REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS (DPWH)
METROPOLITAN MANILA DEVELOPMENT AUTHORITY (MMDA)

MEGA MANILA REGION HIGHWAY NETWORK INTELLIGENT TRANSPORT SYSTEM (ITS) INTEGRATION PROJECT

FINAL REPORT
EXECUTIVE SUMMARY

JULY 2013

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

CTI ENGINEERING INTERNATIONAL CO., LTD
ORIENTAL CONSULTANTS CO., LTD
METROPOLITAN EXPRESSWAY CO., LTD
MITSUBISHI RESEARCH INSTITUTE, INC.

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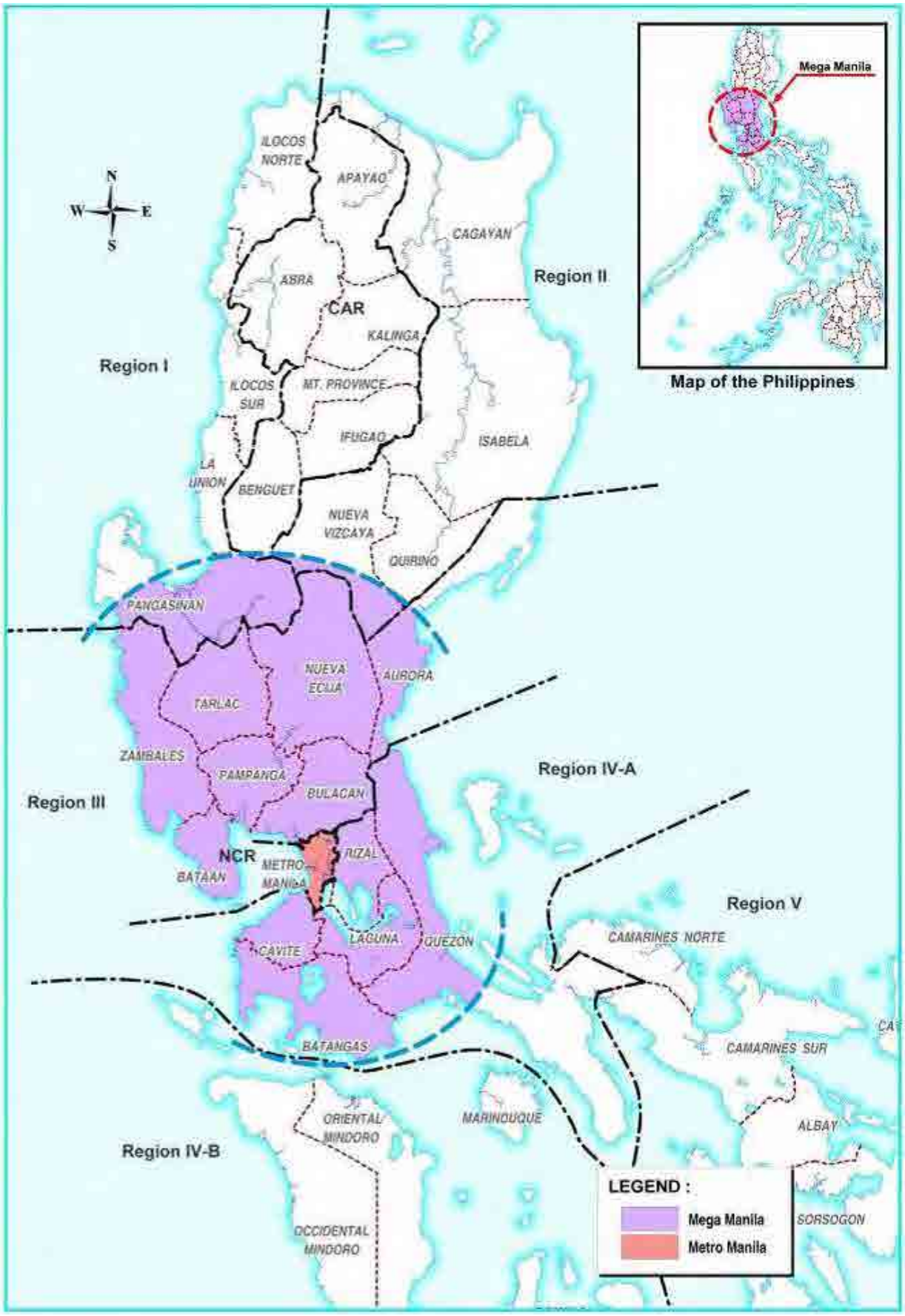

LOCATION MAP

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ACRONYMS AND ABBREVIATIONS

AADT	:	Annual Average Daily Traffic
B/C	:	Benefit/Cost Ratio
BLT	:	Build-Lease-Transfer
BOT	:	Build-Operate-Transfer
BPH	:	Bureau of Public Highways
BRT	:	Bus Rapid Transit
BTO	:	Build-Transfer-and-Operate
CAAP	:	Civil Aviation Authority of the Philippines
CAB	:	Civil Aeronautics Board
CALAX	:	Cavite-Laguna Expressway
CAVITEX	:	Manila Cavite Toll Expressway
CBD	:	Central Business District
CCCC	:	Communication Command and Control Center
CCH	:	Clearing Center House
CCTV	:	Closed-Circuit Television
CDCP	:	Construction Development Corporation of the Philippines
CLLEX	:	Central-Luzon-Link Expressway
CMMTC	:	Citra Metro Manila Tollways Corporation
CO	:	Capital Outlays
CPA	:	Cebu Port Authority
DEO	:	District Engineering Office
DOF	:	Department of Finance
DOST	:	Department of Science and Technology
DOTC	:	Department of Transportation and Communications
DPWH	:	Department of Public Works and Highways
DRM	:	Digital Road Map
DSRC	:	Dedicated Short Range Communications
EIRR	:	Economic Internal Rate of Return
EO	:	Executive Order
ETC	:	Electronic Toll Collection
FCD	:	Floating Car Data
FM	:	Frequency Modulation
GAA	:	General Appropriations Act
GDP	:	Gross Domestic Product
GIS	:	Geographic Information System
GPS	:	Global Positioning System
GRDP	:	Gross Regional Domestic Product
IC	:	Infrastructure Committee
IC	:	Integrated Circuit
IRI	:	International Roughness Index
ISO	:	International Organization for Standardization
IT	:	Information Technology
ITS	:	Intelligent Transport System
JCC	:	Joint Coordination Committee
JICA	:	Japan International Cooperation Agency
JV	:	Joint venture
KPI	:	Key Performance Indicator
LGC	:	Local Government Code
LGUs	:	Local Government Units
LRT	:	Light Rail Transit
LRTA	:	Light Rail Transit Authority
LTFRB	:	Land Transportation Franchising and Regulatory Board
LTO	:	Land Transportation Office

LTTC	:	Land Transportation and Traffic Code
MCIAA	:	Mactan-Cebu International Airport Authority
MCTE	:	Manila-Cavite Toll Expressway
MIAA-NAIA	:	Manila International Airport Authority
MID	:	Management Information Division
MMDA	:	Metropolitan Manila Development Authority
MMPTS	:	Mega Manila Public Transport Study
MNTC	:	Manila North Tollway Corporation
MRT	:	Mass Rapid Transit
MTPDP	:	Medium Term Philippine Development Plan
MVIS	:	Motor Vehicle Inspection System
MVRS	:	Motor Vehicle Registration System
MVUC	:	Motor Vehicle User's Charge
NAIAX	:	Ninoy Aquino International Airport Expressway
NCR	:	National Capital Region
NEDA	:	National Economic and Development Authority
NLEX	:	North Luzon Expressway
NPV	:	Net Present Value
O&M	:	Operation and Maintenance
OBR	:	Organized Bus Routes
OBU	:	On Board Unit
OD	:	Origin Destination
ODA	:	Official Development Assistance
OECF	:	Oversea Economic Cooperation Fund
OTS	:	Office for Transportation Security
PCG	:	Philippine Coast Guard
PD	:	Presidential Decree
PEGR	:	Philippines-Australia Partnership for Economic Government Reform
PLDT	:	Philippine Long Distance Telephone Company
PMO	:	Project Management Office
PMO-BOT	:	Project Management Office – Build-Operate-Transfer
PMO-FS	:	Project Management Office – Feasibility Study
PMO-TEAM	:	Project Management Office – Traffic Engineering and Management
PMS	:	Pavement Management System
PNCC	:	Philippine National Construction Corporation
PNP	:	Philippine National Police
PNR	:	Philippine National Railways
PPA	:	Philippine Ports Authority
PPP	:	Public Private Partnership
PRA	:	Philippine Reclamation Authority (formerly Public Estates Authority)
PSA	:	Public Service Act
PSC	:	Public Service Commission
PhP	:	Philippine Peso
RA	:	Republic Act
RB	:	Road Board
RBIA	:	Road and Bridge Information Application
RDC	:	Regional Development Council
RFID	:	Radio Frequency Identification
RIMSS	:	Road Information Management support system
RO	:	Regional Office
RSA	:	Road Side Antenna
RTIA	:	Road Traffic Information Application
SCATS	:	Sydney Coordinated Adaptive Traffic System
SCTEX	:	Subic- Clark-Tarlac Expressway
SDR	:	Social Discount Rate

SIDC	:	Star Infrastructure Development Corporation
SLEX	:	South Luzon Expressway
SLRF	:	Special Local Road Fund
SNS	:	Social Networking Service
SRSaF	:	Special Road Safety Fund
SRSuF	:	Special Road Support Fund
STAR	:	Southern Tagalog Arterial Road
STOA	:	Supplemental Toll Operation Agreement
SVPCF	:	Special Vehicle Pollution Control Fund
TARAS	:	Traffic Accident Recording and Analysis System
TCA	:	Toll Concession Agreement
TCR	:	Traffic Control Room
TCS	:	Toll Collection System
TDM	:	Transport Demand Management
TDO	:	Traffic Discipline Office
TEAM	:	Traffic Engineering and Management
TEC	:	Traffic Engineering Center
TMC	:	Traffic Management Code
TOA	:	Toll Operation Agreement
TOC	:	Toll Operation Certificate
TPLEX	:	Tarlac-Pangasinan-La Union Expressway
TPMO	:	Traffic and Parking Management Office
TRB	:	Toll Regulatory Board
TWG	:	Technical Working Group
VMS	:	Variable Message Sign
WB	:	World Bank
WIM	:	Weigh-in-Motion

1. INTRODUCTION

1.1. BACKGROUND OF THE STUDY

The extremely concentrated economic activity and population in the Mega Manila Region (i.e., National Capital Region, Region III and Region IV-A) have been causing serious traffic congestion and delays in the movement of people and distribution of goods. These impair the economy by lowering the country's international competitiveness as an investment destination. The living condition has also deteriorated due to air pollution, traffic noise and traffic accidents.

Innovation of information and communication technology (ICT) is rapidly progressing day by day. Real time traffic information can be collected and provided to road users by various means, typical one of which is smart phones. Smart (IC) cards can be also used in various ways including rail/bus fare payment, toll road payment, various payments for shopping, etc.

Based on the above-mentioned recognition, the Mega Manila Region Highway Network Intelligent Transportation Systems (ITS) Master Plan, covering toll expressways as well as urban roads, will be formulated through the efforts of both the Government of Japan (GOJ) and the Government of the Philippines (GOP). The ITS Master Plan preparation includes the formulation of a plan and a strategy to introduce an integrated traffic control system covering expressways and urban roads; and the formulation of a technical and organizational policy framework. The system, which is expected to be introduced in the short term or medium term, was examined and proposed as pre-feasibility projects.

On the part of GOJ, JICA, the official agency responsible for implementation of the technical program of GOJ, is undertaking the Study in accordance with the relevant laws and regulations enforced in Japan.

On the part of GOP, DPWH and MMDA act as the counterpart agencies to the Japanese Study Team (hereinafter referred to as "the Study Team") and also as the coordinating bodies in relation to other governmental and non-governmental organizations for the smooth implementation of the Study.

1.2. OBJECTIVE OF THE STUDY

The objectives of the Study are as follows:

- To develop a master plan to introduce Intelligent Transport Systems (hereinafter referred to as "ITS") in the Mega Manila Region.
- To formulate short, medium and long term ITS deployment plan.

1.3. STUDY AREA

The study area covers the Mega Manila Region (i.e., National Capital Region, Region III and Region IV-A).

1.4. SCOPE OF THE STUDY

In order to achieve the above objectives, the Study covers the following activities:

(1) Preparation, Presentation and Discussion of Inception Report
(2) ITS Seminars
(3) Data Collection of Transportation and ITS related information in Mega Manila Region and Metro Manila Region

(4) Identification and Evaluation of Existing ITS System
(5) Collection of Supplemental Data of ITS Needs
(6) Formulation of Basic Principle of the ITS Master Plan
(7) Preparation, Presentation and Discussion of Interim Report
(8) Formulation of ITS Master Plan for Toll Expressways in Mega Manila Region
(9) Formulation of ITS Master Plan for Urban Roads in Metro Manila Region
(10) Preparation, Presentation and Discussion of Progress Report
(11) Selection of Pilot Project and Implementation of Pre F/S
(12) Preparation, Presentation and Discussion of Draft Final Report
(13) Preparation and Submission of Final Report

1.5. FINAL REPORT ORGANIZATION

1.5.1 Report Prepared

The following reports were prepared in the course of the Study and submitted to DPWH and MMDA.

- Inception Report
- Interim Report
- Progress Report
- Draft Final Report

1.5.2 Organization of the Final Report

The Final Report is organized as follows:

- Executive Summary
- Main Text
- Annex

2. SOCIO-ECONOMIC CHARACTERISTICS OF PROJECT AREA

2.1. PHYSICAL PROFILE

The Study Area consist of Region III, Region Iv-A and the National Capital Region(NCR). NCR or Metro Manila is composed of 16 cities and its total land area of 619sq. km is only 0.2% of total land area in the country.

Source: NSO 2012

FIGURE 2.1-1 LAND AREA SHARE

(1) Population

National Capital Region (NCR) or Metro Manila

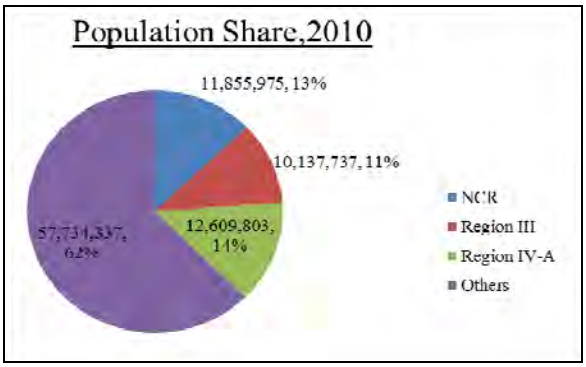
- Population reached 11.9 million in 2010 and shared 13% of the Philippine population.
- Population density is extremely high at 191 persons/ha.
- Population growth rate drastically dropped at 0.99% between 1995 and 2000, but again grew at the rate of 2.18% from 2000 to 2007, then again sharply dropped at 0.88%, lower than the national average.

Region III (Central Luzon)

- Population in 2010 was 10.1 million and shared 11% of the Philippine population.
- Population density is 4.6 persons per ha., much lower than NCR.
- The Region recorded a high population growth rate between 1995 and 2000 at 2.96%, however, it reduced to 2.45% between 2000 and 2007 and to 1.45% between 2007 and 2010.
- There is a steady trend of population increase at a high rate, because spilled over population from NCR is moving to this Region.

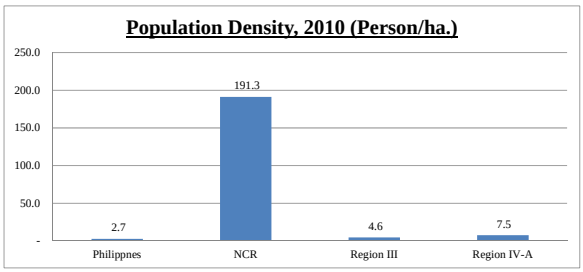
Region IV-A (CALABARZON)

- Population in 2010 reached 12.6 million and shared 14% of the country.
- Population density is 7.5 person/ha., which is much lower than that of NCR.
- The Region recorded high population growth rates at 4.07% from 1990 to 1995, 3.76% from 1995 to 2000, 3.37% from 2000 to 2007, and 2.36% from 2007 to 2010. Population spilled over from NCR moved to this Region. This trend is still continuing.



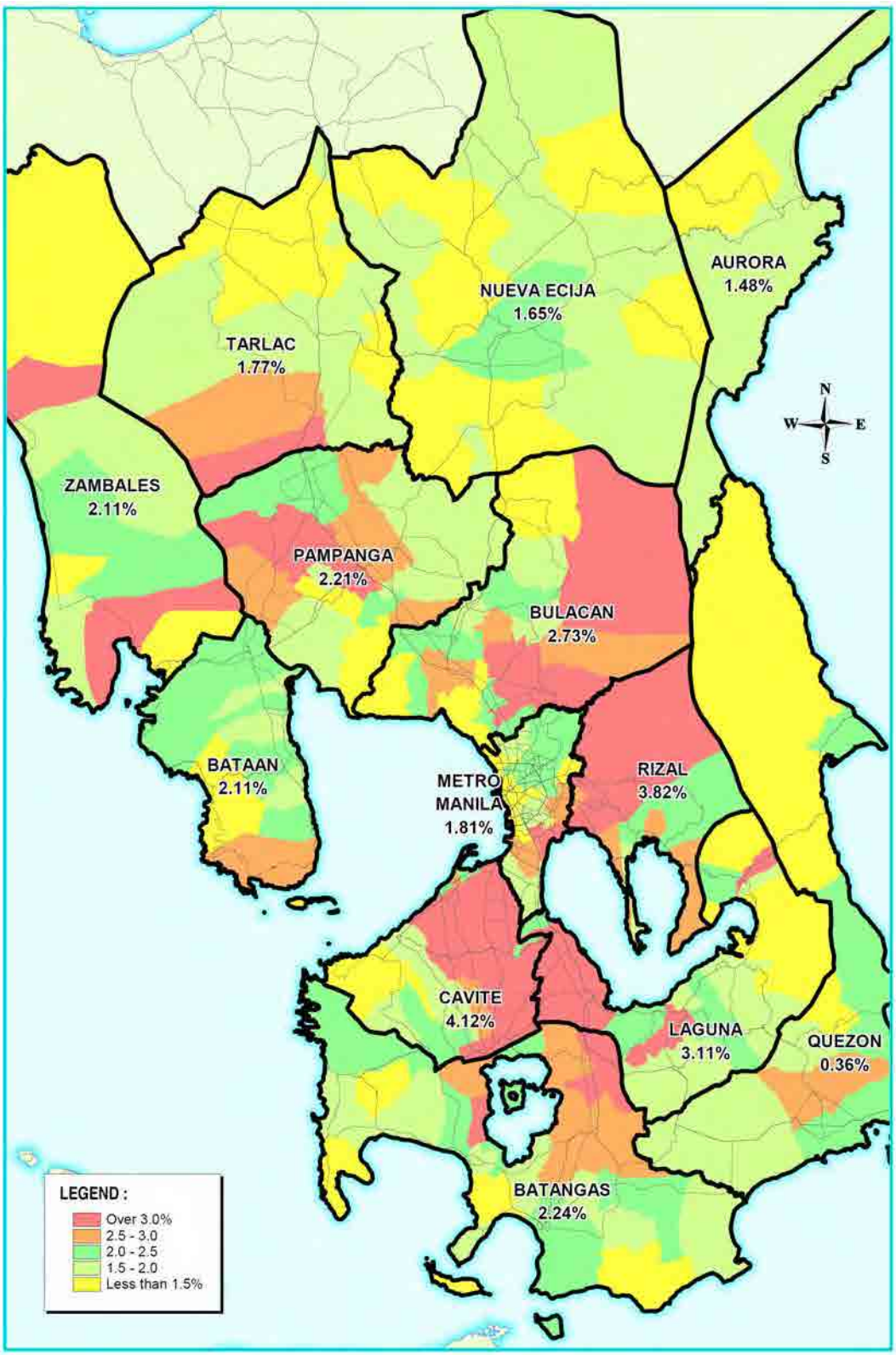
Source: NSO 2012

FIGURE 2.1-2 POPULATION SHARE



Source: NSO 2012

FIGURE 2.1-3 POPULATION DENSITY



Source: NSO 2012

FIGURE 2.1-4 AVERAGE POPULATION GROWTH RATE (YEARS 2000-2010)

(2) Economic Trend

NCR

- NCR produces about 36% of the country's economic output.
- NCR's economic growth rate is almost the same as that of the country. Economic growth rate ranged from 3.5 to 7.6%.
- Industrial structure of NCR is as follows:

  Primary Sector ---------- 0%
  Secondary Sector ---------- 34%
  Tertiary Sector ---------- 66%
- The country's economy is highly depending upon the economic performance of NCR where economic activities are highly concentrating.

Region III

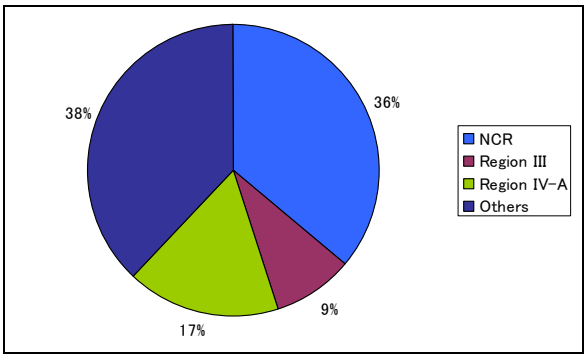
- Region III shares about 9% of the country's economic output.
- Region III's economic growth is higher than that of the country, ranging 7.5% to 10.7%.
- Region III's industrial structure is as follows;

  Primary Sector ---------- 24%
  Secondary Sector ---------- 36%
  Tertiary Sector ---------- 40%
- Since Region III is located close to Metro Manila and has the high potential areas of Subic and Clark, it is expected that the Region will achieve an economic growth rate higher than that of the country.

Region IV-A

- Region IV-A produces about 17% of the country's economic output.
- Industrial share of the Region is as follows;

  Primary Sector ---------- 18%
  Secondary Sector ---------- 40%
  Tertiary Sector ---------- 42%



Source: National Statistical Coordination Board (NSCB)

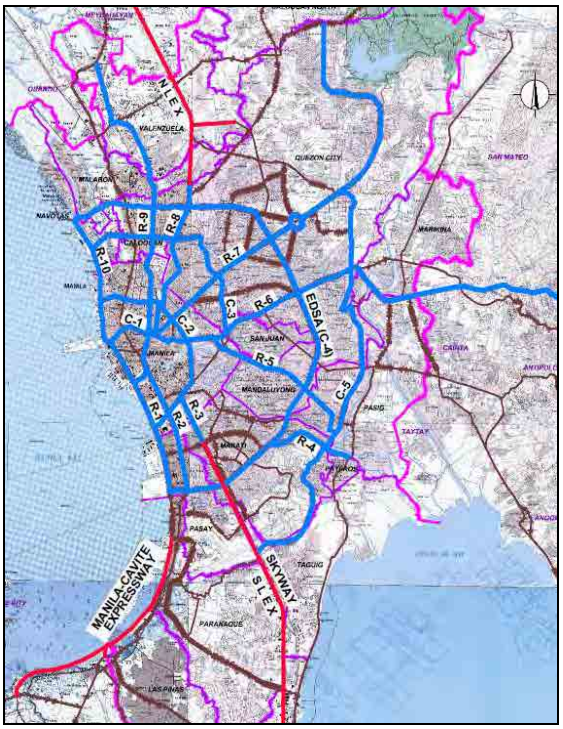
FIGURE 2.1-5 SHARE OF GDP (2011)

3. TRANSPORT NETWORK AND TRAFFIC CONDITIONS

3.1. ROAD TRANSPORT IN METRO MANILA

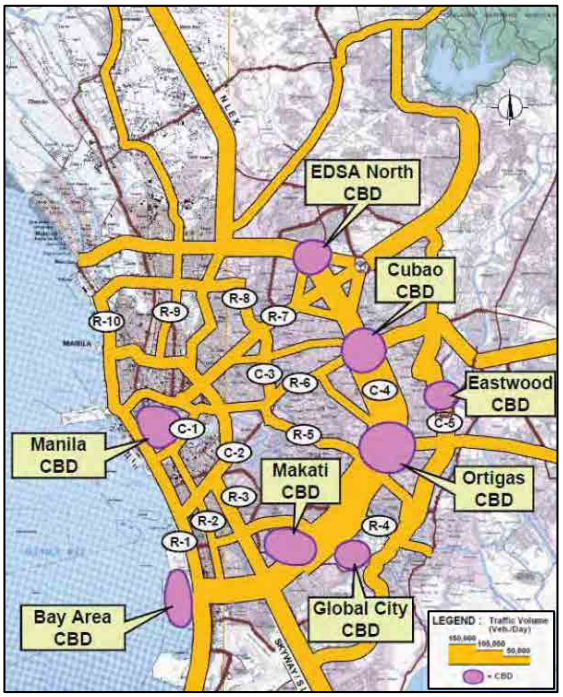
3.1.1 Road Network

The transport network in Metro Manila is formed by roads and railways. The road network consists mainly of five (5) circumferential roads and ten (10) radial roads that are connected to the Central Business District (hereafter called CBD), commercial and residential areas. The road network is shown in **Figure 3.1-1**. There are three expressways, namely, NLEX, Skyway and SLEX, which connect Metro Manila with Region III and Region IV-A. The CBD is the commercial and geographic heart of a city which is concentrated along EDSA. Especially, the Makati CBD and the Ortigas CBD along EDSA are major economic centers in Metro Manila. Therefore, heavy traffic congestion is occurring during weekday along EDSA as shown in **Figure 3.1-2**. The Global City CBD has recently been developing rapidly; traffic volume along C-5 will tremendously increase in the near future.



Source: JICA Study Team

FIGURE 3.1-1 ROAD NETWORK OF METRO MANILA



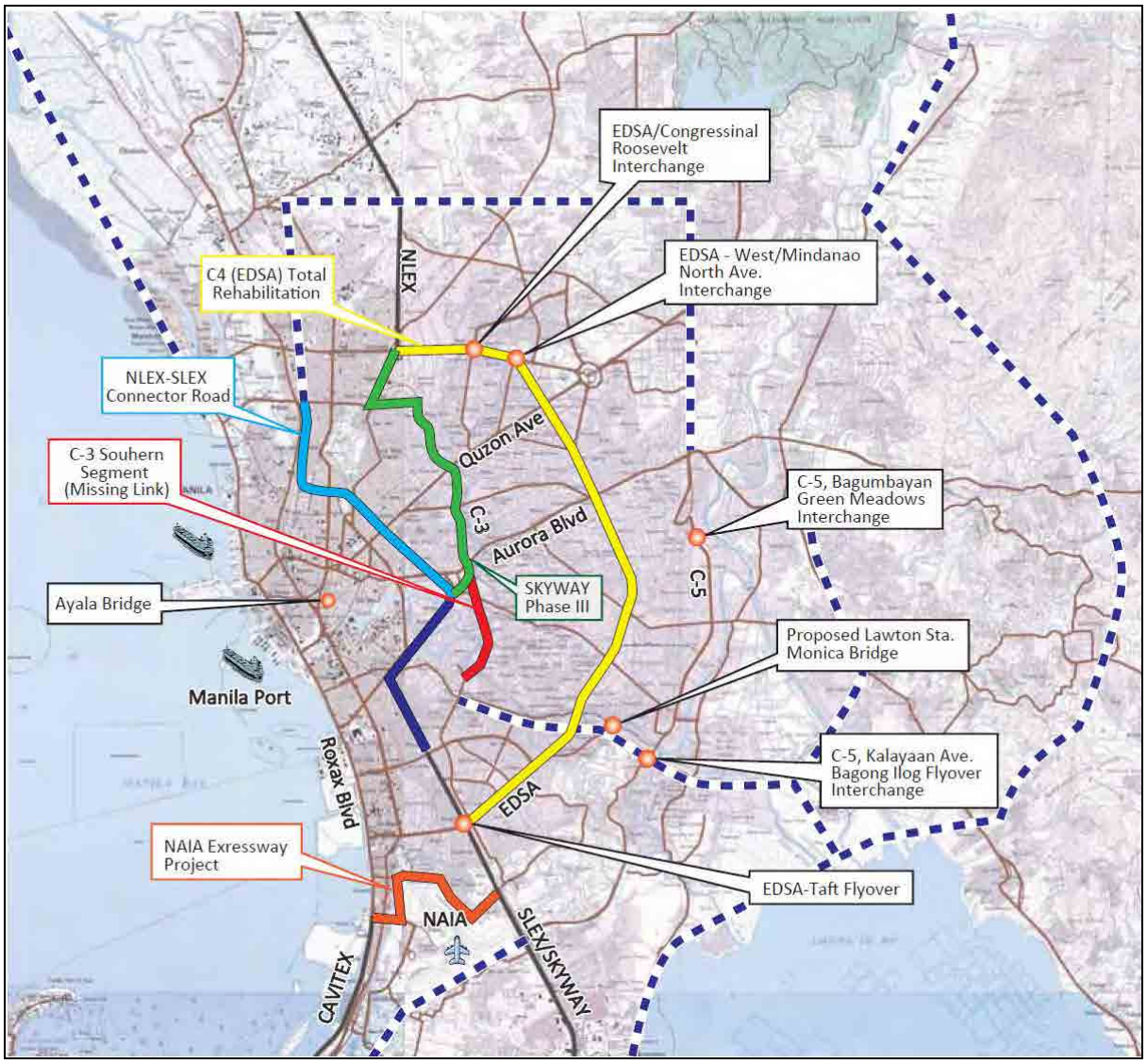
Source: JICA Study Team

FIGURE 3.1-2 CBDS AND ROAD NETWORK

3.1.2 Road Projects

Major road projects in Metro Manila planned by DPWH are shown in **Figure 3.1-3**.

These projects include 3 expressway projects, 5 interchange/flyover projects, 2 bridge projects, and 1 rehabilitation project.

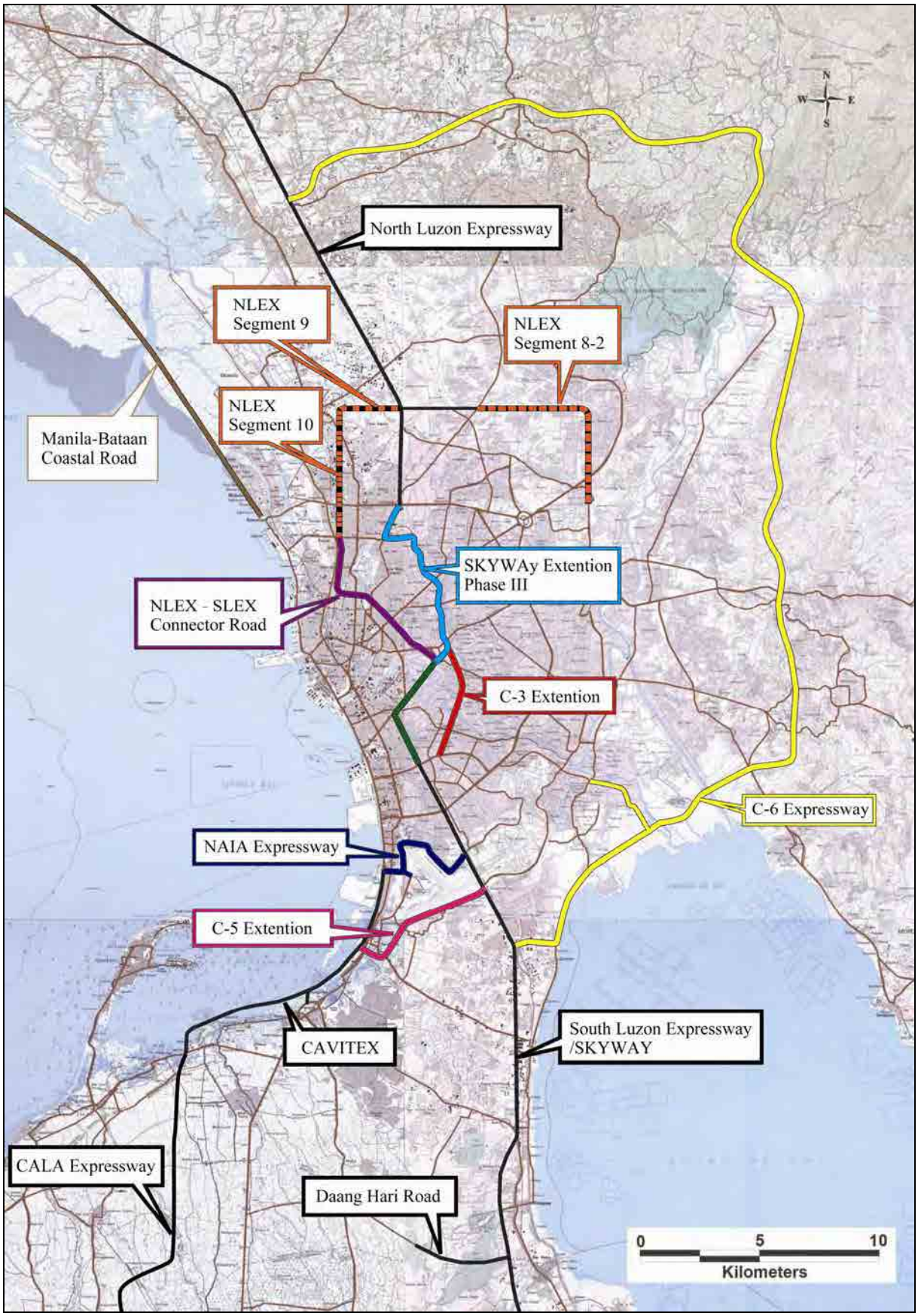


Source: DPWH Strategic infrastructure policies and program in 2012

FIGURE 3.1-3 OCATION OF ROAD PROJECTS IN METRO MANILA

3.1.3 Future Road Network

The future road network is shown in **Figure 3.1-4**. This network is based on the "Master Plan on High Standard Highway Network Development in the Republic of the Philippines, JICA (2010)", which will be constructed until 2030.



Source: DPWH Strategic infrastructure policies and program in 2012, HSH by 2009

FIGURE 3.1-4 UTURE ROAD NETWORK IN METRO MANILA

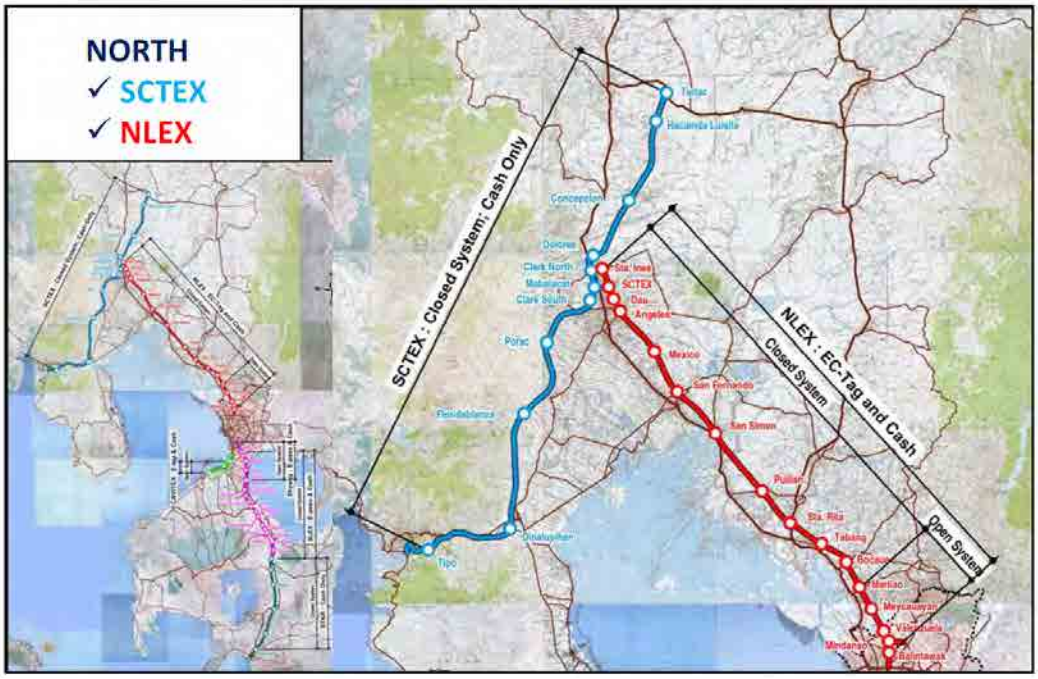
3.2. ROAD TRANSPORT IN MEGA MANILA

Figure 3.2-1 shows the expressway network in Region III , which consist of two expressways at present.

- NLEX
- SCTEX

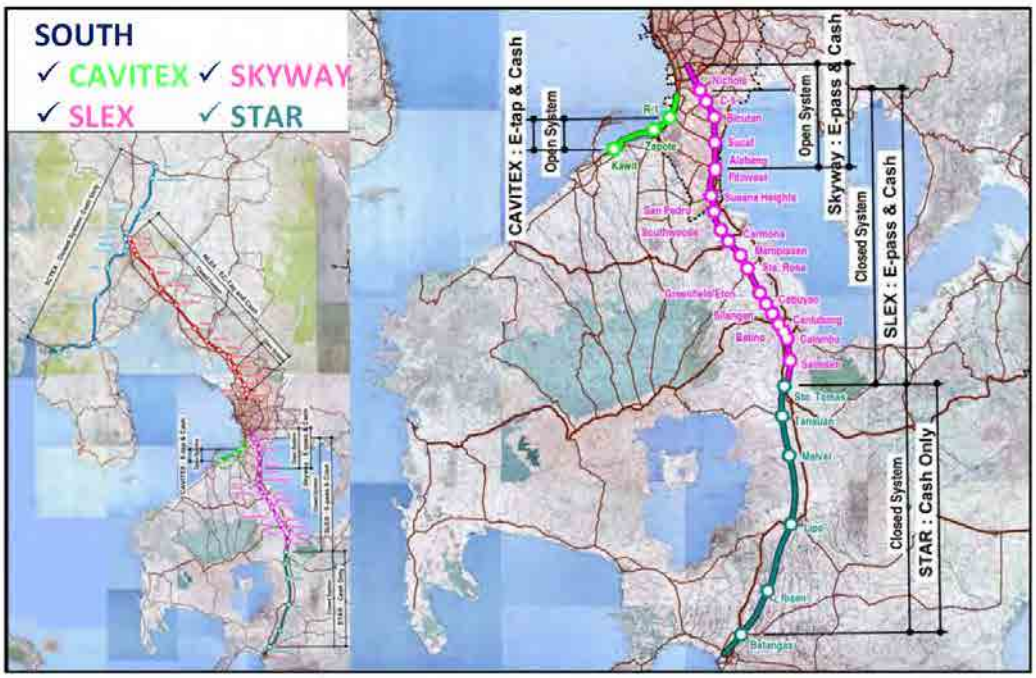
Figure 3.2-2 shows the Expressway network in Region IV-A, which is formed by four expressways.

- CAVITEX
- SKYWAY
- SLEX
- STAR



Source: JICA Study Team

FIGURE 3.2-1 EXPRESSWAY NETWORK IN REGION III



Source: JICA Study Team

FIGURE 3.2-2 EXPRESS NETWORK IN REGION IV-A

3.2.1 Road Projects

The major road projects in Region III and Region IV-A as planned by DPWH are shown in **Table 3.2-1**. These projects include construction and rehabilitation works on four (4) expressway projects, one (1) bypass project, two (2) road improvement and management projects, and two (2) road upgrading projects. Still many other projects are to be done.

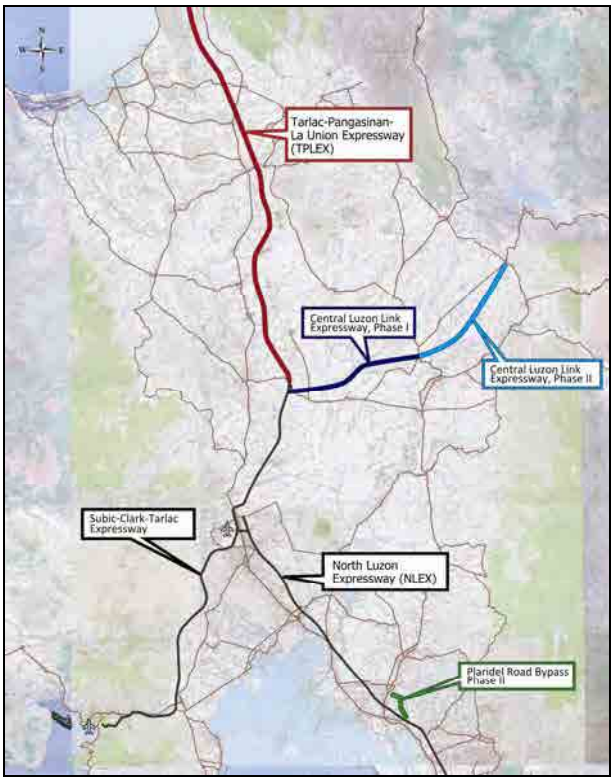
TABLE 3.2-1 ROAD PROJECTS IN METRO MANILA

Road Project		Description
Expressway	Central Luzon Expressway Phase I	Construction of a 4-Lane expressway to decongest traffic at Daang Maharlika
	Central Luzon Expressway Phase II	The project is an extension of CLEx Phase I and will connect Cabanatuan City to San Jose City in Nueva Ecija Province. It will also provide faster and safer access to Region II.
	CALA Expressway (Cavite Section)	Construction of a 4-Lane to 6-Lane expressway with a total length of 28.2 km.
	CALA Expressway (Laguna Section)	Construction of a 4-Lane expressway with a total length of 18.8 km.
Bypass project	Plaridel Road Bypass Phase II	Completion of project: December 2016
Improvement and management	Road Upgrading and Preservation Project (RUPP) - Region III -	This road upgrading and preservation will be conducted from Bazal to Canili and from Pantabangan to Talavera on Pan Philippine Highway. Total length 98.9 km.
	Road Upgrading and Preservation Project (RUPP) - Region IV-A -	This road upgrading and preservation will be conducted from Lipa to Tiaong on Pan Philippine Highway. Total length 37.1 km.
Road upgrading	National Roads Improvement and Management Program (NRIMP), Phase II - Region III -	National roads improvement and management program will be conducted from Baguio to Metro Manila on Manila North Road.
	National Roads Improvement and Management Program (NRIMP), Phase II - Region IV-A -	National roads improvement and management program will be conducted from Tiaong to Pagsanjan and Calauag on Pan Philippine Highway.

Source: DPWH Strategic infrastructure policies and program

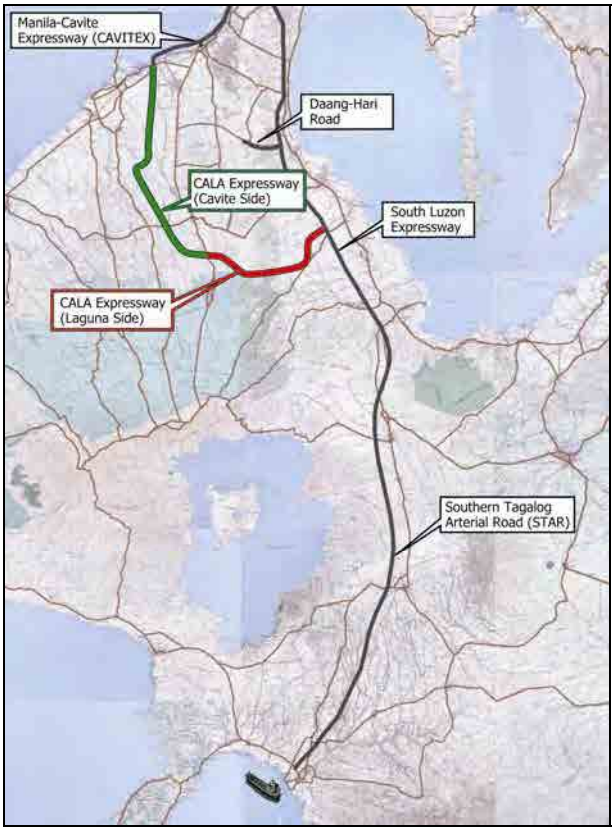
3.2.2 Future Road Network

The future road network is shown in **Figure 3.2-3** and **Figure 3.2-4**. This network is based on the "Master Plan on High Standard Highway Network Development Project in the Republic of the Philippines, JICA (2010)", which will be implemented until 2030.



Source: DPWH Strategic infrastructure policies and program in 2012, HSH by 2009

FIGURE 3.2-3 FUTURE ROAD NETWORK IN REGION III



Source: DPWH Strategic infrastructure policies and program in 2012, HSH by 2009

FIGURE 3.2-4 FUTURE ROAD NETWORK IN REGION IV-A

4. CURRENT ITS APPLICATION

4.1. DPWH

DPWH is responsible for traffic systems on national roads outside of Metro Manila.

- Traffic Counter
- Traffic Signal
- CCTV
- Overload Measurement
- Etc.

4.1.1 Traffic Counters

DPWH operates a total of 2,849 traffic survey stations nationwide, as shown in **Table 4.1-1**.

TABLE 4.1-1 NUMBER OF TRAFFIC SURVEY POINTS

Type of Survey Point	Number of Stations
Automated Count Point	1,350
In-ground sensor (Permanent Stations)	**578**
On-ground sensor (Temporary Stations)	772
Manual Count Point	1,499
	2,849

Source: DPWH

4.1.2 Traffic Signal

There is a total of 66 intersections in Manila North Road (MNR), 53 of which are signalized. However, all signals are not monitored by DPWH in real time. According to the Technical Specification for Microprocessor Traffic Signal Controller for Use in the Philippines which is issued by Traffic Engineering and Management (TEAM)-DPWH, there are three modes of signals: Isolated mode, Cable-link mode and ATC mode. The 53 signals are of the isolated mode only.

4.1.3 CCTV

There is no CCTV monitoring system under the control of DPWH. However, there is a future DPWH plan for CCTV as discussed in the next paragraph.

TABLE 4.1-2 LIST OF PROPOSED LOCATIONS FOR CCTV MONITORING

Name of Intersection	LGU
1. MNR – METRO TOWN	Tarlac City, Tarlac
2. MNR – STA. INES	Mabalacat, Pampanga
3. MNR – GSO ROAD	San Fernando, Pampanga
4. MNR - BALAGTAS	Balagtas, Bulacan
5. MNR - PACHECO	Meycauayan, Bulacan

Source: DPWH

4.1.4 Overload Measurement

DPWH has 24 permanent stations that measure vehicle overload nationwide of these, 8 stations have been decommissioned, and 2 stations are not working.

TABLE 4.1-3 LIST OF NUMBER OF OVERLOAD MEASURE STATIONS

Type of overload sensor	Number of stations
Weighbridge (Existing)	3
Weighbridge (Proposed)	1
Axle load	12
Total	16

Source: DPWH

4.2. TOLL EXPRESSWAY OPERATORS

(1) Present Situation of Toll Collection of Expressways

Two different types of ETC systems are in operation in the three toll expressways in Mega Manila. One is called as EC-tag/Easy-trip pass which was introduced in NLEX. The other is called E-Pass which was introduced in

SKYWAY and SLEX. These two systems are incompatible with each other. Therefore, road users must have two types of on-board units in their vehicles when they use the two expressways.

At present, E-tap is introduced in CAVITEX. E-tap is a touch-and-go IC Card used at toll gates. As for other toll expressways, toll collection is done on cash basis. **Table 4.2-1** shows the toll collection type of each expressway.

TABLE 4.2-1 RESENT TOLL COLLECTION TYPE

Area	Exp.	Length (km)	O&M co.	Toll Structure	Toll Collection Type
North	NLEX	82.6	MNTC	Closed System (partially open)	Cash Easy-trip (DSRC Passive) Magnetic Card
	SCTEX	93.8	BCDA(MNTC O&M)	Closed System	Cash only
South	SKYWAY (elevated)	16.2	CITRA/ San Miguel Corp.	Closed System	Cash E-pass (DSRC Passive)
	SLEX(at grade)	13.4			
	SLEX	37.2	San Miguel Corp.	Closed System	Cash E-pass (DSRC Passive)
	CAVITEX	18.0	PEA tollway Corp.	Open System	Cash E-tap (Touch and Go)
	STAR	41.9	San Miguel Corp.	Closed System	Cash only

Source: JICA Study Team

Source: JICA Study Team

FIGURE 4.2-1 ETC OBU AND IC CARD

(2) Present Status of Traffic Control Center the Expressway

At present, three expressways have installed traffic control centers shown in **Table 4.2-2**.

TABLE 4.2-2 RESENT TRAFFIC CONTROL SYSTEM FOR EXPRESSWAY

	NLEX	SCTEX	SKYWAY/ SLEX	SLEX	STAR	Cavitex
Traffic control center	+	Not yet	+	+	Not yet	Not yet
Traffic between IC	Loop coil	Only toll gate data	CCTV, motion detector (10)	Only toll gate data	Only toll gate data	Only toll gate data
Traffic congestion	Monitoring by CCTV (63), travel speed	Patrol car	Monitoring by CCTV (48)	Monitoring by CCTV (39)	Patrol car	Patrol car
Travel speed	Measure for each lane	Not yet	motion detector	Not yet	Not yet	Not yet
Accident, incident	CCTV, Emergency phone, Cell phone, or Patrol car	Cell phone, or Patrol car	CCTV, Cell phone, or Patrol car	CCTV, Cell phone, or Patrol car	Cell phone, or Patrol car	Cell phone, or Patrol car
Variable Message Sign	+ (31)	Not yet	+	+ (2)	Not yet	Not yet
Traffic information provision	Not yet	Not yet	Website, smartphone with MMDA	Not yet	Not yet	Not yet
Overweigh	Weigh in bridge (4)	Not yet	Weigh in bridge (1)	Weigh in bridge (mobile 1)	Not yet	Not yet

Source: JICA Study Team

4.3. MMDA

The Metropolitan Manila Development Authority (MMDA) is responsible for the formulation of cross-sectional development plans, road traffic management and formulation/implementation of measures against disasters in the Metro Manila region comprising one municipality and 16 cities.

4.3.1 Present Status and Future Vision Concerning ITS

Urban highways in Metro Manila are controlled through the Traffic Engineering Center (TEC) managed by MMDA. TEC consists of the Traffic Signal Control Department and of the Information Provision Department. By utilization of CCTV, TEC is operated for 24 hours a day and 365 days a year. The following description is about traffic signal control and CCTV monitoring:

(1) Present Situation of Traffic Signal Control and Vehicle Detector

As for traffic signal control, Japanese systems ("National" products) were adopted in the past. However, the system was replaced by an Australian system called Sydney Coordinated Adaptive Traffic System (SCATS) 13 years ago. SCATS is now still in the operation. However, since the spare parts now are not produced any more, procurement of spare parts is quite difficult.

Most of the traffic signal control systems adopt loop-coil type vehicle detectors, which are embedded under ground. There are3,130 vehicle detectors. Of these, however, 1,588 detectors are in operation, while the remaining 1,542 detectors are broken down. Out of a total of 455 intersections, 388 are controlled by traffic signal control systems.

TABLE 4.3-1 NUMBER OF INTERSECTIONS, TRAFFIC SIGNAL CONTROL SYSTEMS AND VEHICLE DETECTORS

Breakdown	Region 1	Region 2	Region 3	Region 4	Total
Number of total intersections	112	113	110	110	445
Number of controlled intersections	(90)	(103)	(100)	(95)	(388)
Number of traffic signal control systems	108	104	104	101	417
Number of vehicle detectors	805	860	603	862	3,130

Source: JICA Study Team

(2) CCTV camera

MMDA has installed about 130 CCTV cameras, and the image data is transmitted by WiMAX lines owned by MMDA.

Source: JICA Study Team

FIGURE 4.3-1 USE OF CCTV

Traffic Navigator

MMDA operates Traffic Navigator, a web-based information provision system. On the MMDA official website, there is a link to Traffic Navigator, which is available not only on PCs but also on smart phones.

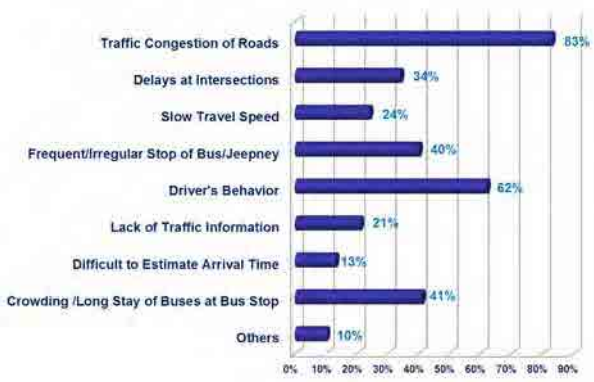
Source: http://www.mmda.gov.ph/

FIGURE 4.3-2 INFORMATION ON TRAFFIC NAVIGATOR FOR SMART PHONES

5. ITS NEEDS SURVEY RESULTS

5.1. TRAFFIC PROBLEMS OF URBAN ROADS:

Major traffic problems of urban roads are "Traffic Congestion of Roads", "Driver's Behavior" and "Crowding/Long Stay of Buses at Bus Stop".

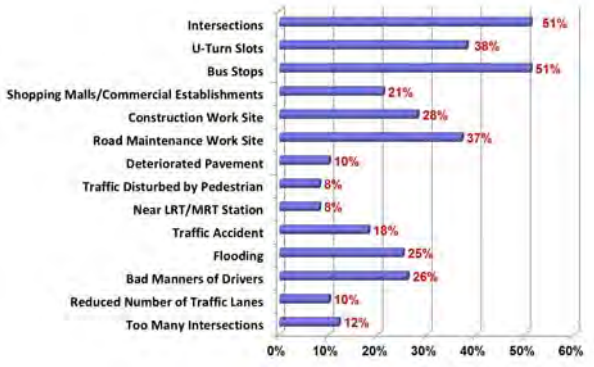


Source JICA Study Team

FIGURE 5.1-1 TRAFFIC PROBLEM EXPERIENCED IN METRO MANILA

5.2. TRAFFIC BOTTLENECKS OF URBAN ROADS

As perceived by the respondents, the major bottlenecks in Metro Manila are "Intersections", "Bus Stops", "U-Turn Slots", and "Road Maintenance Work Site".

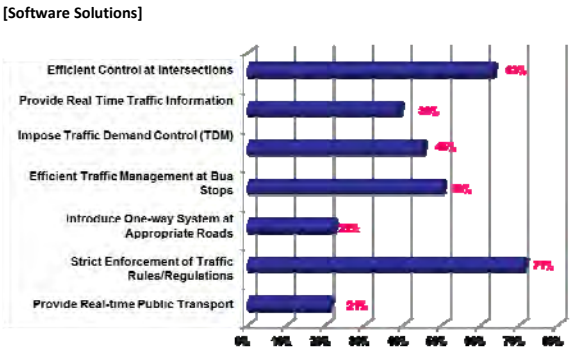


Source JICA Study Team

FIGURE 5.2-1 MAJOR BOTTLENECK IN METRO MANILA

5.3. ROAD USERS OPINIONS FOR POSSIBLE SOLUTIONS

Respondents suggest, as major software solutions, "Strict Enforcement of Traffic Rules/Regulations", "Efficient Control at Intersections" and "Efficient Traffic Management at Bus Stops".



Source JICA Study Team

※ Road Users Interview (2,989 samples)

FIGURE 5.3-1 SUGGESTIONS FOR SOFTWARE SOLUTIONS TO METRO MANILA'S TRAFFIC PROBLEM

5.4. TRAFFIC PROBLEMS OF EXPRESSWAYS AND POSSIBLE SOLUTIONS

- Major Traffic problems of expressways are "Traffic Congestion During Peak Hours", "Traffic Congestion Near interchange" and "Fatal Traffic Accidents".
- "Toll Gate Areas Congested" was only 21%.

Source JICA Study Team

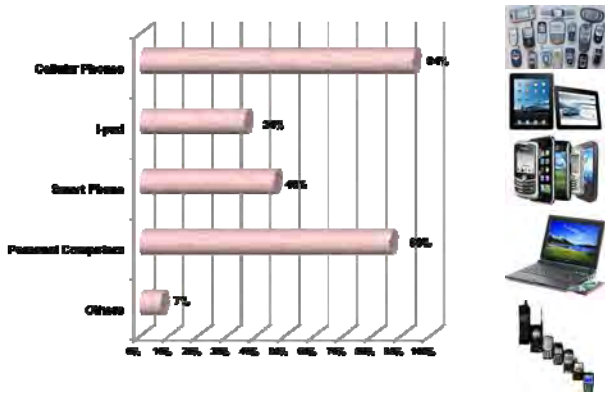
※ Road Users Interview (1,022 samples)

FIGURE 5.4-1 TRAFFIC PROBLEMS EXPERIENCED IN EXPRESSWAYS

5.5. ITS APPLICATION ENVIRONMENT

(1) Communication Tool Penetration Rate (Car Users)

Forty six (46)% of car users already has Smart Phone (iphone, android, blackberry and so on). This user rate will increase in the future.



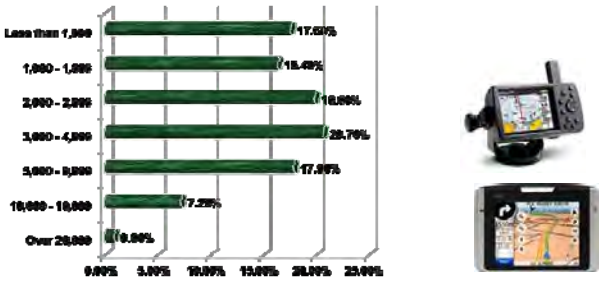
Source JICA Study Team
※ Road Users Interview Survey (2,159 samples)

FIGURE 5.5-1 CURRENT PENETRATION RATES OF COMMUNICATION TOOLS

(2) Car Navigation Utilization

Though willingness to purchase for car navigation is quite high (61%), most respondents do not want to buy an expensive one (less than 5,000 pesos).

- Do you install a car navigation instruments? (1,990 samples)
  → Yes : 22%
- Do you want to install a car navigation? (1,562 samples)
  → Yes : 61%
- How much are you willing to pay for a car navigation? (1,034 samples)



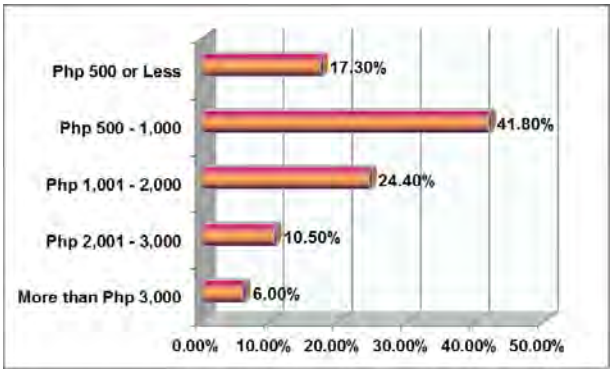
Source JICA Study Team

FIGURE 5.5-2 WILLINGNESS TO PAY FOR A CAR NAVIGATION

(3) ETC Utilization

Willingness to purchase an ETC On-Board Unit is high (61%) if a common ETC system will be established. Most respondents are willing to buy an ETC OBU if the cost is less than Php 1,000, which is the half price of current ETC OBU.

- Current ETC users: 35% (1,022 samples)
- If common ETC system will be established, will you use ETC? (1,002 samples)
  Yes: 61% No: 32% No Answer: 14%
- How much are you willing to pay for ETC on-board unit? (345 samples)



Source JICA Study Team

FIGURE 5.5-3 WILLINGNESS TO PAY FOR ETC OBU

6. IDENTIFICATION OF TRANSPORT PROBLEMS/ISSUES

A summary of transport problems/issues in Metro Manila and Mega Manila Region excluding Metro Manila is shown in **Table 6-1** and **Table 6-2**.

TABLE 6-1 SUMMARY OF TRANSPORT PROBLEMS/ISSUES: METRO MANILA

	Problems/Issues	Current Countermeasures	Possible Additional Countermeasures
Urban Structure	– **Concentration of Central Business Districts (CBDs) along EDSA and C-5 corridors.** – **CBDs are ever growing and becoming huge traffic generation/attraction centers.** – **Slow development of transport facility expansion.**	– **Existing road ROW has been already used for travel ways and no more room for widening.** – **Vertical utilization (i.e. flyovers, elevated expressways, etc.) of existing ROW is being implemented.** – **TDM measures (regulation of car usage, truck ban, regulation of jeepneys entering into major roads) are being implemented.**	– **The Government needs to continuously implement transport facilities expansion projects (physical measures).** – **At the same time, the Government needs to take all kinds of measures to fully utilize the existing transport facilities by adopting software measures.**
Road Transport: Urban Roads	– **Traffic congestion of roads and low travel speed (lack of traffic capacity of roads).**	– **Existing road ROW has been already used for travel ways and no more room for widening.** – **MMDA provides to road users traffic congestion status through internet, smart phone, etc. (MMDA/TV5 Traffic Navigator).** – **Construction of NLEX-SLEX Connector and Skyway Stage 3, and planning of Missing C-3 and C-6 to relieve congestion on main routes.**	– **All kinds of efforts need to be done for full utilization of all existing roads.** – **Provide real-time traffic information in order to guide drivers to less congested routes.** – **MMDA/TV5 Traffic Navigator needs to be up-graded by covering more roads, improving accuracy, etc.**
	– **Delay at intersections.** – Traffic signal controlled intersections **Operational:** 374 intersections (86%) **In-operational:** 62 intersections (14%) **Total:** 436 intersections (100%) – Loop coil traffic detectors: 1,542 detectors (49%) out of 3,130 are not functioning. – Spare parts are no longer available. – Traffic signal phasing is not based on traffic demand, but is based on pre-determined phasing.	– **MMDA entered into a contract for the provision of advanced traffic signal control for 85 intersections.**	– **Remaining 351 traffic signals need to be upgraded.** – **Other intersections need to be identified for traffic signal control.**
		– **DPWH is planning to construct flyovers/grade separation at critical intersections.**	– **Additional flyovers/grade separations need to be implemented with due consideration of future transport projects.**
	– **Traffic congestions at bus stops.** – Long stay of buses at bus stops – Long queue at bus stops – Double or triple parking at bus stops blocking other vehicles	– **Enforcement of rules and regulations by traffic enforcers.**	– **MMDA will start "Bus Management System" in 2013.**
	– **Road Crashes.** – Average 33 road crashes per day on only 7 major roads in Metro Manila. – Road Crashes also cause traffic congestion.	– **Enforcement of rules and regulations by traffic enforcers.**	– **Drivers' education.** – **More strict traffic enforcement.** – **Review of drivers' licensing system.** – **Monitoring/surveillance by CCTV, etc.** – **Quick response system to Road Crashes to be employed.**
	– **Bad driving manners of drivers.** – Blocking traffic flow – Causing Road Crashes – Traffic mess at non-signalized intersections, U-turns, and round-abouts. – **Weak traffic enforcement.** – Laxity and discretion in detecting and penalizing violations – Kotong and other corrupt practices	– **Enforcement of rules and regulations by traffic enforcers.**	– **Drivers' education.** – **Intensive training (including moral reformation) and higher compensation of enforcers to professionalize them.** – **Stricter and more aggressive traffic enforcement.** – **Monitoring/surveillance by CCTV, etc. of traffic conditions and enforcement** – **Review of drivers' licensing system.** – **Review of penalty/fines for violation of traffic rules.**
	– **Temporary traffic bottlenecks.** – Construction work sites – Road maintenance work sites – Road Crashes – Flooding – Road diggings for underground public utilities.	– **MMDA is providing most of the information to the public.**	– **Present information provision system to be upgraded including information on possible detour routes.**
	– **Slow travel speed due to bad pavement condition, particularly along heavy truck traffic routes.** – Overloaded trucks controlled by portable weighing equipment **DPWH:** weighing **Police :** Stop trucks **LTO :** Apprehension	– **Manual weighing by portable weighing equipment.** – **Major rehabilitation of EDSA and other main roads.**	– **Installation of Weigh-in-motion equipment and stricter anti-overloading enforcement system.** – **Outsourcing of weighbridge installation and operation.** – **Intensive and sustained preventive maintenance of major roads.** – **Close monitoring of road conditions including roughness index.**
	– **Transport Demand Management (TDM).** – Color coding – Truck ban – Bus priority lane	– **Degree of enforcement depends on City Government (some are strict while some are not).**	– **Road pricing may be necessary in the future.**
	– **Aggravation of environment due to traffic congestion.**	– **Flyover or underpass construction.** – **Elevated expressway construction.**	– **Introduction of ITS measures to achieve smooth travel.**
	– **Low ranking of the global competitiveness due to inefficient transport system.**	– **Transport facility development** – **Traffic information provision.**	– **Provision of efficient transport system for smooth travel flow.**
	– **Frustrating travel due to unpredictable arrival time to the destination.**	– **Traffic information provision.**	– **Upgrading traffic information provision system including route guidance.**
	– **Traffic is paralyzed by natural disasters, particularly by frequent floods.**	– **Events information provision system.**	– **Upgrading events information provision system with route guidance.**
Bus Transport	– **Illegal bus operations.** – Trip cutting – Operation at the route with no franchise (out of franchised route) – Operation of buses without franchise (colorum buses)	– **LTO/LTFRB/MMDA drive to apprehend drivers and operators of colorum and out-of-line buses.**	– **MMDA will start "Bus Management System" in 2013.** – **On-line linkages of LTO, LTFRB, and MMDA databases to prevent and detect illegal bus operations.**
	– **Many bus terminals of both city buses and provincial buses along EDSA. In-and-out-buses to bus terminals disturbing traffic flow.**	– **The Government is planning to establish the Integrated Terminal System Projects, thereby prohibiting provincial buses to come in Metro Manila.**	– **Efficient operation system of integrated terminals.**
	– **Too many buses on high-passenger demand routes like EDSA.**	– **LTFRB is reviewing franchise allocation to each bus route.**	– **Combine LTFRB and LTO databases.** – **Develop monitoring and enforcement system.**
Rail Transport	– **There are 3 rail lines.** – **LRT-1 and LRT-2 are adopting same (or interoperable) ticket system but not MRT-3.**	– **Common ticketing system is being studied.**	

Source: JICA Study Team

TABLE 6-2 SUMMARY OF TRANSPORT PROBLEMS/ISSUES: MEGA MANILA REGION OUTSIDE METRO MANILA

	Problems/Issues	Current Countermeasures	Possible Additional Countermeasures
Urban Structure	– Urbanization is rapidly progressing in Metro Manila periphery (provinces of Bulacan, Rizal, Cavite and Laguna) – Due to concentrated job opportunities in Metro Manila, commuting trip distances are becoming longer and longer.	– Widening of existing expressways completed. – Construction \of new expressways to cater to growing traffic by PPP instead of constructing ordinary national roads. – LRT Line-1 south extension, LRT Line 2 extension, and MRT-7 are planned and implemented soon.	– Efficient bus transport system – Improvement of MRT-3 capacity – Common ticketing system for rail lines.
	– Regional cities are growing rapidly (Clark, Subic, Tarlac, Cabanatuan, San Fernando, etc. in the north and Dasmariñas, Carmona, Sta. Rosa, Calamba, Sto. Tomas, Lipa, Batangas, etc., in the south of Metro Manila. – Remaining areas are still rural in nature.	– Widening of existing expressways completed – Construction of new expressways to link Metro Manila and regional cities. – Construction of bypasses along major national road corridors is planned.	– Expressways proposed in the Master Plan should be realized.
Road Transport: Major National Road Corridors	– Traffic congestion of national roads within urban areas.	– Plaridel Bypass is being implemented.. – DPWH is planning to install five (5) CCTV at major intersections along Manila North Road and monitoring center.	– Expressways proposed in the Master Plan should be realized. – Install traffic control center, new traffic signals with traffic detectors, CCTV for urban roads sections of major national road corridors.
	– Delays at intersections	– Traffic signal control along Manila North Road.	– Installation of advanced traffic signal control.
	– Road Crashes	– Enforcement of rules and regulations by traffic enforcers.	– Driver's education – More strict traffic enforcement – Review of driver's licensing system
	– Bad driving manners of drivers	– Enforcement of rules and regulations by traffic enforcers.	– Drivers' education – More strict traffic enforcement – Monitoring/surveillance by CCTV, etc. – Review of drivers' licensing system. – Review of penalty/fines for violation of traffic rules.
	– Slow travel speed due to bad pavement condition. – Overloaded truck controlled by weighing equipment at weigh bridges. DPWH: Weighing Police: Stop Trucks LTO: Apprehension	– Manual weighing by portable weighing equipment	– Installation of weigh-in-motion equipment and stricter anti-overloading enforcement system.
	– Frustrating travel due to unpredictable arrival time to the destination		– Traffic information provision system including route guidance to be developed.
	– Traffic is paralyzed by natural disasters, particularly by frequent floods.		– Flood Events Information Provision System to be developed.
Bus Transport	– Illegal bus operations – Operation at routes with no franchise – Operation of buses without franchise (Colorum buses)		– Bus Monitoring and Control System to be developed.
Toll Expressway Transport	– Traffic congestion at toll booths – ETC utilization rate is only 20%. – Two incompatible ETC systems (Easytrip on NLEX and E-Pass on Skyway/SLEX and E-tap (A touch-and-go system) for CAVITEX)	– O & M companies are adopting their own system and no common standards are adopted.	– Introduce a common ETC system for interoperability. – Introduce a various payment system, prepaid, post-paid or debit card, etc. with commonly applicable system to all toll expressways.
	– A few traffic information as well as different level of traffic information provided to expressway users. – Eight (8) toll expressways are operated by 6 different toll expressway operators. Toll expressway operators are adopting their own standards for traffic information collection and provision system. – No traffic information sharing among operators.	– NLEX started the provision of real time information on the website, "Niligtas" (24 Oct. 2012). – Skyway provides traffic information to MMDA, whereby road users can receive Skyway traffic congestion status through internet, smart phone, etc. (MMDA/TV5 Traffic Navigator).	– Install a standard traffic collection and provision system for all expressways. – Establish an integrated traffic information center.
	– Toll expressway users are stopped at connection point from one toll expressway to another. No interoperability operation is possible except between Skyway and SLEX. – Toll road network will be formed in 5 years, thus interoperability system covering all toll roads is urgently needed.	– Interoperability summit will be held with TRB and all expressway O&M companies before the end of year 2012.	– Establishment of Interoperability System
	– Fatal road crashes	– Automatic Vehicle Locator System (AVLS) is installed in NLEX for faster dispatch of patrol cars to the site. The present location of patrol vehicle is identified through GPS and when road crash occurs, the nearest patrol vehicle is informed of occurrence of the road crash. – Overspeeding is detected by a speed gun along NLEX. – Overspeeding is detected by the times of entry and exit of toll booths along SLEX.	– Install a fast emergency vehicle operation system for all expressways, such as AVLS. – Intensify over speeding control.
	– Premature pavement/bridges deterioration due to overloaded trucks.	– Overloaded large vehicles are detected by a measurer of weight which is installed at the toll gate of NLEX. – NLEX is installing weigh-in-motion equipment. – Portable weighing equipment is used by SLEX.	– Installation of Weigh-in-Motion equipment and stricter anti-overloading enforcement system for all expressways.

Source: JICA Study Team

7. GLOBAL TREND OF INTELLIGENT TRANSPORT SYSTEM

Global trends of ITS are summarized and details are describes Main Text (Chapter 9). Global trends are fully considered in the formulation of the Master Plan.

TABLE 7-1 SUMMARY OF GLOBAL TREND OF ITS

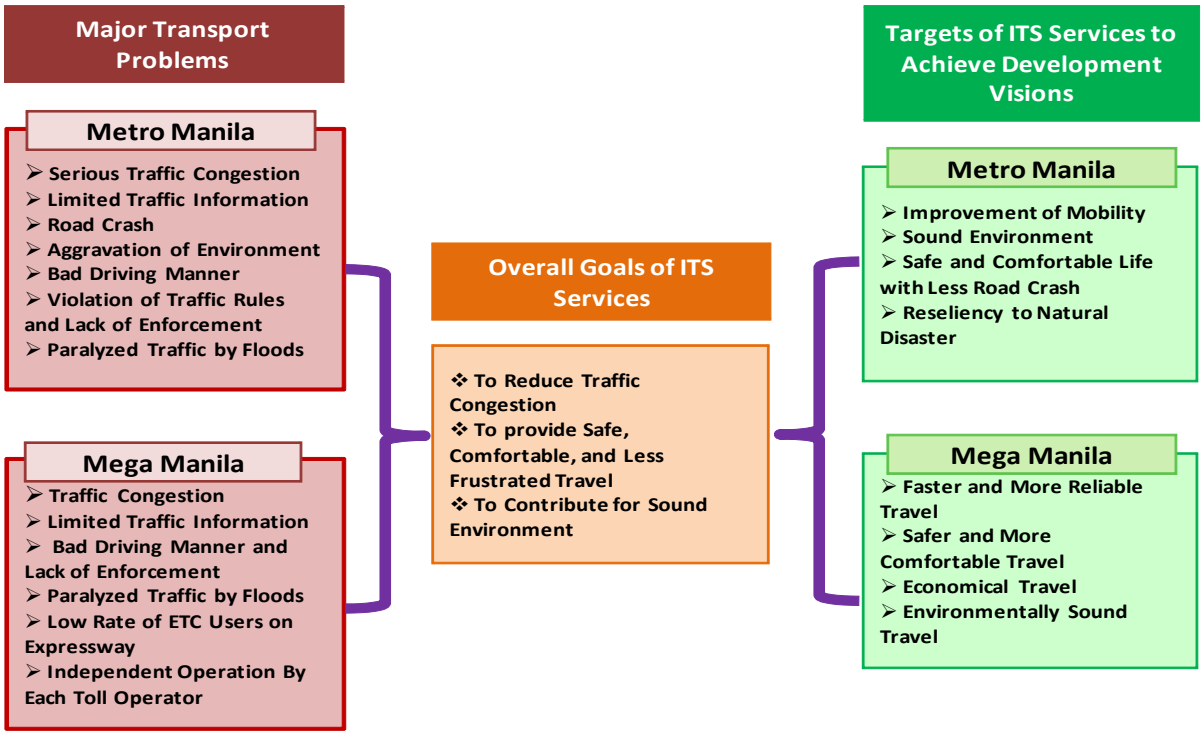
Title	Global Trend of ITS
Introduction	• Smartphone user penetration is sharply increasing • Smartphone will be actively used not only as a device to receive information but also as a device to provide traffic data to a Traffic Center.
Traffic Information Collection/ Provision	• Floating Car Data (FCD) from smartphones will be actively used as a means of traffic data sources. • Installation of roadside equipment will be minimized. • Roadside equipment will be highly functionalized.
Road Operation Management	• Various devices to collect road conditions are being developed. • Accurate information necessary for road management will be easily collected. • Utilization of such devices will achieve effective utilization of limited budget and man-power.
Transport Fare Collection	• Contactless IC Cards are being used for many areas such as rail/bus fare payment, toll payment, shopping, etc. • Mileage based tolling on public roads is being tested, which can be adapted to road pricing.
Communication Infrastructure	• Wired and wireless communication networks are being utilized depending upon respective characteristics. • Commercial based wireless communication infrastructure is actively used. • Vehicle itself will be used as a part of communication network/infrastructure.
Partnership with Private Sector for ITS Development	• Participation of the private sector in ITS development is becoming more important.

Source: JICA Study Team

8. OVERALL GOALS OF ITS SERVICES

To achieve targets for ITS services in Metro Manila and Mega Manila and to mitigate existing transport problems, overall goals of ITS services are:

- **To reduce traffic congestion**
- **To provide safe, comfortable and less frustrating travel**
- **To contribute to sound environment**



Source: JICA Study Team

8.1. STRATEGIES FOR DEVELOPMENT OF ITS SERVICES

To achieve goals of ITS service, strategies for development were established as follows:

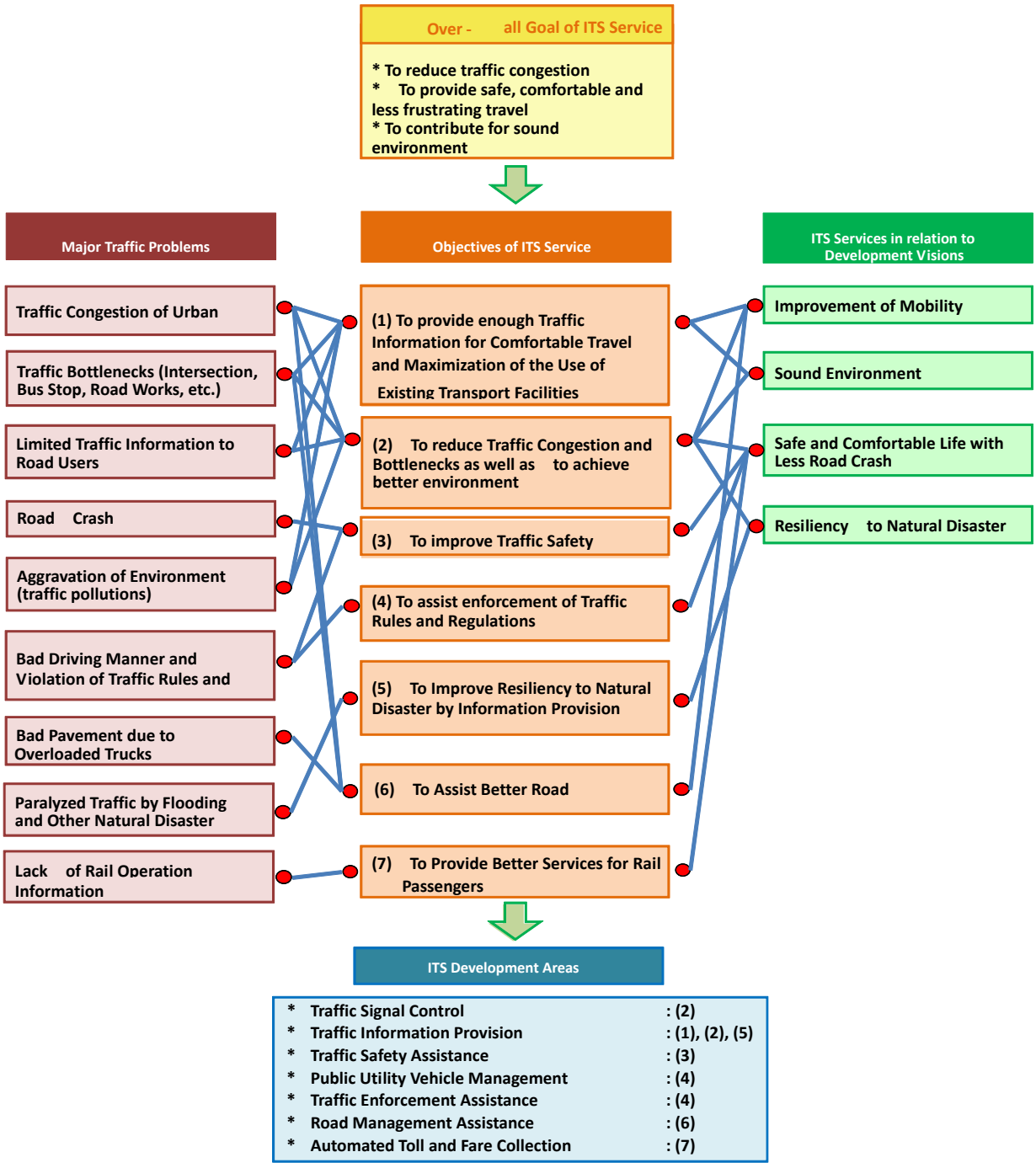
ITS DEVELOPMENT STRATEGIES

1. **Expansion of existing ITS services**
   The existing ITS Services shall be based and upgraded continuously
   E.g., Metro Manila Traffic Navigator ⇨ Automated NAV ⇨ 3rd Generation
2. **Expansion of coverage area**
   ITS Service Coverage Area shall be gradually expanded.
   E.g., Metro Manila ⇨ Metro Manila Periphery ⇨ Mega Manila ⇨ Nationwide
3. **Consideration for existing problems, visions and user needs**
   Selection of ITS Services shall fully consider existing problems, development visions and needs.
4. **Minimization of data collection cost**
   Utilization of information from road users, floating car/vehicle, etc., shall be maximized and information collection devices/tools shall be minimized.
5. **Maximization of historical data utilization**
   Utilization of historical data shall be maximized.
6. **Consideration for fast IT development**
   Information technology (IT) development is quite fast. Master Plan shall be flexible to adopt the latest feasible IT.
7. **Business Model**
   There are many fields where the private sector's initiative can be sought. The Government should advocate the private sector for active usage of ITS technologies.

9. ITS MASTER PLAN IN METROMANILA

9.1. OBJECTIVE OF ITS SERVICES

Seven objectives of ITS services to achieve development visions and to solve traffic problems were identified. The objectives of the ITS services in relation to traffic problems and targets for ITS service are illustrated in **Figure 9-1**. Seven ITS development areas were developed to achieve the objectives of ITS services.



Source: JICA Study Team

FIGURE 9-1 OBJECTIVES OF ITS SERVICES AND ITS DEVELOPMENT AREA FOR METRO MANILA

9.2. ITS DEVELOPMENT AREA AND ITS USER SERVICES

Seven (7) ITS development areas were further divided into twenty one (21) user-service for Metro Manila.

METRO MANILA

ITS Development Areas	ITS User Service
1. Traffic Signal Control	(1) **Advance Traffic Control System at Intersections** to improve traffic efficiency at intersections (2) **Emergency Vehicle Priority System** for safer lives of people
2. Traffic Information Provision	(3) **Upgrading of Traffic Information Collection and Provision System on real-time basis** for faster and comfortable travel and to maximize the use of existing road facilities (4) **Events Information Provision System** to reduce traffic congestion at and around event sites (5) **Route Guidance System to direct drivers to less congested routes** to maximize the use of existing road facilities (6) **Information Provision System for Temporary Traffic Bottlenecks** to achieve less frustrating trips and to reduce traffic congestion at temporary traffic bottlenecks (7) **Traffic Management System at Large-scale Shopping Malls** to reduce localized traffic congestion (8) **Parking Space Information Provision System** to improve traffic flow in CBDs and for better road user service (9) **Commercial Vehicles Location System** for more orderly trips of commercial vehicles
3. Traffic Safety Assistance	(10) **Danger Warning System** to reduce road crashes to improve traffic safety (11) **Pedestrian Safety Support System** to reduce road crashes (12) **Weather Condition and Prediction Information Provision System** for safer travel and to improve resiliency to natural disaster.
4. PUV Management	(13) **Bus operation Monitoring and Control System** to reduce traffic congestion at bus stops and to eliminate illegal bus operations (14) **Rail Operation Information Provision System** for better passenger services
5. Traffic Enforcement Assistance	(15) **Traffic Rules Surveillance and Control System** to achieve smooth traffic flow and to reduce road crashes (16) **On-street Parking Control** to improve traffic capacity for smoother traffic flow (17) **Over Speeding Control System** reduce road crashes (18) **Overloaded Truck Control System** to provide better surfaced roads.
6. Road Management	(19) **Upgrading of Road Condition Information Collection** to improve Road Management and to Secure Service Level
7. Toll/Fare Collection	(20) **Road Pricing System** to reduce cars on the roads for smoother traffic flow (21) **Common Ticketing System** for easier transfer.

Source: JICA Study Team

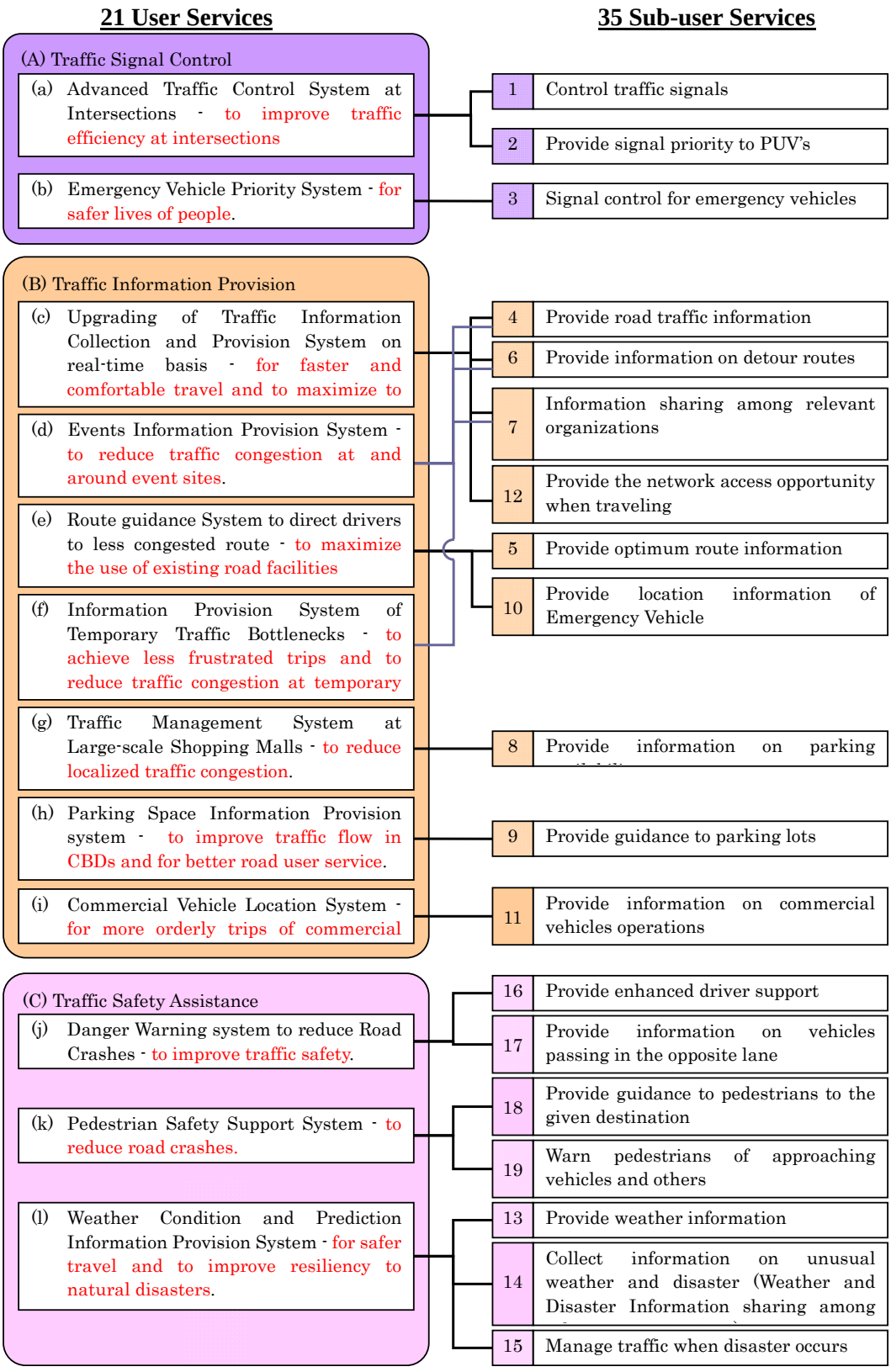
TABLE 9.2-1 BASIC ITS SERVICE FOR METRO MANILA

Major Objectives of ITS Service (7)	Sub-objectives (18)		ITS User Services (21)	Traffic Signal Control		Traffic Information Provision								Traffic Safety Assistance			PUV Management		Traffic Enforcement Assistance				Road Management	Toll/Fare Collection	
			ITS Development Areas (7)																						
				(1) Advanced Traffic Control System at Intersections to improve traffic efficiency at intersections	(2) Emergency Vehicle Priority System for safer lives of people.	(3) Upgrading of Traffic Information Collection and Provision System on real-time basis for faster and comfortable travel and to maximize the use of existing road facilities	(4) Events Information Provision System to reduce traffic congestion at and around event sites.	(5) Route guidance System to direct drivers to less congested route to maximize the use of existing road facilities	(6) Information Provision System of Temporary Traffic Bottlenecks to achieve less frustrated trips and to reduce traffic congestion at temporary traffic bottleneck	(7) Traffic Management System at Large-scale Shopping Malls to reduce localized traffic congestion.	(8) Parking Space Information Provision system to improve traffic flow in CBDs and for better road user service.	(9) Commercial Vehicles Location System for more orderly trips of commercial vehicles	(10) Danger Warning system to reduce Road Crashes to improve traffic safety.	(11) Pedestrian Safety Support System to reduce road crashes.	(12) Weather Condition and Prediction Information Provision System for safer travel and to improve resiliency to natural disaster.	(13) Bus operation Monitoring and Control System te reduce traffic congestion at bus stops and to eliminate illegal bus operation	(14) Rail Operation Information Provision System for better passenger services.	(15) Traffic Rules Surveillance and Control System to achieve smooth traffic flow and to reduce road crashes.	(16) On-street Parking Control to improve traffic capacity for smoother traffic flow.	(17) Over Speeding Control System to reduce road crashes	(18) Overloaded Truck Control System to provide better surfaced roads.	(19) Upgrading of Road Condition Information Collection to Improve Road Management and to Secure Service Level	(20) Road Pricing System to reduce cars on the roads for smoother traffic flow.	(21) Common Ticketing System for easier transfer
Traffic Congestion/ Bottleneck	(1) To reduce traffic Congestion of Urban Roads			●		●	●	●	●	●	●	●					●		●	●				●	
	(2) To reduce Traffic Bottlenecks	• At Intersections		●	●	●		●																		
		• At Bus Stops				●		●			●						●									
		• Temporary Bottlenecks (construction, road crashes, floods, etc)				●		●	●																	
		• At Large-scale Shopping Malls				●	●	●		●																
	(3) To reduce Illegal on-street parking and lack of Parking Areas Information																			●						
	(4) To reinforce Traffic Demand Management Measures					●		●		●	●					●		●							●	
	(5) To improve Operation of Commercial Vehicles											●														
	(6) To improve Urban Environment being aggravated by Traffic Pollution			●		●	●	●	●	●	●	●				●		●	●	●				●	
	(7) To reduce Traffic Congestion due to Large-scale Religious/Commercial/Political						●																			
	(8) To reduce Late arrival of Emergency Vehicles to Destination			●	●	●		●																		
Traffic Information	(9) To reduce travelers frustration due to unpredictable arrival time to destination					●		●																		
	(10) To provide more Traffic Information					●	●	●	●				●				●									
Traffic Safety	(11) To reduce Frequent Road Crashes												●	●					●		●					
	(12) To reduce Road Crashes of Pedestrians/Elderly people													●												
Enforcement	(13) To reduce Illegal Operation of Buses and Jeepneys															●										
	(14) To reduce Violations of Traffic Rules and Regulations and bad driving manners																		●							
Resiliency	(15) To lessen Paralyzed Traffic During Floods and other Natural Disasters					●		●	●						●											
Road Management	(16) To avoid Pre-mature Pavement/Bridge Deterioration due to overloaded trucks																						●	●		
For Rail Passenger	(17) To provide more Information on Rail Operation																●									
	(18) To reduce Congestion at Ticketing Booths																									●

Source: JICA Study Team

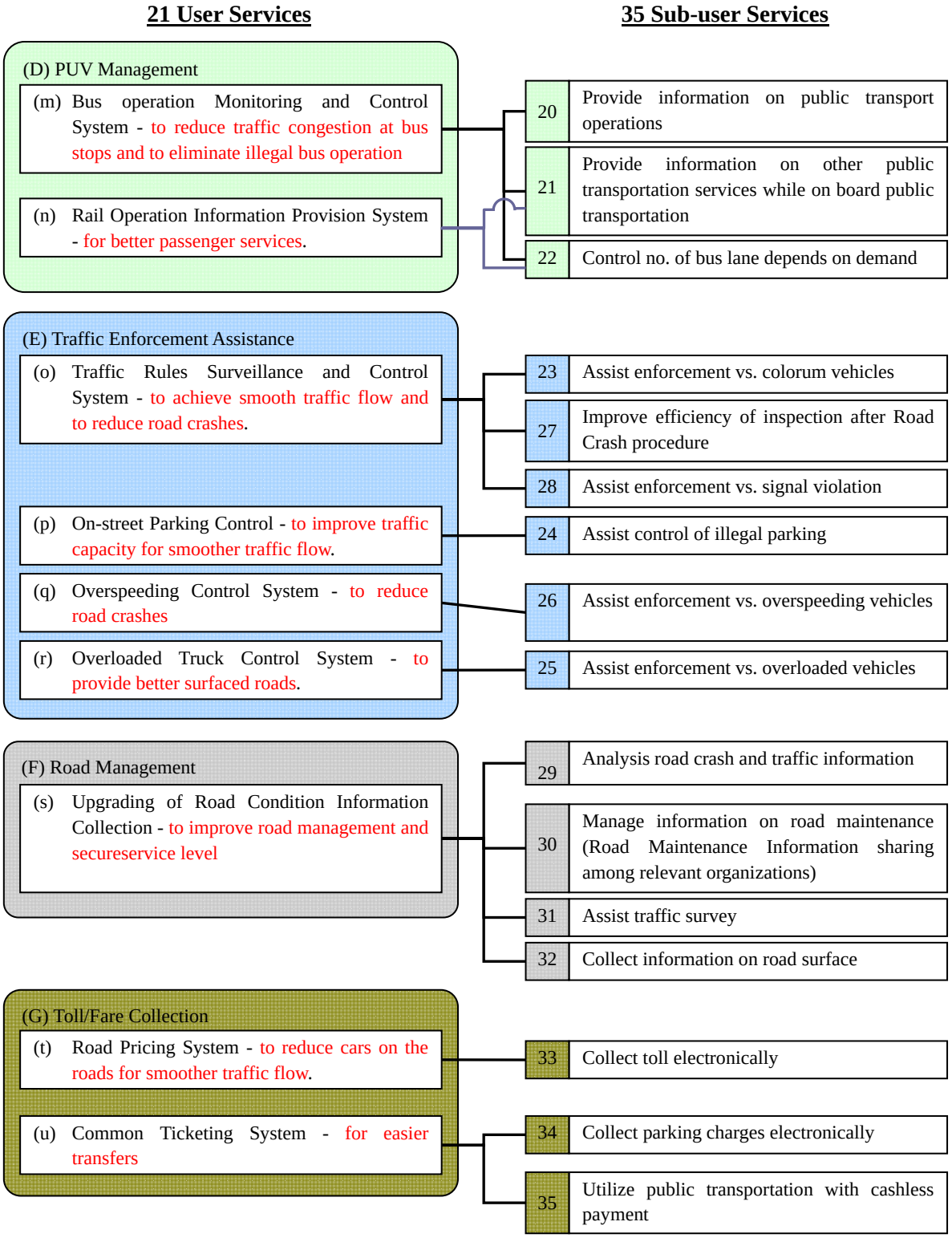
9.3. OVERALL CONFIGURATION OF ITS SERVICES

To achieve the twenty-one (21) ITS user services, 35 sub-user services were proposed. The composition of the 35 sub-user services is shown in **Figure 9.3-1**.



Source: JICA Study Team

FIGURE 9.3-1 (1/2) COMPOSITION OF SUB-USER SERVICES: METRO MANILA



Source: JICA Study Team

FIGURE 9.3-1 (2/2) COMPOSITION OF SUB-USER SERVICES: METRO MANILA

9.4. IMPLEMENTATION SCHEDULE AND COST

Based on the overall priority and time required to arrive at a consensus among Government agencies/private sector companies, the implementation schedule was proposed as shown in **Table 9.4-1** for Metro Manila.

TABLE 9.4-1 IMPLEMENTATION SCHEDULE: METRO MANILA

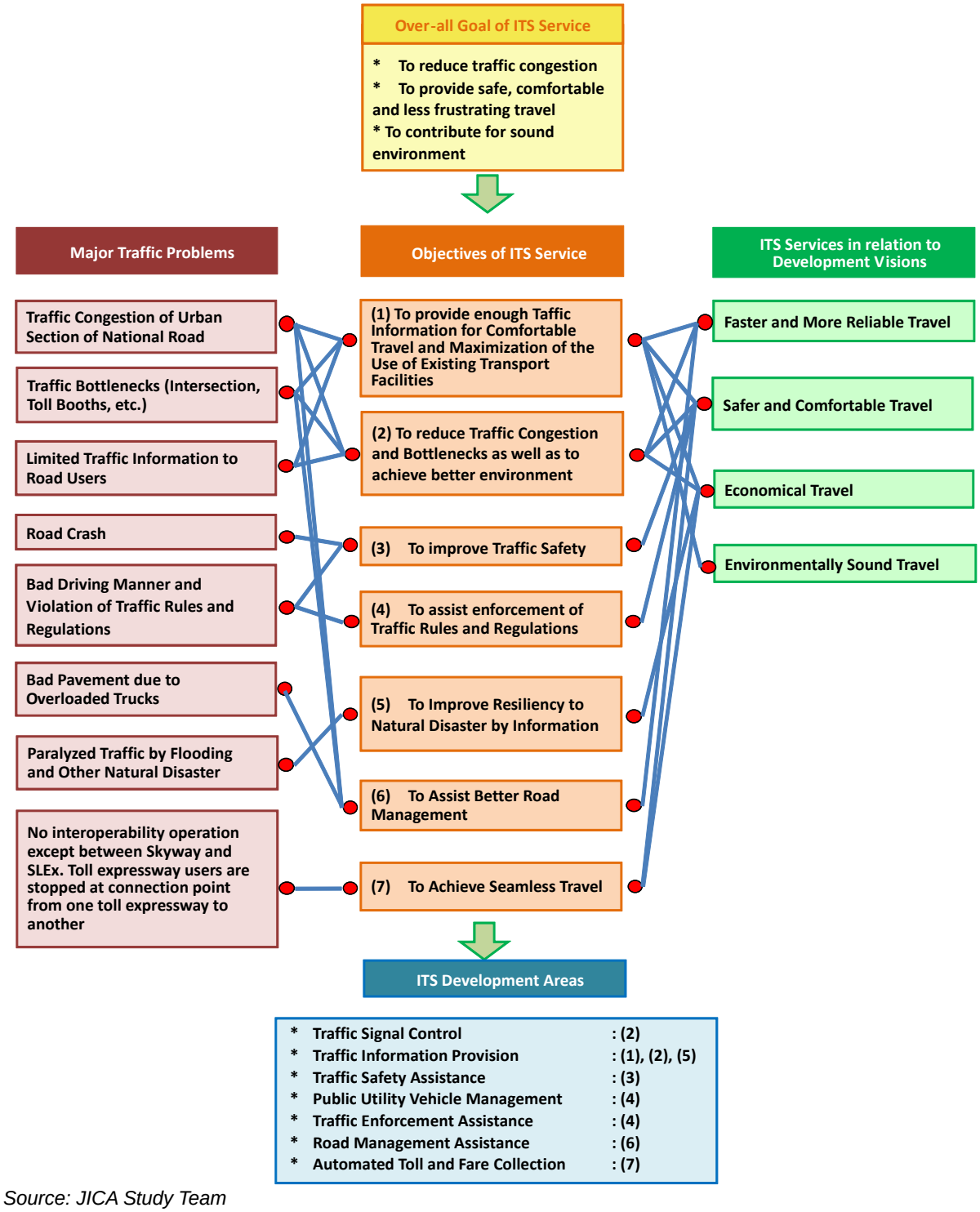
ITS System				Implementing Agency	Present Status	Implementation Schedule: Short-Term (2013-2014)	Medium-Term (2015-2019)	Long-Term (2020-2030)
Traffic Signal Control	(1)	Advanced Traffic Control System at Intersections	Phase-I (85 Intersections)	MMDA	Contractor selected.	System Development	Upgrading	
			Phase-II (120-130 Intersections)	MMDA	Fund being arranged.	System Development		Upgrading
			Phase-III (221-231 Intersections)	MMDA			System Development	Upgrading
	(2)	Emergency Vehicle Priority System		MMDA			System Development	Upgrading
Traffic Information Provision	(3)	Upgrading of Traffic Information Collection and Provision System on real-time basis		MMDA	First generation (TNAV) is in service.	2nd Gen. ATNAV	3rd Generation	4th Generation
	(4)	Route guidance System to direct drivers		MMDA	Being developed.	System Development	Upgrading	Upgrading
	(5)	Information Provision System of Temporary Traffic Bottlenecks		MMDA	Partially in service.	System Development	Upgrading	Upgrading
	(6)	Traffic Management System at Large-scale Shopping Malls		MMDA/Private Developer			System Development	Upgrading
	(7)	Parking Space Information Provision system		MMDA/Private Developer			System Development	Upgrading
	(8)	Weather Condition and Prediction Information Provision System		MMDA			System Development	Upgrading
	(9)	Commercial Vehicles Location System		MMDA Trucking Companies			System Development	Upgrading
	(10)	Events Information Provision System		MMDA	Partially in service.	System Development	Upgrading	Upgrading
	(11)	Rail Operation Information Provision System		MMDA	Partially in service.	System Development	Upgrading	Upgrading
Traffic Safety Assistance	(12)	Danger Warning system to reduce Road Crashes		MMDA				System Development
	(13)	Pedestrian Safety Support System		MMDA				System Development
PUV Management	(14)	Bus operation Monitoring and Control System		MMDA	Being developed.	System Development	Upgrading	Upgrading
				Bus Companies			System Development	Upgrading
Traffic Enforcement Assistance	(15)	Traffic Rules Surveillance and Control System		MMDA		System Development		Upgrading
	(16)	On-street Parking Control		MMDA			System Development	Upgrading
	(17)	Over Speeding Control System		MMDA			System Development	Upgrading
Road Management	(18)	Overloaded Truck Control System		DPWH	Conventional Method		System Development	Upgrading
	(19)	Upgrading of Road Condition Information Collection		DPWH	Conventional Method		System Development	Upgrading
Toll/Fare Collection	(20)	Road Pricing System		DOTC/MMDA				System Development
	(21)	Common Ticketing System		DOTC	To be implemented by PPP. Project advertized.	System Development		Upgrading
Estimated Cost (Million Php)						1183	4970	1131

Source: JICA Study Team

10. ITS MASTER PLAN IN MEGA MANILA

10.1. OBJECTIVE OF ITS SERVICES

Seven objectives of ITS services to achieve development visions and to solve traffic problems were identified. The objectives of the ITS services in relation to traffic problems and targets for ITS service are illustrated in **Figure 10.1-1**. Seven ITS development areas were developed to achieve the objectives of ITS services.



Source: JICA Study Team

FIGURE 10.1-1 OBJECTIVES OF ITS SERVICES AND ITS DEVELOPMNET AREA FOR MEGA MANILA REGION

10.2. ITS DEVELOPMENT AREA AND ITS USER SERVICES

Seven (7) ITS development areas were further divided into thirteen (13) user-service for Mega Manila.

MEGA MANILA

ITS Development Areas	ITS User Service
1. Traffic Signal Control	(1) **Advance Traffic Control System** at Intersections to improve traffic safety
2. Traffic Information Provision	(2) **Traffic Information Collection and Provision System** on real-time basis for faster and comfortable travel (3) **Standardization and Integration of Traffic Information and Provision System** for comfortable and reliable travel throughout the toll expressways (4) **Commercial Vehicles Location System** to efficiently manage cargo movements
3. Traffic Safety Assistance	(5) **Danger warning System** to reduce road crashes to improve traffic safety (6) **Weather Condition and Prediction Information Provision System** for safer travel and to improve resiliency to natural disasters
4. PUV Management	(7) **Bus Operation Monitoring and Control System** for illegal bus operations
5. Traffic Enforcement Assistance	(8) **Traffic Rules Surveillance and control System** to achieve smooth traffic flow and to reduce road crashes (9) **Overloaded Truck System** to provide better surfaced roads (10) **Overspeeding Control System** to improve traffic safety
6. Road Management	(11) **Upgrading of Road Condition Information Collection** to improve road management and to secure service level
7. Toll/Fare Collection	(12) **Inter-operability System** to achieve seamless travel on toll expressways (13) **Standardization of Toll Collection System** to promote ETC and/or non-cash payment toll collection and interoperability

Source: JICA Study Team

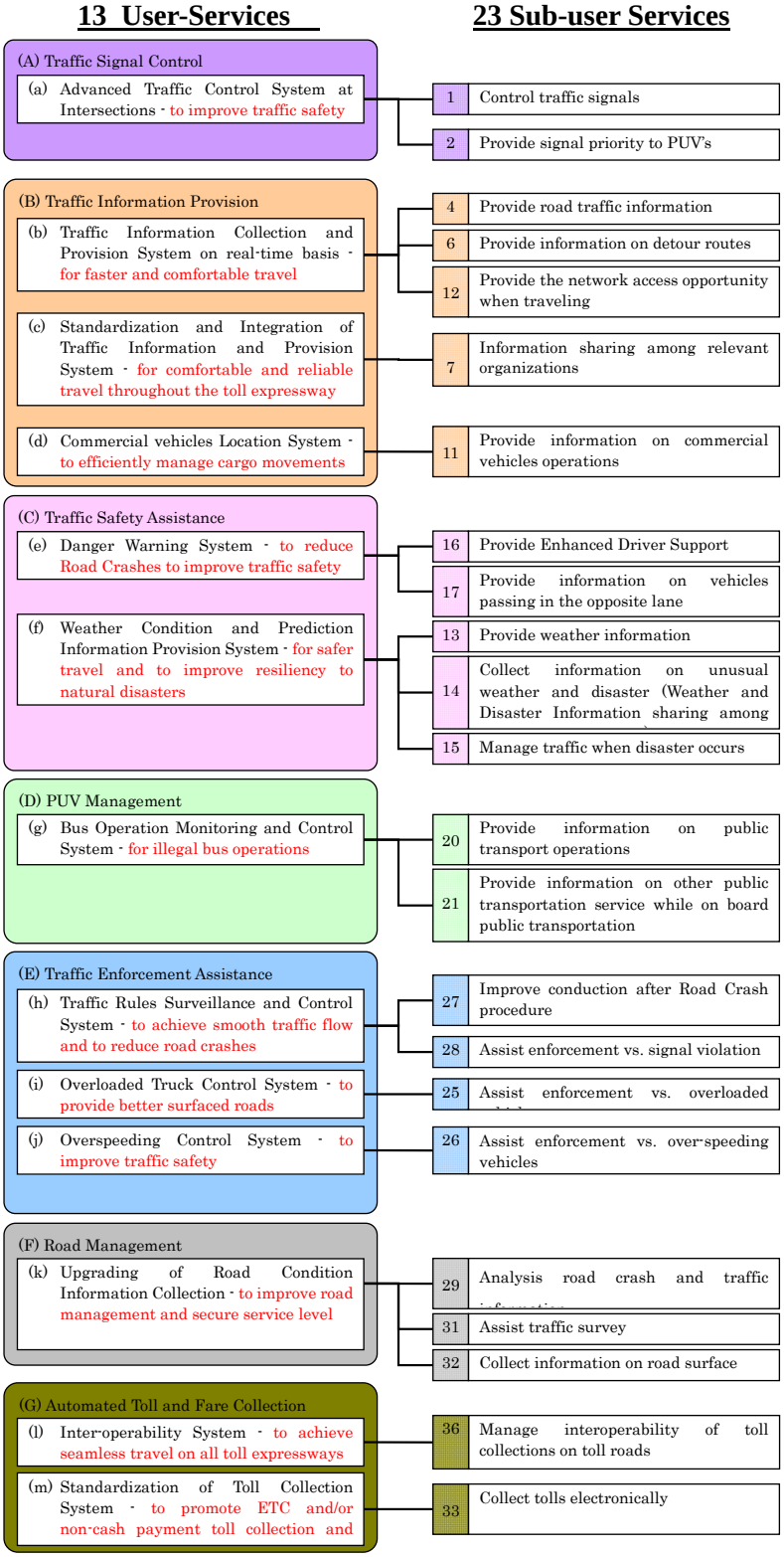
TABLE 10.2-1 BASIC ITS SERVICE FOR MEGA MANILA

Major Objectives of ITS Measures to Achieve Development Visions (7)	Sub-objectives (14) / ITS User Services (13)	(1) Advanced Traffic Control System at Intersections to improve traffic safety	(2) Traffic Information Collection and Provision System on real-time basis for faster and comfortable travel	(3) Standardization and Integration of Traffic Information and Provision System for comfortable and reliable travel throughout the toll expressway	(4) Commercial vehicles Location System to efficiently manage cargo movements	(5)Danger Warning System to reduce Road Crashes to improve traffic safety	(6) Weather Condition and Prediction Information Provision System for safer travel and to improve resiliency to natural	(7) Bus Operation Monitoring and Control System for illegal bus operations	(8) Traffic Rules Surveillance and Control System to achieve smooth traffic flow and to reduce road crashes	(9) Overloaded Truck Control System to provide better surfaced roads	(10) Overspeeding Control System to improve traffic safety	(11) Upgrading of Road Condition Information Collection to Improve Road Management and to Secure Service Level	(12) Inter-operability System to achieve seamless travel on all toll expressways	(13) Standardization of Toll Collection System to promote ETC and/or non-cash payment toll collection and interoperability
(1) To reduce Traffic Congestion and Bottlenecks as well as to achieve better environment	(1) To reduce road traffic Congestion of Urban sections of national road corridors	●	●						●					
	(2) To improve traffic efficiency at intersections	●							●					
	(3) To reduce traffic congestions at toll booths					●								●
(2) To provide enough Traffic Information for Comfortable and Maximization of the Use of Existing Transport Facilities	(4) To provide more traffic information for comfortable travel		●			●	●							
	(5) To improve operation of commercial vehicles				●									
	(6) To provide enough traffic information to expressway users		●	●										●
(3) To Improve Traffic Safety	(7) To reduce road crashes on national roads					●			●		●			
	(8) To reduce road crashes on expressways					●			●		●			
(4) To assist enforcement of Traffic Rules and Regulations	(9) To reduce violations of traffic rules and regulations and bad driving manners								●					
	(10) To reduce illegal operation of Buses and Jeepneys							●						
(5) To Improve Resiliency to Natural Disaster by Information Provision	(11) To provide information on weather condition and natural disasters		●				●							
(6) To Assist Better Road Management	(12) To avoid premature pavement/bridge detorioration due to overload trucks									●		●		
	(13) To avoid premature pavement/bridge by overloaded trucks									●		●		
(7) To Achieve Seamless Travel along expressways	(14) To achieve seamless travel along expressways			●									●	●

Source: JICA Study Team

10.3. OVERALL CONFIGURATION OF ITS SERVICES

To achieve the 13 ITS user services, 23 sub-user services were proposed. The composition of the 23 sub-user services is shown in **Figure 10.3-1**.



Source: JICA Study Team

FIGURE 10.3-1 COMPOSITION OF SUB-USER SERVICES: MEGA MANILA

10.4. IMPLEMENTATION SCHEDULE AND COST

The implementation schedule was proposed as shown in **Table 10.4-1** for Mega Manila.

TABLE 10.4-1 IMPLEMENTATION SCHEDULE: MEGA MANILA

ITS System			Implementing Agency	Present Status	Implementation Schedule		
					Short-Term (2013-2014)	Medium-Term (2015-2019)	Long-Term (2020-2030)
Traffic Signal Control	(1)	Advanced Traffic Control System at Intersections	DPWH	DPWH implemented along Manila North Road	Selection of Corridors →	System Development for Selected Corridor →	Upgrading
Traffic Information Provision	(2)	Traffic Information Collection and Provision System on real-time basis	DPWH	DPWH plans to introduce along Manila North Road	System Development for MNR →	System Development for Other Corridor →	Upgrading
	(3)	Standardization and Integration of Traffic Information and Provision System	DPWH, TRB, Toll Road Operators	Toll road operators adopt different standards	Create Concensus among Agencies/Companies →	System Development →	Upgrading
	(4)	Commercial vehicles Location System	Trucking Companies			System Development →	Upgrading
Traffic Safety Assistance	(5)	Danger Warning system to reduce Road Crashes	DPWH			System Development →	Upgrading
	(6)	Weather Condition and Prediction Information Provision System	DPWH, Toll Road Operators			System Development →	Upgrading
PUV Management	(7)	Bus operation Monitoring and Control System	Bus Companies				System Development → Upgrading
Traffic Enforcement Assistance	(8)	Traffic Rules Surveillance and Control System	DPWH/LGUs			System Development →	Upgrading
	(9)	Overloaded Truck Control System	DPWH	DPWH adopts conventional ways at present.		System Development →	Upgrading
	(10)	Over Speeding Control System	DPWH, LGUs, PNP, Toll Road Operators		System Development →		Upgrading
Road Management	(11)	Upgrading of Road Condition Information Collection	DPWH	DPWH adopts conventional ways at present.		System Development →	Upgrading
Automated Toll and Fare Collection	(12)	Inter-operability System	DPWH, TRB, Toll Road Operators	Skyway - SLEX is implementing.	Create Concensus among Agencies/Companies →	System Development →	Upgrading
	(13)	Standardization of Toll Collection System	DPWH, TRB, Toll Road Operators	Toll road operators adopt different system	Create Concensus among Agencies/Companies →	System Development →	Upgrading
Estimated Cost (Million Php)					216	4438	577

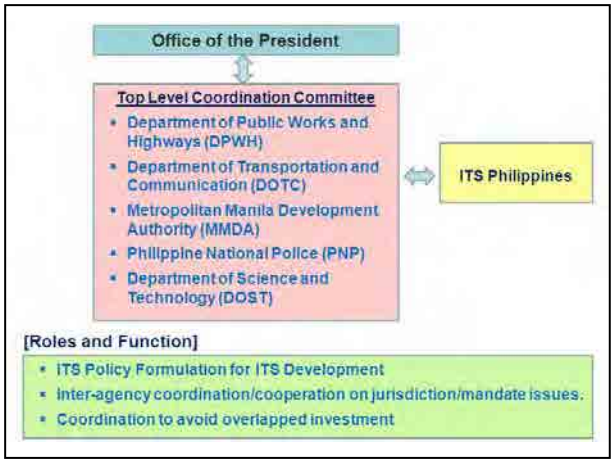
Source: JICA Study Team

11. MEASURES FOR SUSTAINABLE ITS DEVELOPMENT

11.1. WHAT TO BE DONE FOR ITS PROMOTION

For successful implementation of the Master Plan, various aspects need to be considered as follows;

- Creation of strong body for ITS Promotion
- Institutional Arrangements: each agency has its own mandate. Sometimes several agencies have similar mandates, thus these agencies need to coordinate with each other and also share information to avoid overlapped information collection as well as to utilize information effectively.
- Education of Drivers/Pedestrians and Strict Enforcement
- Capacity Development of Agencies Concerned
- Promotion of Private Sector Initiative
- Measures to Cope with Fast Development of IT and ITS Technologies
- Development of Communication Infrastructure



Source: JICA Study Team

FIGURE 11.1-1 CREATION OF STRONG BODY FOR ITS PROMOTION

11.2. TRAFFIC INFORMATION COLLECTION AND PROVISION SYSTEM

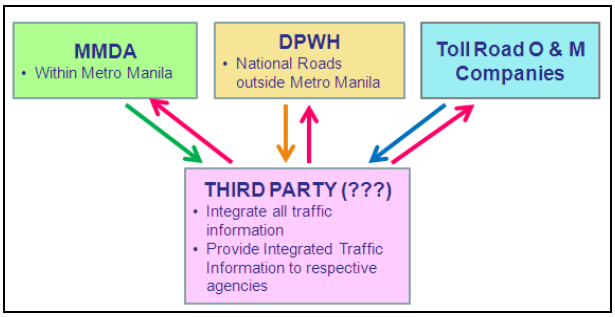
Current responsibility for traffic information collection and provision system in the Philippines is as follows;

MMDA: within Metro Manila

DPWH: National roads outside Metro Manila

Toll Road O & M Companies: respective toll road in-charge

Since socio-economic activities are expanding outside Metro Manila, all traffic information should be integrated by "one body" which maybe MMDA or "a third party" and integrated traffic information should be fed back to respective agency for proper sharing of traffic information.



Source: JICA Study Team

FIGURE 11.2-1 PROPOSED INSTITTUTIONAL ARRANGEMENT OF TRAFFIC INFORMATION AND PROVISION SYSTEM

11.3. PUBLIC TRANSPORT MONITORING SYSTEM

Current responsibility of concerned agencies is as follows:

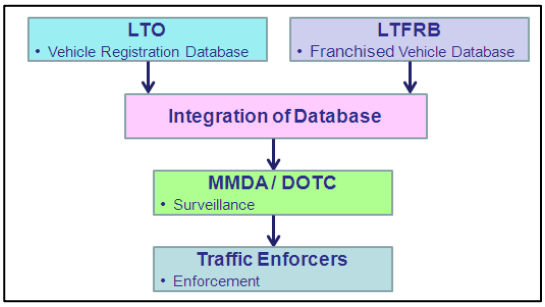
LTO: vehicle registration

LTFRB: Issuance of franchise for public transport

MMDA and DOTC: Surveillance of operation

of franchised public transport

Traffic Enforcer deputized by LTO and LTFRB: Enforcement

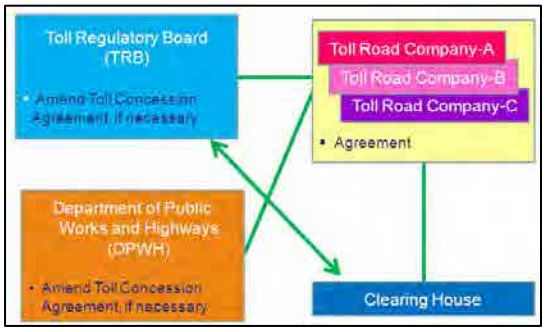


Source: JICA Study Team

FIGURE 11.3-1 PROPOSED INSTITTUTIONAL ARRANGEMENT OF PUBLIC MONITORING SYSTEM

11.4. TOLL ROAD INTEROPERABILITY SYSTEM

In order to realize this system, all toll road operators must agree to this system under the guidance of Toll Regulatory Board (TRB) and DPWH. If necessary, toll concession agreement or supplemental toll operation agreement will be amended to recover additional investment on the part of toll road operators.

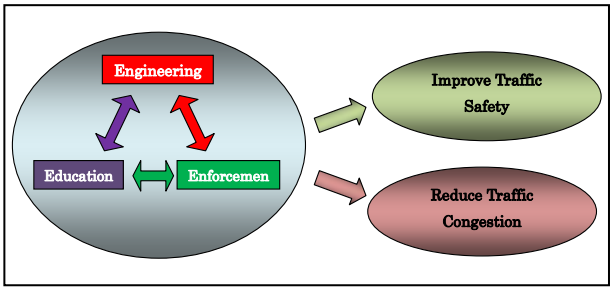


Source: JICA Study Team

FIGURE 11.4-1 PROPOSED INSTITTUTIONAL ARRANGEMENT OF TOLL ROAD INTEROPERABILITY SYSTEM

11.5. EDUCATION OF DRIVERS AND STRICT ENFORCEMENT

Although this Master Plan recommends ITS solutions for improvement of traffic safety and enforcement, ITS services alone will not solve traffic problems. It must be accompanied by 3Es, i.e. Engineering, Enforcement and Education.



Source: JICA Study Team

FIGURE 11.5-1 E COMPONENT TO ASSIST ITS INTRODUCTION

11.6. CAPACITY DEVELOPMENT OF AGENCIES CONCERNED

(1) DPWH

Capacity development is recommended through the following measures;

- On-the-job training through implementation of projects recommended by this Master Plan
- Coordination and cooperation with MMDA
- Active participation to the activities of ITS-Philippines which will be organized in the near future
- Constant coordination with ITS-related private companies

(2) MMDA

MMDA is the most advanced agency in the field of traffic information collection and provision system, intersection traffic control system and PUV monitoring system. Areas needed for capacity development are as follows;

- Optimum route search technology utilizing information from floating cars and cloud source data
- MMDA is highly depending on subjective evaluation which is currently correct direction; however, time will come to do objective evaluation of traffic condition to provide more accurate information.
- To achieve above two issues, MMDA may request JICA to dispatch a long-term ITS specialist for daily consultation with him.

12. PHASE III OF METRO MANILA TRAFFIC SIGNAL CONTROL PROJECT

12.1. BACKGROUND

MMDA is currently operating the traffic signal control system at **436** intersections, which were introduced more than 10 years ago and became obsolete. Even spare parts for the system are no longer available.

MMDA decided to upgrade all the traffic signal control system of intersections: Metro Manila Traffic Signal Control Project. The project is implemented in 3 phases as follows:

Phase I : Upgrading of traffic signal control system at **85** intersections. The contractor was already selected and started the work. It is expected that Phase I is completed within 2013. The Project includes the development of Traffic Control Center. Phase I is estimated to be **300 Million Php**. All major intersections were selected, thus there are scattered at various areas in Metro Manila.

Phase II :Upgrading of the traffic signal control system at **201** intersections mainly located in Quezon City and a part of Manila City. MMDA already secured a national budget for Phase II of **525 Million Php**.

Phase III : Upgrading of traffic signal control system at the remaining **150** intersections which are mainly located in Manila City. The Study Team recommended to include installation of traffic signal control system at **212** intersections which remain at present as non-signalized intersections. A total of **362** intersections will be signal controlled under this phase.

Since Phase I is on-going and Phase II is ready for implementation, this Chapter confirms feasibility of Phase III Project.

12.2. OBJECTIVES OF THE PROJECT

The Project aims at the following:

1) To improve traffic flow at intersections.
2) To improve environmental conditions.
3) To improve traffic safety.

12.3. PROJECT OUTLINE

There are two (2) types of work as follows;

- Upgrading of existing traffic signal control system ……. 150 intersections
- Signalization of currently non-signalized intersection …….. 212 intersections

(1) Upgrading of Existing Traffic Signal Control System

Although Phase I adopts loop-coil type of traffic detector, it is recommended to adopt image recognition type of traffic detector. Loop-coil type which is embedded for each lane in the pavement is easily damaged or destroyed by pavement repair/reconstruction work, while image recognition type which is installed overhead and can cover at least four (4) lanes is recommended.

(2) Signalization of Currently Non-signalized Intersection

For this type of work, the following works need to be implemented together with signalization;

- Improvement of intersection geometry including installation of exclusive left turn lane.
- Shifting of Jeepney loading/unloading zone.
- Alteration of U-turn operation.

Other works are the same as (1) above.

12.4. EQUIPMENT TO BE USED

TABLE 12.4-1 EQUIPMENT TO BE USED

Equipment Name	Unit Price (Php)	Qty. for 362 Intersections
Traffic Signal (LED Lamp)	57,458	2,722
Traffic Light Controller (to be connected with Traffic Center)	306,399	362
Pedestrian Signal	38,305	1,342
Countdown Timer	26,814	713
Vehicle Detector (Image Recognition Type)	191,484	1,361
Layer 2 Switch (Network Equipment)	200,000	223
Switching Hub (Network Equipment)	24,300	2
Optical Network Unit (Network Equipment)	102,947	223

Note: It is assumed that the Traffic Control Center prepared in Phase I has enough capacity to accommodate access from Phase III intersections.

Source: JICA Study Team

12.5. ESTIMATED COST

(1) Traffic Signal Installation Cost

Traffic signal installation cost at the 362 intersections was estimated at Php 1,072.75 Million.

(2) Annual Operation and Maintenance Cost

Annual operation and maintenance cost was estimated at Php 38.66 Million.

12.6. IMPLEMENTING AGENCY AND IMPLEMENTATION SCHEDULE

(1) Implementing Agency

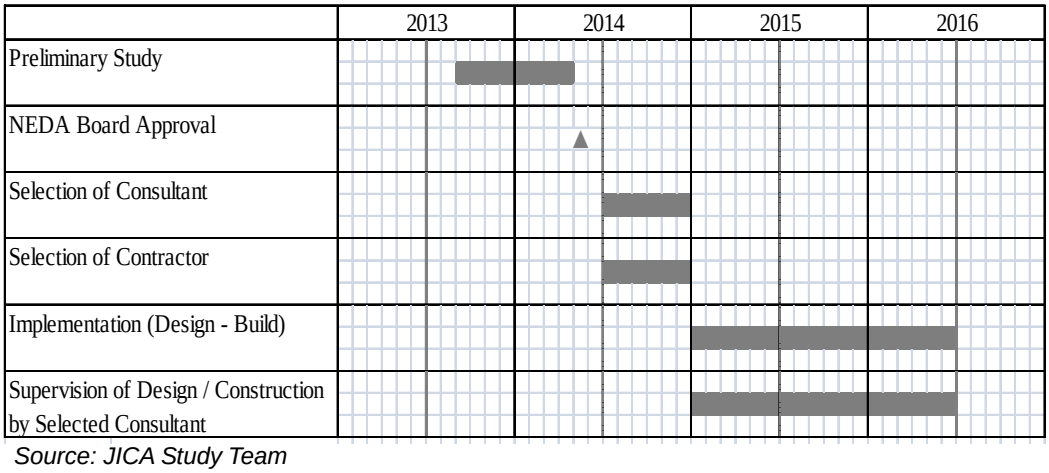
The implementing agency shall be the MMDA.

(2) Implementation Schedule

MMDA has adopted "Design-Build" approach for Phase I and a consultant was not hired, since the nature of work is replacement of existing equipment with the advanced equipment.

Phase III involves traffic signal control system at currently non-signalized intersection, therefore, preliminary design to determine improvement of intersection geometry and communication connection, etc. will be required.

TABLE 12.6-1 PROPOSED IMPLEMENTATION TABLE



Source: JICA Study Team

12.7. EFFECT AND IMPACT OF PROJECT

According to traffic survey results and HCM 2010 formula, the value of reduction of average delay was estimated. (see **Table 12.7-1** and **Table 12.7-3**)

TABLE 12.7-1 ESTIMATION OF HYPOTHETICAL DELAY REDUCTION (NEW SIGNAL)

Name of main road	Reduced Delay [sec/vehicle]
Camarin vs. Zabarte intersection (four-legs intersection)	0.74
Alaban-ConchaCruz (three-legs intersection)	1.23

Source: JICA Study Team

TABLE 12.7-2 SUMMARY OF THE TIME SAVING IMPACT IN TERMS OF "HOURS" (NEW SIGNAL)

Number of targeted intersections	Time saving	unit
212 intersections	100.9	[hrs./hour]
	1,413.1	[hrs./day]
	7,065.5	[hrs./week]
	353,275.3	[hrs/year]

Source: JICA Study Team

TABLE 12.7-3 ESTIMATION OF DELAY REDUCTION (IMPROVEMENT)

Name of main road	Reduced Delay [sec/vehicle]
Quirino highway vs General Luis Rd. (four-legs intersection)	3.13
Dr. A. Santos vs Angelina Canaynai Ave intersection (three-legs intersection)	2.00

Source: JICA Study Team

TABLE 12.7-4 SUMMARY OF THE TIME SAVING IMPACT IN TERMS OF "HOURS" (IMPROVEMENT)

Number of targeted intersections	Time saving	unit
150 intersections	222.7	[hrs./hour]
	3,117.4	[hrs./day]
	15,587.2	[hrs./week]
	779,359.4	[hrs/year]

Source: JICA Study Team

12.8. ECONOMIC ANALYSIS

EIRR exceeds the value of SDR (15%), and the values of NPV and B/C also exceed respective level, showing that the project is economically viable.

TABLE 12.8-1 MAJOR RESULTS OF ECONOMIC EVALUATION

EIRR (%)	NPV (Php.million)	B/C
53.7	1,569	2.34

Source: JICA Study Team

12.8.1 Qualitative Evaluation

In addition to the quantifiable benefits evaluated above, there are also several kinds of unquantifiable benefit worthy of mentioning.

- Faster Moving Traffic Flow in the Overall Road Network of Metro Manila Region
- Effect of VOC Saving beyond That of the Targeted Areas
- Effect of CO2 Emission Reduction beyond That of the Targeted Areas
- Traffic Accident Reduction
- Saving of Manpower Cost in Traffic Enforcement

13. TRAFFIC SIGNAL CONTROL AT BICUTAN AND SUCAT INTERSECTION

13.1. INTRODUCTION

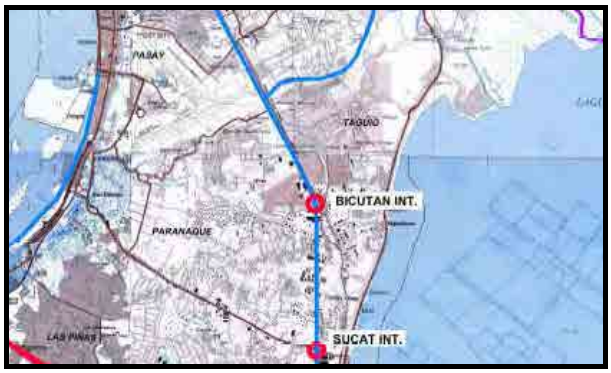
13.1.1 Background

Since Bicutan and Sucat intersections connecting with Interchange (IC) of Skyway, they are very complicated intersections.

Currently these intersections are controlled by manually, no signalized intersection.

In order to improve the traffic situation at Bicutan and Sucat, the pre-feasibility study was conducted.

This project is one of the candidate "experimental project of traffic signal control" of JICA Technical Assistance.



Source: JICA Study Team

FIGURE 13.1-1 LOCATION MAP OF PROPOSED PILOT PROJECT (BICUTAN AND SUCAT INTERSECTION)

13.1.2 Objective of the Project

The objectives of the Project are as follows:

- To improve traffic flow at intersections
- To improve environmental conditions
- To improve traffic safety

13.2. PRESENT CONDITION OF PROJECT SITE

(1) Bicutan Intersection

Figure 13.2-1 shows the Bicutan intersection map.

There are two (2) intersections, east and west side. These distance is very short, only 70m.

- Pedestrian use by pedestrian deck
- PNR line is located beside east side intersection
- Short distance from/to toll gate and intersection (70-120 m.)

Source: JICA Study Team

FIGURE 13.2-1 BICUTAN INTERSECTION

(2) Sucat Intersection

Figure 13.2-2 shows the intersection map.

- There are also two intersection and the distance is very short only 90m.
- Pedestrian deck is located only west side. Other direction, people use pedestrian crossing.
- Short distance from/to toll gate and intersections (60-90m).

Source: JICA Study Team

FIGURE 13.2-2 SUCAT INTERSECTION

13.3. CONCEPT FOR PROJECT

Independent Signal Control

This proposed traffic control system can be calculated optimum green time based on present traffic demand without connecting traffic center.

As these two intersections are located at far from neighbor's signalized intersections, it is not necessary to consider the corridor signal coordination. (Sucat intersection is 1.5 km far from neighbor's signalized intersection, Bicutan intersection is also more than 2km far)

As Japan's traffic signal system can both center control type and independent or local control, it is possible to utilize Japanese signal control technologies as experimental project.

Though traffic signal parameters were calculated by center in previous traffic control system, the current local signal controller will be able to calculate signal parameters by themselves due to drastic computer technology improvement. These technologies can be reduced the burdens in center system and center system can be composed as more sophisticated system. Trend of signal control system will transfer from Centralized control system to Distributed control system.

Improvement of Traffic Safety

Presently two sites have no traffic signal control; they were controlled by traffic enforcers. Since there are many kinds of traffic flows, it always occurred almost-vehicle-collision status then many vehicles stopped at intersections.

It is desired that Bicutan and Sucat intersection should be controlled by traffic signal for improvement of traffic safety.

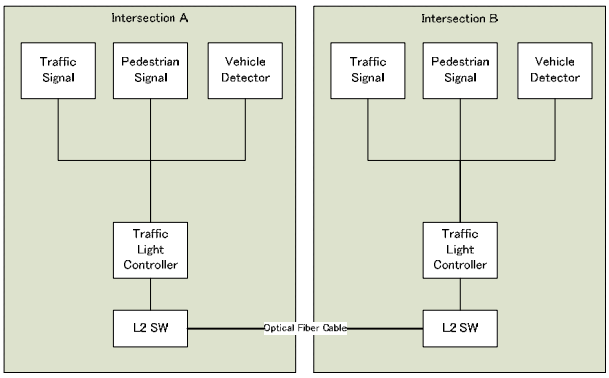
Reduction of Vehicle Delay at Intersections

The following traffic operations are recommended.

- To control together for two intersections as one intersection.
- To consider optimum cycle time in order to minimize the queue vehicles at small waiting space. Cycle time length recommends shorter as much as possible.
- To provide adequate green time for equally vehicle delay of each direction.
- To provide traffic actuated control based on vehicle detector's information.

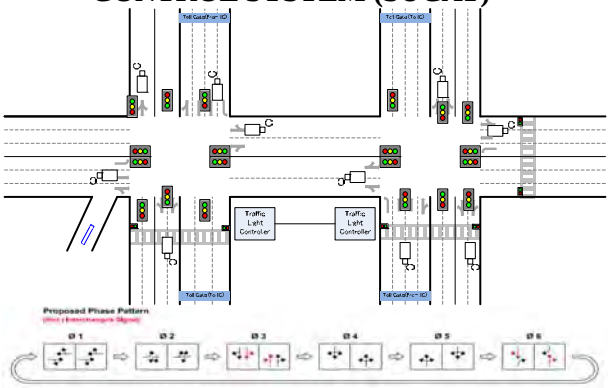
13.4. PROJECT OUTLINE

Figure 13.4-1 and **Figure 13.4-2** shows the image of system configuration for signal system (SUCAT). Two Traffic Light Control will be synchronized via optical fiber cable.



Source: JICA Study Team

FIGURE 13.4-1 SYSTEM CONFIGURATION IMAGE FOR SIGNAL CONTROL SYSTEM (SUCAT)

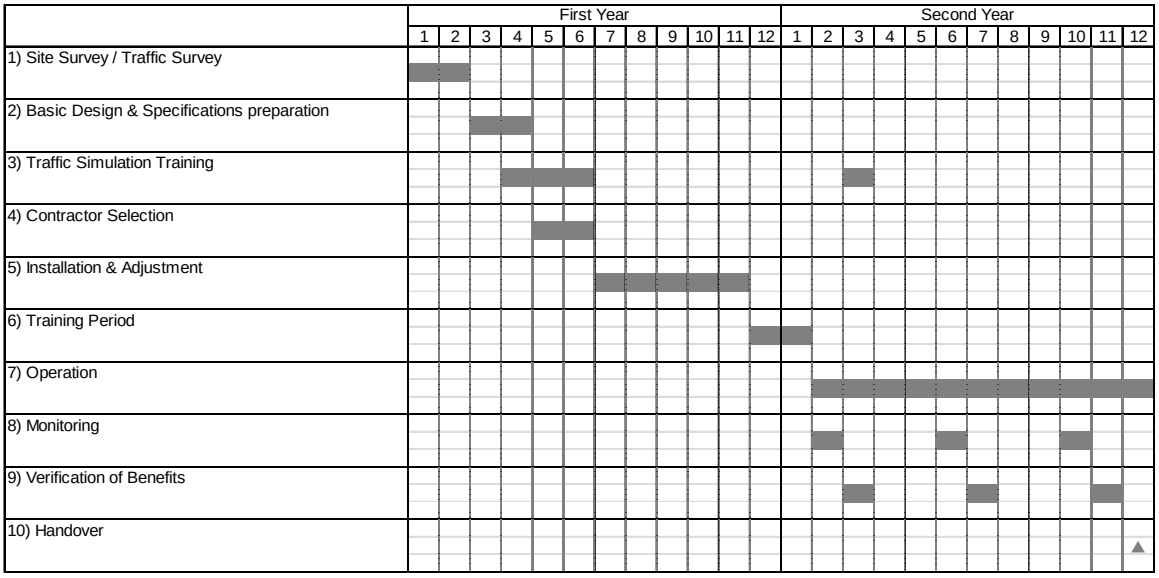


Source: JICA Study Team

FIGURE 13.4-2 EQUIPMENT ARRANGEMENT PLAN FOR SUCAT INTERSECTION

13.5. IMPLEMENTING AGENCY

Implementing Agency is MMDA, Traffic Engineering Center (TEC)



Source: JICA Study Team

FIGURE 13.5-1 IMPLEMENTATION SCHEDULE

13.6. COST ESTIMATION FOR THE PROJECT

The Total Project Cost is 7.55 Million Php for Sucat and 6.92 Million Php for Bicutan. The Annual Operation and Maintenance Cost is 2.63 Million Php for Sucat and 2.59 Million Php for Bicutan.

13.7. EFFECT AND IMPACT OF PROJECT

Impact of introduction of signal control system was evaluated with respect to following 4 non-signalized intersections as Bicutan and Sucat intersection.

TABLE 13.7-1 THE TIME SAVING IMPACT IN TERMS OF "HOURS"

Targeted intersections	Time saving	unit
BICUTAN + SUCAT intersection	6.4	[hrs./hour]
	94.6	[hrs./day]
	473.0	[hrs./week]
	18,920	[hrs/year]

Source: JICA Study Team

13.8. ECONOMIC ANALYSIS

EIRR exceed the value of SDR (15%) and the values of NPV and B/C also exceed respective level, showing that projects economically viable.

TABLE 13.8-1 ECONOMIC EVALUATION

	EIRR (%)	NPV	B/C
Bicutan Int.	50.4	12	1.8
Sucat Int.	26.8	4	1.2
Bicutan and Sucat Int.	38.4	15	1.5

Source: JICA Study Team

13.9. RECOMMENDATION

Sucat and Bicutan intersections should be controlled utilizing latest technologies to achieve smoother traffic flow, and to reduce the potential of traffic accidents.

The Government decided quite recently to establish a temporary integrated bus terminal near Bicutan intersection which will totally change traffic movement, thus traffic signalization at Bicutan should be implemented after assessing traffic movements of a temporary integrated bus terminal. It is recommended that signalization of Sucat Intersection should be implemented first. The experience of Sucat Intersection should be reflected to Bicutan Intersection.

14. METRO MANILA ROUTE GUIDANCE SYSTEM

14.1. OBJECTIVE

For reduce traffic congestion in Metro Manila, promotes dispersal behavior of traffic demand is effective.

To achieve such dispersal behavior, “precise understanding of the traffic condition” and “effective sending of information on traffic condition” would be required.

According to Global Trend, involve users/drivers report for understanding of the traffic condition by using Twitter, Facebook.

Therefore, MMDA’s Traffic Navigator (TNAV) is expected, it is effective and frontier of the traffic service.

Traffic Navigator (TNAV) has potential, will be able to more improved,

- Upgrading and expanding of Information provision
- Function addition, Route Search and Route Guidance with prediction method
- Assistance for improvement the service for road users.

Therefore, the objective of the project is the improvement of TNAV.

Also, to realize the sharing of road and traffic information in collaboration with related sectors for more success.

14.2. AGENDAS OF TRAFFIC NAVIGATOR

(1) Digital Road Map (DRM)

<u>Low Coverage Road Network</u>

- Currently, nine (9) road only

<u>Segmentation of DRM is not proper</u>.

- The road should be divided at turning point such as intersections and all junctions for route guidance.

(2) Data Collection

- Currently, the data collected by MMDA, SLEX and NLEX are in use, and some information from other agencies.

Source: MMDA

FIGURE 14.2-1 COVERED ROAD NETWORK

(3) User Interface of Traffic Navigator

There are discrepancies of user interface.

The user interface is different between PC version and Smartphone version. It causes confusion for the users.

Source: MMDA

FIGURE 14.2-2 PC VERSION

Source: MMDA

FIGURE 14.2-3 SMARTPHONE VERSION

(4) Definition of traffic condition

The definition of traffic condition is subjectively made and provided.

- Currently, there is no standard of the definition. The traffic condition is judged subjectively according to observation by using CCTV and Enforcers.
- The definition is absolutely imperative for Route search, Route Guidance and Travel Time provision automatically.

(5) Encourage of diffusion for upload/ provide Floating Car Data

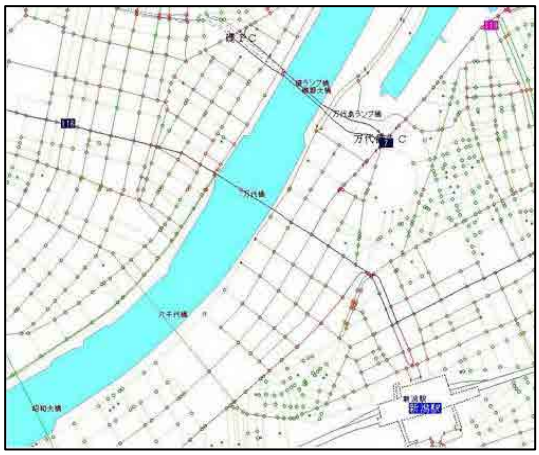
Floating Car Data shall be collected from road users to elaborate the traffic data.

- Recently, FCD (Floating Car Data) is utilized for traffic information provision by a lot of countries, such as HONDA InterNavi in JAPAN, INRIX in USA, Waze in Israel/USA and so on.
- FCD shall be collected from road users however, road user may not upload/provide it without some incentive

14.3. ADVANCED TRAFFIC NAVIGATOR (ATNAV)

(1) Development Digital Road Map

For advanced traffic navigator, proper DRM (Digital Road Map) shall be developed. It is minimum requirement for route search, route guidance function.



Source: Japan Digital Road Map

FIGURE 14.3-1 DIGITAL ROAD MAP IN JAPAN

(2) Development Smartphone application using Gamification

Gamification is the use of game thinking and game mechanics in a non-game context in order to engage users and solve problems.

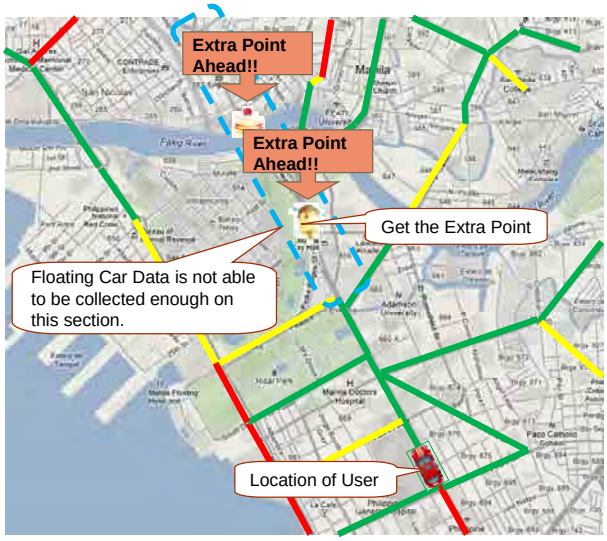
- Through integration of game elements (Gamification), the users are encouraged to use existing systems and services without feeling a large psychological burden to do so.
- This figures are the user interface of Waze what is a FREE social GPS / Car navigation application.

Source: Waze

FIGURE 14.3-2 EXAMPLE OF FREE SOCIAL GPS/CARNAVIGATION APPLICATION

To develop smart-phone application with Gamification method

- The application has the collection function of FCD.
- Also, consider to Gamification method for development of user interface.



Source: JICA Study Team

FIGURE 14.3-3 IMAGINARY OF GIVING A POINT FOR THE COLLECTION OF FLOATING CAR DATA

(3) Utilize the traffic data which is collected by Roadside Unit with FCD (Floating Car Data)

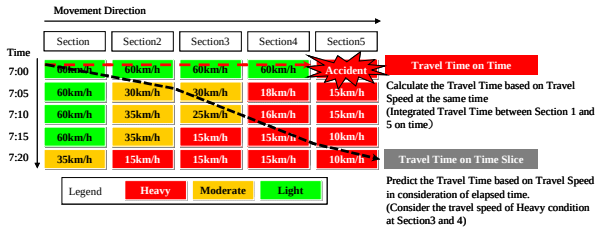
FCD is collected only from vehicles whose drivers have agreed to provide data and sending. Not all links necessarily have information on traffic conditions.

Therefore, for collection of traffic volume and traffic speed, Roadside Unit (such as Vehicle Detector) is needed for interpolation of FCD.

(4) Provision accurate Travel Time and Route Guidance based on the historical and predicted data

To accumulate historical traffic condition data such as FCD and vehicle detector's data is necessary. Then, the accumulated data are utilized for prediction of prospective traffic condition based on the traffic engineering.

Therefore, ATNAV will be able to provide accurate Travel Time and Route Guidance based on the historical and predicted data.

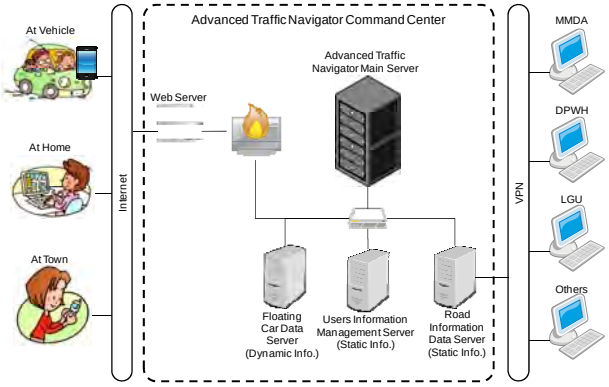


Source: JICA Study Team

FIGURE 14.3-4 TRAVEL TIME PREDICTION

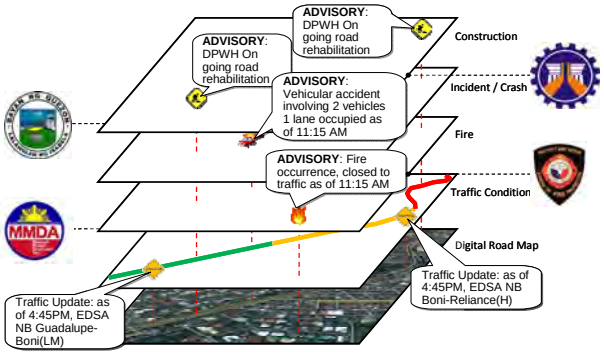
(5) Integrated Road and Traffic Information by using Cloud Web GIS

Information to be controlled in the ATNAV includes static information and dynamic information. Such information is collected and held by various organizations, which is requires an information control based on a layer structure shown in **Figure 14.3-5** and **Figure 14.3-6**.



Source: JICA Study Team

FIGURE 14.3-5 IMAGINARY: SYSTEM ARCHITECTURE OF ATNAV



Source: JICA Study Team

FIGURE 14.3-6 IMAGINARY FOR DATA MANAGEMENT ON LAYER STRUCTURE BY USING WEB BASED GIS

(6) Collaboration with Private Sector and Public Sector

The project will be conducted by MMDA, and DPWH, DOTC, LGU shall be participation in the project for making Road and Traffic information satisfactory.

Also, the collected traffic data are utilized for business. Therefore, Private sector shall be involved to the development of ATNAV

15. RFID-BASED EDSA BUS TRAVEL TIME INFORMATION PROVISION SYSTEM

15.1. OBJECTIVES

This system is proposed to be implemented as a "Pilot Project". The objectives of this system are as follows:

- To provide bus travel time along EDSA to public transport passengers, mainly to bus passengers.
- To improve convenience of public transport passengers.
- To improve bus operations and to reduce congestion at bus stops, since bus passengers are distributed over certain times and overconcentration of passengers are reduced.
- To reduce car users at EDSA which contributes to traffic congestion mitigation when convenience of bus utilization is experienced by people. Car users will shift to public transport mode.

15.2. OUTLINE OF THE PILOT PROJECT

This system is proposed to be implemented along EDSA as the Pilot Project, then expanded to other bus transport corridors.

Outline of the pilot project is as follows;

(1) Data Collection System

- Six RFID checkpoints along EDSA from Magallanes to Timog are established as shown in **Figure 15.2-1**. All checkpoints are selected at the biggest inter-modal points.
- RFID readers (or antenna) are installed for both north and south bounds at established RFID checkpoints.
- RFID tag is stickered at all franchised buses at EDSA (about 3,500 buses).
- Readers (antennas) send each passing bus ID and timestamp to the central server at MMDA Command Center via SMS.
- Data transmission via SMS is planned for reliability and cheaper network charges.

Source: MMDA

FIGURE 15.2-1 RFID CHECKPOINT LOCATION

(2) Data Processing

- The central server processes data into actual travel time.
- When enough historical data are compiled, accurate travel time is estimated by day of a week or a month.

(3) Bus Travel Time Information Provision

Travel time information is provided by various means of communication as follows;

- Trough text message of mobile phones

- Through smart phones
- Through internet
- Through existing LED VMS
- Through VMS at bus stops
- Through monitor inside a bus

(4) Equipment to be Used

Under this pilot project, the following equipment is used;

TABLE 15.2-1 EQUIPMENT LIST

Equipment	Unit Price (Php)	Quantity
a) RFID Tag	90	4,000
b) RFID Antenna	87,000	12
c) Sham Traffic Lane Control Unit	350,000	12
d) Analysis Processor (server and software)	6,500.000	1

Source: JICA Study Team

VMS at bus stops and monitors inside a bus will be installed after this Pilot Project.

15.3. IMPLEMENTING AGENCY AND SCHEDULE

The implementing agency is MMDA. The implementing schedule is estimated at one (1) year including post system impact evaluation period.

15.4. ESTIMATED COST

The system installation cost is estimated at 12.9 Million Pesos.

15.5. POSSIBILITY OF FUTURE EXPANSION OF THE SYSTEM

The proposed system has a great possibility for future expansion in various ways as follows;

- Can be expanded to all other bus routes in Metro Manila.
- Can be used for surveillance and control of illegal bus operation.
- Can be applied to other urban centers in the Philippines as well as mega-cities in other countries under the same situation.
- When the system is expanded to cars, the system can be utilized for “Road Pricing”.

TABLE 15.3-1 IMPLEMENTATION SCHEDULE

Activity	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Basic Study												
Tender Documents Preparation												
Bidding												
Installation of System												
Post Evaluation												

Source: JICA Study Team

TABLE 15.4-1 SYSTEM INSTALLATION COST

Item	Unit	Quantity	Unit Price (Php)	Cost (Php)
RFID Tag	pcs	4,000	90.00	360,000.00
RFID Antenna	set	12	87,000.00	1,044,000.00
Sham Traffic Lane Control Unit	set	12	350,000.00	4,200,000.00
Installation	set	12	65,000.00	780,000.00
Travle Time Prediction Analysis Processor	L.S	1	6,500,000.00	6,500,000.00
Total				**12,884,000.00**

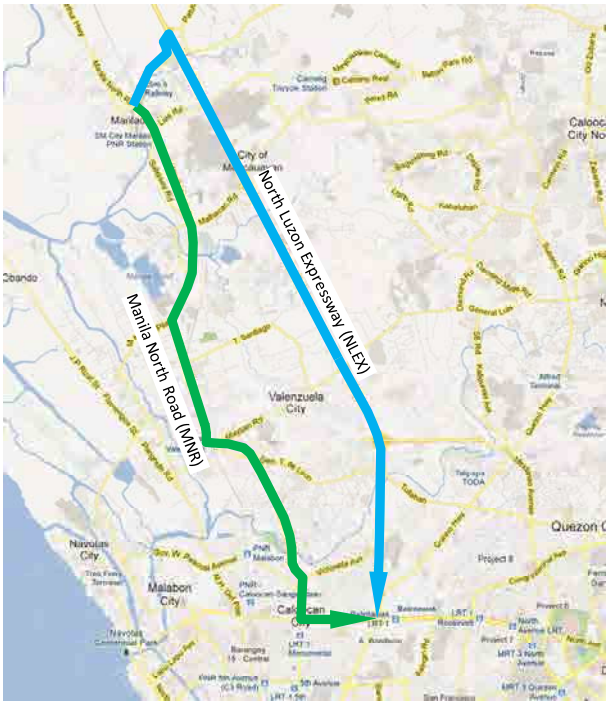
Source: JICA Study Team

16. TRAFFIC INFORMATION PROVISION SYSTEM ALONG MANILA NORTH ROAD AND NORTH LUZON EXPRESSWAY.

16.1. OBJECTIVE

This pilot project is one of candidate for "Experimental Project".

To confirm and validate the advantageous effect of providing travel time information to travelers along MNR/NLEX corridor. What we expect is dispersal behavior of traffic demand from Manila North Road (MNR) to North Luzon Expressway (NLEX).



Source: JICA Study Team

FIGURE 16.1-1 TARGET AREA (ROADS) OF PROJECT

16.2. SCOPE AREA AND ROUTE

MNR and NLEX

MNR and NLEX are located almost in parallel in one traffic corridor.

Information Provision at about 15km from EDSA

In case of Long-trip, driver will use NLEX. Therefore, Short-trip is targeted for the project

Road traffic conditions of MNR and NLEX is summarized below.

(1) Road and Traffic Condition along MNR

Heavy Roadside Friction

- Illegal parking
- Loading/Unloading of Jeepney
- Disturbed by road crossing vehicle / pedestrian etc

Construction Work

- Construction work is implemented even during peak hours; it must be conducted during off-peak hours for reduction of traffic congestions.

(2) Road and Traffic condition along NLEX

Full-access controlled Road

- NLEX is full access controlled, therefore the cause of speed reduction is very minimal.

Flat road surface

- Comparatively higher Level of road maintenance.

Traffic Information Provision

- NLEX collects traffic data via loop coil vehicle detectors and provides information by using VMS and SNS.

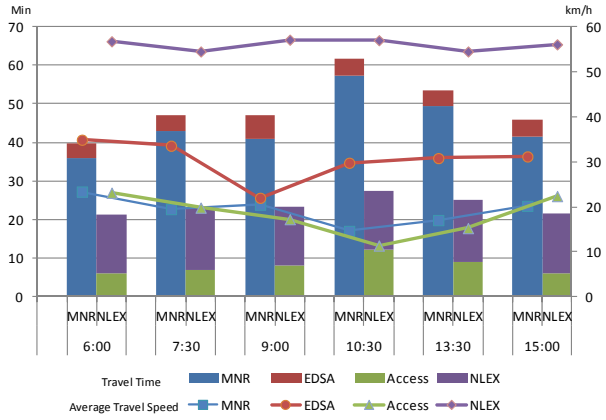
16.3. TRAVEL TIME SURVEY BY FLOATING CAR DATA (COMPARISON WITH MNR AND NLEX)

For understanding of travel time difference

between MNR and NLEX, the Study Team conducted the travel time survey by FCD (Floating Car Data), using GPS tracking device.

The survey was done for the measurement of travel times for both cases using MNR and NLEX when driving a route starting from Marilao on MNR and ending at Balintawak at EDSA (Epifanio de los Santos Avenue).

- The travel time of NLEX is shorter by "18-34 minutes" than to MNR.
- NLEX has secured the higher reliability of travel time.



Source: JICA Study Team

FIGURE 16.3-1 COMPARISON OF TRAVEL TIME AND AVERAGE SPEED

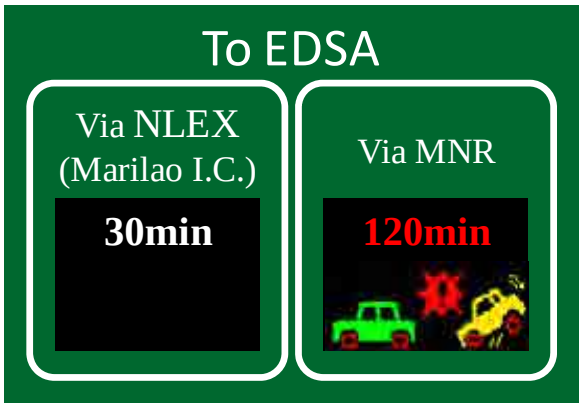
16.4. PROJECT OUTLINE

(1) Collection of traffic volume and travel speed along MNR and NLEX

- Travel time is predicted from the traffic data such as traffic volume and travel speed, therefore collection of traffic data is very important for this project.
- Data of NLEX is already being collected therefore, the collaboration between DPWH and NLEX is most important for the implementation of this project.

(2) Travel Time Provision using VMS

Driver could choose the optimal route to his Destination with reference to travel time, travel fee, punctuality, reliability, safety and so on. **Figure 16.4-1** shows the image of VMS at north of Marilao intersection on MNR.

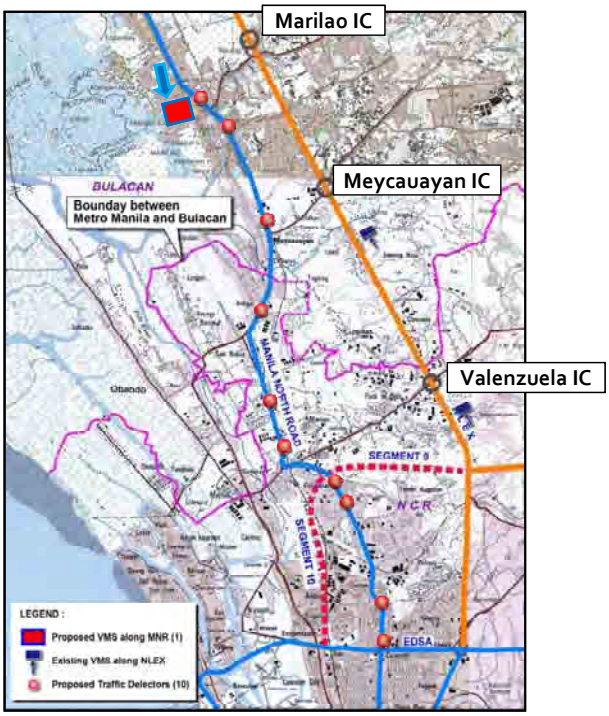


Source: JICA Study Team

FIGURE 16.4-1 TRAVEL TIME INFORMATION PROVISION IMAGE

(3) Location of RSU (Roadside Unit)

- Install the vehicle detector (Supersonic type), 10 unit with CCTV camera.
- Install the VMS, 1 unit at north of Marilao intersection on MNR.



Source: JICA Study Team

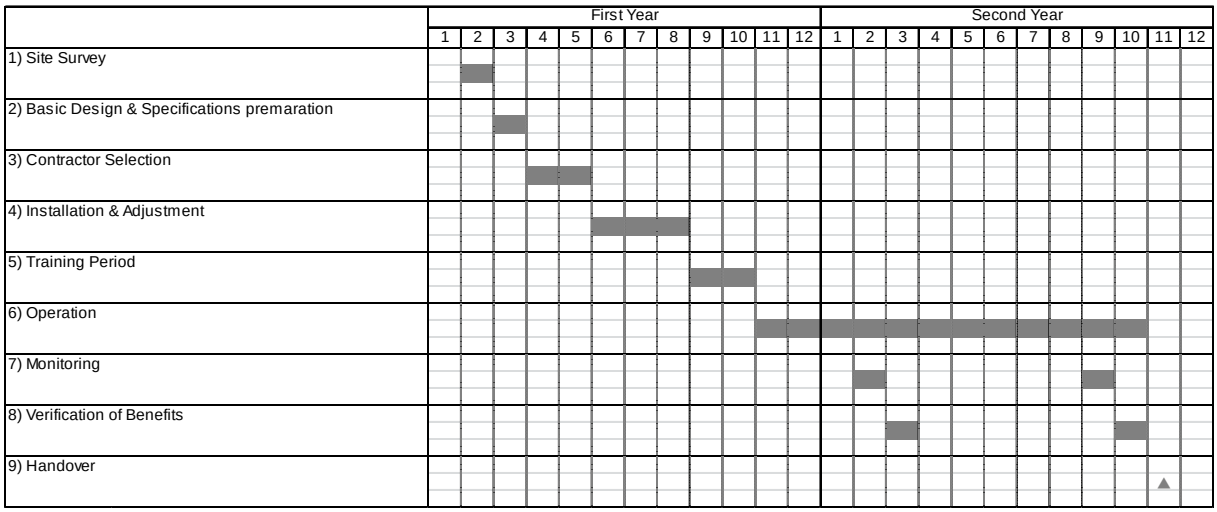
FIGURE 16.4-2 EQUIPMENT ARRANGEMENT PLAN

16.5. IMPLEMENTING AGENCY AND SCHEDULE

The implementing agency is DPWH however shall be corroborated with NLEX and MMDA for the implementation fruitfully.

The implementation schedule is show in **Table 16.5-1**.

TABLE 16.5-1 PROPOSED IMPLEMENTATION TABLE



Source: JICA Study Team

16.6. ESTIMATED COST

The system installation cost is estimated at 15.02 Million Pesos.

16.7. EFFECT AND IMPACT OF PROJECT

Impact of introduction of information provision was conducted with respect to NLEX and North Manila Road (NMR).

TABLE 16.7-1 TRAVEL TIME SAVING EFFECT OF TRAFFIC SHIFTING FROM MNR TO NLEX

Average TT Saving (minutes/trip/PCU)	TT Saving per Day (minutes/day)	TT Saving per Year (minutes/day)
25.6	14,515	3,628,800

Source: JICA Study Team

16.8. ECONOMIC EVALUATION

TABLE 16.8-1 MAJOR RESULTS OF ECONOMIC EVALUATION OF TRAFFIC INFORMATION PROVISION SYSTEM

EIRR (%)	NPV (Php. million)	B/C
161.5	102	4.4

Source: JICA Study Team

As seen from the above table, EIRR is far above the value of SDR (15%), and the values of NPV and B/C also exceed their respective threshold levels, showing that the economic effect of this project will be exceptionally good.

17. STANDARDIZATION OF ETC

17.1. WHY STANDARDIZATION IS NEEDED?

(1) Low Penetration Rate of ETC Users

- Current penetration rate of ETC users is low at about 35% only.

(2) High Cost of On-Board-Unit (OBU)

- Current OBU cost ranges from 1,400 ~ 2,000 pesos.
- About 60% of toll road users answered to the Study Team's survey that they are willing to use ETC if OBU cost is less than 1,000 pesos.

(3) Expected Problems in the Near Future

- Various expressways will be built in the near future and expressway network will be formed.
- Many expressways will be short in distance.
- If expressway users have to stop at each expressway entrance, travel time is lost and faster/seamless travel on expressways will be affected.
- Some expressways to be constructed in the central area of Metro Manila will encounter ROW acquisition difficulty, therefore, number of toll booths needs to be reduced as much as possible.

(4) ETC Users Problems in the Near Future

- ETC users have to buy many OBUs which will discourage promotion of ETC utilization
- ETC users will have a hard time to remember how much remains in each expressway OBU, since mostly prepaid system.
- Many troubles of insufficient remaining balance in OBU at a toll booth will occur and efficiency of ETC will be lost.

(5) Problems on the Part of the Concessionaire

- On the part of the Concessionaires, they need additional investment for the toll barrier, if ETC system is NOT Standardized.
- Penetration rate of ETC users will remain low, thus the operators have to rely on cash-lanes operation. They will encounter high operation cost.

17.2. WHAT ARE THE PROBLEMS, IF STANDARDIZATION IS IMPLEMENTED?

(1) On the part of Concessionaires

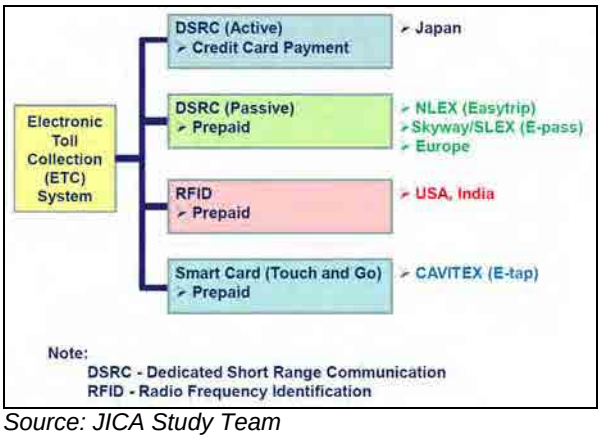
- Existing system needs to be removed and standardized system needs to be newly installed.
- Clearing House needs to be established to distribute toll incomes to respective Concessionaire.

(2) On the part of Expressway Users

- OBU currently being used to be cancelled and standardized OBU has to be purchased.

17.3. ETC IN THE WORLD

Currently, ETC has been operating in the world and various types of ETC exist due to the difference of wireless communication method between Roadside Antenna.



Source: JICA Study Team

FIGURE 17.3-1 ETC IN THE WORLD

17.4. COMPARISON OF CHARACTERISTICS OF ETC SYSTEM

Characteristics of each ETC system is summarized in **Table 17.4-1**.

TABLE 17.4-1 SUMMARY OF CHARACTERISTICS OF ETC SYSTEM

		DSRC Active	DSRC Passive	RFID	Smart Card
Applicability to Toll system		• Flat rate • Distance based	• Flat rate • Distance based	• Flat rate (Note-1)	• Flat rate • Distance based
Technical Specification	International standard	ITU-R M.1453 ISO15628	ITU-R M.1453 ISO15628	ISO18000-6C	ISO14443 type-A (Note-2)
	Frequency of band	5.8GHz	5.8GHz	915MHz (USA)	13.56MHz
	Data communication speed	Down link 1,024Kbps Up link 1,024Kbps	Down link 500Kbps Up link 250Kbps	Max. 512Kbps	Vehicle stops until transaction is completed
	OBU Type	2 Pieces (OBU+IC card)	1 Piece (OBU)	1 Piece (OBU)	IC-Card
	OBU Durability	Long	OBU needs to be replaced after 4~5 years	Long	Long
Accuracy of System	Communication reliability (in specification)	99.9999% (Japan)	99.5% (NLEX)	99.5% (India)	N/A
	Average communication error ratio (actuality)	0.007%	0.3%	N/A	N/A
	Communication errors for 100,000 transactions	7	300	500	N/A
Operation	User Payment Method	Post payment (Credit Card) & Prepaid	Prepaid	Prepaid	Prepaid
	Balance information Recorded at	IC card & Center	Center	Center	IC card & Center
	Updating Speed of Balance after Exit or Reloading	Instantly	After some minutes (Usually 25 min. or more, depend on system design)	After some minutes (Usually 25 min. or more, depend on system design)	Instantly
	Other payment method in the case of OBU or RSA problem	IC card & Cash	Cash	Cash	IC card & Cash
Cost	Facility cost (Operator's cost)	Medium	Medium	Medium	Low
	OBU price (PHP) (User's cost)	About 2,000	1,400～1,700	50～75	100
Vehicle Speed at ETC lane		30～40km/h	0～10km/h	0～5km/h	Vehicle has to stop
Other Usages such as at railways, restaurants, etc.		Possible (IC card can be used for other purpose)	No (No IC card)	No (No IC card)	Possible (IC card can be used for other purpose)

Note-1: Can be applicable for a distance based toll system, though there is not an achievement.
Note-2: Type-B and Felica can also be applicable.
Source: JICA Study Team

17.5. SELECTION OF STANDARD ETC SYSTEM

First Stage

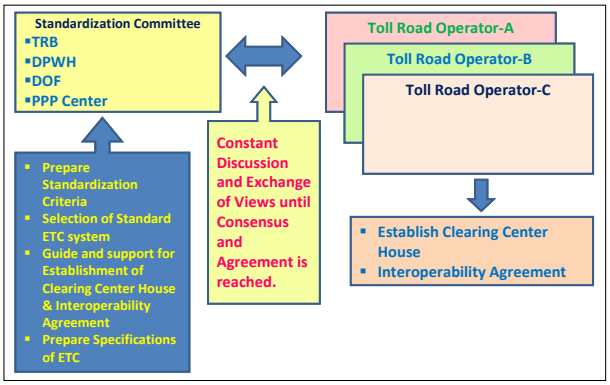
- Most important thing is to drastically increase ETC users penetration rate from present 35% to 80 – 90%.
- Present bottleneck for the low penetration rate is the price of OBU. OBU cost of RFID and Smart Card (Touch and Go) is 100 pesos or less. Therefore, if one of them is selected as a Standard ETC System, ETC users penetration rate will be drastically improved.
- Another factor to be considered is IC card utilization. IC card will be drastically used for multi-purpose payments such as rail fare payment, payment at gas stations, restaurants, parking lots, convenient stores, etc. Toll fee payment should be one of them, therefore, ETC system which uses IC card should be selected.
- Considering OBU price and IC card usage, Smart Card (or Touch & Go) is the strong candidate for the first step ETC system.
- Although in case of Smart Card (or Touch & Go) system, all vehicles have to stop at a toll booth, transaction at a toll booth is much faster than cash payment. Also, DSRC-passive-system users are frequently stopping at a toll booth at present, thus, efficiency of Smart Card System is not so bad compared to DSRC-passive-system.
- One problem of Smart Card (or Touch & Go System) is very limited money loading stations. Money loading at a toll booth should be eliminated.

Second Stage

- Time will come to improve ETC lane efficiency with the increase of traffic, or non-stop operation at ETC lanes.
- When such time comes, it is recommended to adopt "non-stop operation" ETC system which is DSRC-active ETC system with IC card.
- It is expected that OBU price will be much reduced than at present and income level of ETC users will be improved and capable of spending for OBU.

17.6. HOW TO REALIZE STANDARDIZATION OF ETC

TRB and DPWH must firmly decide the standardization of ETC system for efficient and seamless travel on expressways. TRB and DPWH in collaboration with DOF and PPP Center should create a "Standardization Committee"



Source: JICA Study Team

FIGURE 17.6-1 CREATION OF STANDARDIZATION COMMITTEE

18. RECOMMENDATIONS

1. Firm Commitment of the Government to Implement the Master Plan

This Master Plan was jointly prepared by DPWH/MMDA and JICA, with the participation of DOTC, NEDA, TRB and UP-NCTS. The Government, especially DPWH and MMDA should firmly COMMIT to implement the ITS projects recommended by the Master Plan.

2. Collaborated Development of Transport Infrastructure and ITS Projects for Mitigation of Mega Manila Transport Problems

The Government should also pursue the software solutions represented by ITS projects in collaboration with transport infrastructure project. ITS projects do not require huge capital investments unlike transport infrastructure projects, still ITS projects can bring about high effects on transport efficiency improvement. The Government should pursue transport infrastructure projects simultaneously with ITS projects.

3. Active Implementation of ITS Projects

ITS projects bring huge impacts, thus they should be actively implemented. Although effects of ITS projects are not so visible, accumulated effects are huge. For example, in case of advanced signalization project of intersections, savings of travel time at one intersection per vehicle will be only 2 to 3 seconds, however, aggregated savings of 85 intersections will be 14,868 hours per day which will bring about 4.8 Million Php savings per day.

Above shows that ITS projects shall be actively implemented as early as possible.

4. For Sustainable ITS Development

1) Creation of Strong Body for ITS Promotion

Top level coordination committee composed of DPWH, DOTC, MMDA, PNP, and DOST, should be created under the Office of the President which should achieve the following:

- ITS policy formulation for ITS Development
- Inter-agency coordination/cooperation on jurisdiction/mandate issues.
- Coordination to avoid overlapped investment.

2) Institutional Arrangement

- For integration of traffic information and provision
- For effective public transport monitoring
- For toll road interoperability and standardization of ETC system
- For promotion of private sector initiative

5. Strengthening of Driver/Pedestrian Education and Enforcement of Traffic Rules and Regulations

Infrastructure development and ITS technology application alone will not perfectly solve traffic problems. To achieve smoother traffic and safer travel, education of drivers/pedestrians and enforcement of traffic rules and regulations must be simultaneously implemented.

6. Capacity Development of DPWH and MMDA

Past and current DPWH's direction is highly "construction-oriented", thus application of ITS

technology for the road sector has not been so much focused yet. It is high time for DPWH to seriously consider ITS technology for traffic management, road management, information provision for road construction/maintenance works, road closure due to natural calamity, etc. Capacity development of DPWH staff should be made through implementation of projects recommended by this Master Plan.

Although MMDA is one of the most advanced agencies in ITS application, MMDA should still consider capacity development for ITS technology; more staff should gain capacity on ITS technology. Capacity development of more staff should be done through implementation of on-going and future projects.

7. Recommendations on Pilot Projects

1) Phase III of Metro Manila Traffic Signal Control Project

To complete the on-going upgrading of the existing traffic signal controlled intersection (150 intersections) and to traffic signal controlization of currently non-signal controlled intersection (212 intersections), this project should be implemented in succession with Phase II. The project is highly economically feasible, and contributes for reduction of CO2 emission (global warming problem) and improvement of traffic safety.

Implementing agency is MMDA.

2) Traffic Signal Control Project of Bicutan and Sucat Intersections

Sucat and Bicutan intersections are quite complicated intersections with many conflicts of traffic movement. These are currently controlled manually. These intersections should be controlled utilizing latest technologies to achieve smoother traffic flow, and to reduce the potential of traffic accidents.

The Government decided quite recently to establish a temporary integrated bus terminal near Bicutan intersection which will totally change traffic movement, thus traffic signalization at Bicutan should be implemented after assessing traffic movements of a temporary integrated bus terminal. It is recommended that signalization of Sucat Intersection should be implemented first. The experience of Sucat Intersection should be reflected to Bicutan Intersection.

The project is proposed as one of the candidate of “Experimental Project”. Implementing agency is MMDA in collaboration with Paranaque City and Skyway operator.

3) Metro Manila Route Guidance

MMDA launched the Metro Manila Traffic Navigator (TNAV) in 2011. MMDA is developing the second generation of TNAV which is called Automated Traffic Navigator (ATNAV). MMDA is planning to use floating-car-data (FCD) to minimize roadside equipment. This approach is exactly in line with the global trend.

Route Guidance System constitutes an important part of ATNAV. Various recommendations made by this Master Plan should be reflected in the development of ATNAV which should be launched as soon as possible.

Implementing agency is MMDA.

4) RFID-based EDSA Bus Travel Time Information Provision System

EDSA is the most important thoroughfare in

Metro Manila. More than 330,000 bus passengers and 400,000 ~ 500,000 MRT-3 passengers are relying on this thoroughfare for their daily trips. To provide bus travel time information to public transport passengers will greatly improve the convenience of public transport passengers and contribute to traffic congestion mitigation. In a long run, car passengers will shift to bus transport which also contributes the reduction of overall traffic problems in Metro Manila. This pilot project should be implemented as soon as possible as a top priority project.

Implementing agency is MMDA and this project is the current top priority project of MMDA.

5) Traffic Information System Along Manila North Road (MNR) and North Luzon Expressway (NLEX)

MNR and NLEX run almost parallel with each other and located in the one traffic corridor. This project was proposed as one of the candidates of "Experimental Project". This project will examine the effects of a traffic information system and if successful, the similar system should also be adopted for the other traffic corridors.

Implementing agency is DPWH in collaboration with NLEx Operator and TRB.

6) Standardization of ETC

The Government is pursuing development of toll expressway network which will be realized in the near future. `Standardization of ETC system is required to achieve seamless travel on all toll expressways. TRB and DPWH should take initiative for this issue, although it is not easy to realize the standardization because of different opinions of toll operators. Continuous dialogue among TRB, DPWH and toll operators will be definitely needed until consensus will be created.

8. To Cope with Rapid Development of Information / Communication Technology (ICT)

Innovation of Information/Communication Technology is rapidly progressing day by day. Application of latest technology should be always seeked, thus ITS technology adopted initially should be reviewed and updated. Likewise, this Master Plan should be reviewed at every 5-6 years and updated regularly.

9. Creation of ITS-Philippines

ITS-Philippines should be created as soon as possible and ITS technology, standardization and ITS applications should be jointly promoted by the public sector, the private sector and the academic sector.

10. Preparation of ITS Master Plan for Other Areas of the Philippines

ITS Master Plan should be also prepared for other areas of the Philippines such as regional urban centers, strategically important provinces, etc., reflecting characteristics of each area to improve transport efficiency.