JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS (DPWH)
THE REPUBLIC OF THE PHILIPPINES

No.

The Development of The Public-private Partnership Technique for The Metro Manila Urban Expressway Network

FINAL REPORT

Volume I:
MAIN TEXT

March 2003

ALMEC Corporation

NIPPON KOEI Co., Ltd.

SSF
JR
03-49

The exchange rate used in the report is

J. Yen 119.2 = US$ 1 = Philippine Peso 50.50
J. Yen 1 = Philippine Peso 0.4237
(selling rate of the Philippine Central Bank as of July 2002)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS (DPWH)
THE REPUBLIC OF THE PHILIPPINES

The Development of The Public-private Partnership Technique for The Metro Manila Urban Expressway Network

FINAL REPORT

Volume I: MAIN TEXT

March 2003

ALMEC Corporation

NIPPON KOEI Co., Ltd.

PREFACE

In response to the request from the Government of the Republic of the Philippines, the Government of Japan decided to conduct a masterplan study of the Development of the Public-Private Partnership Technique for the Metro Manila Urban Expressway Network and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team consisting of ALMEC Corporation and NIPPON KOEI headed by Mr. Tetsuo Wakui of ALMEC Corporation to the Philippines from December 2001 to March 2003. In addition, JICA set up an advisory committee headed by Mr. Tadashi Okutani of the Ministry of Land, Infrastructure and Transport between December 2001 and March 2003, which examined the study from specialist and technical points of view.

The team made a careful review of past studies and experiences in urban expressway projects, conducted transportation demand forecast and economic/financial analyses; and, through a series of discussions with the officials concerned of the Government of the Philippines, reached the conclusions in this final report.

I hope that this report will contribute to the improvement of traffic conditions in the Metropolitan Region through acceleration of urban expressway network development.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Philippines for their close cooperation extended to the study team.

March 2003

Takao Kawakami
President
Japan International Cooperation Agency

March 2003

Mr. Takao Kawakami
President
Japan International Cooperation Agency

Letter of Transmittal

Dear Sir,

We are pleased to formally submit herewith the final report of "The Development of the Public-Private Partnership Technique for the Metro Manila Urban Expressway Network".

This report compiles the results of the study which was undertaken both in the Philippines and Japan, jointly by the study team organized by ALMEC Corporation & Nippon Koei and the Philippine Counterpart Team, from December 2001 to March 2003.

We owed a lot to many people for the accomplishment of this report. First, we would like to express our sincere appreciation to all those who extended their kind assistance and cooperation to the study team, in particular, the BOT Project Management Office of the Department of Public Works and Highways.

We also acknowledge the officials of your agencies, especially the members of the Steering Committee, the JICA Advisory Committee and the Embassy of Japan in the Philippines for their valuable advice and cooperation given to us throughout the course of the study.

We wish the report would contribute to development of the Metro Manila urban expressway network to solve traffic problems in the National Capital Region.

Very truly yours,

Tetsuo Wakui
Team Leader,
The Study Team for the Development of the Public-Private Partnership Technique for the Metro Manila Urban Expressway Network

TABLE OF CONTENTS

Volume I : Main Text
Volume II : Bidding Documents

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

AASHTO	American Association of State Highways and Officials
ADB	Asian Development Bank
APEC	Asia-Pacific Economic Cooperation
AVC	Automated Vehicle Classification
BCDA	Bases Conversion and Development Authority
BOI	Board of Investment
BOO	Build-Own-Operate
BOT	Build-Operate-Transfer
BOT PMO	BOT Project Management Office
BT	Build-Transfer
BTO	Build-Transfer-Operate
CA	Concession Agreement
CBD	Central Business District
CCPSP	Coordinating Council for Private Sector Participation
CCTV	Closed Circuit Television
CDCP	Construction Development Corporation of the Philippines
CMMTC	Citra Metro Manila Tollways Corporation
COA	Commission on Audit
DAO	Department Administrative Order
DBFO	Design-Build-Finance-Operate
DBM	Department of Budget and Management
DENR	Department of Environment and Natural Resources
DIS	Driver Information System
DOF	Department of Finance
DOTC	Department of Transportation and Communication
DPWH	Department of Public Works and Highways
DSRC	Dedicated Short-range Communication
ECA	Environmentally Critical Area
ECC	Environmental Compliance Certificate
ECP	Environmentally Critical Project
EFC	Electronic Fee Collection
EIA	Environmental Impact Assessment
EIAPO	EIA Project Office
EIS	Environmental Impact Statement
ERA	Environmental Risk Assessment
ETC	Electronic Toll Collection
FIRR	Financial Internal Rate of Return
FPIDC	First Philippine Infrastructure Development Corporation
GOCC	Government-owned and Controlled Corporation

GOP	Government of the Philippines
GRDP	Gross Regional Domestic Product
HOV	High-occupancy Vehicle
IBRD	International Bank for Reconstruction & Development
ICC	Investment Coordinating Council
ICT	Information and Communication Technology
IEE	Initial Environmental Examination
IP	Internet Protocol
ISO	International Standards Organization
ITS	Intelligent Transportation System
ITU	International Telecommunication Union
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
JV	Joint Venture
JVA	Joint Venture Agreement
LAN	Local Area Network
LBCR	Laguna de Bay Coastal Road
LED	Light Emitting Diodes
LGU	Local Government Unit
LRTA	Light Rail Transit Authority
MBE	Manila Bay Expressway
MCCRRP	Manila-Cavite Coastal Road and Reclamation Project
MCTE	Manila-Cavite Toll Expressway
MCTEP	Manila-Cavite Toll Expressway Project
MICT	Manila International Container Terminal
MMDA	Metropolitan Manila Development Authority
MMS	Metro Manila Skyway
MMUEN	Metro Manila Urban Expressway Network
MMUES	Metro Manila Urban Expressway System
MMUTIS	Metro Manila Urban Transportation Integrated Study
MNT	Manila North Tollway
MNTC	Manila North Tollways Corporation
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MPWH	Ministry of Public Works and Highways
MRT	Metro Rail Transit
MSOM	Minimum Standards for Operation and Maintenance
MTDP	Medium-term Development Plan
NAIA	Ninoy Aquino International Airport
NCR	National Capital Region

NEDA	National Economic and Development Authority
NEDA-ICC	NEDA Investment Coordinating Council
NHA	National Housing Authority
NLE	North Luzon Expressway
NLEE	North Luzon Expressway East
NTTP	National Transport Planning Project
O&M	Operation and Maintenance
OD	Origin-Destination
OBU	On-board Unit
ODA	Official Development Assistance
OGCC	Office of the Government Corporate Counsel
OP	Office of the President
OSG	Office of the Solicitor General
OSI	Open System Interconnection
Pasex	Pasig Expressway
PBAC	Prequalification, Bids and Awards Committee
PCU	Passenger Car Unit
PD	Presidential Decree
PEA	Public Estates Authority
PEATC	PEA Tollways Corporation
PFI	Private Finance Initiative
PNCC	Philippine National Construction Corporation
PNP	Philippine National Police
PNR	Philippine National Railway
PPA	Philippine Ports Authority
PPP	Public-private Partnership
PSP	Private Sector Participation
RA	Republic Act
RBIA	Road and Bridge Information Applications
RC	Reinforced Concrete
RIMMS	Road Information and Management Support System
ROI	Return on Investment
RORB	Rate of Return on Base
ROW	Right of Way
RSU	Roadside Unit
SERTI	Southern European Road Telematics Implementation
SIDC	STAR Infrastructure Development Corporation
SLE	South Luzon Expressway
SMDRP	Smoky Mountain Development and Reclamation Project
SMS	Short Message Service

STAR	Southern Tagalog Arterial Road
STOA	Supplemental Toll Operation Agreement
TCA	Toll Concession Agreement
TEAM	Traffic Engineering and Management
TEC	Traffic Engineering Center
TERN	Trans-European Road Network
TICS	Transport Information and Control System
TIS	Traffic Information System
TMSD	Traffic Management and Security Department
TOC	Toll Operating Certificate
TOMMP	Toll Operation and Maintenance Manual and Procedures
TRB	Toll Regulatory Board
TSSD	Traffic Safety and Security Department
TTC	Travel Time Cost
UPTTC	University of the Philippines Transport Training Center
URPO	Urban Roads Project Office
VMS	Variable Message Sign
VOC	Vehicle Operating Cost
WB	World Bank
WIM	Weigh in Motion
WTP	Willingness to Pay

FINAL REPORT

Main Text

INTRODUCTION

Study Background

The rapid growth of Metro Manila has caused a number of serious urban problems. In particular, the widespread traffic congestion due to poor transport infrastructure and traffic management is regarded as one of the biggest obstacles for the metropolis to attain a sustainable development toward a better living environment. It is reported that 2-3% of Metro Manila's gross domestic regional product (GRDP) is lost due to traffic congestion.

In 1993, the Japan International Cooperation Agency (JICA) conducted the Metro Manila Urban Expressway System Study (MMUES) to establish a master plan for the development of an urban expressway network as well as to determine the priority of the proposed projects. In addition, in 1999, JICA carried out an integrated transport master plan study, titled the Metro Manila Urban Transportation Integration Study (MMUTIS), of which a part was a refined plan for the development of an urban expressway system. MMUTIS emphasized the importance of public-private partnership (PPP) arrangement in the development of transport infrastructure, recognizing the lack of financial capacity of the Philippine government.

Since the BOT Law was enacted in 1993, a number of privately financed expressway projects have been proposed. However, most of these projects have been delayed, if not cancelled, due to various reasons which included lack of private funds, absence of clear-cut risk-sharing principle between the public and the private sector, improper setting of toll rates, difficulties in land acquisition, and lack of coordination between government agencies.

Under these circumstances, it is most essential and urgent to establish a reasonable set of PPP rules and guidelines after reviewing current practices in order to accelerate expressway development. For this goal, role- and risk-sharing system of both sectors should be carefully studied and designed.

In addition, a traffic management standard that includes a toll collection system, a traffic information system and a road maintenance system, which at present are developed and operated independently by operators, should also be studied to enable the entire expressway network to function as an effective transport network.

Toward this end the Government of the Republic of the Philippines (GOP) requested the Government of Japan (GOJ) for technical assistance through JICA. JICA dispatched a Preparatory Study Team headed by Mr. Tadashi Okutani from 3 to 22 September 2001 to discuss technical cooperation on the development of the PPP technique for the Metro Manila expressway network with officials of the Department of Public Works and Highways (DPWH) and other concerned organizations. The Pre-Study Team likewise conducted field surveys.

In November 2001, the JICA Study Team officially started with the Study, titled "The Development of the Public-Private Partnership Technique for the Metro Manila Urban Expressway Network in the Republic of the Philippines".

Study Objectives

The objectives of the Study were as follows:

1) To establish the strategic arrangement for an optimum PPP technique for the development of Metro Manila's expressway network;
2) To formulate a standard management system for the entire urban expressway network including a toll collection system, traffic management, information management and road maintenance; and,
3) To conduct a case study of the R10/C3/R9 route in terms of road construction, operation and management using the PPP technique and through information technology.

Study Area

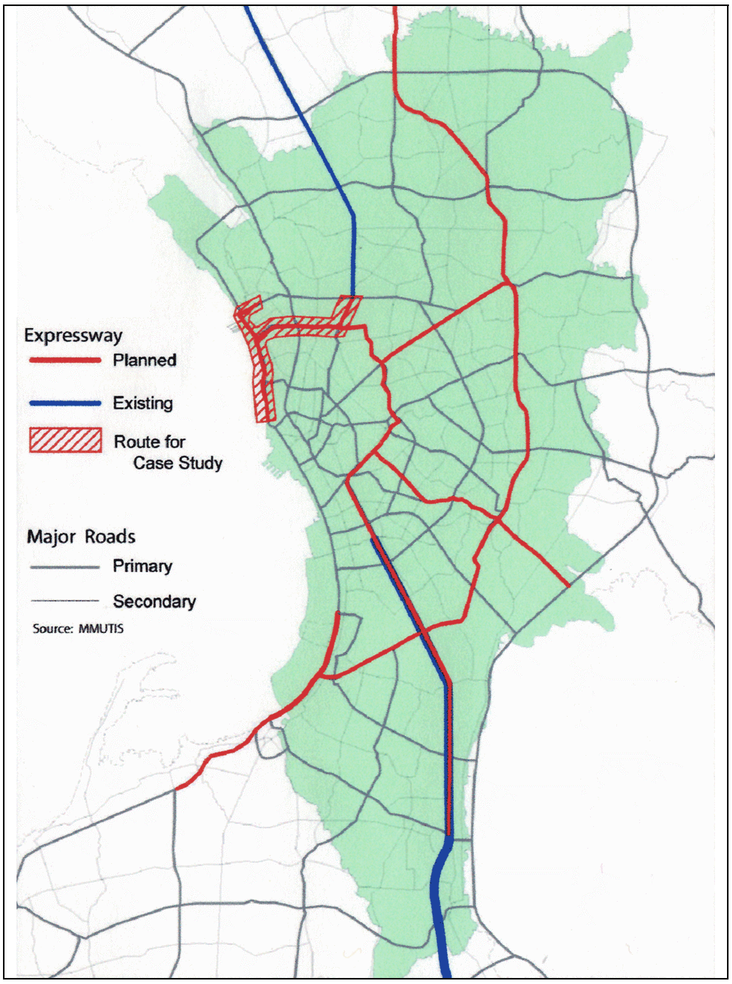
The entire Metro Manila and its adjacent areas affected by the urban expressway network shown in Figure I.1 were used as the study area. The Case Study Expressway is the U10/C3/R9 route. However, in March 2002, at the end of Stage 1 of the Study, the Study Team proposed to extend the R10 section to the north beyond the R10/C3 intersection, turning right on C4 and linking the case study expressway with Manila North Tollway (MNT) C5 Link (Phase 2) at the northern end of Dagat-dagatan Avenue. The proposal was approved and the R10/ Ct Link was included in the Case Study Expressway.

Study Framework

The study framework presented in Figure I.2 is composed of four stages. Stage 1 from January to March 2002 covered the following tasks: 1) review of road development policies of the Government, 2) analysis of existing BOT road development projects, 3) formulation of socio-economic framework, 4) survey and analysis of payable toll level, 5) conduct of transport surveys, 6) demand forecast, 7) review and assessment of existing road information systems, and 8) review of existing MMUES design.

Stage 2 from May to July 2002 focused on the development of the PPP technique and standardization of expressway management system. Specifically, this stage covered the following tasks: 1) setting of optimum toll rates, 2) demand forecast, 3) review and assessment of PPP technique, 4) cost estimate of expressway development, 5) environmental analysis, and formulation of guidelines for 6) road maintenance system, 7) road and traffic information system and 8) toll collection system.

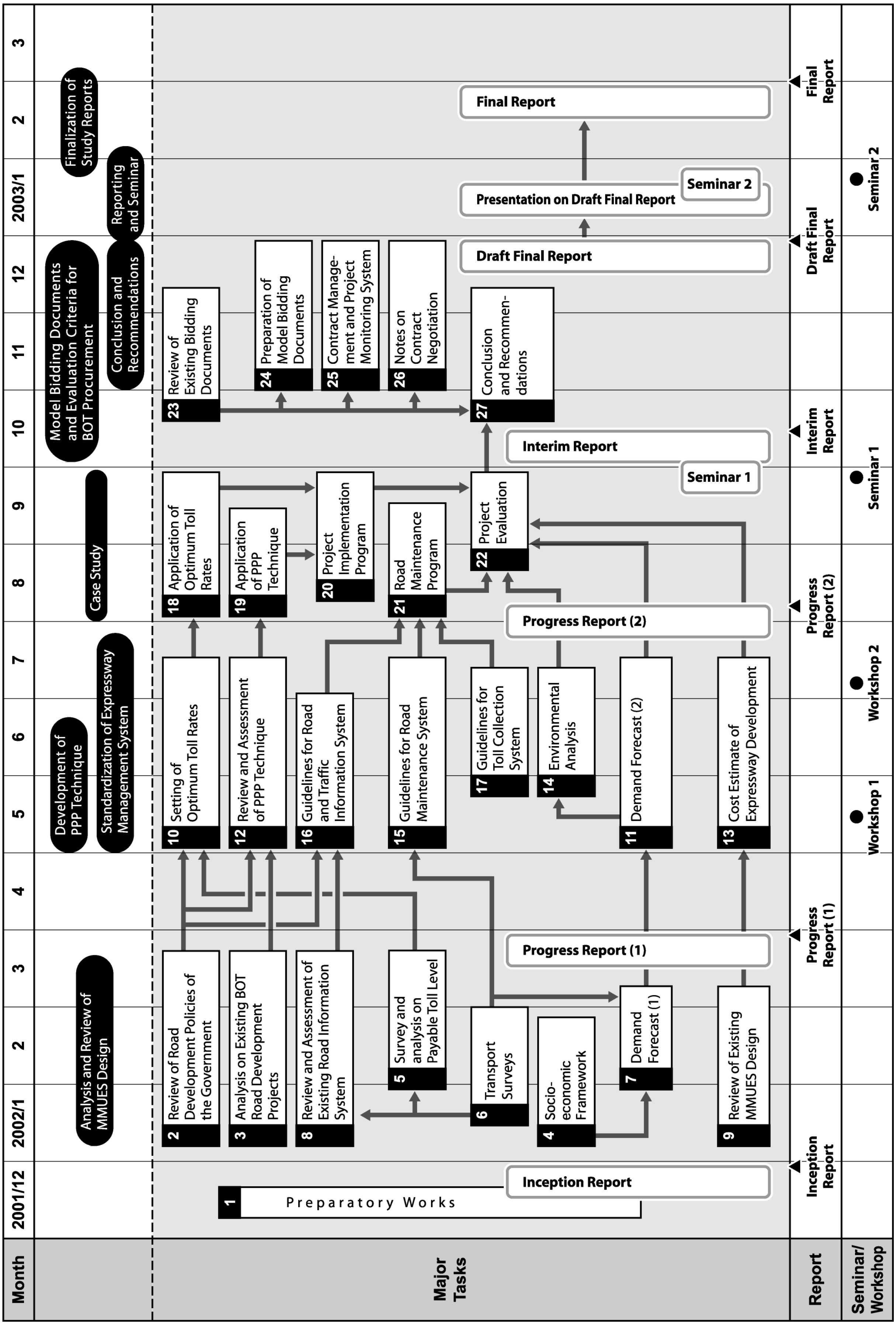
Figure I.1 Study Area



Stage 3 from August to September 2002 dealt with the Case Study Expressway (R10/C3/R9/C5 Link). During this stage the following tasks were conducted: application of 1) optimum toll rates and 2) PPP technique, preparation of a 3) project implementation program and 4) road maintenance program, and 5) project evaluation.

Stage 4 from October to December 2002 covered the following tasks: 1) review of existing bidding documents, preparation of 2) model bidding documents, 3) contract management and project monitoring system, 4) notes on contract negotiation, and 5) conclusion and recommendations. Major recommendations included the concept and principles of PPP in expressway development, guidelines to adopt the PPP technique, and its limitations, bidding procedure for PPP projects, guidelines for standardization of road/traffic information system, electronic toll collection (ETC) system, and maintenance system for expressways, and others (new legal/institutional setup, etc.)

Figure I.2 Study Framework



Study Meetings/Seminars/Workshops

The following major meetings, workshops and seminars were conducted in accordance with the study framework.

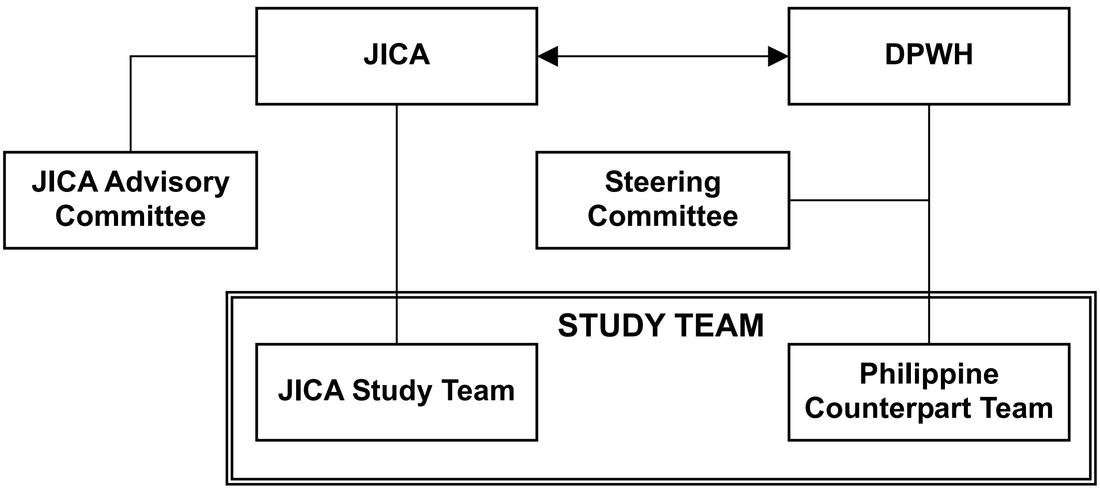
Table I.1 Major Activities Conducted, January 2002-January 2003

Date	Activity	Participants
23 January 2002	1st Steering Committee Meeting	DPWH, NEDA, MMDA, CCPSP, PPA, Caloocan City, JICA Advisory Team, Caloocan City, Malabon City, JICA Study Team
21 May 2002	2nd Steering Committee Meeting	DPWH, NEDA, MMDA, CCPSP, Caloocan City, Manila City, JICA Study Team
28 May 2002	Workshop 1	DPWH, CCPSP, TRB, DOTC, DBM, FPIDC, NEDA, CMMTC, MNTC, PEATC, Manila City, Navotas, JICA Advisory Team, JICA Study Team
6 & 8 August 2002	Workshop 2	DPWH, CCPSP, FPIDC, CMMTC, MNTC, PNCC, PNCC Skyway, PEA, JICA, TRB
11 October 2002	1st Seminar	DPWH, DOTC, NEDA, MMDA, CCPSP, TRB, PPA, Caloocan City, Navotas, Manila City, Malabon City, JICA Study Team
13 December 2002	3rd Steering Committee Meeting	DPWH, SLTC, MNTOMCO, FPIDC, MNTC, MMDA, TRANSPORTAS, TRB, NEDA, PNCC Skyway, CMMTC, DOTC, DOF, TSSP, WB. ADB, WINS Media, Business World, JICA Study Team
14 January 2003	2nd Seminar	DPWH, JICA Advisory Team, JICA Study Team, SLTC, MNTCOMCO, MNTC, MMDA, TRB, NEDA, PNCC Skyway, CMMTC, DOTC, TSSP, PPA, ADB, Taisei Corporation, Mitsui & Co., UMPC, Business World, Philippine Daily Inquirer, Embassy of Japan, Belgian Embassy, Kumagai Gumi, US Embassy, Kajima Corporation, MIAA, Spanish Commercial Office, Takenaka Corporation, Itochu Corporation, Caloocan City, Malabon City, Navotas
15 January 2003	4th Steering Committee Meeting	DPWH, DOTC, PPA, NEDA, MMDA, TRB, CCPSP, Malabon City, Caloocan City, Navotas, JICA Advisory Team, JICA Study Team

Study Organization

The study organization is composed of the JICA Advisory Committee and the JICA Study Team on the Japanese side, and the Steering Committee and the Counterpart Team on the Philippine side, as shown in Figure I.3.

Figure I.3 Study Organization



The following are the members:

JICA Advisory Committee

1)	Mr. Tadashi OKUTANI	Chairman
2)	Mr. Hitoshi HAMAJI	Member

JICA Coordinators

1)	Mr. Tomohiro ONO	JICA HQ
2)	Ms. Kiyoko ITO	JICA HQ
3)	Mr. Hiroyuki ABE	JICA Manila
4)	Mr. Takafumi YASUMOTO	JICA Manila

Embassy of Japan in Manila

1)	Mr. Shuntaro KAWAHARA	First Secretary
2)	Mr. Toshiaki MABUCHI	Second Secretary

JICA Study Team

1)	Mr. Tetsuo WAKUI	Team Leader / Transport Planning
2)	Mr. Masayoshi IWASAKI	Deputy Team Leader / PPP Technique Development 1
3)	Mr. Rene S. Santiago	PPP Technique Development (2)
4)	Mr. James A. Leather	PPP Technique Development (3)
5)	Mr. Takashi SHOYAMA	Toll Rate Setting
6)	Dr. Ian C. Espada	Transport Survey
7)	Mr. Naoshi OKAMURA	Demand Forecast
8)	Mr. Eiichi YOKOTA	Road Planning
9)	Mr. Takashi KAMETANI	Road Structure
10)	Mr. Hisatoshi NAITO	Cost Estimate
11)	Mr. Katsusuke YAMAGUCHI	Environmental Analysis
12)	Ms. Beulah E. Pallana	Relocation Planning
13)	Mr. Hajime TANAKA	Project Evaluation
14)	Mr. Akira SHIROYA	Bidding Documents Specialist (1)
15)	Mr. Paul K. B. Davis	Bidding Documents Specialist (2)
16)	Mr. Ryoichi YAMAGISHI	Deputy Team Leader / Road Information System and ETC (1)
17)	Mr. Seiya MATSUOKA	Road Information System and ETC (2)
18)	Mr. Yuichi TSUJIMOTO	Road maintenance System
19)	Mr. Bernard E. Bulman	Road and Road Facility Maintenance Technology
20)	Dr. Shizuo IWATA	Transport Policy

Steering Committee

1)	Mr. Teodoro Encarnacion	Chairman	Undersecretary, Department of Public Works and Highways
2)	Mr. George D. Esguerra Mr. Robert R. Castanares	Co-Chairman	Former Assistant Secretary Current Assistant Secretary Department of Transportation and Communication
3)	Mr. Noel Eli Kintanar	Member	Executive Director, Coordinating Council for Private Sector Participation
4)	Mr. Dante Canlas Mr. Romulo Neri	Member	Former General Manager Current General Manager National Economic and Development Authority
5)	Mr. Ramon Dumaual	Member	Division Chief, Toll Regulatory Board
6)	Ms. Cora Cruz	Member	Assistant General Manager, Metropolitan Manila Development Authority
7)	Mr. Godofredo Z. Galano	Member	Director, BOT-PMO, Department of Public Works and Highways
8)	Ms. Linda Templo	Member	Director, Planning Service, Department of Public Works and Highways
9)	Mr. Joji NAKANO	Member	JICA Expert, Planning Service, Department of Public Works and Highways
10)	Mr. Roberto C. Aquino	Member	Division Manager, Philippine Ports Authority
11)	Mr. Reynaldo Malonzo	Member	Mayor, City of Caloocan
12)	Mr. Lito Atienza	Member	Mayor, City of Manila
13)	Mr. Amado Vicencio	Member	Mayor, Malabon City
14)	Mr. Tobias Reynald Tiangco	Member	Mayor, Municipality of Navotas

Philippine Counterpart Team

1)	Mr. Godofredo Z. Galano	Director, BOT-PMO Department of Public Works and Highways
2)	Mr. Florencio Rey Alano	Engineer IV, BOT-PMO Department of Public Works and Highways
3)	Ms. Bienvenida Fermalino	Project Manager III, BOT-PMO Department of Public Works and Highways

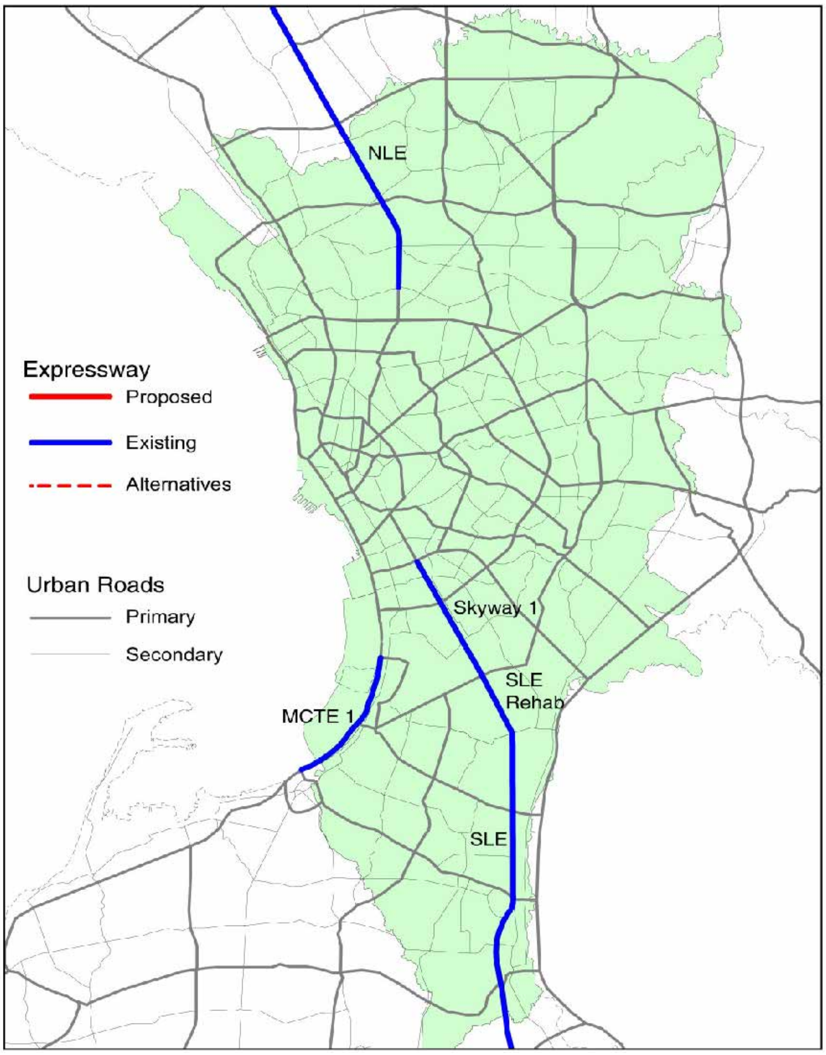
1 THE METRO MANILA URBAN EXPRESSWAY NETWORK

This chapter aims to provide a detailed description and analysis of the Metro Manila Urban Expressway Network (MMUEN). Sections 1.1 and 1.2 describe the existing and future expressways of Metro Manila and outline the projects that will compose the MMUEN. Section 1.3 discusses the characteristics of the future demand for the MMUEN as well as the nature and degree of interrelationships of the MMUEN's components. Section 1.4 discusses the financial aspects of the MMUEN. Section 5 analyzes the issue of toll rate affordability.

1.1 Existing Expressways in Metro Manila

There are four toll roads operating in Metro Manila: the North Luzon Expressway (NLE), the South Luzon Expressway (SLE), the Metro Manila Skyway (Skyway 1) and the Manila-Cavite Toll Expressway (MCTE 1) (see Figure 1.1) with a total length of 161.4 km. The NLE and the SLE have characteristics of a suburban or an intercity expressway rather than an urban expressway. They were constructed in the 1970s with government funding partially financed by the World Bank (WB) and currently operated and maintained by the Philippine National Construction Corporation (PNCC). On the other hand, the Skyway 1 and the MCTE 1 were recently developed using PPP schemes. Skyway 1 opened 6.6-km elevated expressway in 1998 by the Citra Metro Manila Tollways Corporation (CMMTC). The MCTE is a 6.6-km toll road which opened on the same year through a joint venture (JV) between the Renong Group and the Public Estates Authority (PEA).

Figure 1.1 Existing Expressways in Metro Manila



1.2 Future Expressway Network

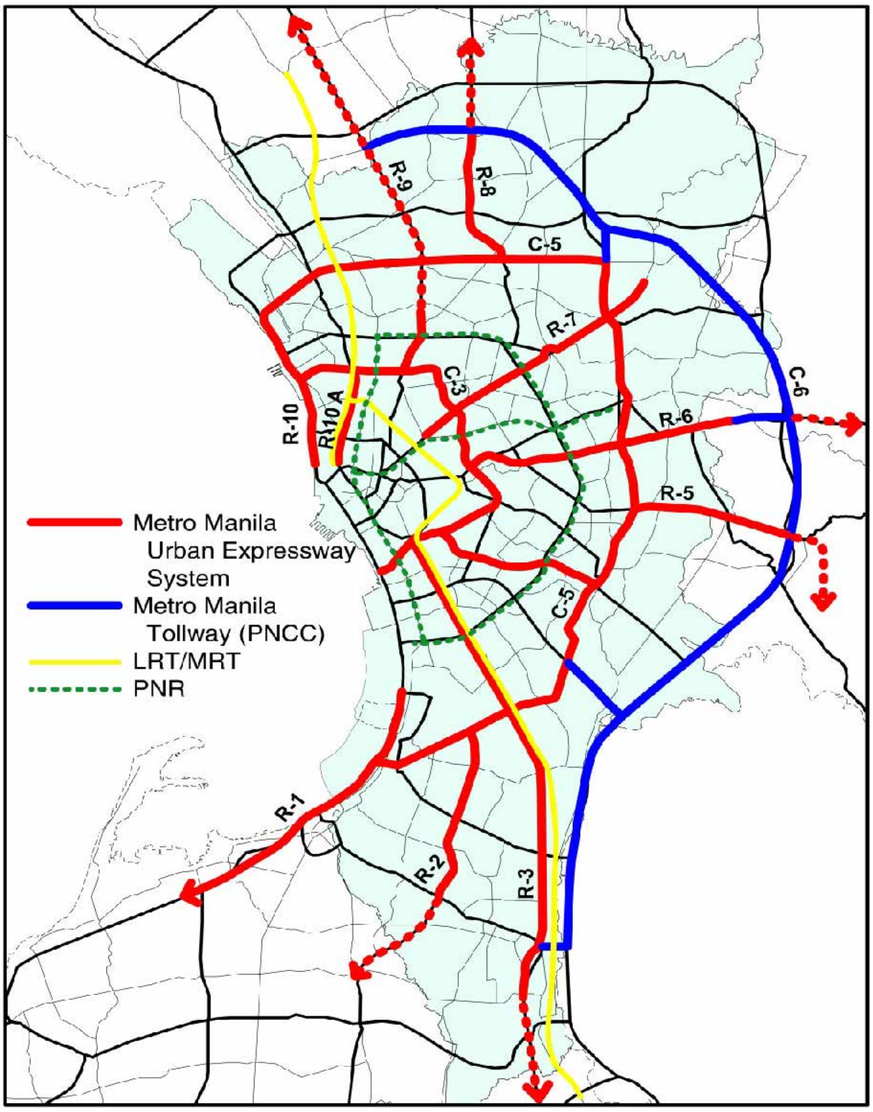
1.2.1 Review of Past and Current Plans

(1) MMUES and MMUTIS

The first master plan on Metro Manila's expressways was developed in 1980 by the Construction Development Corporation of the Philippines (CDCP) now known as the PNCC. The Plan was reviewed and updated twice, first in 1985 by the National Transport Planning Project (NTPP) and second in 1989 by the University of the Philippines Transport Training Center (UPTTC). In 1993, a JICA-assisted project, the MMUES, comprehensively reviewed past plans and prepared a new master plan.

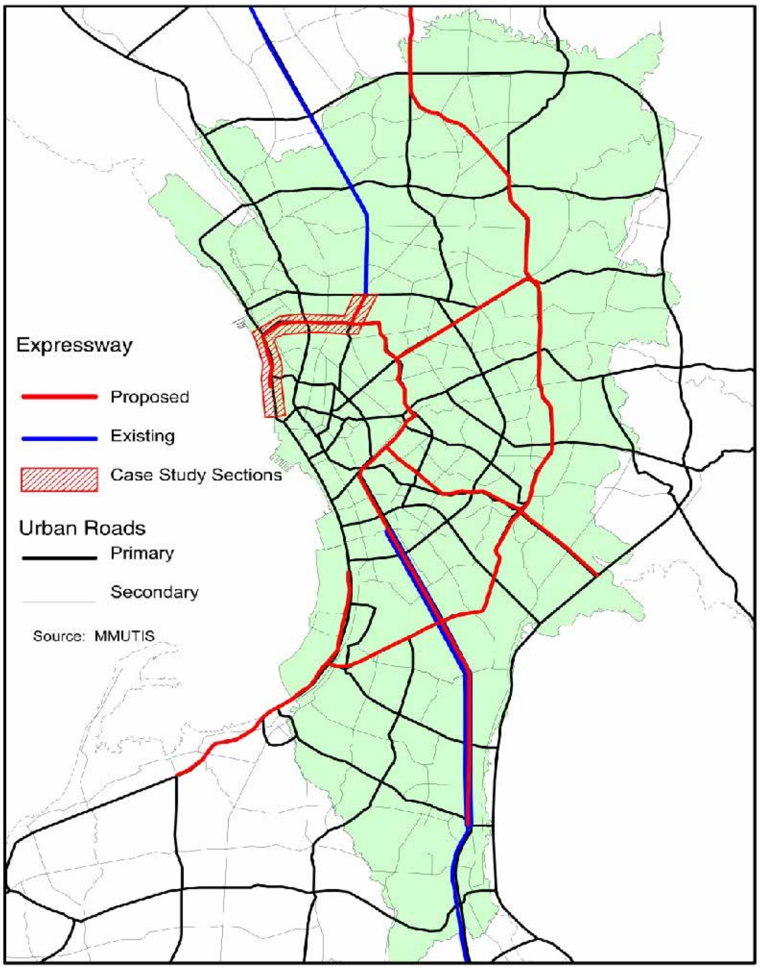
The MMUES network is composed of two circumferential expressways (C3 and C5) and 11 radial expressways. C3 and C5 are 6 to 8 km apart and are connected by six radial expressways at an interval of from 4 to 8 km. Outside C3, eight radial expressways are extended toward the outer areas of Metro Manila: three toward the south, two toward the east and three in the north (see Figure 1.2). The MMUES plan was ambitious: It included 150 km of urban expressways and was conceived before the Asian financial crisis.

Figure 1.2 MMUES Expressway Network



In 1997-1999, a new JICA-assisted master plan study, the MMUTIS was carried out, in which the MMUES network was reviewed and downscaled to 112 km to meet the financial capacity of the Government. Included in the MMUTIS, as well as in the MMUES, is a section of the Case Study Expressway – the R10/C3/R9 section (see Figure 1.3).

Figure 1.3 MMUTIS Expressway Network

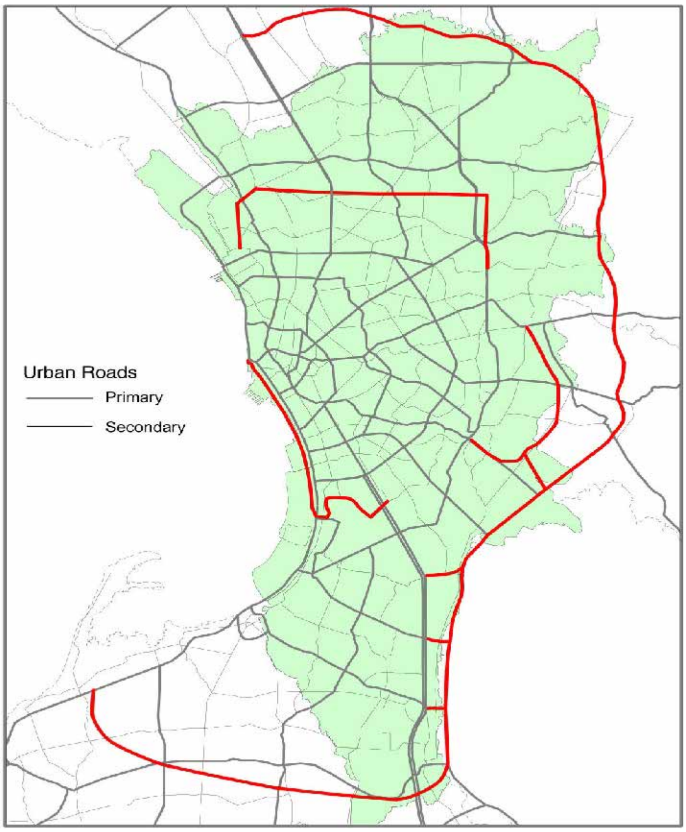


(2) Other Proposed Expressway Projects

After the MMUTIS was concluded, several expressways (listed below) have been committed by the Government or proposed by the private sector. A proper consideration some of them was taken in this Study (see Figure 1.4) and they include the following:

- Pasig Expressway (Pasex) - an alternative to the R4 and R5 expressways proposed by the CMMTC;
- Manila Bay Expressway (MBE) - an expressway proposal that will link Manila's port area to the MCTE 1;
- Manila North Tollway C5 Link - a committed expressway along the northern segment of C5 that is a component of the MNT, a project of the Manila North Tollways Corporation (MNTC);
- Ninoy Aquino International Airport (NAIA) Expressway - a link between Skyway 1 and Roxas Boulevard and an airport access being pursued by the DPWH; and,
- C6 Expressway - composed of the (i) the Metro Manila Tollway (Skyway 4), (ii) the Laguna de Bay Coastal Road (LBCR) and (iii) the C6 Southern Link.

Figure 1.4 Other Proposed Expressways in Metro Manila



1.2.2 Metro Manila Urban Expressway Network

The MMUEN was formed based on the list of expressways proposed in one or more of the reviewed plans and proposals and on a series of consultation meetings with various government agencies and a review of relevant documents. Agencies consulted included the Build-Operate-Transfer Project Management Office (BOT PMO), the Urban Roads Project Office (URPO) and the Planning Office of the DPWH, the Department of Transportation and Communication (DOTC) and the Metropolitan Manila Development Authority (MMDA).

The MMUEN is not a new expressway master plan: Rather, it is an assumption of the future expressway network to test the applicability of various PPP techniques for the purpose of this Study. Table 1.1 lists the components of the MMUEN and describes the status and schedule of each expressway link. Figures 1.5 and 1.6 illustrate the MMUEN at the benchmark years of 2010 and 2020 under two scenarios. Scenario A is the base case and Scenario B assumes an alternative case wherein the Pasex is developed instead of the C5 Expressway.

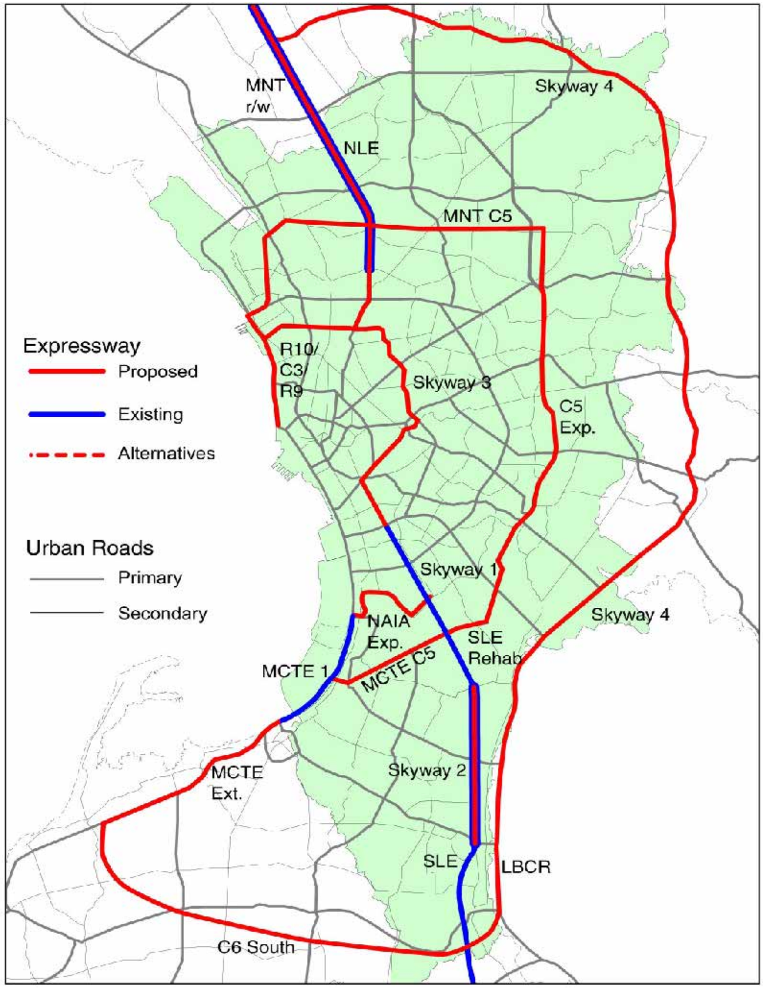
Table 1.1 MMUEN Components

Link	Status/1	Schedule of Operation (Year)				
		2005	2010		2020	
			A	B	A	B
South Luzon Expressway (SLE)	Oper	✓	✓	✓	✓	✓
North Luzon Expressway (NLE)	Oper	✓	✓	✓	✓	✓
Skyway Stage 1 (Skyway 1)	Oper	✓	✓	✓	✓	✓
Skyway Stage 2 (Skyway 2)	Prop		✓	✓	✓	✓
Skyway Stage 3 (Skyway 3)	Prop		✓	✓	✓	✓
Skyway Stage 4/2 (Skyway 4)	Prop		Partial		✓	✓
Manila-Cavite Toll Expressway (MCTE 1)	Oper	✓	✓	✓	✓	✓
Manila-Cavite Toll Expressway - C5 (MCTE-C5)	Com		✓	✓	✓	✓
Manila-Cavite Toll Expressway Extension (MCTE-ext)	Com		✓	✓	✓	✓
Manila North Tollway - r/w (MNT)	Com		✓	✓	✓	✓
Manila North Tollway - C5 (MNT-C5)	Com		✓	✓	✓	✓
Manila Bay Expressway (MBE)	Cons				✓	✓
Laguna de Bay Coastal Road (LBCR)	Prop		✓	✓	✓	✓
C6 Southern Segment (C6 South)	Prop		✓	✓	✓	✓
C5 Expressway (C5 exp)	Prop		✓		✓	
Pasig Expressway (Pasex) /3	Cons			✓		✓
North Luzon Expressway East (NLEE) /4	Prop				✓	✓
R10/C3/R9 Expressway (R10/C3/R9) /5	Prop		✓	✓	✓	✓
NAIA Expressway (NAIA Exp)	Com		✓	✓	✓	✓

/1 Oper = Operational; Com = Committed; Prop = Proposed; Cons = For consideration (i.e. with and without analysis) as of March 2002
/2 Also called the Metro Manila Tollway (C6)
/3 Includes the consideration of the Pasex-C5 Link
/4 Includes only the segment within the study area
/5 Includes the consideration of the R10-C5 Link

Figure 1.5 Future Expressway Network for Study: Scenario A

Year 2010



Year 2020

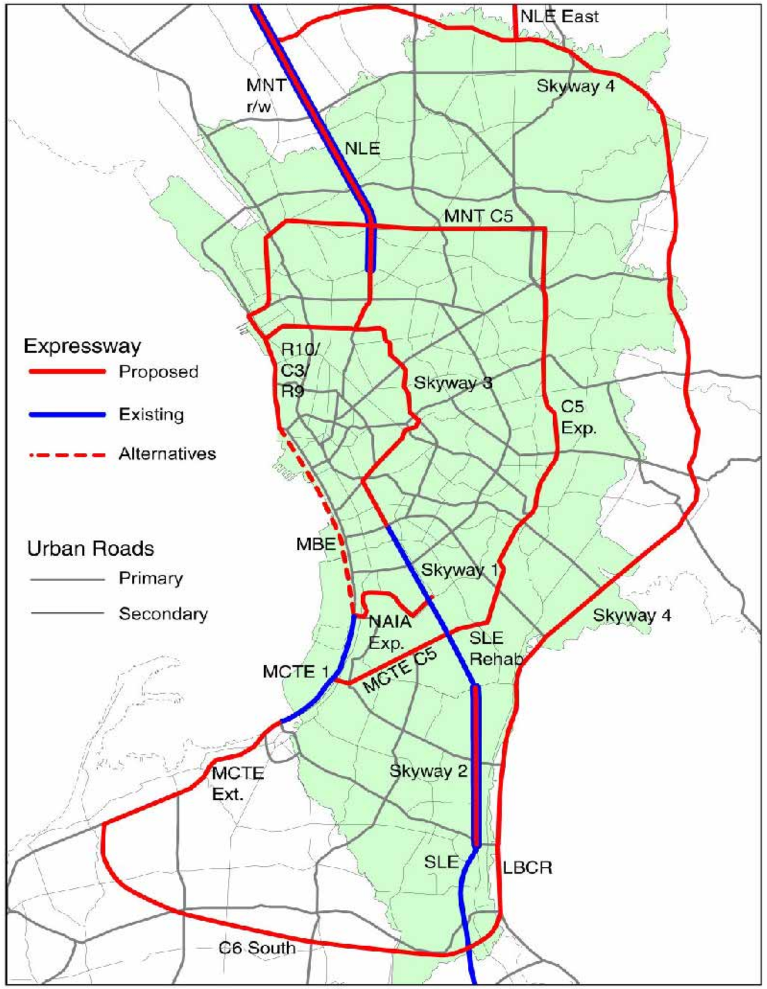
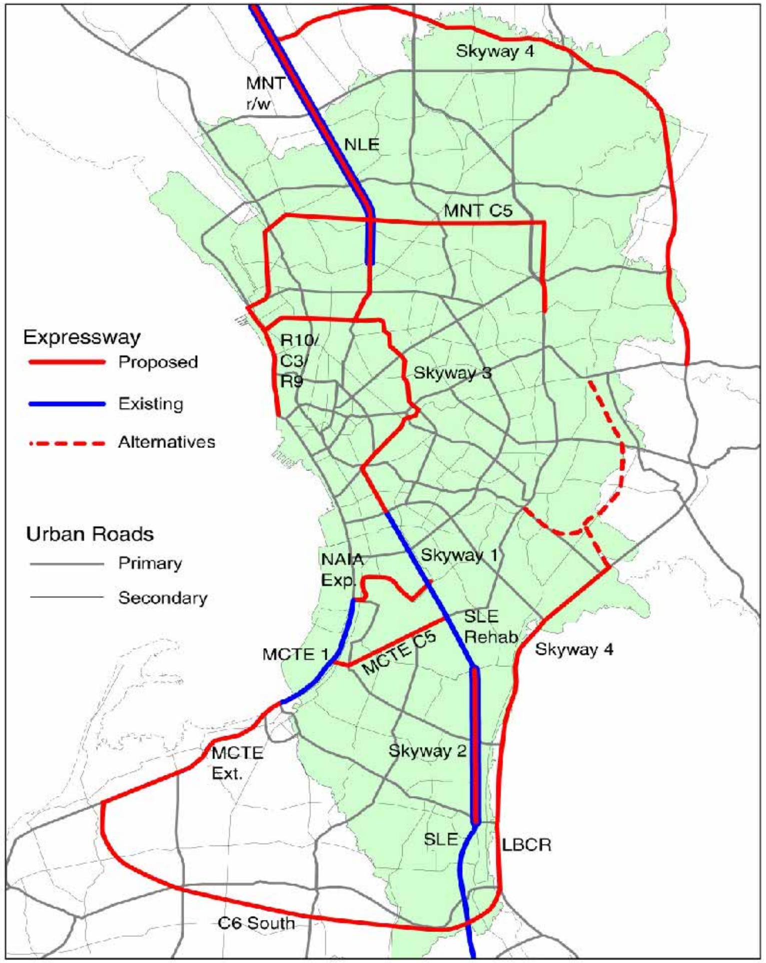
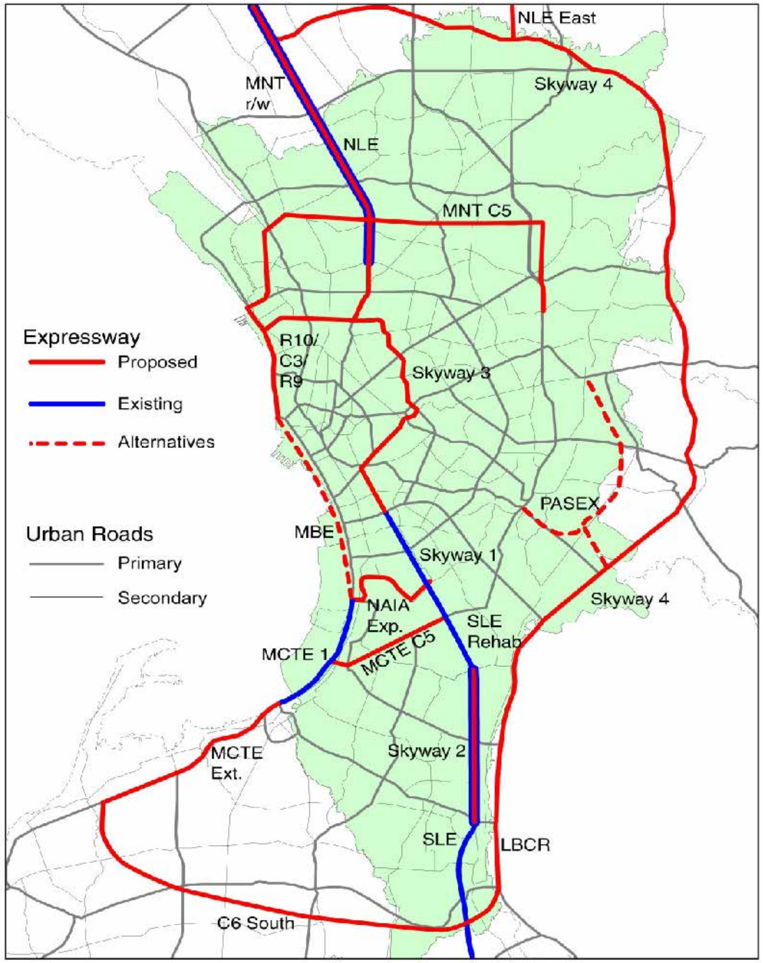


Figure 1.6 Future Expressway Network for Study: Scenario B

Year 2010



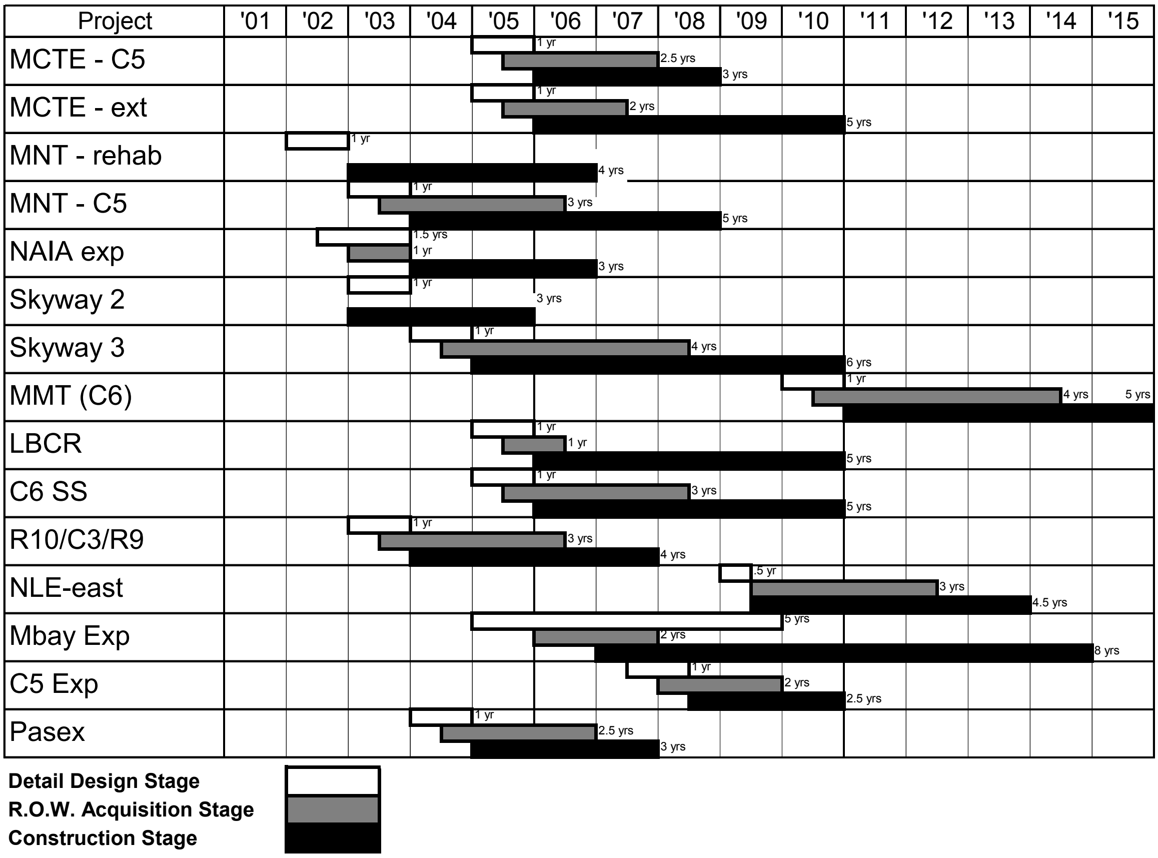
Year 2020



1.2.3 Implementation Schedule

Based on consultation meetings with relevant government agencies, the assumed schedule of implementation of the MMUEN was derived (see Figure 1.7). The schedule served as the basis for the analysis of the applicability and implementability of various PPP techniques. The schedule of implementation of an expressway link is divided into three stages, namely (i) detailed design, (ii) right-of-way (ROW) acquisition, and (iii) construction.

Figure 1.7 Assumed Implementation Schedule of the MMUEN



1.2.4 Review of the MMUEN's Project Cost

(1) General

This section preliminarily reviews the MMUEN's project cost to update the cost inputs for financial analysis. The expressways already in operation were excluded from the review.

(2) Methodology

General Flow of the Review

Available literature on each project was gathered and project cost estimates were compiled. Project costs were then divided into four items as listed below. Further, each cost item is subdivided into three components, namely foreign component, local component and tax component.

- Construction Cost - includes material, labor and equipment
- ROW Acquisition Cost
- Engineering Cost - includes detailed design and construction supervision cost
- Administration Cost

Some projects that are still under preliminary study or for consideration are without detailed cost estimates yet. For these projects, project costs were roughly estimated.

To facilitate the update of the project cost, the following parameters were assumed:

- The foreign, local and tax components of construction cost were estimated based on the assumptions listed in Table 1.2.

Table 1.2 Assumptions on Foreign and Local Project Cost Components

Source of Fund	Foreign Currency Component	Local Currency Component	Tax Component
BOT or PPP	30%	60%	10%
Government Fund or ODA	50%	40%	10%

- Unless specified, ROW Acquisition Cost was assumed as a percentage of Project Cost based on the assumptions in Table 1.3 and was regarded as 100% local component.

Table 1.3 Assumption on % of ROW Cost to Project Cost

Project Status	Type of Structure	Percentage of ROW Cost included in Project Cost	Referred Project
New Construction	At-grade	17.1	MCTE-C5
	Elevated	4.5	NAIA Exp

- Engineering Cost was assumed to be 10% of Construction Cost, unless specified. The foreign and local components were assumed to be 65% and 35%, respectively.

- Administration Cost was assumed to be 1% of Construction Cost, unless specified and was assumed as 100% of the local component.

Costs were then updated using time-based escalation factors. Table 1.4 presents the assumptions on the escalation factors.

Table 1.4 Price Escalation Assumptions

Foreign Component	2.5% for each year from the estimated year to 2002
Local Component	10.0% for each year from the estimated year to 2002

* Price escalations during the disbursement schedule are regarded as included in the original costs.

The 10.0% price escalation of local components was estimated based on a review of yearly price escalations in the Philippines from 1980 to 2000. The average yearly price escalation for the last 20 years was 11.6%, but in the last decade, price increases slightly subsided at 8.7%.

(3) Summary of Updated Project Cost

Tables 1.5 and 1.6 summarize the project cost for each MMUEN component. The most expensive component is the Manila Bay Expressway and the Skyway 4 at around ₱50 billion. However, on the basis of cost per unit length, the Manila Bay Expressway is the most expensive due to tunnel sections required for this project. Typically, construction cost is around ₱250 to 500 million per kilometer for mostly at-grade projects and ₱1.2 to 1.5 billion per kilometer for mostly elevated projects. The R10/C3/R9 Expressway - the case study project - costs around ₱1.0 billion per kilometer. Table 1.7 summarizes the disbursement schedule of funds necessary to develop the MMUEN. Excluding projects that are for consideration, the development of the MMUEN would entail a disbursement of around ₱12 billion per year on average for the next 14 years.

Table 1.5 Summary of Amended Project Cost for Study

Unit: million pesos

Project	Project Status in 2002	Original Project Cost*	Amended Project Cost for Study				
			Construction Cost	Engineering Cost	ROW Acquisition Cost	Administration Cost	Total Project Cost
Manila-Cavite Toll Expressway (MCTE-C5)	Com	2,678.00	2,712.96	246.07	669.43	29.30	3,657.76
Manila-Cavite Toll Expressway (MCTE) R1 extension	Com	2,808.00	2,843.74	257.93	703.02	30.70	3,835.39
Manila North Tollway (MNT) rehabilitation*	Com	3,583.00	502.91	47.87	54.34	5.24	610.36
Manila North Tollway (MNT) C5 segment	Com	2,878.00	2,316.00	225.96	541.35	23.64	3,106.95
Ninoy Aquino International Airport Expressway (NAIA Expressway)	Com	10,355.74	9,580.99	1,055.90	1,066.34	96.33	11,799.56
Metro Manila Skyway Stage 2*	Prop	11,475.00	12,878.90	1,269.61	-	138.85	14,287.36
Metro Manila Skyway Stage 3*	Prop	27,030.00	23,336.07	2,221.60	1,270.78	242.96	27,071.41
Metro Manila Skyway Stage 4 (MCTE 1)	Prop	34,098.21	29,267.22	2,654.56	8,323.14	316.00	50,560.92
Laguna de Bay Coastline Road (LBCR)*	Prop	10,659.28	9,149.07	829.84	5,727.91	98.78	15,805.60
C6 South Segment*	Prop	11,633.51	9,985.28	905.67	6,251.43	107.82	17,250.20
R10/C3/R9 Expressway (Alignment for JICA Study)	Prop	5,406.36	17,118.35	1,112.7	295.51	171.18	18,697.74
- R10	Prop	1,616.55	4,200.44	273.03	59.51	42.00	4,574.98
- C3 and R9	Prop	3,883.80	7,444.60	483.90	162.13	74.45	8,165.08
- R10/C5 link	Prop	-	5,473.31	355.77	73.87	54.73	5,957.68
North Luzon Expressway East (NLEE)*	Prop	16,848.00	1,542.23	139.88	265.98	16.65	1,964.74
Manila Bay Expressway (MBE)*	Cons	63,299.20	41,833.73	4,708.26	3,609.67	370.38	50,522.04
C5 Expressway	Cons	-	4,199.09	419.91	961.43	41.99	5,622.42
Pasig Expressway (Pasex)	Cons	12,688.02	12,456.00	1,245.60	2,178.00	206.05	16,085.65

* Note: Original Project Cost:

- Manila North Tollway (MNT) rehabilitation: "Original Project Length" is 88 km, and "Project Length included in Metro Manila Urban Expressway Network" is 12.9 km.
- Metro Manila Skyway Stage 2 & 3: Only Construction Costs were described in the Original Data.
- Metro Manila Skyway Stage 4, LBCR, C6 South Segment: Only Construction Cost & ROW Cost were described.
- R-10, C-3, R-9 Expressway (Alignment for JICA Study): For the analysis, the route was divided into the following sections:
  - R10
  - C3 and R9
  - R10/C5 (R10 Extension)
  - * For the "Extension Route to C5 Expressway", no original cost estimate is available. The updated costs of other sections (R-10 and C-3 & R-9) were adopted for the estimate.
  - ** The cost of the Case Study Expressway will be further evaluated and modified in Chapter 4.4.
- North Luzon Expressway East (NLEE) : "Original Project Length" is 126 km, and "Project Length included in Metro Manila Urban Expressway Network" is 10.8 km.
- Manila Bay Expressway: Several packages were excluded from the original project because of the overlapping with other projects.

Table 1.6 MMUEN Disbursement Schedule

Unit for Cost: million pesos

Project	Construction Cost	Construction Cost per km (pesos/km)	Total project Length (km)	Number of Lanes	Type of Structure
MCTE-C5	2,712.96	393.18	6.90	6.00	At-grade
Manila-Cavite Toll Expressway (MCTE) R1 extension	2,843.74	236.98	12.00	4.00	At-grade
Manila North Tollway (MNT) rehabilitation*	502.91	38.99	12.90	2	At-grade
Manila North Tollway (MNT) C5 segment	2,316.00	115.80	20.00	6	At-grade
Ninoy Aquino International Airport Expressway (NAIA Expressway)	9,580.99	1,464.98	6.54	4&6	Elevated
Metro Manila Skyway Stage 2*	12,878.90	1,300.90	9.90	4&6	Elevated
Metro Manila Skyway Stage 3*	23,336.07	1,795.08	13.00	6	Elevated
Metro Manila Skyway Stage 4 (MCTE 1)	29,267.22	491.89	59.90	4	At-grade
Laguna de Bay Coastline Road (LBCR)*	9,149.07	491.89	18.60	4	At-grade
C6 South Segment*	9,985.28	491.89	20.30	4	At-grade
R10/C3/R9 Expressway (Alignment for JICA Study)	17,118.35	1,031.85	16.59	4	Elevated
- R-10	4,200.44	1,272.86	3.30	4	Elevated
- C-3 and R-9	7,444.60	828.10	8.99	4	Elevated
- R10/ C5 link	5,473.31	1,272.86	4.30	4	Elevated
North Luzon Expressway East (NLEE)*	1,542.23	142.80	10.80	4	At-grade
Manila Bay Expressway (MBE)*	41,833.73	2,582.33	11.10	6	Mainly Elevated
Pasig Expressway (Pasex)	12,456.00	919.26	13.55	4	Elevated
C5 Expressway	4,199.09	254.49	16.50	6	At-grade

Table 1.7 Summary of Construction Cost

Unit: million pesos

Year	Status of Projects in 2002				
	Committed	Proposed or Under Study	For Consideration	Committed and Proposed	Total
2002	301			301	301
2003	1,604	3431		5,034	5,034
2004	3,902	10,737	1,730	14,639	16,369
2005	6,267	18,848	3,708	25,115	28,823
2006	5,187	19,986	10,029	25,173	35,202
2007	3,103	15,356	9,384	18,459	27,843
2008	1,512	9,989	12,145	11,501	23,646
2009	760	9,780	11,255	10,540	21,795
2010	319	9,331	4,575	9,650	14,225
2011		10,741	1,440	10,741	12,180
2012		11,466	5,386	11,466	16,852
2013		11,466	7,137	11,466	18,603
2014		9,634	5,442	9,634	15,076
2015		4,875	72,230	4,875	77,105
TOTAL	2,2956	145,638	144,460	168,593	313,053

1.3 Demand Forecast

1.3.1 Socio-economic Framework

This Study follows the future socio-economic framework developed in the MMUTIS, as well as its method of demand forecast (see Table 1.8). Out of the four alternative scenarios laid out in the MMUTIS, this Study adopted the transport-led development scenario which assumes that population distribution will be affected mainly by the future transport network which will be developed more strategically (MMUTIS Main Text, pp. II5-9 to II5-17). As a result of the intensive road and rail network development in the suburban areas connecting them to the central Metro Manila area, population increase in the suburbs will be remarkable but Metro Manila, it will be moderate.

Table 1.8 Macrodemographic Framework for 2015

Item	1995	2015	2015/1995
1 Population			
(1) Metro Manila	9,454	12,579	1.33
(2) Adjoining Provinces	4,914	11,133	2.27
Bulacan	1,354	3,589	2.65
Rizal	1,312	2,173	1.66
Cavite/Laguna	2,248	5,371	2,39
(3) Study Area [(1) + (2)]	14,368	23,712	1.65
2 Employment at Workplace			
2-1 Secondary Sector			
(1) Metro Manila	837	1,393	1.66
(2) Adjoining Provinces	426	1,074	2.52
Bulacan	86	261	3.03
Rizal	89	197	2.21
Cavite/Laguna	251	616	2.45
(3) Study Area [(1) + (2)]	1,263	2,467	1.95
2-2 Tertiary Sector			
(1) Metro Manila	2,853	3,899	1.37
(2) Adjoining Provinces	890	1,848	2.08
Bulacan	272	597	2.19
Rizal	213	318	1.49
Cavite/Laguna	405	933	2.30
(3) Study Area [(1) + (2)]	3,743	5,747	1.54
3 Student at School Place			
(1) Metro Manila	1,385	1,866	1.35
(2) Adjoining Provinces	508	1,321	2.60
Bulacan	143	391	2.73
Rizal	111	286	2.58
Cavite/Laguna	254	644	2.54
(3) Study Area [(1) + (2)]	1,893	3,187	1.68

1.3.2 Trip Increase

The total number of daily trips other than "walking" will increase 1.33 times by 2010 and 1.60 times by 2015 in the study area (see Table 1.9). Reflecting the future population growth, trips generated in Metro Manila will increase moderately while in adjoining provinces the increase will be higher, especially in Bulacan and Cavite. Metro Manila, however, will remain the dominant origin-destination (OD) zone with a 70% share of total trips at present but will decrease to 60% by 2015.

Even if a rail transit network is assumed to be widely developed, a modal shift will continue from public to private mode. As a result, the current share of public modes at 74% will decrease to 66% in 2015.

Table 1.9 Increase of Trips by Mode

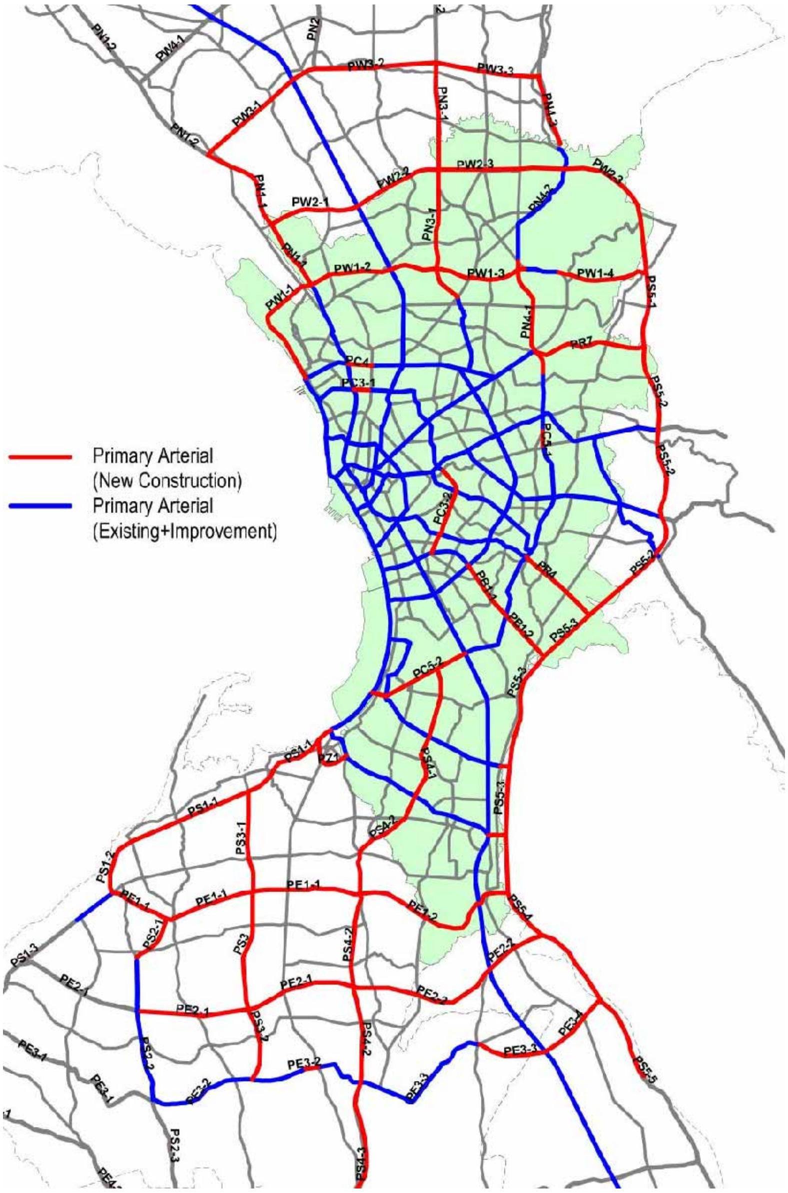
Mode	Area	2002	2010	2015	2010/2002	2015/2002
Public Mode	M-Manila	14,181	15,846	17,236	1.117	1.215
	Bulacan	1,724	2,677	3,447	1.552	1.999
	Rizal	1,523	1,985	2,342	1.303	1.538
	Cavite	2.079	3,487	4,613	1.677	2.219
	Laguna	1,086	1,417	1,688	1.305	1.555
	Total	20,594	25,412	29,327	1.234	1.424
PrivateMode	M-Manila	5,107	7,273	8,963	1.424	1.755
	Bulacan	543	1,208	1,763	2.227	3.248
	Rizal	518	1,014	1,411	1.958	2.724
	Cavite	573	1,251	1,801	2.184	3.144
	Laguna	394	677	906	1.719	2.299
	Total	7,135	11,425	14,843	1.601	1.839
Total	M-Manila	19,289	23,120	26,199	1.199	2.298
	Bulacan	2,267	3,885	1,714	1.714	1.839
	Rizal	2,041	2,999	1,469	1.469	2.419
	Cavite	2,652	4,738	1,787	1.787	2.419
	Laguna	1,480	2,095	1,415	1.415	1.753
	Total	27,729	36,837	44,170	1.328	1.593

1.3.3 Demand for the MMUEN

(1) Network Conditions

In general, the demand for an expressway is much influenced by traffic conditions in the free (non-toll) road network. In order to forecast the demand for the MMUEN, one key input was the future road network. Since the MMUTIS developed a plan for road development for 2015 (see Figure 1.8) and is the only road master plan that has the consensus of relevant government agencies, this Study adopted the MMUTIS road network. Furthermore, it was assumed that the MMUEN would have a capacity of 20,000 passenger car units (PCUs)/lane/day.

Figure 1.8 Road Network for 2015

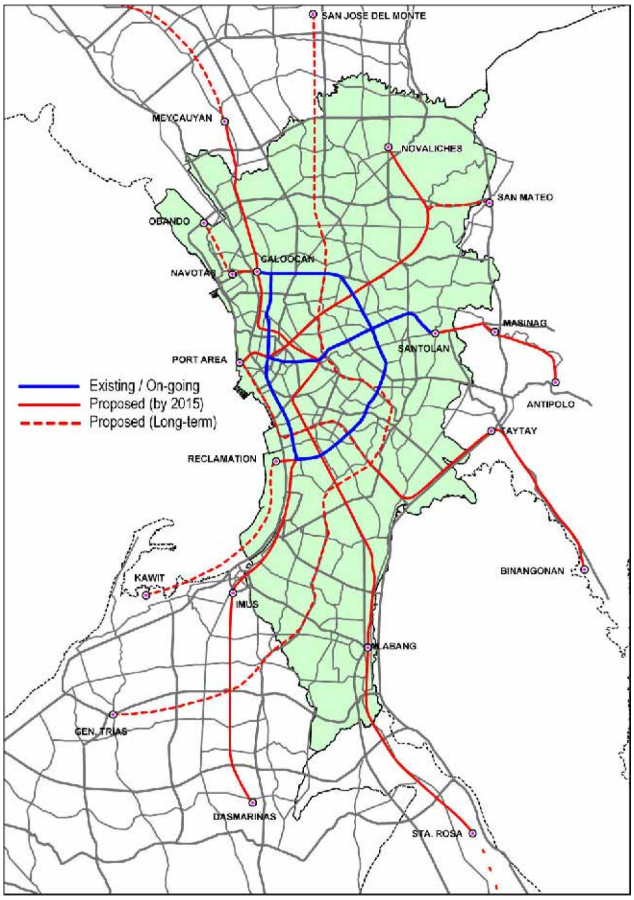


It was also assumed that the future urban rail network would also significantly influence the demand for the MMUEN. This Study, therefore, assumed the rail network proposed by the MMUTIS and it is shown in Table 1.10 and Figure 1.9.

Table 1.10 Assumed Implementation Schedule for the Metro Manila Rail Network

Year	Line in Operation
Existing as of 2002	LRT-1, MRT, PNR
By year 2005	Line 2, MRT Extension, LRT-1 Extension
By year 2010	Line 4
By year 2015	MCX, North Rail

Figure 1.9 Rail Network for 2015



(2) Future Time Value

Another important input for the demand forecast is the trip maker's time value. This time value is the basis for a trip maker to decide whether he or she will use a toll expressway or not which is called "behavioral time value" or "perceived time value". It should be noted that this time value is conceptually different from "financial cost" and "economic cost".

To estimate time value, an interview survey (called stated-preference survey) was conducted in March 2002 among 7,200 trip makers covering eight different transport modes. It asked whether they would use an expressway under various assumed conditions of toll rates and expected time saving.

Using the survey data, a Logit-type diversion model was developed. The ratio of the coefficients of toll rates and travel time gives the present time value (Annex A). Future time values were assumed to increase at the same rate as the economic growth rate in terms of GRDP per capita, which is assumed to be 1.7% per annum (as assumed in MMUTIS). Table 1.11 shows the present and future time values by type of vehicle.

The time values were aggregated into two groups, namely private vehicle and freight vehicle. Using present vehicle-kilometers in the study area as weight, the weighted average time values were calculated for each group (see Table 1.11).

Table 1.11 Behavioral Time Value by Type of Vehicle

a. By Type of Vehicle (Pesos/hour)

Type of Vehicle		2002	2010	2015	2020
Car/Jeep/Van		84.1	96.2	104.7	113.9
Taxi		77.9	89.1	97.0	105.5
HOV Taxi		44.5	50.9	55.4	60.3
Freight Vehicle	Class 1	85.7	98.1	106.7	116.1
	Class 2	138.7	158.7	172.7	187.9
	Class 3 (journey)	193.8	221.8	241.3	262.5
	Class 3 (waiting)	168.1	192.4	209.3	227.7

b. Weighted Average for Traffic Assignment (Pesos/hour)

Type of Vehicle	2002	2010	2015	2020
Car/Jeep/van/Taxi/HOV Taxi	81.3	93.0	101.2	110.1
Freight Vehicle	114.3	130.8	142.3	154.8

(3) Demand for the MMUEN

Based on the assumed network and trip maker characteristics, the demand for the MMUEN network was forecast for the benchmark years of 2010, 2015 and 2020 by assigning the future OD traffic volumes onto the aforementioned network. OD data was based on the MMUTIS OD data which was revised and updated for this Study.

Here, public modes (i.e. bus and jeepney) were assumed to be prohibited on expressways except on the NLE, the SLE, the Skyway at-grade section, and the MCTE.

Toll rates as of June 2002 (see Section 1.5.1) were assumed for existing expressways and a rate of ₱4/km was assumed for all other expressways to be developed, except the NLE East to which the SLE rate was applied, because it is located outside of C6 and is considered an inter-city expressway. The justification for setting toll rates at ₱4/km is stated in Section 1.5.

Table 1.12 illustrates the expected traffic demand of the MMUEN by component project. The demand for each project is shown for two cases: one is under a fully developed MMUEN network and the other is under the condition that only individual expressway projects are developed.

The demand forecast for the MMUEN showed that most projects will have lesser demand due to the development of the network, except for several projects located in suburban areas. However, the difference between the demand under the "with" network case and "without" network case will narrow as the 80,000 PCU capacity for four-lane expressways and 120,000 PCU capacity for six-lane expressways is nearly reached.

Table 1.12 Average Traffic Density by Expressway Project

(1000 PCU-km/km)

Project		Distance (Km)	[A] Demand in the Network			[B] Demand If Developed Alone		
			2010	2015	2020	2010	2015	2020
A	SLE	41.9	93.0	97.8	105.9	94.3	101.0	103.2
B	MCTE 1	6.3	112.8	116.1	121.0	119.2	118.3	127.3
C	Skyway 1	9.1	54.5	103.7	141.0	81.3	125.8	142.0
1	MCTE-ext	12.0	54.8	81.6	83.6	44.1	63.3	77.9
2	MNT-rehab	36.8	125.0	125.0	128.8	122.1	122.4	127.3
3	NAIA Exp	6.5	11.0	33.3	71.3	46.8	54.8	71.7
4	Skyway 2	9.9	24.6	79.3	89.5	95.7	109.5	122.1
5	Skyway 3	13.0	29.2	82.0	125.7	71.7	104.0	102.9
6	R10/C3/R9	15.8	23.4	55.8	65.4	25.9	58.1	59.6
7	MCTE-C5	6.9	24.6	29.7	42.5	19.0	28.1	50.0
8	MNT-C5	20.0	67.4	98.4	113.3	68.8	92.8	117.3
9	LBCR	18.6	27.1	65.8	73.0	40.7	62.0	74.7
10	MBE	11.1	63.2	93.3	115.6	85.5	117.4	134.8
11	C5 Exp	13.6	63.9	77.4	85.1	78.7	92.7	93.9
12	Skyway 4(C6)	59.5	23.4	48.1	63.9	37.5	64.5	78.6
13	C6 South	20.3	23.6	54.8	72.2	9.1	15.2	21.4
14	NLEE	10.8	72.5	81.4	91.6	76.8	81.0	84.8
15	Pasex	16.5	24.6	51.5	87.7	37.2	73.7	103.5

Table 1.13 shows the daily patronage of the entire MMUEN and individual expressway projects. In 2010, the total daily patronage of the entire MMUEN will be 1,374,200 PCU, while the sum of daily patronages of individual projects will be 2,334,200 PCU. The latter is 1.7 times higher than the former, because on average 70% of total patronage will be crossing the boundary of two adjacent projects. The high percentage suggests that installation of a toll gate at every project boundary will cause serious inconvenience to users and traffic congestion on expressways.

The average running distance was estimated by dividing the total daily PCU-km on the entire MMUEN network by the daily patronage. Average running distance will be 13.1 km in 2010, 11.4 km in 2015, and 12.0 km in 2020. Accordingly, the average toll paid by a car will be about ₱45 to ₱52 per use.

Table 1.13 Daily Patronage of the MMUEN

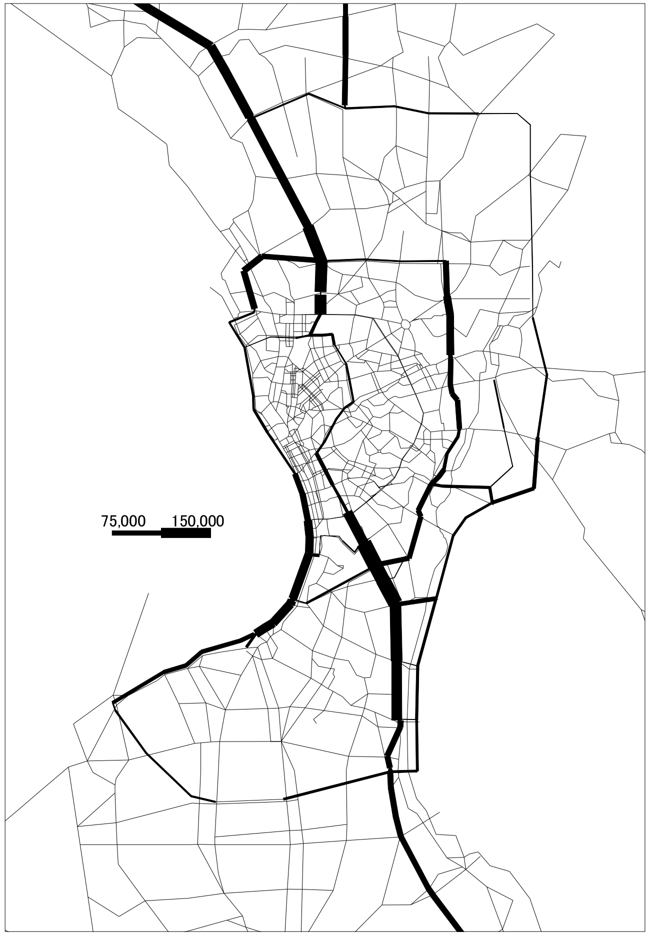
(1000 PCU/day)

Project		Distance (Km)	Daily Patronage of the Network		
			2010	2015	2020
A	SLE	41.9	403.6	522.9	711.2
B	MCTE1	6.3	237.5	271.0	297.7
C	Skyway 1	9.1	81.8	161.6	286.3
1	MCTE-ext	12.0	70.3	103.2	107.8
2	MNT-rehab	36.8	251.9	272.6	272.8
3	NAIA Exp	6.5	59.6	108.9	184.8
4	Skyway 2	9.9	28.9	97.0	97.7
5	Skyway 3	13.0	88.5	189.3	274.5
6	R10/C3/R9	15.8	68.6	161.1	189.8
7	MCTE-C5	6.9	30.8	36.9	55.1
8	MNT-C5	20.0	266.9	370.9	415.0
9	LBCR	18.6	42.2	113.1	127.8
10	MBE	11.1	142.2	203.4	232.2
11	C5 Exp	13.6	114.3	143.7	170.0
12	Skyway 4(C6)	59.5	173.5	289.0	337.9
13	C6 South	20.3	91.5	212.8	262.9
14	NLEE	10.8	129.4	152.8	158.4
15	Pasex	16.5	52.8	106.0	168.4
(X) Sum of component patronage		-	2334.2	3516.1	4350.2
(Y) Network patronage		-	1374.2	2242.8	2520.3
(X) / (Y)		-	1.70	1.57	1.73

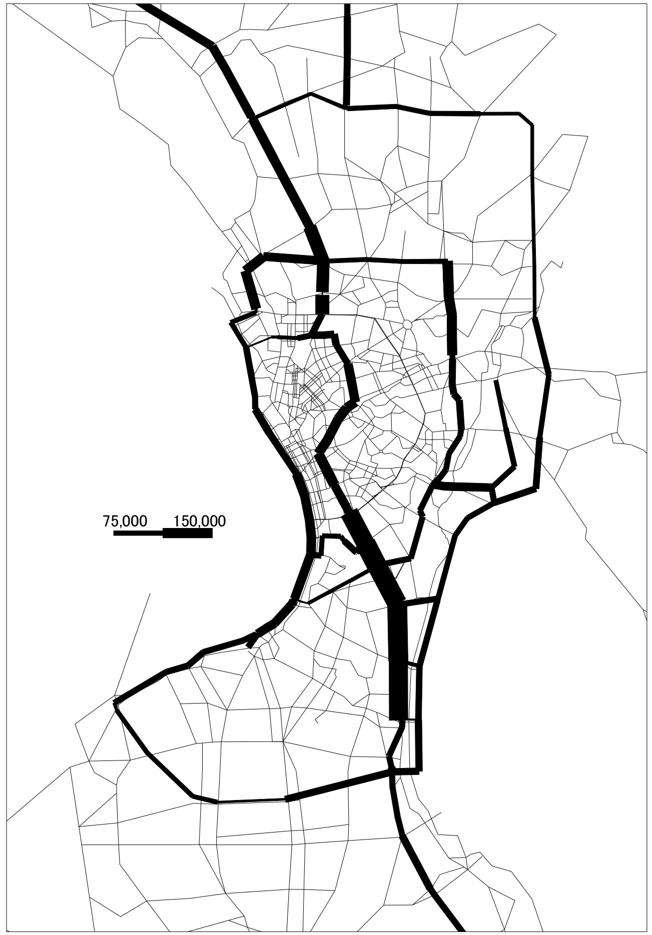
Figure 1.10 illustrates the future traffic flow on the MMUEN. In 2010, traffic volumes on existing sections of the NLE (MNT), the SLE (Skyway) and the MCTE will be outstanding, while demand for new projects will be moderate. The eastern portion of the C5 Expressway, the western arc of the MNT-C5 and NLE East will have daily traffic of over 50,000 PCU. On most expressway sections, however, traffic will reach capacity level by 2020, due to worsening traffic conditions on the general road network as well as a rising willingness to pay by users.

Figure 1.10 Traffic Flow on the MMUEN

2010



2020



(4) Mutual Influence on Demand among Projects

Table 1.14 analyzes the effect of one expressway project on another. Here it can be clearly seen which project can positively or negatively affects the demand for another expressway project.

Among existing expressways, the Skyway 1 will be strongly and positively affected by the Skyway 2 and 3 and negatively affected by the MCTE extension and the C5 Expressway.

Table 1.14 Influence of A Project on Other Projects

Causer (If it exists)		The Affected (Increase or Decrease of Demand in %)																	
		SLE	MCTE1	Skyway 1	MCTE-ext	MNT-rehab	NAIA Exp	Skyway 2	Skyway 3	R10/C3/R9	MCTE-C5	MNT C5	LBCR	MBE	C5 Exp	Skyway 4	C6 South	NLE East	Pasex
Group A	MCTE-ext	-4	9	-16		0	-15	-3	-7	5	108	1	-33	6	5	-6	-37	0	-6
	MNT-rehab	0	0	1	1		2	3	9	1	3	-8	-4	-2	1	-5	-2	-9	-1
	NAIA Exp	0	3	-2	-1	0		0	-1	2	-3	0	-1	2	0	-1	-1	0	-1
	Skyway 2	0	2	11	-2	0	5		4	1	-4	0	-39	-2	-1	-7	-4	0	-2
	Skyway 3	0	3	13	-1	0	-8	4		-13	-4	-1	-1	-14	-3	-2	0	0	-2
	R10/C3/R9	0	0	1	0	0	6	1	3		-13	0	-1	21	-7	-5	0	0	-1
Group B	MCTE-C5	0	1	-3	6	0	-7	-4	-4	-7		1	-9	-6	13	-4	-1	0	-6
	MNT-C5	0	0	-3	4	0	0	1	-38	-9	30		-6	5	39	-14	-1	-2	1
	LBCR	1	0	9	-17	0	0	-39	4	-4	-16	-1		-4	-5	13	79	0	9
	MBE	0	-5	-28	6	0	-56	-6	-32	58	-11	1	-8		-13	-5	-1	0	2
	C5 Exp	-1	-1	-16	8	0	-22	-4	-30	-22	90	3	-19	-15		-15	-3	1	-28
Group C	Skyway 4	-1	0	-9	-5	0	-11	-25	-8	-9	-15	-7	31	-5	-13		9	3	-4
	C6 South	-1	1	-2	24	0	5	-34	-3	-2	17	0	138	0	1	5		0	1
	NLE East	0	1	4	1	2	1	3	-5	-2	-6	4	-3	5	0	2	-1		-3
	Pasex	0	2	-9	-1	0	-1	-8	-3	-4	2	0	6	-2	-9	-1	0	-1	

In Table 1.15, project pairs with mutually strong influence (over 10%) are picked up from Table 1.14 and classified into three categories: competitive, complementary and parasitic relationships. For instance, the MCTE extension will lose 17% of its demand if the LBCR exists and the LBCR will lose 33% if MCTE-ext. will operate. Thus, their relationship is competitive. Complementary projects are mutually beneficial to each other, while parasitic projects refer to the case where one project benefits from another.

Table 1.15 Projects with Strong Mutual Relationships

Competitive				Complementary				Parasitic			
Project	%	Project	%	Project	%	Project	%	Project	%	Project	%
MCTE-ext	-17	LBCR	-33	MCTE-C5	90	C5 Exp	13	MCTE-ext	24	C6 South	-37
Skyway 2	-39	LBCR	-39	LBCR	31	Skyway 4	13				
Skyway 3	-32	MBE	-14	LBCR	138	C6 South	79				
MBE	-15	C5 Exp	-13	R10/C3/R9	58	MBE	21				
C5 Exp	-13	Skyway 4	-15								

% = Percentage change in demand if other project is realized

1.4 Financial Analysis

1.4.1 Toll Rate and Revenue

Several toll rates were systematically tested to determine what rate will maximize the MMUEN's revenue. As shown in Table 1.16, the maximizing rate will be higher in the future, mainly because users' time value and income will increase and traffic conditions on ordinary roads further worsen.

Table 1.16 Relationship between Toll Rate and Toll Revenue

(Billion Peso/year)

Toll Rate	All MMUEN Components			New MMUEN Projects Only		
(Peso/km)	2010	2015	2020	2010	2015	2020
2	11.96	16.26	18.20	9.41	13.23	15.01
3	13.28	19.88	23.31	10.39	16.53	19.78
4	14.76	24.30	29.87	11.46	20.65	26.06
5	15.56	26.87	33.80	12.02	22.83	29.57
6	**15.89**	28.02	38.16	**12.23**	23.73	33.07
7	15.86	28.74	41.30	12.15	**24.47**	36.07
8	15.27	**29.01**	42.94	11.53	24.29	37.42
9	14.45	27.99	**43.86**	10.71	23.11	**38.17**
10	14.05	27.23	43.08	10.24	22.02	37.21

Note: Figures in bold are revenue-maximizing rates.

In 2010, the rate that will maximize revenue is estimated at ₱6/km and will increase to around ₱7 or ₱8/km in 2015. The maximizing rate will further increase to ₱9/km in 2020. In any year, however, the peak will not be sharp. For example, the revenue in 2010 will not be significantly different from the revenue if the maximizing rate will be within the ₱5 to 8/km range.

It should be noted that the revenue-maximizing toll rate might not necessarily be the optimum rate. It may be advantageous to expressway owners or operators, but tolls must be acceptable to users, as well. These aspects are studied in Section 1.5.

The toll rates that will maximize revenues differ by project (see Table 1.17) due to different traffic conditions on alternative ordinary roads of each project. The heavier the congestion on the ordinary road, the higher the maximizing rate will be. As a result, the Skyway 1 and 2, MCTE extension, the MBE, and the C5 Expressway have higher revenue-maximizing rates. Also, the MCTE-C5 and the MNT-C5 also exhibit high maximizing rates, because there will be no alternative ordinary roads that can reasonably compete with these projects.

Table 1.17 Revenue-maximizing Toll Rates by Component

(Peso/km)

Component		2010	2015	2020
Existing	Skyway 1 at-grade	6	6	6
	MCTE1	7	7	9
	Skyway 1	9	10	11
1	MCTE-ext	6	7	10
2	MNT r/w	7	7	9
3	NAIA Exp	7	7	7
4	Skyway 2	10	12	13
5	Skyway 3	7	8	9
6	R10/C3/R9	4	6	7
7	MCTE-C5	6	7	12
8	MNT-C5	7	10	11
9	LBCR	2	5	7
10	MBE	10	12	14
11	C5 Exp	8	8	10
12	Skyway 4	4	5	9
13	C6 South	4	5	6
14	NLEE	4	7	7
15	Pasex	5	6	7
16	R10/C5	4	7	7

In this analysis, a uniform toll rate of ₱4/km was assumed (see Section 1.5 for justification) for all the new projects, while the actual toll rates as of May 2002 were assumed for existing projects. In reality, however, the toll rates will differ by project as they will be based on construction cost.

In the future, when the MMUEN will be almost completed, a flat rate regardless of traveled distance will be desirable for operational convenience. Toward this end, traffic simulations were made to determine the flat rate which will result in almost the same revenue as a ₱4/km toll rate. The result is P68/entry, which is lower than the present rate for the Skyway 1. This suggests that there is a good possibility to feasibly apply a flat rate structure for the MMUEN.

Table 1.18 Flat Rate to Generate the Same Revenue as P4/km Toll

Flat Rate (P/use)	Daily Patronage (1000 PCU)	Annual Revenue (Million Pesos)
10	1643	5,421
20	1559	10,287
30	1462	14,477
40	1375	18,156
50	1278	21,084
60	1192	23,603
68	**1116**	**25,053**
70	1096	25,318
80	1015	26,808
90	946	28,101

1.4.2 Financial Evaluation

A preliminary financial analysis was made to clarify the profitability of each expressway project and the necessary government support to attract private capital. To simplify the analysis, the following assumptions were made:

1) All projects are developed from 2007 to 2009. Investment for each year is 20% in 2007 and 40% each in 2008 and 2009.
2) Price contingency is excluded from the cost.
3) Project life is 30 years starting from 2010 to 2040. Revenue can be interpolated and extrapolated until the network is saturated in 2030. From thereon, revenue level off.
4) Annual operating and maintenance costs are 8% of annual revenue.
5) No residual value is appropriated.
6) Cash flow analysis is made in real terms, thereby assuming that inflation and toll escalation can be disregarded.

Table 1.19 shows revenues in benchmark years. In the first five years, revenues will grow rapidly due to rapid increase in demand. After this period, revenue growth will be moderate, partly because of saturation in most sections.

Table 1.19 Project Revenue Stream of the MMUEN and Its Components

(Million Pesos/Year)

Project		Distance (km)	2010	2015	2020	2015/2010	2020/2015
1	MCTE-ext	12.0	868	1,293	1,324	1.489	1.024
2	MNT r/w*	12.9	289	344	391	1.189	1.138
3	NAIA Exp	6.5	95	287	615	3.034	2.143
4	Skyway 2	9.9	561	1,811	2,043	3.227	1.128
5	Skyway 3	13.0	501	1,407	2,157	2.809	1.533
6	R10/C3/R9	15.8	488	1,163	1,363	2.384	1.172
7	MCTE-C5	6.9	224	270	387	1.207	1.431
8	MNT C5	20.0	1,779	2,597	2,992	1.460	1.152
9	LBCR	18.6	665	1,617	1,791	2.431	1.108
10	MBE	11.1	927	1,367	1,694	1.475	1.239
11	C5 Exp	13.6	1,144	1,384	1,523	1.210	1.101
12	Skyway 4	59.5	1,834	3,780	5,020	2.061	1.328
13	C6 South	20.3	633	1,468	1,935	2.318	1.318
14	NLE East	10.8	85	96	108	1.122	1.126
15	Pasex	16.5	535	1,121	1,910	2.096	1.704
Total		247.4	10,628	20,005	25,254	1.882	1.262

Note: Revenue increased by rehabilitation and widening only

Table 1.20 summarizes the results of the financial analysis. At the bottom of the revenue column is a simple summation of annual revenues for 30 years. The ratios of the total revenues to cost are over 1.0 for all projects, which means that their financial internal rates of return (FIRRs) are all positive. However, the FIRRs of most projects are deemed too low to attract private capital. The subsidy needed to improve the FIRR to increase it to around 15% was calculated. The conclusion is that around 50% of the MMUEN project cost needs to be shouldered by the Government. However, the situation improves when the Manila Bay Expressway and the Pasex are eliminated. As a result, only about a third of the MMUEN project cost is needed from the Government as subsidy to make the project financially attractive.

Table 1.20 FIRR of the MMUEN and Its Components

Priority	Project	Cost	Revenue 2010-2040	Rev./Cost	FIRR (%) All Cost	FIRR (%) Excl. ROW	Cost Reduction to make FIRR 15%
Group A (2002-2010)	MCTE-ext	3,835	40,858	10.7	23.9%	27.9%	0.0%
	MNT-rehab	610	11,600	19.0	41.9%	44.7%	0.0%
	NAIA Exp	11,800	45,676	3.9	6.4%	6.9%	75.2%
	Skyway 2	14,287	88,829	6.2	11.4%	11.4%	33.0%
	Skyway 3	27,071	107,050	4.0	7.3%	7.6%	65.0%
	R10/C3/R9	13,693	46,127	3.4	7.4%	7.6%	57.0%
	Subtotal	**71,297**	**340,141**	**4.8**	**9.3%**	**9.7%**	**48.5%**
Group B (2010-2015)	MCTE-C5	3,658	19,719	5.4	9.9%	11.5%	44.0%
	MNT-C5	3,107	85,577	27.5	48.6%	61.9%	0.0%
	LBCR	15,806	52,740	3.3	8.1%	12.2%	50.5%
	Mbay Exp	50,522	61,224	1.2	1.1%	1.5%	83.8%
	C5 Exp	5,622	45,372	8.1	19.9%	23.2%	0.0%
	Subtotal	**78,715**	**264,631**	**3.4**	**8.2%**	**9.7%**	**48.6%**
Group C (2015-2020)	MMT (C6)	50,561	217,782	4.3	8.6%	12.2%	52.9%
	C6 SS	17,250	74,572	4.3	8.8%	12.5%	51.0%
	NLE-east	1,964	3,715	1.9	3.9%	5.0%	70.0%
	Pasex	16,086	112,778	7.0	10.7%	11.7%	42.5%
	Subtotal	**85,861**	**408,847**	**4.8**	**9.1%**	**12.0%**	**51.0%**
	Total	**235,873**	**1,013,619**	**4.3**	**8.9%**	**10.5%**	**49.5%**
All excl. Mbay Exp & Pasex		**169,265**	**839,618**	**5.0**	**11.5%**	**13.5%**	**33.0%**

1.5 Toll Rate Setting

How to set the optimal expressway toll rate is one of the key subjects of this Study. The optimum toll rate should consider both financial viability of the project and social acceptability of the toll rates.

1.5.1 Historical Change of the Expressway Toll Rate in Metro Manila

The toll rates of the NLE and the SLE (both under the PNCC) have been kept at low levels, primarily due to political pressures. For 20 years from 1977 to 1996, the toll of both expressways was raised only twice for the urban sections and only thrice for the suburban sections. Meanwhile, general prices have inflated 10.2 times over the same period. The last attempt to raise toll levels at the SLE and the NLE was in January 2002. Even at a very modest increase of ₱0.26 to ₱0.33/km for cars (compared to the present Skyway at-grade toll of ₱2.96/km), it generated public outcry which compelled the President to order a rollback of the increase. Experiences in toll rate increases with recently built PPP expressways have been more successful, at least for operators. For example, the Skyway at-grade section opened in 1999 with a toll of ₱0.15/km for cars. Despite strong opposition from the public, the toll rate was increased thrice already in a span of just three years. Currently, it is at ₱2.96/km. Recently, discounts were offered to buses. The following graph illustrates the recent history of toll rate increases in existing expressways. Table 1.21 summarizes the toll rates of existing expressways.

Figure 1.11 Recent History of Toll Increases in Metro Manila

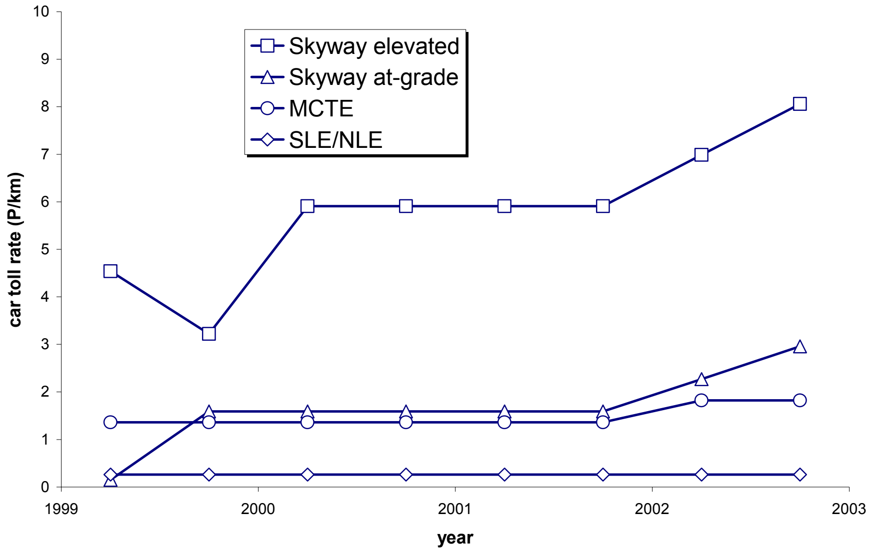


Table 1.21 Historical Toll Rates in Metro Manila Expressways

(1) North Luzon and South Luzon Expressways **(Peso/km)**

Yr.	Section	Vehicle Class/Rate per Km (Peso/km)											
		Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 6+1	Class 6+2	Class 6+3	Class 7	Class 8	Class 9
1977	All	0.094	0.186	0.246	0.306	0.366	0.426	0.521	0.613	0.673	0.153	0.213	0.168
1980	All	0.141	0.280	0.370	0.460	0.550	0.640	0.781	0.920	1.010	0.230	0.320	0.252
1983	All	0.183	0.364	0.481	0.598	0.715	0.832	1.015	1.196	1.313	0.299	0.416	0.328
1989	All	0.183	0.364	0.481	0.328	0.598	-	-	-	-	-	-	-
1996	Urban	0.183	0.364	0.481	0.328	0.598	-	-	-	-	-	-	-
	Suburban	0.30	0.60	0.79	0.54	0.98	-	-	-	-	-	-	-
1999	All	0.26	0.52	0.77	-	-	-	-	-	-	-	-	-
2002/1	All - SLE	0.431	0.861	1.292	-	-	-	-	-	-	-	-	-
	All - NLE	0.333	0.665	0.998	-	-	-	-	-	-	-	-	-

Note: /1 After a few days, the rates were rolled back to 1999 levels.

1977-1989, 12 classes
Class 1: car and jeep
Class 2: truck & bus 2axle
Class 3: truck, combi of 3-axle
Class 4: truck, combi of 4-axle
Class 5: truck, combi of 5-axle
Class 6: truck, combi of 6-axle
Class 6+1: truck, combi of 7-axle
Class 6+2: truck, combi of 8-axle
Class 6+3: truck, combi of 9-axle
Class 7: car & jeep with 1-axle trailer
Class 8: car & jeep with 2-axle trailer
Class 9: passenger bus

1989-1999, 5 classes
Class 1: Cars, jeepneys, taxis, other vehicle with 2 axles except those more than 7-ft high
Class 2: Truck and bus except PUB, with 2 axles, Class 1 with trailer < 7 ft hgh and Class > 7ft high
Class 3: Truck with combination 3 axles, Class 1 with 1-axle trailer > 7ft
Class 4: Public utility busses
Class 5: Trucks with combination 4 to 9 axles and Class with 2-axle trailer > 7ft

From 1999, 3 classes
Class 1: Cars, jeepneys and the like
Class 2: 2-axle trucks, tourist/school bus, PUB and Class 1 > 7ft
Class 3: Heavy vehicles such as 3-axle trucks and trailers

(2) Metro Manila Skyway

a. Elevated Section (9.3 km)

Date	Toll (Peso)			Toll Rate (P/km)		
	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3
12/1998	Free	Free	Free	Free	Free	Free
12/1998	30	60	90	4.54	9.09	13.63
7/1999	30	60	90	3.22	6.45	9.67
10/1999	55	110	165	5.91	11.82	17.74
1/2002	65	130	195	6.99	13.97	20.96
7/2002	75	150	225	8.06	16.12	24.19

b. At-grade Section
(Magallanes-Bicutan, 6.6 km)

Date	Toll (Peso)			Toll Rate (P/km)		
	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3
10/1999	1.00	1.50	2.00	0.15	0.23	0.30
12/1999	10.50	21.00	31.50	1.59	3.18	4.77
1/2002	15.00	30.00	45.00	2.27	4.55	6.82
7/2002	20.00	40.00	60.00	3.03	6.06	9.09

(Bicutan-Sucat, 3.7 km)

Date	Toll (Peso)			Toll Rate (P/km)		
	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3
10/1999	6.00	12.00	18.50	1.62	3.24	5.00
12/1999	6.00	12.00	18.50	1.62	3.24	5.00
1/2002	9.00	18.00	27.00	2.43	4.86	7.30
7/2002	11.00	22.00	33.00	2.97	5.94	8.91

(Sucat-Alabang, 3.9 km)

Date	Toll (Peso)			Toll Rate (P/km)		
	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3
10/1999	6.00	11.50	17.50	1.54	2.95	4.49
12/1999	6.00	11.50	17.50	1.54	2.95	4.49
1/2002	9.00	18.00	27.00	2.31	4.62	6.92
7/2002	11.00	22.00	33.00	2.97	5.94	8.91

(3) Manila-Cavite Toll Expressway

(Peso/km)

Date	Toll (Peso)			Toll Rate (P/km)			Note
	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	
5/1998	9.00	18.00	27.00	1.36	2.73	4.09	
1/2002	12.00	24.00	36.00	1.82	3.64	5.45	

(4) Southern Tagalog Arterial Road

a. Class 1 (Peso/km)

	Sto. Tomas	Sambat	Bulilan
Sto. Tomas	4.00		
Sambat	8.00	4.00	
Bulilan	16.00	13.00	8.00

b. Class 2 (Peso/km)

	Sto. Tomas	Sambat	Bulilan
Sto. Tomas	8.00		
Sambat	16.00	8.00	
Bulilan	33.00	25.00	17.00

c. Class 3 (Peso/km)

	Sto. Tomas	Sambat	Bulilan
Sto. Tomas	12.00		
Sambat	24.00	13.00	
Bulilan	49.00	38.00	25.00

Note: Class 1: Cars, jeepneys, pick-up and the like
Class 2: 2-axle trucks, tourist/school bus, PUB, Class 1 above 7 ft.
Class 3: Heavy vehicles such as 3-axle trucks and trailers

1.5.2 Revenue-maximizing Toll Rates

From the viewpoint of financial considerations, tolls should be set at revenue-maximizing levels. Another consideration is that users should pay for the services as much as possible, which means that government support, in the form of subsidies or guarantees from general taxes, should be kept to a minimum. Using the 2002 time values, the revenue-maximizing toll level was estimated at somewhere between ₱4 and ₱7/km (the range is broad because the revenue-toll level curve is relatively flat). The revenue-maximizing level is expected to rise as time values increase in the future. By 2015, the revenue-maximizing toll rate will be around ₱7/km (see Figure 1.12 and 1.13).

Figure 1.12 Network Demand vs. Toll Rate

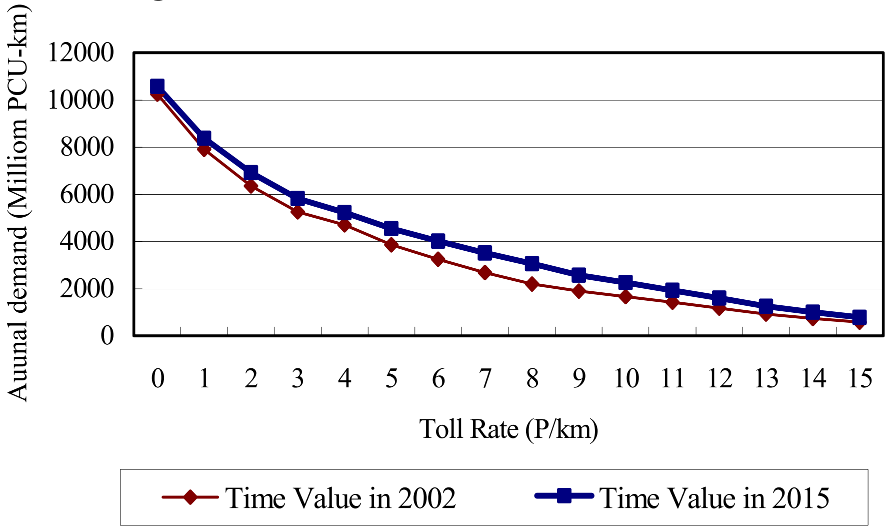
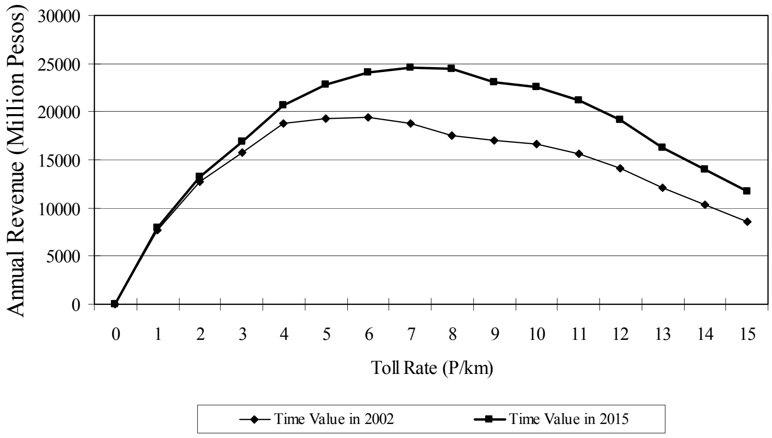


Figure 1.13 Network Revenue vs. Toll Rate



1.5.3 Toll Affordability

The Amended BOT Law (RA 7718) states that all toll fees and adjustments thereof shall take into consideration the reasonableness of the said rates for end-users. This section discusses the issue of toll affordability.

(1) Methodology

Government guidelines on how to define a reasonable toll rate are non-existent. However, there are methodologies to objectively examine the affordability of toll rates, namely (i) percentage of user benefit; (ii) degree of diversion; (iii) percentage of average income; and (iv) comparison with international practice. Each approach is defined and each key merit and demerit discussed in Table 1.22. For this Study, all four approaches are used.

Table 1.22 Methodologies in Examining Toll Rate Affordability

Methodology	Description	Key Merit	Key Demerit
User Benefit	Toll rates should not exceed the total user benefit, which is equal to user savings of time and vehicle operating costs.	Highlights the benefits received by users	May favor high-income class
Diversion Rate	Toll rates should at least attract a certain % of the potential demand. Diversion is defined as the % of potential demand that uses the expressway.	Highlights the number of users benefiting from the project	Not appropriate for monopolistic links
Income	Toll fees should not exceed a certain percentage of income.	Highlights the budget constraint and examines tolls in absolute terms	Difficult to establish reasonable benchmark % of income
International Comparison	Toll rates should be within the range of toll rates used in similar countries	Bases analysis on real world experience	Difference in countries makes transferability of practice questionable

(2) Car User Benefit vs. Toll Rates

The benefit of expressway users depends on the traffic conditions on ordinary roads and the expressway. When the ordinary road network is congested and the travel speed is low, the expressway offers an opportunity for car users to travel much faster.

Table 1.23 quantifies the car user benefit of expressway use for various travel speeds on ordinary road and for various levels of expressway service (i.e. speed difference between expressway and ordinary road). Here, user benefit was calculated as the sum of vehicle operating cost (VOC) and travel time cost (TTC) in financial terms. It was observed that the user benefit would be very large when the travel speeds on ordinary roads are low. If ordinary roads are congested with a low travel speed of 10 kph, an expressway user can enjoy a benefit of ₱11.40/km if the expressway speed is maintained at 60 kph. Even if the expressway is also congested and can offer a travel speed of only 5 kph faster than the ordinary road, an expressway user can still enjoy a benefit of ₱3.90/km. However, if the travel speed on ordinary road is maintained at reasonably fast levels, at 30 kph for instance, the expected benefit is reduced very sharply to around ₱2.00/km.

Table 1.23 Car Benefit by Travel Speed

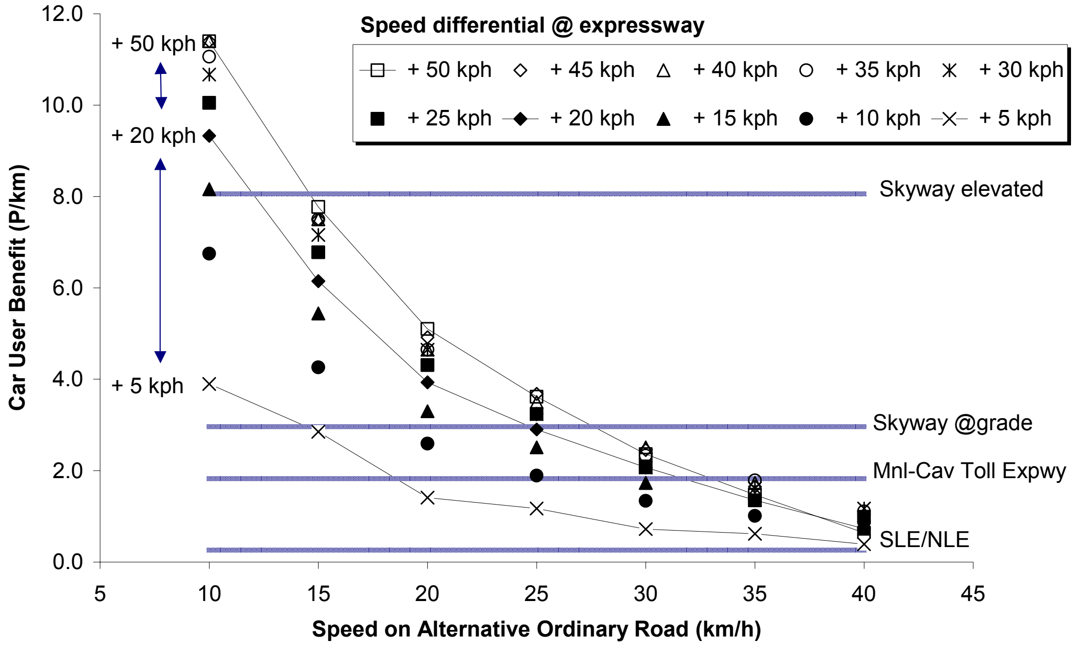
(Peso/km)

Speed on Ordinary Road (kph)	Difference in Speed from Expressway (kph)									
	+ 5	+ 10	+ 15	+ 20	+ 25	+ 30	+ 35	+ 40	+ 45	+ 50
10	3.90	6.75	8.16	9.33	10.05	10.67	11.06	11.40	11.40	<u>11.40</u>
15	2.85	4.26	5.44	6.15	6.78	7.16	7.50	7.50	<u>7.50</u>	7.77
20	1.41	2.59	3.30	3.93	4.31	4.65	4.65	<u>4.65</u>	4.92	5.10
25	1.17	1.89	2.51	2.90	3.24	3.24	<u>3.24</u>	3.50	3.68	3.62
30	0.72	1.34	1.73	2.07	2.07	<u>2.07</u>	2.33	2.51	2.45	2.36
35	0.62	1.01	1.35	1.35	<u>1.35</u>	1.61	1.79	1.73	1.65	1.47
40	0.39	0.73	0.73	<u>0.73</u>	1.17	1.17	1.11	1.02	0.84	0.64

Note: Underlined figures are the design speed of expressways.

The benefit for expressway users can be compared with the actual toll rates of some existing expressways in Metro Manila. Figure 1.14 shows the comparison of car user benefit with current toll rates. The toll rates of the Skyway (elevated section) are very high and can be justified only when alternative ordinary roads are extremely congested with a travel speed below 10 kph.

Figure 1.14 Car User Benefit vs. Existing Toll Rates

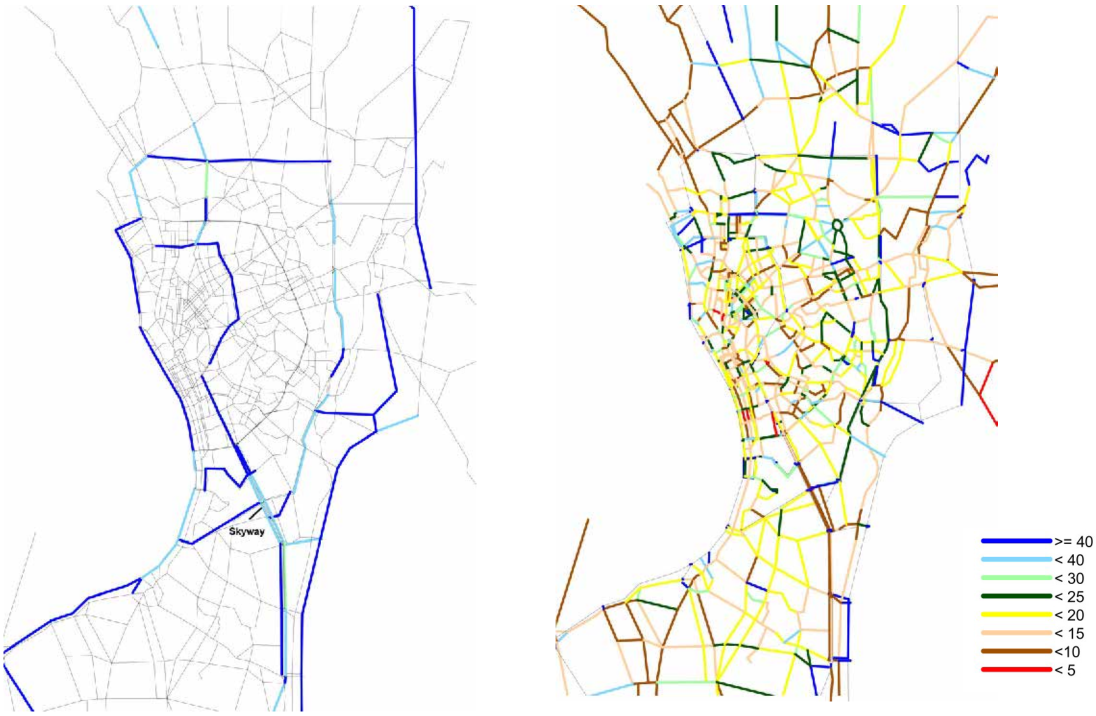


Toll rates should not exceed user benefits. From the discussion above, the maximum affordable toll rate is dependent on the travel speed conditions on alternative ordinary roads and the expressway. Travel speed conditions were simulated for the benchmark years. Figures 1.15 and 1.16 show the expected travel speeds on the network in 2002 and 2015. The typical condition is that ordinary road and expressway travel speed is around 15~20 kph and 35~40 kph, respectively. Assuming a 100% user benefit as the maximum limit, the reasonable toll rate is from ₱3.9/km to ₱6.8/km.

Figure 1.15 Simulated Travel Speed Conditions (kph) in Metro Manila, 2002

(Expressways) (Ordinary Roads)

Figure 1.16 Simulated Travel Speed Conditions (kph) in Metro Manila, 2015

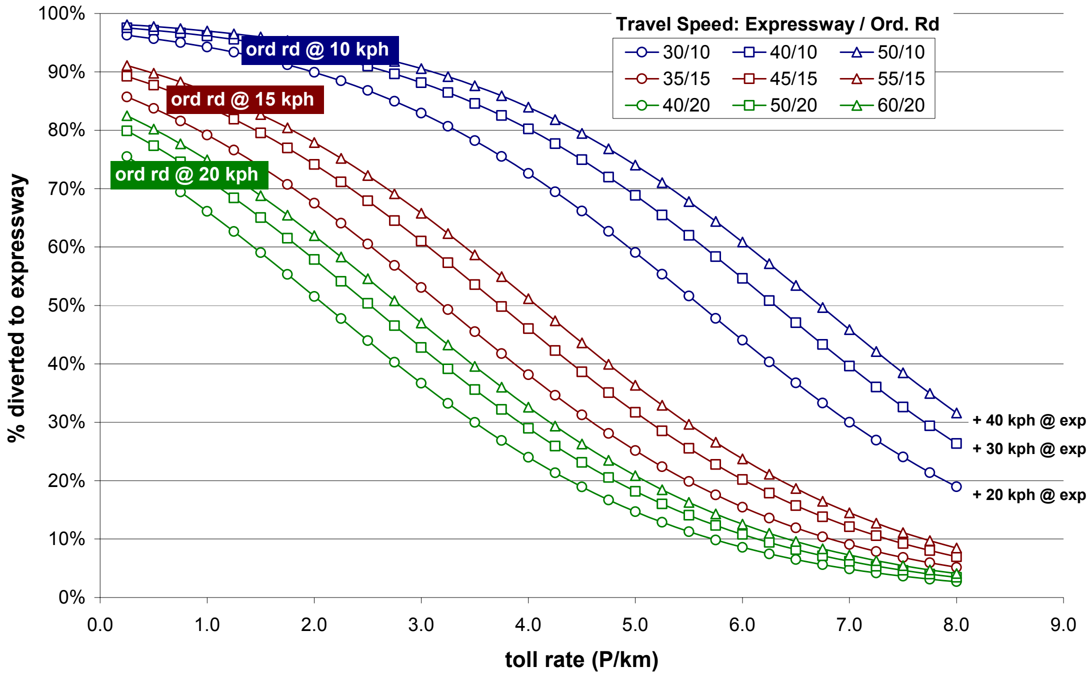


(Expressways) (Ordinary Roads)

(3) Affordability Based on Diversion Rates

Figure 1.17 shows the relationship of expressway diversion and toll rates under several travel speed conditions on the expressway and the alternative ordinary roads. It can be seen that diversion rates are very sensitive to traffic conditions on the ordinary roads. For example, a toll rate of ₱2/km with the expressway being faster by 20 kph, the expressway usage will be around 50%. If speed will further deteriorate to 10 kph, the expressway usage will be around 90%.

Figure 1.17 Diversion Rate Under Several Travel Speed Conditions

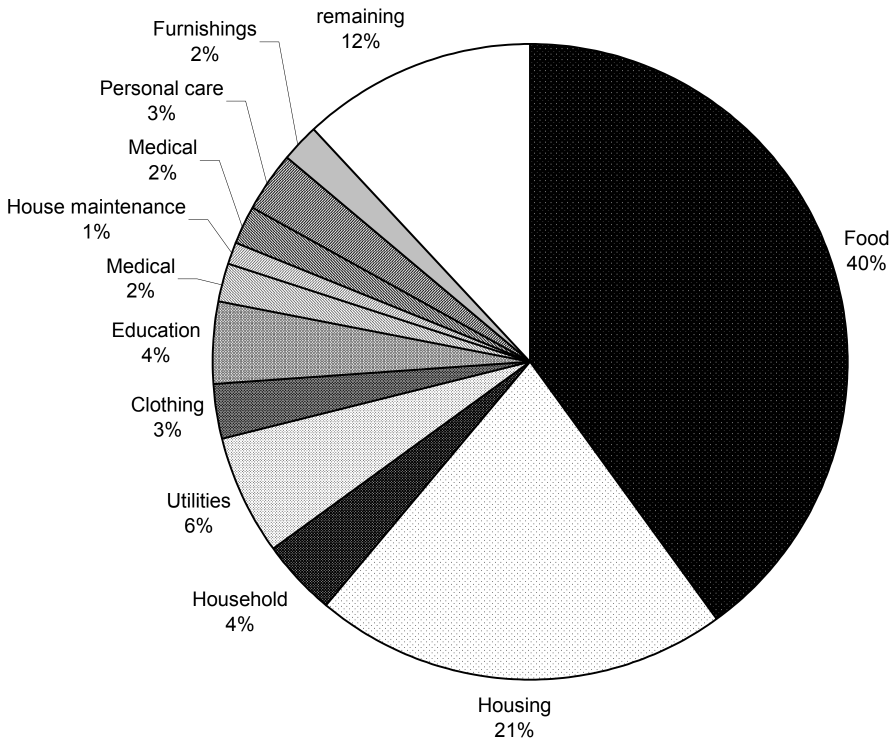


Based on expected travel speed conditions as discussed in the preceding section (i.e. ordinary road at 15-20 kph and expressway at 35-40 kph) and assuming a 50% diversion as the minimum limit, the reasonable toll rate is in the range of ₱2.1-3.8/km.

(4) Affordability Based on Income and Expenditure

Figure 1.18 shows the typical pattern of family expenditure in the National Capital Region. It shows that around 88% of family income goes to essential items, mostly on food and housing. It was assumed that the average car user could afford at most 4% of income to toll payments, which is equivalent to the percentage allotted for utilities. The average income of a car owning household in the NCR is around ₱47,000/month (average income of all household is ₱25,000/month in NCR). This computes to around ₱85/day for tolls or ₱42.5/entry. If an average expressway user travels 10 to 20 kilometers/entry, he or she can afford around ₱2.2/km to ₱4.3/km.

Figure 1.18 Average Pattern of Expenditure at NCR (% of income)



Source: NSCB

(5) International Comparison of Toll Rates

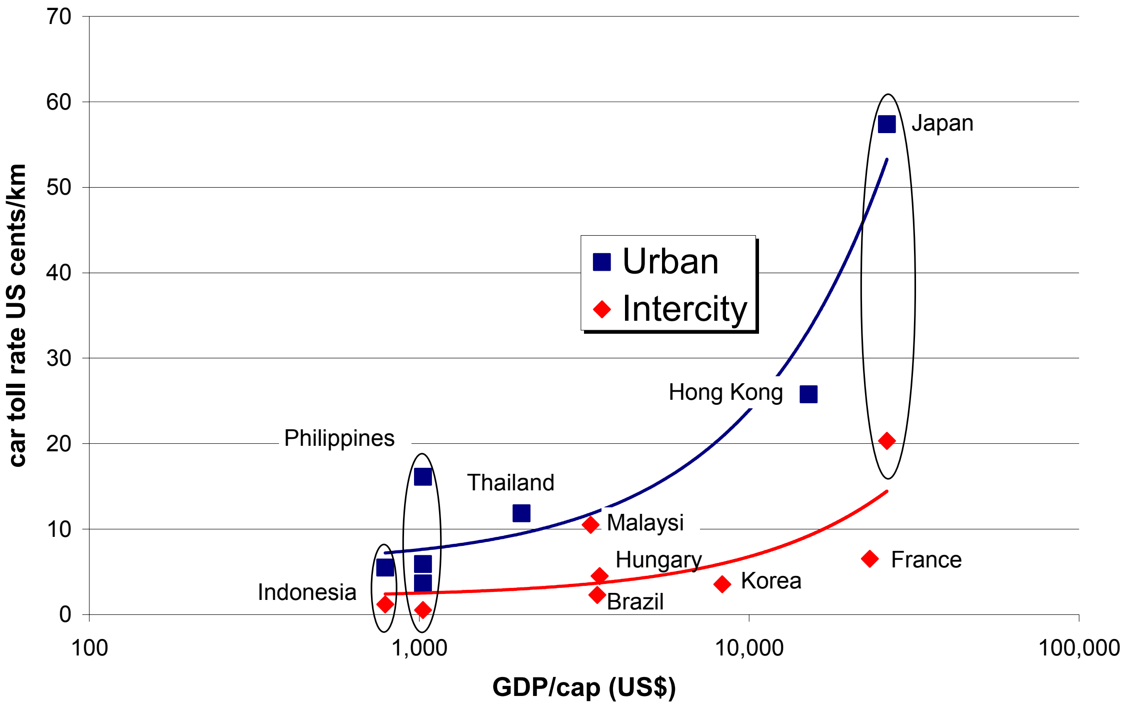
Table 1.24 summarizes the toll rate setting practiced in several countries. Figure 1.19 illustrates the trend of toll rate setting for urban and inter-city expressways against the level of economic development. It can be seen that toll levels of urban expressways are higher than those of inter-city expressways. Moreover, probably due to higher project costs (because of labor cost, etc.) and higher willingness to pay, toll rates are much higher in more economically developed countries.

If the class of US$700-$2,000 GDP per capita class is assumed to be the class for the Philippines, the international toll practice translates to a range of ₱3.0 - ₱5.0/km.

Table 1.24 Toll Rates of Cars in Comparison with Per Capita GDP

Country	Year	Toll Rate (US Cents)	Per Capita GDP (US, 1998)	Remarks
Japan	1997	20.33	26,159	Inter-city
Japan (Tokyo)	2002	57.38	26,159	Urban
France (Paris-Strasbourg)	1998	6.52	23,214	Inter-city
Hong Kong (except the Tunnel)	1999	25.78	15,150	Urban
Korea	1996	3.54	8,284	Inter-city
Hungary (MS)	1998	4.50	3,522	Inter-city
Brazil (Osario-Porto Alegre)	1997	2.30	3,466	Inter-city
Malaysia (North-South Expressway)	1997	10.50	3,305	Inter-city
Thailand (Bangkok Expressway)	1996	11.84	2,043	Urban
Indonesia (Jakarta - Cikampek)	1998	1.20	789	Inter-city
Indonesia (Jakarta Inner Ring)	1998	5.50	789	Urban

Figure 1.19 International Trends: GDP/Capita vs. Toll Rate



(6) Summary and Recommendation

Table 1.25 summarizes the findings on toll rate affordability. Based on the results and the revenue-maximizing toll rate of ₱7/km, this Study recommends the adoption of a ₱4/km car toll rate for the MMUEN. Currently, toll rates for urban expressways in Metro Manila are in the range of ₱1.82/km (MCTE 1) to ₱8.06/km (Skyway 1).

Table 1.25 Maximum Affordable Toll Rate Range

Methodology	Assumption/Remark	Maximum Toll Rate Range (₱/km)
User Benefit	Maximum at 100% User Benefit	**3.9 ~ 6.8**
Diversion Rate	Minimum at 50% Diversion	**2.1 ~ 3.8**
Income and Expenditure	Maximum at 4% of income	**2.2 ~ 4.3**
International Comparison	Class of 750~2,000 GDP/cap	**3.0 ~ 5.0**

2 PPP TECHNIQUE FOR METRO MANILA EXPRESSWAY DEVELOPMENT

2.1 Review and Assessment of PPP Technique

2.1.1 Expressway Development Policy of the Government

(1) PPP Policy of GOP

As stated in the Medium Term Philippine Development Plan, the relevant policy for private sector participation (PSP)[1] in the road sector is:

'Public-private sector partnership shall be used especially in the development of toll expressways along clogged road arteries. A multiplicity of private tollway operators shall be encouraged without sacrificing network integration.'

Subsequent pronouncements by the DPWH rationalized BOT/PPP projects as development instruments:

- to reduce the fiscal burden on the Government
- to accelerate the development of new roads, and
- to improve the efficiency in the delivery of basic services.

Despite the policy pronouncements and the passage of the BOT Law in 1990, the implementation of PPP schemes has not been as fast as the Government originally envisioned it to be. There have been many negative factors, viz:

- The ambiguity in the franchise of the PNCC has tended to dampen new players.
- Getting to financial closure has turned out to be more complex than the traditional mode of implementation;
- Not many viable road projects (nor adequate information) have been available for business decisions to be made;
- Divergence of perceptions between the Government and the private sector about PPP projects.
- A historical bias against commercialization of roads and a long-established philosophy that the provision of roads is a state monopoly. The public is accustomed to using highways for "free".

[1] In the report, the term 'PSP' is used instead of 'PPP' when existing policies and framework regarding private sector participation are discussed.

(2) Macroenvironment for PSP in the Philippines

While the economic fundamentals of a project greatly determine its investment quotient, there are exogenous factors that increase or decrease the realization of PSP.

One favorable factor in the business environment is that there is as yet no established opposition to the building of expressways in the Philippines on the same stridency as those against nuclear plants or garbage incinerators. Unlike in many developed countries, the investment climate is fortunately not (yet) clouded by statist ideas of “cars and freeways as politically incorrect". However, pockets of controversies occur now and then when a road project entails major displacement of people.

There are, however, several, unfavorable factors that tend to limit the volume of PPP activities in the Philippines, viz:

- Road infrastructure has been, and up to the present, considered a government responsibility. The provision of roads by private firms is not yet, and probably will not become, a standard staple in the market. Of the 160 thousand kilometers of roads in the Philippines, only about 17% are national roads administered by the DPWH. After more than 30 years since toll roads opened in the country, only 140 km (about 0.5% of total national roads) of toll roads are in operation.
- All projects being considered by the Government are of the mega-type, i.e. large capital is required. This fact alone reduces the potential number of participants.
- Of the large investors in the Philippines that could engage in PPP ventures, a scant few have the appetite for infrastructure ventures. These few are dominated by property and construction interests.
- Commercial term loans in the market are generally short (5 to 7 years) to match the cash throw-off profile of road projects. The bond market is also inchoate. Hence, the few projects that got implemented relied on foreign funding to get longer repayment periods as well as take advantage of lower interest rates. That, in turn, meant foreign exchange risks especially since tollways do not have foreign exchange revenues.
- Reliance on foreign loans meant that toll road projects, regardless of their merits, would have to bear with prevailing international sentiment about high country risk. The financial market may suddenly become lending-timid, as what happened in the aftermath of the 1997 Asian crisis or this year’s Argentinian crisis. “Foreign investment inflows to emerging

markets in 1999 were less than half of what they had been five years earlier."[2]

- Over the last decade, right-of-way (ROW) issues rose to prominence as major deterrents to road projects, aside from unfriendly behavior of some LGUs. These have unnecessarily raised completion risks, which are usually assumed by private proponents.

Of the above exogenous factors, the mismatch between project demands and available financing is probably the most critical variable to the realization of PPP projects. Development highways that must build their own traffic, such as the Southern Tagalog Arterial Road (STAR) and Subic Expressway, are inherently a longer-term proposition than are congestion relievers, such as the Skyway and Manila-Cavite expressways. However, all four projects had to contend with domestic banks averse to loans with more than seven years maturity. Expressway projects require longer-term debts. Development highways, more specially, have to create their own traffic; it will take some years to cover operating costs, let alone service debt.

Political risk also affects investments in and loans for privately financed infrastructure projects. Although this type of information is highly subjective and dynamic, banks and companies put considerable time and effort into understanding the economic variables that, in part, define "country risk" (i.e. external environmental risks as opposed to risks that are internal to a particular company). Perceptions and reality are not necessarily the same thing; yet perceptions about the Philippines have more often been negative than positive over the last ten years. A survey made in early 1997, for example, rated the importance of political risk in various countries as well as the difficulty of doing business (see Table 2.1).

Table 2.1 Business Risks in Asia, 1997

Country	Importance of Political Risk	Degree of Difficulty in Doing Business	Frustrating Bureaucracy
1. China	68.55	6.33	8.00
2. Hong Kong	62.32	3.61	3.64
3. Vietnam	56.54	5.75	8.13
4. Philippines	56.32	5.83	8.18
5. Taiwan	54.20	4.78	6.17
6. South Korea	50.24	5.62	5.50
7. Thailand	48.70	5.59	7.89
8. Indonesia	48.41	6.27	9.33
9. Malaysia	42.00	5.35	7.00
10. US	32.19	2.89	n.a.
11. Japan	31.79	4.97	7.00
12. Singapore	27.07	3.50	3.10

Source: PERC

[2] Estache, Antonio and Strong, John. "The Rise, The Fall, and the Emerging Recovery of Project Finance in Transport", World Bank Institute, 2000.

It can be seen that political risk was perceived to be more important than other factors in assessing country risks about the Philippines (4th rank). The table indicates that political problems are seen to impinge on business the least in Singapore and Japan. It is significant to note also that the Philippines ranked as the 3rd most difficult country to do business with.

Hutchcroft's matrix, Table 2.2 below, is consistent with the perception about Philippine bureaucracy shown in the last column above. It explains why reality often deviates from official policy.

Table 2.2 Hutchcroft's Matrix

	State > Business (Strong States)	**Business > State (Weak States)**
Rational/Legal States	II –*Developmental State* State establishes policy to create an environment for progress and wealth, like Singapore	I – *Laissez Faire Regulatory State* Business pursues wealth while State watches over public interest, like USA
Predatory States	III – *Bureaucratic Capitalism* State dictates who in business controls wealth, like Suharto's Indonesia	IV – *Oligarchic State (Booty Capitalism)* Business influences state policy to benefit its self-interest, like the Philippines

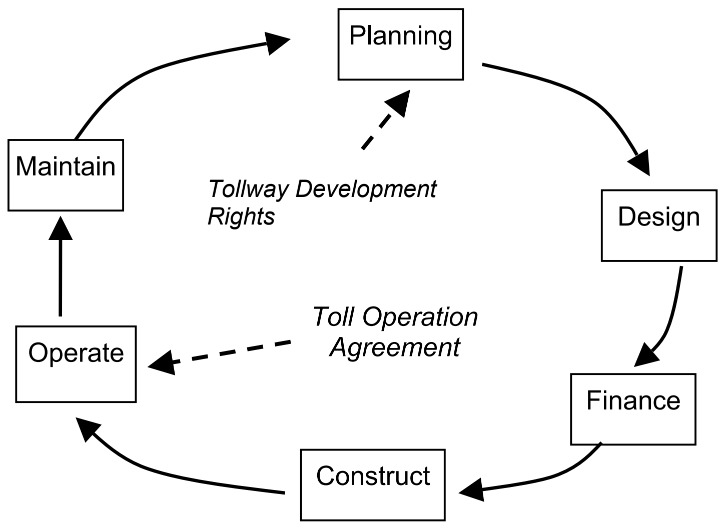
Source: Romulo Neri, Asian Institute of Management, as reported in Philippine Star, 13 March 2002

The credit ratings of the country, as well as the political risks, impact on the financial negotiations – in terms of interest rates, loan conditions, and availability of loans and investors. For example, Moody's Investor Service changed the Philippines' rating from "negative" to "stable" in February 2002, but still short of the desired rating of "positive". Philippine foreign currency bonds are still below investment grade with a rating of Ba1.

(3) PPP Development Process

The development of a PPP expressway in the Philippines may follow two different tracks, but still conform to the same basic process illustrated in Figure 2.1 below. A private proponent would require a toll development rights before it would spend money for planning and design of a tollway.

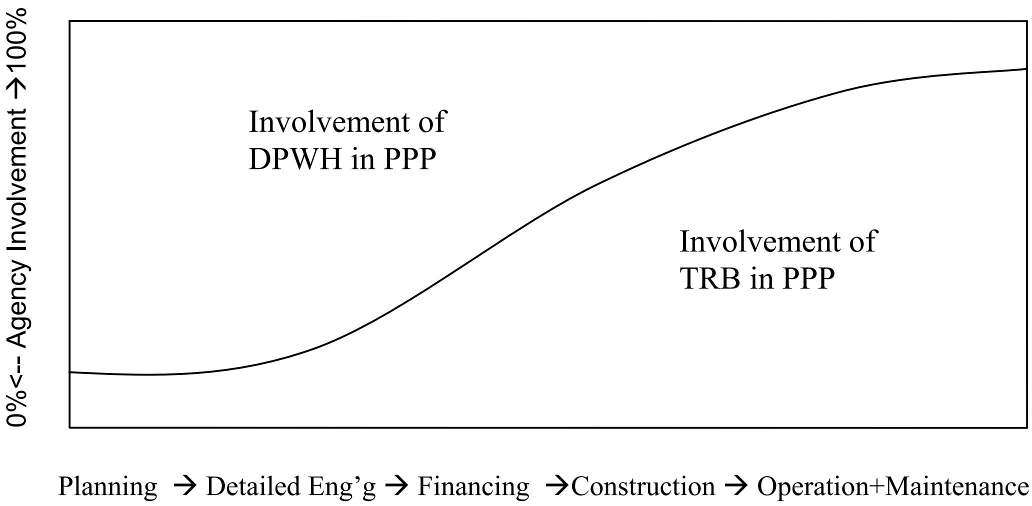
Figure 2.1 PPP Development Process



After pre-feasibility phase, a business decision is made whether to proceed or not with the project. If yes, additional resources are spent for Detailed Engineering – to pin down project cost that becomes the basis to secure financing. With available funding, the project gets constructed; its completion then leads to the issuance of a toll operating certificate. Through time and before the lapse of the concession period, the operator uses these prior rights as an excuse to expand or improve the roads and to justify another lease or extension on its franchise. At every stage of the development cycle, a decision to abort or abandon the project can be made. In an unsolicited mode and joint venture schemes, the proponent assumes two types of completion risk – completion of the plans and completion of construction.

The joint venture route followed by the respective sponsors of the Skyway, Manila North Tollway and the Manila-Cavite Expressway was anchored on prior development rights of the PNCC and the PEA. Theoretically, a toll operating certificate is issued only after substantial completion of construction. However, private financing can not be secured without a guarantee of corresponding rights. To avoid a chicken-and-egg situation, the development and operating rights have been fused together into a Toll Concession Agreement (TCA) to be granted at the start. This brings the TRB upstream of the PPP development process, since the grants would equate to amendments of existing toll operation permits. The further upstream the TRB participates in the process, the greater is the possibility of conflict with the DPWH. This was the inter-agency experience in the four expressway projects that reached implementation stage. It is a natural offshoot of DPWH responsibilities to assume greater involvement during the planning and engineering stages, and to hand over supervision and regulation during the stage of operations to the TRB. The starting point for greenfield and new road projects is the DPWH; but for expansion or revision of existing 'franchises', the starting point is the TRB.

Figure 2.2 Degree of Involvement of the DPWH and the TRB in Different Project Stages



Contract Management and Allocation of Responsibilities

Turf wars often occur even among units within the same organization, much more so within the Government with its myriad of agencies. Notwithstanding the intent of the BOT Law, there are natural tensions between the TRB and the DPWH-BOT on how BOT projects should be approached, and which agency shall call the shots at every stage of the project. Consider the following potential points of conflict between them:

Table 2.3 DPWH and TRB Views on Contract Issues

ISSUE	DPWH LINE	TRB LINE
Contracting Party for the Government	DPWH should sign for the GOP; TRB should limit itself to the O&M aspects of the project	TRB can not wait down the road, as it may find the terms of the Contract unacceptable later on, and preclude grant of TOC
Design and Construction of Toll Facilities	Design standards and approval should be with DPWH, since toll roads and facilities are covered by DPWH's mandate	Should comply with TRB's standards, being part of its requirements for issuance of TOC
Toll Rate Setting and Adjustments	As stipulated for in the BOT contract and TOC to be issued by TRB	Following TRB rules and subjected to public hearing, but if no opposition, appropriate notice is given to the public
Partial Operation of Completed Segments	May be considered for purposes of enhancing financial viability of the project	Not objectionable per se but prefers operation to commence only upon completion of construction of the whole facility
Control of Upside	As proponent is made to assume traffic risk, there should be no cap on its profits if traffic betters initial projections	Profits should be moderated in case traffic is higher than forecast, so that income does not exceed 12% RORB
Principal Concern	Successful implementation of Concession Agreement	Efficient operation of the tollway, at rates acceptable to motorists

The conflicting tendencies and views of the DPWH and the TRB were reflected in the Concession and Toll Operating Agreements. By way of an example, the Skyway STOA had the TRB as grantor in behalf of the GOP and the DPWH as a co-signatory. On the other hand, the draft TCA for the STAR project, included as part of the bidding documents, had DPWH as sole signatory. It had to be revised later during negotiations with the winning bidder to incorporate the concerns of other agencies and to make the DPWH and the TRB as co-grantors in behalf of the GOP.

Conflicts between the DPWH and the TRB should diminish, if not disappear, in the future as both gain insights into each other's concerns. In the future, there will be less and less opportunities for joint ventures simply because the PNCC and the PEA will have virtually exhausted their reserves of development rights. Hence, the foregoing process will be driven more and more by the DPWH in accordance with the BOT Law. While the latter permits solicited as well as unsolicited proposals, the latter route may also dry up. Unsolicited proposals need to satisfy several conditions: They must (i) involve new technology, (ii) not be in the priority list of the DPWH, and (iii) need no direct government guarantee, subsidy, or equity. It is difficult to imagine of a new technology for expressways that are not already known or tried locally. Since urban expressways constitute a network, any component of it would have to be listed *a priori* and put in the priority list of the DPWH. Lastly, these projects would likely require some form of government equity or contribution to be financially viable.

By force of circumstances, therefore, the solicited mode of the BOT Law would become the norm for future urban expressways to be developed with private sector participation. Table 2.4 amplifies the basic process shown in Figure 2.1 in terms of the solicited mode of the BOT Law.

Much has been said about the different contractual options allowed under the BOT Law. What is not generally understood is the difference in risk allocation – and its attendant contingent liabilities. For example, the private sector proponent assumes the biggest risk under a build-operate-own (BOO) arrangement and should therefore be given more liberal concession terms. Under a build-transfer (BT) or build-lease-transfer (BLT) arrangement, the Government takes more risk. Financial closure is more difficult in BOO than BT, because the latter partakes of a sovereign obligation.

Table 2.4 BOT "Solicited Proposal" Process

Requirement	Time Factors*	Cost Factors	Staff Resources
Project Designation as "Priority"	Time not specified; may take 6 months, depending on time of project justification by DPWH officials. The List of BOT Priority Projects to be published every 6 months.	DPWH	BOT PMO Staff required to prepare and justify project as part of MTDP.
Prefeasibility Analysis	A full pre-feasibility analysis may take up to 6 or more months for the DPWH to contract, complete and review.	Depending on project, may cost ₱5M or more.	Usually contracted to external consultant.
Proponent Pre-qualification	21 days*		
Advertisement*	At least 30 days (45 days if project exceeds ₱300 million) after final advertisement	Cost of advertisement	Staff to prepare ads for Pre-Qualification and Tender & Bid Documents.
Application by Candidates	No time limit specified; 21 days is reasonable timeframe; notice to candidate must be within 7 days of analysis completion	(Private Sector only)	(Private Sector only)
Analysis	60 additional working days possible for appeals	DPWH	PBAC to analyze Pre-Qualification forms
Appeals of Pre-disqualification		Legal costs	DPWH staff to explain and justify disqualification
Tender and Bid			
Pre-Bid Conference	At least 30 days before submission by pre-qualified candidates.	DPWH and TRB	PBAC and Staff answer inquiries, conduct Pre-Bid Conference, distribute supplementary materials.
Submission of Technical and Financial Proposals	Varies; 120 days is recommended from date of last advertisement.	(Private Sector)	
Evaluation	30 days for Technical, plus 30 days for Financial.	DPWH and TRB	
Award and Negotiation with Selected Bidder	Period may exceed 45 days, when there are contentious issues. Will probably need 30 days	DPWH and TRB	
Preparation of Concession Agreement (CA)	> 15 days	TRB	
Approval and Review of CA	at least 30 days	NEDA - ICC	
Approval of Final Engineering Design	Within 180 days from effectivity of agreement	DPWH	PMO/ Bureau of Design
Notice to Proceed Construction	Dependent on vacant land in possession (ROW) and approval of Engineering Design	DPWH	

2.1.2 Review of Existing PPP Transport Projects

(1) Current Status of PPP Projects (as of March 2002)

The existing toll roads are the following: a) North Luzon Expressway (NLE); b) South Luzon Expressway (SLE); c) Manila-Cavite Toll Expressway; d) Stage 1 of the Metro Manila Skyway (MMS), and (e) Stage 1 of STAR. The last three tollways came into being only in the last decade.

Manila-Cavite Toll Expressway is a 6.3-km coastal road extending southward of Roxas Boulevard to Cavite. It was initially built by the DPWH as a non-toll road in the 1980s as part of the Manila-Cavite Road and Reclamation Project (MCCRP). The road was rehabilitated into a tollway in 1997 with private funding and transformed into the Manila-Cavite Toll Expressway (MCTE) Project under a joint venture agreement between the Renong Group of Malaysia and PEA. The tollway was opened in May 1998. Construction of Phase 2 (C-5 Link) is long overdue – delayed by ROW problem as well as the withdrawal of the Malaysian partners.

Metro Manila Skyway. Stage 1 Phase 1 of the project, or the southern segment, with a length of about 7 km of elevated structure above the median of the South Luzon Expressway was completed and opened to traffic in the middle of December 1998. Phase 2, the northern segment connecting the Skyway to the Makati CBD, was completed several months after. It was built under a concession agreement granted to Citra Metro Manila Tollways Corporation, at a cost of US$ 514 million, inclusive of rehabilitation of the existing at-grade portions of SLT from Nichols to Alabang. Stage 2, the southern continuation to Alabang, and Stage 3, the northern segment that will link to the North Luzon Tollway (NLT), have not yet reached financial closure. With the reported financial difficulties being encountered under Stage 1, it is doubtful that it can achieve financial closure and commence construction soon. According to the Toll Operation Agreement covering Skyway Stage 2, it should have been completed by 1999.

Southern Tagalog Arterial Road is a 42-km expressway stretching from Sto. Tomas to Batangas City, with an estimated construction cost of ₱1.7 billion (US$ 46 million). Phase 1, about 22-km long from Calamba to Sto. Tomas, was built by the DPWH with JBIC loans; it became operational sometime last year. Phase 2, from Sto.Tomas to Batangas, was bid out by the DPWH following the solicited mode specified under the BOT Law and was won by the same group behind the Skyway project. The concessionaire and project company, STAR Infrastructure Development Corporation, is required to finance the entire phase 2 works, some modifications and improvements (such as adding toll plazas and interchanges) to Phase 1, as well as ROW acquisition up to ₱500 million. On the other hand, the Government is obligated to absorb ROW cost in excess of ₱500 million and to turn over the operating rights and maintenance responsibility of Phase 1 of the tollway. There is as yet no financial closure for Phase 2.

Manila North Tollways Project entails the rehabilitation of the existing NLE (83 km), construction of a new road to the Subic Freeport Area (67 km) and the construction of the northern arc of C-5 (35 km) under a joint venture agreement between the PNCC and the First Philippine Infrastructure Development Corporation (FPIDC). The total construction cost of the MNT project is estimated at ₱14 billion (US$ 370 million). Segment 7, about 8.5 km from Tipo to Binictican, was advanced for the Asia-Pacific Economic Conference in 1996. To date, it is the only operational element of the MNT project. Phase 1 was supposed to be completed by end of 1999, but only bridge widening and access improvements have been performed so far.

Reportedly, lenders have withheld releases until enough land for ROW could be secured. Financial difficulties confronting its proponents are also contributing to the uncertainties.

(2) Analysis of Expressway Projects

Table 2.5 compares the four expressway projects in terms of their project history, costs, concession terms, and other features. The salient findings about these projects are as follows:

All four expressway projects have suffered completion delays.

Phase 1 of MCTE appeared to have the best record among the four – 667 days from award of toll concession to start of operation. With a simple scope, i.e. rehabilitation of existing roads and upgrading to expressway status, and short length (6.45 km), a shorter construction period is only to be expected. But reckoned from the original authorization issued by the TRB to the PEA in May 1990, the realization of MCTE took the longest. Phases 2 and 3 are supposed to be completed and operational by 1998, but financial closure and start of construction are still far away.

Stage 1 of the MMS project was completed in three years, but entailed only 9.3 km of elevated roadway. Nevertheless, it could be considered as a reasonable duration in light of oppositions encountered by the project proponent from LGUs. Construction of Stages 2 and 3 of Skyway were supposed to follow immediately and be completed by 2000; financial closure is not yet in sight by start of 2002.

Construction of STAR Phase 2 and MNT is already behind their original timetables. The former has not yet reached financial closure. On the other hand, MNT has announced a financial closure, but loan effectivity appears to be on hold due to ROW issues. STAR has a smaller scale and cost than MNT, and on this yardstick may have a better chance of earlier completion.

Build-Transfer-Operate (BTO)

BTO is the common contractual framework of the four aforementioned expressway projects, notwithstanding the fact that only one of the four projects was undertaken under the BOT Law. Ownership is transferred to the Government upon substantial completion of construction – to the TRB in the case of MMS and MNT, to the DPWH in the case of STAR, and to the PEA in the case of MCTE. Usufructs or operating benefits are retained by the concessionaire for 30 years (except MCTE, which has 35 years). There is, of course, an inherent advantage of BTO over BOT scheme for linear infrastructure projects like expressways: the private proponents are less exposed to the excesses of tort liability if they owned the facilities, as well as to the vagaries of property taxation from LGUs.

Table 2.5 Comparison of the Four Existing PPP Expressway Projects

		STAR	Manila-Cavite Toll Expressway	Manila North Tollway	Metro Manila Skyway
BASIC INFORMATION	Description	At-grade extension of the SLE from Calamba to Batangas. The so-called STAR is a 42-km 4-lane divided expressway to be built in 2 stages. Stage 1 is from Sto. Tomas to Lipa City, while Stage 2 is from Lipa City to Batangas City.	At-grade 25.2-km road to be developed in 3 phases. Phase 1 is 6.45 km and mainly rehabilitation of existing road into tollway; Phase 2 is 7.5-km C-5 link to SLE; Phase 3 is 11.24-km extension from Zapote to Noveleta.	Rehabilitation of the existing NLE and its expansion to Subic and Clark SEZs. Rehab portion involves 82-km plus additional 2 lanes x 41.2 km. New construction involves 81.4 km.	6-lane elevated expressway linking NLE in Balintawak to the SLE up to Alabang, in 3 stages (Stage 1=9.3 km; Stage 2=13.8 km; Stage 3=11.6 km). Also rehabilitation and upgrading of the SLE from Nichols to Alabang.
	Cost	Phase 1 was funded directly by the Government, while Phase 2 is privately financed. Cost for Phase 1 Stage 2 is ₱607.423 million. No valuation was placed on Stage 1, but DPWH documents put the cost at ₱3,195 million.	Cost of Phase 1 is unclear, but probably around ₱550 million; Phase 2 is estimated to cost ₱2.6 billion, and Phase 3 ₱2.3 billion.	Cost of segment 7 = ₱679.7 million; Total project cost placed at ₱15.7 billion in 1995.	Stage 1= ₱11.6 billion; Stage 2 = ₱9.8 billion; Stage 3 = ₱8.5 billion.
	Gov't Agency	DPWH	PEA	PNCC	PNCC
	Private Sector	Strategic Alliance Development Corporation formed a joint venture company called Star Infrastructure Development Corporation	Renong Berhad and MARA formed a joint venture with PEA to undertake the project. Renong's interest was transferred to United Engineers Malaysia which formed UEM-MARA Phils. Corp.	Benpres Holdings Corp. and First Philippine Holdings Corp. formed a project company called First Philippine Infrastructure Development Corp. to undertake the project, with Transroute International as its equity partner.	Strategic Alliance Development Corporation formed a joint venture company called Citra Metro Manila Tollways Corporation
	Legal Framework	BOT Law. Contract awarded by DPWH after public tender.	Proponent secured a Toll Operating Agreement (TOA) from the TRB	Joint venture with PNCC under Presidential Decree 1113; with a toll Operation Agreement (TOA) from TRB	Joint venture with PNCC under Presidential Decree 1113; with a TOA from TRB
	Scheme	BTO; ownership is transferred to DPWH upon substantial completion of construction	BTO; ownership is transferred to TRB at start of concession period	Joint venture with PNCC. Scheme is BTO.	Joint venture with PNCC. Scheme is BTO.
	Status	Phase 1 is operational; Phase 2 yet to be constructed.	Phase 1 was completed 12 May 1998. Commercial operations began 24 May 1998. Phases 2 and 3 have not started construction.	Segment 7 (Bo. Tipo-Binictican), 8.5 km, is operational since completion in 1996. Rehab works partially done for segment 1	Stage 1 began construction in 1996 and completed in 2000. Stage 2 scheduled from 2000 to 2007. Stage 3 scheduled from 2001 to 2002
HISTORY	Government Decision/ Approval	DPWH and ICC approval. Concession agreement awarded jointly by DPWH and TRB. Final approval of the President of the Philippines.	TRB granted PEA the authority to design, construct, operate, and maintain Phases 1 and 3 on 31 May 1990. PEA entered into a joint venture agreement with MARA and Renong on 27 Dec 1994.	Assignment of PNCC rights to FPIDC on 16 May 1995. MOU between FPIDC and BCDA/SBMA executed on 6 March 1995 for segment 7. Issuance of TOA by TRB on ??	Joint venture agreement was approved by the Office of the President. Implementation and award of concession agreement from TRB.
	Bidding	Tendered by DPWH on 16 May 1997	None. PEA simply chose MARA and Renong	None	None
	Award of Concession	18 June 1998 by DPWH and TRB.	Original concession to PEA on 31 May 1990. TOA awarded by TRB on 26 July 1996.	Supplemental TOA issued on 15 June 1998 by TRB	27 Nov 1995 by TRB
	Financial closure	No financial closure yet for Stage 2	Financing appears to have been documented as advances by UEM to UMPC.	Exact date not known for segment 7	
	Construction	Original implementation schedule 1993-98. Phase 1 was completed only in 2000; but Phase 2 is yet to begin.	Construction of Phase 1 commenced on 13 Nov 1996 and completed on 12 May 1998.	Bridges under Phase 1 have been widened, other sections re-surfaced. Works currently suspended.	
	Start of Operation	Late 2000 for Phase 1	24 May 1998	Segment 7 (Bo. Tipo-Binictican), 8.5 km, is operational since completion in 1996.	19 Dec 98

Cont'd… Table 2.5 Comparison of the Four Existing PPP Expressway Projects

		STAR	Manila-Cavite Toll Expressway	Manila North Tollway	Metro Manila Skyway
PROJECT STRUCTURE	Project Company	Star Infrastructure Development Corporation	UEM-MARA Philippines Corporation (UMPC)	Manila North Tollways Corporation	Citra Metro Manila Tollways Corporation
	Shareholding Structure	Consortium of 6 (STRADEC, William Uy Construction, JH Pajara Construction, Walter Bauag/Betonval Ready Concrete, PNCC, JF Cancio)	Originally owned by United Engineers (Malaysia) Bhd and Renong; later ceded to Coastal Road Corporation	FPIDC will own 80% of the project company, with PNCC subscribing to 20%. Operating company to be majority-owned by FPIDC, with PNCC and Transroute as minority shareholders. Transroute will be majority owner of maintenance company.	Could not yet be ascertained. PNCC and STRADEC are known shareholders. Citra of Indonesia is in the minority.
	Operator	Intention is to incorporate a separate O&M company.	PEATC, 100% owned by PEA	Intention of FPIDC is to incorporate a separate company for operation and another maintenance.	PNCC Skyway Corporation
	Financial Adviser		Jardine Fleming Exchange Capital	JP Morgan (Hong Kong)	AIA Capital
	Legal Adviser			Puno and Puno/Linklaters and Alliance (Hong Kong)	Chavez, Laureta and Associates
COSTS & FUNDING	Construction Costs	₱1.7 billion ($46 million)	Civil works =₱282.5 million, Property and equipment=₱1,004 million		Stage 1 = US$514 million
	Operation cost/yr		P54 million/year	Not yet completed	
	Maintenance Cost/Yr		included in above cost	Not yet completed	
	Equity	Not yet finalized	P28.375 million	31.76% of project cost. 80% of which is subscribed by FPIDC, while 20% is owned by PNCC	About 20% of project cost = $103 million
	Debt/Sub-debt	Not firm	Advances from affiliates = ₱918 million plus Accounts Payable = ₱420 million	68.24%; foreign loan =$252,500,000 for Phase 1	Foreign Loan=$262 million [~30% ($154 million) as convertible debt and 30% senior debt] 7 years to pay
	Credit Enhancement	ROW and other components assumed by DPWH. Grantee did not spend for Phase 1 (22 km), but will reap benefits from its inclusion in the toll system.	Cost of ROW to be assumed and undertaken by TRB. Existing R-1 road was built as an open road in the early 80s by DPWH, then assigned to UMPC, which was also given right to reclaim and develop 800 hectares of land.	Traffic and revenues from existing NLE integrated into the project after completion, thus assuring a cross-subsidy from the 'old' but rehabilitated expressways into the new segments.	Tolls at the included sections of SLE were also raised, thus a cross-subsidy from the old, albeit rehabilitated section, to the new & more expensive but unprofitable sections.
	ODA Funds	JBIC funding was used by DPWH for Phase 1	None	None	None
	Profitability	Not yet clear. But financial model in the Concession Agreement showed 15.22% IRR.	Phase 1 appears to be profitable, with gross toll collections = ₱260 million/year and EBITDA = ₱160 million/year.	Project study submitted to TRB showed IRR=19% up to year 2033.	Not yet available. Likely to be negative

Cont'd… Table 2.5 Comparison of the Four Existing PPP Expressway Projects

		STAR	Manila-Cavite Toll Expressway	Manila North Tollway	Metro Manila Skyway
CONCESSION TERMS	Concession Period	30 years. Indicative start of 1 January 2000 and expiry on 31 December 2029	35 years from 1 October 1998, or last final operation date for all phases, whichever is earlier	30 years for each competed phase. Phase 1 ends 31 December 2030	30 years from final operation date
	Revenue-sharing	None	Until debts are fully repaid, PEA gets 10% of net income; Its share goes up to 60% thereafter. UEMPC gets 90% share, then 40%.	PNCC gets 2% of gross toll revenues for the Subic segment and 6% for the NLE upon completion	PNCC gets 10% share of gross toll revenues
	Toll Setting and Adjustment Mechanism	Parametric cost-recovery formula that sets out the input variables: consumer price index, exchange rates, beginning toll rate. Periodic adjustments every 3 years.	Parametric formula analogous to STAR's - adjusted based on CPI and foreign exchange rate relative to base rates. Review every 3 years.	Periodic adjustments using a parametric formula based on CPI for Philippines and US, foreign exchange rates between Peso and US$, and composition of debts. Toll fee review every 2 years.	Periodic adjustments using a parametric formula based on devaluation rate and schedule of escalation rates. Toll review every 2 years.
	Franchise Fee	Supervision Fee = 2% of construction cost	??	Concession fee under PD No. 1113 and PD No. 1894 shall apply.	Concession fee under PD No. 1113 to apply, which is the repayment schedule for the old loans/cost of SLE.
	Government Undertakings	DPWH acquired the ROW; but part of the cost - up to ₱500 million - came from SIDC (concessionaire) to be recovered later as part of project cost.	TRB to acquire the ROW and make it available to UMPC, 6 months supply of "lands in possession"	ROW to be made available by DPWH, SBMA, PNCC, and TRB for specific segments	TRB was supposed to secure the ROW for the access ramps; but this task was performed by the concessionaire on cost-reimbursement basis.
	BOI	6 years tax holiday for the Grantee	6 years tax holiday for each phases	6 years tax holiday	6 years tax holiday
	Problems and Constraints	ROW acquisition took longer than anticipated, with major cost overruns.	Toll collections temporarily halted on two occasions by virtue of court order, when the rates and project were questioned.	ROW for the C-5 connections (segments 8, 9, and 10) has not progressed, with cost escalating to nearly ₱10 billion. Alignment has undergone modifications – especially the C-5 links as well as the NLE-to-Dinalupihan segments. Even for rehab of existing segments, ROW for interchange improvements could not be secured because of uncooperative LGUs.	Initial conflict with Pabahay-sa-Riles project of PNR for the 2nd-level ROW in Makati alignment. Original plan for access ramp on Gil Puyat Avenue was opposed by the Makati city government, hence modified to Arnaiz-Don Bosco. Third problem with Parañaque (LGU) which filed court cases against the project on grounds of environmental non-compliance.
	Current Problems	Congress is questioning the authority of TRB to allow SIDC to charge for a project which received government money.	Only about 50% of the ROW for Phase 2 had been acquired by TRB but funds were already depleted. Additional ₱2 billion required. Entire interest of MARA-UEM acquired by a local group Coastal Road Corporation.	Financial difficulties of main proponent (BHC and FPHC). Although financial closure was announced, lenders have withheld further release until adequate lands are in possession. No definitive timetable on ROW clearing. Segment 7 does not have enough volume, until other segments are completed.	Unable to get enough traffic volume on the elevated section and could not start Stage 2 or 3 with negative cash flow on Stage 1
	Related Projects/ Phases	Section to connect the SLE from Calamba to Sto. Tomas to be done through JVA with PNCC. Section from Sto. Tomas to Lipa built by DPWH at its own expense	As indicated above.	As indicated above. Phase 1 covers segments 1-3 and 7. Phase 2 covers segments 8 and 9, while Phase 3 covers segments 4-6 and 10.	Stage 3 (11.6 km) to link NLE and SLE along C-3. Stage 2 is 13.8 km from Sucat to Alabang.

Projects have incurred (or are negotiating) foreign loans.

The proponents may have valid reasons to tap the foreign capital markets, instead of borrowing locally. But this mode of financing has exposed the projects to foreign exchange risks, especially since all revenues are peso denominated. The proponents, however, effectively transferred these risks to the motorists or prospective users of the tollways. The toll rates and the agreed adjustment formula incorporated the peso-to-dollar exchange rates – at the start of construction and at time of settlements.

A project company is formed separate and distinct from the sponsors.

None of the private proponents assumed directly the obligations and rights attendant to holders of Toll Operating Certificates or concessionaires. A special purpose vehicle is created to undertake the project to isolate project risks from the other business activities of the proponents. The project itself is treated as a separate entity from the sponsors, and this project entity borrows funds solely on the strength of the project's cash flows and the equity of sponsors in the entity itself. It permits transparency of the financing commitments, as well as allow the sponsors to leverage their equity contributions. For MMS, the project company is Citra Metro Manila Tollways Corporation; for MNT, it is Manila North Tollways Corporation; for MCTE, it is UEM-MARA Philippines Corporation; and for STAR, it is called the STAR Infrastructure Development Corporation (SIDC). Probably to avoid the legal limitations on foreign equity ownership of public utilities, or doubts about assignability of franchises, a separate "operator" entity is also created. This has been the case for the four expressways under review. The MNT project has even gone further, by splitting operations from maintenance, with its foreign partners assuming majority control in the maintenance entity.

All projects got varying degrees of the Government's endowment or support.

The MMS would benefit from the established traffic over the existing South Luzon Expressway (SLE) from Nichols to Alabang. Similarly with MNT, STAR and MCTE. Existing roads were folded into the project, after some improvements. The cost of the ROW was also for the account of the government. It is difficult to estimate the values of these government contributions in the absence of asset accounting by both the TRB and the DPWH, or appraisal of the intrinsic values of the SLE and the NLE at time of cession by the PNCC. In all cases, the Government's share can be classified as capital grants.

Automatic adjustment in cost-based toll rates.

Another significant commonality in the toll concession agreements governing the four expressways is the toll setting and adjustment provisions. All were granted freedom to set their initial toll rates based on project costs and to adjust them periodically based on changes in two or more pre-defined cost variables without prior public hearing. Historically, price regulation in the Philippines has followed a quasi-judicial process that involves petitions and lengthy public hearings. In effect, the TRB has waived or relaxed its rate-fixing role to the comfort of creditors.

(3) Toll Rate Setting Mechanism

Probably as a form of standardization by the TRB, the toll setting mechanism is similar in structure for all expressways. They share the following features:

1) An initial toll rate is agreed between the TRB and the concessionaire to become effective upon start of operations. The rates are on per-kilometer basis and stipulated for three classes of vehicles. Class I vehicles cover cars, jeepneys, taxis, vans, pick-ups, and other light vehicles. Class II vehicles include medium weight vehicles such as buses and two-axle trucks. Class III vehicles refer to heavy trucks, with three axles or more. What these initial toll rates would be for each class of vehicles will depend on the proper appreciation of the TRB of project costs, followed by negotiation between the TRB and the project company.

2) Two kinds of future adjustments in the initial toll rates are envisaged, i.e. periodic and interim. Periodic adjustment is predictable and is supposed to be made only every toll review dates. In the case of MMS and MNT, the periodic adjustments can only occur every two years; for STAR and MCTE, every three years. It is not clear why the frequency of rate reviews is shorter for the first two projects.

   Interim adjustments, on the other hand, can be made much more frequently but predicated on the occurrence of "substantial increase in debt-service burden" resulting from currency devaluation. When such an adjustment is made, it shall be considered only an advance to be set off against future toll rate adjustments. In other words, interim adjustments cannot be on top of, or separate from, periodic adjustments.

3) The basic formula for the periodic adjustment is $AT_R = AT_O \times K$, where

   AT_R = agreed toll rate at next review date

   AT_O = agreed toll rate at start of operation, or previous review date

   K = coefficients or multipliers based on a number of variables, as follows:

   MMS: K = an index of currency devaluations

   MNT: K = an index based on the Philippine Consumer Price Indices as well as the peso-dollar exchange rates between the two dates

STAR: K = an index based on the Consumer Price Indices in Batangas as well as the peso-dollar exchange rates between the two dates
MCTE: K = an index based on the Consumer Price Indices in Manila as well as the M$ and Peso exchange rates between the two dates

(4) Allocation of Cost and Risks

The risk allocation between the Government and the private sector is summarized in Table 2.6a for the STAR project (which was tendered), and Table 2.6b for the Metro Manila Skyway System (which was negotiated).

Generally, the concession agreements for the two are similar in many respects. The notable feature, as is the case for the other two 'committed' expressway projects, is the assumption by the private sector of the commercial risk. There is no government guarantee on traffic volume, unlike Manila's MRT 3 or the Malaysian toll road. However, there are salient differences in the risk allocation between STAR and MMS, viz:

Project sponsors distinct from project company

In the Supplemental Toll Operation Agreement applicable to MMS, the Investor (or Project Proponents) was clearly differentiated from the project company and the operating company. The completion risk for MMS is borne by the Investor, while that for STAR, it is the project vehicle SIDC. This means, the attendant or contingent costs by the SIDC can be passed on to the motorists or toll users. The assignment of risks arising from design changes not otherwise raised by the DPWH shall be absorbed by the SIDC, rather than by its investors as in the case of MMS.

Obligation for Right of Way

In both projects, it is the Government who will take the responsibility for procuring the ROW. In the case of MMS, the costs to acquire the land and to relocate informal and/or formal dwellers shall be shouldered by the Government (through the TRB). The Investor will pay only for the expense of utilities removal, relocation or re-instatement. In the case of STAR, the project company SIDC is required to fund the ROW and the clearing thereof of occupiers up to a maximum of ₱500 million. It is also obligated to pay for the expenses of utilities removal, relocation or reinstatement.

Concession Fees

The SIDC is required to pay the DPWH the amount of 2% of the total construction cost as Operation and Maintenance Supervision Fee. This implies a fixed amount after project completion. In contrast, public utilities are subjected to a 3% common carriers' tax – a variable amount – that could be construed as concession fees. There is no equivalent imposition on the Citra Metro Manila Tollways Corporation, other than continued payment by the PNCC of its obligations under the original PNCC franchise. Under PD No. 1113, Construction and Development Corporation of the Philippines (CDCP, former name of the PNCC) was required to reimburse the Government for the loans obtained from the International Bank for Reconstruction and Development (IBRD) and other project costs, estimated at ₱912 million. After December 2006, the amount goes down to zero. Effectively, the operator will not pay a concession fee.

2.1.3 Proposed or Pending Expressway Projects

(1) Active JV-initiated projects

There is no official list of proposed or pending expressway projects. In so far as the TRB is concerned, two projects are currently under consideration or evaluation, viz:

SLE Extension, Alabang to Lucena

This used to be known as the Hopewell Expressway Project covered by a Memorandum of Understanding signed in 1994 between the PNCC and Hopewell Holdings Ltd. With the collapse of Hopewell, the project was assumed by Crown Equities, who hopes to rehabilitate the SLE from Alabang to Calamba, thence extend the tollway farther south to Santo Tomas and Lucena.

The joint proposal is under evaluation by the TRB. If granted favorable assessment, it will still have to proceed to final engineering design and financial closure. At best, this project is two years away from start of construction.

MCTE, Phase 3, Zapote to Noveleta

This involves a 11.24-km extension of the previously approved MCTE awarded to UEM-Mara Philippines Corporation (EPC) in July 1996. Phase 2, the C-5 Link, is stalled due to slow assembly of ROW. In addition, the original proponent has undergone financial re-structuring in Malaysia and ceded its interests to a local group. This local group has been actively seeking strategic partners to invest in the project, with some unconfirmed reports about the entry of Leighton Contractors Phils. Inc. as EPC contractor. The possible changes in project structure or ownership are still to be cleared by the TRB. In the absence as yet of financial closure, it is unlikely for the project to move into construction stage in the next two years.

Table 2.6a Risk Allocation Matrix – Southern Tagalog Arterial Road

Type of Risk	Contractor	Operator	Equity	Lenders	Gov't	Insurance	Unallocated
Construction Phase							
1. Cost overruns/ delays due to:							
Design		OO					
Engineering	O	OO					
Construction	OO	completion risks					
2. Change in legal requirement							
National					OO		
Local					OO		
3. Land acquisition		O			O		
4. Natural disaster	*inferred; no specific provisions in the Toll Concession Agreement*						
Insurable						OO	
Uninsurable		OO					
5. Industrial action							
Site-specific	OO						
General							OO
6. Environmental	*inferred; ECC attached as Annex D of the Toll Concession Agreement*						
EIS breach					OO		
Known/caused by State					OO		
7. Traffic and activity relocation		O			O		
8. Insurance							
Workers compensation	OO						
Public liability		O				OO	
9. Force majeure		O			O		
10. Confiscation – state					OO		
11. Approvals/licenses/ permits	O	O			O		
12. Variations							
By government					OO		
By contractor	OO						
13. Interest rate risk		OO					
14. Taxation		OO					
Operating Phase							
1. Revenue/Traffic demand		OO					
2. Operation		OO					
4. Defects liability		OO					
5. Natural disaster	*inferred; no specific provisions in the Toll Concession Agreement*						
Insurable			O			OO	
Uninsurable					OO		
6. Industrial action							
Site-specific		OO					
General							OO
7. Environmental	*inferred; ECC attached as Annex D of the Toll Concession Agreement*						
EIS breach		OO					
Known/caused by State					OO		
8. Traffic and activity relocation		OO					
9. Insurance							
Workers' compensation		OO					
Public liability		OO					
10. Force majeure		O	O		O		
11. Confiscation – state					OO		
12. Approvals/licenses/permits		OO					
13. Restrictions on toll					OO		
14. Interest rate risk		OO					
15. Taxation		OO					

Legend: O – minor/joint responsibility OO – major responsibility

Table 2.6b Risk Allocation Matrix – Metro Manila Skyway System

Type of Risk	Contractor	Operator	Equity	Lenders	Gov't	Insurance	Unallocated
Construction Phase							
1. Cost overruns/ delays due to:							
Design			OO				
Engineering	O		OO				
Construction	OO	completion risks					
2. Change in legal requirement							
National					OO		
Local					OO		
3. Land acquisition					OO		
4. Natural disaster	*inferred; no specific provisions in the Supplemental Toll Operation Agreement*						
Insurable						OO	
Uninsurable		OO					
5. Industrial action							
Site specific	OO						
General							OO
6. Environmental	*inferred; no specific provisions in the Supplemental Toll Operation Agreement*						
EIS breach					OO		
Known/caused by State					OO		
7. Traffic and activity relocation					O		
8. Insurance							
Workers compensation	OO						
Public liability			O			OO	
9. Force majeure		O			O		
10. Confiscation – state					OO		
11. Approvals/licenses/permits	O		O		O		
12. Variations							
By government					OO		
By contractor	OO						
13. Interest rate risk		OO					
14. Taxation		OO					
Operating Phase							
1. Revenue/Traffic demand		OO					
2. Operation		OO					
3. Maintenance		OO					
4. Defects liability			OO				
5. Natural disaster	*inferred; no specific provisions in the Supplemental Toll Operation Agreement*						
Insurable			O			OO	
Uninsurable					OO		
6. Industrial action							
Site specific		OO					
General							OO
7. Environmental	*inferred; no specific provisions in the Supplemental Toll Operation Agreement*						
EIS breach		OO					
Known/caused by State					OO		
8. Traffic and activity relocation		OO					
9. Insurance							
Workers compensation		OO					
Public liability		OO					
10. Force majeure		O	O		O		
11. Confiscation – state					O		
12. Approvals/licenses/permits		OO					
13. Restrictions on toll					OO		
14. Interest rate risk		OO					
15. Taxation		OO					

Legend: O – minor/joint responsibility OO – major responsibility

Skyway, Stage 2, Bicutan to Alabang Section

Also exhibiting some life is Stage 2 of the Skyway Project. Citra Metro Manila Tollways Corporation, the project company, is reportedly on the verge of a financial closure. However, the inability of Stage 1 to generate enough cash flow for debt servicing has given potential lenders the proverbial cold feet. On the other hand, it is recognized that Stage 2 is necessary for Stage 1 to gain patronage. Among the three tollway projects in the active list, Stage 2 of the Skyway has the best chances of early realization.

(2) DPWH's Current List

The DPWH has identified a number of expressway projects for implementation under the umbrella of the BOT Law. Aside from the STAR project, only two may be deemed 'active', viz:

R10/C3/R9 Expressway

Because of the unfavorable court decision on the missing C3 Link, the DPWH was constrained to examine the alternative of building an elevated expressway originating from the Port area (R-10) and generally following the C-3 alignment up to Bonifacio Avenue then the following A. Bonifacio (R9), providing a direct route to NLE. Unlike other tollway projects, this one is intended to cater mostly to trucks – which are subjected to truck bans for 15 hours on most streets of Metro Manila – and to alleviate the congestion to the Port of Manila.

This is the subject of a case study under this PPP Study, where basic design, cost estimates, and bidding documents shall be prepared. The target is to solicit bids for its development sometime in the second quarter of 2003. Originally, the R9 segment was included as part of the Skyway concession, but the Skyway concessionaire has partially waived its right over the segment which will be considered part of the Case Study Expressway (R10/C3/R9).

NAIA Access Road

Another road in the active list of the DPWH is the NAIA Access Road. Conceived as an elevated 2.4-km tollway that will link Bonifacio Global City and SLE to the new NAIA Terminal 3, the project scope has been expanded to include a 3.24-km connection to NAIA Terminal 1 and thence westward to MIA Road and R-1. Estimated to cost ₱9.3 billion for the two packages, the project concession will be tendered by the latter part of 2002. Bidding documents are reportedly under preparation, as well as studies on possible credit enhancements and revenue capture, by the CCPSP-BOT Center.

(3) Inactive or Otherwise

There were many other projects that surfaced during the last ten years, but for one reason or another, have not moved forward nor progressed in the project development cycle. Only two of the ten proposals can be classified as DPWH-initiated; the rest were driven by private sector proponents.

NLEE Extension to Cagayan Valley

This was supposed to be a new 117-km expressway from C6-Quezon City following a northeasterly alignment parallel to, but east of, the existing Pan-Philippine Highway to Nueva Ecija and Cagayan Valley. Upon the initiative of the DPWH, the project was examined in 1999 under an ADB-funded study[3], which concluded that the project is not financially viable for PPP within the next ten years, unless substantial public sector contribution is allocated.

With the negative study findings on the NLEE extension and the absence of a serious private sector proponent, the DPWH apparently has consigned the expressway project into the backburner. This is unlikely to be re-activated over the next ten years.

MMUES R6 and R7 Expressway

Following the Metro Manila Urban Expressway Study (MMUES) in 1993 which recommended a system of elevated radial and circumferential expressway network, the DPWH pushed the R6 and R7 expressways. The first, R6, entails a 6.2-km elevated roadway from C3 paralleling Aurora Boulevard and Marcos Highway towards Sumulong Highway in Cainta. With the construction of LRT Line 2 along the same alignment, combined with a proposed Pasig Expressway, the rationale for R6 has diminished, if not disappeared.

R7 is supposed to be a 12-km elevated structure along Quezon Avenue, but at-grade along Commonwealth Avenue up to Batasan Complex. At one time, disputes between the DPWH and the DOTC emerged because of the project's conflict with the proposed LRT 4 on the same corridor. With the construction of the EDSA-Quezon flyover and other improvements along Commonwealth Avenue, this project would have to be radically altered if re-activated.

Neither R6 nor R7 has been included in the medium-term program recommended in the MMUTIS, nor feasibility studies initiated for them by the DPWH. These two projects should be classified as 'dead'.

[3] Transport Infrastructure and Capacity Development Project, conducted by Halcow Fox.

C5 Expressway

The eastern segment of C5 was initially suggested in the MMUTIS for upgrading into expressway standard because of the anticipated high-density development in Fort Bonifacio. Doubts have been raised about its political viability, because of the EDSA-like activities that had mushroomed along the C-5 corridor. In the absence of private interest, and any feasibility study, this project is unlikely to move forward in the project development cycle.

Pasig Expressway

Sometime in 1997, this project was high on the list of probable realization. It had a feasibility study, presence of big-name proponents (Strategic Alliance Development Corporation, Marubeni Corporation and Kumagai Gumi) as well as 1st-pass approval from the NEDA-ICC. Nothing much has been heard since. The proponents might have had second thoughts on the viability of the project – ROW obstacles, large capital cost (US$500 million), and deviations from the road network master plan for Metro Manila.

This project should probably be classified as ‘dead’.

C6 Expressway

Another private-sector-driven project is the C6 Expressway. It comprises three sub-projects: the C6 Northern Section, the Laguna de Bay Coastal Road, and the C6-Southern Section. The PNCC has claimed the project as part of its Eastern Expressway franchise - difference in alignment to the contrary notwithstanding.

The middle section is the subject of a joint venture between the PNCC and the DMCI, John Laing, Filinvest, and the CMMTC. The proponents managed to complete their basic designs, but were unable to convert their studies into serious investment proposal for evaluation of the TRB. None of the parties would admit to abandonment of this project; neither can any one indicate a timetable for implementation.

The southern segment was proposed as a joint venture project of the PEA and Renong Berhad of Malaysia. Given the withdrawal of the latter from R-1/MCTE, and the bad experience on the C5 Link, this sub-project can now be considered an orphan.

Implementation of any section of C6 Expressway is unlikely to happen within the next ten years.

C-3 Southern Segment

This project would have supplied the missing section of C3 from Ayala Avenue up to Araneta Avenue, with a total length of 7 km. It was submitted as an unsolicited proposal to the DPWH from Mancom Berhad, Coastal Builders Corporation, and the Norwegian Aker Kvaerner Group. The additional information requested by the DPWH was not responded to.

This project should be classified as 'dead'.

Pabahay-sa-Riles Tollway

From the start, the tollway component of the Pabahay-sa-Riles project had strange characteristics. It was promoted as the 'cash cow' that would subsidize the 'housing-for-the-poor' part. It had no feasibility study to back it up, and did not even emerge as a serious option in the MMUES and MMUTIS studies. Conceived as an elevated road 16.3-km long on top of the PNR tracks, it would have competed partly with Stage 3 of the Skyway project.

With the failure of its housing component, this whole project should be considered as dead with no possibility of resurrection.

Calamba-Tagaytay Expressway

The study on the Tagaytay Expressway was announced in December 1994 by the PNCC as the fifth joint venture deal it had entered into. John Laing International, a British construction company, was supposed to undertake the feasibility study of a 4-lane expressway from SLE to Tagaytay via Sta. Rosa or Calamba.

No serious investment proposal ever reached the TRB for its evaluation. With the opening of the Sta. Rosa bypass road to Tagaytay, the necessity for this project has become doubtful. It can be considered an aborted project.

NLE Extension to Pangasinan

In 1994, the PNCC entered into a MOU with Ital Thai for the extension of the NLE to Pangasinan and La Union. Nothing came out of that undertaking. Later, a pre-feasibility study was initiated by Itochu Corporation of Japan with the PNCC. Subsequently, there were reports in 1999 about the interest of Leighton to pursue the project.

Because of the traffic volume and the traffic congestion at several points along the existing highway, this project will continue to elicit interest – from construction and/or engineering outfits. It is unlikely, however, to get into the stage of an investment proposal either to the TRB or the DPWH until the MNTC project gets completed.

Manila Bay Expressway

This was conceptualized by Pacific Consultants International of Japan as a 6-lane 28.3-km tollway along the shores of Manila Bay. With a price tag of ₱62.3 billion, the bursting of the property bubble, and reliance on government funding (not PPP) for the first three phases, this engineering dream of a project should be consigned into the archive of nice proposals.

2.1.4 Some Conclusions

The number of expressway projects mooted over the last ten years is a manifestation of the initial exuberance over PPP ventures engendered by the passage of the BOT Law in 1991. That many of them failed to take off is no reflection on the capability of the Government, as many critics are wont to do. In commercial ventures as well as private-financed infrastructure, it is only natural for some project proposals to fall by the wayside. It may be futile to quantify the 'success' or conversion rate, simply because each project is sufficiently different from the others, or a project is often divided into several phases.

However, it can be concluded that the conversion rate is likely to slow down further because:

- Exuberance has now given way to the harsh demands of the financial markets,
- Lenders and investors have been scarred or burned in several PPP projects across Asia, and,
- The highest-traffic roads have already been taken, and the remaining ones are not that robust.

It can also be concluded that there is no systematic procedure for handling the 'birth' and 'death' of projects. In an attempt to establish a comprehensive list of expressway projects under consideration, and their status, the Study Team has to piece together data from several sources. Which of the private-sector-driven projects have the Government taken official cognizance of, and which ones are in the realm of possibilities? When is a project worthy of further review and consideration? Which ones can already be dismissed and interred as dead proposals?

Further, the sectors from which the PPP players come from are revealing. Most of them are into construction and/or property developments. Among the foreign construction entities were: John Laing, Leighton, Kumagai Gumi, United Engineers Malaysia, and Ital Thai. On the other hand, the domestic construction companies that appeared as proponents or consortium members included DMCI, PNCC, William Uy, JH Pajara, New San Jose Builders, Coastal Builders, etc. Filinvest and the PEA are primarily real-estate developers. Strategic Alliance Development Corporation – which spearheaded the Skyway, Pasig and STAR projects – acted more as an aggressive ‘project integrator’ rather than a strategic investor. A key ingredient of successful PPP projects is a strategic investor; on this score, only Benpres Holdings can qualify as such, although it has a subsidiary involved in construction also. There is nothing wrong per se about the composition of proponents, but they do create conflict of interest. Suppliers have the incentive to jack up project cost and raise margins, while project companies should reduce cost to ensure long-term viability.

The implemented expressway projects are still far from the ends of their concession periods, with the exception of the PNCC’s NLE and SLE. Because of this, the Government has not yet bothered to address the issue on what to do with tollways with expiring concession. Will the charges be lifted and the expressways (or sections of it) turned into toll-free system? Economic efficiency considerations point to the continuation of toll charges, but profit accumulations by a fully paid concessionaire is indefensible.

2.1.5 Problems and Constraints

(1) Limited Government Resources

Project studies and other preparatory works for tollway projects signed under a joint-venture umbrella were funded by the private sector proponents. This has occasioned divergences of views on traffic projections, toll rates, toll adjustment formulae, real project costs, and other issues. The absence of comparable bids would naturally invite questions on whether Government is getting value for money. The private proponents, on the other hand, can claim confidentiality so as not to divulge their full financial assumptions and behind-the-scenes arrangements. To secure financing, proponents would tend to favor more optimistic traffic projections. If the government had money to fund the preparatory works, the divergent viewpoints would have been minimized while reducing uncertainties faced by the private sector.

Limited funds and manpower have hampered pro-active planning in toll road development. To resolve this problem, the re-establishment of a fund for project development has been mooted. However, the prognosis that it can be realized soon is not encouraging. For the same reason, the DPWH's repeated appeal to the DBM for funding and organization of a BOT Projects Office has remained in the doldrums.

(2) Right-of-way Acquisition

Lack of government resources is also partly to blame for the inability to secure ROW. Without exception, and for good reason, all the PPP projects assigned to the Government the responsibility for ROW acquisitions. The power of eminent domain or expropriation lies with the government. However, the track records of the DPWH and the TRB in this regard have been egregious.

But funding is only one-half of the problem. The convoluted procedures involved in ROW acquisition often shift the burden to the overloaded courts of the land. Republic Act No. 8974 was enacted in July 2000 to facilitate the acquisition of ROW. It remains to be seen, however, whether it will work.

(3) Institutional Inadequacies

Division of Work between DPWH and TRB

As acknowledged by the agencies themselves and per experience of the private sector, tensions and differences of opinions between the DPWH and the TRB surfaced during the early years of the BOT Law. The broad definition of the roles of the two agencies had led to some confusion as to which entity shall evaluate, approve, or negotiate at every stage of the PPP process. When BOT/PFI/PPP became fashionable, project proposals started coming into both the DPWH and the TRB. During those early years, it was unclear as to which agency would evaluate and who would comprise the government negotiating panel. The 'dust should have settled' by the time the STAR Project got bid out in 1997, but apparently this was not the case, leading to delays beyond the control of the proponent.

The indications are now becoming favorable that a *modus vivendi* has emerged between the DPWH and the TRB as a result of their experiences on several toll concession agreements. Except for projects pursued through the PNCC or the PEA franchises, the TRB would now be less involved at the beginning of the PPP process.

The DPWH will take the lead and handle procurement of services and construction for projects pursued under the BOT Law. Once the project moves into operation and maintenance, the role of the TRB greatly increases while the DPWH's participation declines. In either case, the DPWH and the TRB have agreed to nominate their respective members in the Pre-qualification, Bids and Award Committee (PBAC) or evaluation and negotiating panel.

Embryonic PPP Expertise in DPWH and TRB

BOT projects turned out to be more complex than previously thought by government personnel hewn and nurtured in the traditional mode of project implementation. This lack of expertise and understanding of the business mindset became palpable during negotiations with the private proponents. Consequently, the process either gets protracted or the Government ends up assuming more contingent risks than it could handle. This weakness, apparently, is being addressed through the participation of the BOT Center and its consultants.

2.1.6 Best Practices from International Experience

(1) Characteristics of PPP Techniques

PPP is often viewed as a panacea for the development and management of tolled expressway network. It covers many levels of interaction between the public and private sectors, and can be implemented in many different forms, from development of new expressways (Thailand) to maintenance contracts of existing highways (New Zealand and Argentina). It includes heavy public sector commitments such as in China or Malaysia to a relatively free hand for the private sector. It is not a new phenomenon, with much of the existing highway network in Western Europe developed under various forms of PPP over the last 40 years.

Asia is increasingly becoming dependent on PPP techniques to ensure infrastructure projects are delivered. Throughout the world the techniques for involving a combination of both public and private involvement has allowed many projects that would not have been realized under the more traditional public sector system. The increasing transition to this type of delivery has not been without its problems. Many projects have been attempted this way and the PPP techniques have been applied at various stages of the project life cycle. One might think that with this level of diverse experience the mechanism would now be understood. However, the reality is very different, with many PPP initiatives not being carried thoroughly as originally envisaged. What lessons can be learnt from this international experience and how can these be brought to bear on the PPP techniques applicable to the circumstances found in the Philippines?

The range of PPP techniques is vast, including the development of whole projects or certain elements of a project from the planning stages through operation and maintenance. Table 2.7 highlights the various characteristics that PPP can take in the transport highway sector.

Table 2.7 Type of PPP Schemes

Type	Description	Examples
Management	The private sector is involved with the maintenance of existing highways. Measurement of performance is set against predetermined criteria.	Australia USA
Turnkey	The private sector designs and constructs new highway infrastructure to specifications defined by the public sector.	USA Hong Kong
Operate and Maintain	Similar to the management form of PPP, but during operation and maintenance compensation is made through collection of tolls.	Argentina Hong Kong
Rehabilitation	The private sector rehabilitates existing highways to predefined specifications. Tolls are collected to cover these costs and the costs of maintenance and operations during a concession term.	Argentina Columbia
BOT and Its Variants	The private sector designs, finances and constructs new highway infrastructure. Tolls are collected to cover the cost of construction and operation and maintenance over the concession period.	Malaysia Thailand Philippines
Corridor Management	Corridor management contracts are a combination of both BOT and operation and maintenance concessions applied to section of the highway network.	UK (DBFO) Columbia

The various types of PPP schemes described above increase in complexity towards the bottom of the list presented in Table 2.7. Maintenance contracts are the simplest form of PPP to implement, with clearly defined scope of works, timetables and performance measures. BOT and its many variants are the most difficult to implement and the demands on both the public and private sectors are great. In addition, the risk and ability to secure finance is also increasingly more difficult.

Another point of interest outlined in Table 2.7 is that many of the PPP techniques refer to involvement with existing infrastructure. This is against the trend in Asia where PPP is seen as a vehicle to implement new tolled expressways and might go some way to explain the problems that have been encountered with PPP techniques within the region.

The level of participation in a project by the public or private sector can also vary from full project development by the private sector under an unsolicited BOT type contract to assistance with the planning phases or specialist inputs during design or operations. The techniques for compensating the private sector are also varied from direct collection of revenues via tolls, to government finance or other fiscal benefits (i.e. tax holidays or free usage of existing infrastructure).

The reason for involving PPP techniques to deliver tolled expressways are also varied, from beliefs that market forces and competition will develop a better system to the lack of public sector resources. As shown in the assessment of the Philippines, PPP involvement is required to meet the objectives of the GOP, namely:

- to develop the toll road network;
- to reduce fiscal burden of the Government; and
- to improve efficiency in the delivery of basic services.

There are common characteristics within the PPP environment. However, PPP techniques are a complex interrelation of variables, which vary from country to country and, perhaps above all, must be viewed with "realism". It is naïve to assume that the use of PPP techniques will solve all problems; it can, but the right environment must first be established.

The success in the Philippines as in the rest of the world has been mixed. Several projects have been implemented through PPP, but more often there are delays and the expansion of PPP has declined rapidly after the Asian financial crisis of 1997/8.

Can examples and experience be gained from other countries which will allow the Philippine PPP process to deliver the tolled highway network in line with the specified government goals?

One of the key ingredients in the utilization of PPP techniques is to establish a suitable environment in which such practices can succeed. In the initial stages the environment must be established by the public sector and their involvement should be maintained throughout the project life cycle or concession period. The list below highlights the involvement required from Government at each stage to establish such an environment.

- Define objectives – these should define the fundamental goals of a government, including those specific to the transport sector.
- Define strategies – define how these goals and objectives are to be implemented.
- Develop coherent plans – develop strategic plans for the transport network. These should include interaction between transport modes and incorporate the long-term objectives for development of a city or region.
- Ensure environment for delivery – all relevant government agencies need to be "on-board" with the goals and objectives and a legal framework developed which allow these to be implemented.
- Define specific project – once the strategic plans have been developed specific projects can be defined in detail and prioritized for implementation scheduling.
- Review options – the various options available for implementation should be reviewed and the most sensible route selected, whether via PPP or not.

- Review budgeting – the full financial implications of the selected options must be fully understood, including a realistic perspective of the requirements for both the public and private sectors. The demand on resources from all competing requirements must be reviewed to assess how the transport sector fits with other government policies and objectives.
- Specify PPP techniques and involvements – the full range of PPP options available should be reviewed and the most suitable one for a specific project selected.
- Support project at all stages – the commitment of the public sector must be ensured and honored throughout the concession period and commitments delivered on time.
- Monitor performance throughout the concession period – the Government should continually monitor performance of the private sector and ensure that they are performing in line with the terms of their engagement within their PPP role.

It is important to ensure that each of these steps are followed, as only after several successful PPP tolled expressways have been implemented in a country can the sense that the system is suitably developed and mature enough to allow confidence both in the public and private sectors. If each of these items is addressed the private sector becomes increasingly more confident as they fully understand at the outset what commitments they are expected to deliver on. One of the common failures in the PPP process is the poor definition or establishment of a suitable environment and this often leads to reluctance on the part of the private sector to get involved with specific projects or within certain countries.

International experience has shown that PPP techniques are often more difficult to implement in the transport sector than in other sectors, for example power or water. What are the specific characteristics of tolled expressways, which make PSP harder to implement?

- Investment timeframe – Expressways have a high, inflexible initial investment requirement with long recuperation period.
- Profitability – profitable tolled expressways are the exception not the norm. Revenue (predominately toll) is often insufficient to cover cost of implementation, operation, and maintenance and still make acceptable returns.
- Externalities – expressways provide many benefits, not just to those using the expressways. These are rarely captured and returned to the project or project proponent.
- Network effect – expressways need associated policies and investment in surrounding access and egress roads to ensure operational performance.

- Uncertainty – demand is not fixed, toll roads are not like other sectors (water, power) whose market is often defined.
- Roads are free – people are willing to pay for power, public transport and water but are reluctant to pay for roads.
- Land requirements – the availability is limited and cost often high, particularly for urban expressways.

(2) Best Practices from International Experience – An Overview

Much can be learnt from the experiences of PPP techniques employed in other countries. Specific case studies will be reviewed in detail during the second phase of the project. However, it is useful at this early stage to show examples of the diverse nature of PPP techniques and the great wealth of experience, both good and bad that can be drawn on.

Western Europe – Much of Europe has been at the forefront in the use and development of PPP techniques and private financing for the development of a tolled highway network. France was offering concessions to the private sector in the 1960s and much of its current highway network has been developed through the involvement of the private sector, although the Government now has taken a large interest in many of the originally private concessions. Italy has had a similar experience, where Autostrade manages and develops large sections of the countries' highway network. As with France the relationship between these private companies and the State is very close. Such countries demonstrate that PPP techniques do work and can offer valuable lessons in the relationship between the public and private sectors. The UK by contrast, has developed a more indirect approach to PPP, with the underlying perception that roads are free at point of use. This has led to the development of the DBFO (Design-Build-Finance-Operate) process and the associated "shadow tolls". This system enables no tolls to be levied for use of the roads, but rely on the Government to pay the private sector concession holder in proportion to the usage of the roads. This type of PPP technique demonstrates a cautious approach, allowing the performance of PPP to be evaluated without direct impact on the public, but does require a carefully developed environment and continual support from the Government.

Eastern Europe – With the collapse of the communist governments in Eastern Europe the move to embrace private sector involvement and market forces has taken many different forms and could still be said to be in its infancy in several countries. Hungary has led the way with respect to tolled expressways, but overall the number of projects implemented using PPP techniques has been limited, despite the level of interest shown and the number of projects being proposed. Historical impacts of the political systems have been partially responsible for the slow development of PPP in Eastern Europe, with fundamental changes required to governance and the legal system to allow the private sector into the provision of service and utilities. This has been mirrored by the lack of willingness on behalf of the investors, who view many of these countries as high risk. In addition, it is the perception that many of the projects offer limited financial benefits and thus impact on their viability and attractiveness for investors. The reasons for this are manifold, including low toll rates, low traffic demand, and limited external benefits allocated or transferred to the private sector in lieu of direct financial benefits.

North and South America – The Americas provide a wide range of PPP techniques and can demonstrate many valuable lessons for the development of a coherent policy for the Philippines. Mexico has been one of the most advanced countries in attracting the private sector for the development of its highway network, which has more than doubled as a result. By contrast is the approach taken by Argentina, who has made extensive use of PPP techniques for the operation and maintenance of the highway network, rather than the development of new tolled expressway infrastructure. The USA has only recently turned to private sector involvement in the development of their tolled expressway network. Prior to the 1990s the Government-controlled Inter-State Highway System undertook the development and management of the highway network. Recently, there are a few examples where the private sector is now getting involved. The examples are limited to a few states, with California leading the way with SR91. This is an interesting example, as the private sector involvement is in the provision of four express lanes running parallel to the existing highway.

Australasia – Australia has used PPP techniques to develop certain sections of its urban tolled expressways, for example the Melbourne City Link and the Sydney Harbour tunnel. The Australian Government has maintained a major involvement and commitment to most of the PPP projects, for example ROW provisions and underwriting revenue forecasts. Australia has also used PPP techniques for maintenance management contracts of certain sections of the highway network. The approach taken in New Zealand is to contract out much of the development and management of the highway network. They have not developed tolled expressways in the BOT type scenario, rather relying on the private sector to get involved with bidding and carrying out work on specific contracts, traditionally undertaken by the public sector.

Asia – Although much focus within the PPP arena has been placed on Asia, relatively few PPP tolled expressways are in operation within the region. At present, just under 30 PPP-type tolled expressways are in operation. Many of these are in one or two countries, with Malaysia, China and Thailand accounting for over half of the total operational PPP expressways in the region. By contrast the number of expressways currently under consideration is very large. This apparent imbalance is not surprising considering the issues that have been highlighted above and Asia's late involvement with PPP techniques for provision and maintenance of highway networks. A similar picture exists within the Philippines, with two PPP tolled urban expressways in operation (MCTE 1/R-1 and Skyway 1) as opposed to around 10 currently under consideration.

The type of projects undertaken by PPP in the region vary considerably, including inter-urban highways (Malaysia's north-south expressway) and urban expressways. The type of projects in China and the Indian sub-continent are again quite different. China has had a relatively successful history with PPP, due to the local conditions (often limited alternate routes and rapidly growing demand), the share of commitment by the public sector and the central role they play in many aspects of the delivery of these projects. The examples of PPP techniques in the Indian sub-continent have also encountered their own problems (low per capita incomes, political risk, limited experience within the countries).

(3) Institutional Setup

The first step in developing PPP techniques is to review what role they are to play in the development of a country's highway infrastructure. The need for a clearly defined set of objectives with respect to the involvement of both the pubic and private sectors in the provision of infrastructure is vital as this establishes the basis by which all aspects of the process are subsequently defined. A central requirement is for the Government to establish at the outset what it intends to allow under the PPP techniques and how these fit with their overall goals and objectives. Inherent in this is how such an approach will be handled by the Government within its institutional establishments.

As outlined above, the reason for considering PPP as a means by which to provide or manage infrastructure has several driving factors. Some of the key ones, as defined by governments undertaking this route, are as follows:

- to develop the toll road network;
- to reduce fiscal burden of the Government; and
- to improve efficiency in the delivery of basic services.

The common course of action has usually been for the public sector to provide a highway network, often as a free service to the population, as in the UK. Limited financial resources, competing demand on government spending and the need for new or efficient delivery have resulted in many governments turning to some form of

PPP technique to realize their ambitions. As outlined above, developing Asian countries over the last several years have turned to PPP particularly for major pieces of infrastructure such as tolled expressways.

The initial step in any process is to ensure that the Government is ready and committed to undertake this course of action. Despite the obvious need for such fundamental decision, several countries have entered into PPP provisions of expressways without fully appreciating the full institutional requirements. This has inevitably resulted in failure of some form or another during the process. Common practice is for governments to establish a policy to embrace PPP techniques for delivery of infrastructure, but fail to make the necessary institutional changes. The role of PPP is usually “shoehorned” into existing government institutions, which are invariably unfit for their newly defined role. The simple reason is that public works or transportation departments, which originally were responsible for delivery and management of the highway network, have retained this role under the new PPP techniques. However, the skills and resources required to ensure successful delivery of PPP tolled expressways are more akin to the planning, financial and contractual need of a project as opposed to the original core skills of engineering design and construction.

On the positive side, where a country has established a clear set of objectives, backed up by the institutions necessary to implement these, the process has been successful. China, for example, identified a need to develop an expressway network from a limited base and approached multilateral funding agencies to provide technical assistance for the initial stages of the process. This assistance filled the gap in the government organizations and allowed them to establish such institutions.

Support has often been provided for capacity building of the relevant institutions. The Philippines is a good example with a clearly defined objective to involve the private sector in the provision of infrastructure under Republic Act No. 7718 and the implementing rules and regulations. In addition, the provision of United States Agency for International Development (USAID) funds, as well as working closely with the BOT Center to establish a government body to provide PSP/PPP advise both to other public agencies and the private sector, has proved successful in the initial stages of the PPP process.

Bodies, such as the CCPSP’s BOT Center, have a wide remit to review all PPP activities across a number of sectors. Elsewhere specific expressway institutions have been established for the sole purpose of expressway provision or management, such as the government agency PT Jasa Marga in Indonesia. Some have evolved from necessity rather than a concerted effort to enhance the delivery of projects via PPP. Europe has seen several organizations established to regulate the organizations that evolved out of the expressway operations described above (France and Italy).

The clear consensus is that the Government must set the policy and determine the strategy for expressway development through PPP and that these actions must be supported by government institutions. This policy and strategy should be based on a clearly defined set of objectives and the understanding on how these are to be delivered. If expressway development is to be by PPP, then an institution with the necessary skills within the bodies responsible should be established to facilitate it. Government institutions must also have the necessary legal ability to ensure that projects are delivered.

(4) Public Funding and Resources

Once a suitable institution is established it must be given the resources to carry out its mandate. The resources should include financial as well as staff resources with the relevant skills and expertise.

As many expressways are not profitable on a stand alone basis, and are becoming increasingly less so as the more lucrative expressways have already been developed, it is more important than ever to fully understand the implications of both time and money that are involved in the process. Government support of some form, be this technical, legal, institutional, or financial, will become increasingly more necessary to deliver expressways via PPP.

A lack of government resources is not an excuse to invite the private sector to deliver infrastructure with a relatively free hand. Many countries (Thailand, Malaysia, Indonesia, India) utilizing PPP techniques for the delivery of expressways have examples of project failure. Perhaps the most striking example is the Hopewell expressway in Bangkok, Thailand. The half-constructed expressway provides a poignant legacy to the complexities of PPP expressway delivery. If a government decides a project is required then it should be viable under almost any circumstances, with the risk and associated undertakings divided between the public and private sectors to ensure successful delivery of the expressway.

The majority of funds and resources required to establish an expressway project are incurred during the project preparation phase, the bulk of which should be undertaken by the Government if the project is to be successful. As will be discussed below it depends on governments to establish the strategic objectives for the expressway network and to provide the project identification and project preparation, if projects are to make the best use of the benefits that PPP has to offer. Thus, sufficient public sector resources must be allocated at the early stages of the project life cycle. These should include staff with technical knowledge of the legal, contractual, engineering, operational, financing and demand forecasting elements. If such resources are not present they should be sourced from external bodies, other government agencies or the private sector. Again, following best practices of a structured approach, the establishment of institutions to oversee the process should have addressed these issues at the initial stages.

The other area where the Government must get involved with PPP tolled expressways is via financial support in one form or another. Of all the PPP tolled expressways undertaken around the world, very few were funded entirely by the private sector and almost all have some form of government support. This might not necessarily be direct capital provision but provisions to offset against shortfalls between costs and revenues, for example, tax holidays, land provisions and reduced import duties. The Government must undertake some form of subsidy and increasingly more so as higher risks and less lucrative expressways are being developed. Thus, sufficient financial resources must be made available, not just for the technical development work, but also in the form of real capital or provisions for reduced profitability.

Allocation of such resources should also consider the potential risks associated with any expressway project. Capital costs are often underestimated and thus a capital injection or refinancing is required. Revenue streams are often short of forecasts, resulting in refinancing or increased inputs by the Government to support the project's operations and debt servicing. The Incheon Airport Expressway in Seoul, Korea, is such an example, where poor performance of revenue collection in relation to predictions has triggered government guarantees to be implemented to match a certain percentage of the shortfall.

The requirement to borrow internationally due to lack of financial resources in the domestic market exposes expressway projects to currency risks. Capital is borrowed internationally and revenues are collected in domestic currency. If a major change in exchange rates occurs then the revenues are unlikely to provide sufficient resources to service debt payments. This was clearly demonstrated by many expressways in Asia during the financial crisis of 1997/8. Countries and lending institutions are now looking for means to protect their investments against such future fluctuations by either borrowing locally as in Korea or including provisions within the concession agreement as in the Philippines.

Another example of public resource allocation to the PPP provision of expressways is shown in the UK, where shadow tolling is used to compensate toll operators. This entails the Government "paying" the tolls for expressways users, rather than the users themselves. Japan and France also utilize cross-subsidization, with pooled revenues providing adequate resources for expansion and development of the expressway network in a "ring-fenced" environment.

(5) Legal Issues

As with the establishment of correct institutions, the need for a clear and well-defined legal framework is vital. Many countries entered into PPP without such legal frameworks and have encountered problems. The net result has been that such legal institutions evolved out of the process rather than being part of the process at the early stages. Such delays in the process inevitably impact on both the financial and time costs of a project. The associated risks and uncertainties that this develops also affect performance as the legal process often becomes one of negotiation as is the case of Malaysia, rather than a well-structured and established process as in the case of Japan.

Legal requirements are necessary at several levels. They need to allow the PPP to be implemented, by allowing foreign firms to be involved with infrastructure provision. Many countries do not allow foreign-owned companies to operate expressways. Thus, joint venture or special purpose vehicles are established as resources are often not present in the host country and the foreign investors insist on having some control over their investment. This has been the case in China where most expressways have been developed through joint venture arrangements. The legal process must allow the concessions to operate effectively, with the process for arbitration and enforcement fully documented. Even though the process is well defined, problems might still occur as was the case in the Philippines where a temporary restraining order was issued on the Coastal Road Expressway while the legal basis for toll collection was debated. Undoubtedly, such issues increase the risks associated with projects, with direct impacts on the cost of money required to develop the expressways.

The legal requirements vary by the type of PPP technique to be pursued. The simpler management or turnkey type of contracts are simpler to define and thus easier to establish the legal framework as in the case of New Zealand. At the other extreme, the more complex BOT type projects require a significant and well-developed legal framework covering all aspects of the process, from bidding, construction to operation.

(6) Regulatory Framework

A regulatory framework should be established to allow the competitive nature and advantages of the “market” to provide the associated benefits via the PPP techniques. However, this often requires being under public sector control to ensure that the market is delivering what is required competitively. Thus, public regulation should be maintained:

- When the provision of expressways duplicates projects or increases utilization of resources (a natural monopoly environment);
- When the lack of regulation results in the provision of expressways outside central goals and objectives or of inferior quality (prevention of "unsolicited" projects); or,
- To ensure support is offered to the most efficient expressway proponent, usually through competitive bidding for all or part of an expressway.

The need for a regulatory framework to ensure that PPP techniques are kept within the goals and objectives of the government policy is required. As with the establishment of institutions to allow PPP projects to proceed, the need to monitor and review the projects, often at every step of the project life cycle, requires a detailed and workable regulatory framework. A body with the legal basis to enforce the regulations of the PPP environment as in the case of Chile or the UK is required.

Countries where one organization has control, such as PT Jasa Marga in Indonesia, are open to abuse as the regulator can become too closely connected to the expressway proponent itself. In Mexico, this lack of established regulatory framework with legal basis led to similar problems with the regulator and concessionaire becoming too close to allow effective monitoring of the projects. A need for distance and a truly impartial regulatory body is required if an open and competitive market is to be established for PPP.

(7) Strategic Planning

Strategic planning is important as it defines the macroobjectives and goals of a government and applies some tools on which decisions can be made. Most successful strategic plans are developed through some form of financial and economic evaluation process. The same measures should be applied to all sectors, which are competing for scarce time and money. This is assuming that strategic goals and objectives have already been identified by a government and that the sectors under review are those that fall within these pre-defined goals.

The first step in the evaluation of any expressway is thus the review of a government's objectives. Does expressway development warrant the resources of the nation more than other needs, or at least as much as the resources that are to be allocated to it?

To allow such decisions to be made the strategic planning process requires some realistic estimates of capital and resources required within each sector. This will allow both monetary and social benefits to be measured. This requires close cooperation within a government to ensure that the technical skills and knowledge held within the various departments are utilizing similar evaluation criteria and that each is undertaking these decisions realistically. All too often budgetary requirements are overestimated to ensure a department or agency is allocated higher levels of central resources. Often, the only way to ensure that all demands are equally evaluated is for a central body, off line from the downstream process, to act as watchdog and evaluator.

This is not an easy process as often social demands are competing with financial ones and a careful evaluation of monetized social benefits needs to be undertaken to assess each proposal on similar merits.

The strategic planning process is also a rolling requirement, as the environment in which demands for resources are measured will inevitably change with time. As such the projects or schemes that are developed must be reviewed regularly. This not only allows new potentials to be recognized, but also allows the ranking of previously identified projects to be reworked to suit prevailing conditions.

The added advantage of a centralized review process is that the resources can be grouped to ensure that the benefits are fully received. For example, the planning of a new government-sponsored development, such as new town or industrial development should be linked to associated issues such as access, power and environmental issues. The need for realistic estimates to be provided can be demonstrated in the Philippines, where the Port of Batangas was developed without providing proper road access in time. The delays in this case were due to land issues, which should have been taken into consideration during project identification and preparation. Although such issues are perhaps too detailed for strategic plans it clearly shows the requirement for a holistic approach to be adopted. One where all demand for scarce resources of skilled staff and financing are evaluated on a level playing field. The need for a central government body, off line from the various agencies submitting the proposals, should ensure that a fair evaluation process is undertaken.

(8) Project Identification and Management

Project identification continues directly from the strategic planning of infrastructure. Once the key needs for a highway network have been identified at the strategic level, the projects must be developed in enough detail to allow the package for delivery to be identified, including the options available from PPP techniques.

The need for planning of the expressway network is important to ensure resources are allocated correctly. A medium- and long-term plan should be produced, prioritizing expressways required to meet the demands for travel over the coming years. It is important that the expressways are carefully considered in terms of the long-term goals and objectives of the Government and that they match the overall public policy for a country as defined in its strategic plans.

Although the level of detail need not be that great, enough information must be produced to allow sensible decisions to be made. At a minimum the review of potential expressway must identify financial and economic benefits or rates of return. As such, some realistic estimate of revenue and costs (including capital costs, land acquisition, operation and maintenance, development costs [planning resources]) and cost of borrowing, whether this is within the public or private sector, must be identified. Once a suitable amount of information is available, expressways that meet the objectives of the proposed highway network can more easily be identified.

The capital cost requirements are important as often the strategic planning identifies a wish list of projects, which is actually nothing more than an unrealistic dream. Many countries fall prey to this: Over 20 expressways are on the current PICKO PPI initiative list in Korea, more than twice those developed over the last ten years but are being proposed within half the timeframe. India is another country that has proposed many kilometers of expressways to be developed under PPP techniques. The problem with such a long list is that the most beneficial projects are often lost in the sheer number of proposals. To aid in the decision process and to add some realism to the development process, strategic planning needs to rank the project in the order of their benefits and their fit in the national goals and objectives.

Without proper project identification, the capital involved to develop the potential list of projects is often well beyond the financial reserves of a government, or indeed that of the public sector. Capital for expressway development is limited: the current proposals in many countries far outstrip that which is available and thus the planning process is not providing an adequate evaluation process.

This is also true for the time and effort required to develop the projects during the more detailed planning phases as well as budgetary issues over the coming years. A strategic plan ought to ensure that sufficient resources and capital is available over realistic timetables to ensure that the projects can be developed as planned.

Capital is very important as many sectors compete for the money available. For example, if a government's mid-term goals are to develop education or institute agricultural reforms, then the spare capital to be allocated to major infrastructure projects such as expressways will be limited at best. Without ample resources the projects are not conceived well and even with significant private sector investment the projects are likely to fail as the detailed planning or counterpart inputs are inadequate.

A realistic time estimate for the projects identified is also important, as this will allow budgets to be set and resources to be allocated over the coming years. Many Asian countries (China, Malaysia, Indonesia, and Thailand) have very aggressive list of potential expressways in their strategic plans. However, if the public sector capital required or staff resources needed were realistically compared to the effort required to realize the strategic plan within the specified timetable, it soon becomes obvious that the strategic plan is not realistic.

However, this is not to say that expressways should not be identified if the resources are insufficient. They should still be identified but the timetable for implementation should be sufficient to allow realistic allocation of resources to ensure that they are realized.

It is also not true to say that project identification will consist of all expressways that can be developed. The time involved to develop a new expressway, from conception to operation is usually in the order of ten years. Within this period, changes may well have occurred that would require the strategic plan to be re-addressed to suit current conditions, needs and goals. A rolling strategic plan is required; one that is updated every few years. Even those projects that were considered less important some years ago might now be more financially and economically rewarding. This is especially true in economies that are growing rapidly.

(9) Government Support

If the initial stages have been completed thoroughly, project preparation and structuring should be a relatively easy exercise. The main process in the preparation is refining project issues that have been identified in the earlier stages of the project life cycle.

More recently, this has proven to be the exception rather than the rule. The delivery of a successful tolled expressway through PPP techniques requires careful planning and structuring to ensure that both the public and private partners in the project are fully committed to the undertakings they must each carry out. The project should be fully reviewed and the most suitable form of PPP technique selected for each individual expressway. The bulk of this planning stage falls within public sector responsibilities, and thus the support of the Government in the project development is vital.

The other area where governments must increasingly become involved in the support of expressway developments is through financial undertakings. These can be in the form of guarantees or increased direct financial involvement.

The European Bank for Reconstruction and Development has suggested that the level of government financial support to the development of projects should be in the order of 50% for the expressways currently being proposed for Eastern Europe. This is now seen as the most likely split of financial undertaking required by the public and private partners if successful projects are to be delivered.

There are many forms that government support can take. If the premise is that this support is vital if any expressway is to be developed, and that this is increasingly becoming the general thinking with respect to PPP tolled expressways, then what forms are there available for governments? Below are some international examples.

- Providing existing infrastructure (France, Malaysia, Hungary)
- Providing ROW (most countries)
- Guaranteeing demand or revenue (Chile, Argentina)
- Providing shadow toll payments (UK)
- Providing capital grant (Australia, Brazil)
- Reducing risk of cost of borrowing, interest rate and foreign exchange (Malaysia)
- Injecting direct capital investment (Australia)

The options and how these are practiced in each country vary, which often have to do with national laws and perception of risk.

Another key element in the form the government support takes is the resources available to the public sector. If the resources are high then often the Government will develop much of the expressway, relying on the private sector for management and operation contracts. If the resources are limited then the provision of ROW and government guarantees are more common.

The international tolled expressway market is showing a common thread: There is a need for governments to become more involved in the process and for this involvement to increasingly take the form of financial undertakings.

(10) Risk Mitigation

What are the key items that need to be addressed to avoid failure in delivering the tolled highway network? International experience points to a number of areas where the PPP technique process is not fully understood and which has led to problems with implementation. These can be broadly broken down into the following:

- Policy/framework of the PPP environment;
- Understanding of the profitability of the project (or lack thereof);

- Land acquisition;
- Project life cycle and timetable;
- Acceptance of tolls;
- Development of a highway network; and
- Use of the various PPP techniques to meet particular requirements.

The policy framework is a very important element in the development of PPP projects as it establishes a clear set of guidelines by which both parties operate. It is essential that these guidelines are developed to allow clear rules of engagement, but not too restrictive as to restrict the usage of new techniques or technologies. The Philippines is in a rare situation, particularly for Asia, in that such a document already exists in the BOT Law. However, the current reliance on other methods (joint venture arrangements) to develop PPP tolled expressways has highlighted perceived problems with the BOT Law. These problems are reviewed in this chapter and suggestions are made to improve the law's acceptability and ensure successful delivery of expressways.

The profitability of tolled expressway projects as stand alone entities is very rare. This must be fully understood so that the means of making such projects happen is addressed. Experience has shown that there has been a fundamental misunderstanding of project financial performance, particularly in the early planning stages. Reliance on the private sector to address this issue through associated external benefits, such as property development or through additional revenue sources such as advertising or service station concessions, has inevitably created problems with delivery of projects. Thus, it falls on the Government to ensure that their objectives of delivery of services through the developing infrastructure include certain undertakings. These can take many forms, but one commonly found and workable example is the provision of an existing asset. This has been used in Hong Kong, Malaysia and even in the Philippines, where the first section of the STAR expressway was rolled up in the concession arrangements. Although the impacts of this cannot necessarily be included in a general policy framework, the perception of government requirements must be fully appreciated at the earliest stages of any project.

Associated with the profitability of PPP tolled expressways is the source of financing. The cost of borrowing on the international money markets can lead to exposure during currency fluctuations as observed in the Philippines during 1998. Tapping the local money markets is one way to avoid this, but it can often restrict the amount of resources available, particularly as they are demanded by other sectors or if the overall resource base is limited.

Provision of land for development of expressways has also proved to be a problem in the delivery of the infrastructure, and the Philippines has experienced this on several occasions. The objective of this project is to develop a policy for PPP technologies to allow the development of the tolled highway network within Metro Manila, which will inevitably mean the development of urban expressways. Urban expressways are notoriously difficult to develop successfully due to the constraints and competition for the scarce available land within rapidly developing cities such as Manila. The ability of the private sector to secure vacant land inevitably reverts back to their financial obligations. The public sector can play a significant role in this key element through compulsory purchase of land or through redevelopment and relocation schemes. Either way the provision of ROW will almost always rely heavily on the public sector.

There has been mixed experience with the time taken to deliver projects. There are many examples where projects have come in ahead of schedule (Australia) and many where they have fallen well behind. The Philippines has experienced delays with all of its operational and proposed expressways. The reasons for some of these delays have been discussed earlier in this section. However, there is a misunderstanding of the time required to ensure successful delivery of projects, particularly where financing is concerned.

Another key element in the associated risk of tolled expressways is the acceptance of the users to pay tolls. The Philippines is at an advantage in this respect as it has operated toll roads for some 24 years and the common perspective is that tolls will be collected for use of expressways. The Government is also fully supportive of this and has taken steps to ensure that tolls on the existing expressways are collected with review of the legal process, for example the successful removal of the Temporary Restraining Order on the Manila Cavite Toll Expressway.

To avoid risk in the delivery of tolled expressways the early planning stages must be stringently reviewed to ensure that the proposed expressway fits with Governments objectives and that it is capable of being delivered. This is particularly important when competing for scarce resources. The planning must also form part of a coherent multimodal policy to avoid the ultimate incorrect use of land and resources. The Philippines has already experienced such problems with alternative demands being placed on available land. Such issues need to be resolved at the earliest opportunity if a sensible and ultimately sustainable city is to be developed.

The PPP techniques used in the delivery of the Government’s goals should not be limited to one model. The international experience highlighted above has shown that the range of models is diverse, both in the techniques that can be employed and also in its usage at various stages during a project life cycle. To allow the correct technique to be used at the right time requires flexibility in the delivery of the PPP.

2.1.7 Comparative Analysis with Practices in the Philippines

The above outline highlights the diverse nature of PPP techniques as they relate to tolled expressway development. There is much that can be learnt from experiences of the past, both from those projects successfully implemented and perhaps as much from those that did not. Risk mitigation outlines the key areas that must be addressed to ensure that a workable solution is found for PPP techniques in the Philippines. This analysis is undertaken in detail in this chapter to draw lessons from specific examples from around the world.

The assessment of the Philippine experience is interesting in that many of the problems encountered are common to other projects throughout the world. This is not to say that the current system within the Philippines is flawed, but that certain elements need to be understood in more detail. Often this would require little more than a realistic perspective of the overall expressway development project life cycle. For example the time taken and requirements needed to reach financial closure have been underestimated on several occasions in the Philippines. By drawing from international experience a realistic timetable can be developed.

The Philippines has a relatively detailed and defined process by which to undertake PPP project development. The BOT Law is established and has been used to develop infrastructure projects, even expressways (STAR expressway). This mode will increasingly become the norm as outlined above. Joint venture opportunities are now limited and the unsolicited route is being phased out due to stringent requirements on behalf of government commitments (fiscal and planning) and technology requirements. The analysis of the BOT Law attempts to build on the solicited BOT Law as it applies to PPP development of tolled expressways and, in those areas where problems have been identified, to propose solutions that have been implemented in similar situations around the world.
Initial assessment would point to several areas where the Philippine PPP techniques need to be reviewed, namely:

- Clearer guidelines and information at the identification and development stages of a project;
- A realistic understanding of the project timetable;
- A clearer understanding of the Government's role in the project, including its level of support (financial or otherwise);
- A more streamlined institutional path; and,
- Delivery of land to ensure that construction can be undertaken within the desired timetable.

These issues are by no means insurmountable and with a clearer understanding of the expressway development process the problems that have been encountered to date should be removed.

2.2 Institutional and Legal Environment for PPP

2.2.1 Introduction

The Philippines has a long history, albeit very limited experiences, on PPP. Since the 1990s, the BOT Law (RA No. 7718) has been the guiding framework for undertaking PPP projects in the country. It is considered by many as a 'model' for other developing countries who have embraced the concept of private sector participation in infrastructure projects. Implementation, however, has fallen short of expectations for a number of reasons, i.e. institutional inadequacies, a highly politicized environment, inertia of past policies, a fossilized regulatory environment, and a public inured to social welfare but averse to paying taxes.

2.2.2 Evolution of PPP in the Philippines

(1) The State as the Sole Provider

The traditional concept was that the State, in exchange for its exercise of its sovereign attribute to tax its citizens, was in turn obliged to provide protection and other benefits thereto, including basic infrastructure required for conducting commerce. Thus, historically and up to the present, the construction and maintenance of public infrastructure is deemed a principal obligation of the Government.

(2) Beginnings of Private Participation in Public Projects

The earliest case of private sector participation in the country was in 1887, when the concession for building and operating the Manila-Dagupan rail line was awarded by the Spanish colonial government to the Manila Railroad Company Ltd. of London.

Since the country regained independence in 1946, it has hewed closely to the doctrine of the State as sole provider of infrastructure. In 1963, the Government opened its eyes to the possibility of tapping private resources for purposes of prosecuting public works such as national highways, roads, bridges, public markets, irrigation systems and "other self-liquidating public improvements", through the enactment of Republic Act No. 3741, otherwise known then as the "Private Financing Law".

There are no evidences of road projects that were prosecuted under this 1963 law. It was repealed through Presidential Decree No. 1005 in 1976, ostensibly in order not to “distort the national government priority pattern since the overriding consideration under this law is the self-liquidating character of the project rather than its social and economic contribution to the country”.

A major expansion of the road network occurred in the 1970s. Among the roadways that were built by the Government using a combination of ODA and internal funds were the initial stretches of the Manila North and South Diversion roads, which were later privatized into the NLE and the SLE.

(3) Era of Monopoly

Even before the construction of the aforesaid diversion roads were completed, then President Marcos issued Presidential Decree No. 1113 in 1977, granting to the then privately owned CDCP, an exclusive 30-year franchise to construct, operate and maintain as toll roads the NLE and the SLE. The grantee was obligated to complete the construction of the expressway to Pangasinan Province in the north and to Quezon Province in the south and to pay the Government some ₱912 million it spent for the projects. Simultaneously therewith, under Presidential Decree No. 1112, the TRB was created to supervise and regulate that lone toll road project, for which a “Toll Operation Agreement” (TOA) was executed between the TRB and the CDCP in October 1977.

Subsequently, in 1983, CDCP’s monopolistic franchise was further extended under Presidential Decree No. 1894 to include the construction and operation as a toll road the proposed “Metro Manila Expressway”, together with any “extension, linkage or stretch” from any portion of its original franchise which the TRB may so approve.
When CDCP defaulted on its loans to various government financial institutions, it was taken over by the Government and renamed PNCC. The tollway franchises, however, remained and became the ‘lamp that attracted the moths’ in the 1990s, when the PNCC entered into several joint venture deals.

Another institution created during the martial law years was the PEA. Presidential Decree No. 1084 was issued in 1977 primarily to salvage two failed reclamation projects – one of which was that undertaken by the CDCP in Manila Bay – and secondarily to administer all reclamation ventures and manage Government-owned and acquired properties. As part of its charter, the PEA was allowed to build roads within its properties. The Manila-Cavite Coastal Road was deemed part of its expanded reclamation ventures, for which it secured toll development rights from the TRB in 1990.

(4) Era of Less Government

With the end of the Marcos dictatorship in 1986, the government processes and policies underwent a sea of change. For one, a franchise was no longer deemed an exclusive privilege. Transfer of some responsibilities to LGUs, as well as to the private sector, was pursued.
In accord with the global trends towards PPP, Republic Act No. 6957 (the BOT Law) was passed in 1990 (later amended by RA No. 7718), to set the legal basis for private sector participation in public infrastructure programs of the national and LGUs.

2.2.3 Regulatory Environment

(1) Price as the Regulatory Issue

Although the concept of PSP has undergone changes over the years, the regulatory philosophy has remained essentially unchanged.

A pervasive notion in the Philippines is that toll rates ought to be regulated or controlled by the Government to protect the public. This argument is actually rooted on the economic theory that the State has to intervene when there is a monopoly situation or when the market breaks down. However, bureaucrats and politicians often support price regulation even when the economic context is vastly different.

Regulation of public utilities invariably focuses on prices, rather than the quality of the service delivered. Philippine jurisprudence has enshrined the 12% rate-of-return cap on the value of the operating assets. It is a legal relic of the American era. Although already jettisoned in the USA, this regulatory dictum is still followed in the Philippines. Also, legal precedents require prior public hearings before any adjustment in toll fees can be decided.

(2) Regulator of Record

In so far as toll roads are concerned, the acknowledged and sole regulator for expressways in the country since 1977 is the TRB. Although there appears to be two legitimate routes for undertaking PPP road projects, all converge on the need for a toll operating certificate (equivalent to a franchise) from the TRB. The role and function of the TRB has remained unchanged for nearly 25 years, although its position in the Philippine bureaucracy has been shifted several times. At the start, it was organizationally attached to the NEDA. Later, it was moved to the DOTC, then the DPWH and then the Office of the President. In the context of Philippine public administration, the term 'attachment' is supposed to imply alignment of TRB's activities with the policy directions of the line agency to which it has been attached.

Notwithstanding the constancy of its powers and responsibilities, the TRB exhibited different characters over the years – a passive and timid regulator up to the late 1980s, an active tollway authority in constant tension with the DPWH in the early 1990s, and lately, a facilitator of PPP projects in the road sector.

(3) Point of Market Entry

Economic regulation, of course, carries with it the regulation of entrants into the market. In this case, private companies going into the tollway business.

A private company can secure a franchise directly from Congress, or from the DPWH following the BOT Law, or via joint venture with the PNCC (or PEA and BCDA). Previously, as in the case of the PNCC, toll franchises can only be issued by Congress. Presidential Decree 1113, the franchise of the PNCC for the NLT and SLT, is considered a legislative act.

The TRB is authorized by law to issue toll operating permits or certificates that had all the features and characteristics of a congressional franchise, except for a possible grant of tax privileges. The passage of the BOT Law re-stated the regulatory power of the TRB, but opened the possibility of two agencies being able to grant a toll franchise. As the implementing line agency, the DPWH could automatically grant the franchise for a toll road project pursued under the BOT Law. Similarly, the TRB could, even if it is not the implementing agency. The apparent existence of "two gatekeepers" into the tollway business was unintended, or a case of splitting hairs. The TRB consists of a five-man Board chaired by the DPWH Secretary, with memberships drawn from the DOTC, NEDA, DOF, and a private sector representative. This inter-agency composition was meant to achieve harmonization, as well as facilitate governmental approvals of any concession agreement.

To overcome this seeming ambiguity, both the DPWH and the TRB sign off on the Concession Agreement. The compromise may have provided some comfort to investors and funders, but it also created a regulatory dilemma – where the TRB is asked to adjudicate on a contract in which it is a signatory.

(4) Joint Venture Route into Tollway

Aside from the DPWH or the TRB, a private proponent could go into the tollway business via a circuitous route – by forging a joint venture deal with the PNCC or the

PEA. It is, however, a form of backdoor entry that is expected to disappear in the future.

Judging from the proposals that emerged in the last decade, it may appear that private proponents prefer the joint-venture route with the PNCC (in the case of Skyway and NLT) or the PEA (in the case of Manila-Cavite Expressway) rather than the elaborate procedures prescribed under the BOT Law. Since the three projects necessarily have to deal with the TRB, it has given rise to a wrong perception about conflicting laws.

The basic reason for the bias or preference for joint ventures with the PNCC or the PEA was a natural aversion on the part of private proponents to go though competitive tender – with its attendant risk of lower returns or losing the rights altogether. It was easier to cut a deal with the PNCC, especially with its existing franchise and operational SLE and NLE. Furthermore, there was expectation of faster implementation through joint venture – which on hindsight turned out to be false.

As an autonomous corporation, there is no doubt about the prerogative of the PNCC (or PEA) to enter into joint ventures. The Government Corporate Counsel (in OGCC Opinion No. 224 dated 8 November 1993) and the Secretary of Justice (DOJ Opinion No. 79 dated 2 June 1994) opined that:

> *"PNCC may enter into joint venture agreements with other corporations without necessarily going through public bidding, subject to the inherent limitations of its franchise x x x and Memorandum Order No. 266. PNCC must formulate its own guidelines in the choice of prospective partners, taking into consideration the requirements and qualifications of contractors set forth under the BOT Law, and with the approval of the Toll Regulatory Board, DPWH and the Office of the President."*

There are some basic differences in prosecuting government road infrastructure projects under the BOT Law and in joint venture with the PNCC or PEA. These may be summarized in Table 2.8.

Table 2.8 Comparison of BOT Law and Joint Venture with PNCC

ASPECT	BOT LAW	PNCC FRANCHISE
Identification of Project	By government infrastructure agencies, with approval of NEDA-ICC	Limited to expansion or modification of existing franchises and approved by TRB
Duration of Franchise	As set out in the Concession Agreement, but not to exceed 50 years.	As fixed in the respective Toll Operation Agreements/ Certificates approved by TRB
Public Bidding	2-envelope system of bidding for solicited projects; price challenge procedure for unsolicited projects	Selection process at discretion of PNCC or PEA. However, assignment or revision in PNCC franchise requires TRB and OP approval.
Supervising Agency	Government infrastructure agency which awarded the contract; For roads, DPWH at start and up to end of construction. TRB assumes jurisdiction during operation.	TRB, regarding franchise matters, but DPWH gets involved on road construction issues. Office of the President intervenes on what PNCC and PEA can do, like choice and terms of joint venture
Toll Rate Setting	As bid out if stated in the bid documents and approved by TRB; otherwise, as approved by TRB	As approved by TRB
Toll Rate Adjustment	Following pre-agreed formulae stated in Concession Agreement and approved by NEDA; not greater than 12% RORB if monopoly	As set out in their respective Toll Operation Agreements/Certificates, but impliedly subject always to TRB's determination of its "reasonableness"
Fiscal Incentives	Eligible to incentives provided under the Omnibus Investment Code and other laws providing additional incentives	Same
Government Undertakings	Open for solicited projects, e.g. Cost Sharing, Credit Enhancements, Direct Government Guarantees, Direct Government Subsidies and/or Government Equity as may be given in the bid offer	Limited. Any form of financial support or guaranty from the Government prohibited under PNCC's franchise
Financial Sourcing	May be financed partly from direct government appropriations and/or from ODA and other bilateral sources, where available	Use of ODA or government appropriations prohibited under PNCC's franchise. GFIs may lend directly to project company at its own discretion
Right-of-Way and Relocation	Government obligation normally shouldered by DPWH.	Government obligation, assumed by TRB under the PNCC franchises, or PEA under its joint venture deals
Nationality requirement	Franchise operator should at least be 60% Filipino-owned	Same: minimum 60% Filipino ownership
Fees payable to the Government	As may be provided in the bidding offer	PNCC concession fees that remain outstanding; and whatever TRB may impose
Form of Authorization	Concession contract attached as part of the bidding documents and per Toll Operation Agreement/ Certificate approved by TRB	Supplemental Toll Operation Agreement/Certificate approved by TRB
Contractual Scheme	Usually BTO; but other schemes allowed under the BOT Law	Following the form of the original franchises, basically BTO scheme
Approval Process	a) For solicited Projects: Approval of project by NEDA Board or NEDA-ICC and the subsequent concession agreement b) For unsolicited projects: Acceptance of proposal by DPWH and endorsement to NEDA-ICC for first pass approval; Conduct of price challenge and NEDA-ICC approval of award and final concession agreement.	PNCC/PEA selects their respective joint venture partners in accordance with their internal rules. Finalized joint venture agreement subject to review by OGCC/OSG, and approval of the GCMCC/Office of the President Investment Proposal jointly submitted to the DPWH and/or TRB evaluation and approval . Negotiation of terms of concession agreement with DPWH and TRB and review by OGCC/OSG/OP.

(5) Public Aversion to Toll Fee Increases

Of critical importance to proponents as well as their funders is the ability to set the necessary toll fees and adjust the same during the life of the concession. Since there is a direct impact on the motoring public, any changes would necessarily encounter acceptance or resistance from the users. However, what is at issue is the ability of the TRB to live up to the terms of the concession agreement.

PNCC/PEA Experience

The PNCC had the longest experience in dealing with periodic toll fee adjustments. Ever since it came into government control in the mid-1980s, its private sector instinct for covering cost increases via toll adjustments was sublimated. As a consequence, toll users became inured to static toll fees for more than 15 years.

In 1990, the Solicitor General, upon the prodding of some activist groups, attempted to free certain segments of the NLE and SLE from the burden of toll, managing to secure a short-lived but damaging court injunction. As the DPWH was in no position to assume the maintenance responsibilities from the PNCC, and ‘free use’ encouraged more traffic, the condition of the expressways deteriorated to the point that the motoring public itself called for the resumption of toll operations, forcing the Solicitor General to strike a compromise with the PNCC for the return of the disenfranchised segments back to the latter’s care.

An analogous experience happened to the MCTE under the PEA Tollway Corporation (PEATC). Where before, it was a ‘free-use’ road, it got converted into a tolled expressway where the rates were deemed too high relative to the prevailing rates then on SLE and NLE. A court battle ensued. Subsequently, the decision was handed upholding the validity of the rates decided by the TRB in accordance with the Concession Agreement. Through time, users have grudgingly accepted the rates on the MCTE.

Against this backdrop, the commencement of Skyway and its attendant new toll rates – both on the elevated and at-grade segments – attracted controversies and oppositions. After some delays, the new rates got implemented. The adjusted rates for the old segments of the NLE and the SLE, however, were held back and became casualties of political intervention.

Political Intervention

As the PNCC and PEA experiences showed, the issue has never really been whether or not there should be toll, but rather, how much toll should be charged. This can only be expected considering the long history of deferments of necessary rate adjustments, and the relatively low affordability levels of toll users.

Thus, any attempt by the proponents to increase the level of toll rates – whether small or big – is almost always met with stiff opposition from the public, with local politicians jumping into the fray. What almost always results is that the proceedings for toll rate adjustment/setting pending before the TRB gets politicized and unnecessarily delayed, if not derailed.

As the PNCC, the PEA and the TRB are all government agencies, they are particularly susceptible to political pressures. As experience has shown, toll rate settings involving PNCC- and PEA-managed toll roads have always been long-winded proceedings that ended up in political compromises to suit political ends, irrespective of economic principles or honoring the contractual obligations. Rare is the political or career official who bucks what is popular in favor of what is right. In a highly centralized government, the political will ends at the President. Prior to 1986, it took a presidential issuance (under Letters of Instructions No. 1334-A) to short-circuit the TRB process and grant the toll rate increases sought by the then CDCP.

The same procedure, i.e. that of the TRB conducting public hearings before approving any adjustment in toll rates, still presently obtains and will continue to be the norm in respect of all tollways. Lately, however, the adverse implications of not honoring contractual obligations have dawned on the Government so much so that recent toll adjustments remained despite strong public and political opposition.

Judicial Incursion

Together with political pressure, opponents of toll increases have often resorted to the courts to prevent the TRB from granting the increase in toll rates sought by toll road operators. While courts have generally been reluctant in preventing the TRB from performing its quasi-judicial mandate, the mere delay occasioned by the pendency of the matter before the courts often already serves as its own reward.

Contract Default

As a legal defense to potential restriction on investors' freedom to set/adjust toll fees, a default clause on the matter found its way into the concession agreements.

The delay, if not failure, of the Government to provide relief to the proponent and its funders by way of allowing an adjustment in the prevailing toll rate setting may, in accordance with the particular Toll Concession Agreement involved, trigger a "Default" situation whereby the Government may be compelled to take out the proponent's interests in the project, at a premium, thereby assuming its attendant risks together with the obligation of repaying outstanding loans thereon.

Aside from a potential embarrassment to the Government, such a default may also lead to a downgrading of the credit standing of the country.

(6) Nationality Limitations

Toll roads are considered public utilities subject to the limitations on ownership by foreigners. Some quarters see this as a negative factor in enticing foreign investors, although it has not prevented the latter's participation.

Under an old ruling of the Supreme Court promulgated in 1936 (*North Negros Sugar Co. vs. Hidalgo, 68 Phil. 664*), private roadway that is operated for public use automatically qualifies the activity as a public utility. While the particular situation under which it was formulated may have been vastly different from that which obtains presently, said ruling still remains effective.

Being so, all the prescriptions under Article XII, Section 11, of the Constitution for an operator of a public utility franchise are made applicable to the operator of a toll road facility, namely: (a) that the facility operator be a Filipino, or if a corporation, must be registered with the Philippine Securities and Exchange Commission and owned up to at least sixty percent (60%) by Filipinos; and (b) that all executive and managing officers thereof must be citizens of the Philippines.

Experience in the MCTE as well as in other BOT transport projects (e.g. NAIA 3 and MRT 3), however, proved that the nationality restriction was a bugaboo. A separate operating entity that complies with the ownership rule could be set up, but bound to funnel incomes into a designated project company (which may be foreign). For example, in the case of the MCTE, the PEA incorporated a 100% Filipino-owned toll operating company called the PEATC. The revenues generated by the latter, however, were to be subdivided in accordance with a pre-agreed formula between the foreign project company (UEM-MARA Phils) and the PEA.

(7) Other Legal Hurdles

There are three other legal requirements that toll proponents have to hurdle before they can proceed to implementation, or in some instances, arise during construction. These are: environmental compliance, clearing of the ROW and LGUs.

Environmental clearance

Although well meaning, the procedures for securing Environmental Compliance Certificates (ECCs) have often proved nightmarish to project proponents. The term 'environment' has widened in scope as to include political and social acceptability of the project. Even a small group of squatters could thwart or delay the project, on the pretext that its environment would be altered or despoiled.

Provision of Right of Way and Relocation

The charter of the TRB clearly allows the agency to provide the ROW for tollways. This is also a government obligation that is often conceded in the Concession Agreement, because of its power of eminent domain. Experiences of MCTE, MNT and STAR showed that protracted delays in securing the ROW were the norm rather than the exception. Lenders – as in the case of MNT – could withhold funding when the ROW is not yet cleared for possession of contractor. Often, it is the illegal occupants seeking comfortable relocations that hamper the process.

RA No. 8974 was enacted in July 2000 precisely to address the ROW conundrum.

LGU Gauntlets

An uncooperative LGU could delay the completion of road construction works. As a matter of course, building permits have to be secured from LGUs. In Metro Manila, permits from the MMDA maybe necessary where existing roads might be affected by construction. The fate of the Skyway project almost hang in the balance when Parañaque tried to stop construction, claiming a number of violations of its ECC.

2.3 Guideline for the Development of the PPP Technique

2.3.1 Searching for a Development Strategy

The past strategy can be characterized more as a case of muddling through, reactive rather than proactive, with a tinge of opportunism. This will not work in the future, where PPP projects have to compete in a tight financial market and require substantial dose of support from a government that is in a tighter fix.

The ideal strategy should remedy existing weaknesses and leverage strengths, as well as exploit emerging opportunities and overcome anticipated threats and problems.

The **weaknesses** in developing toll roads through PPP are many and can be summarized as follows:

- Institutional inadequacies, e.g. lack of expertise within the Government exacerbated by a climate where politics is perceived to impinge greatly on business decisions, conflicts between the TRB and the DPWH, and ambiguity in their issuance of franchise;
- Unclear objectives evident in the absence of a coherent long-term plan on the desired expressway network, often alluded to as lack of a master plan;
- No forward funding for ROW acquisition, compounded by procedural difficulties in expropriation and eviction of informal settlers;
- PNCC's 'elastic' franchise that contain a provision for automatic extension and inclusion of any road linked to its existing toll ways;
- Presence of GOCCs with tollway ambitions may intimidate new entrants about the unevenness of the playing field;
- No long-term financing in the domestic scene, which forces proponents to rely more on foreign loans and consequently expose their operations to foreign-exchange risks;
- Political pressures against increases in toll fees and a low base – due to years of inaction on toll fees changes – from which to start from.

On the other hand, the acknowledged **strengths** are few: a BOT Law that sets out an explicit framework for PSP in road development (as well as other infrastructure projects), a history of honoring contracts, and a legal system that protects private rights.

The outlook over the medium-term period is not promising. What can be considered as **threats** to expressway development include the following:

- Possible incompatible electronic ticketing standards under a multioperator regime in a future expressway network;
- Possible challenges on the validity of PNCC's conveyance of its franchise (over SLE and NLE) to its joint venture partners;
- Ballooning deficits of the Government, which could scuttle any future scheme of financial support; and,
- One inoperable expressway section could shut down the entire network unless a shared traffic information system is put in place across the expressway network for the speedy handling of accident, reduction of congestion and coordinated maintenance works.

The **opportunities** for realization of the urban expressway network through PPP are likewise few and far between, viz:

- Increasing motorization and suburbanization will fuel demand for a more extensive and efficient expressway network than currently available;
- The expiry of the PNCC franchise (in year 2007) can create a level playing field for more investors; and,
- Recent adjustments in toll fees, triggered by Skyway, can provide a good base of experience and precedent to future operators.

2.3.2 Smoothing Out the 'Road Bumps and Potholes'

To improve the PPP process for development of the urban expressways, the current weaknesses must be addressed. This encompasses adoption of clear objectives (and expectations) of PPP, fine-tuning the process and adopting a number of policy reforms.

(1) Clarifying Objectives of PPP

Over the last decade, the overarching objective of the Government was to expand the expressway network with private funds. Mega projects with huge price tag became the norm. New roads are deemed politically efficient, as they cater to politicians' inclination for physical symbols of progress. Private sector participation for efficiency gains took a back seat. Consequently, privatizing existing roads – even for rehabilitation and maintenance, with its lower capital requirements – has not been pursued.

The pre-occupation with new roads has also led to the consideration of unsolicited proposals for specific segments that do not form a network. This has elicited valid observations about the lack or absence of a 'master plan'.

The Government should have a long-term vision of the urban expressway network that it plans to develop over time, with clear priorities on which segment ought to be implemented first. Because public and private resources are scarce, and because these projects will entail various forms of government support, the priorities should be decided on the basis of highest economic benefits and the principle of 'value for money'.

The long-term vision should also include widening commercialization of the highway system and creating markets for highway service. Thus, the Government should pursue other modalities for PSP – to entice new and smaller players, and lay the foundation for sustainable PPP. This is discussed further in section 2.3.4

Another objective in the development of urban expressways is to allocate to the greatest extent possible the full cost of these roads to those who directly use them. Any direct or hidden subsidy would mean burdening taxpayers outside Metro Manila and other motorists who do not necessarily use these roads.

(2) Fine-tuning the Process

PSP has turned out to be more demanding on government institutions than originally anticipated or in comparison with the traditional mode of implementation. And yet, the organization (much less the culture) of the infrastructure sector has remained largely unchanged since the passage of the BOT Law.

Dividing the Work Pie

Previous studies have already examined the organizational structure and processes of the DPWH and the TRB with respect to expressways. The latest available study was prepared under the RIMMS Project and dated March 2001. An earlier study (May 1993) entitled "Needs Assessment for a Toll Road Authority" also included a review of the role of the PNCC. This study cannot pretend to add more to the literature nor is it part of its scope to do so.

It is very clear from the review of legislations and executive orders that the DPWH is pre-eminent during construction (to decide on technical or engineering issues), while the TRB is the sole regulatory authority when it comes to operations and toll rates.

The basic recommendations of RIMMS, most of which remain valid, are as follows:

- Allow the TRB to remain the sole economic regulator
- Clarify the attachment of the TRB to the Office of the President
- Revise the IRR so as to remove the authority of the TRB to issue TOAs, interpreting the same as subsumed under automatic grant of franchise under RA 7718.
- Amend the IRR to include the term "Board" in its definition of agencies, in effect, unequivocally obligating the TRB to conform to the IRR;
- Divide the work between the TRB and the DPWH via a Memorandum of Understanding whereby
  - the TRB shall be responsible for the legal and financial aspects of toll road planning and contracting, plus the monitoring of operations;
  - the DPWH shall be responsible for planning, design, construction oversight, plus supplying any facilities that the project may require from the government.

- Allow the TRB to shed off its operational functions and limit itself to economic regulations over the long term.

Certainly, to entice more investments in expressways, the Government has to improve its internal processes. Beyond what had already been recommended, this study can only add the following recommendations:

1) Focus on the process, which both the DPWH and the TRB have to carry out. During the early stages, the ball falls more heavily on the DPWH. On the other hand, as the project gets nearer to completion, the TRB becomes ascendant.

2) Adopt a practical solution to the seeming conflict between the grant of TOA by the TRB and the automatic grant of a franchise (by the DPWH) for a BOT road project. The two can co-exist. The rule applied in telecommunications under R.A. 7925 offers guidance: A franchise is required from Congress for an entity to enter the business but requires a Certificate of Public Convenience from the regulator (in the telecommunications case, NTC). Thus, a franchise or Concession Agreement can be issued by the DPWH to authorize the development of an expressway but that a TOA must be secured afterwards upon completion of construction and prior to operation. In effect, the issuance of a TOA by the TRB becomes an occasion for a final review of the out-turn construction. Such a treatment would obviate premature detailing of toll adjustment formula before actual costs are determined and minimize duplication of tasks between the DPWH and the TRB.

3) Clarification of the attachment of the TRB (from the DPWH to the Office of the President) may be unnecessary. Likewise, a MOU between the TRB and the DPWH may be superfluous. Under the Administrative Code, the implication of ‘attachment’ has been clearly specified, i.e. it is intended for policy coordination. Thus, the attachment of the TRB to the OP means the former has to conform to the policy directives (and development strategy) of the latter. As chairman of the TRB, the DPWH Secretary can (and should) delineate the responsibilities of the TRB vis-à-vis that of the DPWH so that the strengths of both organizations can be made to bear on the task at hand.

Solving the Expertise Gap

The management culture and the mindset of people in the Government are geared towards project implementation in the conventional mode, i.e. design, finance, build, operate, and maintain solely by the Government. Despite the more than ten years of experience with BOT schemes, the human resources for handling PPP projects are still lacking. This is recognized by both the DPWH and the TRB. For one, the DPWH has not succeeded in beefing up its BOT-PMO for many reasons such as budget lack and poor salary.

The lack of expertise has forced the Government to offload project planning onto the private proponent. As a consequence, it has taken a long time for the DPWH and TRB staff to understand and appreciate the details of projects where they had no hand in preparing. During the negotiation stage, an ad hoc government panel was formed to deal with a high-powered private panel.

The usual remedy is to undertake capacity-building exercise for the DPWH and the TRB. This is desirable but unlikely to be effective in the short term because of the low salary within the Government as well as the non-commercial origins of new recruits. The more practical solution is to establish first a cadre of PPP experts within the Coordinating Council for Private Sector Participation (CCPSP) that can be made available to the DPWH and the TRB (and other agencies). As more experiences are gained, and PPP projects multiply, the core staff can be enlarged and spun off – with specialization on expressways – to the DPWH and the TRB. Additionally, CCPSP, DPWH and TRB can seek technical assistance from ODA sources to undertake project studies, establish the business case as well as the proper scale for the projects, and put the project into competitive tender. Working hand-in-hand with ODA-funded consultants will also provide hands-on training to government personnel. Until such time that a pool of in-house experts are trained, consultants can also be tapped to assist the government panel during bidding and negotiations.

Burying Old (and Incompatible) Proposals

Review of toll road projects in the last decade revealed the absence of a systematic procedure for handling the ‘birth’ and ‘death’ of projects. In an attempt to establish a comprehensive list of expressway projects under consideration and their status, the Study Team has to piece together data from several sources. With a realistic target expressway network to year 2020, the Government should lay to rest incompatible (and often unsolicited) proposals.

To simplify the process and avoid future complications, the following projects should be declared not worthy of further consideration: (a) Manila Bay Expressway, for being too costly; (b) Pasig Expressway, for non-viability without substantial government support; (c) Pabahay-sa-Riles Tollway, incompatibility with the overall master plan; (d) C3-Southern Segment, for incompatibility with Skyway Stage 3; and, (e) R6 and R7 Expressways, for incompatibility with the proposed rail lines.

Resisting the Temptation to Give In

The cards are stacked against killing a project once it has been announced and a concession let. The politicians' imperative is to deliver a highly visible project as soon as possible, and PPP projects are convenient to push on the pretext that no government funding is involved. Once they have spent money for project preparation and lobbying, proponents and contractors alike do not want to discontinue or kill the project at the 11th hour. Lenders, however, may insist on changes in the terms of the concession. The proponent may intentionally prolong the process in order to buy time for financial closure, or to wear down the government panel and exact more favorable terms. At that stage, the temptation is for the government officials to give in and to assume more obligations than warranted by public interest.

In several BOT projects in the Philippines, the concession agreements went into many revisions – progressively transferring risks to the Government. Fortunately, there is no evidence (yet) that this has happened in the road sector. The DPWH and the TRB should "make haste slowly", and recognize that not all roads are a good thing, nor all private investment in tollways desirable.

To protect lower-level personnel of the DPWH and the TRB from external pressures to give in to proponents, the draft concession agreement should be made part of the bidding documents, and any changes made shall be released or made known also to losing bidders. The bidding documents should state, *a priori*, that losing bidders should be allowed to contest the result if a material change has been made on the draft contract. In addition, the rules should declare a bidding failure if no concession agreement is signed with the first-ranked bidder within six months from notice of award.

(3) Instituting Other Policy Reforms

One of the strengths of the PPP technique in the Philippines is the legal framework for BOT projects. Unfortunately, past projects have tended to follow 'the cracks in this framework', rather than the core procedures stipulated under the BOT Law. The most fundamental reform, therefore, is to stick to the BOT Law, avoid joint venture agreements (sans competitive tender) and eschew unsolicited proposals. The Government should entertain only solicited proposals. The concept of a planned network implies that all projects should have been identified and specified in the agency's priorities a priori. This criterion would knock out an unsolicited proposal.

Obviating Future Conflict Between TRB and DPWH

Although much has been learned by the two agencies involved in the development of urban expressways, there is still some room for improvement. The DPWH and the TRB have to present a coordinated and consistent front amid a tightening market and low appetite of lenders. The conflict that transpired between the two agencies in the past should no longer be repeated. There are several favorable factors why this tension would naturally ease: (i) personalities have changed, (ii) accommodations learned in dealing with the four PPP projects, (iii) prospect for joint venture, which placed the TRB in the upstream stage of the PPP process and on collision course with the DPWH, has diminished since the PNCC has no more operating and mature toll roads to cede. Nevertheless, to avoid their recurrence, a policy should be adopted wherein all greenfield projects must commence with the DPWH (and not the TRB). In other words, initial evaluation as to conformity to the long-term plan and road engineering standards shall be with DPWH.

Tempering PNCC's Broad Franchise

Another encouraging step is to curtail the PNCC's broad franchise. Presidential Decree No. 1113 has granted the PNCC (formerly CDCP) a flexible scope, with its provision that any extension or road link becomes part of its franchise. Ideally, PD#1113 should be amended in the context of new realities. However, congress is unlikely to act on such a bill. New concessions for the North and South Luzon Expressway have effectively divided and ceded the old franchise to new entities, with corresponding TOAs granted by the TRB that contain features approximating new franchises. Under the BOT Law, renewal of the PNCC's franchise becomes moot and academic. Therefore, the best course of action is to let PD No. 1113 lapse. The PNCC's claims to the contrary notwithstanding, its alleged vested rights on future tollways (that it has not yet built) cannot be deemed exclusive under the 1987 Constitution. Its franchise does not preclude the DPWH (or the TRB for that matter) to award a new concession, e.g. Extension to Pangasinan or C6 Expressway, to other entities.

Disallowing GOCCs with Tollway Ambitions

The charters of the PEA and that of the Bases Conversion Development Authority (BCDA) provide leeway for these entities to undertake toll roads. In particular, PEA has gone into a joint venture arrangement for the Cavite toll road and is considering a C-5 tollway. The presence of government entities into the market would tend to discourage other players (who were not as lucky in becoming the joint venture partner). Competing with the Government is almost always a 'no-win' proposition.

To avoid market distortions, the Office of the President should temper the ambitions of any GOCC in venturing into urban expressways. The charters of the PEA and the BCDA should be viewed as circumscribed by their property boundaries, i.e. prohibited from pursuing toll road developments outside their property boundaries. Outside their territorial jurisdiction, they should not be given advantage by the DPWH or the TRB and should be treated as less than private proponents. As a matter of transparency, GOCCs' choice of joint venture partners should likewise be subjected to competitive tender.

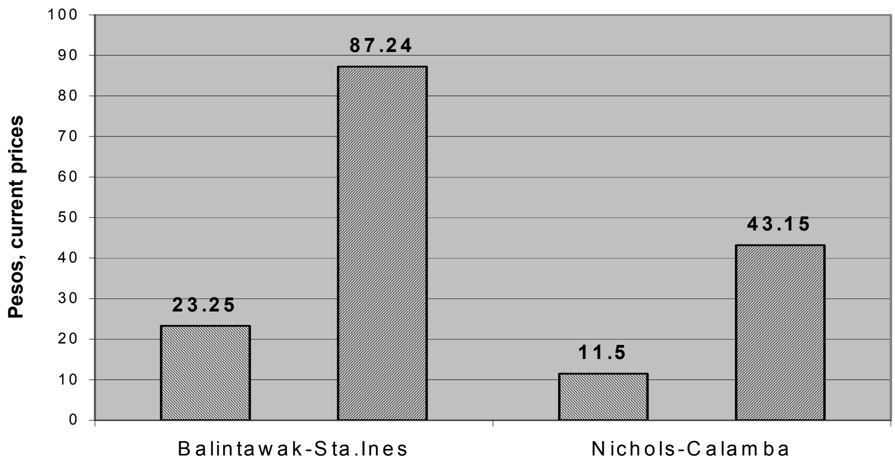
Allowing More Frequent Adjustments of Toll Fees

Any increases in toll rates will almost always invite opposition, and pressures from politicians with an eye towards the next election. The severe opposition experienced by Skyway and MCTE could be traced to the public's being inured to the stagnant rates of the NLE and the SLE.

For more than 15 years, the toll fees in the PNCC-controlled expressways remained unchanged. Had the rates followed the behavior of the consumer price index from 1987 to 2001, the toll fees from Balintawak to Sta. Ines on the NLE would have been ₱87.24 last year, instead of the ₱23.25 of 1987 and at present. Similarly, the Nichols-Calamba section of the SLE would have been charging ₱43.15 (instead of ₱11.50) by the time the adjustments arising from the Skyway got introduced. This is illustrated in Figure 2.3.

The TRB should adopt a policy of frequent reviews, e.g. every 6 months, of rates, maintenance expenses and level of service. The motoring public would be able to tolerate small increments in toll fees, but not abrupt jumps.

Figure 2.3 Toll Fees: 1987 Actual and CPI-based 2001



2.3.3 Lowering the High Hurdles

(1) Statement of the Problem

Although the preceding problems posed some obstacles, they have not prevented the realization of PPP projects in the past. The obstacles that could make or break a project are: lack of domestic long-term financing, reliance on foreign loans, ROW conundrum, and negative cash flows during the early years of a toll road.

Any PPP or BOT projects revolve around financial viability for the private investors and economic viability for the public sector. A project may be feasible on economic grounds but not necessarily on financial terms. Basically, an expressway project becomes attractive to private investors if its return on investment (ROI) exceeds a minimum hurdle rate.

$$ROI = \frac{\Sigma(\text{Revenue-Expense}) \times Pr \pm S}{(Cost_1 + Cost_2)}$$

where $Cost_1$ = cost of project borne by the private sector
$Cost_2$ = cost of project assumed by the public sector
S = support from the public either in terms of tax breaks, incentives, credit enhancement, subsidies, and the like
Pr = probability of realizing the forecast incomes

The objective of the Government is to get the project implemented with $Cost_2 = 0$ and Support = 0. On the other hand, the objective of the private investor is to maximize ROI by minimizing $Cost_1$ (which can only occur by increasing $Cost_2$), increasing S and reducing risks (pushing Pr towards 1). The key to the PPP technique is to balance the two conflicting objectives, so that the calculated ROI is attractive enough.

(2) Variations on the Same Theme

Under traditional mode of implementation, project cost = $Cost_2$, i.e. all investments are provided for by the Government and the ROI hurdle is the EIRR or economic internal rate of return. At the other extreme, a pure BOO scheme would make $Cost_2 = 0$. All the other contractual schemes and variants envisioned under the BOT Law differ only in the values of the key variables: $Cost_1$, $Cost_2$, Pr, and S.

In a BLT or BT scheme, Pr = 1, the income to the investor is guaranteed and commercial risk is assumed by the Government. In such a situation, the Government should ensure that project cost (= $Cost_1 + Cost_2$) is optimal. This implies more explicit intervention on the design and engineering of the project and more stringent postures during contract negotiations.

In a BOT or BTO scheme, Pr < 1 and the market risk is assumed by the private proponent. In this case, the proponent itself has the incentive to minimize $Cost_1$, especially when $Cost_2$ is predetermined and not subject to bargaining. A civil works constructor among proponents may have the incentive to bloat cost, to maximize profit at the beginning, but the other parties (including lenders) would have the opposing tendencies.

Although the BOT Law allows the foregoing variants, the structure of PPP expressway projects should be BTO (or RTO, for rehabilitate-transfer-operate), as in the case of all four expressway projects of recent vintage.

Different investors have different ROI targets. Invariably, these cannot be lower than the cost of borrowings. In the Philippines, this ranges from 15% to 30%. It would be difficult to attract local investors for any expressway projects that show an ROI < 15%. However, some investors may appear to be satisfied with lower ROIs if they perceive the venture to have collateral benefits. That means, they can derive extra incomes not captured in the project's equation. Construction companies have predisposition for expressway projects, since they get profits from the works itself (short-term gains) rather than from toll operations (long-term gains).

Government support should be considered when projects indicate an ROI below 15%. This means the Government should adjust Pr, $Cost_2$ and S.

(3) Government Support – Other Countries

In Europe and other countries, road concessions almost always involved government support or aid. Governments used an array of mechanisms to provide financial support that will make the project attractive to private investors.

Table 2.9 summarizes the kind of support adopted in several countries and their suitability and applicability to the Philippines.

The Government should be prepared to extend the kind of support that other countries, particularly France, Thailand, Brazil, and Mexico, have provided road concessionaires. Not just one of them, but all that is feasible under Philippine conditions.

(4) Elements of Existing Toll Concessions

Commercial or Market Risk

All the four expressway projects that were covered by concession agreements were structured as BTO, which meant that market or traffic risk is assumed by the project proponent rather than by the Government. There is no reason why the Government should change this condition, although the pressure on future projects, especially from lenders, would lean towards traffic guarantees.

A BLT scheme, where the Government effectively assumes commercial risk, should only be considered for urban expressways when the corresponding schedule of lease payments approximates that of an ODA loan.

Table 2.9 Government Support Based on International Experience

Country	Description of Government Support	Applicability to the Philippines
Mexico	In the Toluca Toll Road project, the Government guaranteed traffic volumes by vehicle and category. If volume falls short, concessionaire may request for extension of concession term	Yes. However, it may not address the short-term cash flow crunch arising from debts of short maturities.
Brazil	Linha Amerala road: City of Rio de Janeiro gave a capital grant of $112 million (out of $174 million project cost)	Yes. However, it requires Congressional appropriation and direct assumption of specific project items.
Malaysia	North-South Expressway: Government guaranteed the interest rate and exchange rate.	Already adapted to the extent that concessionaire is allowed to adjust toll fees to recover the financial market fluctuations. Direct assumption of risk unlikely.
Thailand	Don Muang Tollway: Government guaranteed tariff rate per contract. Expressway authority failed to honor commitments, leading to a government rescue.	Already incorporated in the TOA to the extent that concessionaire is allowed to adjust toll fees periodically.
Chile	South Access to Concepcion: Revenue guarantee.	Not feasible. Will rely on unstable yearly appropriation.
Norway	Toll collection is privatized, but design, financing, construction, and maintenance remain with the Government	Few opportunities to apply in the Philippines. Does not capture inherent strengths of public and private sectors.
United Kingdom	Widespread use of design-build-finance-operate (DBFO) or shadow toll. For example, extension of highway A13 to east of London. British Highway Agency pays the concessionaire based on traffic.	Not applicable. No funds to dip from with which to pay the shadow toll. High transaction costs. Long cycle time. Weak ability to measure traffic.
Spain	State advances a given sum which must be subsequently reimbursed by the concession company. Also, issuance of participating capital loans to be repaid according to agreed schedule.	Not feasible. Will require Congressional appropriation.
France	A new tollway is backed up by an existing more mature toll road, accompanied by a longer concession period, for the combined entity	Yes. Already adapted in the case of Skyway and Manila North Tollway.

<u>Built-in Toll Adjustment Mechanism</u>

The toll setting mechanism for the four expressway concessions shared the following features:

1) An initial toll rate is agreed between the TRB and the concessionaire to become effective upon start of operations. What these initial toll rates would be for each class of vehicles will depend on the proper appreciation of the TRB of project costs, followed by negotiation between the TRB and the project company.

2) Two kinds of future adjustments in the initial toll rates are envisaged, i.e. periodic and interim. Periodic adjustment is predictable and is supposed to be made only every toll review dates. In the case of the MMS and the MNT, the periodic adjustments can only occur every 2 years; for the STAR and the MCTE, every 3 years. Interim adjustments, on the other hand, can be made much more frequently but predicated on the occurrence of "substantial increase in debt-service burden" resulting from currency devaluation. When such an adjustment is made, it shall be considered only an advance to be set off against future toll rate adjustments. In other words, interim adjustments cannot be on top of or separate from periodic adjustments.

Without freedom to adjust toll fees, there can be no financial closure and no projects would be realized under BOO or BTO schemes. Hence, unless the Government is prepared to assume market risk, the inclusion of a toll adjustment formula in the concession agreement should be retained. Improvements, however, should be sought along the following lines: (a) principles stated in the concession agreement, but the actual and detailed formula to be set out in the TOA, (b) the starting or base rate should be based on out-turn cost at the completion of construction and subject to audit; and (c) limitation on the extent of foreign exchange.

Capital Cost, Not Operating Subsidy

Additional support in the form of six-year income tax holidays from the BOI should extend to future projects. Apart from the revenue streams of existing mature toll roads, there is no other recurring government financial support that can be contemplated. In the context of Philippine governance, it is difficult for the Executive branch to commit a fixed amount of financial support, since the annual budget is determined by Congress. Subsidy is also not politically defensible, especially if the recipient is a private company. Also, there is no Special Fund that can be tapped for this purpose.

Hence, specific capital grant is the most transparent and explicit way of extending support to future expressways. It will, however, entail Congressional approval and inclusion in the budget ceiling of the DPWH.

(5) Feasible Forms of Government Support

Table 2.10 lists specific types of government support that can be mustered for urban expressways.

The schemes that are recommended for specific sections of the target network are the following:

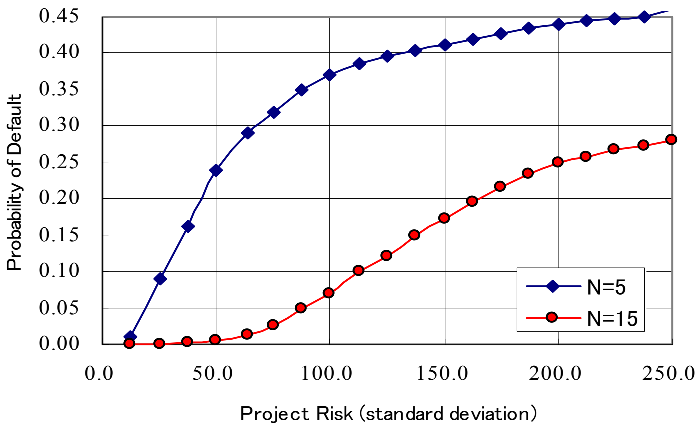
- Leverage ODA funds with private capital – the DPWH designs the project and secures ODA financing for its construction. Two competitive tenders are conducted: one for construction and the other for the concession to operate and maintain the tollway. The concessionaire will be required to provide the counterpart funds in the amount and timing required by the construction schedule.

- Provide endogenous toll concession period – initial concession period is for 25 years from completion of construction, but extendible to recoup losses. Conversely, the period can be shortened if incomes exceed thresholds. A target cumulative revenue level should be adopted in determining expiry.

- Guarantee the balloon payment of project loans – this should only be pursued in lieu of ODA loans and only up to 50% of loan face values at time of maturity, which in no case shall be less than six years. This will have the effect of doubling the maturity period. In project finance, lenders typically have no recourse to the assets of the sponsoring company and rely on the project's cash flows for repayment. Longer maturity brings down project risk as illustrated in Figure 2.4, by as much as 50% with a 15-year maturity compared to a five-year loan maturity despite the higher interest rate of the former.

- Two projects in one – depending on the traffic pattern and volumes, the Case Study Expressway can be merged with Stage 3 of the Skyway to form one concession, with the latter being constructed and financed by government under traditional method. This assumes that CMMTE and the PNCC will waive their rights over the latter. Corollarily, a project can be split into two – with one funded by the Government with ODA loan, the other as a BOT with private funds – but still operated together as one tollway concession.

Figure 2.4 Loan Maturity and Project Risk



Parameter assumptions are: i) Initial investment = $1000, financed with a mix of $200 equity and $800, debt; ii) Loan payment = end-of-period equal amount; iii) Rate of return on the project = 25%; iv) Distribution of project revenues, net of all non-capital production expenses, assumed to be normal with mean = 250 and with standard deviation that is assumed to vary from 12.4 to 250 with an increment of 12.5; and v) Debt service ratio = 1.1.

Source: Mansoor Dailami andDanny Leipziger, "Infrastructure Project Finance and Capital Flows: A New Perspective", Economic Development Institute, 1997

Table 2.10 Forms of Government Support to Urban Toll Road Concessions

Scheme	Description	Advantages	Disadvantages
Fund for ROW Acquisition	• Contemplated by TRB as a surcharge on existing toll fees to be channeled into a fund that will later be used to acquire ROWs • A possible variation is to impose an urban congestion charge at peak hours	• Provides a continuing source of funds • Means of collection is simple	• Special fund may require legislation to be set up • Rates for new toll roads are already too high for cost-recovery, even without the surcharge • Accumulation of funds may take a long time
Privatization of Operation and Maintenance of Tollway	• Government designs and builds the toll way through loans and direct appropriations from national treasury	• Low toll fees possible and allows more users to benefit • Lowers capital hurdle and allows more players to come in • Proper scaling/scoping of project	• Does not augment public resources for new toll roads • Taxpayers' money is not replaced by users' money • Burden of planning, design and construction remains with Government
Leveraging of ODA Funds	• Government borrows from ODA sources to finance the project, but taps private funding for the required counterpart money	• Proper scaling/scoping of project • Stretches out debt amortization, likely to lead to viability and/or lower toll fees	• ODA funding will still fall within the budgetary ceilings of DPWH • ODA lenders may not always agree to scheme
Two Projects in One	• One part of the toll road shall be designed, financed and built by the Government while another part will be under BTO scheme. The two, however, will be operated and maintained as one by the private concessionaire	• Distinct separation of construction and funding responsibilities • Akin to a non-repayable capital grant • Already tried in STAR project	• Requires stricter coordination of designs and schedules for the two parts to mesh into one
Provision of Minimum Traffic Guarantees	• Government guarantees a minimum volume of vehicles, below which the toll company gets subsidy. • Alternatively, shortfall to be paid with long-term government bonds	• Similar to what Malaysia did • Financial closure maybe faster	• DPWH or TRB cannot be sure of money availability as and when needed • Adds to demands on public coffers

Cont'd…Table 2.10 Forms of Government Support to Urban Toll Road Concessions

Scheme	Description	Advantages	Disadvantages
Provision of Guarantee to the Balloon Payment	• The balloon payments on maturity of the commercial loans incurred by the project company are guaranteed by the Government, which can then be rolled over for similar tenor. Alternatively, the balloon is replaced by government bonds	• Effectively doubles the tenor of available commercial loans • Liability is postponed by 5-7 years depending on tenor of loan • Project cost remains outside the budgetary ceiling of DPWH	• Increases the level of government's financial liability • May embolden proponent to enlarge unnecessarily project scope
Combination of the Old and the New	• Private concessionaire rehabilitates and improves an existing road asset, enlarges tollway capacity and collects fees over the combined assets	• Has the effect of guaranteeing a minimum traffic volume; • Reduces total investment • Project cost remains outside the budgetary ceiling of DPWH • Already tried in the case of Skyway, MCTE, and NLE	• No real a priori valuation of the 'old assets' folded into the new; • Uncertain on what the Government should do in the event that concessionaire fails to live up to its part of the bargain
Provision of Endogenous Toll Concession Periods	• The length of the concession is not fixed a priori, but ends when cumulative revenue collections, as discounted, reaches the amount quoted by the concession company in its bid • [Applied in Latin America]	• Lenders are assured that enough time will be given to recover investments and profit • Low toll fees are possible in lieu of longer period to collect	• Does not address the short-term cash flow problem faced by concessionaire
Provision of Capital Loans	• Government advances or allocates an amount of capital, sufficient to make the project financially-balanced, which can either be: (a) participating, to be repaid like ordinary shareholders; (b) non-interest bearing (or a lower than market rate)	• Softens the cash crunch faced by tollway company during initial operating periods	• Government dips into strained public coffers to assume role of investor or lender • Requires congressional action for the appropriation of the capital • Interest rate lower than market is contrary to government policy

2.3.4 Guidelines for PPP Project Development

(1) Expanding the PPP Modality

Normally, the type of PPP technique used to develop a particular expressway project should be selected to suit the individual criteria of that project. However, there are several elements that are common to all PPP modalities and these should form the fundamental guidelines for future project development within the Philippines.

To date, the Philippines has tended to utilize the more complex BOT type arrangement for the expressways that have been delivered in the country. The comparative success, with respect to international experience, in this relatively complex process has been a result of government commitment, a well-established structure in the form of the BOT Law and the lack of resources to develop the simpler forms (which invariably require larger financial support from the Government).

Table 2.11 highlights the PPP options available and their relevant applicability to the circumstances in the Philippines.

Due to the proposed expressway network development criteria and the prevailing economic conditions in the Philippines it is the BOT type, and its derivatives, that provide the most suitable PPP mode for delivery of future Expressways. This has the added advantage in that it has been used successfully before, but with the need to improve certain elements of the process.

The most optimum way to review what amendments should be made to the existing process is to understand the project delivery life cycle. Based on international experience one of the key areas is to ensure thorough preparation of projects. The responsibility of this falls within the public sector as their goals and objectives, which dictate the process of delivering infrastructure to a country. This process is usually given to highway agencies or public works departments, as they are the government agencies that have traditionally been responsible for delivering highway projects.

However, the proposed PPP mode takes the delivery of expressways from a more engineering-based approach to a truly multidisciplinary exercise, with legal, contractual and financial specialists required. Governments have often overlooked this fundamental change, with the inevitable problems and delays encountered as a result.

The first step should thus be for the Philippine government to review the requirements of project preparation and implementation stages. This will require additional skills from those found within the existing executing agencies (DPWH and TRB). There is a need to establish a special body with relevant skills, most likely led by the DPWH, but drawing on DOF, NEDA and CCPSP resources.

The time and resources required should not be underestimated and often these specialist skills will be required for several years, particularly as a full highway network is to be developed through PPP in the Philippines.

Table 2.11 PPP Modality Options for the Philippines

Type	Description	Applicability to Philippines
Management	The private sector is involved with the maintenance of existing highways.	Lack of highways without existing concession arrangements, thus not a real option.
Turnkey	The private sector designs and constructs new highway infrastructure to specifications defined by the public sector.	This requires significant public sector financial resources, again not an option at present.
Operation and Maintenance	Similar to the management form of PPP, but during operation and maintenance compensation is made through collection of tolls.	Again the lack of suitable roads makes this option limited in its applicability to the Philippines.
Rehabilitation	The private sector rehabilitates existing highways to predefined specifications. Tolls are collected to cover rehabilitation costs and the costs of maintenance and operations during a concession term.	Again the proposed tolled expressways (without existing proponents) are primarily green-field sites, thus not applicable.
BOT and Derivatives	The private sector designs, finances and constructs new highway infrastructure. Tolls are collected to cover the construction cost and cost of operation and maintenance during a concession period.	This shares the resources required between the public and private partners. There are several variants of the same approach and the level of risk undertaken by each party can vary from project to project. Most suitable for the Philippines.
Corridor Management	Corridor management contracts are a combination of both BOT and operation and maintenance concessions applied to a section of the highway network.	This is a relatively new concept and perhaps more applicable to non-tolled highways through management (O&M) contracts

(2) Government Doing Its Homework First

A typical project life cycle is presented in Table 2.12. The process clearly shows the significant amount of work that must be undertaken during the early stages. Thus, the earlier recommendation to avoid unsolicited proposal and for the Government to do the project study and design.

Table 2.12 Project Life Cycle Process

Project Preparation
• Setting of national goals and objectives
• Sector review
• Project identification
• Project preparation
• Detailed review of projects
• Evaluation of finance, legal, social, economic and risk profile
• Selection of the type of PPP technique
• Detailed bid documentation
• Review of sector and government requirements and objectives
• Bid advertising
• Bid preparation
• Bid submission
• Bid evaluation and negotiation
Project Implementation
• Award concession
• Financing
• Construction
• Government review and support
Project Operation
• Operations
• Maintenance
• Government review and support

The concept for expressway development should be one that the Government is committed to; it must follow their fundamental goals and objectives in terms of delivering basic needs. This initial stage can be addressed by the Government's adopting an expressway network plan through PPP.

Each expressway that will form part of the proposed expressway network requires thorough review, in line with the stages identified in Table 2.12. Detailed business cases need to be developed which address all key elements of the project.

The Philippines is well developed in terms of its ability to deliver BOT projects, although this will become increasingly more difficult as the "crown jewels" (NLE, SLE) have been bid out already. If the delivery of additional expressway projects is to move forward, it must do so through a competitive bidding process, one that understands the full project requirements.

Much of the contract documentation for this is already in place with the BOT Law and experiences on the STAR and the joint venture arrangements with the PNCC.

However, the strategic planning stage should be revisited to include a more realistic understanding of the harsh realities of project finances and the increasing need for the Government to undertake a significant amount of project cost.

The expressway network currently proposed is ambitious and if the requirements for public sector funds are factored in, the existing timetable is unachievable under current arrangements or public sector resources. A review of the strategic planning process will allow prioritization of projects and develop a realistic timetable for network development.

A significant aspect of this is the financial performance of projects. Prior to any invitations submitted to the private sector to enter into a BOT type arrangement for the development of an expressway, the full financial positions should be understood and the commitment required by the public sector capable of being met.

The current list of proposed expressway projects has been reviewed and it is apparent that the financial funding "gap" for acceptable ROI performance for a purely privately financed project is around 50%. This is in line with the experience in other countries -- the emerging economies of Asia and Eastern Europe. Hence, the Government needs to identify means to raise their share of the project capital.

The most sensible approach is to allocate those costs, which can most suitably be undertaken by the public sector. Most international examples have already followed this approach, through provision of ROW, land acquisition or existing infrastructure. However, it is becoming more evident that expressways are not offering the right incentives under these items alone and still retaining the interest of the private sector. Additional undertakings will have to be made, if the development of the expressway network is to continue in line with government policy.

There are additional risks associated with securing financing for expressway projects, e.g. foreign exchange risk, the inability to ensure toll hikes due to public resistance, cost overruns, and lower than anticipated demand and hence revenues. Thus, a realistic appreciation of these risks is required to provide a structure that ensures successful project delivery. All these stages must be undertaken prior to moving a project into the market.

The business case documentation must be a comprehensive piece of work, similar to that requested from the private sector proponent. Although this might initially appear to be doubling the effort, groundwork preparation such as this enables the evaluation of project bid submissions to be undertaken relatively easily and to ensure the capabilities of the private sector group awarded a concession.

(3) Moving the Project into the Market

Marketing should be undertaken to identify the attractiveness of the project to the financial markets. The financial performance of the project should be understood and the share in the risk for each the public and private sector well defined. The marketing of a project will ensure that the project as defined and structured will be attractive to the private sector.

The pre-qualified companies must be able to prove they can deliver the project. They must have the confidence of the financial community, technical skills and sufficient past performance to ensure their longevity.

Several proponents should be invited to bid to ensure the competitive advantages of PPP techniques in the market are present. Clear guidelines (bid documents and support literature) should be given to the bidders and ample time to allow them to prepare bids. The bid evaluation criteria should also be defined in the documentation. This can be based on a single item (toll rate), or several key performance indicators (vehicle-kilometers, construction period, O&M costs).

(4) Closing the Deal

The proposals should be reviewed both technically and financially to ensure that they will provide value for money. This requires enough information to be provided by bidders to ensure that the expressways will last the length of the concession and well beyond, when it is handed back to the public sector, or re-bid under another PPP technique (operational and management). The single evaluation criteria, although easier for the evaluation process, often does not ensure that value for money will be received, although experience has been mixed.

Governments are often skeptical of negotiations, believing the private sector is attempting to improve their position. Initially it has been the decision of the Government to invite the private sector to assist in providing infrastructure and thus they should view the private sector as their partners, not as adversaries as has so often been the case. Negotiations should not necessarily be viewed as a failure of the system but as a natural step in ensuring that the agreement reached is one that both the public and private sector "partners" are comfortable with.
During the negotiation process the contract drawn up should stipulate in detail the undertakings that are expected by both parties. The documentation should clearly state key performance indicators that are to be met and how these will be assessed, as well as make provisions for bonuses or penalties if these are not met.

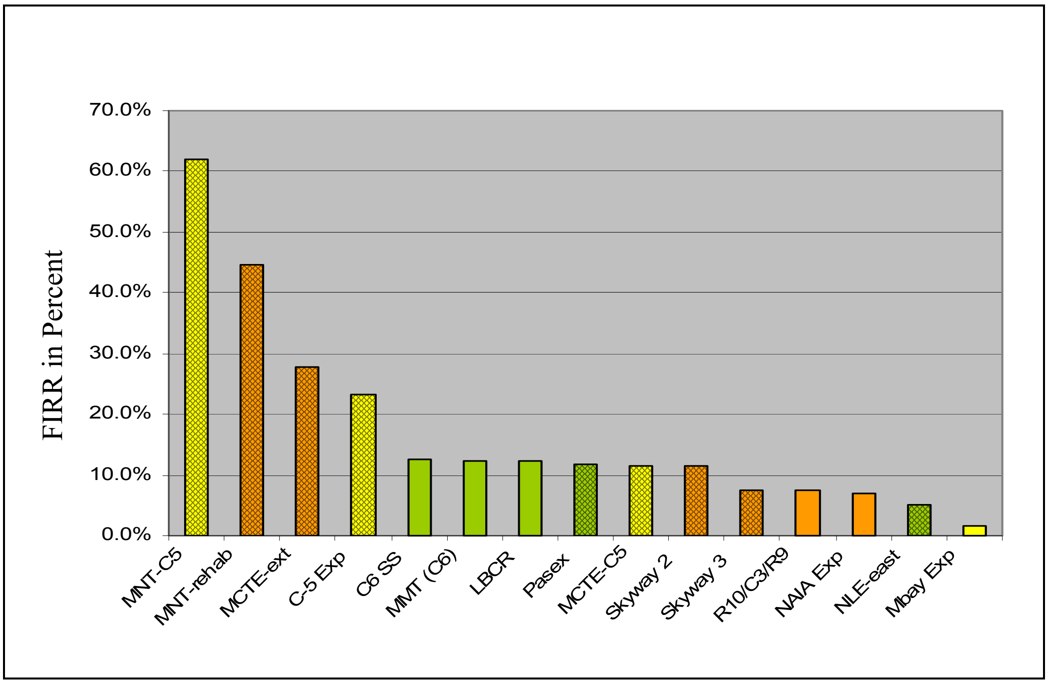
Monitoring of performance, as specified in the contract documents should be undertaken by an independent and impartial body. Often this will inevitably fall within the Government's wider role, as they have the legal basis by which to enforce the agreement.

2.3.5 Guidelines for Network Development through PPP

(1) Need for Government Support

Figure 2.5 shows the comparative financial rate of returns (FIRR) for the 15 sections of the contemplated urban expressway network up to year 2020.

Figure 2.5 Comparative FIRR of Urban Expressways



It can be gleaned from the chart that the four expressway sections showing FIRR above 15% have already been taken. The remaining ones, including those that had been taken but remain unimplemented, showed returns below 15%.

This means that none of the 11 expressway sections could be realized without some form of government support. The support should take any or a combination of those discussed in preceding sections.

(2) Optimization of Government Support

And because public resources would have to be poured into expressway development, it behooves policy makers to optimize these funding commitments.

Firstly, any road segment to be let out should be viewed as part of an overall network, rather than isolated ‘islands’, whose combined effects must be more than the sum of its parts. The overall capacity and efficiency of the network should not be diminished by the addition of the next expressway segment. This means the choice of expressway segment to support and their respective sequencing should be predicated on ‘value-for-money’ or highest economic returns.

Table 2.13a shows the average traffic density on the identified road sections, if developed as part of the network and compared to a situation of isolated development. To emphasize the systemic effects, Table 2.13b shows the degree of changes in demand when one of the projects is not built. In both tables the effect of the development of the network on the patronage of a specific project is clearly manifested. This highlights the network effect and in most cases it is negative except for a few cases, indicating competition among certain links.

Usually, a concessionaire would stipulate a protection clause against competing expressways, until such time that the proponent has recovered his investments. It is therefore important for the Government to understand the relationships of links in the expressways and avoid situations that will complicate the position of the Government in PPP. However, there are cases in which demand of link will increase with the development of other links in the network. This is especially the case for contiguous links such as the MCTE-C5 and the C5 Expressway. As the enhancement of demand of both links (thereby higher revenues) is a result of government initiatives and at no effort of the concessionaire the Government should, therefore, reap the resultant benefits. One method is to provide for a shortening of the concession period (i.e. endogenous concession period) or allocating incremental revenues into an expressway fund.

Lastly, the Government should look at long-term program financing for the development of the whole network, rather than piece-meal project-by-project approach. As one section matures, its healthier cash flows should be made to support the construction of missing sections and to reduce differences in toll fees across the network.

Table 2.13a. Average Traffic Density by Project

(1,000 pcu-km/km)

	Project	Distance (Km)	[A] Demand in the Network			[B] Demand if developed alone		
			2010	2015	2020	2010	2015	2020
	SLE	41.9	93.0	97.8	105.9	94.3	101.0	103.2
	MCTE1	6.3	112.8	116.1	121.0	119.2	118.3	127.3
	Skyway 1	9.1	54.5	103.7	141.0	81.3	125.8	142.0
1	MCTE-ext	12.0	54.8	81.6	83.6	44.1	63.3	77.9
2	MNT-rehab	36.8	125.0	125.0	128.8	122.1	122.4	127.3
3	NAIA Exp	6.5	11.0	33.3	71.3	46.8	54.8	71.7
4	Skyway 2	9.9	24.6	79.3	89.5	95.7	109.5	122.1
5	Skyway 3	13.0	29.2	82.0	125.7	71.7	104.0	102.9
6	R10/C3/R9	15.8	23.4	55.8	65.4	25.9	58.1	59.6
7	MCTE-C5	6.9	24.6	29.7	42.5	19.0	28.1	50.0
8	MNT-C5	20.0	67.4	98.4	113.3	68.8	92.8	117.3
9	LBCR	18.6	27.1	65.8	73.0	40.7	62.0	74.7
10	Mbay Exp	11.1	63.2	93.3	115.6	85.5	117.4	134.8
11	C5 Exp	13.6	63.9	77.4	85.1	78.7	92.7	93.9
12	Skyway 4(C6)	59.5	23.4	48.1	63.9	37.5	64.5	78.6
13	C6 South	20.3	23.6	54.8	72.2	9.1	15.2	21.4
14	NLE-east	10.8	72.5	81.4	91.6	76.8	81.0	84.8
15	Pasex	16.5	24.6	51.5	87.7	37.2	73.7	103.5

Table 2.13b Influence of a Project to Another

Causer (If it exists)		The Affected (Increase or decrease of demand in %)																	
		SLE	MCTE1	Skyway 1	MCTE-ext	MNT-rehab	NAIA Exp	Skyway 2	Skyway 3	R10/C3/R9	MCTE-C5	MNT C5	LBCR	Mbay Exp	C5 Exp	Skyway 4	C6 South	NLE East	Pasex
Group A	MCTE-ext	-4	9	-16		0	-15	-3	-7	5	108	1	-33	6	5	-6	-37	0	-6
	MNT-rehab	0	0	1	1		2	3	9	1	3	-8	-4	-2	1	-5	-2	-9	-1
	NAIA Exp	0	3	-2	-1	0		0	-1	2	-3	0	-1	2	0	-1	-1	0	-1
	Skyway 2	0	2	11	-2	0	5		4	1	-4	0	-39	-2	-1	-7	-4	0	-2
	Skyway 3	0	3	13	-1	0	-8	4		-13	-4	-1	-1	-14	-3	-2	0	0	-2
	R10/C3/R9	0	0	1	0	0	6	1	3		-13	0	-1	21	-7	-5	0	0	-1
Group B	MCTE-C5	0	1	-3	6	0	-7	-4	-4	-7		1	-9	-6	13	-4	-1	0	-6
	MNT C5	0	0	-3	4	0	0	1	-38	-9	30		-6	5	39	-14	-1	-2	1
	LBCR	1	0	9	-17	0	0	-39	4	-4	-16	-1		-4	-5	13	79	0	9
	Mbay Exp	0	-5	-28	6	0	-56	-6	-32	58	-11	1	-8		-13	-5	-1	0	2
	C5 Exp	-1	-1	-16	8	0	-22	-4	-30	-22	90	3	-19	-15		-15	-3	1	-28
Group C	Skyway 4	-1	0	-9	-5	0	-11	-25	-8	-9	-15	-7	31	-5	-13		9	3	-4
	C6 South	-1	1	-2	24	0	5	-34	-3	-2	17	0	138	0	1	5		0	1
	NLE East	0	1	4	1	2	1	3	-5	-2	-6	4	-3	5	0	2	-1		-3
	Pasex	0	2	-9	-1	0	-1	-8	-3	-4	2	0	6	-2	-9	-1	0	-1	

(3) Securing Inter-operability

The imperatives of inter-operability arise from the following:

- Motorists can move from one concession to another seamlessly, using the same payment system;
- Congestion in one part could be mitigated by proper re-distribution of traffic to other parts of the network;
- Number of tollbooths can be reduced and requirements for toll space minimized; and
- Overhead for maintenance (e.g. location and number of maintenance stations, various classes of maintenance equipment, etc.) and emergencies can be shared among several operators, aside from reaping the benefits of coordinated maintenance schedules.

To achieve the above, the Government, particularly the TRB, should ensure the adoption of a compatible electronic toll collection system (ETC) and a network-wide traffic information system (TIS).

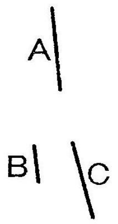
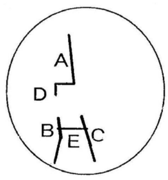
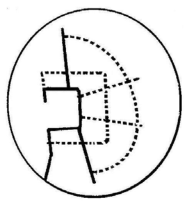
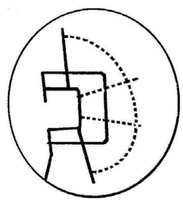
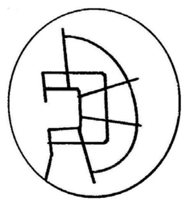
(4) Organizing for Network Management

At present, and until the different expressways become interconnected, there is no compelling need to consider new institutions. Based on the anticipated implementation schedule, an urban expressway network would emerge only between 2006 and 2010.

The need for a special-purpose expressway organization should be felt once the Skyway 2, Skyway 3, and the Case Study Expressway are completed, primarily because of the requirements of ETC and TIS. Before then, however, the demand would be for an organization within the DPWH to manage and sustain the long-term development of the proposed urban expressway network. It will focus on preparing the project, bidding out concessions one at a time, arranging for the required government support, and ensuring that the 'threats' mentioned in Section 2.3.1 are blunted.

Figure 2.6 sets out the changing organizational challenges against an evolving expressway network. It assumes that a multiplicity of toll concessions and operators would emerge which would then engender a need for another organizational layer to harmonize their respective activities. At that stage, the question would arise: Should a public entity be formed to address these 'network' challenges? Or can it be left to the private tollway operators, in the hope that they would rise above their parochial concerns?

Figure 2.6 Future Phases in Expressway Development

Phase	Present	Phase 1	Phase 2	Phase 3	Phase 4
Situation	▪ Fragmented projects; ▪ Sectionalized management; ▪ No network	▪ Network planning; ▪ Coordinated development ▪ Inchoate network	▪ Network implementation; ▪ Emergence of a strong network;	▪ Integrated TIS and ETC ▪ Cooperation on O&M; ▪ Strong network	▪ Integrated TIS and ETC; ▪ Shared O&M; ▪ Complex & robust network
Network Topology					
Traffic Mgt	Virtually none, as a network	Low requirements for network traffic	Medium demand for network management	High demand for network management	High demand for network management
Activity		Focus on project preparation	Construction of many sections	Construction of many sections	Renewal & rehabilitation

Note: Traffic Mgt = Traffic Management

Table 2.14 summarizes the organizational choices in addressing the different challenges arising from an urban expressway network driven by several toll operators.

The decision on organizational options can be deferred for now. However, there are several considerations that will shape such a decision, viz:

- Forming a new government corporation is not practical, as it is unlikely to get Congressional support;
- The PNCC, a government-controlled corporation, can very well shed its current role and become an "expressway network coordinator" with its continuing participation in the SLE, the NLE and the Skyway despite the lapse of its franchise by 2007;
- The different 'shared' tasks can be performed either by the DPWH (for network planning and development), the TRB (for toll regulation, ETC standards) or the MMDA (for traffic information system) without need of new legislation;

Table 2.14 Choices on Network Development, Operation & Maintenance

Parameters	Government				Private		Remarks
	DPWH Existing	DPWH New Div	GOCC New Co	MMDA Traf OC	Toll Op Co or Proponent	Joint Co	
Toll operating entity							
Maintenance							
- Periodic							Intrinsic obligation of toll operating company
- Routine (80km)							Preferably, organized by Tollway operators' association
Traffic Information System							Preferably, set up as part of MMDA's TIS and traffic control
Electronic Toll Card System (standards, inter-operability)							Compatible ETC system, clearinghouse can be set up by Tollway operators' association. Standards can be imposed by TRB.
Ownership							
- Toll roads							Ownership transferred to Government from day 1
- Toll facilities							Can be owned initially by operator and transferred to Government at end of concession
Network Planning							A government function that cannot be delegated
Project Preparation							Should be handled by Government as basis for tender
Bid & award of concession							A government function that cannot be delegated
Financing							
-ROW							Usually, a government obligation (by DPWH/TRB)
-Gov't share of capital							Utilize ODA funding, up to 50% of project cost
- Credit enhancement							Guarantee on balloon payment, or loan repayment shortfall when and if Expressway Fund is created. DOF can perform this
- Private sector share							Combined equity and project loan, 50% or more of total project cost
Toll Operation Regulation	**TRB**	**TRB**	**TRB**				A government function that cannot be delegated, ie TRB

Legend:
Not feasible [dark grey] *Can be feasible* [white] *Preferred/Recommended* [light grey]

Note: Div = Division, Co = Company, OC = Operating Center, Op Co = Operating Company

- The Philippine expressway network will remain a small niche of the entire highway network. Therefore, there is no compelling reason for treating Metro Manila expressways separately from the inter-urban ones;
- Mobilizing public resources (ODA plus national budget) for various expressway projects can be shouldered by the DPWH and would not entail a 'banking-type' agency since the desirable form of government support is capital grant rather than project loan;
- The active tollway operators have organized themselves into an association which could also address network issues alluded to earlier.

2.3.6 Action Program

(1) Implementation Scenario

The basic premise is that the Government will adopt an expressway network plan (whose configuration is presented in earlier sections of this report), with three groups of expressways to be implemented: Group A from 2002 to 2010, Group B from 2010-2015 and Group C from 2015 to 2020.

Group A constitutes the priority list. Because of the need for government support amid a large budgetary deficit, compounded by delayed project preparation and poor macroeconomic conditions deterring foreign investments, implementation would be slow in the next three to five years. Competitive tenders for the NAIA Expressway as well as the Case Study Expressway would only commence after - not before - public sector funding and credit enhancement schemes are secured.

Another assumption in the proposed expressway development program is that the committed segments (i.e. those covered by concession agreement), like MCTE extension and the MNT Rehabilitation, would overcome their respective financing obstacles and complete construction before 2010.

Two projects (Skyway Stages 2 and 3) in Group A are deemed ineligible for government support. Because of their high capital costs, they are unlikely to be bankable without government support. Therefore, it will take time before the Government and the concessionaire for these two projects could reach agreement on how to proceed. It may require an amendment to the Supplemental Toll Operation Agreement dated November 1995 or a waiver from the CMMTE.

(2) Commentary on the Action Plan

The initial activity is for the forging of a consensus on the expressway network to be developed and the corresponding strategy and policies to be adopted to support that development. This means that the DPWH would have to take a long-term view of the PPP challenge.

With a shared vision on what needs to be done, the DPWH and the TRB should resolve to delineate their respective roles – not as agencies competing for turfs, but within the framework of partnerships leveraging their respective core competencies and organizational strengths. This should lead to greater coordination (and collaboration) within the Government vis-à-vis private sector proponents/players.

The Action Plan envisions the end to unsolicited proposals, and for the Government to do its homework – by undertaking project preparation (feasibility studies and detailed designs) prior to bidding. ODA sources shall be tapped for these activities. As part of the capability-building program for the DPWH and the TRB staff on PPP development of expressways, the project preparation activities should be undertaken by Consultants together with counterpart staff. Staff development should rely less on seminars and attendance in special courses and more on 'learning by doing' exercises. Capability building should also encompass skills for evaluation of proposals or bids, marketing the projects to the private sector and the local governments, and negotiations.

There should be two major changes in thinking among policy makers: about government support and about the price road users have to pay.

In the past and up to the present, most policy makers, especially Congress, have the mistaken notion that PPP/BOT projects would not require government funding. The concept that toll roads would, in fact, entail government support should be communicated to all policy makers and become accepted. A major plank of the Action Plan is to secure funding for expressway projects through ODA sources and from the National Budget for advance ROW acquisition. Thus, the pre-investment activities for PPP projects would follow the same pattern and budgetary cycle for projects under traditional mode of implementation.

Toll fees have always been contentious in the Philippines, to the point of scaring foreign (and local) investors. The public should slowly be weaned away from the idea of free roads. Aside from complying with existing commitments about toll adjustments, a more transparent method of setting fares, not unlike that in the power sector, should be established and made known long before operation of the toll road.

Table 2.15 Action Plan for PPP Development of Urban Expressways

Issue/Problem	Interventions	Action Required	Time Frame	Responsible Agency	Remarks
1. Consensus on a target urban expressway network to year 2020	Formulate and adopt an indicative plan for an urban expressway network • Secure commitment from the DPWH and the TRB about the network • Establish priorities and timetable for implementation • Decide on a course of action for projects to be dropped • Re-structure stalled (but with concession) projects to be eligible for government support	i. Create an Inter-agency committee to follow up the action plan ii. Brief DPWH and TRB officials on network and its rationale iii. Present network plan to RDC & MMDA for endorsement iv. Prepare revised implementation schedule and multiyear investment program v. Evaluate implication of plan to existing commitments vi. Set new deadlines for stalled projects, and terms and conditions for government support	Year '03 Year '03 Year '03 Year '03 Year '03, '04 Year '03, '04	DPWH DPWH DPWH DPWH DPWH TRB (& DPWH)	Based on the Steering Committee of the Study
2. Clarify objectives for PPP or private sector participation in roads sector	• Delimit PPP options for new roads or for capacity expansion projects • Set out other modalities for PPP other than capital projects	i. Policy pronouncement that: • BTO structure for new roads is preferred scheme • Bidding for concessions, or JV partner ii. Re-launch other PSP initiatives, e.g. private maintenance	Year '03 Year '03	DPWH DPWH	
3. Government support, other than ROW	Short-list types of government support that can be extended and parameters for extending such support	i. Draft guidelines for PPP for expressways ii. Budget proposal for future ROW acquisition	4Q '02 Year '03, '04	PPP Study Steering Committee	Recom-mendations from the Study Team

Cont'd… Table 2.15 Action Plan for PPP Development of Urban Expressway

Issue/Problem	Interventions	Action Required	Time Frame	Responsible Agency	Remarks
4. Fine-tune the PPP process	• Redefine respective roles of TRB and BOT-PMO in the PPP process • Provide policy directions to TRB re acceptance of new proposals • Strengthen staff of TRB and BOT-PMO to meet PPP challenges • Prepare business case for high-priority projects of network	i. Executive Order from OP (assuming TRB is attached to OP) stating collaboration: • Lead role of DPWH in network decision, design, and construction issues; • Lead role of TRB in legal, financial and economic issues • Granting of Concession Agreement to project company by DPWH, while granting of TOC to toll operator by TRB ii. Identify staff and required training • Arrange for external training • On-the-job training + seminars iii. Case study of R10/C3/R9 • Establish Business case and project structure • Prepare bid documents • Arrange ODA funding	Year '04 Year '04 Year '03, '04 Year '03	OP/CCPSP OP/OS (DPWH) TRB/DPWH DPWH DPWH	
5. Toll adjustments	• Conduct more intensive information campaign on rationale for new rates • Initiate periodic reviews of tolls, say 2x a year, to avoid abrupt jumps/changes	i. Comply with commitments under existing Concession Agreements ii. Introduce incremental adjustments to NLE tariff also, and earmark them to better maintenance and for repaving iii. Presentation to political leaders on implications of stagnant toll charges iv. Create an Inter-agency Task Force (DOTC, TRB, DPWH, NEDA) to review current tolls v. Recruit local consultants, if required, to assist in the review of charges	Year '04, '05	TRB	

2.3.7 Summary of Recommendations

The recommended guidelines for PPP development of the urban expressways can be summarized as follows:

- Expand objective for PSP to include modalities other than big-ticket BOT projects, with the side benefit of enticing more PPP players into infrastructure;
- Define a long-term expressway network plan up to 2020, with explicit project priorities over the medium-term horizon;
- Carefully prepare project studies and establish the business case for the priority segments prior to moving the projects into the market;
- Tap ODA resources for technical assistance in project preparation and use this also as an opportunity for building interdisciplinary capacity for PPP within the DPWH and the TRB;
- Extend government support in the form of capital grant up to 50% of project cost, inclusive of ROW, via splitting of a project into two – one segment under the traditional mode of implementation and another segment with private funding under the BOT Law - but operated as one tollway;
- Move the project into the market through open, transparent, competitive tender with clear rules, only after undergoing preparatory studies;
- Stick to the BTO structure, following the precedents of four existing expressway concessions, but enhanced it with an endogenous concession period and fine-tune other features.

Other recommendations to complement the foregoing are as follows:

- Temper the aggressiveness of government agencies (PEA, BCDA and also PNCC) with tollway ambitions by requiring that joint venture schemes undergo competitive tender;
- Establish time-bound limits on future options to subsequent extensions of an expressway concession to avoid tying up government hands (like the Stage 3 of the Skyway, or the MCTE Stage 3);
- Designate the DPWH as the lead agency in developing expressways and the sole signatory in the grant of development rights, and the TRB as the toll regulator that will issue a corresponding Toll Operation Certificate upon completion of construction;
- For the key agencies to collaborate with each other, each contributing their core strengths (DPWH – in planning, design and construction; TRB – in legal, financial and post-completion monitoring; CCPSP – in driving the

process as well as marketing) in putting the project into the market and closing the deal.

- Adjust toll fees more frequently, at least once a year, to reflect increases in toll operating costs as well as project input costs, to inure the public into accepting many small increments rather than few-and-far-between big rate jumps; and,
- Seek appropriation for ROW acquisition in advance of tendering the concession and avoid off-loading the cost thereof to private proponents.

3 GUIDELINE FOR THE OPERATION AND MAINTENANCE OF METRO MANILA EXPRESSWAYS

The multioperator nature of the MMUEN necessitates the use of a more sophisticated operation and maintenance scheme. To attain cost savings through synergies between operators, the organizational framework of the MMUEN operation and maintenance needs to be rationalized. Moreover, it is also of benefit to end-users if the MMUEN is integrated and functions as a seamless expressway network. This chapter aims to discuss the issues and recommend directions towards this end. Section 3.1 overviews the activities needed to cover the operation and maintenance of the MMUEN. Section 3.2 describes the traffic information and toll collection systems of the MMUEN. Section 3.3 describes the recommended organizational setup and costs needed for the efficient operation and maintenance of the MMUEN.

3.1 Operation and Maintenance Activities

This section covers the scope of the operation and maintenance of the MMUEN. It includes:

- Routine Maintenance (Section 3.1.1),
- Repair Works (Section 3.1.2),
- Rehabilitation (Section 3.1.3),
- Disaster Prevention (Section 3.1.4),
- Maintenance of Building and Equipment (Section 3.1.5), and,
- Expressway Operation and Traffic Management (Section 3.1.6).

3.1.1 Routine Maintenance Activities

This section details activities regarding routine maintenance, which include:

- Inspection,
- Cleaning,
- Vegetation,
- Traffic Accident Recovery, and
- Traffic Regulation at Work Site**.**

(1) Inspection

General

Road inspection aims to accurately monitor and evaluate the present condition of the roadway in order to maintain safe and smooth traffic flow and prevent accidents and vehicle breakdown or damage. The objects for inspection are summarized in Table 3.1. There are three levels of inspection, each of which is described below.

Routine Inspection

Routine inspection involves regular, ocular, on-vehicle inspection on or off the expressway by technicians from a moving patrol vehicle. The typical frequency is once a day for “on-expressway” inspection, and two to four times a year for “off-expressway” inspections.

Periodic Inspection

Periodic inspection involves close ocular and on-foot inspections of the entire assigned section by a group of engineers and technicians on a periodic basis. The typical frequency is once a year.

Special Inspection

Special inspection entails a close ocular and aural, detailed on-foot inspection of a specific site by a team of professional engineers and technicians to obtain actual data needed to determine the required special repair program. Such an inspection is carried out on a need basis but typically it is conducted at least once in every five years.

(2) Cleaning

General

The roadway must be cleaned to restore function, preserve its environment and improve its amenities. The timing, means and frequency of cleaning are substantially dependent on traffic volume, heavy-vehicle composition, weather condition, ongoing activities in areas along the roadway, and roadway incidents. Special attention must be paid to cases such as after a very windy weather, before an anticipated heavy rainfall and at harvest time in agricultural areas along the roadway. For safety and efficiency, most cleaning activities are implemented with complementary traffic regulations.

Cleaning of Roadway Surface

Both right and left shoulders of the divided carriageway and the ramp are cleaned mechanically by a brush- or vacuum-type sweeper or by a water sprinkler. Other parts are manually cleaned.

Cleaning of Associated Facilities

Paved and landscaped areas of the interchange and rest areas are cleaned manually. Buildings and lavatories are also cleaned manually.

Table 3.1 Objects for Inspection

Objects	Level	Routine Inspection		Periodic Inspection	Special Inspection
		On Expressway	Outside Expressway		
Pavement	Pavement	*	—		—
	Curb	*	—	*	—
	Surface Drainage	*	—		*
Slope	Bank Slope	*	*		*
	Special Slope	*	*		*
	Masonry	*	*		*
	Retaining Wall	*	*		*
	Reinforced Earth	*	*	*	*
	Ground Anchors	*	*		*
	Cut Slope	—	*		*
	Slope Drainage	*	*		*
Bridge & Overbridge	Steel Bridge	*	*		*
	Concrete Bridge	*	*		*
	Concrete Deck	*	*		*
	Precast Deck	*	*		*
	Substructure	*	*		*
	Shoe	—	*	*	*
	Inspection Path	—	*		*
	Expansion Joint	*	*		*
	Guard Wall/Curb	*	*		*
	Bridge Drainage	*	*		*
	Girder Linkage	—	—		*
Culvert	RC Box Culvert	*	*		*
	RC Pipe Culvert	—	*	*	*
	Corrugated Pipe	*	*		*
Traffic Safety Facility	Guard Fence	*	—		*
	Anti-glare Net	*	—		*
	Median Split Net	—	*	*	*
	Anti-throw Fence	*	*		*
Traffic Control Facility	Traffic Sign	*			*
	Outer Guide Sign	—	*		*
	Road Marking	*	—	*	—
	Delineator	*	—		*
	Kilometer Post	*	—		*
Others	Noise Barrier	*	*	*	*
	Outer Drainage	—	*		*

Note: * : applicable
— : not applicable

Cleaning of Road Accessories

Road accessories are cleaned as follows:

- Guardrails, manually or mechanically with a water sprinkler;
- Traffic signs, manually with an extendable boom lifter;
- Drain pipes, mechanically by a high-pressure washer or manually;
- Gutters, mechanically by a vacuum-type sweeper;
- Median inlets, manually;
- Catch basins, manually or mechanically by a vacuum-type sweeper;
- Bridge joints, mechanically by a high-pressure washer or manually with a water sprinkler; and
- Bridge catch basins, mechanically by a high-pressure washer or manually with a water sprinkler.

(3) Vegetation

General

Roadside vegetation is provided to preserve the environment, improve the landscape and enhance safety. The timing and means used in vegetation works depend on the types of vegetation to be planted and their state of growth.

Highway vegetation works are implemented for the following purposes – tree/forest control, lawn and slope vegetation control. For safety and efficiency, some vegetation works must be implemented together with complementary traffic regulations.

Tree/Forest Control

Tree/forest control consists of the following:

- Plant pruning,
- Plant fertilization,
- Insecticide spraying,
- Weed and vine clearing,
- Irrigation,
- Prop renovation,
- Damaged tree removal,
- Weed cutting, and
- Tree felling.

Lawn Control

Lawn control consists of the following:

- Lawn mowing,
- Lawn fertilization,
- Manual weeding,
- Chemical spraying,
- Insecticide spraying, and
- Top dressing.

Slope Vegetation Control

The slope vegetation control includes:

- Weeding, and
- Slope fertilization.

(4) Traffic Accident Recovery

Except for major works to be contracted out, the expressway operator must conduct minor recovery works for damages on roadway components caused by traffic accidents, which usually include replacement of:

- Guardrails,
- Boundary fences,
- Anti-glare nets/plates,
- Delineators,
- Kilometer posts, and
- Traffic signs.

(5) Traffic Regulation at Work Site

A portion of a roadway cross-section must be temporarily secured for implementing on-road activities such as roadworks, cleaning and inspection. Traffic regulation for any of these purposes is an expressway operator's responsibility. This is typically classified as follows:

- Shoulder regulation (Figure 3.1),
- Lane regulation for median lanes (Figure 3.2) or shoulder lanes (Figure 3.3),
- Median regulation (Figure 3.4),
- Contra-flow (i.e. counterflow) regulation (Figure 3.5), and
- Moving regulation (Figure 3.6).

Figure 3.1 Shoulder Regulation

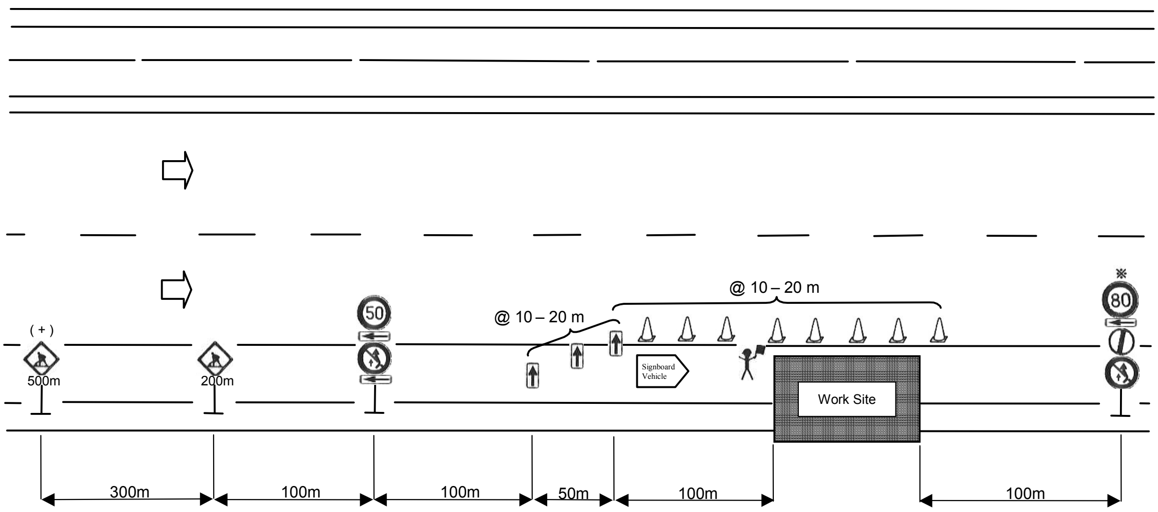


Figure 3.2 Median Lane Regulation

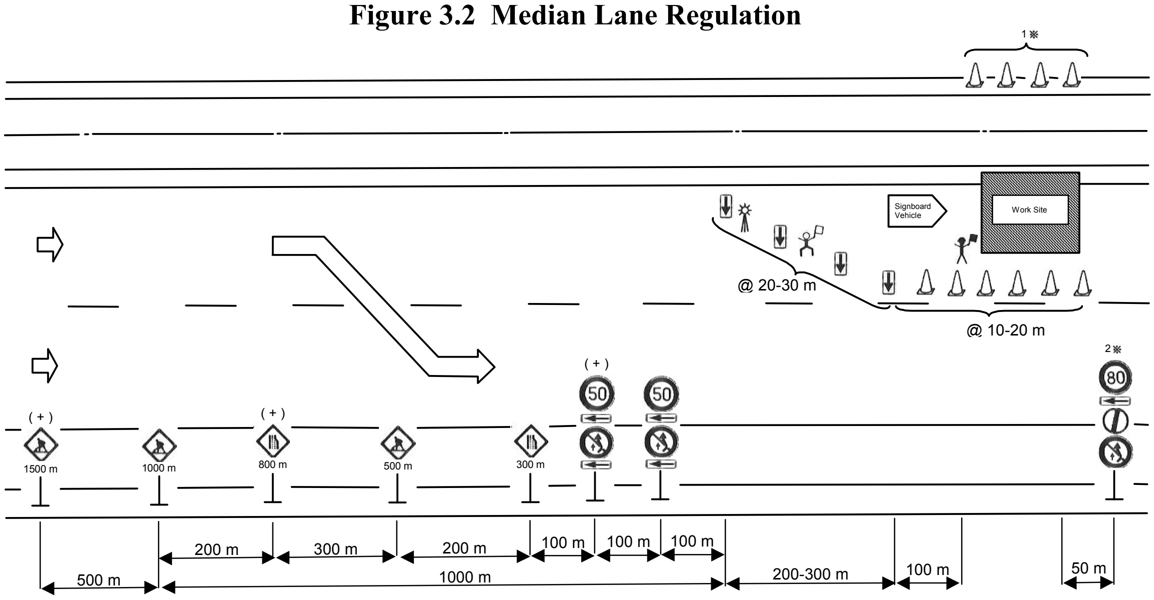


Figure 3.3 Shoulder Lane Regulation

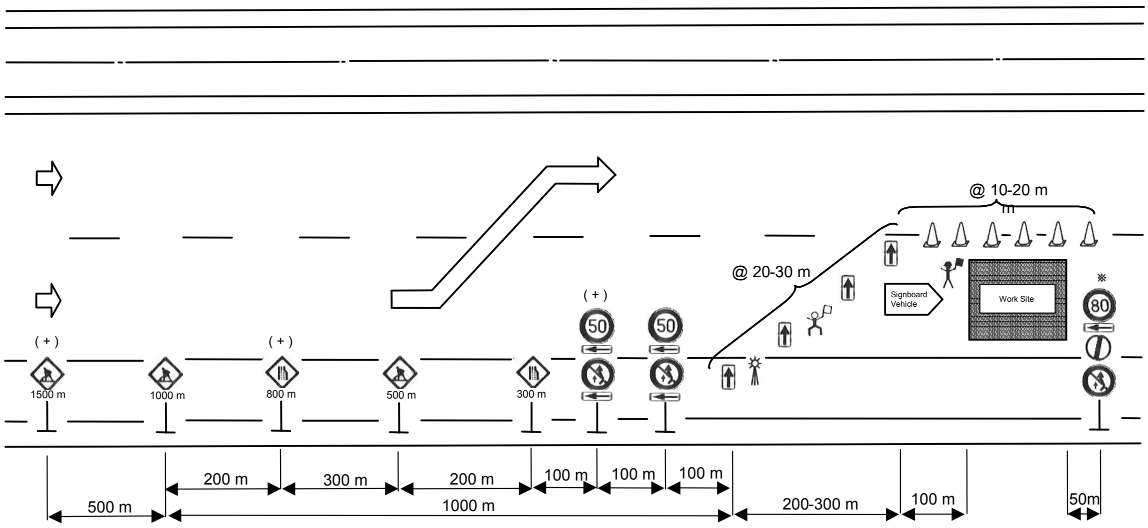


Figure 3.4 Median Regulation

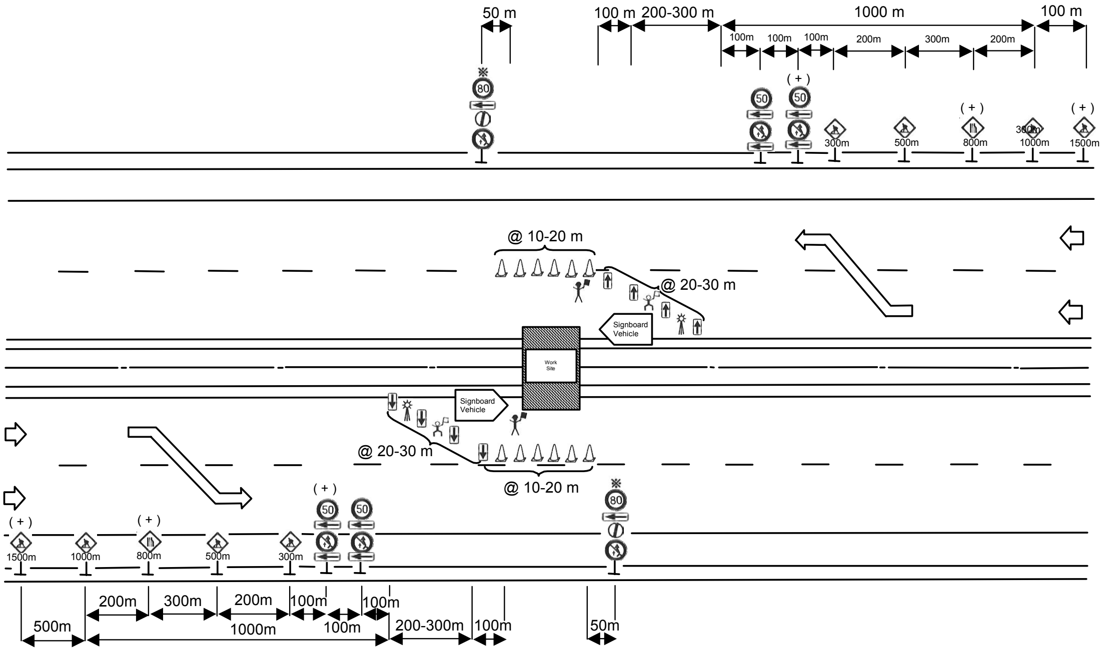


Figure 3.5 Contra-flow Two-way Regulation

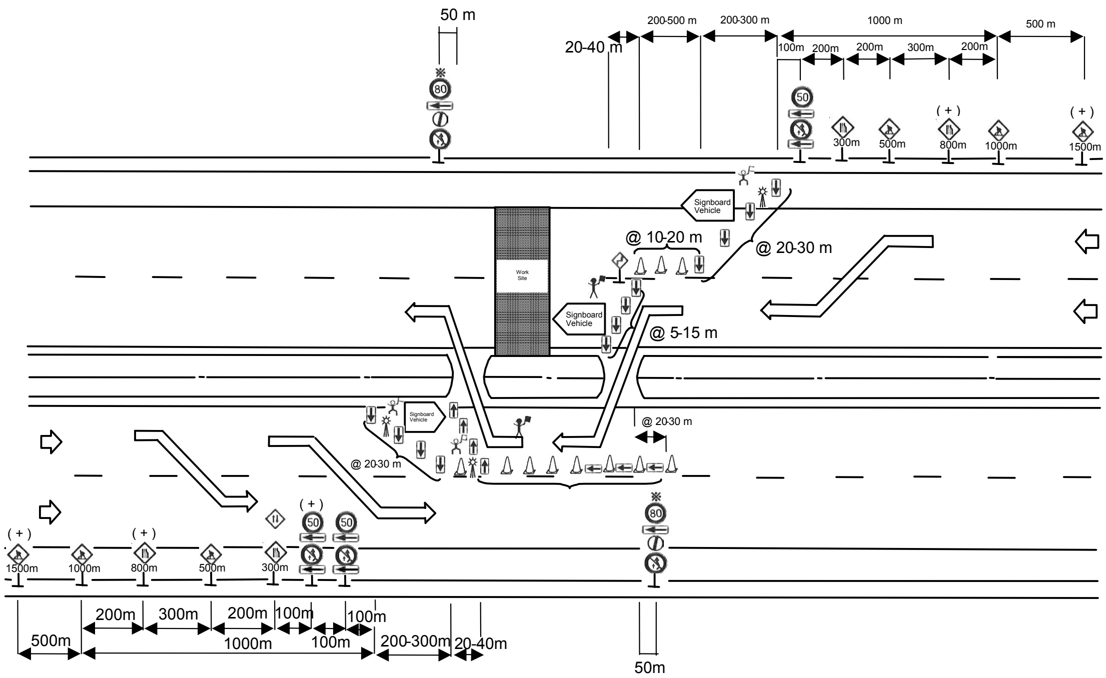
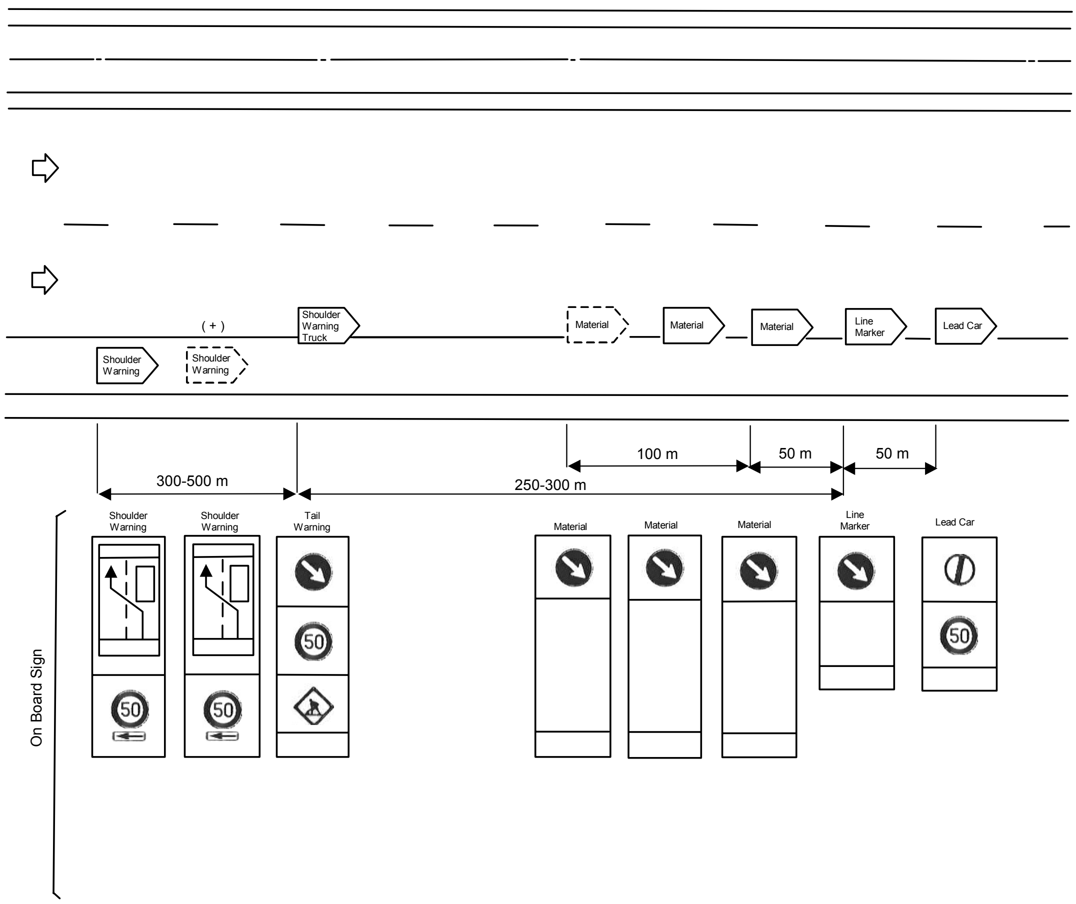


Figure 3.6 Moving Regulation



3.1.2 Repair Works

This section details activities regarding repair works which include:

- Pavement Renovation, and
- Repair of Bridges and Structures.

(1) Pavement Renovation

General

Minor damages to the pavement must be repaired immediately or as promptly as possible by various means.

Patching

Potholes, dents and other localized surface irregularities must be refilled with mixed materials.

Crack Seal

Minor cracks must be mended by injecting asphalt or filler.

Spot Replacement of the Pavement

Pavement damage as deep as into the base or sub-base must be partially cut off, removed and replaced.

Correction of Rugged Road Surface

Road surface unevenness due to settlement of the embankment adjacent to a bridge or over a culvert is corrected by partially cutting the pavement to a certain depth and overlaying an asphalt mixture to level the surface.

Surface Treatment

Minor damages to the surface must be treated by applying chemicals, asphalt or sand, or by grooving the concrete pavement surface.

Repaint of Road Markings

Road markings must be periodically repainted, as their conspicuousness decreases with time.

(2) Repair of Bridges and Structures

General

Some components of the structures must be periodically renovated and/or repaired, due to the inevitable deterioration with time.

Expansion Joints

Repair of expansion joints commonly used on expressways – rubber, steel finger, and buried joints – can be done by any of the following:

1)	Replacement	(1-1) Replacement with the same type
		(1-2) Replacement with another type
2)	Partial repair	(2-1) Recast of the post-cast pavement portion
		(2-2) Replacement of joint parts
		(2-3) Waterproofing of the curb portion
3)	Special repair	(3-1) Conversion to the non-drain steel finger joints
		(3-2) Adjustment of expansion openings
		(3-3) Elevation adjustment by uplifting the joint

Repainting of Steel Structures

Steel structures must be repainted with sufficient thickness of paint coating primarily to build rust resistance and weather durability. Painting consists of five steps – abrasive blasting, touch-up, primer application, second coating, and top coating. Repainting is classified into three types:

1) Whole Bridge Repainting: A steel bridge is entirely repainted at certain time intervals depending on local climatic conditions.

2) Partial/Spot Repainting: Partial or spot repainting is done regularly on portions of steel structures where more deterioration or rusting has progressed.

3) Special Repainting: Special repainting is done on road accessories, such as guardrails and lighting poles, and certain parts of the bridge such as splice plates, high-tensile bolts, shoes, expansion joints, and catch basins.

Partial Repair of the Bridge Deck

A damaged portion of a bridge deck may be partially repaired. The work consists of peeling off the pavement, chipping off the concrete deck of the damaged area, rearranging the reinforcing bars, fixing the undermolds, casting and curing the concrete, and repaving the renovated deck surface.

Repair of the Guard Wall

Deteriorated bridge guard walls must be repaired by chipping off peeling or cracked concrete surfaces, rustproofing the reinforcing bars, applying the primer, refilling the chipped portions with grading materials, and applying the base filler and finishing coat.

Re-galvanization of the Guardrails

Rusted guardrails may be re-galvanized and reused.

3.1.3 Rehabilitation

This section details activities regarding rehabilitation which include:

- Pavement Rehabilitation,
- Bridges and Structures Rehabilitation, and
- Traffic Safety and Control Rehabilitation.

(1) Pavement Rehabilitation

General

Pavement must be occasionally reinforced to restore their functions, thereby improving their durability and serviceability, ensuring traffic safety and comfort, and preventing further degradation of the roadside environment.

Pavement Survey

Four major components of pavement survey are pavement surface condition survey, pavement mixture survey, pavement structure survey, and evaluation pavement structure survey.

Pavement Surface Condition Survey

The surface conditions are surveyed for overall rehabilitation programming, when ocular inspection cannot provide a reliable evaluation of damages, or when long-term evaluation of particular pavement sections is in progress. The items subject to survey include:

- Ruts,
- Cracks,
- Longitudinal surface roughness,
- Ruggedness, and
- Skid resistance.

Pavement Mixture Survey

For damages caused by deterioration or aging of the pavement mixture or when determining the type of road surface regeneration, pavement samples cored at sites are taken to test their physical properties and evaluate their performance.

Pavement Structure Survey

If pavement damage is suspected to be the result of an unusual deflection, the bearing capacity of the pavement and/or sub-grade is checked by core sampling or spot excavation, if necessary.

Evaluation Pavement Structure Survey

The survey results are technically evaluated to judge the necessity for pavement rehabilitation. An example of the target levels for rehabilitation is shown in Table 3.2.

Table 3.2 Target Levels for Pavement Rehabilitation

Ruts (mm)	Ruggedness (mm)		Skid Resistance (at 80 kph)	Longitudinal Roughness (mm) 3 m Profile	Cracks
	Approach to Bridge	Approach to Culvert			
25	20	30	0.25	3.5(mm)	Rate 20% Asphalt Pavement Intensity 20 cm/m^2 Concrete Pavement

Asphalt Pavement Overlay

A pavement that is rutted, rough or not skid-resistant, can be rehabilitated by overlay, unless severely deteriorated. The work consists of tack coating, application of asphalt mixture, leveling, and compaction. As a result, the pavement usually becomes thicker than before. This requires simultaneously overlaying adjacent multiple lanes and raising the roadway profile and the elevation of drainage, traffic safety facilities, etc.

Asphalt Pavement Mill and Overlay

The mill and overlay method can be applied in two cases. One is when the pavement is not severely deteriorated and raising the roadway profile is impossible or impractical. The other is when the cracks on the surface, although serious, only penetrate the upper layer of the pavement.

The process involves milling the pavement surface, loading out the scraps and cleaning the newly exposed surface by a sweeper and compressor before tack coating, finishing and compaction.

Asphalt Surface Regeneration

Surface regeneration is a derivative of the pavement mill and overlay. In the process, the existing pavement surface is heated and raked. The scraps are not loaded out but reused for overlaying together with the new asphalt mixture. This process has two work types, as follows:

1) Re-pavement - When the existing pavement to be recycled, although deformed but still sound, is milled and the resulting mixture is spread under the new asphalt mixture and compacted.

2) Re-mixing – When regenerative additives are blended to the milled pavement, which is too deteriorated to be directly reused, and then mixed with the new asphalt mixture, finished and compacted.

Pavement Resurfacing

If the pavement is heavily rutted or cracked, rough or not skid-resistant so much so that the deterioration extends deeply into the entire pavement thickness, it is completely removed and resurfaced up to the necessary area and depth.

Concrete Pavement Overlay

Seriously raveled or cracked concrete pavement is rehabilitated by overlaying, or milling and overlaying. Overlaying material is mostly asphalt mixture because of its workability and economy, but a thin layer of cement can also be applied. When milling is applied, the surface is milled with a heavy cutting machine, then cleaned and shotblasted.

(2) Bridge and Structure Rehabilitation

General

Bridges and structures must be maintained, repaired and rehabilitated for one or several of the following reasons:

- To prevent wear and tear;
- To prevent deterioration and/or corrosion;
- To allow upsizing of allowable vehicle dimensions;
- To increase driving comfort; and
- To reinforce earthquake resistance.

For steel structures, measures against fatigue of welded member portions and a countermeasure to increase the structure's fatigue strength must be selected. If the failure is unrecoverable, the rigidity of the floor slab must be raised to decrease induced stresses at the cracked members. If this is again unsuccessful, the rigidity of main girders must be increased.

Most damages to concrete structures typically originate from cracks or scales on the surface, which may lead to corrosion and dilation of the reinforcing bars and eventually to the structure's malfunction.

Recovery of Fatigue Failures

Cracks detected at welded portions must be mended either by spot welding or winding up the high-tensile bolts at the stop holes or on the splice plates, depending on whether the cracks have reached the member material or not. Spot welding and stop hole methods are used primarily for temporary restoration of the member's function and are usually combined with other methods. The splice plate method must be applied in cases where cracks have progressed considerably.

Cross-sectional Reinforcement of Main Girders

The loading capacity of a bridge must be increased by reinforcing the cross-section of existing main girders. For steel bridges this involves:

- Changing plate girders to box girders,
- Reinforcing the lower flanges,
- Reinforcing the splice portions, and
- Reinforcing the stiffeners on the support points.

For concrete bridges, it involves:

- Anchoring and bonding steel plates to the bottom surface of the girder, and
- Bonding carbon fiber resin plates to the girder surfaces.

Continuation of Consecutive Simple Girders

A set of adjacent simple girders and floor slabs, which will eliminate the need for expansion joints between them and will replace the metallic bearings with rubber ones, must be integrated into a single multi-span continuous girder, which will allow less bending moments at mid-points of the effective span.

Installation of Extra Main Girders

Increasing the number of main girders of a steel bridge by installing extra girders between the existing main girders improves the rigidity and loading capacity of the bridge.

Prestressing by Post-installed Outer Cables

By tensioning the PC cables additionally installed outside of the girder and inducing additional prestresses to the girder will improve the bending and shearing strengths of the girder.

Partial Replacement of Floor Slabs

A portion of the floor slab where cracks have substantially progressed must be chipped off. The damaged reinforcing bars must then either be repaired or replaced before casting the super-high early-strength concrete. It must be waterproofed before paving.

Deck Top Thickening

To reinforce the bending and shearing strengths of the floor slab, the steel-fiber-reinforced concrete is cast over the shotblasted surface of the existing concrete slab, and the two new layers integrated into a single solid deck for increased total thickness. The hard-mix fresh concrete with super-high early-strength cement and steel fibers must be spread out and compacted sequentially by a dedicated concrete finisher. In some cases, reinforcement must be done by arranging steel bars in the thickened concrete.

Deck Bottom Thickening

To increase the bending strength of the floor slab, it is sometimes thickened at the bottom. Reinforcing bars are anchored to the sandblasted bottom surface of the slab, and resin mortar, usually flexible, and watertight polymer mortar with powerful cohesion are sprayed up to a certain thickness.

Deck Waterproofing

Whenever the deck is repaired or rehabilitated, its upper surface is waterproofed prior to paving to make it watertight. The waterproofing layer can either be the sheet type or the paint-film type, depending on the roughness of the slab surface and the size of work.

Shoe

The bridge shoe has diverse functions such as support of the vertical force, smooth rotation of the superstructure caused by strains, smooth movement of the superstructure due to elasticity, restraint on over movements, and, in case of an earthquake, resistance to uplift and transmission of horizontal forces. These functions must be restored promptly by eliminating failures to the shoe and their causes.

When failure is found, it must first be determined whether the failure extends to the super- and/or substructure(s) or not. Afterward, the necessity for a functional appraisal of the shoe must be determined. If needed, the whole shoe will be replaced, primarily by a rubber shoe or by another type that meets local requirements. If there is no need to raise the functional capacity of the shoe, only a partial repair will be undertaken. In this case, if rustproofing is necessary, the shoe will either be repainted with spray zinc or galvanized.

Drainage

A smooth drainage is essential to ensure a bridge's sound function and longer life. Drainage improvement is sometimes needed on bridges in use. When catch basins need to be improved, additional ones must be provided instead of merely replacing existing ones.

Bending of the drainpipe must be as moderate as possible for smoother passage of drained water. The drainpipes attached to the super- and substructures must be linked together by flexible elastic joints.

(3) Traffic Safety and Control Facilities Rehabilitation

Guard Fences

Guard fences must be reinforced either by using a concrete guard wall (Autoguard of the New Jersey type) or by reinforcing solid guardrails with extra beams and posts.

Delineators

Conventional delineators with decreased performance must sometimes be replaced with improved types that are self-cleaning, luminous, bigger, etc.

Traffic Signs

Deteriorated traffic signs are replaced with new ones to recover legibility and conspicuousness. Technical improvements, such as illumination methods, posting locations, board sizing and design of the display, and innovations, such as provision of real-time information through variable message signs (VMSs), are applied to newly posted signs or replacements to facilitate smoother and safer traffic.

3.1.4 Disaster Prevention

This section details activities regarding disaster prevention which include:

- Slope Protection, and
- Seismic Disaster Prevention.

(1) Slope Protection

The cross-sectional slopes resulting from roadway construction, i.e. embankment and cut, are prone to natural disasters such as collapses, cracks, swells, scales, gully erosion, spring water, boulders, and scouring. To prevent disasters, various slope protection works must be installed or implemented even after completion of the roadway construction, which include:

- Concrete block frames,
- Concrete and mortar spray,

- Free shape frames,
- Mat gabions,
- Rockfall prevention nets,
- Boulder treatment,
- Concrete block masonry, and
- Earth reinforcement.

(2) Seismic Disaster Prevention

Bridges in use must be reinforced to strengthen their resistance against earthquakes by:

- Widening the top surface of the substructure to provide sufficient length between the support point of the shoe and the edge;
- Linking adjacent girders with PC bars;
- Reinforcing the piers by lining them up with additional reinforced concrete, steel plates, or carbon fiber sheets; and,
- Protecting the abutment and its back-fill by building a cofferdam around it to control displacement which can be triggered by a landslide caused by an earthquake.

3.1.5 Maintenance of Equipment and Buildings

This section details activities regarding maintenance of equipment and buildings which include:

- Inspection and Testing of Equipment,
- Maintenance of Equipment,
- Maintenance of Buildings, and
- Vehicle Management.

To maintain the performance of various electric, mechanical and communication equipment as well as buildings used in the operation of an expressway, they must be properly inspected, tested, maintained, repaired, and improved.

(1) Inspection and Testing of Equipment

Compliance with specific standards must be monitored and the performance of each electric and mechanical equipment must be regularly tested and inspected for unusual appearance, loose connections and fittings, abnormal noise, overheating, lubrication, rust, loose grounding terminals, and so on. The equipment to be inspected include:

- Power receiver/distributor,
- Auto-generator,
- Roadway lighting
- Meteorological measurement equipment, and
- VMS.

For communication equipment, inspection, testing and cleaning must be carried out by checking appearance, calling performance, fluorescent light, I/O level, optical loss, optical pulse, cable condition, voltage and current levels, alarm, and other components of the following:

- Emergency telephone,
- Fiber optic cables, and
- Wave transmission system.

The water supply and disposal systems for the rest area must likewise be regularly inspected for electrode, pipe stain, and damages, operating conditions of the pump, bearing lubrication, oil, condition of screens, volume of foul deposits, foulness level, adjustment of components, ingredient analysis of discharged water, and so on.

(2) Maintenance of Equipment

Routine maintenance of equipment primarily includes the following:

- Cleaning of lighting equipment along the roadway, toll plaza, rest area, and traffic signs, together with periodic replacement of worn-out bulbs;
- Cleaning of VMSs; and
- Cleaning of fire hydrants.

Electric, mechanical and communication equipment also require periodic replacement of parts, oiling and lubrication, and overhaul.

(3) Maintenance of Buildings

The architectural components of the toll plaza, comprising the tollbooths, islands and shed, must be periodically repainted. All buildings for both public use and operation/maintenance of the expressway must be routinely cleaned.

(4) Vehicle Management

Vehicles used for the operation and maintenance of the expressway must be properly managed. These vehicles include patrol cars, sign vehicles, sweepers, water sprinklers, high-pressure washers, lift trucks, crane trucks, etc.

3.1.6 Expressway Operation and Traffic Management

This section details activities regarding expressway operation which include:

- Asset Management,
- Patrols,
- Emergency Management,
- Overlimit Vehicle Regulation,
- Breakdown Service,
- Communication System,
- Information Management, and,
- Toll Collection.

(1) Asset Management

An expressway operator must always know its highway assets and their condition. For this purpose, the operator must have a sophisticated inventory system. The Road and Bridge Information Applications (RBIA), being developed as one of the Road Information and Management Support System (RIMSS) efforts by the DPWH for road maintenance and management, are a suitable inventory and database system for Metro Manila expressways. Besides storing basic data such as Road Names, Road Sections, Nodes, and Location Reference Points, the RBIA will be designed to allow importing of such database items as inventory elements and attributes and condition survey data. Inventory elements and attributes include Number of Lanes, Carriageway Width, ROW, Junctions, Bridges, Culverts, Pavement Type, Pavement Thickness, Median, Shoulders, Drainage, Side Slope, Signs, Markings, Hazards, Gradient, Terrain and so on, while condition survey data include Surface Condition, Roughness, etc.

Management of road assets must be properly undertaken based on an accurate, updated inventory together with other relevant documentation.

(2) Patrols

Periodic patrols of the roadway by a dedicated units working on shifts all day throughout the year with easily recognizable patrol cars must be conducted. This is necessary to report traffic flow conditions; detect and report extraordinary incidents on the roadway, such as traffic accidents, vehicle breakdowns, traffic congestion, malfunction of road facilities, and unexpected disasters; offer assistance to motorists in trouble; and remove dropped objects that can be potential risks to motorists.

(3) Emergency Management

In case of emergencies, like accidents, fires and disasters, the expressway operator is responsible for traffic control and safety measures at site. Once an incident is detected, the report must be immediately transmitted to relevant operation and maintenance (O&M) stations as well as to relevant authorities including the police, fire departments, ambulance services, and other relevant road operators, garages, and municipalities.

In coordination with these agencies, the expressway operator must carry out traffic management at site, such as temporary roadway closure and partial lane regulation; assistance to emergency activities by the police, ambulance, fire departments, and others; removal of disabled vehicles; cleanup of site; and so on.

(4) Vehicle Regulation

Vehicles with illegal size (height, width and length) or illegal weight (total load and axle load) are not allowed to use certain public roads. In reality, however, it is observed that a number of overlimit vehicles use the existing road network.

A major concern for expressways is the damages caused by very heavy commercial vehicles. An expressway operator must install measures to restrict overloaded vehicles to protect the expressway, save on repair/rehabilitation cost and prolong its life.

Ideally, each expressway operator must have at least one weighbridge at a roadside location to check the actual load of commercial vehicles. But if it is physically or economically unfeasible, an alternative is the weigh-in-motion (WIM) system, which is a dynamic axle load measurement system. The WIM system can provide a statistical recording of heavy-vehicle loads and detect existing overloaded vehicles.

(5) Breakdown Service

When vehicle breakdown is detected, a repair crew from the expressway operator or a contracted garage is dispatched to the site. If the breakdown is too serious to be repaired at site, the vehicle is towed away to a selected garage.

(6) Communication System

In expressway operation, three kinds of communication systems – emergency telephones, intra-organization communication network and radio system – are usually set up.

- Emergency telephones - Roadside emergency telephones must be installed at certain intervals. By picking up the receiver, users are automatically connected to the Operations Center where operators are on duty 24 hours a day.
- Intra-organization communication network - All components of expressway operation and maintenance, including the Operations Center, O&M stations, toll plazas, and other facilities along the expressway, must be connected with each other through a private automatic exchange system as well as an intra-organization computer network.
- Radio system - All maintenance and operation vehicles of the expressway operator must be equipped with a mobile radio system connected with each other, the Operations Center and O&M stations.

(7) Information Management

General

A variety of information on expressway operation and traffic situation must be collected, transmitted, processed, monitored, relayed to relevant activity points, and provided to motorists. This type of information management system must also allow real-time collection, processing and provision of data and information.

Information Collection

Roadway traffic information and data, which include traffic volumes, average travel speeds, degree of congestion, weather conditions, visual traffic flow conditions, and any incidents, such as accidents, breakdowns, works and disasters, are transmitted to the Operations Center from various sources, viz:

- Vehicle detection and surveillance technologies such as inductive loop detectors, ultrasonic sensors, etc.;
- Traffic monitoring devices by industrial television;
- Roadside meteorological measurement devices;
- Patrol cars and maintenance vehicles on the road;
- Toll plazas and O&M stations;
- Emergency telephones; and
- Relevant authorities such as police, fire departments, municipalities, other road operators, etc.

Information Processing and Integration

Information or requests are responded to by a switchboard operator and inputted to the processing system, if necessary. Transmitted data and information are immediately processed and displayed in the Operations Center. Necessary information is reported to relevant authorities, while instructions are issued to O&M stations and toll plazas through a dedicated communication system, if necessary. All information are integrated by the Operations Center for coordination with relevant authorities. All actions are undertaken by both the Operations Center and relevant O&M stations.

Information Provision

The Operations Center provides essential real-time information to motorists on the road and to the public. One mode of providing motorists with timely, on-site information is through VMSs at selected locations such as on the roadway, the entrance to the interchange, upstream of off-ramp, toll gates, and rest areas. Most of the conventional VMSs are of the text type, but graphic types are also in use for area-wide traffic information. The messages to be given are mostly controlled manually. But, in some advanced information systems, dynamic information is computed by analyzing continuously detected data. Examples are the anticipated travel times to a few interchanges ahead; the length and starting location of the queue ahead and the anticipated travel time; and the occupancy of the parking lot in the rest area ahead. VMSs can automatically display these kinds of information in real time.

Another common mode of information dissemination is through one-way radio communications to the in-vehicle radio using area-wide commercial broadcasting. The conveyed information is more general and area-wide. A dedicated wave band transmission along the expressway for specific intervals can be used, if desired.

(8) Toll Collection

Since toll collection, including maintenance of toll collection equipment, constitutes one of the most important activities of expressway operation, it is discussed separately and in depth in the latter part of this chapter.

3.2 Traffic Information System and Electronic Toll Collection System

Sections 3.2.1 and 3.2.2 discuss current trends in intelligent transportation systems (ITSs) particularly in the areas of traffic information system (TIS), electronic toll collection (ETC) and electronic payment. Section 3.2.3 describe the current status of TIS and ETC in Metro Manila and the issues that beset the current system. Section 3.2.4 presents the rationale and need for TIS and ETC. Section 3.2.5 enumerates key aspects to be considered in the MMUEN TIS and ETC system. Finally, recommendations for the TIS and ETC for the MMUEN are presented in Sections 3.2.6 and 3.2.7, respectively.

3.2.1 Recent Global Trends in Traffic Information System and Electronic Toll Collection

The concept of ITS, which aims to contribute in solving transportation problems by applying information and communications technology (ICT), was proposed sometime in 1970. Since then ITS application has remarkably advanced in the US, Europe, Japan, and other countries. At present, ITS applications have passed the research and development stage and are now in use.

(1) TICS Fundamental Services[1]

There are various definitions and classifications of ITS services, but the most accepted worldwide is the TICS (Transport Information and Control System) fundamental services (See Annex B) by the ISO (International Organization for Standardization) / TC 204 (Technical Committee 204) wherein 32 services are classified into eight categories, namely: (i) traveler information (traffic information), (ii) traffic management, (iii) vehicle, (iv) commercial vehicle, (v) public transport, (vi) emergency, (vii) electronic payment, and (viii) safety.

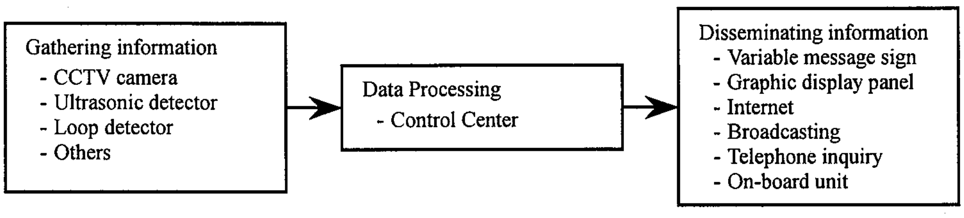
Each ITS service and category has its own level of technological development and commercialization, but certain services in the categories of traveler information, traffic management, public transport, emergency, and electronic payment are already in use.

The following section provides an overview of the global trend in ITS application, particularly traveler information and electronic payment, with a view to introducing ITS in the Metro Manila expressway network.

(2) Traveler Information

The TICS fundamental services list five services under traveler information: pre-trip information, on-trip driver information, on-trip public transport information, personal information services, and route guidance and navigation. For supplying any service, the needed infrastructure should start from information collection by a sensor to information processing by an information processing system and finally to information dissemination by media.

Figure 3.7 Infrastructure of Traveler Information Services



[1] ISO/TR 14813-1:1999(E), Transport information and control systems – Reference model architecture(s) for the TICS sector – Part 1: TICS fundamental services

The infrastructure needed to provide traveler information service, including sensors, on-board units (OBUs), information processing algorithm, etc., is already established technologically for single systems, and such systems are in operation, albeit needing more improvement.

At present, Europe and Japan are developing a standardized system (i.e. the information collected and processed by one system can be used by another system) and multilanguage systems (i.e. the same information is disseminated in several languages).

In the future, the standardization of traveler information system will be an important issue particularly in Metro Manila where many expressway projects are planned through the build-operate-transfer (BOT) scheme. Further, multilanguage systems will be useful in the Philippines where English and Filipino as well as a host of dialects are spoken.

Example 1: Road Communication Standard in Japan (see Annex C)

Example 2: SERTI Project (20 areas in Germany, France, Italy, Spain, and Switzerland)

Five countries (Germany, France, Italy, Spain, and Switzerland) and 35 agencies have carried out the Southern European Road Telematics Implementation (SERTI) Project, aiming at the Trans-European Road Network (TERN). The project provides multilanguage and multimedia traffic information through VMS, radio, Radio Data System-Traffic Message Channel (RDS-TMC), Internet, telephone, etc. Information and services differ by area and media but are generally as follows:

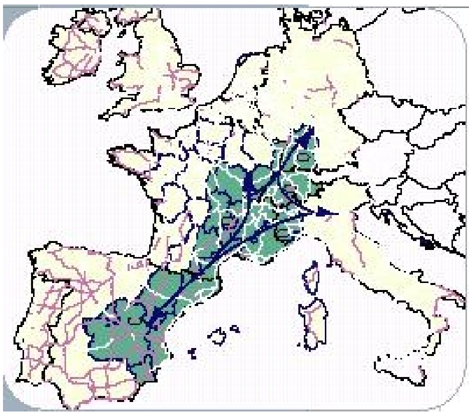
- Traffic control information,
- Traffic accident information,
- Traffic condition forecast,
- Inter-city route suggestion,
- Weather forecast,
- Road image, and
- Travel distance calculation.

Though the information provided is local, the SERTI Project offers it in other languages.

The project budget is 115 million euro, of which 17 million euro is covered by the EU budget.

Table 3.3 Outline of the SERTI Project

Project Name	SERTI Project
Country/Area	20 regions across the five countries of Germany, France, Italy, Spain and Switzerland Covers 5,000 km of the TERN
Executor	35 agencies, including central governments of member countries, local governments, universities, research institutes, highway companies, transportation companies, etc.
Objectives	• To solve automobile traffic congestion between these countries, particularly during summer and winter holiday seasons. • To manage automobile traffic flows by supplying transport information.
Schedule	Started in 1997, the fourth phase is being implemented.

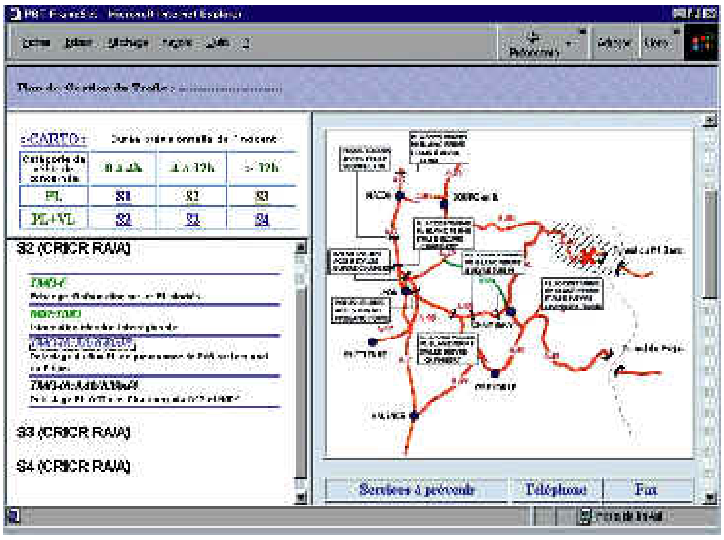


Photograph: SERTI introducing areas

Photograph: Information supply by VMS

Photograph: Information supply by VMS

Photograph: Control Center



Internet screen image

3.2.2 Electronic Payment

As a TICS service category, electronic payment covers only electronic financial transactions, often referred to as Electronic Fee Collection (EFC).

Three trends in the use of EFC have started recently – standardization, application to road pricing and multi-application.

(1) Standardization

To make an OBU usable on different toll roads, a standard must be applied, and that entails standardization of the dedicated short-range communication (DSRC) system. The DSRC system is a type of communication that links a vehicle and a roadside electronic reading device, enabling a motorist to pay highway tolls without stopping, thus avoiding queues at toll plazas. At present, there are two types of signal generation at the same frequency range which the International Telecommunication Union (ITU) recommends as international standards: These are the 5.8GHz active type and 5.8GHz passive type DSRC.

The 5.8GHz active type is the adopted standard in Japan. It is used in about 600 toll plazas, while more than 160,000 OBUs (as of end-February 2002) made by various makers are now in use. On the other hand, the 5.8GHz passive type is the standard in European countries and Australia. There is no compatibility between systems used in OBUs and toll plazas; i.e. a 5.8GHz passive type OBU manufactured by one company cannot be used at a 5.8GHz passive type toll plaza manufactured by another company. At present, European venders are developing a system to effect compatibility between systems.

DSRCs with frequency ranges of 915MHz, 2.45GHz and 5.8GHz have long been used in the United States. However, 5.9GHz active type DSRCs are being developed now and these are expected to become the US standard.

(2) Application to Road Pricing

When the EFC is introduced, collection at toll plazas can be done without motorists stopping, thus minimizing queues and congestion. It will also be easier to adjust the toll fees by time zones. With these advantages, it is expected that the EFC will soon be widely applied to road pricing. Singapore pioneered Electronic Road Pricing (ERP) in 1998 and since then it has been widely used in the city-state. It is now being considered for adoption in Hong Kong, Tokyo and London.

Overview of the Singapore ERP

- Introduced in April 1998, the ERP system is installed at 42 points;
- 2.45GHz passive system, free flow and smart-card type (delivered by the consortium of Mitsubishi Heavy Industries and Phillips Singapore); and
- A toll is levied when a motorist passes the ERP gantry, with the amount varying by time and congestion level.

Photograph: ERP Gantry in Singapore

(3) Multi-application

In addition to toll collection the EFC application in other transactions, such as settling other charges and disseminating information, has started. This trend fully maximizes the capability of the 5.8GHz active type DSRC which was originally developed for ITS applications other than toll collection.

In fact, the full-scale development of ITS applications has already started in Japan. Six private companies established a consortium to examine the feasibility of using the DSRC system in paying parking fees, refueling in gas stations, providing parking space information at car parks, and supplying traffic information.
In China, because of the affordability of 5.8GHz passive type OBUs and the flexibility of the 5.8GHz active type OBUs, both DSRCs are used there. Further, the pilot testing of a hybrid roadside unit (RSU) compatible with both active and passive types is under way in Shanghai.

(4) EFC Standardization Project in Europe: The DELTA Project

The DSRC Electronics Implementation for Transport and Automotive Applications (DELTA) Project aims to establish, through corporate partnership, a validation system to ensure compatibility between 5.8GHz passive DSRC units.

The project also aims to secure the interoperability of Committee European de Normalization (CEN) -type DSRCs, following VASCO/ CARDME and A1, a basic research project preceding DELTA.

Table 3.4 Outline of the Project

Project Name	DELTA Project
Country/Area	Whole EU area (Not yet installed due to ongoing research)
Executor	Implementation by partnership among: • Automotive electronics makers: Bosch Telecom (Germany), Mannesmann (Germany) • Car makers: Fiat Research Center (Italy), Opel (Germany), Renault (France) • DSRC makers: Thales e-Transactions CGA (France), Q-Free (Norway) • Road operators: ASFA (France), Autostrade (Italy), Cofiroute (France) • Others: AAU (Germany), ERTICO (Belgium) Project management is done by ERTICO, and the responsibility for validation is taken by Aachen Institute of Technology.
Purpose	Integration of DSRC as basic OBU (standardization of interface between CEN-type DSRC units and OBUs)
Schedule	2000.03 DELTA Forum for user needs analysis and confirmation 2000.04 Setting of user needs and Agreement on high level system requirements 2000.12 DELTA Forum on architecture and interface specification (antenna design, position, etc.) 2001.01 Presentation of NWP proposal to CEN 2001.01 Preparation of related proposals 2001.04 Agreement on validation plan (evaluation guideline) 2001.11 Prototype OBU and testing of RSU 2002.04 DELTA Forum on validation results 2002.05 Presentation to CEN of architecture and prENV of interface specification 5 Proposals on related matters

3.2.3 Current Status of Traffic Information System and ETC in Metro Manila

(1) Traffic Information System

Introduction

Traffic information is information about traffic flow, incidents and road conditions affecting smooth traffic flow. In a narrow sense, it refers to the traffic situation of an area, a street or any particular location. Traffic volume, level of service, speed, queue lengths, and number of signal cycles in a signalized intersection are some examples of typical traffic information. It also includes weather conditions and other events, such as construction and maintenance work, that also affect traffic flow. Traffic information is useful not only to road users but also to road administrators to ensure good traffic management. From the viewpoint of road users, traffic information is sometimes called driver information.

An information processing and storage system processes collected information into a format more understandable to users and stores it temporarily or permanently for later use. For example, data from a vehicle detector is often converted to traffic volume, saturation levels, travel time, or queue lengths. Visual observation through closed-circuit television (CCTV) monitors and judgment of the traffic condition by operators are a kind of manual processing of information.

To be useful, traffic information must be disseminated to road users. There are a variety of media for this purpose. The most common type is the roadside VMS (also called changeable message sign), which shows traffic information in text or simple graphics. Another type, which is popular in Metro Manila, is traffic news program provided by commercial broadcasting stations. In Japan, the car navigation system already in use for several years transmits traffic information to an in-vehicle navigation unit, which can show congestion in a geographic format and in real time.

In terms of road classification, the traffic information systems for expressways (or toll road) is differ from those of ordinary city roads, mainly because a different organization is in charge of each road class.

In this section, the current status of traffic information systems for both expressways and ordinary roads is presented together with the organizations responsible for providing traffic information.

Organizations Responsible for Traffic Information Provision

In Metro Manila, several organizations deal, or are supposed to deal, with traffic information. In general, the organization in charge of road administration is also responsible for gathering and disseminating traffic information. The following table lists these organizations and the roads they cover. It must be noted, however, that there is no clear delineation of the scope, role and responsibility of these agencies when it comes to traffic information collection and dissemination.

Table 3.5 Organizations Responsible for Traffic Information Provision

Organization	Road Type	Road Covered
Philippine National Construction Corporation	Expressway (toll road)	North Luzon Expressway South Luzon Expressway Skyway
PEA-Tollway Corporation	- do -	Manila-Cavite Toll Expressway
National Capital Region, Department of Public Works and Highways	Ordinary road	National roads in Metro Manila
Traffic Engineering Center, Department of Public Works and Highways	- do -	Arterials roads with signalized intersection
Metropolitan Manila Development Authority	- do -	Arterial roads in Metro Manila
Local Government Units	- do -	City/municipal and barangay roads in their respective jurisdiction
Broadcasting Networks (unofficially)	Both expressway and ordinary road	All roads

1) Philippine National Construction Corporation

The PNCC operates the NLE, the SLE and the Skyway, all of which have no traffic information systems. Information about accidents, congestion and others are collected and processed manually, but virtually no traffic information is given to users of these expressways except through radio programs of commercial broadcasting stations.

2) PEA Tollway Corporation

The PEA Tollway Corporation (PEATC) is a subsidiary of the Public Estates Authority (PEA). It operates the Manila-Cavite Toll Expressway 1 (MCTE 1), which also has no traffic information system. The staff positioned at both ends of the expressway and at the midpoint monitor traffic condition and report it to the management office at the toll plaza. However, no system is installed to provide traffic information to road users.

3) National Capital Region, Department of Public Works and Highways

The DPWH-National Capital Region (NCR) is one of the regional offices of the Department of Public Works and Highways (DPWH) and it covers Metro Manila. It is responsible for the construction and maintenance of national roads in Metro

Manila. As such, the NCR is expected to possess information on road conditions such as damaged pavement, flooded area, and planned and ongoing road works. But even with the availability of such information, these traffic information are not disseminated to road users.

4) Traffic Engineering Center, Department of Public Works and Highways

The Traffic Engineering Center (TEC) is one of the project management offices of the DPWH. Its task is to plan, design, install, operate, and maintain the traffic signal system in Metro Manila. The TEC used to be entirely under the DPWH. In 1995, the TEC's Operation and Maintenance Division was transferred to the Metropolitan Manila Development Authority (MMDA). Now, the TEC only has the Planning and Design Department and the Construction Department. Its area traffic control system has a CCTV system and driver information system (DIS), can provide traffic information to drivers through VMS. Unfortunately, both systems are currently not functioning.

5) Metropolitan Manila Development Authority

The MMDA is responsible for traffic management in Metro Manila, particularly when it concerns two or more LGUs. Two of its departments are involved in traffic-related activities. One is the Traffic Operations Center (TOC) which has a pool of traffic enforcers, who are deployed at key intersections throughout Metro Manila to direct traffic and enforce traffic laws. They are also required to report the traffic situation to the TOC through handheld radio. Recently, the TOC introduced a CCTV system at its Traffic Command Center to monitor traffic condition. Another department is the Operation and Maintenance Division, formerly of the DPWH-TEC, which manages a computerized area traffic control system.

The Communication and Information Center (commonly called Metrobase) also handles traffic information, in addition to other activities such as public safety promotion and natural disaster prevention and rescue. It has a radio communication network, through which the field staff (MMDA traffic enforcers and traffic police of the Philippine National Police [PNP]) report traffic information.

The MMDA has a plan to expand the TOC into a Traffic Information Center, but it is at the conceptual stage yet. Should it progress, it would need an in-depth study to prepare a detailed plan.

6) Local Government Units

Seventeen (17) LGUs comprise Metro Manila. While they are responsible for traffic management of the road network in their respective jurisdictions, the MMDA is responsible for traffic management of a nature involving two or more LGUs, an unclear delineation of tasks, to say the least. In reality, traffic management is very weak at most LGUs and no traffic information activities are carried out.

7) Broadcasting Networks

Several TV and radio stations in Metro Manila have a traffic program that report traffic conditions. Among the TV stations, ABS-CBN is the only one that owns a helicopter and dispatches it every weekday to observe traffic conditions. All other stations rely on the traffic information collected and supplied by the Metrobase.

The types of information collection and dissemination facility per organization are summarized in Table 3.6. Other organizations listed in Table 3.5 that are not listed in Table 3.6 are currently not handling traffic information, i.e. DPWH-NCR and LGUs.

Traffic information in Metro Manila is at a very rudimentary stage. Information collection and dissemination are done manually, while vehicle detectors, CCTV cameras and VMSs are no longer working.

Table 3.6 Traffic Information Collection and Dissemination in Metro Manila

	Information Collection			Information Dissemination	
Organization	Vehicle detector	CCTV	Manual collection	DIS	Manual dissemination
TEC	(operative)	(inoperative)		(inoperative)	
MMDA			By traffic enforcer		
Toll Road Operator		Not installed	Patrolling and observation point		Signboard at tollbooth
Broadcasting Networks			Helicopter		Traffic news program

Closed Circuit Television System

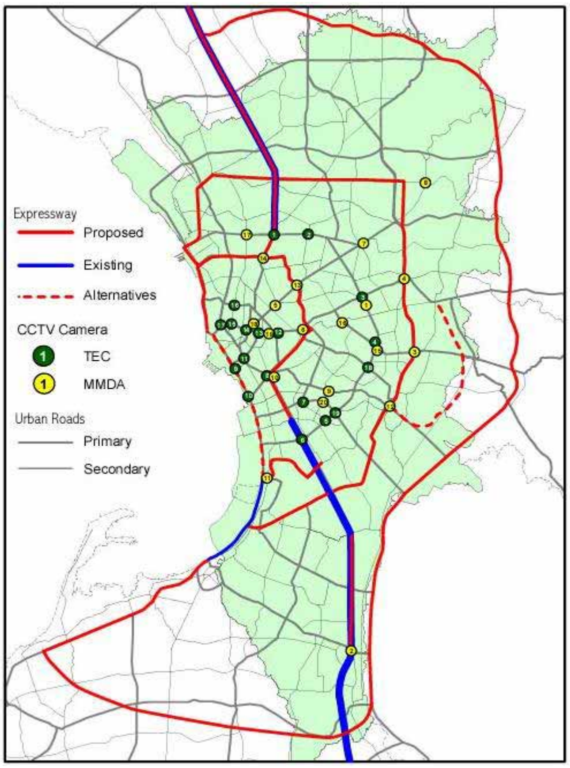
There are two CCTV systems in Metro Manila. One is owned by the TEC, which was installed during the Metro Manila Traffic Engineering and Management (TEAM) project. A total of 19 television cameras were installed from 1980 to 1995 at locations listed in Table 3.7 and shown in Figure 3.8. The system uses fiber optic cables for clearer and faster video transmission and easy camera control. Unfortunately, the system is not functioning anymore as all the circuits are damaged and most of the equipment are defective due to years of neglect. TEC and MMDA are planning to restore the network, but the required fund is reportedly significant, as the extent of the damage is so severe.

Table 3.7 TEC Camera Locations and Condition

Intersection			Status	Remarks
1	EDSA	Balintawak	Inoperative	Damaged communication facilities
2	EDSA	Roosevelt	- ditto -	Damaged due to vehicular accident
3	EDSA	Aurora Blvd.	- ditto -	Damaged communication facilities
4	EDSA	Ortigas	- ditto -	- ditto -
5	EDSA	Ayala	- ditto -	- ditto -
6	EDSA	Magallanes	- ditto -	No available spare parts
7	Ayala	Sen. Gil Puyat Avenue	- ditto -	- ditto -
8	Pres. Quirino	South Superhighway	- ditto -	- ditto -
9	Roxas Blvd.	T. M. Kalaw	- ditto -	- ditto -
10	Roxas Blvd.	Pres. Quirino	- ditto -	- ditto -
11	P. Burgos	Finance	- ditto -	- ditto -
12	A. H. Lacson	R. Magsaysay	- ditto -	- ditto -
13	Legarda	Mendiola	- ditto -	- ditto -
14	C. M. Recto	Quezon Blvd.	- ditto -	- ditto -
15	España	Lerma	- ditto -	- ditto -
16	España	A. H. Lacson	- ditto -	- ditto -
17	C. M. Recto	J. A. Santos	- ditto -	- ditto -
18	EDSA	Shaw Blvd.	- ditto -	- ditto -
19	EDSA	Sen. Gil Puvat Avenue	- ditto -	- ditto -

Note: Cameras 1 through 5 show images in color and were installed during TEAM Phase III, while others are in black and white and were installed either during TEAM Phase I or II.

Figure 3.8 Locations of MMDA and TEC Cameras



A similar number of monitors as with cameras were installed at the TEC so that the view from all cameras could be seen at the same time. At present, only five monitors for cameras 1 through 5 exist, but they are not functioning anymore.

Another CCTV system is owned and operated by the MMDA, which started installing it in 2001. Twenty (20) locations listed in Table 3.8 and shown in Figure 3.9 are scheduled to have CCTV cameras. As of March 2002, 17 intersections are already connected to the MMDA's Traffic Command Center in Guadalupe, Makati City. The system operating on 1 November 2001. As three cameras are not yet connected, the system has not yet been accepted by the MMDA.

Table 3.8 MMDA Camera Locations and Condition

	Intersection		Status
1	EDSA	P. Tuazon	Connected to MMDA
2	Alabang	South Superhighway	- ditto -
3	C5	Ortigas Avenue	- ditto -
4	C5	Katipunan Road	- ditto -
5	Welcome Rotonda		- ditto -
6	Nagtahan Flyover		- ditto -
7	Elliptical Road	Commonwealth Avenue	- ditto -
8	Batasan	Commonwealth Avenue	- ditto -
9	J. P. Rizal	Makati Avenue	- ditto -
10	President Quirino	South Superhighway	- ditto -
11	Roxas Blvd.	MIA Road	- ditto -
12	C5	Kalayaan Avenue	- ditto -
13	Quezon Avenue	Araneta Avenue	- ditto -
14	C3	A. Bonifacio Avenue	- ditto -
15	EDSA	Ortigas Avenue	- ditto -
16	Ortigas Avenue	Santolan Road	- ditto -
17	Monumento	Samson Road	- ditto -
18	España	N. Reyes	To be connected
19	Mendiola	C. M. Recto Avenue	- ditto -
20	Makati Avenue	Sen. Gil Puyat Avenue	- ditto -

Video footage from the cameras is transmitted at two frames per second through the wireless communication system offered by Meridian Telekoms, Inc. The leased communication line costs ₱30,000/month/channel, which is very expensive considering the speed it offers. The nominal data transmission speed is 256 kilobits/sec, which increases up to 512 kilobits/sec depending on the communication traffic.

The Traffic Command Center system consists of several desk-top computers and a large-screen projection monitor. Browser (Internet Explorer ™)-based viewing software is used to monitor the screen. A maximum of four views are shown in tile format on a monitor. Pan, tilt and zoom control functions are provided and activated by clicking a control button on the monitor screen. Metrobase located in the adjacent building has a plan to install TV monitors for the CCTV system but no definite schedule has been made so far.

Manual Traffic Information Collection by the MMDA

Currently, the MMDA collects traffic information manually. The MMDA has about 2,400 traffic enforcers and 270-300 units of portable radio. Traffic enforcers are deployed at key intersections in Metro Manila for traffic guidance and enforcement. There is an established operating procedure for traffic enforcers on how to report traffic conditions. On a normal day, enforcers are requested to report the traffic condition every 15 minutes during peak hours. The frequency increases if necessary. Peak hours are 5:30-9:30 AM and 3:30-9:30 PM. The frequency also varies based on traffic condition and location.

The MMDA is equipped with computerized and voice radio systems. The computerized system has five channels operating in 800 MHz band and all calls are monitored and recorded automatically together with caller ID, call duration, etc. Call logs stored in a hard disk can be retrieved and printed. The voice system is the conventional radio. Some 270–300 portable units are currently used by traffic enforcers and the majority is the conventional voice system. Another 170 units are being requested to cover crucial locations.

The terms "light," "moderate" and "heavy" are used to describe traffic situations when they are reported to Metrobase. They are defined as follows:

Description	Speed
Light	30 kph or more
Moderate	20 – 29 kph
Heavy	19 kph or below

The report from field traffic enforcers is recorded on a record sheet by an operator and then inputted into a computer as text. There are no graphics of the traffic condition either on the computer monitor or the hard board. A big board map in the Metrobase room is used mainly for flood management and not for traffic management. When requested, a summary of traffic reports is produced from the text database of traffic reports without any analysis.

The Metrobase supplies traffic information to 19 radio stations (11 AM stations and eight FM stations) and three TV stations (ABS-CBN, GMA and RPN) through telephone for their news programs.

Expressway Traffic Information System

Currently, four expressways are in operation in Metro Manila. They are the NLE, the SLE, the Skyway, and the MCTE 1. The PNCC group operates and manages the first three expressways, while the PEATC operates the last.

On all expressways, traffic information is handled as part of traffic management. The PNCC's Traffic Safety and Security Department (TSSD) is in charge of traffic management on the NLE and SLE, and its Traffic Management and Security Department (TMSD) is responsible for the Skyway. The key resources that these departments have at their disposal are listed in Table 3.9.

Table 3.9 Resources of the PNCC's Traffic Management Departments

	TSSD-NLE	TSSD-SLE	TMSD-PSC
Personnel			
Staff	340	152	208
Agency guard	10	43	43
Total	350	195	251
Equipment			
Patrol vehicle	24	11	8
Motorcycle	23	12	20
Radio communication unit	96	67	57

Collection of traffic information is done manually by personnel on patrol cars and motorcycles. Patrolling by car is carried out round the clock in three shifts, while patrolling by motorcycle is conducted from 5:00 AM to 6:00 PM.

In addition, traffic observation points have been established on the NLE and the SLE. There are 23, 10 and 13 observation points for the NLE, the SLE and theSkyway, respectively. No CCTV camera or call box (emergency telephone) is available on all three expressways.

A standard operating procedure is established with the PNCC group regarding reporting and recording of accidents, congestion and other incidents that affect tollway operations. The procedure details what to do upon arrival, what data to collect, how to conduct an investigation, what to report, and what to do with damaged vehicles. However, it does not include procedures in reporting traffic conditions as a result of accidents. Thus, incident information is not conveyed to the traffic management office, and so no appropriate action is initiated to prevent traffic congestion from worsening. But then, expressway operators do not have the means to provide traffic information to motorists.

Driver Information System of the TEC

The Driver Information System (DIS), which consists of a central controller and operator console at the TEC and VMS at roadside, was constructed during TEAM Phases II and III. Seven VMSs were installed mainly on radial roads for inbound traffic, as shown in Table 3.10 and Figure 3.9.

The DIS is capable of automatically displaying queue length information which the system calculates based on data from vehicle detectors placed at the approach of key intersections in Metro Manila. Twenty-six (26) intersections are equipped with these detectors. In addition, the system can display any message manually fed into the system through an operator console. The status and message actually shown on the signboard can be monitored on the VMS monitor at the TEC.

At present, the system is not functioning and all VMSs stand idle. Their status as reported by the TEC is summarized in the table below.

Table 3.10 Status of Variable Message Signs

	Location	Status	Remarks
1	MIA Road	Inoperative	Damaged communication cable, ducting and power cable.
2	South Superhighway	- ditto -	For replacement by Citra (LED type)
3	Toll Expressway	- ditto -	Damaged communication cable, ducting and power cable
4	Ortigas Ave.	- ditto -	Ongoing restoration by URPO
5	Aurora Blvd.	- ditto -	Damaged communication cable, ducting and power cable
6	Commonwealth Ave.	- ditto -	- ditto -
7	North Expressway	- ditto -	- ditto -

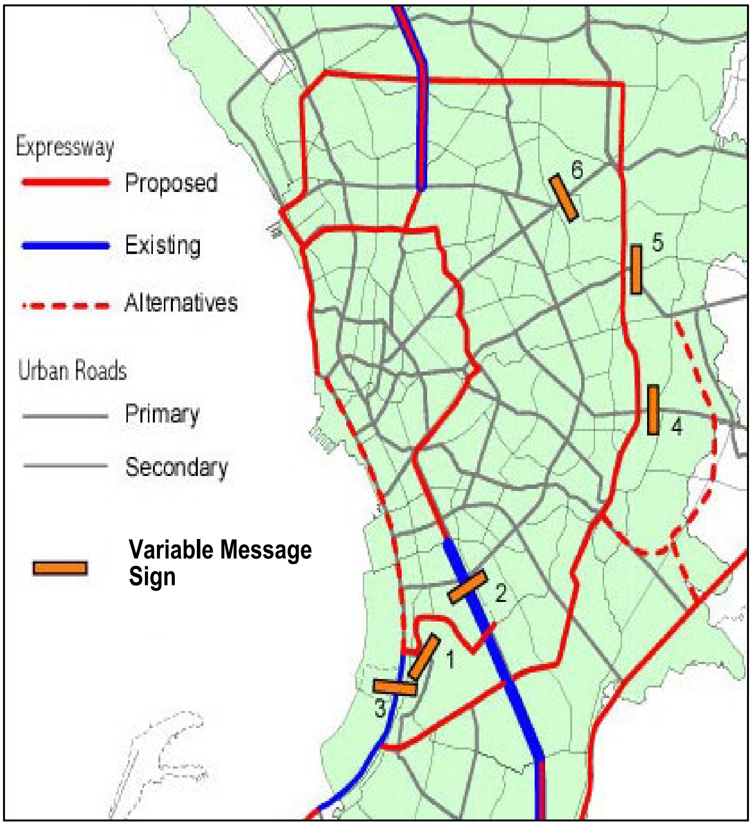
Source: Traffic Engineering Center, DPWH

The VMS monitor, which shows the messages on the message board is still kept at the TEC. It is useless as the system is not functioning.

The VMSs are connected to the TEC through a communication cable network constructed during the TEAM projects. The cable network is damaged at many points and is not functioning.

It is doubtful whether the DIS would work if the communication cable network is restored, as no maintenance has been done on the DIS and the operator console has already been removed.

Figure 3.9 Locations of Variable Message Signs



(2) Traffic Information Problems

Traffic information problems in Metro Manila can be summarized as follows:

- There is virtually no traffic information system. In effect, motorists in Metro Manila are blind when they drive on the congested road network, because there is no traffic information to guide them. Traffic news programs of commercial radio stations are far from sufficient in terms of coverage area, frequency and accuracy. As a result, congestion is not known until one runs into it. Losses caused by the situation, such as wasted fuel, wasted person time, and emitted exhaust gases, are enormous.

- No organization is explicitly responsible for traffic information. The MMDA is probably the most suitable agency, as metro-wide traffic management is one of their tasks, but it lacks resources and long-term planning. The MMDA recently introduced a CCTV system without a clear vision as to its purpose and the use of the information it collects. The delineation of roles between the MMDA and the TEC, is also not clear. Moreover, expressway operators are not required to establish a traffic information system or driver assistance system in their concession agreements. The introduction of such system solely depends on the operator and the system is not expected to be available in the near future.

(3) Electronic Toll Collection System

Introduction

The ETC system is a system that automatically collects toll from vehicles passing on a toll road without stopping and paying cash at a tollbooth. In addition, setting up an exclusive lane for ETC-equipped vehicles can eliminate queuing at toll gates. Thus, transaction time is much faster. The ETC system consists of an OBU installed in the user's vehicle, an electronic gate that identifies and classifies passing vehicles, and a central processing system.

Among the four toll expressways in operation in Metro Manila, only the Skyway and the SLE have an ETC system. The same system is planned for the NLE, but no definite schedule is decided yet. The PEATC, operating the MCTE 1, plans on installing an ETC system and has already conducted a feasibility study. The implementation schedule has not yet been established.

ETC on the Skyway and the SLE

The SLE starts at Nichols and ends in Calamba, Laguna, while the Skyway is an elevated expressway running above the SLE from Buendia to Bicutan. The Skyway and the section of the SLE between Nichols and Alabang interchanges are managed by the PNCC Skyway Corporation, while other sections of SLE south of Alabang are managed by the PNCC. The toll system of both expressways is integrated and adopts a closed toll system, that is, toll is charged based on the traveled distance. Non-ETC-equipped vehicles receive a ticket at the entry gate, then surrender it and pay the toll at the exit gate. ETC-equipped vehicles, on the other hand, are detected at entry and exit points by the ETC system and the corresponding toll is deducted from the user's prepaid account. The number of ETC violators is four or five a day for the whole expressway, which is not a serious problem.

On the Skyway and the SLE, there are four types of gate for toll collection. They are:

- e-Pass only,
- e-Pass/cash coupon,
- e-Pass/exact toll, and
- Cash coupon.

There is also a lane accepting both ETC-equipped vehicles and non-ETC-equipped vehicles. In addition, a reversible lane serves as entry or exit when traffic volume is high. There are 152 operating lanes on the Skyway and the SLE, 106 (70%) of which are equipped with ETC.

The system installed on the Skyway and the SLT uses the technology developed by Amtech Transporation Group of USA. The system vendor is TransCore, which acquired Amtech Transportation Group in July 2000. The Amtech system adopts the 5.8GHz passive type DSRC, which, as mentioned earlier, is what the ITU has recommended as the global standard. Skyway/SLE staff that underwent training on maintaining this system does the maintenance of the equipment. No technical problem exists at present.

The ETC system for the Skyway/SLE is a prepaid system, requiring an initial deposit of ₱500. No discount on toll rate is given to ETC-equipped vehicles installed with an in-vehicle tag called e-Pass. The application and payment procedure is described below.

1) Application procedure

- Fill out application form.
- Submit application form to any participating Shell station, the PNCC Nichols office or the PNCC C5 off-site office and get an e-Pass.
- Mount the e-Pass on the inside surface of the windshield behind the rearview mirror.
- The e-Pass is activated within 48 hours after receipt.
- Pay a tag lease fee of ₱2,200 (including VAT for five years) and an initial prepaid fee of ₱500. In case of premature termination, the lease fee for the remaining period will be refunded pro rata. After five years, tag users only have to pay to recharge the tag's battery.

2) Balance check

- Yellow light turns on at exit point if balance is ₱250 or below.
- Yellow light turns on at entry point if balance is ₱250 or below.
- Red light turns on at entry point if balance is zero, and gate will not open.

3) Usage record

- A monthly statement with details on the date, time, entry and exit points, and the corresponding toll paid is available through fax upon request.

4) Reloading

There are four ways to replenish the e-Pass:

- Pay cash or use credit card at the e-Pass Customer Service Center in Bicutan.

- Buy an e-Pass value card (₱200, ₱500, and ₱1,000 denominations) at any designated Shell station. Call the e-Pass Call Center, follow the automated voice guide and key in the number on the e-Pass value card.
- Call 776-7575 and pay through credit card. This method requires enrollment of credit card when applying for e-Pass.
- Opt for automatic replenishment when balance reaches ₱250 or below through credit card. This also requires enrollment of credit card when applying for e-Pass.

There are about 48,000 OBUs installed already. The average daily ETC transaction in December 2001 was 51,000 for the whole expressway or about 19% of the average daily transaction of 270,000.

Planned ETC System of the PEATC

The PEATC uses an open toll collection system for the MCTE 1 and has only one toll plaza at the middle of the expressway's length. The toll plaza has 19 booths for 20 lanes, of which six are reversible. The existing toll collection system was supplied by Teras Technology of Malaysia and consists of a lane computer, plaza computer and plaza server, axis counter and wheel counter. At present, there is no ETC system in use on the expressway.

Last year, the PEATC conducted a feasibility study for ETC using a system called Q-Free manufactured by Micro Design ASA of Norway. The feasibility study report was submitted to the PEATC management, which has not yet made any decisions. The report is an internal document and cannot be released outside of the company, hence details are not available.

The Q-Free system adopts the 5.8GHz passive type DSRC which the SLE and Skyway are using. However, since 5.8GHz passive type DSRCs are not interoperable with passive-type systems manufactured by other venders, as mentioned earlier, the OBU used for the current e-Pass system cannot be used on the MCTE 1. The OBU is a two-piece type using an IC card, which can be used for other purposes such as shopping.

3.2.4 Necessity and Rationale for the Traffic Information System and ETC

(1) Traffic Information System

Expressways are access-controlled and communication with the outside world is very limited. As such, an incident on an expressway could lead to disaster if inadequately handled. Continuous surveillance of traffic condition on expressways is therefore essential for the early detection of incidents and prompt implementation of countermeasures. In this way, human lives can be saved and negative consequences of incidents, such as prolonged congestion or secondary accidents, can be minimized, if not avoided. Drivers can be informed of an incident upstream before they enter the expressway, enabling them to make a detour, thus saving on time and fuel.

Recurrent congestion, which occurs due to excess demand even without any incident, is already a daily event on some sections of the NLE and the SLE. Traffic flow is often reduced to a snail's pace. Even if there is no severe incident on the roadway, providing information on minor disturbances can contribute much to the improvement of expressway safety and congestion.

In order to make an expressway safer and more efficient, concerted effort by concerned agencies, such as the expressway management body, traffic police, ambulance, hospital, and tow company, are required. A traffic control center is needed to provide a venue for interaction and cooperation among these organizations and to gather and analyze traffic data, make decisions, adopt countermeasures, and log traffic and operations data.

Traffic volume on Metro Manila expressways already exceeds capacity. Congestion and accidents are more frequent with increased traffic volume and once they happen, traffic turns for the worse. At the same time, with the improvement of living standards of the people, expressway users have started to expect and demand better services from the traffic management body of the expressways such as up-to-the-minute information on congestion. In view of the above, a traffic information system is urgently required on Metro Manila expressways.

(2) Electronic Toll Collection

Since land to be used for the planned Metro Manila expressway network is already developed, most of the planned expressways will be elevated. This means that it will be very difficult to construct tollbooths, which usually must cover an area that exceeds the number of lanes of the expressway.

It is easy to imagine how the use of conventional manual toll collection systems at these areas could worsen traffic congestion. However, high-speed toll collection through ETC can help overcome this obstacle and should be seriously considered.

Since the future formation of the Metro Manila expressway network will be implemented through a BOT scheme, this could raise the possibility of these expressway operators (expected to be at least 10 different companies) to independently set up toll collection systems along their expressway sections, forcing cars to stop at entrances and/or exits of their expressway sections to collect tolls. In order to avoid such a situation, the number of times that tolls will be collected needs to be kept to a minimum with the collected tolls being appropriately distributed to expressway operators. A toll collection system that makes full use of ETC is one scheme that can achieve this purpose.

3.2.5 Considerations for the Introduction of ITS

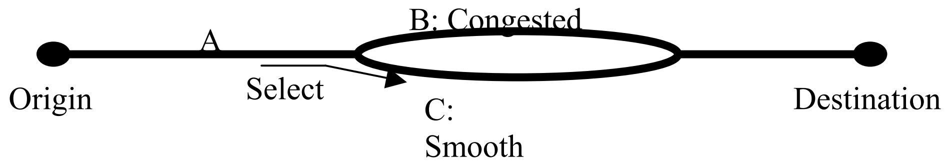
(1) Operation and Maintenance

Operators need to be aware that annual maintenance costs of an ITS is around 20% of the initial investment required for setting it up (Source: PIARC ITS Handbook 2000).

If a portion of the system becomes unserviceable due to poor maintenance, the traffic information system and ETC cease to function as a network, and overall function is lost.

(2) Interoperability

For roads to function efficiently as a network, a system that is compatible with the entire network, and not different systems for each expressway section, must be introduced. To illustrate this point for the traffic information system, it will be important for section A to be aware of the traffic conditions on sections B and C as shown in the diagram below.



If a system that is not compatible with all sections of an ETC network is introduced, users will need to install multiple on-board devices. Furthermore, if there will be individual toll collection systems on each of the expressway sections it will be much harder to introduce a system that could be seen as a fair toll collection system for both users and expressway operators. Philippine standards for ETC and traffic information system will need to be established to create a system compatible with various expressway sections.

(3) Introduction of a Multi-vendor System Consistent with International Standards

The ETC and traffic information system standards to be introduced for the Metro Manila expressway network must be based on international standards and should support a multi-vendor system. The ETC equipment and traffic information system will also need to be provided by several system vendors, so that prices will be competitive, especially when Metro Manila decides to expand the system's functions. This will also ensure continued maintenance and system expansion. There have been several examples of such problems occurring. One notable example is the case in Guangdong Province, China, wherein unreasonably high prices were quoted for system expansion.

(4) Expandability / Multi-applications

Creating a system capable of handling both traffic information system and ETC would likely result in a system that in the future could also support a host of other functions. This, in turn, could help promote the development of new businesses. Toward this end, Japan has been developing a multi-application system using DSRC (a communications system using ETC to exchange information between roadside units [RSUs] and OBUs).

In the Philippines, the use of ETC for cargo control along the expressway linking Subic, Clark and Tarlac is currently being studied. These examples highlight the fact that the traffic information system and ETC should be introduced considering that other applications will likely be added in the future.

(5) Toll System

Plans call for many companies (expressway operators) to participate in the construction and management of the Metro Manila expressway network. In light of this situation it will be very important to select the most suitable toll collection system. The strengths and weaknesses of various options are outlined below.

Three Tolling System Options

- Flat Rate for the Entire Network - With this option a flat rate is adopted for the entire network. The toll is a fixed amount and one can enter through any entrance and go out from any exit.

- Single Toll Rate for the Entire Network - With this option a single toll collection system (based on distance) is used for the entire network. Various expressway operators will not be allowed to independently set tolls. Rather, the collected tolls will be fairly allocated to various operators based on the amount of traffic on their respective expressway sections and their construction and operating costs.

- Independent Rates for Each Expressway Section - With this option various expressway operators can set up their own systems to collect tolls on their respective expressway sections. Each company can freely set their own rates, either based on distance or entry (i.e. flat rate).

Strength and Weaknesses of Each System

- Independent Collection Systems for Each Expressway Section - The current operations of the Skyway, the SLE and the NLE use independent toll collection systems. With this method an overall network collection system can be created including these independent collection systems.

  Generally, expressway operators are more agreeable to a system in which they can collect tolls for their respective expressway sections, as opposed to a system in which tolls collected by one overall system are then allocated to the various companies following specific guidelines. However, if there are closed systems (tolls collected based on distance) and open systems (tolls based on a flat fee), drivers will be forced to stop frequently to pay toll. The large number of tollbooths would also result in more traffic congestion.

- Overall Network Collection System - If this system is adopted, the toll collection systems currently being used by the Skyway, SLE and the NLE would need to be reconfigured or replaced, therefore the consensus of existing expressway operators would be a critical issue. The newly introduced toll collection system would need to guarantee earnings equal to or greater than those being obtained with the current system. It is assumed that this level of toll fare revenue would need to be very high, especially when considering that a portion would eventually be allotted to a new expressway operator (current toll fares for the Skyway is around ₱8/km).

  With the network still being developed and not all of the roads are interconnected, this method has many problems to address such as determining toll levels and collection methods, setting toll fees when new roads are opened and allocating collected tolls to the new expressway operator. However, this method has the huge advantage of requiring users to pay tolls only once, and when the distance method is used they only have to stop at tollbooths twice at the most.

(6) Operational Organization

There are two methods for operating the traffic information system and ETC: one is making each expressway operator responsible for operating the traffic information system and ETC along their expressway sections; another is using only one traffic information system and/or ETC system for the entire expressway network.

It has been mentioned earlier that compatibility among systems is very important for the traffic information system and the ETC to function on the entire network and not just on individual expressway sections. If the system functions for the entire network, damage to even just one section of the system will necessitate maintenance of the entire system. In other words, a system error in just one section of the network could pose a serious problem for the overall network. Furthermore, control centers independently established for each expressway section would likely result in the inefficient sharing of information among sections.

With these considerations and the scale of the Metro Manila expressway network, it would be better to have a single organization providing integrated management of the entire system, as opposed to the operation of individual systems for each expressway section.

(7) Financial Burden

TIS Funding: Road Operators or Government

It is assumed that the funding for the establishment and operation of a traffic information system will come from either the expressway operators or government organizations. In determining which party should bear these expenses, the ultimate goal for establishing a traffic information system must first be clarified. If the goal is for expressway operators, which are for-profit entities, to provide competitive transport services to users, then these companies should shoulder the expenses. However, if the goal is to realize smoother traffic flow in the entire transport network, then the expense should be borne by the Government as the beneficiaries are not just expressway users but also all other road users. In reality, the goal is both to improve service thereby attracting more patronage which leads to higher profits and to improve traffic flow not just on expressways but also on the entire network. Thus, both sectors have a role in the development of TIS. As system components along the expressway are within the scope of responsibility of private operators, they should shoulder the cost of their implementation. On the other hand, system components on non-expressway segments are within the realm of the Government and the use of taxes for their implementation is well justified.

TIS Funding: Entry of New Operations

It has been proposed in preceeding sections to introduce an integrated traffic information management system for the MMUEN. If an integrated management system is built any incremental development of the network will require additional capital in its TIS capacity development to accommodate the new entrant operator. Existing operators would naturally object if they would have to pay for the needed investments. It is therefore reasonable that the new entrant expressway operator be responsible for installing the information collection and delivery system on its own expressway section and link it to the existing system.

A similar issue is that the integrated system would need to have reserved capacity to be able to efficiently accommodate future expressway operators. This means that it is unreasonable and perhaps unacceptable that early operators shoulder the cost of the reserved capacity as it would in effect subsidize later operators. The role of the Government in this issue is therefore important as it may require the Government to shoulder part of the cost for the reserved capacity and be refunded by new entrant operators when they link to the TIS network.

ETC

The ETC equipment consists of (1) roadside facilities (roadside equipment, AVC or Automated Vehicle Classification, enforcement equipment, etc.), (2) OBU and (3) backyard facilities (central processing equipment, communications equipment, etc.).
The ETC equipment is used for toll collection, and in principle the expenses associated with installing such equipment is borne by the expressway operator. Here, each expressway operator can set up their own roadside facilities along their sections of the expressway. The problem is who will bear the expenses associated with the OBU and backyard facilities.

With the OBU there are three options: (1) users purchase the OBU themselves, (2) the expressway operator purchases OBUs and lends them to users in exchange for a deposit, and (3) the expressway operator purchases the OBUs and provides them to users for free.

Option 3 in which the OBU is provided to users for free is seen as the most effective option in terms of promoting the use of ETC, but this option has the following problems:

- Will free replacements be provided if the users intentionally or accidentally damage the OBU? In this case the users responsible for the damage may try to blame the expressway operator or other users;
- When the user intentionally or accidentally damages the OBU, should this user be compelled to pay for the replacement? In this case users may resent having to pay for the equipment, which in turn could lead to a reduction in the number of properly functioning ETC equipment and number of ETC users; and
- Which groups should be lent the equipment? Giving the equipment to anyone who wants it without any conditions would be very inefficient, as the equipment might be given to some people who use expressways no more than once a year.

For Option 1, in which users must purchase the equipment, some new laws and additional systems may be needed to prevent users from modifying the OBU or overwriting its data. Moreover, this option makes it difficult for the system to be more widely adopted, since not everyone would want to purchase it.

Considering the above problems, Option 2, in which the expressway operator will buy the equipment and lend it to the users in return for a deposit, appears to be the best.

Backyard facilities, like the ETC and traffic information system, will require integrated management and operation for the entire system. It is enough to build one Control Center for the whole Metro Manila expressway network. Therefore, it is appropriate for the Control Center to maintain and operate the backyard facilities.

(8) Phased Development

An expressway does not become complete at one time. Rather, it develops through time, acquiring features, such as traffic information provision and toll collection. Therefore, a phased development strategy which aims to introduce TIS and ETC system stage by stage, is recommended. Starting with the basic requirements, the systems become complex and more advanced as the expressway network expands.

(9) Cable Network Installation

In general, installing power and communication cables after the completion of construction work costs higher than doing it during construction. Even if the introduction of TIS and ETC systems is delayed, installing ducts during the construction stage is still more cost-efficient.

3.2.6 Proposals for the Traffic Information System

(1) System Concept

<u>Objectives of Traffic Information System</u>

The objectives of a traffic information system for expressways are to enhance the safety and comfort of users, ensure fast and smooth traffic flow, maximize efficiency of expressway operation, and minimize adverse effect of incidents.
Expressway users expect a smooth and fast traffic flow on the expressway and they pay tolls for such service. If congestion occurs on the expressway and the service level deteriorates, users will complain and their trust will be lost. Besides the economic losses due to delay, environmental damage caused by pollutants will also

be significant. Traffic information system helps by continuously monitoring expressway operations so that necessary countermeasures can be implemented expeditiously.

It is most annoying and inconvenient on the part of expressway users to find themselves trapped in traffic without knowing how long before they can get through. If expressway users are provided with sufficient information on traffic conditions, their irritation can be much eased even if there is congestion. A traffic information system provides expressway users with traffic information to guide them in taking the most appropriate route, which in turn maximizes the operational efficiency of the expressway network.

As the speed on expressways is much higher than that on ordinary streets because of the controlled access and elimination of conflicting movements, any accident on the expressway can be serious. Congestion, stalled vehicle, fallen objects, construction and maintenance work, and adverse weather condition are all potential threats to the safety of traffic flow on expressways. If drivers are warned of these hazards beforehand, they can take precautions such as decreasing speed. A traffic information system enhances the safety of expressways by detecting incident through data gathering and continuous surveillance, and providing incident information to expressway users.

Early detection of incidents also enables the expressway operator to take countermeasures such as dispatching rescue vehicle or directing drivers to make a detour. Drivers can divert to another road or enter and exit through different points to avoid sections affected by incidents. Currently, expressways in Metro Manila are not interconnected except for the SLE and the Skyway 1. But once they are connected and a network is formed, traffic information will play a more important role in route selection. Expressways become more efficient if traffic approaching a congested route is diverted to a less congested one.

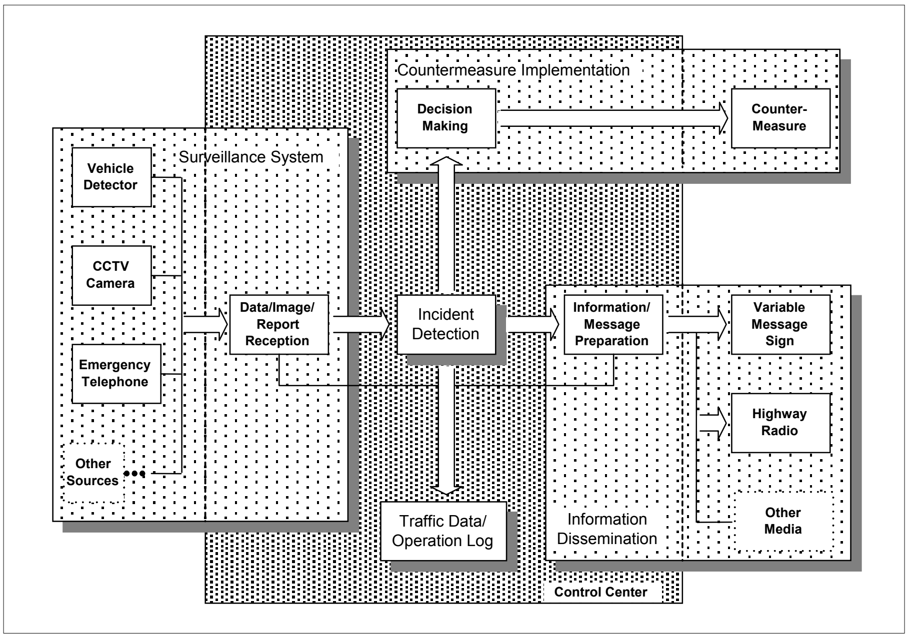
System's Functions

A traffic information system achieves the objectives described in the preceding section through various functions as listed below.

- Traffic surveillance;
- Data processing and incident detection;
- Information dissemination;
- Assistance in countermeasure implementation; and
- Data logging.

Figure 3.10 schematically presents the functions of an expressway traffic information system.

Figure 3.10 Functions of a Traffic Information System



Traffic Surveillance

An expressway operator carries out traffic surveillance at the Control Center round the clock via a CCTV system and a wall map. Detectors installed at each section of expressway collect and send traffic data to the Control Center where the data are automatically processed. The results are graphically displayed on the wall map indicating various degrees of congestion or free flow condition. By operating CCTV cameras from the Control Center, the expressway operator can visually inspect the traffic situation on the expressways. Also, emergency telephones installed along the expressways allow road users to report incidents to the Control Center.

Other sources of information include patrol car reports, tollgate operator and area traffic control systems (signal systems). Patrol cars plying the expressway regularly complement the surveillance function and incidents are reported to the Control Center through radio. Sometimes expressway users themselves report incidents to the tollgate operator who in turn reports them to the Control Center. Traffic condition on the streets near the off-ramp can be obtained from the area traffic control system. On-line real-time information exchange is necessary between the expressway information system and signal system. To realize such information exchange, both systems must be connected other through a data communication channel and an agreement on the protocol and contents must be made.

Data Processing and Incident Detection

A vehicle detector detects the presence of a vehicle within its detection range. The signal is then processed into data such as traffic volume, occupancy rate or average speed, which represents the traffic flow and is more understandable to users. Short-term traffic data, such as 5-minute volume, is then accumulated or averaged into hourly data or daily data. This processing is done automatically and no operator intervention is required. The type of data to be produced by the system depends on the objectives and functions of the system.

The level of service including congestion on each expressway section is obtained by processing detector data and the results are displayed on the wall map. If there is a sudden change in traffic flow, it is highly possible that an incident has occurred. The video image from the CCTV camera also assists in the detection of incidents manually or automatically. Video image processing technology has made it possible to automatically detect an incident with reasonable accuracy.

Information Dissemination

Traffic information obtained can be disseminated to expressway users via a number of media. One of the effective ways is through VMS and graphic display panels installed at strategic locations both on the through lane and at entry points of the expressway. Roadside radio can also provide traffic information and convey more messages than the signboard. Other means, which are already in use in other systems, are on-vehicle route guidance device (VICS), radio broadcasting, auto-answering telephone, traffic information through short message service (SMS), traffic information terminal at rest area, and computer network like Internet.

The table below summarizes the various media used in providing traffic information to road users. Traffic information is required both before the trip and during the trip. Pre-trip traffic information helps users in selecting mode, route and start time, while on-trip information helps those already on the road to follow their desired route or alter it. Information is provided as voice signal, text or graphics.

Table 3.11 Media Used for Traffic Information Dissemination

Type of Information	Voice	Text	Graphic
Pre-trip	• Telephone guide • Radio broadcasting	• Short message service	• Internet • Information terminal
On-trip	• Highway radio[1] • Radio broadcasting	• Variable message sign[1] • Travel time display[1] • Short message service	• Graphic display panel[1] • VICS[2] • Information terminal

Notes: [1] Roadside facilities
[2] VICS (vehicle information and communication system), provides real-time traffic information to OBUs.

Assistance in Countermeasure Implementation

Once an incident occurs, countermeasures must be taken. To control and manage incidents, patrol cars must be instructed through radio to go to the site. Depending on the situation, rescue vehicle or ambulance must be dispatched without delay through a quick incident disposal system established in the Control Center. Another countermeasure is to inform the road users of the existence of an abnormal condition, such as expressway closure, lane closure, congestion, or speed limit control, and to advise them of the action to take. Accurate and updated information is vital in decision making and countermeasure implementation.

Data Logging

All operations and activities are recorded by the system. Traffic data gathered by vehicle detectors are automatically processed and stored in a suitable format for future use. Such data are a valuable reference in planning improvement work or new expressways. Operations log and malfunction data of various facilities, such as VMS, is also automatically recorded.

Coverage Area

The traffic information system should be considered as standard facility of today's expressways. Ideally, the system must be built at the same time an expressway is constructed to lessen the construction cost of the system. The introduction of a traffic information system, however, requires a large capital investment. Consideration must, therefore, be given to its economic aspects. The construction and operational costs of the system depends on the coverage area (total expressway length covered), and the type and number of facilities. On the other hand, the benefits derived from the system are received by individual expressway users so that the total amount of benefits, whether quantitative or qualitative, is proportional to the traffic volume. Hence, since the adverse consequence of an incident would be more severe at the section where traffic is heavy, a traffic information system has higher priority at expressway sections with larger traffic volume.

It would be reasonable to establish a guideline in terms of traffic volume that will be applied to determine the coverage area of a traffic information system. The Study Team proposes an annual average traffic volume of 30,000 vehicles a day as the guideline to be used in this study. In principle, a traffic information system will be introduced in toll expressway sections with a traffic volume of more than 30,000 vehicles a day. It should be noted, however, that other factors, such as network topology, road alignment, accident rate, and future traffic demand forecast, must also be taken into account in selecting the section. If the criterion described above is applied to expressways under study, all expressway sections need a TIS.

Skyway 1, although its average traffic volume is only about 26,000 vehicles a day, still needs such a system because Skyway 1 and SLE cater to more than 130,000 vehicles a day, and both links run along the same route. Thus, both expressways must have a traffic information system.

The system will be constructed in phases. The initial phase will cover the expressways already in operation, namely the SLE, the NLE, the Skyway 1, and the MCTE 1. The system will then be expanded gradually as new expressways are completed and put into operation.

Control Center

The Control Center is the nucleus of the traffic information system where communications are directed, data are processed, decisions are made, information and instruction are issued, and traffic and operation data are stored. To perform these functions, a suitable space is required to accommodate both its equipment and staff. Normally, most of the equipment, including computers and communication devices, are placed in a machine room while the operators are stationed in the control room in which man-machine interface equipment, such as wall map, video monitor, computer terminal, and base for radio communication, are installed. Support facilities, such as uninterruptible power supply and air conditioning, are equally important for normal and continuous operation of the system and are usually housed in a separate room. There are other spaces needed for the operation of the center, which include office space, conference room, visitor's hall, and workshop.

Technically speaking, the location of the control center is not an important issue as long as it is located along the expressway for easy access. The reason is that transmission network will be established to transmit the bulk of data to and from the Control Center and the terminal equipment which are scattered all over the network. The location will be selected based on the availability and size of land, accessibility from the expressway and surface street, ease of commuting, and other non-technical factors. It is pointed out that the cost of the system will not be affected much by the location of the center at the conceptual design level.

Currently, the expressway network in Metro Manila consists of three separate segments. They will be connected to form one continuous network when the expressways linking these segments are constructed. Until then, a temporary Control Center will be established in each segment. In the future, one of them will be the main Control Center and the other two will serve as subcenters. Because the Control Center is related to expressway management body, a more detailed discussion is given in proceeding section entitled "Organizational Setup".

Data Exchange with Other Systems

The Metro Manila expressway's traffic information system will cover all expressways, both existing and planned. There are, however, other systems that deal with traffic information, most of which are still in the planning stage.

One of these important systems is traffic information system for ordinary streets. There is a move at the MMDA to establish this system. The existing area traffic control system, which controls most of the signals in Metro Manila, does not handle traffic information such as congestion or queue lengths on the road networks. If a traffic information system for ordinary streets is constructed, congestion and other traffic data must be exchanged between the two systems, as two networks must complement each other.

There is a rudimentary traffic information system operated by the MMDA. The system relies on manual data collection and information dissemination. Traffic condition is reported by traffic enforcer, patrol car, traffic volunteer, etc. to the Metrobase of the MMDA. The information is then inputted into a computer by an encoder. Traffic information is disseminated through telephone. Most telephone inquiries come from radio stations for their traffic information programs.

A web site that offers traffic information service in Metro Manila is called *trapik.com* (http://www.trapik.com/). It has pages that show maps and the traffic condition of more than 30 pre-defined routes in Metro Manila. However, the route is too long, the description too general and the updating frequency low. It also sends traffic condition of pre-selected routes through short message service (SMS) to registered users at specified times. The accuracy, capacity and functionality of the system are limited at present but if a more comprehensive traffic information database is established, improved service can be possible. Such system requires updated traffic information from an expressway traffic information system.

Information will yield more benefits if it is used by other systems. This requires the promotion of data exchange and standardization of traffic information systems.

Road Communication Standards

In order to achieve interoperability, interconnectivity and compatibility with other systems related to road traffic, Philippine standards for ITS, such as Road Communication Standards (RCS), must be established and adopted so that all systems will operate on the same platform. RCS aims to reduce barriers and difficulties in connecting systems by establishing standards..

The main components of RCS are data dictionary, message set and protocol. The first two components are essential for correct interpretation of messages. Data dictionary defines the syntax and semantics of the minimum unit of information to be included in the messages and the message set defines syntax of the messages. Protocol sets the procedure for two systems to establish connection and data exchange based on the reference model of open system interconnection (OSI). Protocol itself adopts standard protocols. Use of Internet protocol (IP) is a main feature of the standards, and other commonly used protocols are specified for each layer. The application of RCS covers all forms of data transmission on the expressway such as moving picture, file transfer, data transmission, ETC, and vehicle and roadside communication.

Interconnection of systems that adopt RCS will be easier. No interface equipment will be required for hardware compatibility and data conversion. Data can be exchanged and messages can be interpreted correctly among systems.

Another merit in adopting standards is the possibility of multiple suppliers of the system's equipment. If a device is exclusively supplied by one manufacturer, source is limited and maintenance can become a problem. On the other hand, if there are several suppliers for the standard equipment, costs can be minimized.

(2) Standard Traffic Information System

The traffic information system is an integrated system consisting of several subsystems which have their respective functions. The complexity of the system varies depending on the subsystems employed and their configurations. In addition, there are different types of equipment to be used in each subsystem. As a result, the level of sophistication of a traffic information system can vary from the basic and simple to the most advanced and complicated. This section presents the most suitable system for Metro Manila expressways and describes its configuration. The subsystems to be considered are:

- Vehicle detector,
- CCTV,
- Emergency telephone,
- VMS,
- Graphic display panel,
- Highway radio,
- Central computers,
- Transmission, and
- Radio communication.

Vehicle Detector System

The vehicle detector system provides real-time traffic information on expressways. As congestion surveillance and incident detection are the most basic functions of the expressway traffic information system, the deployment of a vehicle detector sub-system is the core of the surveillance system. The location of vehicle detectors, density, type of data to be acquired, their accuracy and data-gathering frequency are important factors in designing such a system.

Various types of vehicle detectors have been developed and installed. Among them are inductive loop detector, ultrasonic sensor, Doppler ultrasonic sensor, infrared sensor, and several kinds of video detector using conventional or dedicated video camera. These devices have their own advantages and disadvantages in installation method, detectable vehicle, type of data, accuracy, stability, and initial and maintenance costs.

Vehicle detector in an expressway traffic information system is used for three purposes, namely: 1) traffic count at main lane, on-ramp and off-ramp, 2) spot speed measurement at detector location, and 3) congestion detection and queue length measurement at congestion-prone section. Table 3.12 summarizes the recommended vehicle detector deployment standards for each detector application.

Table 3.12 Recommended Detector Deployment Standards

Application	Processing		Location				Lane
	Data	Unit Time	Main Lane	Junction	On-ramp	Off-ramp	
Traffic Count	Accumul-ated count	5 min.	1 representative location for each section between interchanges (ICs).	Transfer lane	On-ramp[1]	Off-ramp[2]	All lanes
Flow Speed	Average speed	2.5 min.	1 representative location for each section between ICs.	NA[3]	NA	NA	All lanes
Queue Length	Discrete queue length	2.5 min.	Every 500 m for congestion-prone section	Every 500 m for queue-prone junction	NA	1-2 detectors for queue-prone off-ramp	Represent-ative lane
Congestion on arterial streets	Occupan-cy rate	5 min.	NA	NA	NA	Downstream of congestion-prone off-ramp	Represent-ative lane

[1] Tollbooth detector may be used.
[2] Tollbooth detector may be used for the closed toll system section.
[3] Not applicable

Closed Circuit Television System

A CCTV system provides visual information on the traffic conditions, which is useful for the system operator at the Control Center in making sound decisions. Visual data, although they cannot be expressed quantitatively, contain much more information than numeric data which a vehicle detector system can provide. It should be noted, however, that a CCTV system is more expensive on a per location basis than vehicle detectors and it requires wide-band communication channels for video signal transmission. For this reason, the number of cameras and their locations must be carefully studied. Candidate locations for camera are:

- at on-ramps where merging traffic occurs,
- at junctions where flows from two expressways meet,
- at accident-prone locations such as tight curve, and
- at queue-prone locations such as off-ramp, tollgate and bottleneck.

As the system is provided with pan, tilt and zoom functions, one camera can cover about 500 meters upstream and downstream of the location.

Video signal has a bandwidth of 6 MHz and requires a wide band transmission system. There are several video signal transmission systems used in many applications. Different methods have different features for different applications and transmission distances. In accordance with the hierarchical structure of the transmission system, two levels of transmission methods are adopted. From the camera to the nearest carrier terminal station base band transmission over fiber optic cable using short or long wavelength is used. Between the carrier terminal stations, carrier transmission system is adopted. If the camera is near the Control Center, the video signal is directly transmitted to it through base band.

Recent developments in compression and digital signal processing technologies, such as the MPEG standard, make it possible to digitize video signals and compress it into a much smaller data stream than raw data without degrading video quality. Using this technology, it is possible to send video signal from the camera to the Control Center over 1.5 Mbps or 2.0 Mbps channel. The selection of transmission method will be made after a more detailed analysis of the two systems has been done in terms of initial cost, operation cost, video image quality, expandability, etc.

Emergency Telephone System

As the expressway is an isolated world, communication with the outside is not easy. With the proliferation of cellular phones, the situation has eased a little bit. However, even those who have cellular phones may not know the proper numbers to call in case of trouble. And if they do, the cellular phone system will not function, as it is overloaded with calls and cannot process all of them. For majority of road users, it is difficult to contact the expressway management body or others for assistance in case of emergency.

It is during such event that the emergency telephone system is helpful. The system is a closed telephone system exclusively provided for expressway users. Telephones are installed along both sides of expressways at one-kilometer intervals. All calls are automatically connected to a call center usually set up at the Control Center. A mechanism will be provided to allow the automatic identification of the location of a telephone in use.

The PNCC once tried to introduce an emergency telephone system along the SLE but all were stolen within one month of installation. From this experience, the type of roadside emergency telephone and installation must be carefully designed.

Variable Message Sign System

In an expressway traffic information system, all traffic data, visual image and emergency calls converge at the Control Center. After analyzing the data, a decision is made. Most of the time, it is necessary to provide road users with the information on the incidents and countermeasures. The VMS system is one form of information dissemination from the Control Center directly to the road users. A signboard will be installed upstream of each off-ramp to allow drivers to divert to another route if the downstream section is heavily congested.

A variety of VMSs using different display elements has been developed and installed. Among them, the dot-pattern type has become predominant because of its flexibility and capability of displaying both character and graphics. Dot-pattern type using light-emitting diodes (LED) as display element is recommended for low-power consumption, multicolor display and longer life of display element.

Travel Time Display System

Travel time display board is a kind of VMS dedicated to displaying expected travel time from the current locations to several downstream locations. If there is more than one route in the same direction, travel time along each route is shown so that drivers can choose the route with shorter travel time. Travel time is calculated based on the traffic condition on each section and the display is updated automatically at fixed intervals such as five minutes. The display is useful for Skyway 1 and SLE as drivers can compare the travel time of two routes

Graphic Display Panel System

Graphic display panel is another tool to disseminate congestion information. The expressway network is schematically drawn on a large signboard, and the congested section is shown in orange or red color. The advantage of this device is that it provides congestion information in an intuitive way. But each signboard must be designed individually, as the road network shown on the board varies for each location. The device will be installed on expressways upstream of junctions once the expressway network is formed. Table 3.13 summarizes the use of both VMS and graphic display panel.

Highway Radio System

The highway radio system is another medium through which information from the expressway management body can be conveyed to road users. A special kind of coaxial cable installed under or above the ground along a certain section of the expressway emits radio signals. The output power of the radio wave is very small. Drivers obtain traffic and other information through the radio in their cars as they drive along that particular road section.

Table 3.13 Use of Variable Message Sign and Graphic Display Panel

Location	Signboard type	Information	Installation
Expressway main lane upstream of off-ramp	VMS	Traffic/road condition on immediate downstream section Advice or instruction to driver	Gantry
Expressway main lane upstream of junction	Graphic display board	Congestion on toll road network downstream of junction	Gantry
On-ramp	VMS	Traffic/road condition on toll road network	Gantry
Access road street leading to on-ramp	VMS	Traffic/road condition on toll road network	Overhung

Highway advisory radio provides traffic and road information of the downstream section so that drivers can make a detour or at least be prepared for the incident. The system is suitable on a straight section 3 km or longer where flow is uniform so that drivers can listen to the highway radio without too much interference.

Central Computer System

Many kinds of data are collected, processed and stored at the Control Center. They include traffic flow data in the form of count, occupancy or speed gathered from various locations in the expressway network and equipment operation log such as messages displayed on the VMS or record of equipment malfunction. A central computer system is required to collect, process and store the bulk of the data used in the traffic information system.

Some information dissemination devices, such as web server and automatic telephone answering system, will be placed at the Control Center and connected with the central computer system. In the future, car navigation system will be introduced in Metro Manila, which requires real-time information dissemination through wireless technology from the Control Center to an on-board car navigation unit.

Interaction between the traffic information system and the expressway operator is not only important but also necessary. Data are processed by the computer but data interpretation and decision making must be done by the operator. To enable the operator to correctly understand the traffic situation and decide on an action, man-machine interface system must be efficient and user friendly. The man-machine interface system of expressway traffic information system includes a wall map, television monitors, emergency telephone reception console, various computer terminals, and printers, through which the operator obtains data and results, and inputs the operation command. The device and the user interface software must be easy to use and have built-in security to prevent unauthorized use.

Transmission System

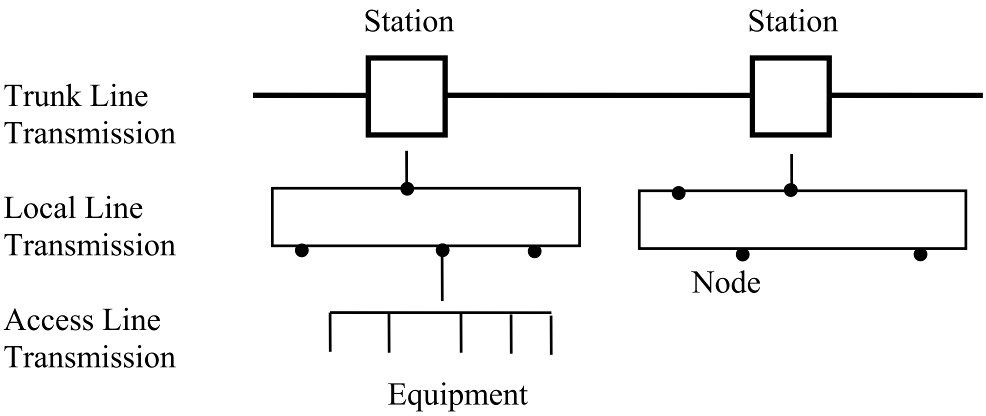
In an expressway traffic information system, various kinds of signal, such as data, voice and image, are exchanged between the Control Center and the terminal equipment such as vehicle detector, CCTV camera, emergency telephone, and VMS. A transmission system is needed to provide the channels for such data. The type and configuration of the communication system to be constructed is determined by the requirements for the system such as the amount of data, its location, transmission speed, signal level, bandwidth, and other factors such as installation and maintenance costs.

The system can also be utilized by other systems, such as local area network (LAN) and in-house telephone system, of the expressway operator. It is also possible for expressway management organizations to offer their transmission system and cable network to the public as common carrier or simply as "*dark fiber*".

The traffic information system covering long distances along an expressway has a hierarchical configuration consisting of three layers – trunk line transmission system, local line transmission system and access line transmission system. A trunk line transmission system handles long-haul high-speed transmission between carrier terminal stations. Local line transmission system provides transmission channels between nodes established at 10-to 20-km intervals to collect voice and data signals for a trunk line transmission. Access line transmission system connects the facilities and equipment in offices and at roadsides to a node for local line transmission. The transmission distance is short, normally less than 20 km.

Figure 3. 11 shows the conceptual configuration of the proposed expressway traffic information system.

Figure 3.11 Transmission System Hierarchy



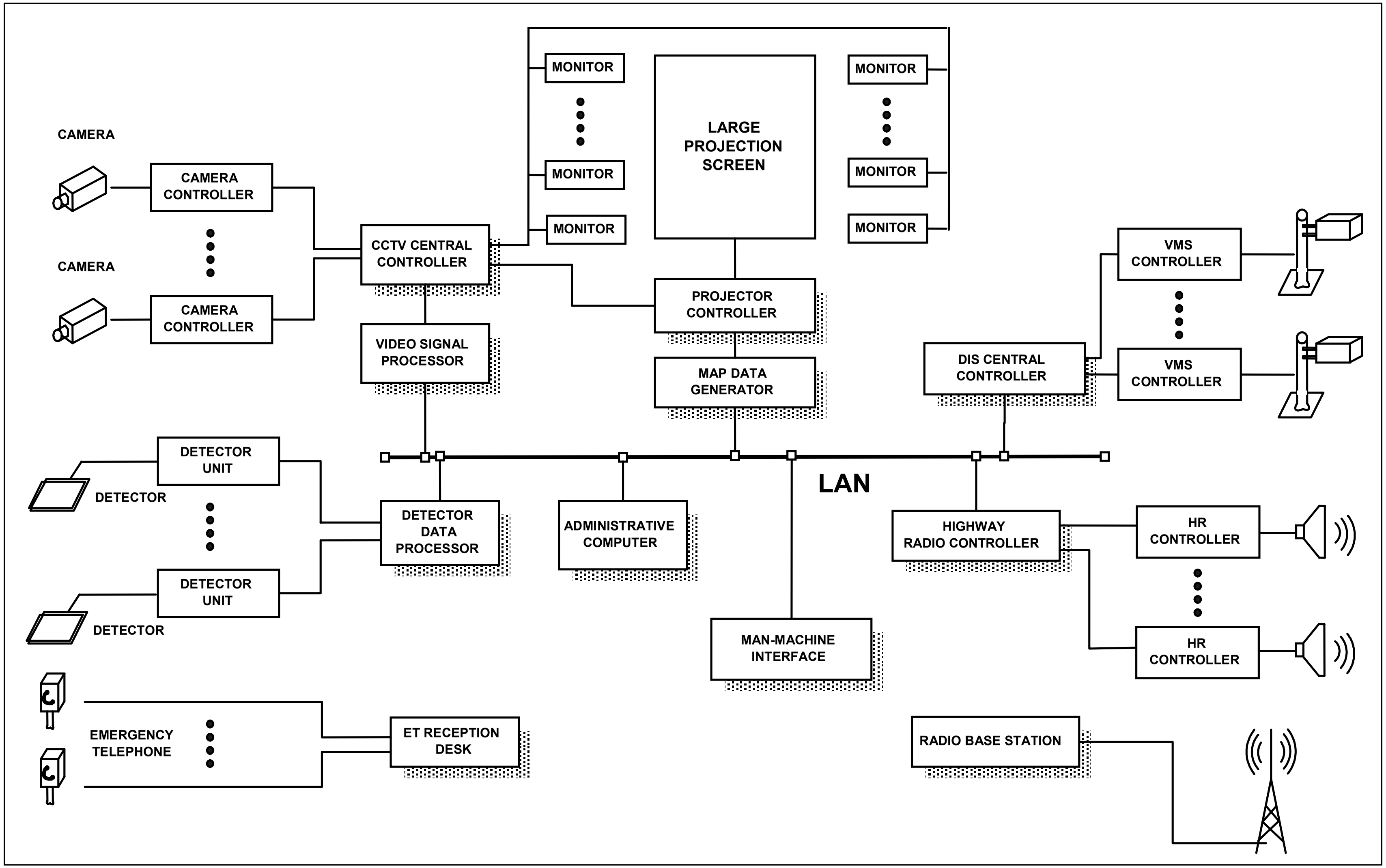
Currently, no cable is installed along any of the existing expressways. Thus, cable must be laid along them to establish a transmission system. In addition, all new expressways to be constructed should have a cable along it, or at least a conduit line, at the time of construction so that the necessary cable can easily be installed when the need arises.

Radio Communication System

The existing radio communication system owned by an expressway operator and used for voice communication between offices and the patrol car will be expanded. A base station will be established at the Control Center which will serve as communication center complete with patrol cars and roadside offices each equipped with radio. If an incident is detected by a patrol car, the details of the incident will be reported to the Control Center through radio. Upon receipt of an incident report, a decision must be made and necessary instructions are given to the parties involved through the radio system, in-house telephone system or public telephone system.

Figure 3.12 shows the conceptual configuration of the proposed toll road traffic information system.

Figure 3.12 Proposed Toll Road Traffic Information System



3.2.7 Proposals for ETC in Metro Manila

(1) Basic Philosophies for Toll System and Toll Collection Methods

The toll system options for the Metro Manila expressway network are grouped into two. An overview of their relevant strengths and weaknesses is shown in the table below.

Table 3.14 Advantages and Disadvantages of Toll Systems

	Advantage and Disadvantage
Independent Systems for Each Road Section	[Advantage] • Can use the toll systems already in place on the Skyway, SLE and NLE. • Clarifies the relationship between the traffic volumes of each expressway section and the earnings gained by the expressway operator. [Disadvantage] • User convenience is sacrificed when there is an independent toll collection on various expressway sections. A large number of tollbooths increases traffic congestion.
Single System for the Entire Network	[Advantage] • Improved convenience to users, as tolls only need to be paid once. • Can help alleviate traffic congestion. [Disadvantage] • The toll systems currently being used on the Skyway, SLE and NLE will need to be reconfigured or replaced, requiring a higher pricing system to be implemented to guarantee that the expressway operator will be able to maintain their current level of earnings. • Many problems must be addressed while creating the network such as the method of determining, collecting and allotting tolls.

The above comparisons would suggest that the independent toll system would be the better option for the Metro Manila expressway network, provided that the toll collection problem can be overcome, which centers on whether or not the traffic volume of each expressway section can be accurately obtained to allow for a fair clearing of collected tolls.

This problem can be solved fairly easily through the introduction of ETC. Points of entry and exit of a particular car can be easily recorded when using ETC. Information on which roads are used can also be accurately obtained by installing roadside equipment at the boundaries of sections operated.

Even non-ETC-equipped vehicles can use magnetic cards or other such devices so that information on expressway sections can be easily obtained. However, for magnetic cards to identify which particular routes are taken, cars would have to stop at booths set up at the boundaries of expressway sections operated so that the exact route taken can be recorded onto the cards. Therefore, using magnetic cards cannot really solve this toll collection problem. However, this problem can be overcome by giving these cars ETC tags instead. In this case cars need not stop at tollbooths, just like the ETC-equipped vehicles, and information about cars in transit can also be obtained. When a non-ETC-equipped vehicle enters the expressway it will be given an ETC tag that it will then return when exiting the expressway. Here, the tolls will be based on the actual distances traveled according to the data recorded in the ETC tag. In this manner non-ETC-equipped vehicles will only need to stop when entering and exiting the expressways. Cars equipped with permanently attached ETC units can enter and exit the network without stopping. Moreover, the collected tolls can be accurately cleared to each expressway operator, regardless of the toll collection system used.

(2) System Concept

System Functions

For ETC to collect tolls accurately from individual moving vehicles, the basic functions described below have to be provided at entrances, exits and junctions of expressways belonging to different operators.

Entrance System

- Vehicle detection / Vehicle identification
- Transmission of data, such as vehicle identification data, to the central computer system

Junction System

- Vehicle detection / Vehicle identification
- Transmission of data, such as junction data, to the Tag
- Transmission of data, such as vehicle identification data and junction identification data, to the central computer system

Roadside Unit at the Exit

- Vehicle detection / Vehicle identification
- Receive the data, such as entrance information, running route information, from the Tag
- Calculation of the amount of toll
- Withdrawal of the amount of toll from the tag (ETC-equipped vehicle) or collection of toll from the driver (non-ETC-equipped vehicle)

Central Computer System

- Reception of vehicle identification data, entrance identification data, junction identification data, and exit identification data from the entrance, junction(s) and exit.
- To tally up the gathered data, to send the data to every concessionaire and government by real time, and to record the data.
- To calculate the amounts of toll revenue for each concessionaire based on the data and to take necessary procedure for fair toll clearance.

Tag (On-board unit)

- Storage of vehicle identification data
- Storage of prepaid or postpaid toll information
- Reception of request from the RSU
- Transmission of requested data to the RSU
- Rewriting of prepaid or postpaid stored toll information according to request from the RSU

Dedicated Short Range Communication Standard

DSRC is a communications system used between RSUs and tags. The ITU recommendations currently recognize 5.8GHz passive and 5.8GHz active systems as the two international standards. The 5.8GHz passive system uses waves in the 5.8GHz band for communications, and the tag has no transmitter. Radiation from the RSU is modulated and reflected to send a signal. Under the 5.8GHz active system, the same band is used as that for the passive system, but the tag has a transmitter and can send signals to the RSU. The systems have characteristics as described below due to the difference in their operating principles and development paths.

Table 3.15 Comparison of 5.8GHz Passive and Active DSRC

	5.8GHz Passive DSRC	5.8GHz Active DSRC
Transmission Seed	Mid→Limited expansibility	High→High expansibility
Wave Strength	Low→Mid reliability	High→High reliability
Interoperability Between Vendors	Being developed	Developed
Tag Price (Production Cost)	Low (approx. ₱1200 for a two-piece tag)	High (approx. ₱2400 for a two-piece tag)

The above differences in technical specifications mean that ETC as an isolated function can operate on the 5.8GHz passive system, but if applications, such as container management, will be added to the ETC system's functions in the future, the 5.8GHz active system is more appropriate.

The problem of compatibility between vendors is discussed in previous sections, but a project aiming to secure intervendor compatibility in 5.8GHz passive systems is now under way. The progress of this project will have to be watched closely to determine the future for DSRC.

There are also RSUs dubbed “hybrid” which are now under trial in Shanghai. They are able to deal simultaneously with tags of both 5.8GHz active and 5.8GHz passive systems. The use of hybrid RSUs leaves users free to choose the type of tag, and manufacturers are expected to diversify tag functions and develop more attractive tags at lower prices.

<u>**Standard Electronic Toll Collection System**</u>

To realize the above functions, ETC will have to incorporate the subsystems listed below.

Entrance System for ETC-equipped Vehicle

The entrance system for ETC-equipped vehicle comprises the vehicle detector, the RSU, the automated vehicle identification system (AVI) (including CCTV camera), and terminal computer.

At the entrance, the vehicle detector detects an approaching vehicle, then the RSU sends the tag a signal, requesting for vehicle identification data. The tag receives the signal and sends the data to the RSU. The AVI system refers to the data received by the RSU, together with the number plate captured by the CCTV camera. If the two do not match, the AVI judges the vehicle to be fraudulent and blocks its entry. If the data and the number plate match, the information on what vehicle entered which entrance at what time is transmitted to the tag, and the tag stores the information in its memory. The entrance system simultaneously transmits the same information to the central computer.

Entrance System for Non-ETC-equipped Vehicle

The entrance system for non-ETC-equipped vehicles comprises the vehicle detector, RSU, Automated Vehicle Classification system (AVC), AVI (including CCTV camera), terminal computer, and a tag writer.

At the entrance, the vehicle detector detects an approaching vehicle, then the AVC classifies the vehicle type while the AVI reads the number plate. The tag writer immediately writes the number read from the number plate to the loaned tag, together with the vehicle type, entry time and entrance used. The entering vehicle stops briefly at the entrance and the loan tag, which has previously been recorded with the vehicle number, entry time and entrance used, is passed on to the driver. At the same time, the entrance system sends these information to the central computer system.

Junction System

The junction system comprises the vehicle detector, RSU and terminal computer. The vehicle detector detects an approaching vehicle, then the RSU sends the signal, requesting for vehicle identification data, junction data and time data from the tag. The tag then sends vehicle identification data in response to the request and records the junction data and time data. The junction system simultaneously sends the information on what vehicle passes which junction at what time to the central computer.

Exit System

The exit system comprises the vehicle detector, RSU and terminal computer. It detects the approach of a vehicle and its RSU requests the tag to send vehicle identification data, entrance data and running route data. The tag sends the requested data to the RSU. The RSU forwards the data received from the tag to the terminal computer and in turn receives toll data on the vehicle concerned. The RSU then instructs the tag to deduct the appropriate sum from the stored amount in the case of ETC-equipped vehicles. Booths for non-ETC-equipped vehicles display the toll to the driver, and the booth attendant collects payment in cash from the driver, as well as recovers the tag. Finally, the exit system sends toll collection related data, such as vehicle ID data, entrance and exit data, running route data, and time and amount of toll, to the central computer system.

Central Computer System

The central computer system consists of a server computer, memory equipment mainly. It has many functions, but the most important are as follows:

- To receive data from each entrance system, junction system and exit system;
- To tally the gathered data, send the data to every concessionaire and the Government in real time and record the data;
- To calculate the amounts of toll revenue for each concessionaire based on the data and adopt the necessary procedure for fair toll clearance; and,
- To analyze, verify and inspect data and take measures against errant vehicles.

Transmission System

ETC shares the transmission system with the traffic information system.

3.2.8 Cost Estimates

(1) Assumptions of Cost Estimates

<u>Phased Development Strategy</u>

The following development stages are assumed to estimate the cost of introducing TIS and ETC systems:

Stage 1: Existing Expressway + R10/C3/R9+R10/C5 (Case Study Section)

At this stage, the MMUEN is divided into the northern and southern parts. Drivers cannot select route alternatives yet. Therefore, an advanced TIS, such as graphic display panel, is not yet needed. However, a simple TIS, such as VMS at toll plazas, should already be available at this stage.

In terms of toll collection, if both entrance and exit are identified, toll is fixed. There is no need to identify the route a driver takes. Hence, a tag lending system is not necessary; the ordinary ETC is sufficient.

However, there is a need to establish at this stage the foundation for an integrated O&M organization and unified systems to prepare for the future development and operation of a large-scale expressway network.

Stage 2: Existing Expressway + R10/C3/R9 + Skyway3

At this stage, the northern and southern parts are connected. However, drivers still do not have alternative routes to choose from. Therefore, neither an advanced TIS nor a tag lending system is necessary.

Traffic volumes on all completed sections are expected to exceed 30,000 vehicles per day, requiring VMS at toll plazas and junctions to provide more detailed traffic information.

Stage 3: Existing Expressway + Group A Section (expected to be completed in 2010)

Drivers still cannot choose alternative routes even at this stage. The same system as that available in Stage 2 is installed on newly completed sections.

Stage 4: Whole Network Except for Unsolicited Section (Pasex & MBE)

At this stage, most of the expressway sections are completed and drivers can select alternative routes. Therefore, traffic information should be provided through a graphic display panel installed at main junctions. Since traffic volumes on peripheral sections, such as Skyway 4 and C6 south, are smaller than those on central sections, they should have a simple TIS.

In terms of ETC, the introduction of a tag lending system to trace and identify the route taken is necessary for exact toll calculation, collection and clearing.

Stage 5: Whole Network

The same system as that available in Stage 4 is installed on newly developed sections.

Figure 3.13 Development Stages of the MMUEN

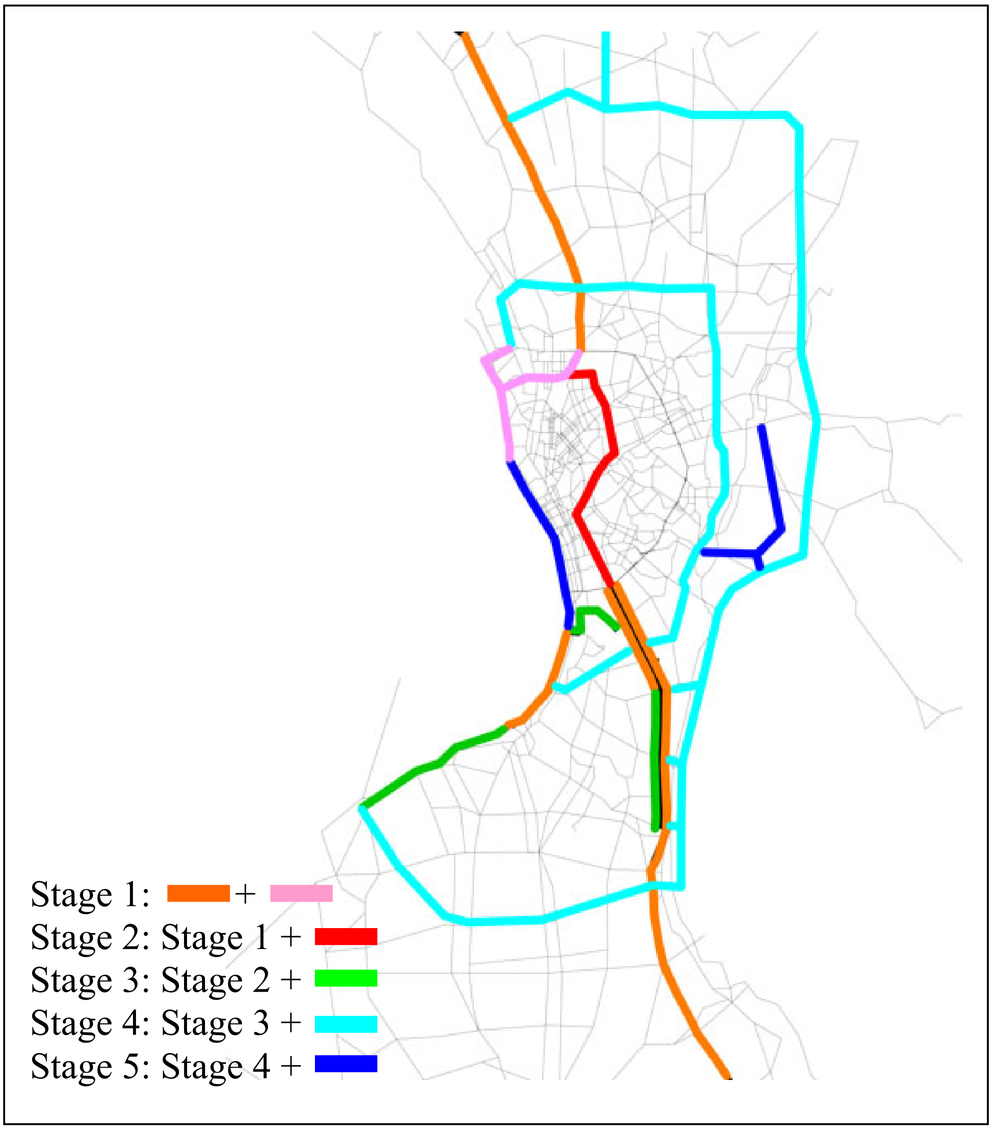
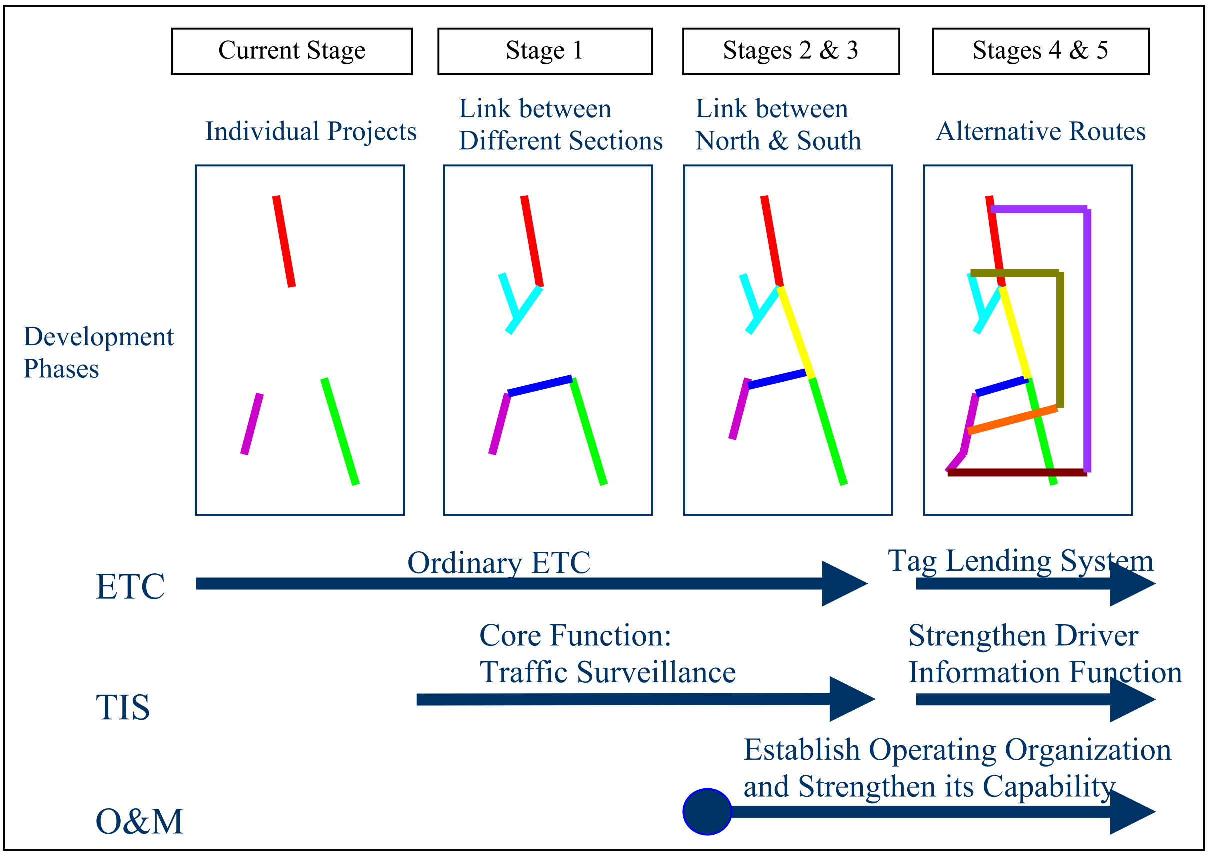


Figure 3.14 Phased Development Strategy



Level of Equipment

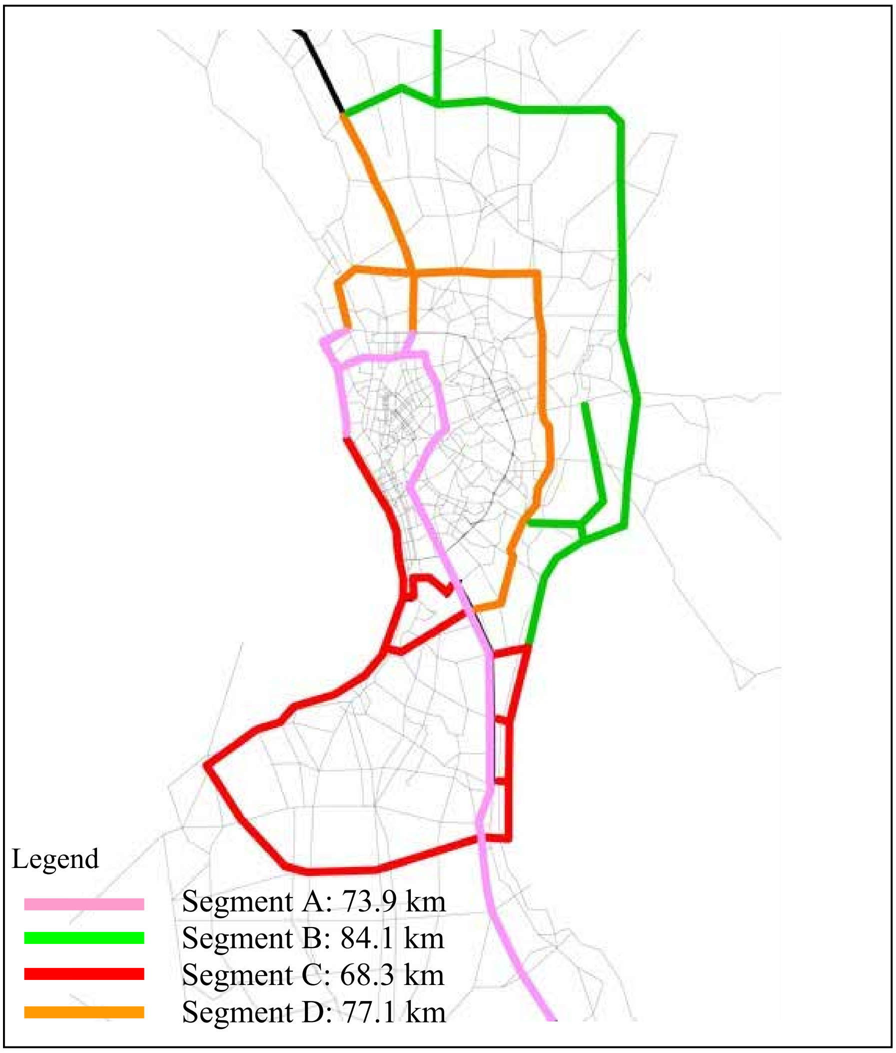
The assumptions of the required equipment size used to estimate costs are as follows:

TIS

Central Computer System: 1
Number of Maintenance Office: 4 (To carry out monitoring)
Field Equipment

	Segment A	Segment B	Segment C	Segment D
Vehicle Detector	At every section between junctions, at every junction and at every ramp	At every section between junctions, at every junction and at every ramp	At every section between junctions, at every junction and at every ramp	At every section between junctions, at every junction and at every ramp
CCTV Camera	At every junction	At every junction	At every junction	At every junction
VMS on Main Line	Before every junction and off-ramp	Before every junction and off-ramp	Before every junction and off-ramp	Before every junction and off-ramp
VMS at Ramp	At every on-ramp	At every on-ramp	At every on-ramp	At every on-ramp
Graphic Display Panel	3 sets	None	1 set	1 set
Emergency Telephone	Every 500m	Every 500m	Every 500m	Every 500m
Highway Radio	3 sets	None	1 set	1 set

Figure 3.15 Assumption of Segmentation



ETC

Center System: 1
Entrance System: 1 system at every on-ramp (average 1.5 lanes per ramp)
Exit System: 1 system at every off-ramp (average 1.5 lanes per ramp)
Junction System: 1 system at every junction (1 system includes 3 gantries)

(2) Cost Estimates

Initial Investment

- Table 3.16 shows that investment in TIS/ETC systems increases in proportion to the network's scale. Stage 1 will needs approximately ₱3.3 billion and Stage 5 approximately ₱11.8 billion.
- Table 3.17 shows that investment in the systems excluding those on existing sections amount to ₱1.8 billion in Stage 1 (or approximately

11.2% of the total project cost of Stage 1) and ₱ 11 billion in Stage 5 (or approximately 4.4% of the total project cost of Stage 5).

- Table 3.18 shows the share of the estimated costs of the TIS/ETC system to total investment cost (including ROW); toll revenue in 2010, 2015 and 2020; and total revenue for 30 years from 2010 to 2040. Comparing the systems' cost with toll revenue from 2010 to 2040, it accounts for only 1.1% of toll revenue for 30 years.

Table 3.16 TIS/ ETC Cost Estimates

	Length (km)	No. of Junction	No. of Ramps	ETC Cost (₱ mil)	TIS Cost (₱ mil)	Cost of Communication System and Cable (₱ mil)	Total (₱ mil)
Stage 1	73.9	1	50	1,138	1,376	774	3,287
Stage 2	99.8	1	80	1,610	1,782	1,047	4,438
Stage 3	124.6	13	105	2,121	1,624	826	4,571
Stage 4	278.7	16	198	5,710	2,765	2,233	10,708
Stage 5	303.4	19	230	6,335	2,989	2,464	11,788

Table 3.17 TIS/ ETC Cost Estimates (excl. cost for existing sections)

	Length (km)	No. of Junction	No. of Ramps	ETC Cost (₱ mil)	TIS Cost (₱ mil)	Cost of Communication System and Cable (₱ mil)	Total (₱ mil)
Stage 1	16.6	1	13	555	987	266	1,808
Stage 2	42.5	1	43	1,027	1,390	557	2,973
Stage 3	68.6	13	71	1,538	1,624	826	4,034
Stage 4	221.4	16	161	4,806	2,765	2,233	9,923
Stage 5	246.1	19	193	5,430	2,989	2,464	11,051

Table 3.18 Percentage of TIS/ETC Cost to Total Investment Cost and Toll Revenue

	% Cost/1	Revenue			
		2010	2015	2020	2010-2040
Stage 1	11.22	232.66	119.96	103.06	3.13
Stage 2	6.70	232.65	102.03	76.02	1.80
Stage 3	5.30	142.34	63.26	50.53	1.17
Stage 4	5.47	106.96	55.97	45.28	1.17
Stage 5	4.41	102.40	54.40	43.10	1.07

/1 % cost = share of estimated TIS/ETC cost to total investment cost (including ROW)

3.3 Organization and Cost of Expressway Operation & Maintenance

3.3.1 Organizational Framework

Over the prospective Metro Manila Urban Expressway Network to be developed on a public-private-partnership scheme, it is programmed that multiple concessionaires, ultimately around ten in number, will take part and consequently operate and maintain respective sections of the network.

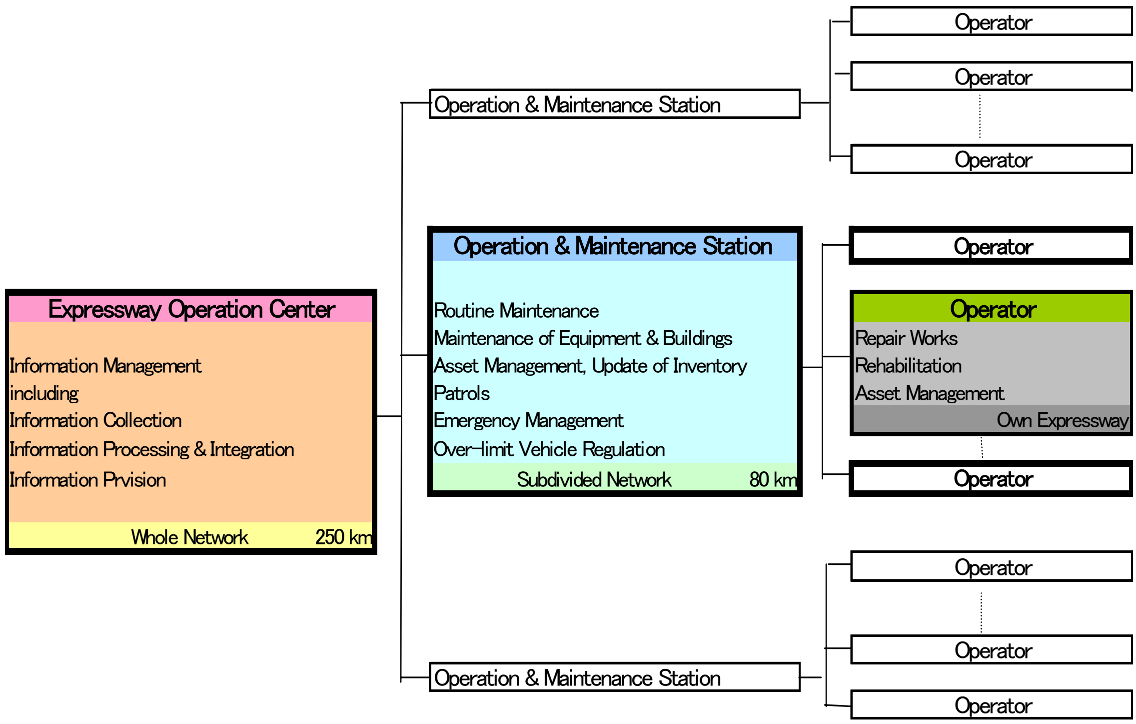
However, it is unusual and unrealistic to assume that as many different entities as ten will independently operate and maintain the different portions of a single network in Metro Manila with a total length of about 300 kilometers.

For operational efficiency and convenience to motorists, an organizational framework is therefore proposed, based on the following principles:

- Day-to-day activities will be undertaken by a central unit set up jointly by all concessionaires concerned ensuring uniform standards and centralization of knowledge and expertise as well as cost savings through resource sharing.
- Activities to be implemented routinely or periodically, or those to be swiftly carried out on site at any time, will be undertaken by a certain number of integrated stations, each of which will be set up by a few connected or adjacent concessionaires. The station will be responsible for all sections of the member concessionaires.
- Activities based on a long- or medium-term program, or those requiring major capital expenditure, will be undertaken independently by each concessionaire.

Thus, a three-layer hierarchical structure, consisting of the Expressway Operations Center, O&M stations and each operator, will be constituted for operation and maintenance of the Metro Manila Urban Expressway Network (see Figure 3.16).

Figure 3.16 Organizational Framework for Operation and Maintenance



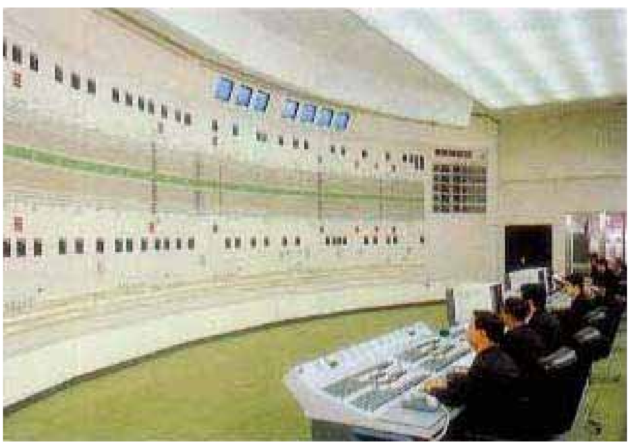
(1) Implementation of Operation and Maintenance

At each level of the three-layer structure, the organized work entities will be in charge of operation and maintenance tasks as follows:

1) Expressway Operations Center will be responsible for:

- Asset management, supplemental task for updating the inventory.
- Information management including collection, processing and integration, and provision of information for the whole network with an ultimate total length of about 250 kilometers.

Figure 3.17 An Image of the Expressway Operation Center



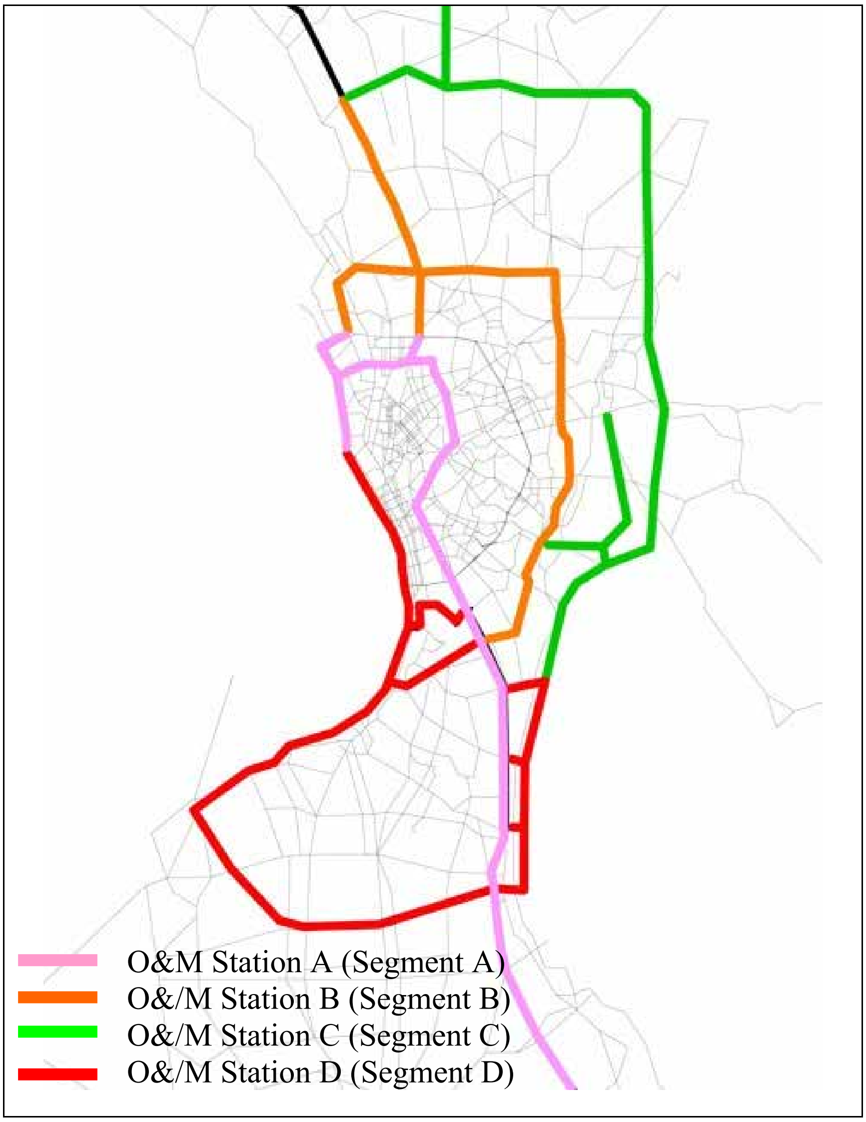
2) Each O&M Station will be responsible for:
   - Routine maintenance,
   - Maintenance of equipment and buildings,
   - Patrols,
   - Over-limit vehicle regulation, and
   - Emergency management

   The scope of an O&M station will be a section of the expressway network with an average length of 80 kilometers, if the whole network is assumed to be divided into three as shown in Figure 3.18.

3) Each Operator will be responsible for its own expressway segment and will undertake the following activities:
   - Asset management,
   - Repair works, and
   - Rehabilitation

These tasks are usually contracted out. It should be noted that this three-layer structure is adopted virtually for efficiency of operation and maintenance activities as a whole and convenience to the motorists. Therefore, all information on the present conditions and circumstances of the expressway, gained from day-to-day activities by the O&M Station and the Expressway Operations Center, must always be provided without delay and understood by each operator, which as provided for in the concession agreement, is the operator's primary responsibility.

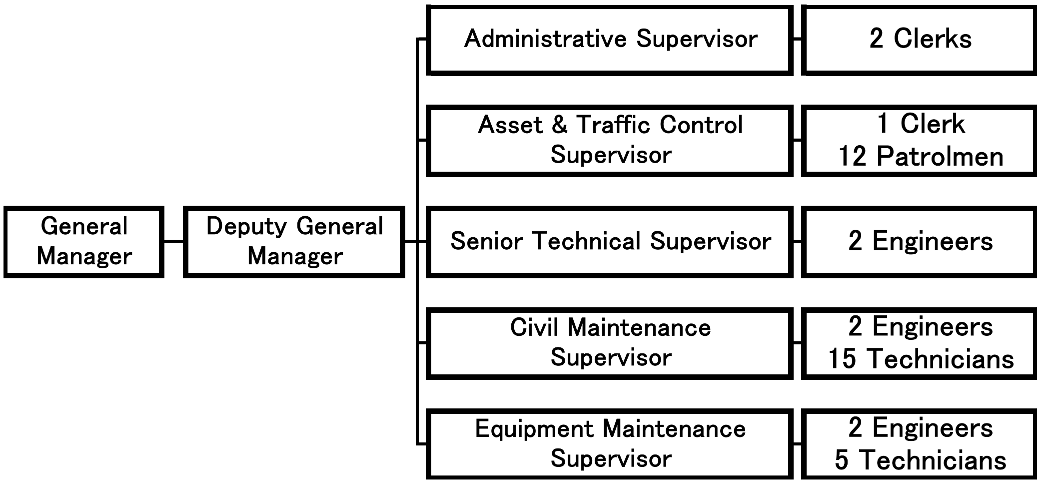
Figure 3.18 An Example of the Subdivided Network for O&M Stations



(2) Typical Composition of the Operation and Maintenance Station

An O&M Station which is responsible for a portion of the network, covering several concessionaires and averaging about 80 kilometers in length, will have a typical staff organization as shown in Figure 3.19.

Figure 3.19 Typical Staff Composition of an Operation and Maintenance Station



Typical machinery and equipment needed for daily activities of an O&M station are listed in Table 3.19.

Table 3.19 List of Typical Machinery for an Operation and Maintenance Station

Item	Designation	Equipment	Quantity
Car	General	Wireless phone	2
Patrol car	Emergency/Patrol/Inspection	Wireless phone	4
Brush-type sweeper	Cleaning	Wireless phone	1
Vacuum-type sweeper	Cleaning	Wireless phone	1
Water sprinkler	Cleaning/Vegetation	Wireless phone	1
High-pressure washer	Cleaning	Wireless phone	1
High-crane lifter	Cleaning/Maintenance	Wireless phone	1
Maintenance truck	Maintenance/Traffic regulation	Wireless phone/Sign	3
Movable signboard vehicle	Traffic regulation	Wireless phone/Sign	4
Tractor shovel	Maintenance	Wireless phone	1
Trimmer	Vegetation		10
Chemicals spray	Vegetation		10
Chain saw	Vegetation		5
Mower	Vegetation		5
Temporary sign	Traffic regulation		A set
Rubber cone	Traffic regulation		A set
Guide arrow	Traffic regulation		A set

The O&M station should be located in a place immediately adjacent to one of its responsible expressways and have a land area of around 20,000 sqm to accommodate an office building, warehouses, garages, and a yard with parking space.

The Expressway Operations Center, which is operational round the clock, must be manned in shifts by teams consisting of a supervisor and several operators. The required staff will be composed of a general manager, five supervisors, 15 operators, and two administrative clerks.

Besides these two jointly operated organizations, each concessionaire has its own staff who will carry out daily toll collection and periodic repair works and rehabilitation of the expressway.

3.3.2 Standardized Cost Estimate For Expressway Operation and Maintenance

(1) General

The unit costs for operation and maintenance of the Metro Manila expressways are estimated (see Table 3.20), based on the unit costs at present time per kilometer per annum for maintenance and per capita per annum for operation of the expressway. Annual costs are estimated for routine maintenance and operation of the Expressway Operations Center, an O&M station and a toll plaza.

Operators can estimate their annual routine costs by applying these unit costs. However, the actual cost would be dependent on several other factors such as length of their expressway section, number of toll plazas and traffic volumes to pass through the tollgates, and these factors are incorporated as much as possible.

In addition, operators will separately bear the costs for repair works and rehabilitation of their expressways, which are fundamentally subject to their respective programs and business management. As an overall average, however, such periodic expenditure will be standardized as an average annual cost.

(2) Standardized Cost Estimates

Principal unit costs at 2002 price per kilometer per annum for most of the expressway routine maintenance activities and some repair/rehabilitation works are determined in reference to figures derived from practice in Japan. The costs of all unspecified activities are assumed to be covered by relevant activity items.

Similarly, costs per capita per annum for expressway operation and maintenance are based on present prevailing wage levels in the Philippines.

Table 3.20 Unit Costs Estimated for O&M of MMUEN

1) Routine Maintenance

(2002 ₱)

	Unit Cost Million Peso per Kilometer per Annum (2002 ₱)	Remarks
Cleaning	1.45	>4 lanes
Earthwork Maintenance	2.71 3.33	4 lanes 6 lanes
Bridge Maintenance	1.96 2.82	4 lanes 6 lanes
Tunnel Maintenance	10.55 per tube 16.04 per tube	without ventilation with ventilation
Lighting	1.18	4-6 lanes
Snow/Ice Control	3.06 11.7	4 lanes 6 lanes
Indirect Cost	10% of the above subtotal	

2) Repair/Rehabilitation

(2002 ₱)

	Unit Cost Million Peso per Kilometer	Remarks
Steel Bridge Repainting	136, every 5-10 years 196, every 5-10 years	4 lanes 6 lanes
Pavement Overlay	14.5, every 8-15 years 22.0, every 8-15 years	4 lanes 6 lanes

3) O&M Station

(2002 ₱)

		Unit Cost Peso per Capita per Annum	Quantity	Cost Thousand Peso per Annum
Personnel	General Manager	480,000	1	480
	Dep. Gen. Manager	360,000	1	360
	Supervisor	240,000	5	1,200
	Clerk	156,000	3	468
	Engineer	200,000	6	1,200
	Technician	180,000	20	3,600
	Patrolman	180,000	12	2,160
	Secretary	144,000	3	432
	Janitor	66,000	2	132
	Subtotal		53	10,032
Supply, Utility, Housing, Machinery, etc.		40,000	53	2,120
Total				**12,152**

4) Expressway Operations Center

(2002 ₱)

		Unit Cost Peso per Capita per Annum	Quantity	Cost Thousand Peso per Annum
Personnel	General Manager	480,000	1	480
	Supervisor	240,000	5	1,200
	Operator	180,000	15	2,700
	Clerk	156,000	2	312
	Secretary	144,000	1	144
	Janitor	66,000	1	66
	Subtotal		25	4,902
Supply, Utility, Housing, Machinery, etc.		20,000	25	500
Communication System Maintenance 10% of Personnel Cost		4,902,000 x 0.10		490
Total				**5,892**

5) Toll Plaza

(2002 ₱)

		Unit Cost Peso per Capita per Annum	Quantity	Cost Thousand Peso per Annum
Personnel	General Manager	290,000	1	290
	Deputy General Manager	240,000	1	240
	Toll Attendant	162,000	N*	162N
Supply, Utility, Housing, Machinery, etc.		15,000	N	15N
Toll Collection Machine Maintenance 10% of Personnel Cost		0.1 x (290+240+177N) x 1,000		53 + 17.7N
Total				**583 + 194.7N**

* Empirical equation for the required total number of toll attendants, N, at a toll plaza: N = 0.18V + 13, where V is the daily traffic volume in thousand vehicles to be handled at the toll plaza

6) General Expenses: 25 % of the above subtotal

3.3.3 Cost Estimates for the Operation and Maintenance of the MMUEN

(1) Assumptions

The O&M cost was estimated based on the assumptions listed in Table 3.21. Other assumptions are: average daily traffic volume at each toll plaza is 57.2 thousand vehicles and the number of O&M stations is four.

Table 3.21 Assumptions of Operation and Maintenance Cost Estimates

	Distance	No. of IC	Number of Ramps			No. of Junction	No. of Lanes	Type of Structure
SLE	41.9	6	10	10	20	1	6	At-grade
MCTE	6.3	3	4	4	8	3	4	At-grade
Skyway1	9.1	5	5	4	9	3	6	Elevated
MCTE-ext	12.0	4	6	6	12	2	4	At-grade
MNT r/w	12.9	4	6	6	12	0	6	At-grade
NAIA Exp	4.2	4	4	4	8	3	4 & 6	Elevated
Skyway 2	9.9	3	4	4	8	3	4 & 6	Elevated
S2kyway 3	13.0	5	9	9	18	2	6	Elevated
R10/C3/R9	16.6	6	7	6	13	3	4	Elevated
MCTE-C5	6.9	2	2	2	4	1	6	At-grade
MNT C5	20.0	7	10	10	20	3	6	At-grade
LBCR	18.6	2	2	2	4	5	4	At-grade
MBE	11.1	5	10	10	20	1	6	Underground
C5 Exp	16.5	4	8	8	16	1	4	Elevated
Skyway 4	59.5	7	14	14	28	4	4	At-grade
C6 South	20.3	5	9	9	18	1	4	At-grade
NLE East	11.0	0	0	0	0	1	4	At-grade
Pasex	13.6	4	6	6	12	1	6	At-grade
Total	**303.4**	**76**	**116**	**114**	**230**	**net 19**	**-**	**-**

(2) Results

The estimated O&M cost of the entire network is ₱35 billion, or approximately 14% of the annual toll revenue in 2020.

Table 3.22 Estimated O&M Cost

Million Peso/Year

Items	Cost
Routine Maintenance	1,980
Repair Works/Rehabilitation	580
O&M Stations Running	49
Operation Center Running	6
Toll Plazas Running	923
Total	**3,538**