CHAPTER 4 COMPARATIVE ANALYSIS AMONG MEGACITIES, OLYMPIC HOST CITIES, AND RIO DE JANEIRO

4.1 MEGACITIES COMPARATIVE ANALYSIS

This section provides a comparative analysis between the city of Rio de Janeiro and other megacities worldwide with regard to basic socioeconomic data, public transport infrastructure, and intelligent transport system (ITS) services. The objective of such comparison is to put the city of Rio de Janeiro (and its metropolitan area) in perspective with international developments of public transport infrastructure and technology.

4.1.1 Megacities Selection Process

In order to provide a useful comparison between the city of Rio de Janeiro and megacities, the JICA Study Team decided to use the following criteria in selecting the cities for comparison: 1) current GDP ranking and estimated growth; and 2) population and area (and population density). It was also decided to select one city per country (although Sao Paulo and Brasilia were included to put Rio de Janeiro in a national perspective). The main data source was the PricewaterCoopers Global City GDP Rankings 2008-2025 Study. Additional socioeconomic data was collected from respective census bureaus of each city. The selected cities were Tokyo, New York, London, Paris, Sao Paulo, Rio de Janeiro and Brasilia. Table 4-1 summarizes such socioeconomic data.

Table 4-1 Socioeconomic Data Comparison

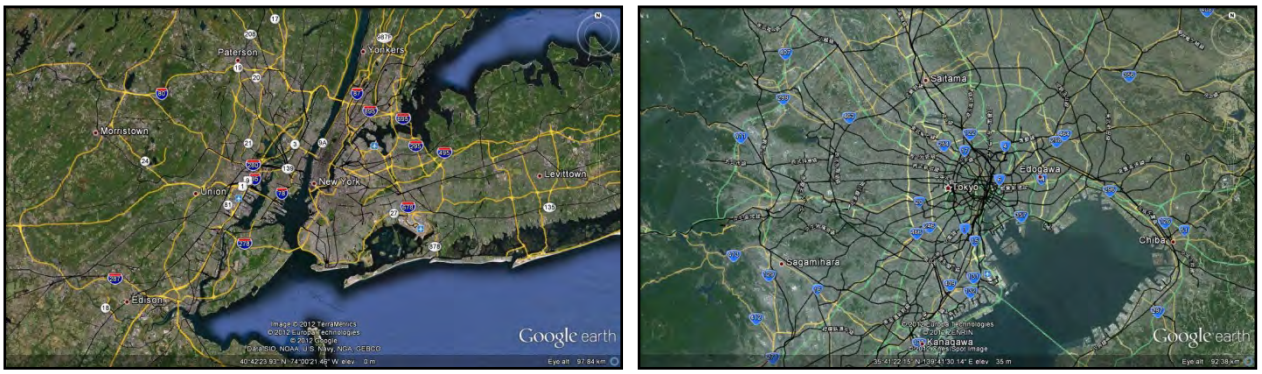
Urban Area	2008 GDP (US$ billion)	2008 GDP Global Rank	Population (2010-2011) (million)	Area (km^2)	Density (population/ km^2)	2025 GDP (US$ billion)	2025 GDP Global Rank
Tokyo	1,479	1	35.6	13,754	2,590	1,981	1
New York	1406	2	22.1	30,670	720.11	1915	2
London	565	5	12.6	8,382	1,511	821	4
Paris	564	6	12.1	17,174	708	741	8
Sao Paulo	388	**10**	19.9	7,944	2,504	782	**6**
Rio de Janeiro	201	**30**	12.6	4,557	2,766	407	**24**
Brasilia, DF	110	**60**	2.5	5,802	442	210	**51**

Source: PricewaterCoopers Global City GDP Rankings 2008-2025 Rankings, Census Bureaus

As shown in Table 4-1, London, Rio de Janeiro, Sao Paulo and Brasilia will move up in the estimated 2025 GDP ranking while Paris will move down from sixth to eight places. Tokyo and New York will remain at first and second places, respectively. Such initial comparison is important because it shows the rapid growth of Brazil's megacities over the next ten years. This requires added investment in transport infrastructure and technology to serve high population density areas and support the needs of personal and commercial trips.

4.1.2 Aerial Photo Comparison

In this section, an aerial comparison showing the urban areas of all seven cities is presented. The aerial snapshots were taken using Google Earth Pro at about the same eye altitude so that a comparative analysis of urban sprawl, area, and transportation facilities could be made. As summarized in Table 4-1, New York has the largest metropolitan area (30,670 km^2), while Tokyo is the second most dense city (2,590 population/km^2) on the list. A comparison of this urban sprawl is shown in Figure 4-1. The same figure also shows the major highway networks of New York and Tokyo and their difference in design.



Source: JICA Study Team

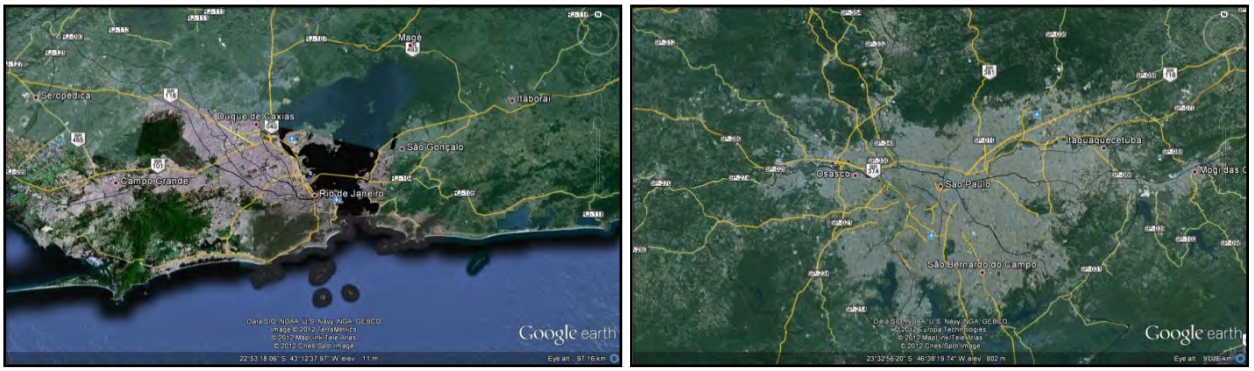
Figure 4-1 Comparison of the Metropolitan Areas of New York and Tokyo

Figure 4-2 compares the urban sprawl of the cities of London and Paris. Despite the higher population density of London, it can be noted that these two European cities followed the same arrangement in terms of highway network design. Several highway rings (roadways that contour a specific area avoiding unnecessary trips through downtowns and business districts) can be observed, especially towards the central area of both cities.

Source: JICA Study Team

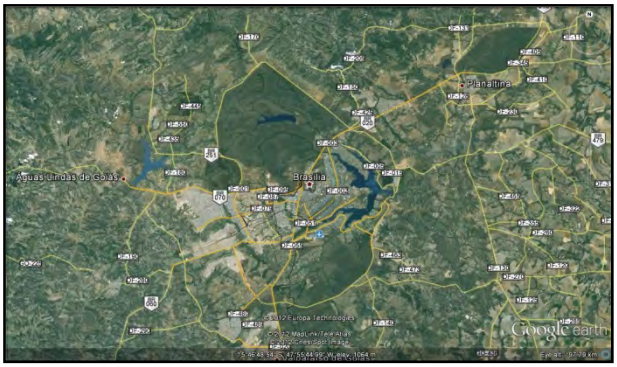
Figure 4-2 Comparison of the Metropolitan Areas of London and Paris

Figure 4-3 and Figure 4-4 show the urban sprawl and major highway networks of Rio de Janeiro, Sao Paulo, and Brasilia. Rio and Sao Paulo have high-density metropolitan areas (similar to Tokyo); however, the highway networks of the Brazilian cities are much less developed. In addition, there are no highway rings around the downtown/urban areas, forcing long-distance travelers to cross low-speed or congested areas. Lastly, Rio de Janeiro's geographic characteristics (hills and dense green areas) make it harder to fully develop an extensive highway network.



Source: JICA Study Team

Figure 4-3 Comparison of the Metropolitan Areas of Rio de Janeiro and São Paulo



Source: JICA Study Team

Figure 4-4 Metropolitan Area of Brasília, DF

4.1.3 Basic Public Transport Characteristics

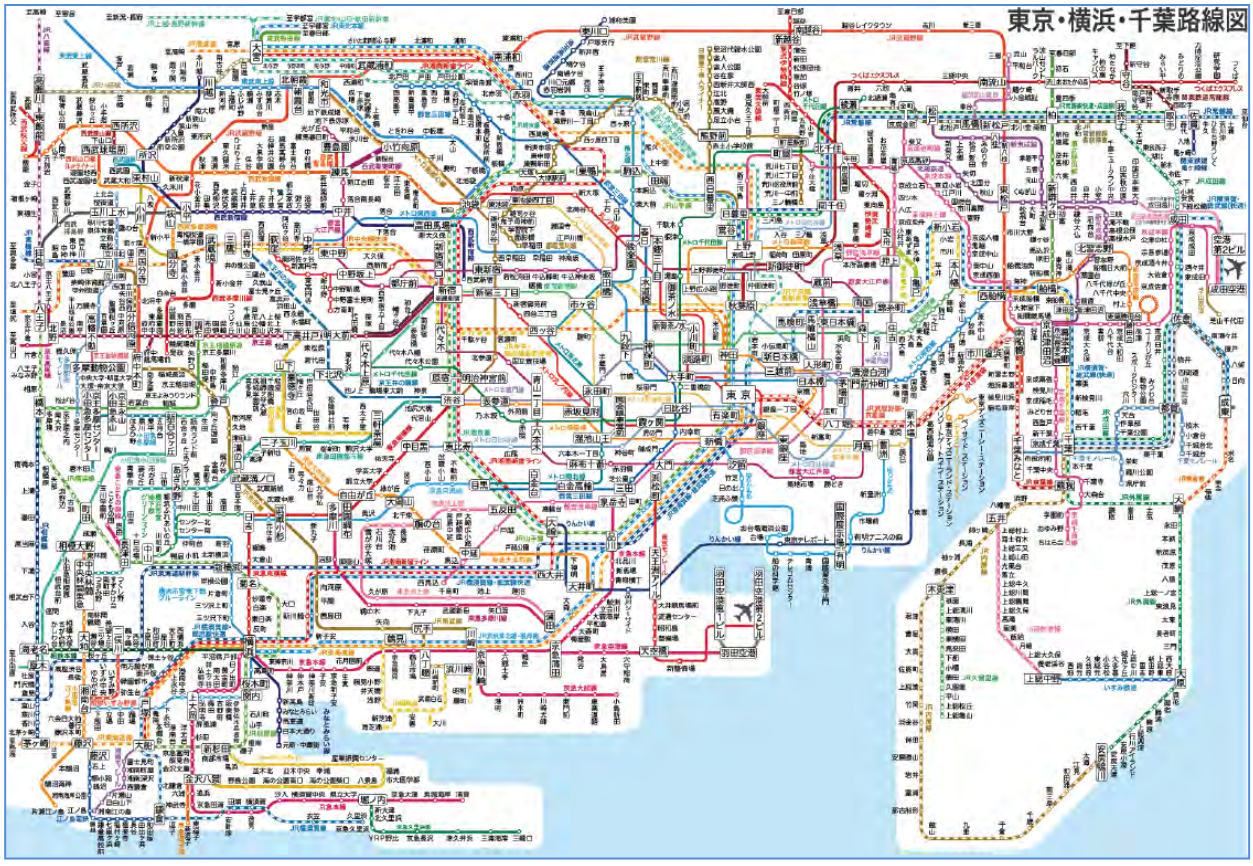
(1) Tokyo

In order to serve the 35.6 million inhabitants of Tokyo's metropolitan area, a large network of public transport involving rail, metro, trains, and buses was built around the city. The basic characteristics of Tokyo's public transport infrastructure are shown in Table 4-2. Figure 4-5 shows a diagram of the metro/rail system of Tokyo. It can be noted that the entire region is served by at least one of these two modes.

Table 4-2 Tokyo's Basic Public Transport Characteristics

Mode	Number of Lines	Network Extension (km)	Number of Stations/Stops	Average Station Spacing
Suburban Rail	121	2865	1243	1 station/2.3 km
Metro	13	292	202	1 station/1.4 km
Tram	1	12	30	1 stop/400 m
Bus	138	1121	3874	1 stop/300 m

Source: www.kotsu.metro.tokyo.jp/eng/



Source: www.kotsu.metro.tokyo.jp/eng/

Figure 4-5 Metro/Rail Map of Tokyo

(2) New York

With over 30,000 km^2 of metropolitan area, New York uses commuter rail trains and metro as the main modes of public transport, as shown in Table 4-3. The highway system is still the major connector outside downtown and most dense areas (Manhattan, Queens, Bronx, Brooklyn, and portions of New Jersey).

Table 4-3 New York's Basic Public Transportation Characteristics

Mode	Number of Lines	Network Extension (km)	Number of Stations/Stops	Average Station Spacing
Commuter Rail	16	1670*	244	1 station/6.8 km
Subway	24	337	468	1 station/720 m
Bus	338	NA	NA	
BRT	4	NA	NA	

Note: *Estimate from MTA info

Source: www.mta.info

Source: www.mta.info

Figure 4-6 Metro/Rail Map of New York

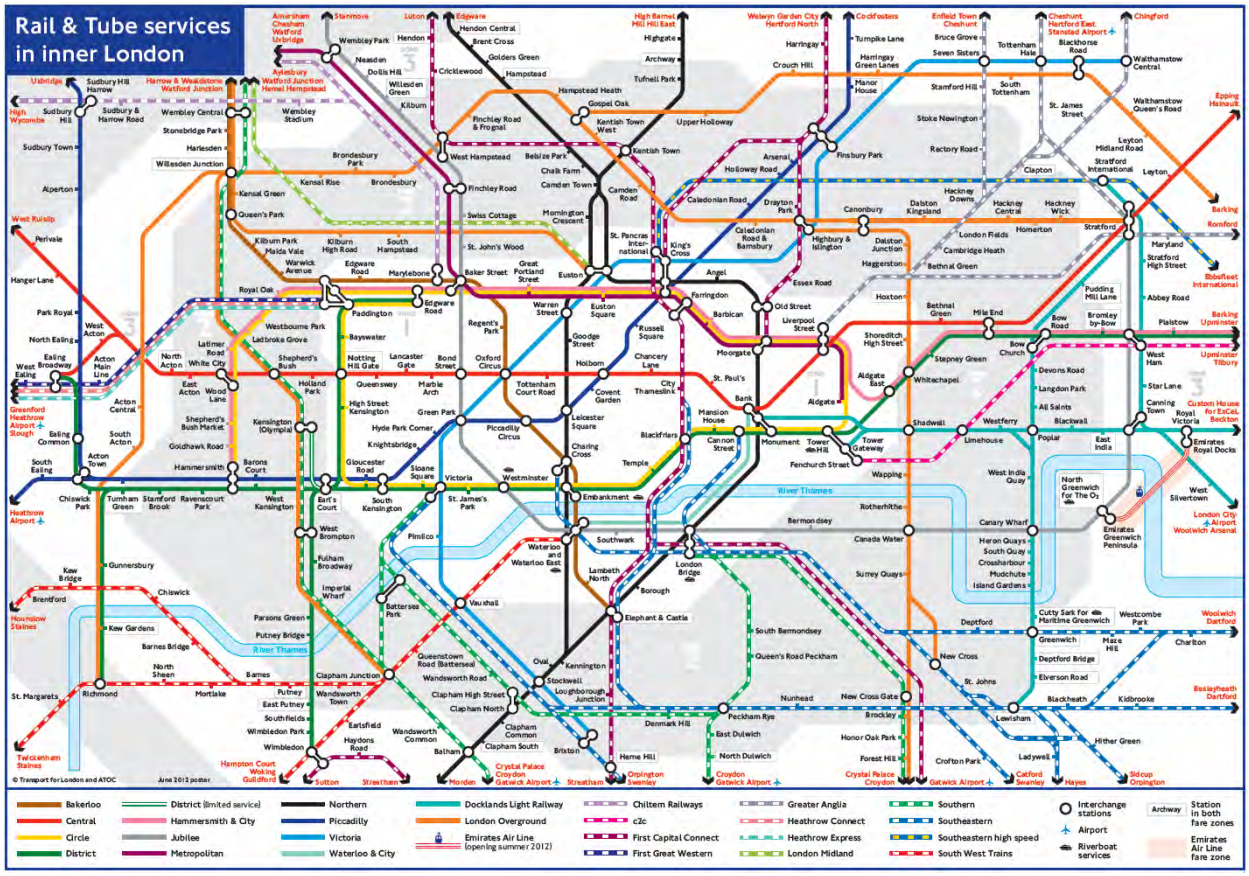
(3) London

London has probably one of the most developed/interconnected public transport systems among the megacities with an extensive network of metro (underground), rail (overground, light rail, and tram), and buses as shown in Table 4-4. The same table shows that the maximum spacing between transit stops is 1.5 km. Figure 4-7 shows the coverage area of rail and metro (tube) in London.

Table 4-4 London's Basic Public Transportation Characteristics

Mode	Number of Lines	Network Extension (km)	Number of Stations/Stops	Average Station Spacing
Underground	11	402	270	1 station/1.5 km
Overground	5	86	78	1 station/1.1 km
Light Rail	2	34	45	1 station/750 km
Tram Link	4	28	39	1 station/700 m
Bus	NA	7,000*	19,500	1 stop/400 m

Source: www.tfl.gov.uk



Source: www.tfl.gov

Figure 4-7 Metro/Rail Map of London

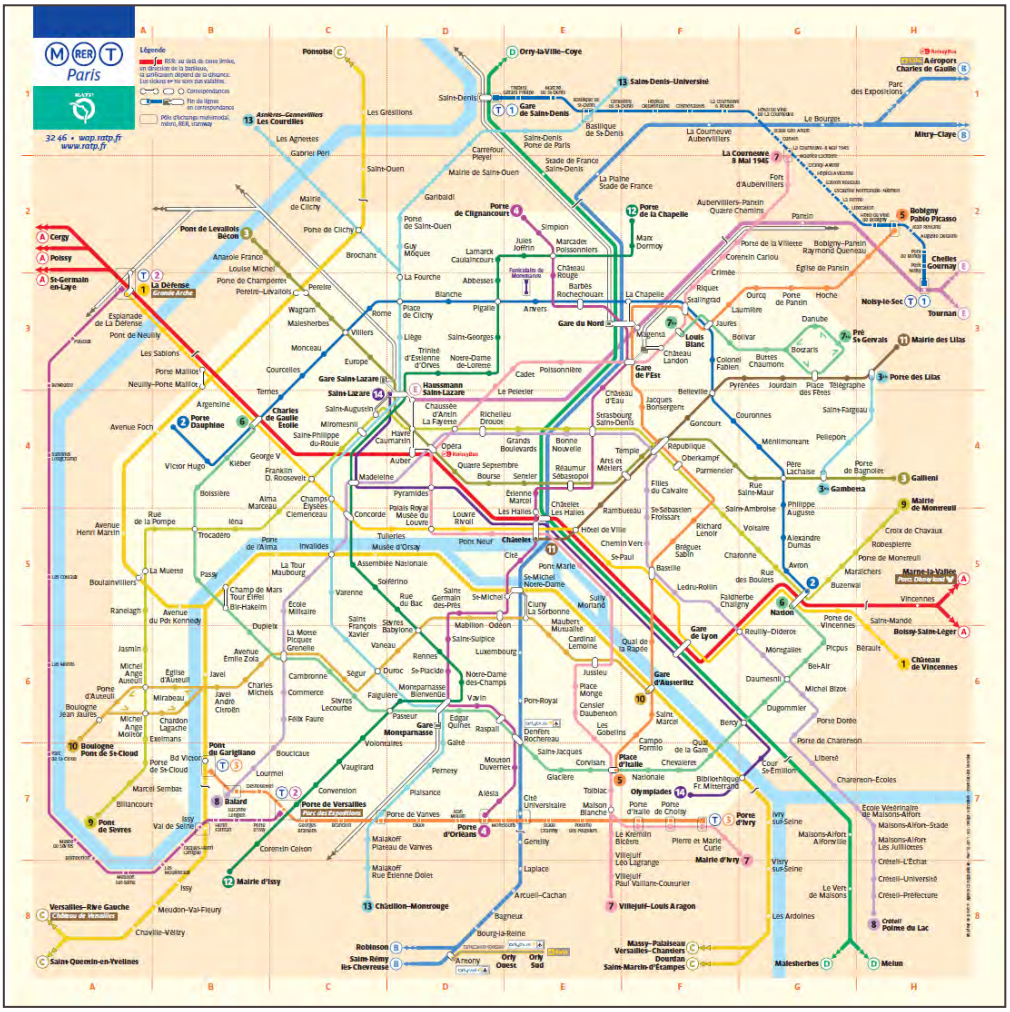
(4) Paris

Paris, with 12.1 million populations in its metropolitan area, has a well-covered network of public transport services as shown in Table 4-5. Metro and suburban rail are the most extensive networks in Paris serving an area of over 1,200 km^2. Figure 4-8 shows a diagram of the metro/rail system of Paris.

Table 4-5 Paris' Basic Public Transportation Characteristics

Mode	Number of Lines	Network Extension (km)	Number of Stations/Stops	Average Station Spacing
Metro	16 (including 2 branch lines)	202	297	1 station/680 m
RER (Long-distance Metro)	5	587	443	1 station/3 km
Suburban Rail	8	709		
Tram	4	37	60	1 stop/600 m
Paris Bus	59	568	1,274	1 stop/450 m
Suburban Bus	1,312	22,676	28,794	1 stop/800 m

Source: www.paris.fr and www.rapt.fr



Source: www.paris.fr. and www.rapt.fr

Figure 4-8 Metro/Rail Map of Paris

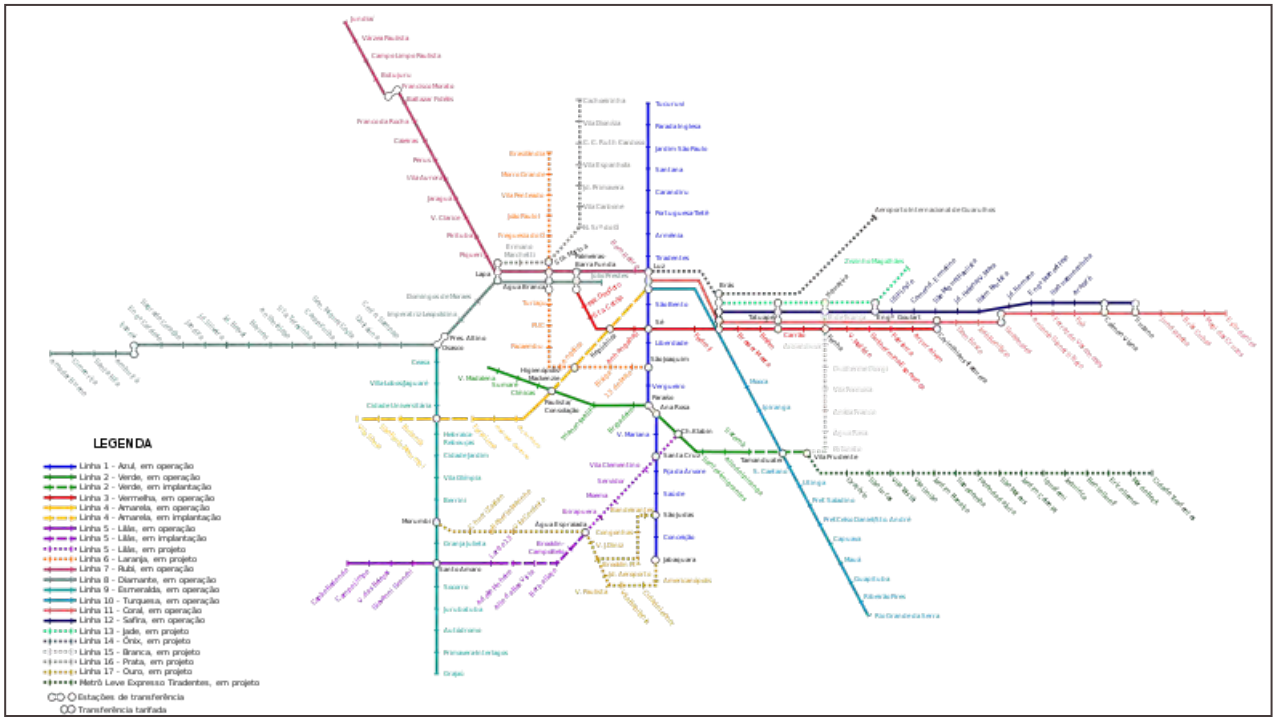
(5) Sao Paulo

The metropolitan area of Sao Paulo, with a population of about 20 million inhabitants and density of 2504 inhabitants/km^2, is mainly served by municipal and inter-municipal buses while rail and metro serve a portion of the region, as shown in Table 4-6. This shows the contrast when compared with the previous cities above, where rail and metro are the main high-capacity/long-distance modes.

Table 4-6 Sao Paulo's Basic Public Transportation Characteristics

Mode	Number of Lines	Network Extension (km)	Number of Stations/Stop	Average Station Spacing
Municipal Bus	1,349	4,518	19,000	1 stop/240 m
Rail	6	233.3	94	1 stop/2.5 km
Metro	5	90.3	83	1 stop/1.1 km
Inter-municipal Bus	450	NA	NA	NA

Source: www.sptransp.com.br and www.stm.sp.gov.br.



Source: www.sptransp.com.br and www.stm.sp.gov.br

Figure 4-9 Metro/Rail Map of Sao Paulo

(6) Rio de Janeiro

As shown in Table 4-7, the main public transport network of Rio de Janeiro consists of rail, metro, and bus modes (although cable car and ferry services also exist on a smaller scale). The network system is relatively small as compared with the other megacities outside Brazil; however, such networks are being expanded to serve the growing needs, especially to supply the demands of the 2014 FIFA World Cup and the 2016 Summer Olympic Games. The main focus is being placed on BRT systems with the development of four different corridors connecting the entire city by 2016. The public transport system of Rio is further detailed as follows.

Table 4-7 Rio de Janeiro's Basic Public Transportation Characteristics

Mode	Number of Lines	Network Extension (km)	Number of Stations/Stops	Average Station Spacing
Metro (Metro Rio)	2	46.2	35	1 station/1.3 km
Rail (Super Via)	8	270	99	1 station/2.7 km
BRS	5 (BRS 1, 2, 3, 4, 5) Each BRS group serves several municipal lines)	29	123	1 stop/235 m*
BRT**	4 (TransOeste, TransOlímpica, TransCarioca, TransBrasil)	155	145	1 station/1.1 km

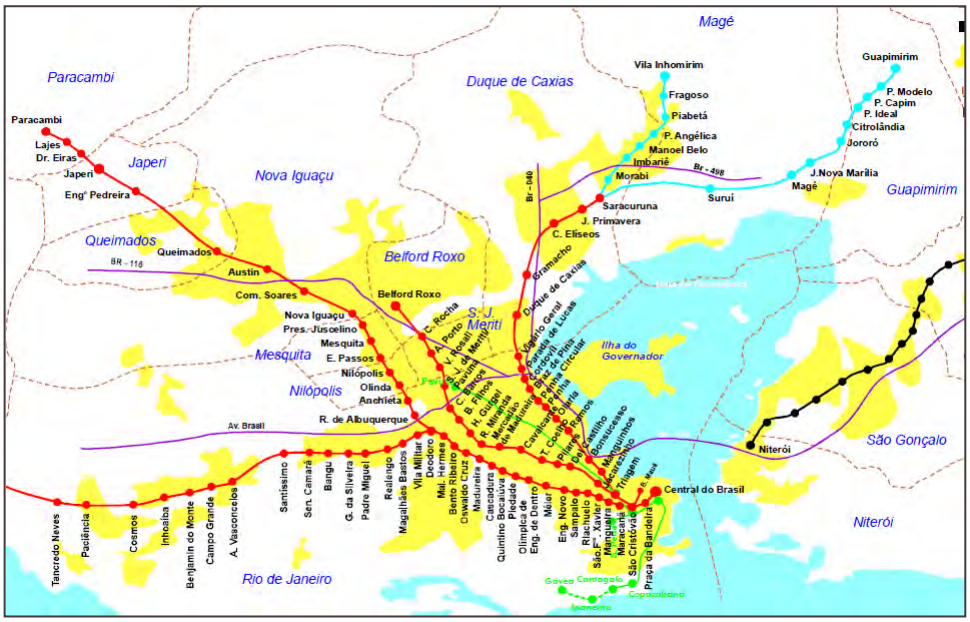
*spacing of 500 m within the same BRS group

**BRT to be completed by 2016

Sources: MetroRio, SuperVia, Fetranspor, www.cidadeolimpica.com

1) Rail (SuperVia)

- Eight lines – total of 99 stations, 270 km
- Serves Rio and surrounding RMRJ municipalities
- Capacity: 650,000 passengers/day



Source: http://www.supervia.com.br/

Figure 4-10 Rail Map of Rio de Janeiro

2) Metro

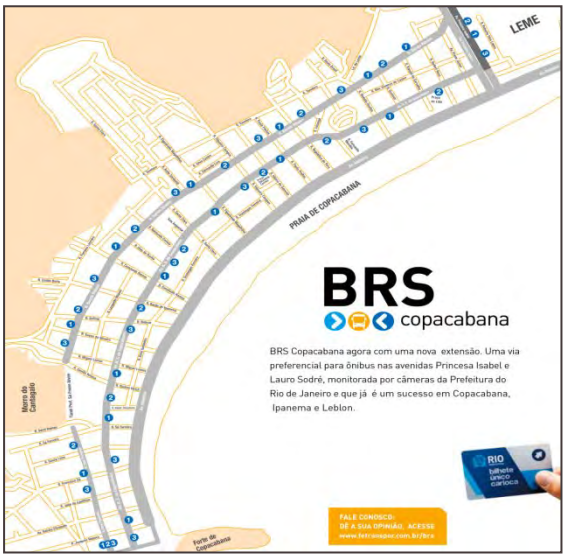
- Two lines – total of 35 stations, 46.2 km
  - Line 1: 19 stations, 16 km
  - Line 2: 26 stations, 30.2 km
  - Shared pathway: ten stations, 6 km
- Serves Zona Sul (Ipanema/Copacabana), Centro (Downtown) and North of Rio
- Capacity: 645,000 passengers/day
- Expansion Plan
  - Line 4 – Expansion of Line 1 toward Barra da Tijuca
  - Six stations, 13.5 km
  - Estimated demand: 250,000 passengers/day

Source: http://www.metrorio.com.br/

Figure 4-11 Metro Map of Rio de Janeiro

3) BRS

- Four strategic areas: 29 km of dedicated lanes
  - Copacabana – 45 stops, 13 km
  - Ipanema/Leblon – 32 stops, 7 km
  - Centro (Av. Presidente Vargas) – 32 stops, 7 km
  - Centro (Av. Rio Branco) – 14 stops, 2 km
- Five BRS groups (500 m spacing within the group)



Source: http://www.fetranspor.com.br/brs/index.php

Figure 4-12 Example of BRS Map in Rio de Janeiro

4) BRT

- Four major corridors for the 2016 Olympic Games:
  - TransOeste – 53 stations, 56 km
  - TransOlimpica* – 18 stations, 26 km
  - TransCarioca – 46 stations, 41 km
  - TransBrasil ** – 28 stations, 32 km
- Estimated demand: 100,000* to 900,000** passengers/day

Source: SMTR

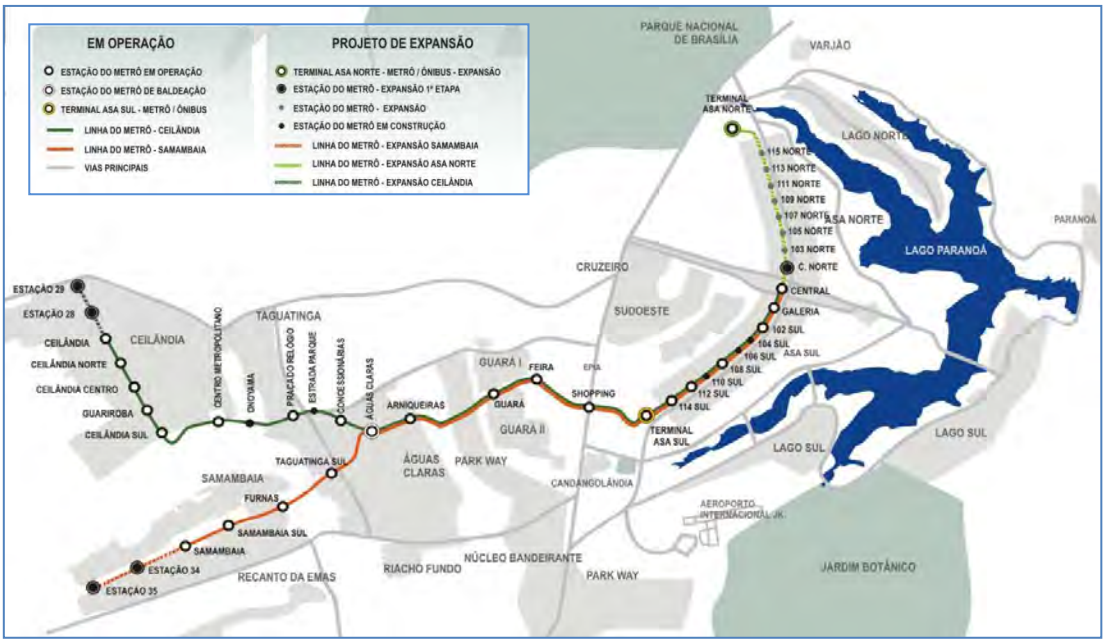
Figure 4-13 Future BRT Map of Rio de Janeiro

(7) Brasilia

Brasilia is a relatively small city as compared with the other cities in this section; however, it is another Brazilian city that will observe fast growth over the next 10-15 years. The metro system is still under expansion as shown in Table 4-8 and Figure 4-14. The important figure here is the metro network system's extension of 42.38 km, which is fairly close to Rio's metro network (46 km), despite differences in population and area.

Table 4-8 Brasilia's Basic Public Transportation Characteristics

Mode	Number of Lines	Network Extension (km)	Number of Stations/Stops	Average Station Spacing
Metro	2	42.38	24	1 station/1.7 km
Bus	968	1,157	NA	

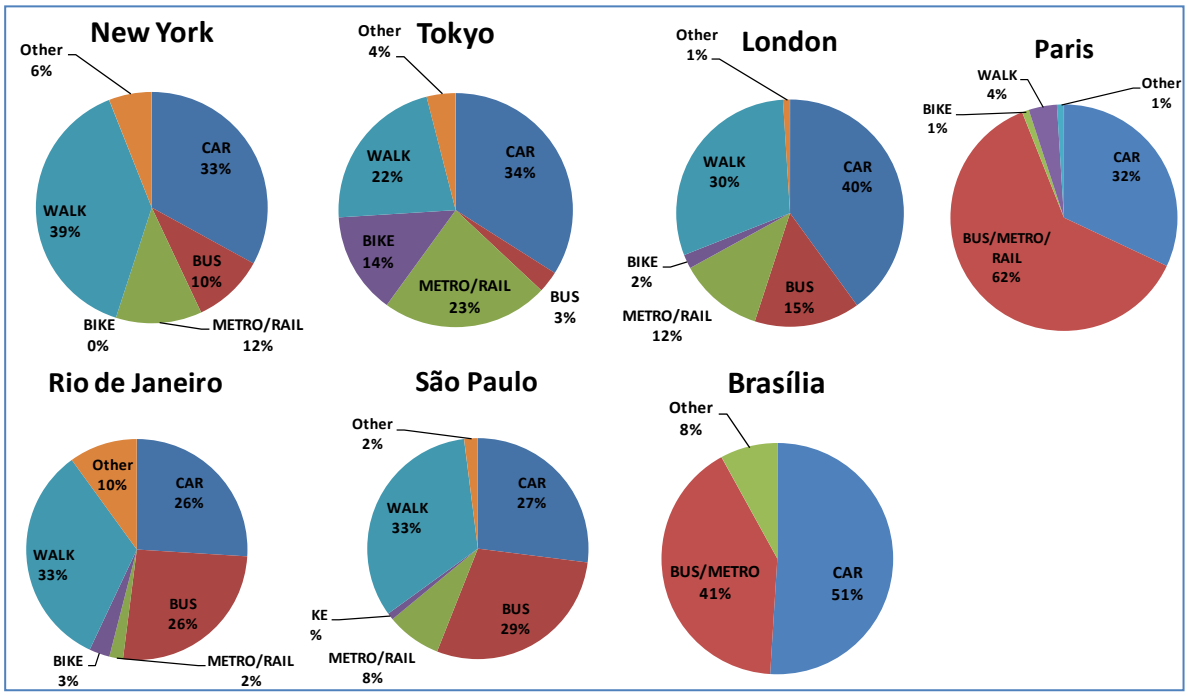


Source: www.metro.df.gov.br

Figure 4-14 Metro/Bus Map of Brasília

4.1.4 Modal Split Characteristics

Modal split information regarding the megacities were collected and summarized in a pie chart as shown in Figure 4-15. The comparison shows that the megacities have a similar split when comparing private and public transportation. Trips by car range from 26% to 40% across the cities. Regarding the distribution of public transportation, the scenario is different. Brazil's megacities (Rio and Sao Paulo) are heavily focused on bus mode (26% and 29%, respectively) as compared to small percentages of metro and rail modes (2% and 8%, respectively). Meanwhile, the other megacities have a more even split between the metro/rail and bus modes. This emphasizes the difference of public transportation infrastructure investment made over the last decade with regard to high-capacity modes between the Brazilian and international megacities. The Brazilian cities have been relying on the existing highway infrastructure to operate crowded bus systems that compete with automobiles.



Source: PDTU RJ, Prefeitura de SP (Infocidade), IBGE, PDTU DF, Person Trip Survey Japão, Census Bureau, GL Authority, UK

Figure 4-15 Modal Split Comparison among New York, Tokyo, London, Paris, Rio de Janeiro, Sao Paulo, and Brasilia

4.1.5 Summary of Basic Socioeconomic and Public Transportation Characteristics

Table 4-9 summarizes and compares the compiled information of the megacities presented in Section 4.1. The key features in the table are the following: faster GDP growth of Brazilian cities (over 4%), and the difference in network extension when compared with the international megacities.

Table 4-9 Summary of Comparison of Megacities Data

Urban Area	Population (million)	Density (population/ km^2)	Public Transport	Network Extension (Metro + Rail)	Modal Split	2008-2025 GDP Growth
Tokyo	35.6	2,590	Rail, Metro, Tram, Bus	3,157 km	Auto: 34% Public Transport: 26%	1.7%
New York	22.1	720.11	Rail, Metro, Bus, BRT	2,007 km	Auto: 33% Public Transport: 22%	1.8%
London	12.6	1,511	Rail, Metro, Light Rail, Tram, Bus	522 km	Auto: 40% Public Transport: 27%	2.2%
Paris	12.1	708	Suburban Metro, Suburban Rail, Metro, Tram, Bus	1,498 km	Auto: 32% Public Transport: 62%	1.6%
Sao Paulo	19.9	2,504	Metro, Rail, Bus, BRT	323.6 km	Auto: 26% Public Transport: 28%	4.2%
Rio de Janeiro	12.6	2,766	Metro, Rail, Bus, BRT	316.2 km	Auto: 27% Public Transport: 37%	4.2%
Brasilia, DF	2.5	442	Metro, Bus	42.4 km	Auto: 51% Public Transport: 41%	3.9%

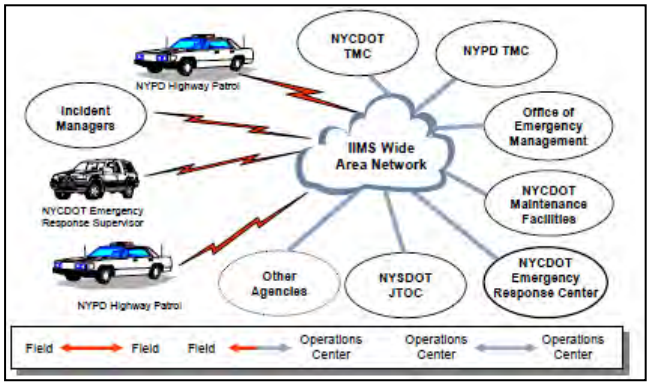
Source: JICA Study Team

4.1.6 Main ITS Features

In this subsection, the existing ITS features of the megacities discussed in this report are presented and compared as follows:

(1) New York

- Traffic Control Center
- Congestion Management/Integrated Incident Management System (see Figure 4-16)
- Metro Card – Integration of Bus/Rail/Metro
- Managed Lanes/Expansion of ETC



Source: http://www.nymtc.org/

Figure 4-16 New York City Integrated Incident Management System

(2) Tokyo

- Traffic Control Center
- ETC (Widely prevalent)
- IC Card – Integration of Bus/Rail/Metro
- User Information (Congestion ahead, travel time, and routes)

Source: Google Image

Figure 4-17 User Information Panels in Tokyo Metro

(3) London

- Traffic Control Center (SCOOT)
- Congestion Tolling – Downtown Area (See Figure 4-18)
- Oyster Card – Integration of Bus/Rail/Metro
- Travel Demand Management – Real-time information for users

Source: Google Image

Figure 4-18 London Congestion Charging Monitoring System

(4) Paris

- Traffic Control Center (SACEM) – Real-time travel time info available for main network
- Freight and Delivery Management
- Navigo Card – Integration of Bus/Rail/Metro
- Automated info for public transportation users

Source: http://www.paris.fr/

Figure 4-19 Paris Traffic Control System Displays

(5) Rio de Janeiro

- Traffic Control Center (CET-Rio) – mainly fixed-time control
- Bus Tracking System (pilot – not for users)
- Bilhete Unico – Integration of Bus/Rail/Metro
- DMS System in Major Corridors

Source: Google Images

Figure 4-20 Bilhete Unico – Rio de Janeiro

(6) Sao Paulo

- Traffic Control Center (CET-SP) – SCOOT System
- Bus Tracking System (not for users)
- Bilhete Unico – Integration of Bus/Rail/Metro
- Speed and Red Light Running Cameras (See Figure 4-21)

Source: Google Images

Figure 4-21 Speed Cameras in Sao Paulo

4.1.7 Megacities ITS Trends and Projections

In this subsection, the main trending ITS features and upcoming projects of the megacities discussed in this report are presented and compared as follows:

(1) New York

- Use of ITS to support mobility, travel time reliability, and safety
- Collaborative approach among stakeholders towards a seamless transportation system

(2) Tokyo

- Promote increased accessibility for the physically disabled
- Promote seamless transportation system
- Move toward “zero accidents”

(3) London

- Maximize ITS investments for the Olympic Games by increasing public transportation use
- Upgrade traffic control system (SCOOT)

(4) Paris

- Support travel time reliability management
- Grand Paris Express – expansion of metro and train lines
- Improve emergency response program

(5) Rio de Janeiro

- Promote mobility for bicyclists and pedestrians
- Implement congestion management program (PDTU 2011)

(6) Sao Paulo

- Congestion management program
- Pedestrian protection program

Table 4-10 summarizes and compares the existing ITS features and trends over the next five to ten years. It can be noted that Rio de Janeiro and Sao Paulo are a step behind when compared to other megacities since they are still implementing their congestion/mobility programs. The international megacities are either enhancing or upgrading their implemented programs towards mobility, accessibility, and accident reduction.

Table 4-10 Summary of Data on Existing ITS Features and Trends

Urban Area	ITS Features	Trends and Projections
Tokyo	-Traffic Control Center; ETC (widely prevalent) -Integration of Bus/Rail/Metro; User Information	-Accessibility for the physically disabled -Seamless transportation system -"Zero Accidents" Program
New York	-Traffic Control Center; Integrated Incident Management System -Integration of Bus/Rail/Metro; Managed Lanes and ETC	-ITS to support mobility, travel time reliability, and safety -Collaborative approach among stakeholders
London	-Traffic Control Center (SCOOT); Congestion Tolling -Integration of Bus/Rail/Metro; Real-time information for users	-Maximize ITS investments made in the Olympic Games -Upgrade traffic control system (SCOOT)
Paris	- Traffic Control Center (SACEM); Freight Management - Integration of Bus/Rail/Metro; Automated info for the public	-Support travel time reliability -Grand Paris Express: expansion of metro and rail -Improve emergency response program
Sao Paulo	-Traffic Control Center (SCOOT); Bus Tracking System (not for users) -Integration of Bus/Rail/Metro; Automated Radar Cameras	-Congestion management program -Pedestrian protection program
Rio de Janeiro	-Traffic Control Center (Telvent); Bus Tracking System (pilot – not for users) -Integration of Bus/Rail/Metro; DMS System	-Promote mobility for cyclists and pedestrians -Implement congestion management program (PDTU 2011)

Source: JICA Study Team

4.1.8 Comparative Summary of Rio De Janeiro

Based on the comparison of megacities in the previous sections of this report, the main findings for the city of Rio de Janeiro are the following:

- Rio de Janeiro's main future infrastructure investments are in BRT while the other megacities are looking into the expansion of their rail/metro networks;
- There is less than adequate user information provided at bus stops and metro/rail stations regarding routes and travel times;
- Difficult for users (specially tourists and foreigners) to understand public transport system due to many operators;
- No collaboration plan among different stakeholders and operators;
- Megacities are moving toward developing an efficient real-time management system (travel time reliability);
- The trend of ITS services is toward safety, seamless transportation, mobility of pedestrian/bikes, and congestion management (ETC and managed lanes); and
- Collaboration among different stakeholders to reduce bureaucracy and improve decision-making (such as investments).

Thus, the following high-level guidelines are recommended for Rio of Janeiro's decision-makers based on the lessons learned from the megacities comparison:

- Develop a plan to improve user awareness and available real-time information regarding public transport system;
- Develop management plans (congestion, special events, emergency response, and work zones) by collaborating with different stakeholders;
- Start considering travel time reliability and options for road users (roadway x toll x public transport travel times);
- Use ITS to reduce accidents and promote mobility; and
- Integrate different systems towards a seamless transport system.

4.2 COMPARATIVE ANALYSIS OF OLYMPIC CITIES

The objective of comparing past Olympic cities is to discuss how such hosts of the Olympic Games prepared themselves for the event. The investments made and how the host cities used this opportunity in their favor are important to Rio de Janeiro's preparation for the 2016 Olympic Games so that they can be put into perspective and the lessons learned can be adopted in the plan.

4.2.1 Selection of Target Cities

The JICA Study Team selected all host cities from the 2000 to 2012 Olympic Games for the comparative analysis. The selected cities are the following: Sydney (2000), Athens (2004), Beijing (2008), and London (2012). Table 4-11 summarizes the characteristics of the Olympic Games and the main public transport utilized during the events in each Olympic city. Each plan is further described below.

Table 4-11 Olympic Games Data Comparison

	Sydney 2000	ATHENS 2004	Beijing 2008		Rio 2016 *2
Spectators	340,000/day	400,000/day	410,000/day ***1**	440,000/day	500,000/day
Athletes participating	10,651	10,684	10,942	10,931	15,000
Main Transit as Olympic Preparation	Rail/Metro Bus	Metro/Tram Bus	Rail/Metro Bus	Metro -improvement- Bus	4 BRT Metro-Line 4 Rail-new vehicle
Dedicated Lane for Buses	Some	Three Routes	34 Routes, 285.7 km	240 km	More than 150 km
Other	Congestion Charge at Main Corridor	Roads International Airport	More than 300 km roads rebuilt or built	Cycle lane and dock Integration for Transport and Transit	To be prepared?

Notes: *1. Estimation by the Project Team. *2 Rio Transport Strategic Plan 2016
Source: Official Report of each Olympic City

4.2.2 Basic Information on the Sydney 2000 Olympic Games

Source: JICA Study Team

Figure 4-22 Main Area of the Sydney 2000 Olympic Games

The city of Sydney created the Olympic Transport Roads and Transport Authority (ORTA), which was responsible for the overall transport strategy, including the following:

- Total trips per day
- Olympic transit lanes
- Removal of parking areas within Olympic routes
- Restriction of certain vehicles within Olympic boundaries
- Encouragement of carpooling, changing of work hours, and working from home
- The CityRail and bus network handled around 80% and 50% more people, respectively
- Free transport on trains and Olympic buses for spectators within the metropolitan area and outer points of the CityRail Network.

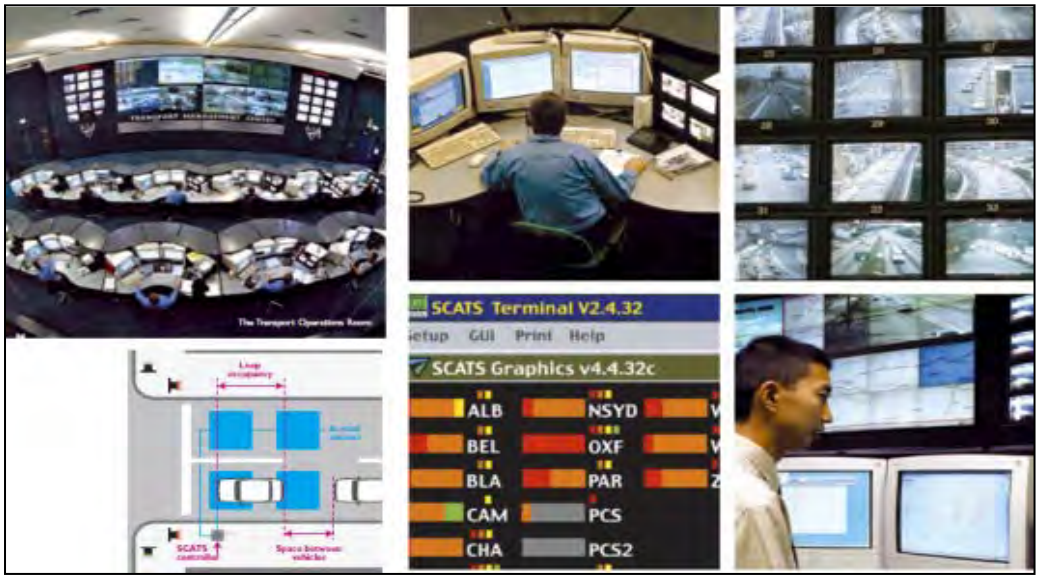
For ORTA, the Olympic Games began 13 days before the opening ceremony. September 2, 2000 (Saturday) signaled the start of transportation for an estimated 22,000 athletes and officials.

The ORTA was required to transport athletes and team officials by bus to the Olympic Village via an accreditation center at the Sydney Olympic Park. Transport to training venues commenced the following day. On September 5, official transport also began for an estimated 17,600 accredited media.

The Olympic Transport Operations Centre (TOC) was located at the RTA's Transport Management Centre (TMC) in the suburb of Eveleigh, which is located immediately south of Sydney's

central business district. The AU$30 million (R$61.5 million) TMC (see Figure 4-23) opened about a year before the Olympic Games, and included some of the world's most sophisticated transport management facilities.

While the RTA continued its core road management tasks in the TMC, ORTA coordinated the Olympic transport from a special incident management room overlooking the control room. The TOC was linked with a wide range of other centers, including the main Olympic command centre, Sydney's train control centre, the Common Domain Operations Centre at the Sydney Olympic Park, and the police.



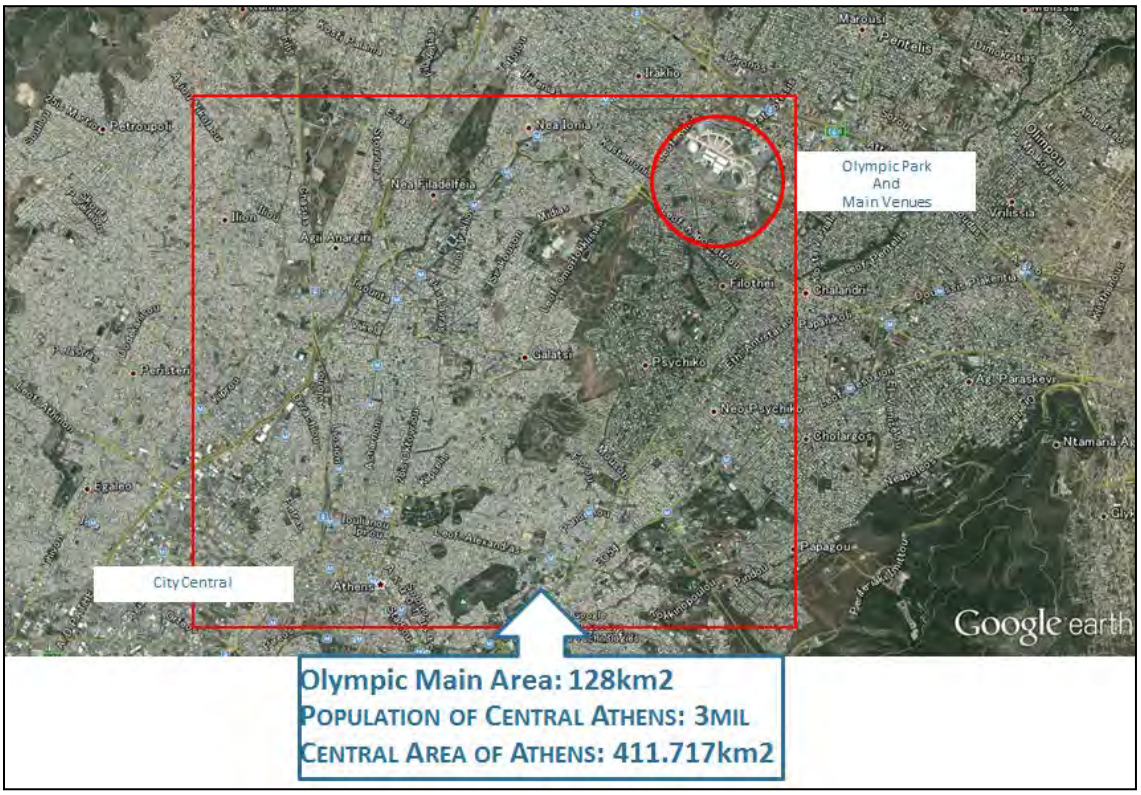
Source: Sydney Organizing Committee, Sydney Integrated Transport Strategy, and RTA website

Figure 4-23 Sydney TMC

The features of Sydney's TMC are as follows:

- CCTV: 700 for detecting traffic flow incident management
- VMS: 200
- SCATS: 250 to 8192
- Electric Lane Changing System (ELCS)
- Variable speed limits sign
- Web-based info
- Traffic info

4.2.3 Basic Information on the Athens 2004 Olympic Games



Source: JICA Study Team

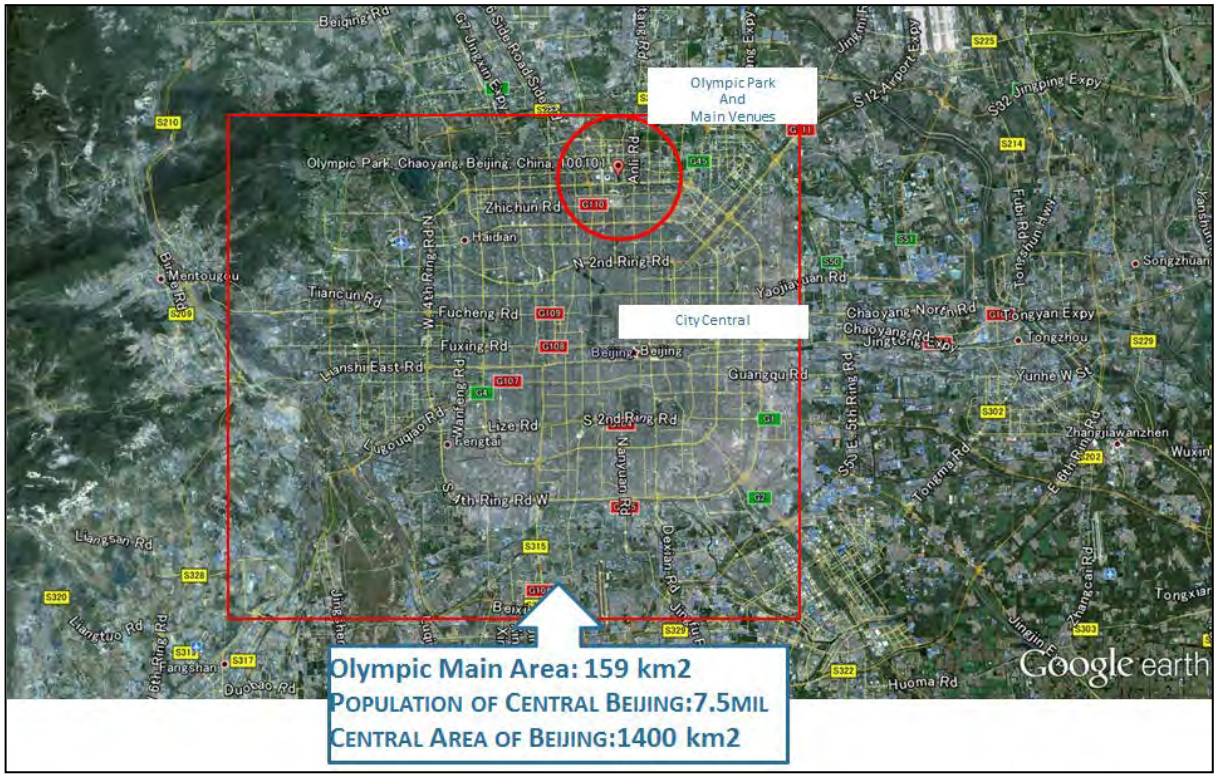
Figure 4-24 Main Area of the Athens 2004 Olympic Games

For the 2004 Olympic Games, Athens implemented its traffic management and control centre (THEPEK) and other Olympic-related centers, such as the security monitoring center, in order to achieve successful management of the Olympic Games. Athens' TMC is shown in Figure 4-25. The total cost was not mentioned.

Source: Athens Olympic Report

Figure 4-25 Athens' TMC

4.2.4 Basic Information on the Beijing 2008 Olympic Games



Source: JICA Study Team

Figure 4-26 Main Area of the Beijing 2008 Olympic Games

The city of Beijing upgraded its TMC (see Figure 4-27) to monitor the Beijing 2008 Olympic Games. The total cost of the system was not mentioned. The main features of Beijing's TMC are the following:

- Bus Priority
- Dynamic Signal
- Real-time Congestion
- Lane Management
- Bus Passenger Counting
- Accident Detection (Figure 4-28)

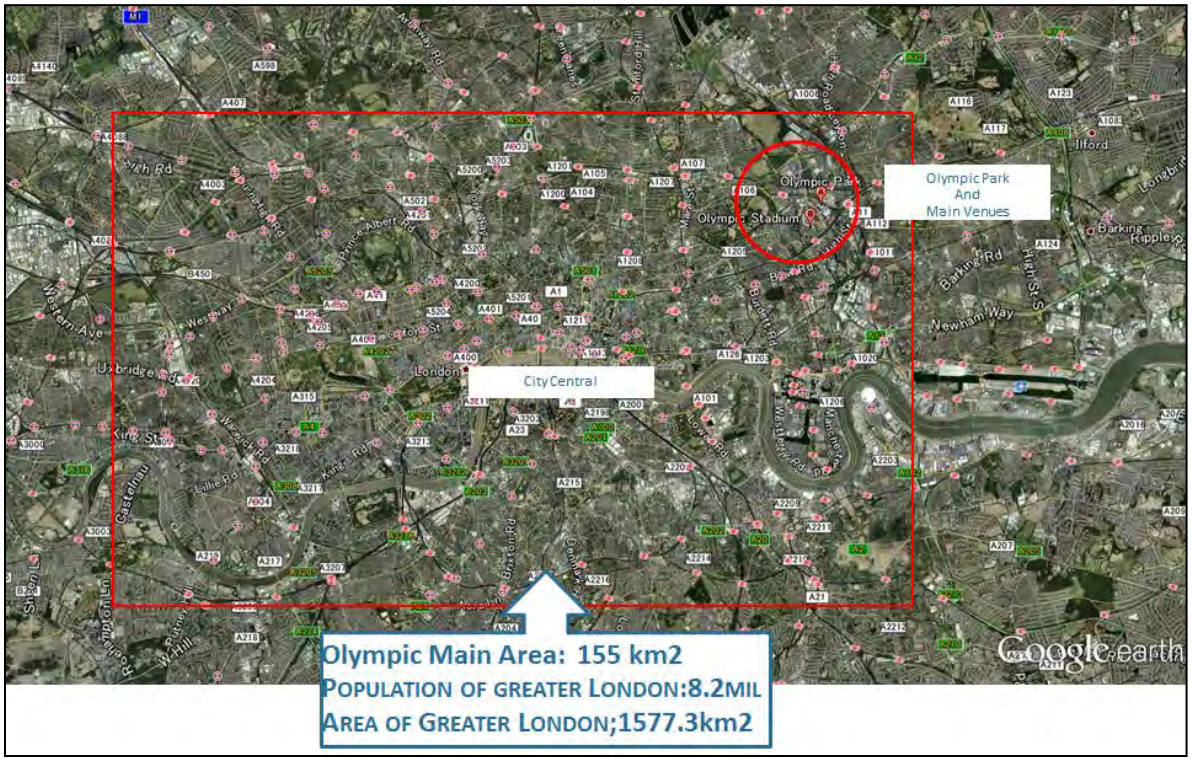
Source: JICA Study Team

Figure 4-27 Beijing's TMC

Source: JICA Study Team

Figure 4-28 Traffic Volume, Enforcement, and Accident Panels

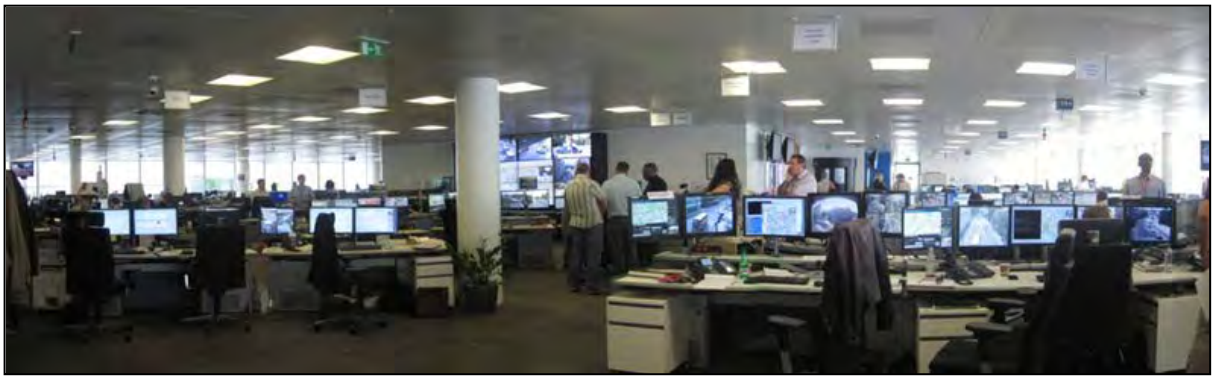
4.2.5 Basic Information on the London 2012 Olympic Games



Source: JICA Study Team

Figure 4-29 Main Area of the London 2012 Olympic Games

Traffic signal timings were developed for the 2012 Olympic Games to provide greater capacity and journey reliability for vehicles used in the Olympic Games. These measures were carefully developed by taking into account and mitigating the impacts to other users as much as possible. The time plans implemented during the Olympic Games conformed to current road safety standards. London benefitted from having one of the most advanced technological traffic management systems in the world. The London Streets Traffic Control Centre (LSTCC) is a fully integrated traffic control center responsible for controlling London's road traffic. The LSTCC has been co-located alongside CentreComm, the London buses' emergency command and control centre, and MetroComm, part of the Metropolitan Police's operational command unit.



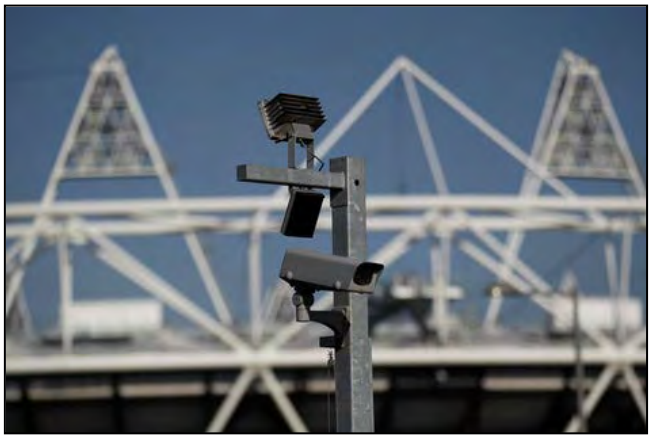
Source: Candidate file, Photos from SMTR

Figure 4-30 London Transport Coordination Centre (Road, Rail, Games, and Security)

In addition, LSTCC used VMS and surveillance cameras for lane management and traffic control during the games as shown in Figure 4-31 and Figure 4-32.

Source: SMTR

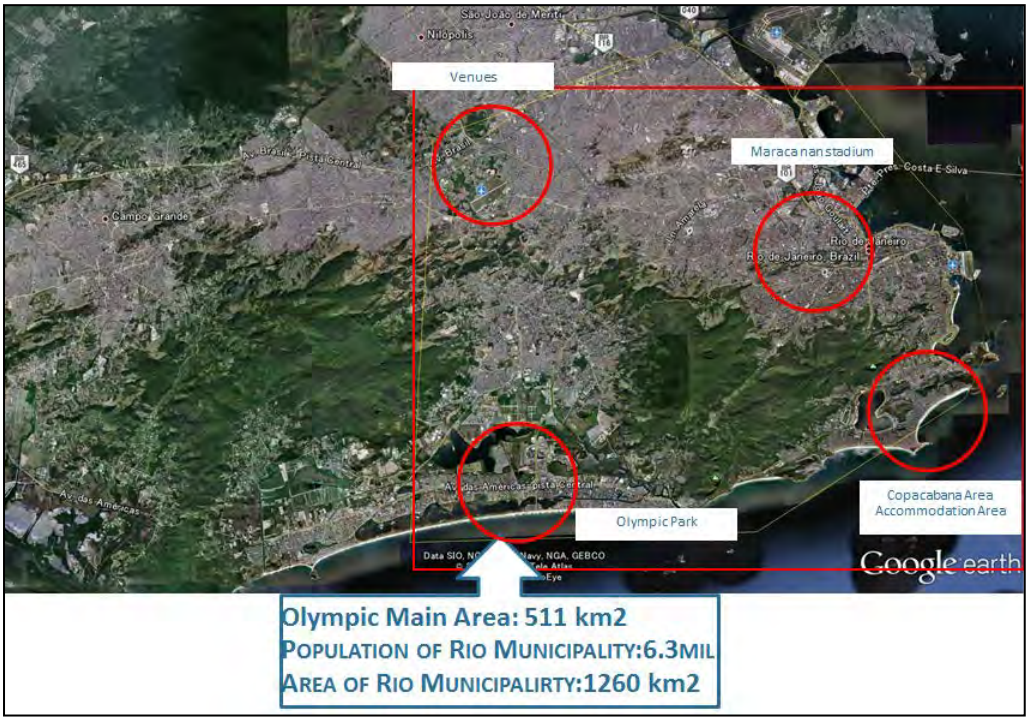
Figure 4-31 VMS – Lane Management



Source: SMTR

Figure 4-32 Surveillance Systems

4.2.6 Basic Information on the Rio 2016 Olympic Games



Source: JICA Study Team

Figure 4-33 Main Area of the Rio de Janeiro 2016 Olympic Games

Rio de Janeiro has below concept for the Rio 2016 Olympic Games;

- Spectators and workforce with free access to all four Games Zones
- Construction of High Performance Transport Ring
- It comprises existing Rail and Metro systems and 4 new under construction BRT systems.
- By 2016, the transport ring will increase mass transit systems from the current 12% to 40% (excluding city buses).

Source: JICA Study Team

Figure 4-34 Facilities, Venues, and Future Transportation Network for the Rio 2016 Olympic Games

4.2.7 The Key to Olympic Success

Table 4-12 summarizes and compares the transport system aspects of the Olympic cities. As shown in Figure 4-33 and Table 4-12, the Rio de Janeiro 2016 Olympic Games has the largest and widest main Olympic area. Therefore, a traffic/transport/transit management program is essential to minimize travel time within the city.

Lastly, the main public transport mode for spectators of the Rio de Janeiro 2016 Olympic Games will be BRT. In the other Olympic cities, metro, tram or rail was the main modes of transportation. Therefore, the following should be ensured for the success of the games:

- Secured/smooth flow of traffic on the highway;
- Optimized connection of different transport modes
- Cooperation among traffic/transport/transit operators

Table 4-12 Summary of the Transport Aspects of the Olympic Cities

	Sydney 2000	ATHENS 2004	Beijing 2008	London	Rio 2016
Main Olympic Area	89 km^2	128 km^2	159 km^2	155 km^2	511 km^2
Population	4.6 million	3 million	7.5 million	8.2 million	6.3 million
Main Transit for Olympic Transport	Rail/Metro Bus	Metro/Tram Bus	Rail/Metro Bus	Metro -improvement- Bus	4 BRT Metro - Line 4 Rail - new vehicle
Dedicated Bus Lanes	Some	3 Routes	34 Routes, 285.7 km	240 km	More than 150 km
ITS	-Traffic control center, field equipment and systems -R$65 million -Cooperation with Security, Transit and Olympic Stadium Management	-Traffic control center, field equipment and systems -Cooperation with Security, Transit and Olympic Stadium Management	-Traffic control center, field equipment and systems -Cooperation with Security, Transit and Olympic Stadium Management	Traffic control center, field equipment and systems -Cooperation with Security, Transit and Olympic Stadium Management	*Traffic control center, field equipment and systems* *-Cooperation with Security, Transit and Olympic Stadium Management PROGRESS?*

Source: JICA Study Team

CHAPTER 5 CLARIFICATION OF INTELLIGENT TRANSPORT SYSTEM NEEDS

5.1 SURVEY ON ITS NEEDS OF USERS

5.1.1 Objective and Survey Methodology

(1) Objective

The objective of this survey is to obtain information about the need for ITS user services. The survey targeted people who travel to central Rio by car or public transport.

(2) Methodology

1) Summary

The survey questions were about the need for ITS solution on traffic or transportation problems in Rio. The survey was conducted on a weekday and on a weekend in order to obtain information about the various reasons why people come to central Rio.

2) Survey Schedule

Weekday: August 14, 2012 (Tuesday)
Weekend: August 12, 2012 (Sunday)

3) Survey Coverage

The survey locations and number of samples collected are shown in Table 5-1 below. The map of the survey location is shown in Figure 5-1.

Table 5-1 Survey Locations and Number of Samples

No.	Location	Area	Type	August	
				14	12
1	Central Metro Station / Central do Brasil Rail Station / Bus Stops	Centro	Public Transport	480	378
2	Carioca Metro Station / Bus Stops	Centro	Public Transport	245	
3	Ipanema / General Osório Metro Station / Bus Stops	Copacabana (Ipanema)	Public Transport	214	220
4	Car Parking (Building) on Ed. Menezes Cortes	Centro	Car	279	51
5	Car Parking (Underground) near Cinelandia	Centro	Car	211	
6	Praca XV	Centro	Ferry	624	513
Total				2,053	1,162
				3,215	

Source: JICA Study Team

Weekday: August 14, 2012

Weekend: August 12, 2012

Source: JICA Study Team

Figure 5-1 Map of Survey Locations

4) Survey Method

The ITS needs survey was conducted by interviewing the public about their requirements for ITS solutions on traffic and transportation problems in Rio de Janeiro. The interviewees were car users and public transport users at car parks, metro/train stations and bus stops close to each survey station.

The questionnaires used are shown in the following pages.

5) ITS Services Questionnaire

The ITS services questions were determined according to the ITS Service Domain from ISO, as shown in Figure 5-2 below. In this survey, the services were selected focusing on "Traveler Information," "Traffic Management and Operations," "Transport-Related Electronic Payment," and "Disaster Response Management and Coordination," which will benefit users. "Vehicle Services," was not included because this service is dependent on vehicle development.

Source: JICA Study Team

Figure 5-2 ITS Service Domains

Table 5-2 ITS Services Referred to in the Questionnaire

Service Domain	ITS Services Asked in the Questionnaire			
	Car Users	Public Transport Users	Large-scale Event	Disaster Case
1. Traveler Information	-Travel time information for road traffic -Congestion information in the road network -Optimized route navigation -Information of parking lot occupation	-Travel time information for public transport -Information of service condition (e.g., delay, suspend, cancel, headway) -Approaching information (Location information of the next bus/train) -Information of the level of occupation in cars (bus, train)	-Information of the event provided around the venues -Information of traffic congestion on the way to the venues -Information of public transport timing around the venues	-
2. Traffic Management and Operations	-Dynamic lane control -Traffic signal optimization -Danger warning of vehicles ahead (traffic jam, obstacle, or opposing vehicle) -Information of road construction	(For bus users) Priority Traffic Signal Control for the Bus	-	-
3. Vehicle Services	X	X	X	X
4. Freight Transport	X	X	X	X
5. Public Transport	X	X	X	X
6. Emergency	X	X	X	X
7. Transport-related Electronic Payment	Already implemented (Electronic toll collection)	Cashless payment		
8. Road Transport-related Personal Safety	X	X	X	X
9. Weather and Environmental Conditions Monitoring	X	X	X	X
10. Disaster Response Management and Coordination	-	-	-	-Provision of information on the water level of the river -Disaster risk information in the concerned area -Traffic/transport closure information due to the disaster
11. National Security	X	X	X	X
12. ITS Data Management	X	X	X	X

Source: JICA Study Team

[Questionnaire in English]

Introduction

This interview survey is aimed at clarifying the traffic and transport problems in Rio, and is conducted by Nippon Koei Co., Ltd. and the State of Rio. The results of this survey will be used to formulate a traffic and transportation improvement plan using information technology. We appreciate your cooperation.

1. About you

(1) Gender (1. Male 2. Female)
(2) Age (1. 10-19, 2. 20-29, 3. 30-39, 4. 40-49, 5. 50-51, 6. 60-69, 7. 70+)
(3) Employment Status (1. Employed for wages, 2. Self-employed, 3. Out of work, 4. Homemaker, 5. Student, 6. Retired, 7. Others)
(4) Home Address (Municipality: Area:)

2. About your trip

(1) Origin of This Trip (Municipality: Area:)
(2) Final Destination of This Trip (Municipality: Area:)
(3) Transportation Used for This Trip (1. Car 2. Bus 3. Train 4. Metro 5. Barcas 6. Other( )) (Multiple)
(4) The Purpose of This Trip (1. Commuting, 2. School, 3. Shopping, 4. Business, 5. Private, 6. Other( ))

3. Please answer the questions below and tell us if you need any of the services listed (Traffic / Transport Improvement Solutions). For each service, choose one of the six options, such as:
(1. Very Important, 2. Important, 3. Normal, 4. Not so Important, 5. Not Important at all, 6. Unknown)

(1) Do you usually use a car for work (including commuting, business, and school) or private purpose?
1. No 2. Yes (Answer the question below)

Do you need these services when you use a car?	For Work Purpose	For Private Purpose
Travel Time Information for Road Traffic	1 2 3 4 5 6	1 2 3 4 5 6
Congestion Information in the Road Network	1 2 3 4 5 6	1 2 3 4 5 6
Optimized Route Navigation	1 2 3 4 5 6	1 2 3 4 5 6
Dynamic Lane Control	1 2 3 4 5 6	1 2 3 4 5 6
Traffic Signal Optimization	1 2 3 4 5 6	1 2 3 4 5 6
Danger Warning of Vehicles Ahead (Accident, Obstacle, or Opposing Vehicle)	1 2 3 4 5 6	1 2 3 4 5 6
Information of Parking Lot Occupation	1 2 3 4 5 6	1 2 3 4 5 6
Information of Road Construction	1 2 3 4 5 6	1 2 3 4 5 6

(2) Do you usually use public transport for work (including commuting, business, and school) or private purpose?
1. No 2. Yes (Answer the question below)

Do you need these services when you use public transport?	For Work Purpose	For Private Purpose
Travel Time Information for Public Transport	1 2 3 4 5 6	1 2 3 4 5 6
Cashless Payment	1 2 3 4 5 6	1 2 3 4 5 6
Information of Service Condition (e.g., Delay, Suspend, Cancel, Headway)	1 2 3 4 5 6	1 2 3 4 5 6
Approaching Information (Location Information of the Next Bus/Train)	1 2 3 4 5 6	1 2 3 4 5 6
Information of the Level of Occupation in Cars (Bus, Train)	1 2 3 4 5 6	1 2 3 4 5 6
(For bus users) Priority Traffic Signal Control for the Bus	1 2 3 4 5 6	1 2 3 4 5 6

(3) Do you go to large-scale events such as Olympics, World Cup, Carnival, and New Year's Eve?
1. No 2. Yes (Answer the question below)

Do you need these services before and after the event?	Before the Event	After the Event
Information on the Event Provided around the Venues	1 2 3 4 5 6	1 2 3 4 5 6
Information on Traffic Congestion on the way to the Venues	1 2 3 4 5 6	1 2 3 4 5 6
Information on Public Transport Timing around the Venues	1 2 3 4 5 6	1 2 3 4 5 6

(4) For all

Do you need these services in case of a natural disaster, such as flooding or landslide?	In case of Natural Disaster	
Information on the Water Level of the River	1 2 3 4 5 6	
Disaster Risk Information in the Concerned Area	1 2 3 4 5 6	
Traffic/Transport Closure Information due to the Disaster	1 2 3 4 5 6	

Source: JICA Study Team

[Description of the Services in English]

	Services	Description
1.1	Travel Time Information Provision for Road Traffic	You can get the estimated travel time to your destination before and during your trip. via message sign on the road or your device (navigation system or mobile).
.2	Congestion Information	You can be informed about congestion points and routes via message board on the road or your device (navigation system or mobile).
.3	Optimized Route Navigation	You can get the optimized route considering the current traffic conditions via your device (navigation system).
.4	Dynamic Lane Control	This is the control of the lane direction of the road. The lane direction can be changed depending on the time (i.e., rush hour, events). Example: Av. Atlantica in Copacabana
.5	Traffic Signal Optimization	Traffic signals are controlled automatically by detecting traffic volume and queue lengths at junctions. The waiting time due to the signal will be decreased.
.6	Danger Warning of Vehicles Ahead (Accident, Obstacle, or Opposing Vehicle)	You are warned if there is a risk of collision due to the lack of vision of an accident ahead or an obstacle on the road, or an opposing vehicle at the curve ahead via message sign on the road or your device (navigation system or mobile).
.7	Information of Parking Lot Occupation	You can know if car parking space is available or the car park is full via message sign on the road or your mobile.
.8	Information of Road Construction	You can be informed of any road constructions being done on your way via message sign on the road or your mobile.
2.1	Travel Time Information Provision for Public Transport	You can get the estimated travel time to your destination before and during your trip via message sign at the station/stop or your device (mobile).
.2	Cashless Payment	You do not need to wait in queue for payment when taking the bus or train/tube. Use like IC card. Example: Rio Card
.3	Information of Service Condition (e.g., Delay, Suspend, Cancel, Headway)	You can be informed of any delayed or suspended service of bus and rail services before you go. Via your device (mobile).
.4	Approaching Information (Information on the Location of the Next Bus/Train)	You can be informed when your bus or train will arrive. You can know if your bus or train is approaching by the estimated time of arrival via message sign at the station/stop.
.5	Information of the Level of Occupation in Cars (Bus, Train)	You can know how full your bus or train is and decide whether to take the approaching one or wait for the next via message sign at the station/stop or your device (mobile).
.6	(For bus users) Priority Traffic Signal Control for the Bus	Traffic signals are controlled automatically to detect incoming buses. When your bus approaches the signal, the signal turns to green.
3.1	Information of the Event Provided around the Venue	You can obtain information about an event, such as timetable or results when and where you like via your device (mobile).
.2	Information of Traffic Congestion on the way to the Venue	You can be informed of the traffic congestion at the venues on arrival and departure via your device (mobile).
.3	Information of Public Transport Timing around the Venue	You can find out when your return bus or train will arrive after an event via your device like mobile.
4.1	Information of the Water Level of the River	You can see the water levels of nearby rivers when there is risk of flooding via your device such as mobile and TV.
.2	Disaster Risk Information in the Concerned Area	You can know if there is any risk of a disaster such as landslide and/or flooding in your area on the map via your device (mobile).
.3	Traffic/Transport Closure Information due to the Disaster	You can obtain information about road closures and suspended bus /train services in case of a disaster via message sign or your device (mobile).

Source: JICA Study Team

[Questionnaire in Portuguese]

Introdução

Esta é uma pesquisa por entrevistas para esclarecer problemas de tráfego e transportes no Rio, conduzida pela Nippon Koei Co. Ltd e pelo Estado do Rio. O resultado da pesquisa será usado para formular o plano de melhorias de tráfego e transportes utilizando tecnologia da informação. Agradecemos a sua cooperação.

1. Sobre você

(1) Sexo (1. Homem 2. Mulher)
(2) Idade (1. 10-19, 2. 20-29, 3. 30-39, 4. 40-49, 5. 50- 51, 6. 60 – 69, 7.70 -)
(3) Emprego (1. Assalariado, 2. Autônomo, 3. Desempregado, 4. Dona de casa, 5. Estudante, 6. Aposentado, 7. Outros)
(4) Endereço Residencial (Município: Bairro:)

2. Sobre esta viagem

(1) Qual a origem desta viagem (Município: Bairro:)
(2) Qual o destino Final desta viagem (Município: Bairro:)
(3) Quais os meios de transporte utilizados nesta viagem (1. Carro 2. Ônibus 3. Trem 4. Metrô 5. Barcas 6.Outros) (múltiplas opções)
(4) Qual o motivo desta viagem (1. Trabalho 2. Escola 3. Compras 4. Negócios 5. Particular 6. Outros)

3. Necessidades de Soluções de Melhoria do Tráfego/Transportes
Escolha uma das 6 opções :
(1. Muito Importante, 2. Importante, 3. Médio, 4. Pouco Importante, 5. Não Importante, 6. Desconhecido)

(1) Você costuma usar o carro para o trabalho (incluindo ir e voltar ao trabalho, negócio ou escola) ou para fins particulares?
1. Não 2. Sim (Responda a pergunta abaixo)

Você acha que estes serviços são necessários quando você usa um carro?	Para Trabalho Muito > > > Não	Para Fins Particulares Muito > > > > Não
Informações sobre o tempo de viagem para o tráfego nas vias	1 2 3 4 5 6	1 2 3 4 5 6
Informações sobre congestionamento nas vias	1 2 3 4 5 6	1 2 3 4 5 6
Informações sobre escolha das melhores rotas	1 2 3 4 5 6	1 2 3 4 5 6
Informações sobre sentido de tráfego de faixas reversíveis	1 2 3 4 5 6	1 2 3 4 5 6
Otimização do funcionamento dos sinais de trânsito (onda verde, etc)	1 2 3 4 5 6	1 2 3 4 5 6
Aviso de perigo devido à veículos a frente (acidentes, obstáculos)	1 2 3 4 5 6	1 2 3 4 5 6
Informações sobre vagas em estacionamentos	1 2 3 4 5 6	1 2 3 4 5 6
Informações sobre obras nas vias	1 2 3 4 5 6	1 2 3 4 5 6

(2) Habitualmente você usa o Ônibus, Metrô ou Trem para o Trabalho (incluindo ir e voltar ao trabalho, negócio ou escola) ou para fins particulares?
1. Não 2. Sim (Responda a pergunta abaixo)

Você acha que estes serviços são necessários quando você usa Ônibus, Metrô ou Trem?	Para Trabalho Muito > > > Não	Para Fins Particulares Muito > > > > Não
Informações sobre o tempo de viagem para os transportes públicos	1 2 3 4 5 6	1 2 3 4 5 6
Pagamento sem dinheiro (vale transporte, cartões, etc.)	1 2 3 4 5 6	1 2 3 4 5 6
Informações sobre a operação dos ônibus / trens / metrô (atrasos, intervalos, interrupção)	1 2 3 4 5 6	1 2 3 4 5 6
Informações sobre a aproximação (localização) do próximo ônibus/ trem/ metro	1 2 3 4 5 6	1 2 3 4 5 6
Informações sobre a lotação	1 2 3 4 5 6	1 2 3 4 5 6
(Para os usuários de ônibus) Prioridade para ônibus nos sinais de trânsito	1 2 3 4 5 6	1 2 3 4 5 6

(3) Você costuma ir aos locais de acontecimento de Grandes Eventos como Carnaval, Reveillon, Jogos, da Copa ou Jogos Olímpicos?
1. Não 2. Sim (Responda a pergunta abaixo)

Você acha que estes serviços são necessários antes e após um Grande Evento?	Antes do Evento Muito > > > Não	Após o Evento Muito > > > > Não
Informações sobre o evento fornecidas próximo aos locais dos eventos	1 2 3 4 5 6	1 2 3 4 5 6
Informações sobre congestionamento de trânsito à caminho dos locais dos eventos	1 2 3 4 5 6	1 2 3 4 5 6
Informações sobre os horários dos transportes públicos próximo aos locais dos eventos	1 2 3 4 5 6	1 2 3 4 5 6

(4) Para todos

Você acha que estes serviços são necessários em caso de desastre natural, como enchentes e deslizamentos de terra?		
Informações sobre o nível de água dos rios	1 2 3 4 5 6	
Informações sobre possibilidade de desastre em áreas de risco	1 2 3 4 5 6	
Informações sobre interrupção do tráfego ou dos transportes devido à desastres naturais	1 2 3 4 5 6	

Source: JICA Study Team

[Description of the Services in Portuguese]

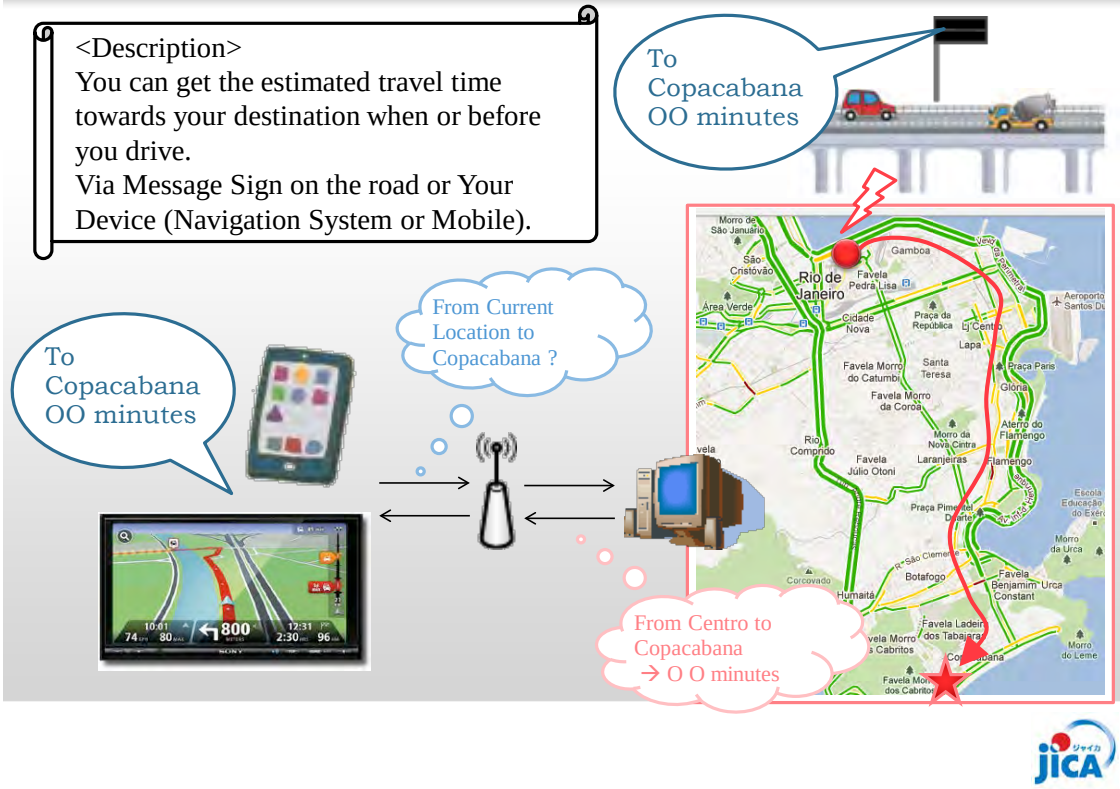
	Serviços	Descrição
1.1	Informações sobre o tempo de viagem para o tráfego nas vias	Você pode obter o tempo de viagem estimado em direção ao seu destino antes ou quando você dirige. Através de Sinalização com Mensagens nas vias ou no Seu Aparelho (Sistema de Navegação ou Celular).
.2	Informações sobre congestionamento nas vias	Você pode obter pontos e rotas congestionadas. Através de Sinalização com Mensagens nas vias ou no Seu Aparelho (Sistema de Navegação ou Celular).
.3	Informações sobre escolha das melhores rotas	Você pode obter a melhor rota considerando as condições atuais do tráfego Através do Seu Aparelho (Sistema de Navegação)
.4	Informações sobre sentido de tráfego de faixas reversíveis	Esta é a operação das pistas na via. A direção da pista é mudada conforme o horário. Exemplo: Av. Atlântica em Copacabana.
.5	Otimização do funcionamento dos sinais de trânsito (onda verde, etc.)	Os semáforos de trânsito são controlados automaticamente através da detecção do volume de tráfego e do comprimento das filas nos cruzamentos. O tempo de espera será reduzido nas paradas dos semáforos.
.6	Aviso de perigo devido à veículos à frente (acidentes, obstáculos)	Quando houver risco de colisão por você não poder ver à sua frente, como carros acidentados, obstáculos na via e veículos no sentido oposto depois de uma curva, você é avisado. Através de Sinalização com Mensagens nas vias ou do Seu Aparelho (Sistema de Navegação ou Celular).
.7	Informações sobre vagas em estacionamentos	Você poderá saber se há ou não vagas de estacionamento. Através de Sinalização com Mensagens nas Vias ou no Seu Celular.
.8	Informações sobre obras nas vias	Você pode saber se a construção de estradas está sendo feito em seu caminho. Via sinal de mensagem na estrada ou o celular.
2.1	Informações sobre o tempo de viagem para os transportes públicos	Você pode obter o tempo de viagem estimado em direção ao seu destino antes de embarcar ou enquanto viaja de ônibus / trem ou metrô. Através de Sinalização com Mensagens nas estações, pontos de parada ou no seu aparelho celular.
.2	Pagamento sem dinheiro (vale transporte, cartões, etc.)	Você não precisa esperar na fila para pagar ao tomar um ônibus ou trem. Utilização de algo similar a um cartão magnético. Exemplo: Cartão Rio Card ou Bilhete Único
.3	Informações sobre a operação dos ônibus/ trens/ metrô (atrasos, intervalos, interrupção)	Você pode saber se há um atraso ou se foram suspensos os serviços de ônibus ou trem antes de sair. Através do seu aparelho, por exemplo, Celular.
.4	Informações sobre a aproximação (localização) do próximo ônibus / trem / metrô	Você pode saber quando seu ônibus / trem chegará. Você pode saber se seu ônibus / trem já está se aproximando ou não. Através de Sinalização com Mensagens na estação / parada.
.5	Informações sobre a lotação	Você pode saber se seu ônibus ou trem está cheio ou não. Então, você pode decidir se vai tomar o que vem ou o próximo. Através de Sinalização com Mensagens na estação / parada ou no seu aparelho, por exemplo, Celular.
.6	(Para os usuários de ônibus) Prioridade para ônibus nos sinais de trânsito	Sinal de trânsito é controlado automaticamente na detecção de ônibus. Quando o ônibus se aproxima do sinal, o sinal fica verde.
3.1	Informações sobre o evento fornecidas próximo aos locais dos eventos	Você pode obter informações sobre o evento, como a agenda, e obter o resultado como e quando quiser. Através do seu aparelho, por exemplo, Celular.
.2	Informações sobre congestionamento de trânsito à caminho dos locais dos eventos	Você pode saber o quanto o tráfego para os locais está congestionado, quando você vai e quando volta. Através do seu aparelho, por exemplo, celular.
.3	Informações sobre os horários dos transportes públicos próximo aos locais dos eventos	Você pode saber quando seu ônibus / trem virá após o evento para voltar para casa. Através do seu aparelho, por exemplo, Celular.
4.1	Informações sobre o nível de água dos rios	Você pode ver o nível de água do rio próximo a você quando há risco de enchente. Através do seu aparelho, por exemplo, Celular e TV.
.2	Informações sobre possibilidade de desastre em áreas de risco	Você pode saber se há risco de desastre, como deslizamento de terra e enchente, próximo à sua área. No mapa através do seu aparelho, por exemplo, Celular.
.3	Informações sobre interrupção do tráfego ou dos transportes devido à desastres naturais	Você pode saber se há interrupção das vias ou e suspensão dos serviços de ônibus / trem em caso de desastre. Através de Sinalização com Mensagem ou no seu aparelho, por exemplo, Celular.

Source: JICA Study Team

[Description Sheet of Services]

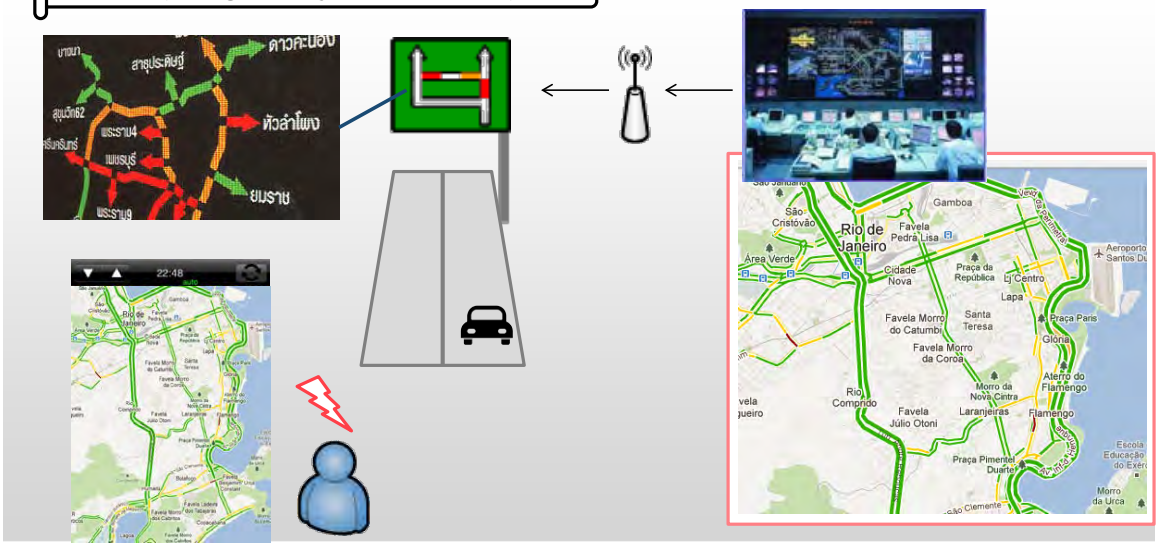
Travel Time Information for Road Traffic

<Description>
You can get the estimated travel time towards your destination when or before you drive.
Via Message Sign on the road or Your Device (Navigation System or Mobile).



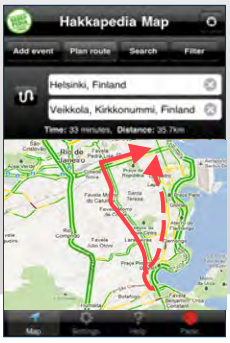
Congestion Information in the Road Network

<Description>
You can know congestion point and route.
Via Message Board on the road or Your Device (Navigation System or Mobile).



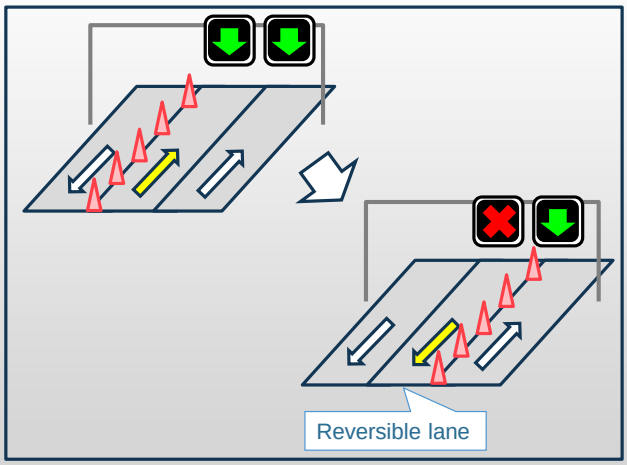
Optimized Route Navigation

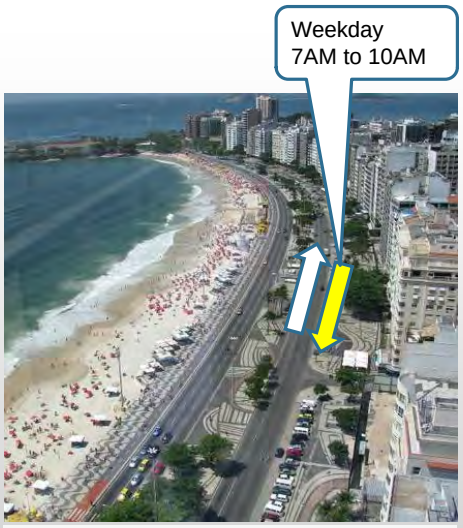
<Description>
You can get the optimized route considering the current traffic condition.
Via Your Device (Navigation System).



Dynamic Lane Control

<Description>
This is the operation of the lane of the road.
The direction of the lane is changed depending on the time.
Example: Av. Atlantica in Copacabana.

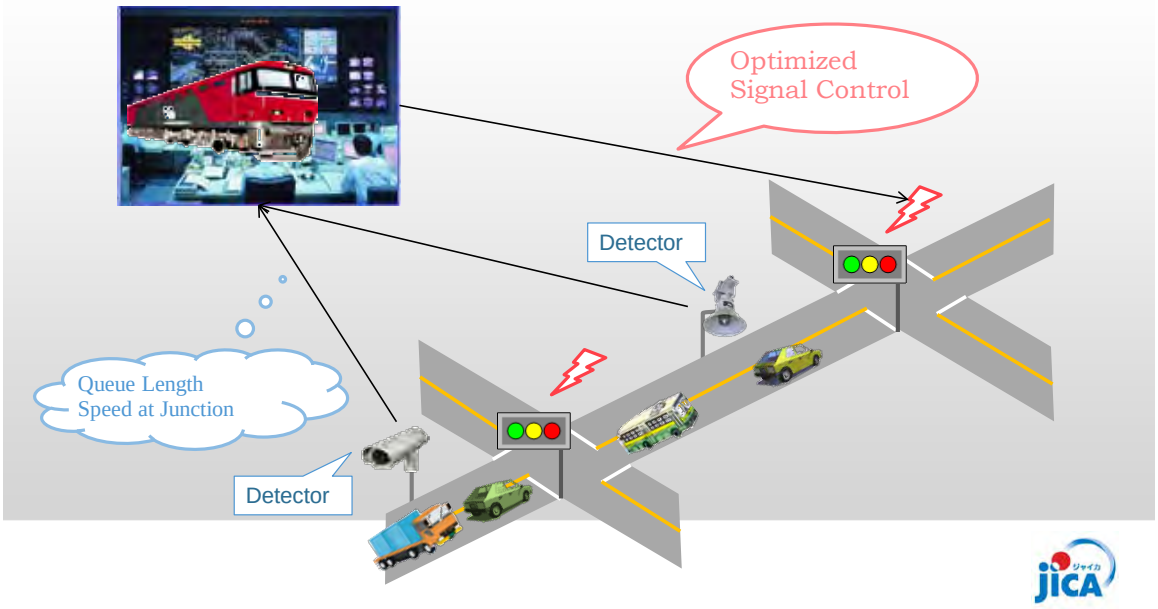




Av. Atlantica

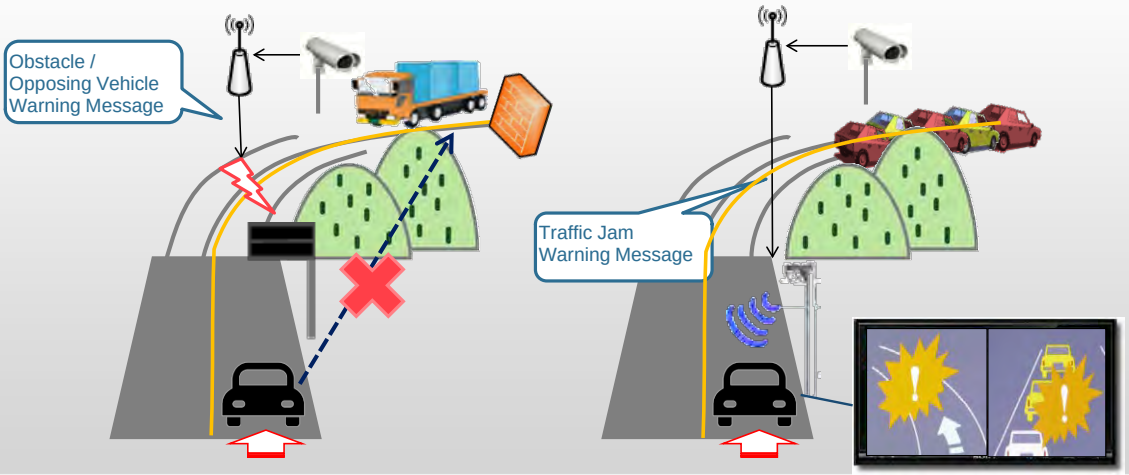
Traffic Signal Optimization

<Description>
Traffic signal is controlled automatically in detecting traffic volume and queue length at junctions.
The waiting time due to the signal will be decreased.



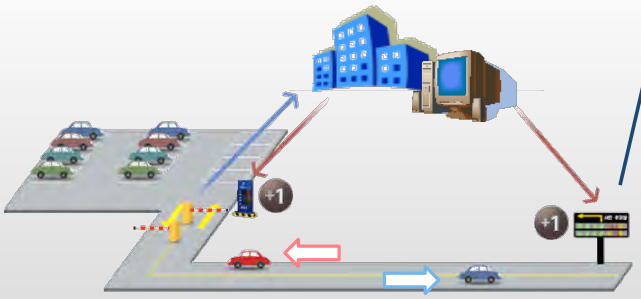
Danger Warning of Vehicles Ahead (Traffic Jam, obstacle, or opposing vehicle)

<Description>
If there is a risk of collision you cannot see from the vehicle such as queue in traffic jam, obstacle on the road and opposing vehicle ahead of the curve, you are warned.
Via Message Sign on the road or Your Device (Navigation System or Mobile).



Information of Parking Lot Occupation

<Description>
You can know if car parking is available or full.
Via Message Sign on the road or Your Mobile.

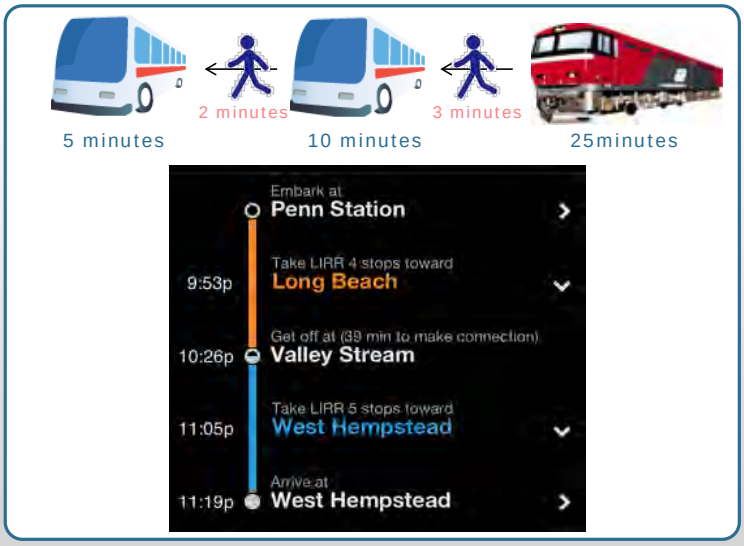


Information of Road Construction

<Description>
You can know if road construction is being done on your way.
Via Message Sign on the road or Your Mobile

Travel Time Information for Public Transport

<Description>
You can get the estimated travel time towards your destination when or before you go.
Via Message Sign at the station / stop or your device like Mobile.

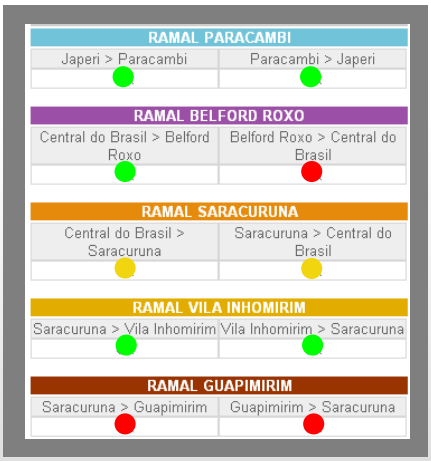


Cashless Payment

<Description>
You do not need to wait in the queue for payment when you take a bus and rail.
Using like IC card.
Example: Rio Card

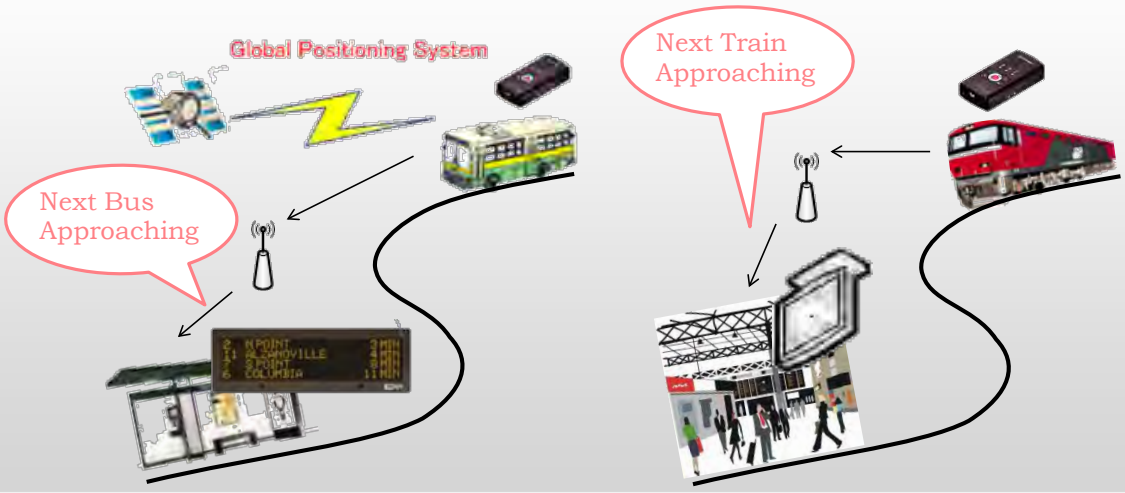
Information of Service Condition (ex. Delay, Suspend, Cancel, Headway)

<Description>
You can know if the delay or suspended service has been occurred for the bus and rail services before you go.
Via your device like Mobile.



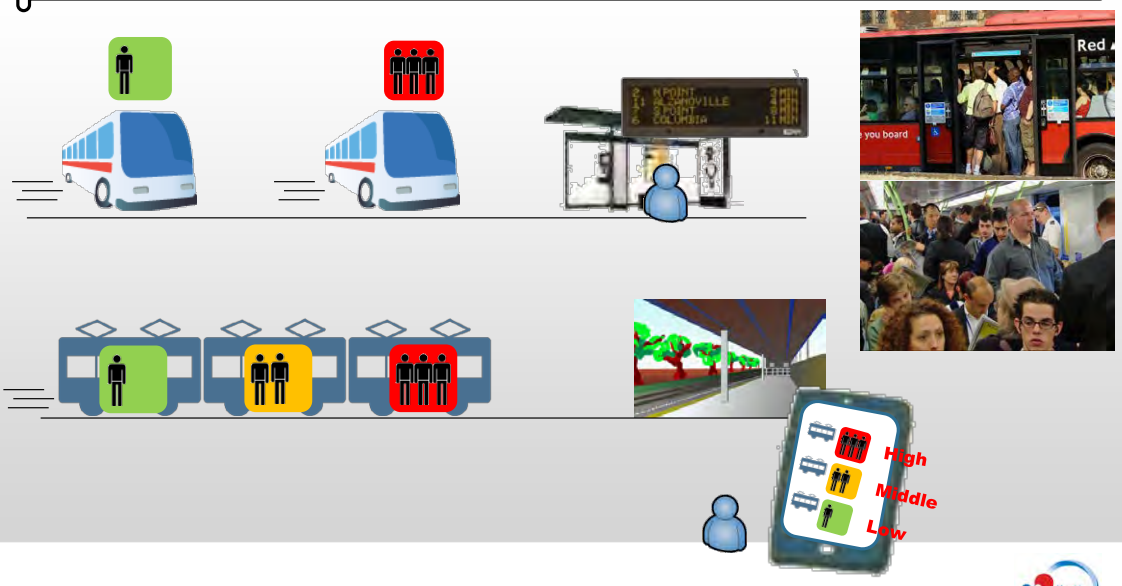
Approaching Information (Location Information of the Next Bus / Train)

<Description>
You can know when your bus / train will come.
You can know if your bus / train is approaching or not yet.
Via Message Sign at the station / stop.



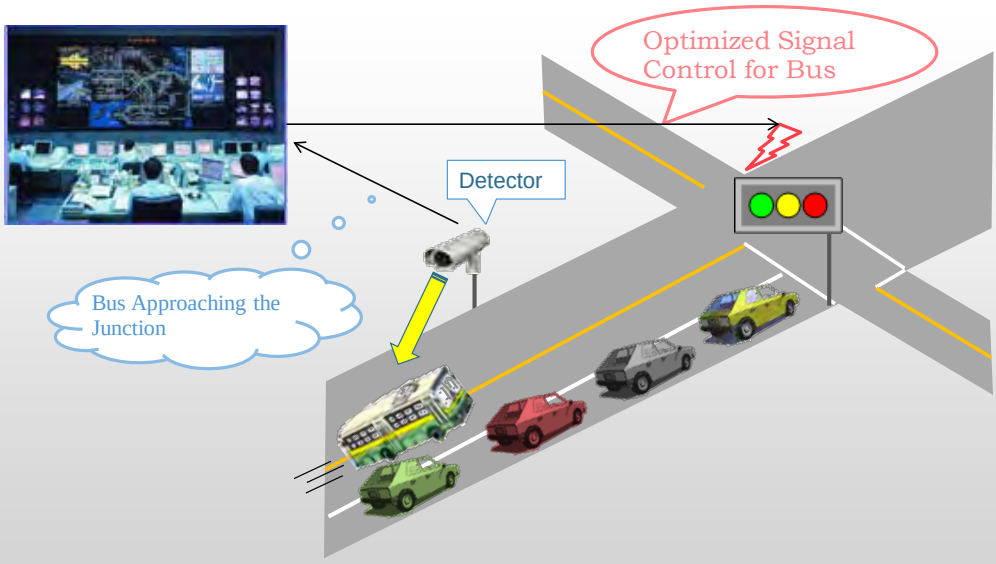
Information of the Level of Occupation in Cars (Bus, Train)

<Description>
You can know how your bus or rail is congested or occupied. Then, you can decide if you are going to take the one or next one.
Via Message Sign at the station / stop or your device like Mobile.



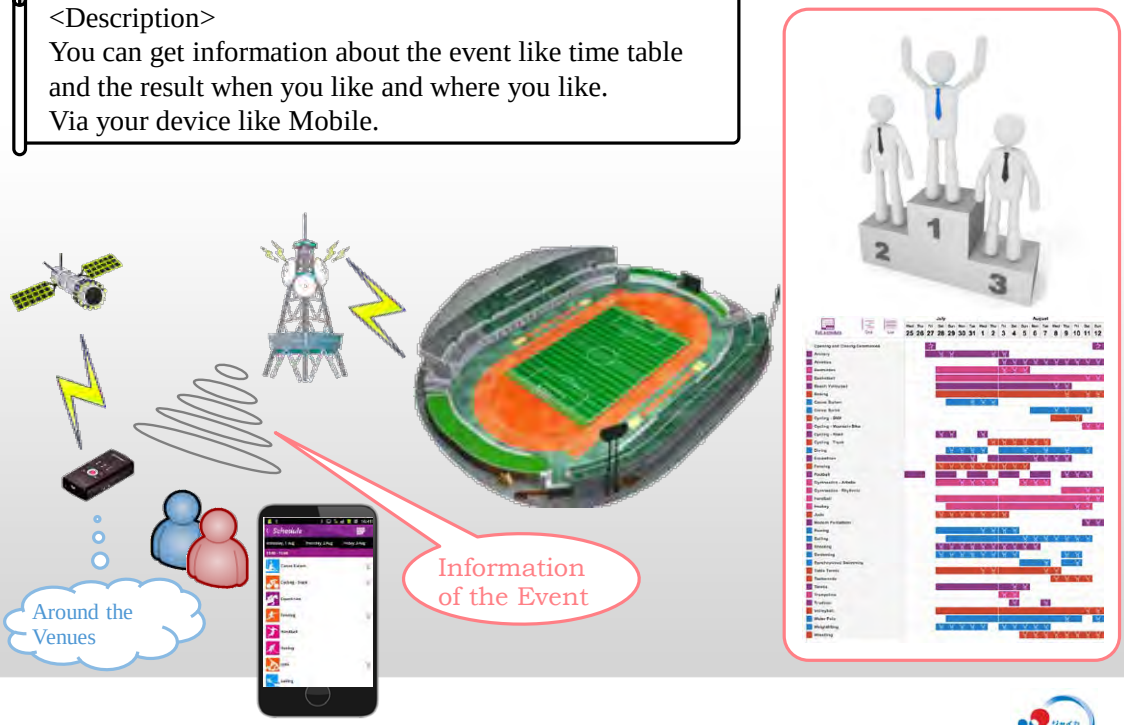
(For bus users) Priority Traffic Signal Control for the Bus

<Description>
Traffic signal is controlled automatically in detecting buses.
When your bus approaches the signal, the signal turns into green.



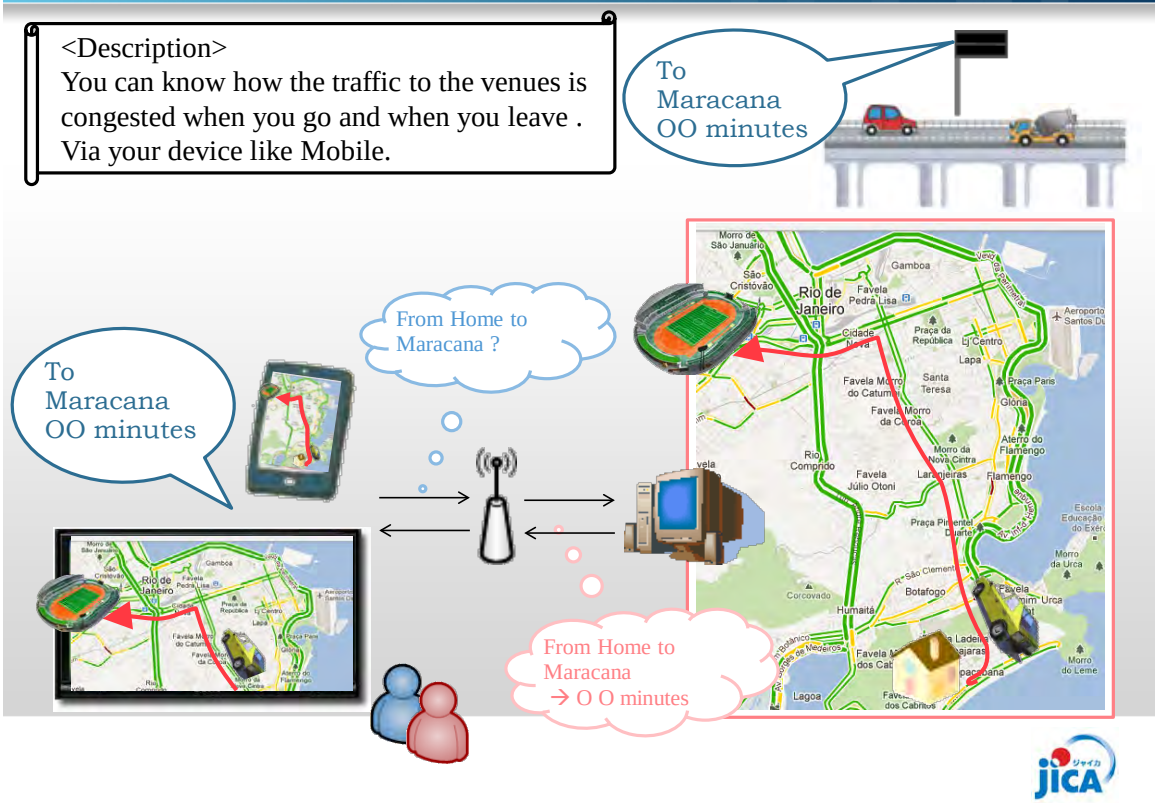
Information of the Event Provided around the Venues

<Description>
You can get information about the event like time table and the result when you like and where you like.
Via your device like Mobile.



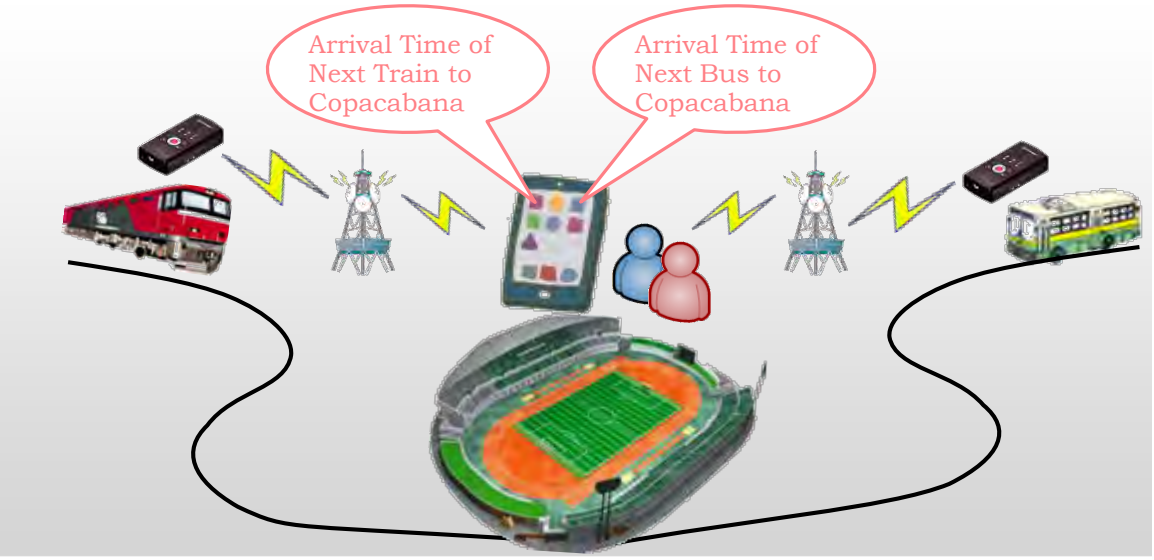
Information of Traffic Congestion on the way to the Venues

<Description>
You can know how the traffic to the venues is congested when you go and when you leave .
Via your device like Mobile.



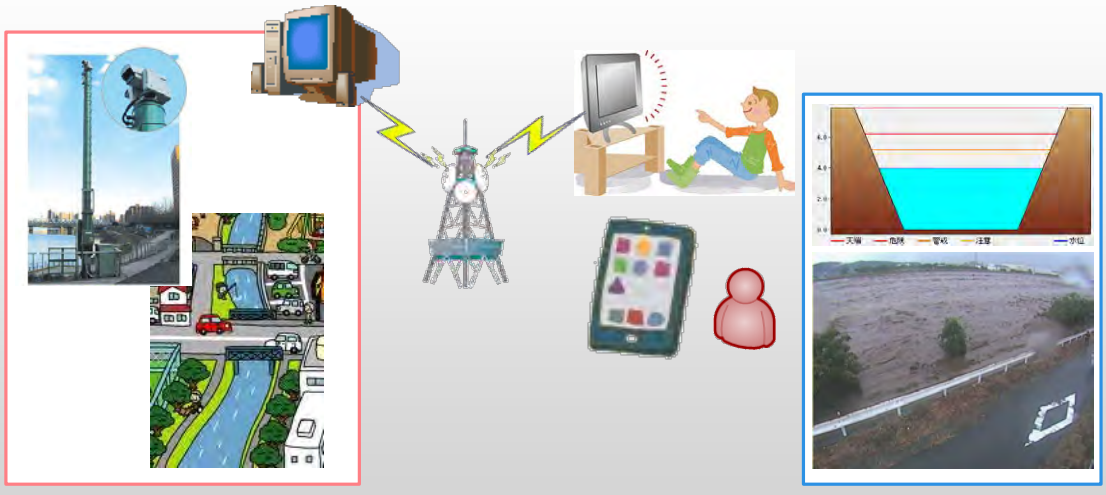
Information of Public Transport Timing around the Venues

<Description>
You can know when your bus / rail will come after the event in order to go home.
Via your device like Mobile.



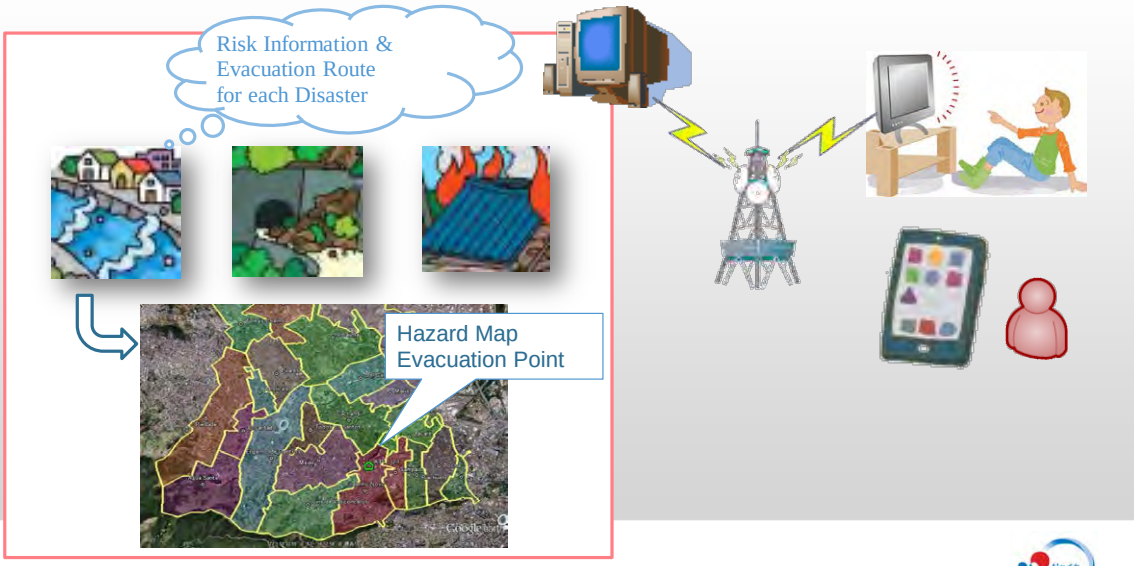
Information Provision of the Water Level of the River

<Description>
You can see the water level of the river around you when there is the risk of flooding.
Via your device like Mobile and TV.



Risk Information of the Disaster of the Concerned Area

<Description>
You can know if there is a risk of disaster like land-slide and flooding in your area.
On the map via your device like mobile.



Closure Information of Traffic / Transport due to Disaster

<Description>
You can know the closure information of the road and suspended services of bus / rail in the case of disaster.
Via Message Sign or your device like Mobile.