2.1 8.2 8.3 8.4
		1.7	Incident Management	2.2 8.2 8.3
		1.8	Travel Demand Management	2.3
		1.9	Emissions Testing And Mitigation	2.5
		1.10	Highway Rail Intersection	None
2	Public Transportation Management	2.1	Public Transportation Management	5.1
		2.2	En-route Transit Information	1.2
		2.3	Personalized Public Transit	5.2
		2.4	Public Travel Security	8.1
3	Electronic Payment Services	3.1	Electronic Payment Services	7.1 7.2
4	Commercial Vehicle Operations	4.1	Commercial Vehicle Electronic Clearance	4.1
		4.2	Automated Roadside Safety Inspection	4.3
		4.3	On-board Safety And Security Monitoring	4.4 6.2
		4.4		4.2
			Commercial Vehicle Administrative Processes	4.2
		4.5	Hazardous Materials Security And Incident	4.8
		4.6	Response	
		4.0	Freight Mobility	4.5 4.6 4.7
No.	ITS User Services	No.	Service Group Bundles	Adaptive Check to ISO
5	Emergency Management	5.1	Emergency Notification And Personal Security	6.1 11.1 11.2
		5.2	Emergency Vehicle Management	6.3 6.4
		5.3	Disaster Response And Evacuation	10.1 10.2 10.3
6	Advanced Vehicle Safety Systems	6.1	Longitudinal Collision Avoidance	3.3
		6.2	Lateral Collision Avoidance	3.3
		6.3	Intersection Collision Avoidance	3.3
		6.4	Vision Enhancement For Crash Avoidance	3.1
		6.4 6.5		3.1 3.4
			Vision Enhancement For Crash Avoidance Safety Readiness Pre-crash Restraint Deployment	3.4
		6.5 6.6	Safety Readiness Pre-crash Restraint Deployment	3.4 3.5
7	Information Management	6.5 6.6 6.7	Safety Readiness Pre-crash Restraint Deployment Automated Vehicle Operation	3.4 3.5 3.2
7	Information Management	6.5 6.6	Safety Readiness Pre-crash Restraint Deployment	3.4 3.5

CHAPTER 7 FORMULATION OF THE INTELLIGENT TRANSPORT SYSTEM MASTER PLAN OF RIO DE JANEIRO

7.1 DEFINITION OF THE ITS MASTER PLAN DEVELOPMENT POLICY

It is quite important for the ITS Master Plan of Rio de Janeiro Metropolitan Area to develop a unified policy. The main purpose of the ITS master plan is to integrate all existing systems to secure interoperability between stakeholders and to enhance the efficiency of transport systems. Considering these characteristics of ITS, the policy of the ITS master plan shall follow the existing strategic plans for Rio de Janeiro state and municipal government.

There are two related plans: one is the Strategic Plan of the State Government, and the other one is the Transport Strategic Plan of the Rio de Janeiro Municipal Government. The JICA Study Team conducted a review of these related plans and set a unified policy for the ITS Master Plan of Rio de Janeiro Metropolitan Area.

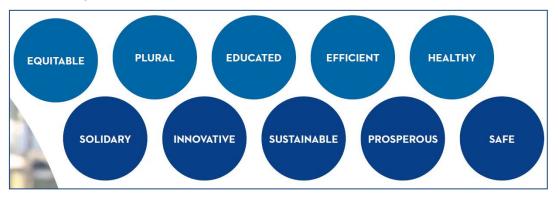
7.1.1 Strategic Plan 2012-2031

The Strategic Plan 2012-2031 is the plan for the strategic development of the state of Rio de Janeiro from 2012-2031 which includes the following:

- 1. Context and Trends;
- 2. Vision of Rio de Janeiro for 2031;
- 3. Scenarios and Forecasts;
- 4. Long-term Sectorial Challenges;
- 5. Sectorial Strategies; and
- 6. Programmed Sectorial Investments.

It also describes the role of agencies for long-term development. Budget allocation is also mentioned in the plan.

In Chapter 3, Vision of Rio de Janeiro for 2031, ten essential aspects for future development are clearly described in Figure 7-1.



Source: Strategic Plan, State Government of Rio de Janeiro, 2012-2031

Figure 7-1 Ten Essential Aspects for Future Development of Rio de Janeiro State

In setting a policy for ITS master plan, it is quite important to consider the ten essential aspects for future development and to broadly cover the issues of the regional characteristics of the Rio de Janeiro State and Metropolitan Area.

7.1.2 Transport Strategic Plan for Rio 2016 Olympic and Paralympic Games

This plan is the transport strategic plan for Rio 2016 Olympic and Paralympic Games. The mission of this plan is as follows:.

Rio 2016, in partnership with the three levels of government, is totally committed to delivering transport services of the highest level of safety, comfort, quality reliability, and efficiency to all games clients, while minimizing the impact on the citizens of Rio.

Source: Transport Strategic Plan for Rio 2016 Olympic and Paralympic Games

The objectives of the strategy are listed below.

- 1. To develop and maintain a client service culture as the highest priority.
- 2. To construct transport infrastructure and systems that support urban development and leave a lasting legacy.
- 3. To deliver superior service levels to all games clients in terms of safety, comfort, quality, reliability, and efficiency.
- 4. To incorporate lessons learned and best practices from previous games.
- 5. To implement innovative transport solutions and proven technology, adapted to Rio's environment.
- 6. To integrate environmental and sustainability planning in the Olympic transport.
- 7. To ensure fully accessible and inclusive games for people with restricted mobility.
- 8. To build an integrated transport team, with all partners sharing a common mission.
- 9. To capitalize on the extended experience of Rio de Janeiro and Brazil in organizing major sports and other events.
- 10. To ensure effective responses to all incidents and emergencies.

Source: Transport Strategic Plan for Rio 2016 Olympic and Paralympic Games

According to the Transport Strategic Plan for Rio 2016, the essential aspects and keywords of the short-term ITS projects for achieving the success of the Olympic Games are summarized as follows:

- ✓ Safety
- ✓ Comfort
- ✓ Quality
- ✓ Reliability
- ✓ Efficiency

To all clients and users

7.1.3 Policy Setting for the ITS Master Plan of Rio de Janeiro Metropolitan Area

After reviewing the preceding related plans, essential elements were extracted as keywords for setting the policy. These elements and keywords consist of the main objectives and related plans, which shall be utilized and followed as policy of the ITS master plan.

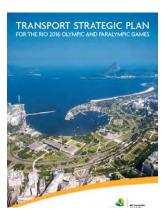
Key Words from two Plans

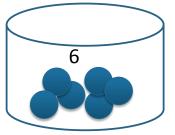
Results of the review are summarized below.

Elements for ITS Master Plan Policy Setting



Equitable Plural Educated Healthy Safe Prosperous Efficient Innovative Sustainable Solidary Safety Comfort Quality Reliability Efficiency All Client





Source: JICA Study Team

Figure 7-2 Summary of Essential Aspects and Keywords for Setting a Policy for ITS Master Plan

Considering these reviews, the JICA Study Team set up the policy for the ITS Master Plan of Rio de Janeiro Metropolitan Area by factorizing the meaning of essential aspects and keywords and verifying the ITS cover area in general.

The ITS master plan sets out the following policies:

- 1. Promote efficient system management and operation;
- 2. Enhance the integration and connectivity of the transportation system;
- 3. Promote and enhance the environmental and economic sustainable development;
- 4. Develop the economic diversity of the metropolitan area by enhancing productivity and efficiency; and
- 5. Increase the safety and security of the transportation system.

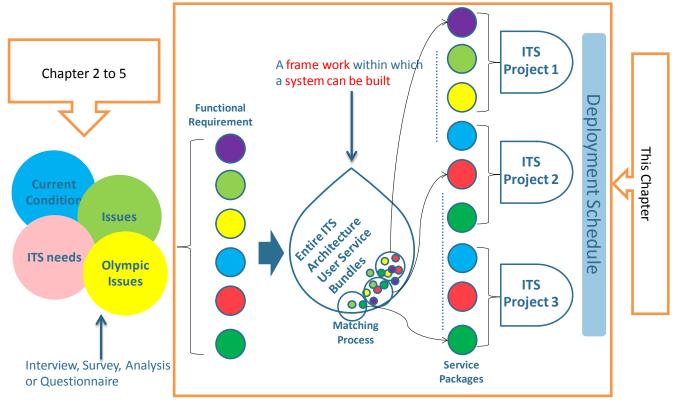
The development policy of the ITS master plan shall include a wide range of perspectives, characteristics, and user needs to achieve sustainable development. Based on this policy, components of the ITS master plan, such as ITS projects, deployment plans, and a selection of short-term projects are studied.

7.2 FORMULATION OF THE ITS MASTER PLAN OF RIO DE JANEIRO

The ITS master plan shall include short- and long-term system deployment to utilize existing systems and integrate all transport-related systems as information exchange. The contents of the ITS master plan is as follows:

- 1. ITS projects architecture (conceptual design for ITS projects);
- 2. ITS deployment schedule; and
- 3. Short-term projects and its schedule in detail.

The study flow on the formulation of the ITS master plan is shown in Figure 7-3 below.



Source: JICA Study Team

Figure 7-3 ITS Master Plan Study Flow

7.2.1 Clarification of Functional Requirement

Identifying the required system functions is an important step in building up the ITS master plan. From Chapters 2 to 4, the current conditions and issues were realized by conducting data analysis such as statistics, geometry data, current and future traffic/transportation/ transit situation, infrastructure development conditions, and the Olympic Games situation. In Chapter 5, ITS needs are clarified through stakeholder's interviews and questionnaires for normal users.

Considering the current condition, issues, and needs of ITS, the required system functions are identified. The required system functions can be defined as "A statement that specifies WHAT a system must do". The statement should use formal "shall" language and specify a function in terms that the stakeholders, particularly the system implementers, will understand. In the National ITS Architecture, functional requirements have been defined for each equipment package that focuses on the high-level requirements that support regional integration.

In this study, functional requirements are studied based on the current condition, issues, and ITS needs, which are described in Figure 7-4 shown in the next page.

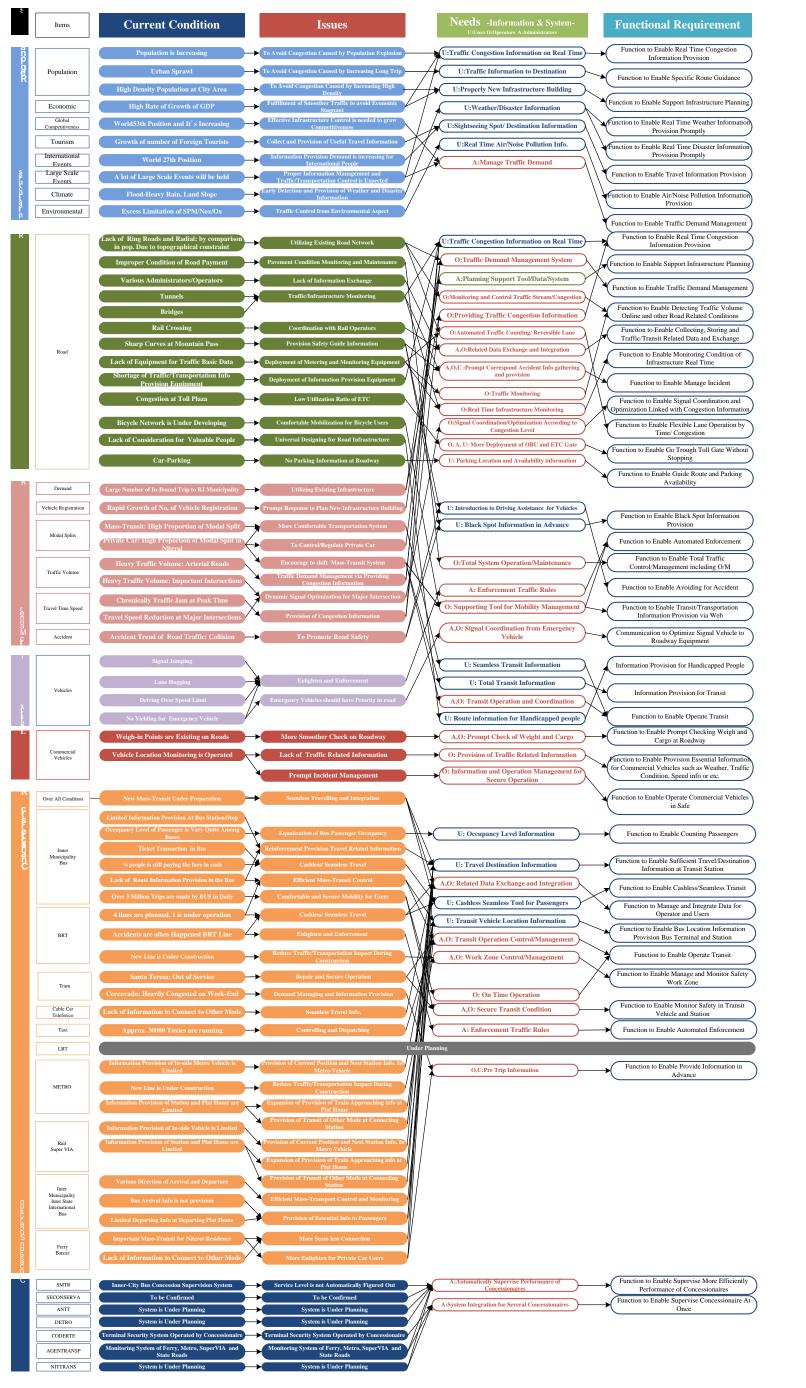


Figure 7-4 Matching Process

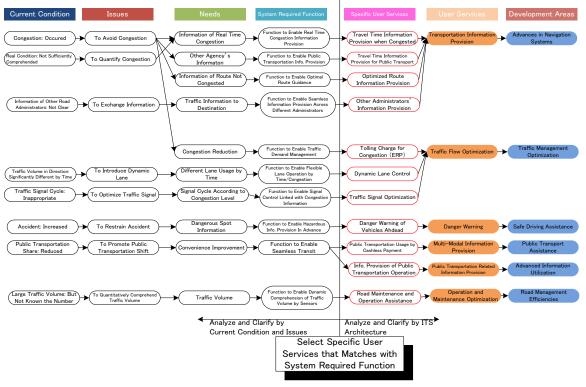
7.2.2 Matching with User Services

User services document what ITS should do from the user's perspective. A broad range of users are considered, including the traveling public as well as many different types of system operators. User services, including the corresponding user service requirements, form the basis for the National ITS Architecture development efforts. The initial user services were jointly defined by the United States Department of Transportation (USDOT) and Intelligent Transportation Society of America (ITS America) with significant stakeholder input which are documented in the National Program Plan. The concept of user services allows system or project definition to begin by establishing the high-level services that will be provided to address identified problems and needs. New or updated user services have been and will continue to be satisfied by the National ITS Architecture over time.

Source: The National ITS Architecture 7.0

The matching process shall be considered as a check of coherency of the logical aspect for developing the ITS master plan because the referred architecture is formulated in the U.S.

However, in general, architecture defines the entire framework of ITS but does not define the details of ITS. From this perspective, the National ITS Architecture 7.0 can be utilized as a framework of the ITS master plan development. Figure 7-5 below shows the outline of the matching process between functional requirement and user services. Figure 7-6 on the next page shows the results of the matching process which illustrate the relationship of the current condition to user services and its bundles.



Source: JICA Study Team

Figure 7-5 Outline of the Matching Process

The Federative Republic of Brazil Study on the Introduction of Intelligent Transport Systems

Image: Construction Construction Construction Construction Construction Image: Construction Construction Construction Construction Construction Construction Image: Construction Constructi	ð	Items	Current Condition	Issues		Needs -Information & System- U:Users O:Operators A:Administrators		Functional Requirement	1	User Services Bundle
Image:		Population	Urban Sprawl 🔶	To Avoid Congestion Caused by Increasing Long Trip		U:Traffic Information to Destination		Information Provision		
Image: State of the state		Economic		Density Fulfillment of Smoother Traffic to avoid Economic Stagnant	Η			Function to Enable Support Infrastructure Planning		1.1 Pre-Trip Information
Image: Control of the control of th			World53th Position and It's Increasing	Effective Infrastructure Control is needed to grow Competitiveness		U:Sightseeing Spot/ Destination Information				1.2 En-Route Driver Information
Image: market in the second			Growth of number of Foreign Tourists		K	U:Real Time Air/Noise Pollution Info.		Function to Enable Real Time Disaster Information		1.3 Route Guidance
Image:		Events		Information Provision Demand is increasing for International People Proper Information Management and	μ	A:Manage Traffic Demand				1 4 Pida Matabing and Paragratian
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Image: Control of the Control of th		Environmental	Excess Limitation of SPM/Nox/Ox	Traffic Control from Environmental Aspect	/			Provision		1.5 Traveler Service Information
In the standard of the standard	R		Lack of Ring Roads and Radial: by comparison			ULTratic Connection Information on Deal Time				1.6 Traffic Control
Image: Control in the control in th			in pop. Due to topographical constraint		\searrow		1			1.7 Incident Management
Norm					\mathbb{X}	A:Planning Support Tool/Data/System	K			1.8 Travel Demand Management
Not Image: I			Tunnels	Traffic/Infrastructure Monitoring	K X)	O:Monitoring and Control Traffic Stream/Congestion				1.9 Emission Testing and Mitigation
Image: Construction of the construc				O and the other with Dath Oreserver	\mathbb{N}	O:Providing Traffic Congestion Information	1	Online and other Road Related Conditions		
Instrumentation Instrumentation Instrumentation Instrumentation Instrumentation Instrumentation Instrumentation Instrumentation Instrume							þ			
Image: State Stat		Road	Lack of Equipment for Traffic Basic Data	Deployment of Metering and Monitoring Equipment	(T)		1			
Image: Control of Contro			Shortage of Traffic/Transportation Info Provision Equipment	Deployment of Information Provision Equipment	WA		¥•	Function to Enable Manage Incident		
Image: An other and the state of the st			Congestion at Toll Plaza	Low Utilization Ratio of ETC						2.2 En.Route Transit Information
Image: Control contro control control contro control control control control control co			Bicycle Network is Under Developing	Comfortable Mobilization for Bicycle Users					\V\/\XX <i>\//M</i>	
Image: Section of the section of th					VIA)				N X X AN <i>M</i> M	
Image: The stand			Car-Parking	No Parking Information at Roadway	WI X	U: Parking Location and Availability information				2.4 Public Travel Security
Image: State of the state		Demand	Large Number of In-Bound Trip to RJ Municipality	Utilizing Existing Infrastructure	WN /N			Availability		3. Electric Payment
India India (1) (1) (1) (1) (1) (1) (1) (1) (1) (1)		Vehicle Registration			INX \		->		// V\ \ <i>XXII 1</i> 1444	3.1 Electronic Payment Services
Image:		Modal Splits			$M \setminus $	U: Black Spot Information in Advance				A Commercial Vehicle
Interview			Niteroi Heavy Traffic Volume: Arterial Roads		X\X	O:Total System Operation/Maintenance	\mathbb{A}			
Image:		Traffic Volume		Traffic Demand Management via Providing Congestion Information			\mathbb{Z}			4.1 Commercial Vehicle Electric Clearance
Image: market of the standard o		Travel Time Speed	Chronically Traffic Jam at Peak Time	Dynamic Signal Optimization for Major Intersection		Σ/	_		X 🗙 X V 11 V 11 / 1	4.2 Automated Roadside Safety Inspection
view					/\}	A,O: Signal Coordination from Emergency				
Image: Control of the control of th	Í	Accident	Accident Trend of Road Traffic: Collision	To Promote Road Safety	\mathbb{N}	Vehicle	-			
Norm Improve the stand we down and the sta			Signal Jumping		/ / \	U: Seamless Transit Information	1	Information Provision for Handicapped People		4.4 Commercial Vehicle Administrative Processes
Image: state stat		Vehicles	Lane Hogging				\checkmark	Information Provision for Transit		4.5 Hazardous Security And Incident Response
Image: state of the state				Lintegency reacted should note i northy in road			1	Function to Enable Operate Transit		4.6 Freight Mobility
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Image: Control of the state of the stat		Commercial Vehicles	Vehicle Location Monitoring is Operated	Lack of Traffic Related Information						
Intervent			7	Prompt Incident Management						5.1 Emergency Notification And Personal Security
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Wirking Laboration and Transit Statistics A state water and the state of t				Equalization of Bus Passenger Occupancy		Li: Occupancy Lavel Information		Function to Enable Counting Passengers		5.3 Disaster Response And Evacuation
bs Experies routing programment of the first routing programment routing pr		Inner	Buses Ticket Transaction in Bus				ĺ		///////////////////////////////////////	
Image: Construction of the constructin of the construct		Bus			\mathbb{N}	U: Travel Destination Information	-)			
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Bit T Acidents are often Happened BR Link Findplane and Endorcement A.O. Transit Operation Control/Management Panetion to Enable Bps Location Information Provision BBs Termination States Tran Stata Tereas: Out of Nervice Repair and Secure Operation O: Or Transit Operation Punction to Enable Monitor Safety 6.3 Intersection Collision Avoidance Tran Stata Tereas: Out of Nervice Repair and Secure Operation O: On Time Operation Punction to Enable Monitor Safety 6.4 Vision Enhancement For Crash Avoidance Tran Corcorosci Liervity Congrested on Week-End Houndain Provision O: On Time Operation Punction to Enable Monitor Safety Work Zone 6.5 Safety Reatiness Tai Approx.30000 Taxies are remaing Controlling O: On Time Operation Function to Enable Monitor Safety in Transit 6.7 Automated Vehicle Operation MERO Meron Monitor Safety Or Orbition of Control Other Mode Samese Travel Info O: Or Time Operation Function to Enable Monitor Safety in Transit 6.7 Automated Vehicle Operation MERO Meron Monitor Safety Controlling and Disputsbias O: Or Time Operation Function to Enable Provide Information In Advance 7.1 Information Management 6.7 Automated Vehicle Operation MERO Meron Mero Safety Restanding Inford Co			4 lines are planned, 1 is under operation	Cashless/ Seamless Travel	Ŕ		7			6.2 Lateral Collision Avoidance
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			Information Provision of In-side Vehicle is Limited	Station						
		Rail Super VIA	Limited	Metro Vehicle Expansion of Provision of Train Approaching info at						8.1 Maintenance And Construction Operations

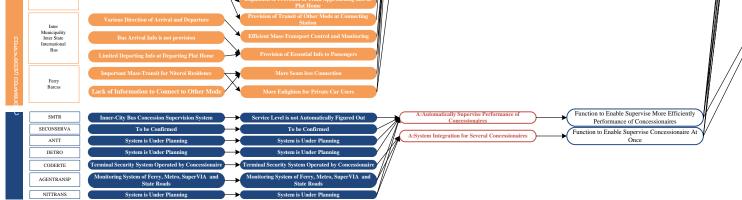


Figure 7-6 Results of the Matching Process

Source: JICA Study Team

The matching process results show that only one user service; 2.3 Personalized Public Transport, which is bundled under Public Transport Management is not matched from the needs and functional requirements because the public transport network, especially the bus transport, widely covers the Rio de Janeiro municipal area. In addition, the survey on ITS needs was conducted in an urban area only. Due to this project circumstances, user service 2.3 Personalized Public Transport will not be considered in the ITS master plan and architecture of the Rio de Janeiro Metropolitan Area.

However, the other user services and bundles are adapted to the ITS needs and functional requirements of the Rio de Janeiro Metropolitan Area.

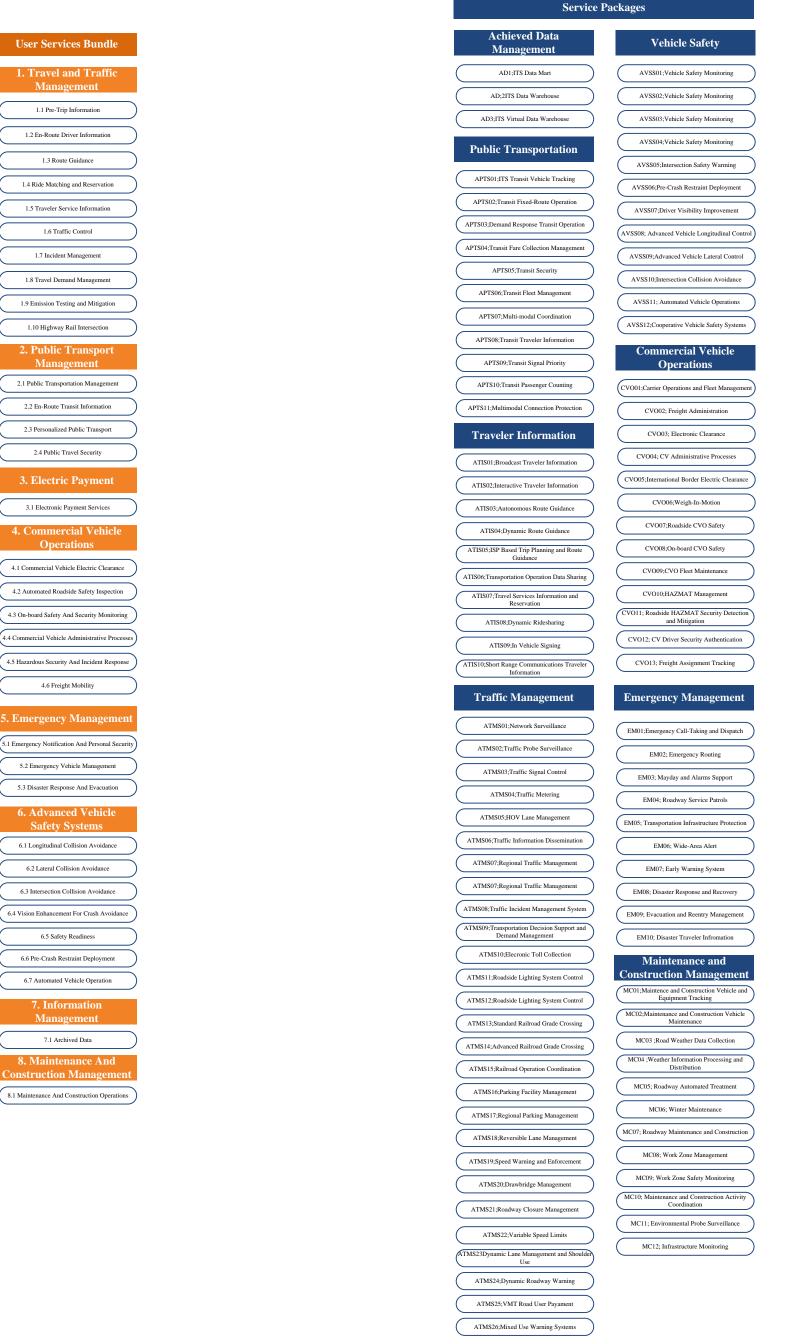
7.2.3 Clarification of Relationship between User Service Bundles and Service Packages

The service packages, formerly known as market packages, provide an accessible, service-oriented perspective to the National ITS Architecture. They are tailored to fit, separately or in combination, real world transportation problems and needs. Service packages collect together one or more equipment packages that must work together to deliver a given ITS service and the architecture flows that connect them and other important external systems. In other words, they identify the pieces of physical architecture that are required to implement a particular ITS service. Service packages implemented through projects (or groups of projects, a.k.a. programs) and in transportation planning, are directly related to ITS strategies used to meet regional goals and objectives.

Source: The National ITS Architecture 7.0

It is quite important to understand the relativity of user services and services packages for developing a comprehensive ITS master plan, which can describe the connectivity of existing systems in the real world and ideal form from user perspective. Figure 7-7 to Figure 7-15 in the following pages (sausage diagrams) show the relativity between user service bundles and service packages. To know more about user services and service packages, please go to the website of The National ITS Architecture 7.0 found on: http://www.iteris.com/itsarch/.

/Ianas





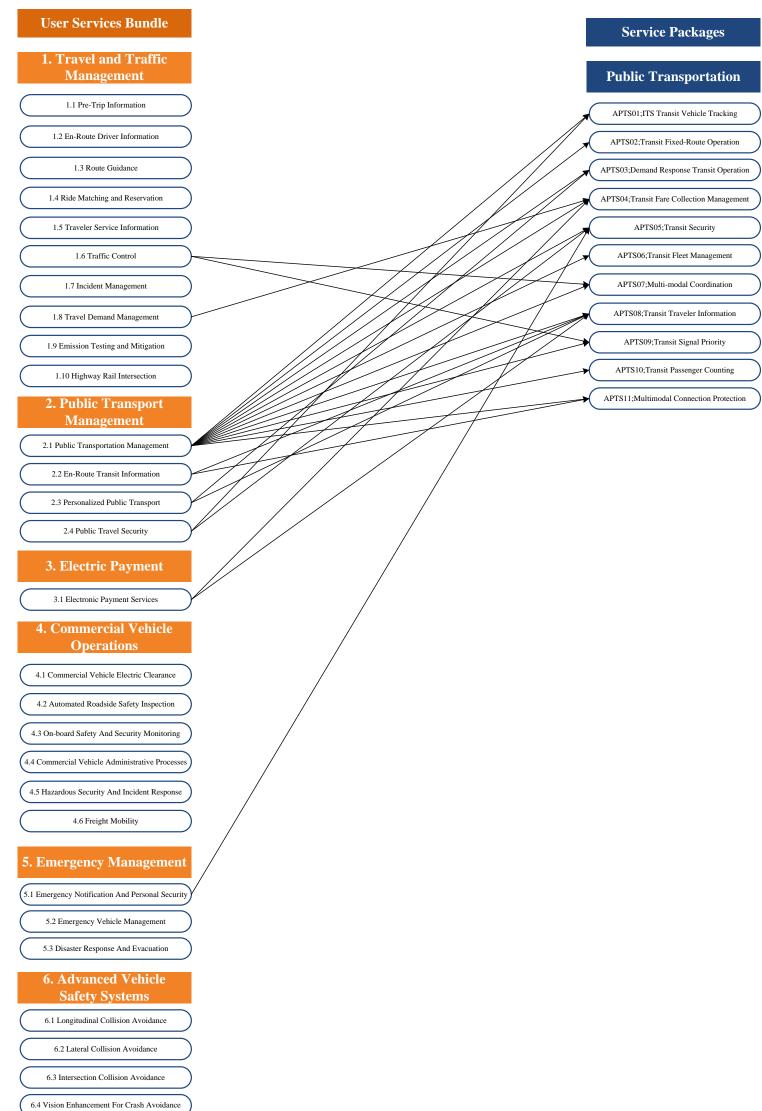
Source: JICA Study Team

Figure 7-7 User Service Bundles and Service Packages



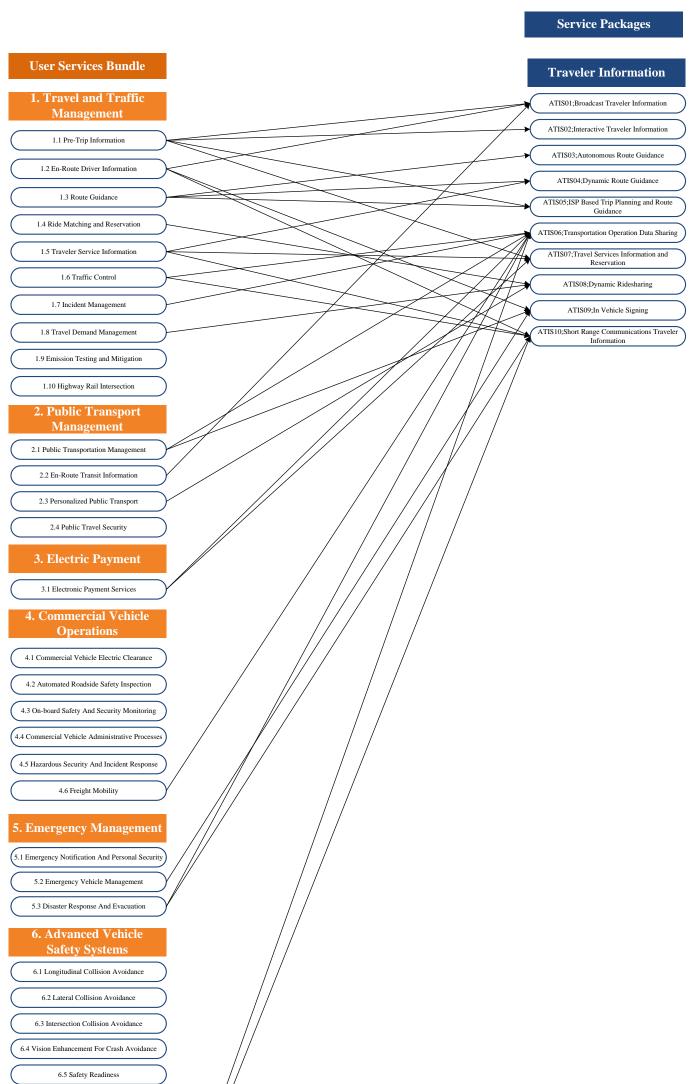
6.5 Safety Readiness
6.6 Pre-Crash Restraint Deployment
6.7 Automated Vehicle Operation
7. Information Management
7.1 Archived Data
8. Maintenance And Construction Management
8.1 Maintenance And Construction Operations

Figure 7-8 Relativity of User Service Bundles and Service Packages (1/8)



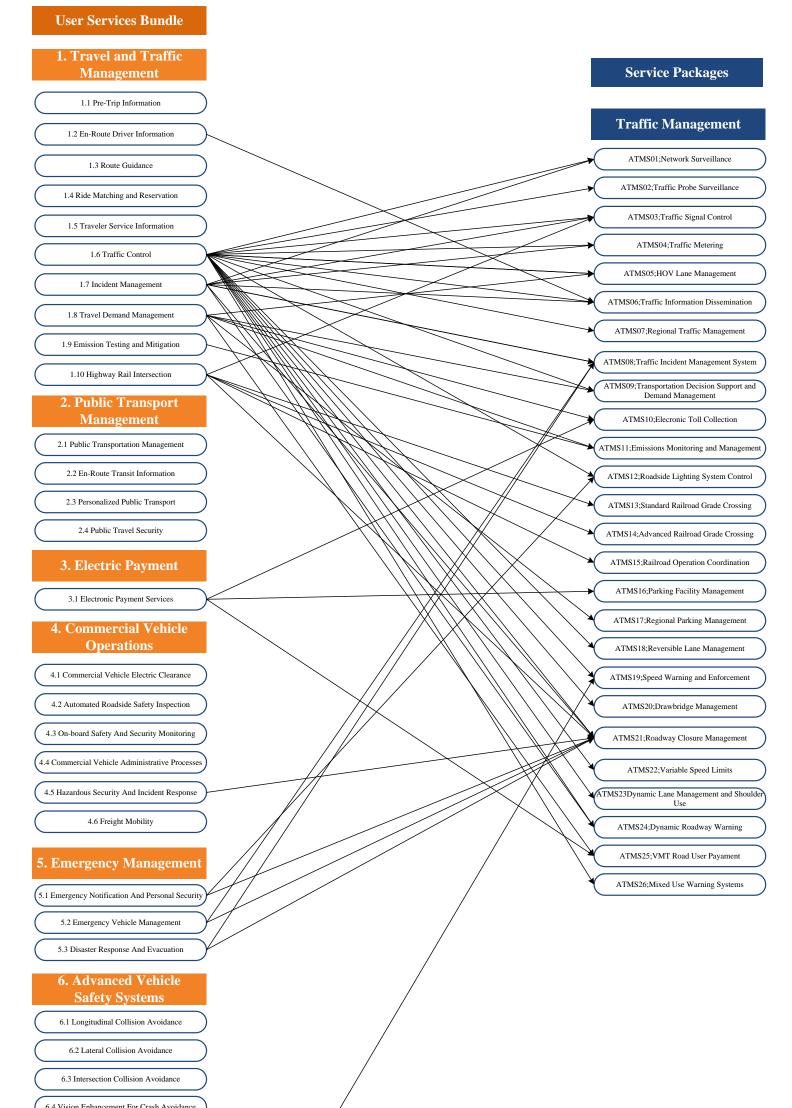
6.5 Safety Readiness
6.6 Pre-Crash Restraint Deployment
6.7 Automated Vehicle Operation
7. Information Management
7.1 Archived Data
8. Maintenance And Construction Management
8.1 Maintenance And Construction Operations

Figure 7-9 Relativity of User Service Bundles and Service Packages (2/8)



6.6 Pre-Crash Restraint Deployment
6.7 Automated Vehicle Operation
7. Information Management
7.1 Archived Data
8. Maintenance And Construction Management
8.1 Maintenance And Construction Operations

Figure 7-10 Relativity of User Service Bundles and Service Packages (3/8)

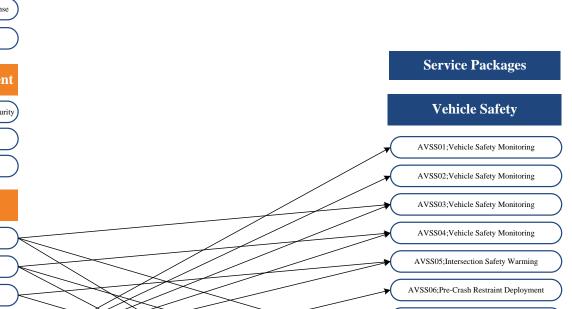


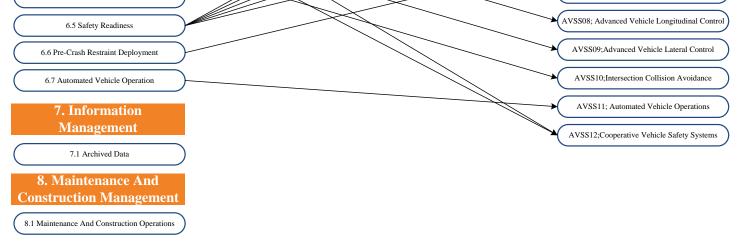
6.5 Safety Readiness
6.6 Pre-Crash Restraint Deployment
6.7 Automated Vehicle Operation
7. Information Management
7.1 Archived Data
8. Maintenance And Construction Management
8.1 Maintenance And Construction Operations

Figure 7-11 Relativity of User Service Bundles and Service Packages (4/8)



6.3 Intersection Collision Avoidance





Source: JICA Study Team

AVSS07;Driver Visibility Improvement

Figure 7-12 Relativity of User Service Bundles and Service Packages (5/8)

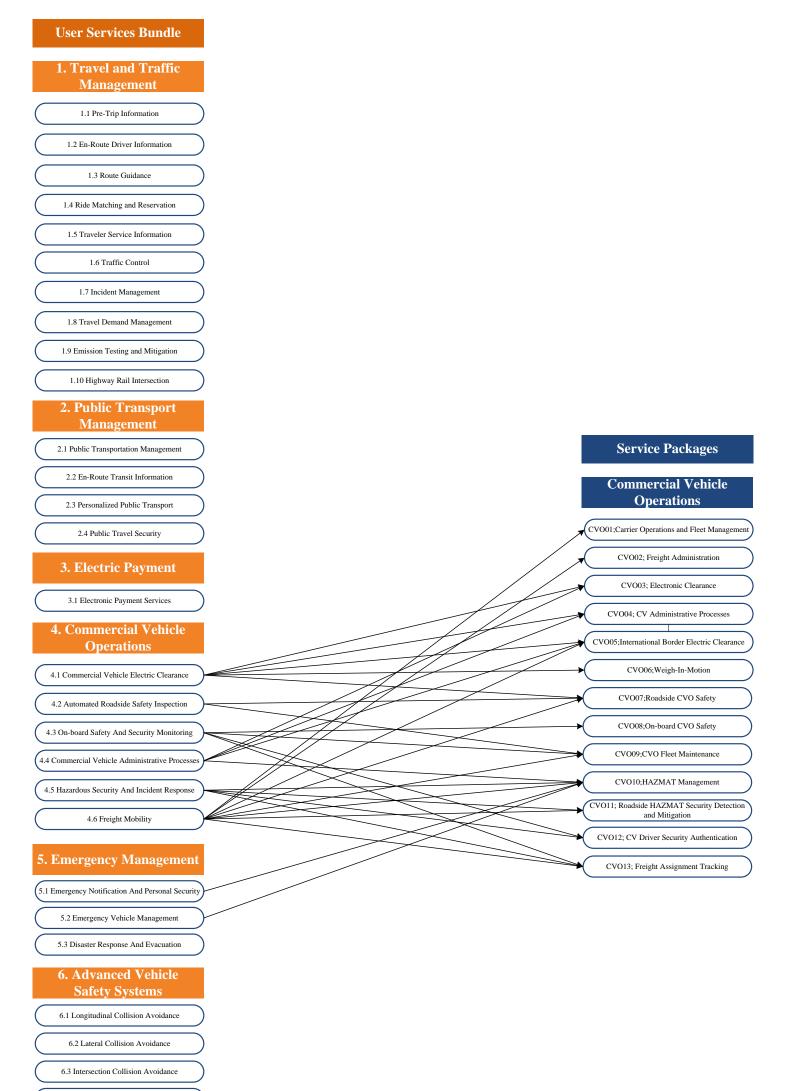




Figure 7-13 Relativity of User Service Bundles and Service Packages (6/8)

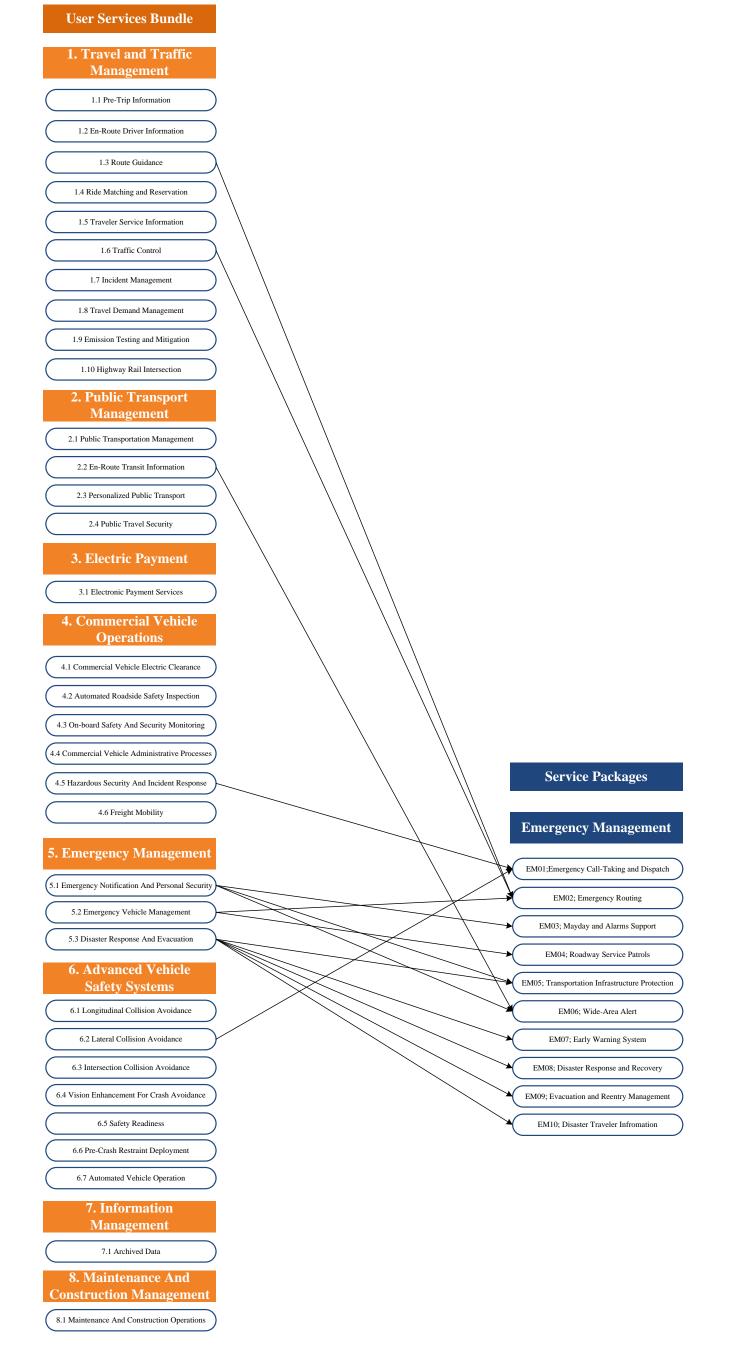


Figure 7-14 Relativity of User Service Bundles and Service Packages (7/8)

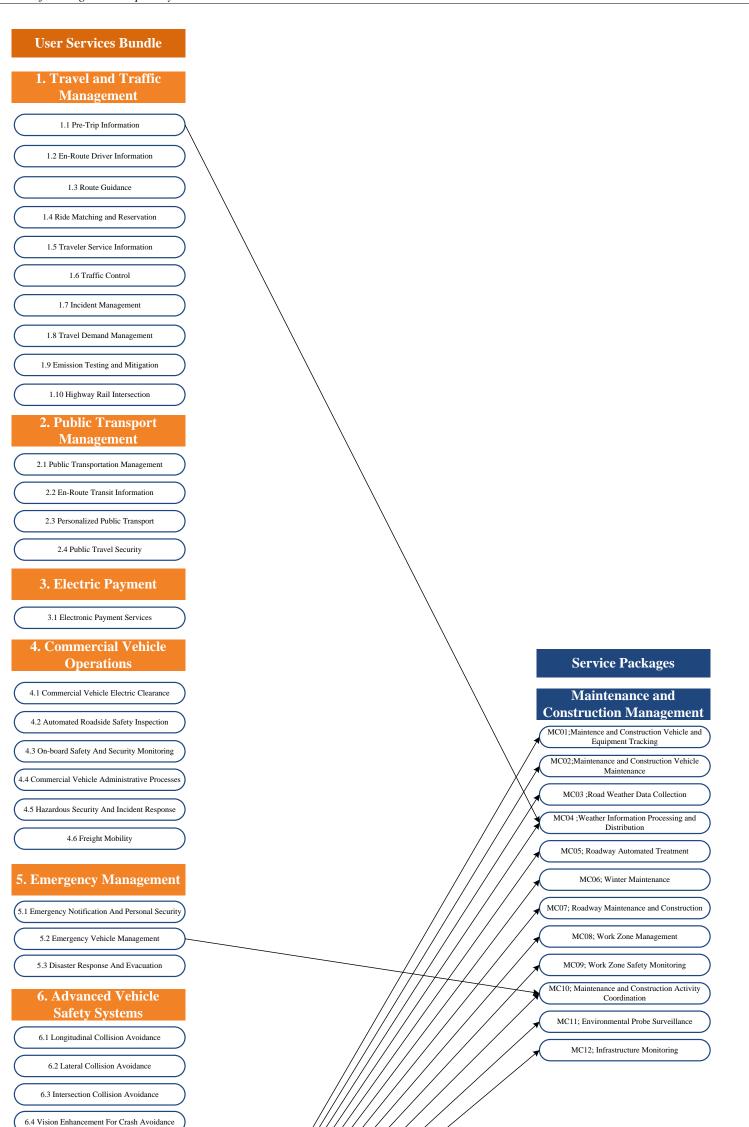




Figure 7-15 Relativity of User Service Bundles and Service Packages (8/8)

7.2.4 Conceptual Design for ITS Projects

(1) Study on Essential ITS Projects for Rio de Janeiro Metropolitan Area

There are three perspectives which shall be considered to build up ITS projects for Rio de Janeiro Metropolitan Area as follows:

- 1. Policy of ITS Master Plan,
- 2. Current Condition and Issues, and
- 3. ITS Needs.

In addition, the keywords for further development of the ITS field in Rio de Janeiro Metropolitan Area is the following:

- 1. Integration,
- 2. Information Exchange,
- 3. Utilization,
- 4. Dissemination, and
- 5. Cooperation (Interoperability).

The coverage of ITS projects shall focus on these aspects. Furthermore, it shall be adaptive to ITS architecture such as service packages, user services and bundles. Figure 7-16 below shows the developing process of ITS projects for Rio de Janeiro Metropolitan Area.

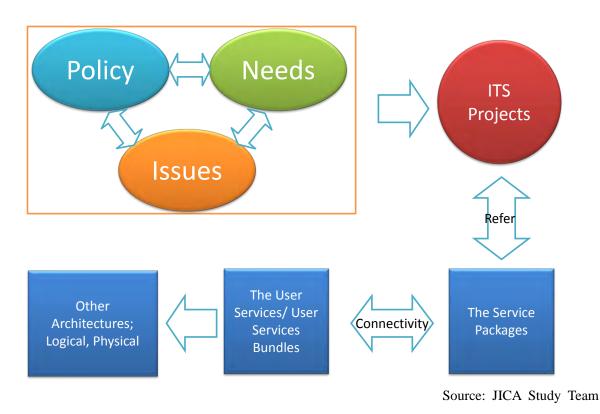


Figure 7-16 Developing Process of ITS Projects

(2) Conceptual Design for ITS Projects

Considering the circumstances, the JICA Study Team prepared 13 ITS projects, which are shown below.

Table 7-1 ITS Projects

No.	ITS Project Name
1	ITS Center
2	Real Time Traffic/Transport Condition Information Processing
3	Olympic Security and Transport Coordination Center
4	Bus Condition Information Provision
5	Dissemination of On-board Unit for More Integrated Transport
6	Information Exchange of Road Operators
7	Information Exchange via ITS Center between Municipalities
8	Improvement of Traffic/Transit Operational Center with Essential ITS
	Equipment in Rio de Janeiro Municipal Area
9	Improvement of Traffic/Transit Operational Center with Essential ITS
	Equipment in Other Municipal Areas in RMRJ
10	Emergency Vehicle Operating Management
11	Commercial Vehicle Operation and Management
12	Advanced Vehicle Safety Systems
13	Deployment of X-band Radars

ITS Project Name	1. ITS Center - for Information Integration and Dissemination		
Objectives	To integrate all transport/transit-related information into one place.		
,	To process useful information for all stakeholders.		
	To disseminate information to everyone through media.		
Graphic	Image: state of the		
Target Area (Area to be applied)	Rio de Janeiro Metropolitan Area		
Required System	1. Information Exchange System		
Required System	2. ITS Center Building (COR (<i>Centro de Operações da Prefeitura</i>		
	<i>do Rio</i> : Operation Center of Rio de Janeiro) or CICC (<i>Centro</i>		
	Integrado de Comando e Controle: Center for Integrated		
	Command and Control) or New building)		
Rough Order of Magnitude	R\$59.900.000/¥2,371,000,000		
Estimate			
Implementation Period	From short term to long term: Stepwise development		
ITS Service Packages	AD area, ATIS area, ATMS06, and ATMS09		
Reference No.			
Remarks	Intense and quick development shall be done in the short term for Olympics preparation. After the Olympic Games, it shall expand and improve in a stepwise manner along with other related system development.		

ITS Project Name	2. Real Time Traffic/Transport Condition Information Processing		
Objectives	To gather and process information to monitor the actual real t		
	condition of Rio de Janeiro Metropolitan Area.		
Graphic	Private Vehicles Vehi		
	WEB Digital Broadcasting		
Target Area (Area to be applied) Required System	Rio de Janeiro Metropolitan Area 1. Probe Data System		
Kequiled System	 Probe Data System Transit Data System 		
	 Point Data System Point Data System 		
	 Incident Monitoring System 		
	 Weather Monitoring System 		
Rough Order of Magnitude	R\$45.900.000/¥1,815,000,000		
Estimate			
Implementation Period	Short term: Rio de Janeiro municipal area		
r	Long term: Stepwise development		
ITS Service Packages Reference	AD area, ATIS area, ATMS06, and ATMS09		
No.			
Remarks	For the fulfillment of traffic/transit management, real time		
	traffic/transit data shall be gathered, processed, and supervised		
	intensively.		
	Weather and disaster information is also important.		

ITS Project Name	3. Olympic Security and Transport Coordination Center		
Objective	To expand and improve the functions of existing ITS equipment for		
	smoother and smarter transportation and transit.		
Graphic			
Security Monitoring/Em Security Monitoring/Em Security Monitoring/Em CICC Entire Traffic Condition and Condition info from Dissemination of All Moo Transportation Information ITS Center	Transit Operational TTS Center Entire Traffic Condition and Transit Operational Condition info from ITS Center Entire Traffic Condition Delay and Passenger Occupancy Ratio of BRT Next Bus, Train or METRO Information Exchange		
Target Area (Area to be applied)	Rio de Janeiro municipal area		
Target Area (Area to be applied) Required System	1. System Integration for Olympic Security and Transport		
Kequileu System	Coordination		
	2. Information Exchange System		
Rough Order of Magnitude	2. Information Exchange System R\$48.900.000/¥1,936,000,000		
Estimate	κφ+6.200.000/+1,230,000,000		
Implementation Period	Short term		
ITS Service Packages	ATIS01, APTS 05,06,07,08,09,10 and 11, ATMS06, and EM area		
Reference No.	$A_{11501}, A_{115}, 05, 00, 07, 06, 09, 10$ and 11, A1W500, and EM area		
	Integration of traffic/transit and security for the success of the		
Remarks	Integration of traffic/transit and security for the success of the Olympic Games. The project shall be commenced immediately.		
	Source: UCA Study T		

ITS Project Name	4. Bus Condition Information Provision			
Objectives	To enhance passenger satisfaction.			
Graphic Buses GPS Data	Bus Operation Center Bus Terminal/Stops/Inside Vehicle Provine dn/bus 477 está chogendo Provine dn/bus 47			
Target Area (Area to be applied)	Rio de Janeiro municipal area to Metropolitan Region of Rio de Janeiro (<i>Região Metropolitana do Rio de Janeiro</i> : RMRJ)			
Required System	 Bus Condition Provision System Bus Information Panel for Bus Stop (500 bus stops) Information Display in Bus Terminal (44 bus terminals) Information Display in Bus (3000 buses) Bus Operation Center (3 bus operation centers) GPS for Bus (8000 buses) 			
Rough Order of Magnitude Estimate	R\$122.300.000/¥4,840,000,000			
Implementation Period	Short term: Rio de Janeiro municipal area Long term: Other municipalities and inter buses			
ITS Service Packages Reference No.	APTS05,06,07,08,09,10 and 11			
Remarks	Bus arrival information is useful to every bus user. This project is also important to the spectators of Olympic Games. Deployment planning shall be done more precisely before installing equipment at each bus stop.			

ITS Project Name	5. Dissemination of On-Board Unit for More Integrated Transport	
Objectives	To reduce congestion at the toll gates.	
	To manage traffic demand.	
	To enhance further the connectivity of all modes of transport.	
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Target Area (Area to be applied)	Rio de Janeiro Metropolitan Area	
Required System	1. Electronic Toll Collection (ETC) System (8 locations)	
	2. Free-flow Cashless System (50 parking areas)	
	3. Electronic Road Pricing (ERP) System (35 locations)	
	4. On-board Unit (OBU) (200,000 vehicles)	
Rough Order of Magnitude	R\$344.900.000/¥13,643,000,000	
Estimate		
Implementation Period	Short term: OBU Dissemination, ETC promotion of utilization,	
	parking dedicated short-range communications (DSRC) electronic	
	payment and integration of integrated circuit (IC)-Card.	
	Long term: ERP and DSRC information dissemination.	
ITS Service Packages	ATMS10, ATIS04, and 10	
Reference No.		
Remarks	It is important to disseminate the on-board unit for further utilization	
	of traffic/transport information systems.	
	or autre, autoport information 5,500mb.	

ITS Project Name	6. Information Exchange of Road Operators	
Objectives	To connect road operators in terms of traffic information.	
	To enhance essential information provision for road users.	
	To ensure smoother traffic flow.	
Graphic		
Detector Observation of Road Condition Traffic Volume, Traffic Speed etc CCTV Observation of Road Condition Traffic Accident, Traffic Volume, Traffic Speed etc OCR Detect Over-speeding Vehicles	ITS Center	
Registered Number Meteorological Observation Equipment Observation of Weather Condition		
Rain, Temp etc <i>VMS</i> Provision of information Traffic, Accidents, etc ETC Making smoother traffic and raise business efficiency DSRC Spot Provision of information Traffic, Accidents, etc and Collecting Probe data via ITS OBU	Image: Second	
Target Area (Area to be applied)	Rio de Janeiro Metropolitan Area	
Required System	1. Information Exchange System	
Rough Order of Magnitude	R\$24.500.000/¥968,000,000	
Estimate	From medium to long term	
Estimate Implementation Period	From medium to long term	
Implementation Period	From medium to long term AD1.2.3 ATIS06	
Implementation Period ITS Service Packages Reference	AD1,2,3 ATIS06	
Implementation Period ITS Service Packages Reference No.	AD1,2,3 ATIS06 ATMS01,02,04,06,07,08,10,23	
Implementation Period ITS Service Packages Reference	AD1,2,3 ATIS06 ATMS01,02,04,06,07,08,10,23 Highway-related information shall be exchanged to manage and	
Implementation Period ITS Service Packages Reference No.	AD1,2,3 ATIS06 ATMS01,02,04,06,07,08,10,23	

ITS Project Name	7. Information Exchange via ITS Center Between Municipalities
Objectives	To monitor traffic and transit for more secure transport.
	To control traffic and transit for smoother transport.
Graphic	Municipality Traffic/Transit Operator Sor Bus Operators Municipality Traffic/Transit Operator Sa Concal Bus Operators Municipality Traffic/Transit Operator Sa Concal Bus Operators Municipality Traffic/Transit Operator Su Operators Municipality Traffic/Transit Operator Nova Iguacu Bus Operators Municipality
	Traffic/Transit Operators Municipality Traffic/Transit Operators Belford Roxo Bus Operators Municipality Traffic/Transit Operators Belford Roxo Bus Operators TOC for smoother Traffic/Transit Operation
Target Area (Area to be applied)	NITTRAISt Operators NITTANS Bus Operators Municipality Traffic/Transit Operator Belford Roxo Bus Operators TOC for smoother Traffic/Transit Operation Rio de Janeiro Metropolitan Area
Required System	NITRANS Bus Operators Municipality Traffic/Transit Operators Municipality Traffic/Transit Operators Bus Operators Tot C for smoother Traffic/Transit Operation Tot C for smoother Traffic/Transit Operation Tot C for smoother Traffic/Transit Operation Rio de Janeiro Metropolitan Area 1. Information Exchange System
_	NITRANS Bus Operators Municipality Traffic/Transit Operators Municipality Traffic/Transit Operators Bus Operators Tot C for smoother Traffic/Transit Operation Tot C for smoother Traffic/Transit Operation Tot C for smoother Traffic/Transit Operation Rio de Janeiro Metropolitan Area 1. Information Exchange System
Required System Rough Order of Magnitude	NITRANS Bus Operators Municipality Traffic/Transit Operators Municipality Traffic/Transit Operators Bus Operators Tot C for smoother Traffic/Transit Operation Tot C for smoother Traffic/Transit Operation Tot C for smoother Traffic/Transit Operation Rio de Janeiro Metropolitan Area 1. Information Exchange System
Required System Rough Order of Magnitude Estimate	Rio de Janeiro Metropolitan Area 1. Information Exchange System R\$58.100.000/¥2,299,000,000
Required System Rough Order of Magnitude Estimate Implementation Period	NITRANS Bus Operators Municipality Traffic/Transit Operator Belford Roxo Bus Operators Municipality Traffic/Transit Operator Belford Roxo Bus Operators Rio de Janeiro Metropolitan Area 1. Information Exchange System R\$58.100.000/¥2,299,000,000 Short term: Rio de Janeiro municipalities Medium to long term: Other municipalities in RMRJ
Required System Rough Order of Magnitude Estimate Implementation Period	NITRANS Bus Operators Municipality Traffic/Transit Operator Belford Roxo Bus Operators Municipality Traffic/Transit Operator Belford Roxo Bus Operators Rio de Janeiro Metropolitan Area 1. Information Exchange System R\$58.100.000/¥2,299,000,000 Short term: Rio de Janeiro municipalities Medium to long term: Other municipalities in RMRJ
Required System Rough Order of Magnitude Estimate Implementation Period ITS Service Packages Reference	NITRANS Bus Operators Municipality Traffic/Transit Operators Belford Roxo Bus Operators Isus Location info, Passenger Counting, IC-card Taxi Dispatching for Response to Taxi Customers, Monitoring Traffic Condition Rio de Janeiro Metropolitan Area 1. Information Exchange System R\$58.100.000/¥2,299,000,000 Short term: Rio de Janeiro municipalities Medium to long term: Other municipalities in RMRJ
Required System Rough Order of Magnitude Estimate Implementation Period ITS Service Packages Reference No.	Rio de Janeiro Metropolitan Area 1. Information Exchange System R\$58.100.000/¥2,299,000,000 Short term: Rio de Janeiro municipalities Medium to long term: Other municipalities in RMRJ AD1,2,3 ATIS06, ATMS06
Required System Rough Order of Magnitude Estimate Implementation Period ITS Service Packages Reference No.	Nitream Numicipality Numicipality Numicipality Municipality Sub Operators Numicipality Sub Operators R\$58.100.000/¥2,299,000,000 Sub Operators Short term: Rio de Janeiro municipalities Numicipalities in RMRJ AD1,2,3 ATISO6, ATMSO6 All municipalities share information and computerized data are

ITS Project Name	8. Improvement o	of Traffic/Transit Operational Center with Essential
	ITS Equipment in	Rio de Janeiro municipal area
Objectives		nprove the functions of existing ITS equipment for
5	^	arter transportation and transit.
Graphic		I
Municipality		Now Proposed Plan
Traffic/Transit Ope Rio de Janeiro Muni	cipality 🔐	TOC for smoother Traffic/Transit Operation Not Sufficient
CET-RIO(at COL SMTR Bus Operators	e 🦷	Exchange info nearest important road operators, integration BRT operators.
Adaptivo Signal Co		r Deployment
Adaptive Signal Co For More Smoother Traffi	c 30/2265	Concentrated Infrastructure Monitoring
ITAKA is already installed in 30 lc expansion is needed for more smoot		Accuracy improvement for detecting incidents
VMS for More Inform	ation Provision	MOE for Weather and Air Monitoring None
Gathered information from several shall be disseminate via VM		Road side weather information shall be gathered operators to provide road side weather information to users
CCTV for Infrastructure	585+120	OVNAMIC LANE MANAGEMENT For More Utilization of Existing Road Network 10 location Manual
585 CCTVs are already installed. L Motion Picture Analysis Software		Traffic Detector shall be deployed to count traffic volume to determine lane direction dynamically
OCR for Enforce Monitoring Traffic OCR and other systems are separat The data shall be utilized as central	c Condition ed. 487	Bus Related ITS for Bus Location info, Passenger Counting, Travel Time Info. Bus related information disseminated via ITS Center. BRT Operation shall be integrated traffic operation for
metering, real time point speed data	monitoring	comfortable journey
Work Zone Monit Safer Road Work and Informa SECONSERVA All of Work Zone Information shall b be disseminate information to users	tion Provision Prepared e gathered in advance and will	Taxi Dispatching for Response to Taxi Customers, Monitoring Traffic Condition GPS data shall be utilized for monitoring current traffic condition on time
Parking Availa Information Prove SECONSERVA and Private Parking Availability Information she and provided via VMS, Web, Car No	Companies Prepared	Rail Crossing Management None for More Safer and Secure Traffic Prepared With SUPERVIA Rail Crossing shall be controlled by Rail Operator and also coordinated with Traffic Operator
Target Area (Area to be applied)	Rio de Janeiro mu	inicipal area
Required System	 Adaptive Signal intersections) VMS (24 sets) CCTV (3 sets) OCR (68 sets) 	 I Control (400 MOE (5 sets) Dynamic Lane Management (10 locations) Taxi Dispatching System(10 systems) Rail Crossing Management (11 sets)
Rough Order of Magnitude	R\$229.900.000/¥9	
Estimate		
Implementation Period	Short term: Data	a integration and adaptive signal expansion and
	variable message	sign (VMS)
	Medium term: Oth	hers
ITS Service Packages	ATMS area, MC a	area, AD1, APTS01,02,04,05,06,07,08,09,10 and 11
Ref No.		
Remarks	System integration	n, new VMSs, and data utilization are necessary.

ITS Project Name	9. Improvement o	f Traffic/Transit Operational Center with Essential
	_	Other Municipal Areas in RMRJ
Objectives	To expand and im	prove the functions of existing ITS equipment for
	smoother and sma	rter transportation and transit.
Graphic		
Municipality Traffic/Transit Opera NITTRANS Bus Operators	nter	Now Proposed Plan
	Further	Deployment
Adaptive Signal Cont For Smoother Traffic	trol None Should be Prepared	MOE for Weather and Air Monitoring None Road side weather information shall be gathered operators to provide road side weather information to users Should be Prepared
VMS for More Informat	ion Provision Should be Prepared	Image: Specific Detector shall be deployed to count traffic volume to determine lane direction dynamically DynAMIC LANE MANAGEMENT None Image: Specific Detector shall be deployed to count traffic volume to determine lane direction dynamically To be Image: Specific Detector shall be deployed to count traffic volume to determine lane direction dynamically
CCTV for Infrastructure M	onitoring None Should be Prepared	Bus Related ITS for Bus Location info, Passenger Counting, Travel Time Info. Bus related information disseminate via ITS Center. BRT Operation shall be integrated traffic operation for comfortable journey
Source Monitoring Traffic C	Charletter	GPS data shall be utilized for monitoring current traffic condition on time
Work Zone Monito Safer Road Work and Informatio All of Work Zone Information shall be g advance and will be disseminated infor users and operators	n Provision sathered in Should be Prepared	TOC for smoother Traffic/Transit Operation Traffic Operation Control center need to be improved. Transit Operation Center shall be established in the near future
Parking Availab Information Prov Parking Availability Information shall and provided via VMS, Web, Car Navi	be collected	Rail Crossing Management for More Safer and Secure Traffic With SUPERVIA Rail Crossing shall be controlled by Rail Operator and also coordinated with Traffic Operator
Target Area (Area to be applied)	Rio de Janeiro Me	tropolitan Area
Required System	 Adaptive Signal intersections) VMS (47 sets) CCTV (15 sets) OCR (29 sets) 	-
Rough Order of Magnitude	R\$234.800.000/¥9	
Estimate		
Implementation Period	From medium tern	n to long term
ITS Service Packages Reference No.	ATMS area, MC a	rea, AD1, APTS01,02,04,05,06,07,08,09,10, and11
Remarks	Objective cities s	shall be determined by considering the trend of
	population increas	e and production of OD (Origin-Destination).

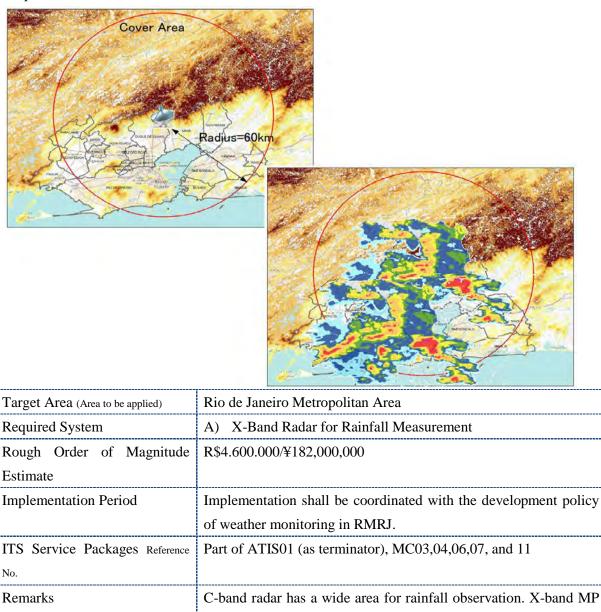
ITS Project Name	10. Emergency Vehicle Operating Management
Objectives	To prioritize all emergency vehicles for quicker emergency response.
Graphic	
COR OBU OBU COR COR COR COR COR COR COR COR	
-Data Warehouse and Data Distribution Center-	
Contraction of the second seco	
Target Area (Area to be applied	Rio de Janeiro Metropolitan Area
Required System	 Traffic Light Prioritizing System for Emergency Vehicles (for 200 vehicles)
Rough Order of Magnitud Estimate	
Implementation Period	Short term
ITS Service Package Reference No.	s ATIS10,ATMS06,08, AVSS12 and EM area especially EM02
Remarks	CICC will be in charge of the emergency and hazardous information
	management center. CICC, the core of emergency management, and
	the traffic/transit center and ITS Center shall coordinate several
	systems for a more efficient operation.

ITS Project Name	11. Commercial Vehicle Operation and Management	
Objectives	To enhance automated monitoring for overloaded	
	commercial vehicles.	
	To disseminate traffic-related information for more	
	efficient logistics.	
Graphic		
Weigh-in-Motion	More ITS Projects will be considered in the next phase	
	-Data Warehouse and Data Distribution Center-	
Target Area (Area to be applied)	Rio de Janeiro Metropolitan Area	
Required System	1. Weigh-in-Motion (WIM) System	
	2. On-Board Unit (OBU) to obtain traffic/transport-related	
	information	
Rough Order of Magnitude	R\$17.600.000/¥696,000,000	
Estimate	WIM in 6 locations and OBU for 1000 vehicles	
Implementation Period	From medium to long term	
ITS Service Packages	Commercial Vehicle Operation (CVO) Service Area	
Reference No.		
Remarks	The need for information, operation, and supervision shall be clarified	
	more clearly and precisely in January (in the next assignment of the	
	JICA Study Team)	

	12. Advanced Vehicle Safety Systems
Objectives	To prevent traffic accidents.
	To ensure more driving comfort.
Graphic	
Juture 120km/h 220	Vehicle to Roadway Communication
Cru Crash Sudden Breaking Vehicle 1	to Vehicle inication
Target Area (Area to be applied)	Rio de Janeiro Metropolitan Area
Target Area (Area to be applied)	Rio de Janeiro Metropolitan Area 1. Vehicle to Roadway Communication System 2. Vehicle to Vehicle Communication System
Target Area (Area to be applied) Required System	 Vehicle to Roadway Communication System Vehicle to Vehicle Communication System
Target Area (Area to be applied) Required System	 Vehicle to Roadway Communication System Vehicle to Vehicle Communication System
Target Area (Area to be applied) Required System Rough Order of Magnitu Estimate	1. Vehicle to Roadway Communication System 2. Vehicle to Vehicle Communication System ude Depends on the industrial car maker's technological development
Target Area (Area to be applied) Required System Rough Order of Magnitu	1. Vehicle to Roadway Communication System 2. Vehicle to Vehicle Communication System ude Depends on the industrial car maker's technological development Depends on the industrial car maker's technological development

ITS Project Name	13. Deployment of X-Band Radars
(Actually not ITS Project)	
Objectives	To grasp more accurate nimbus condition real-time.
	To get a date for more precise simulation and weather forecasting.
	To provide information for transportation-related agencies, entities
	and concessionaires.
	To prepare for hazardous incidents in advance.

Graphic



radar has an even tougher observation area and is narrower than the C-band radar, but can detect rainfall conditions more precisely. In addition, the X-band radar has an information delivery cycle of 1 min.