REPUBLIC OF THE PHILIPPINES

Preparatory Survey
on
PPP Project for Development of a connector road
in
Manila

FINAL REPORT
(JR)

October 2011

JAPAN INTERNATIONAL COOPERATION AGENCY

OPS
JR（先）
11-011

REPUBLIC OF THE PHILIPPINES

Preparatory Survey
on
PPP Project for Development of a connector road
in
Manila

FINAL REPORT
(JR)

October 2011

JAPAN INTERNATIONAL COOPERATION AGENCY

ABBREVIATION (1/3)

AASHTO	American Association of State Highway and Transportation Office
ADB	Asian Development Bank
ASTM	American Society for Testing and Materials
AVI	Automatic Vehicle Identification
BCDA	Base Conversion Development Authority
BIR	Bureau of Internal Revenue
BOT	Build-Operate-Transfer
BPO	Business Processing Outsourcing
CCTV	Closed-Circuit Television
CDCP	Construction Development Corporation of the Philippines
CTMS	Central Traffic Control System
DBM	Department of Budget and Management
DBP	Development Bank of the Philippines
DED	Detailed Engineering Design
DENR	Department of Environment and Natural Resources
DFS	Detailed Feasibility Study
DOF	Department of Finance
DPWH	Department of Public Works and Highways
DSCR	Debt Service Coverage Ratio
ECB	Emergency Call Box
ECC	Environmental Compliance Certificate
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EIS	Environmental Impact Statement
EMB	Environmental Management Bureau
EO	Executive Order
EMP	Environment Management Plan
ETC	Electronic Toll Collection
FACE	JBIC Facility for Asia Cooperation and Environment
FIRR	Financial Internal Rate of Return
FOB	Free on Board
FOE	Fixed Operational Equipment
FWD	Falling Weight Deflection Meter
GDP	Gross Domestic Product
GFI	Government Financial Institutions
GOP	Government of The Philippines
HCP	Hollow Core Plank
HGC	Home Guarantee Corporation
ISO	International Organization for Standardization
ITS	Intelligent Transport Systems
JBIC	Japan Bank International Cooperation
JETRO	Japan International Cooperation Agency

ABBREVIATION (2/3)

JICA	Japan International Cooperation Agency
KOICA	Korean International Cooperation Agency
LCC	Life Cycle Cost
LRT	Light Rail Transit System (Manila)
METI	Ministry of Economy, Trade and Industry
MNTC	Manila North Tollways Corporation
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MPIC	Metro Pacific Investment Corporation
MPTC	Metro Pacific Tollways Corporation
MRT	Metro Rail Transit System (Manila)
NEDA	National Economic Development Authority
NEPC	National Environmental Protection Council
NLEX	North Luzon Expressway
NOE	Non-Operational Equipment
NPCC	National Pollution Control Commission
NPV	Net Present Value
O&M	Operation and Maintenance
OD	Origin-Destination
ODA	Official Development Assistance
OMA	Operation Management Agreement
PABX	Private Automatic Branch exchange
PC	Prestressed Concrete
PCU	Passenger Car Unit
PD	President Decree
PFI	Private Finance Initiative
PMO	Project Management Office
PNCC	Philippine National Construction Corporation
PNR	Philippines National Railroad
POS	Point of Sales
PPP	Public Private Partnership
PSSD	The Philippine Strategy for Sustainable Development
RAP	Resettlement Action Plan
RC	Reinforced Concrete
RIMS	Road Maintenance Information Management System
ROW	Right of Way
SCTEX	Subic-Clark-Tarlac Expressway
SFEX	The Subic Freeport Expressway
SLEX	South Luzon Expressway
SNC	Ernst & Young ShinNihon LLC
SPC	Special Purpose Company
STOA	Supplemental Toll Operation Agreement
STRADA	System for Traffic Demand Analysis

ABBREVIATION (3/3)

TCS	Traffic Control System
TDM	Traffic Demand Management
TOA	Toll Operation Agreement
TPCS	Toll Plaza Computer System
TRB	Toll Regulatory Board
TTC	Travel Time Cost
VCR	Vehicle Capacity Ratio
VICS	Vehicle Information and Communication System
VOC	Vehicle Operation Cost
UPS	Uninterruptible Power Supply
VMS	Variable Message Sign

Table of Contents

Chapter 1

Study Method

(1) Contents of Study

1. Background and Objectives of the Preparatory Survey

In many developing countries, it is widely seen that the infrastructure projects are developed by BOT/BTO/BT scheme, etc. in collaboration with the public finance. Consequently, it has become more important for JICA to consider facilitation of private investment in infrastructure in addition to its traditional assistance. Against this background, JICA has started a new Survey scheme as a part of the Preparatory Survey scheme. Under the new scheme, JICA intends to promote identification and preparation of PPP infrastructure projects that can be candidates for the Private Sector Investment Finance which can be extended to private entities using ODA fund. This preparatory survey would be prepared the feasibility study of a connector road which is the infrastructure project deployment (package infrastructure project deployment) in the Republic of the Philippines on condition of participation of Japanese companies.

2. Background and Objectives of the Project

In the Philippines, the North Luzon Expressway (NLEX) from Tarlac, Subic and Clark, north of Metro Manila has been constructed, while the construction of an extension to C3-Road, which leads to Manila Port, has been authorized. In the south of Metro Manila, the South Luzon Expressway (SLEX) from Batangas of the south part (not connected between Sto. Tomas and Calamba) and the Skyway to Makati, located in the central area of Metro Manila, have been constructed.

However, the physical distribution from an industrial complex at the south part of Manila to Manila Port is hindered by the fact that the section, approximately 13 km long between NLEX and SLEX, (or Skyway) has not been built. This unconnected section is a central part of Metro Manila and a densely populated area. There is heavy traffic for not only private cars and trucks for physical distribution in the central part of Metro Manila but they also cause environmental and economical damage.

In view of the said background, the construction of the Project is urgently required.

3. Scope of the Project

This project is to construct and implement O&M for the said unconnected section, approximately 13 km long between NLEX and SLEX, (or Skyway).

This elevated structure with four lanes above the right of way of the PNR and trunk road of Osmeña is planned and requires special attention to safety and efficient traffic control after the service begins through the completion of construction.

4. Survey Area

This project area includes the section, approximately 13.4 km long between NLEX and SLEX / Skyway.

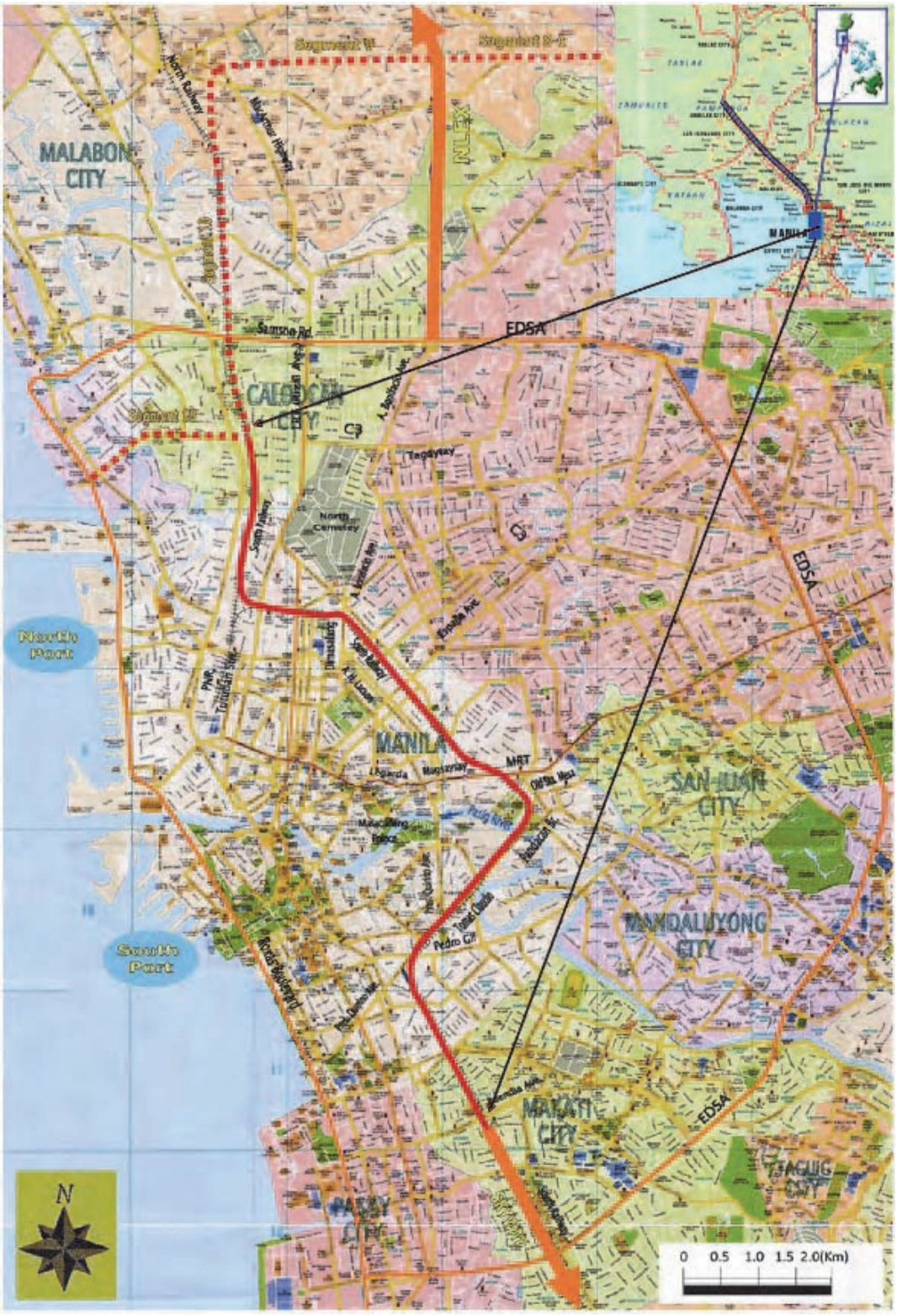


Figure 1-1 Location Map of the Project

5. Outline of the Project

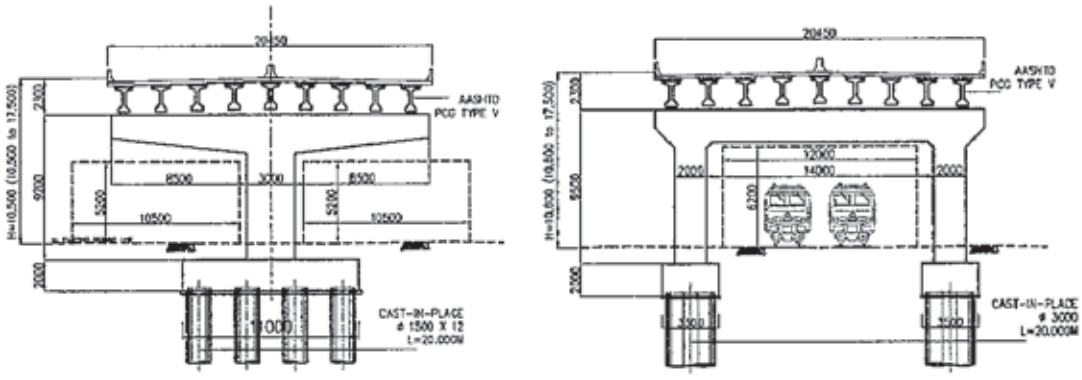
This is a Feasibility Study to make a basic plan for this unconnected expressway, approximately 13.5 km long, which is planned to be connected between NLEX and SLEX/Skyway.

The plan is to construct six (6) interchanges and rump way inclusive of two interchanges at starting and ending points in the project. This elevated structure with four lanes above the right of way of the PNR and trunk road of Osmeña is planned and requires special attention to safety and efficient traffic control after the service begins through the completion of construction. Finally, the feasibility of PPP for this project will be studied in this report.

Table 1-1 Location of Interchanges

Location		Interchange	Ramp way				Remarks
			North Bound		South Bound		
			ON	OFF	ON	OFF	
① Segment 10	(STA.5+000)	○	-	-	-	-	Starting Point
② C-3 Road	(STA.5+500)	-	◎	○	○	○	
③ España Blvd.	(STA.10+500)	-	◎	○	◎	○	
④ Pres. Quirino Ave.	(STA.15+300)	-	-	-	◎	-	
⑤ Osmeña Highway	(STA.17+200)	-	-	-	◎	-	
⑥ Skyway	(STA.18+857)	◎	-	-	-	-	Ending Point

○ : Interchange Ramp way ◎ : Toll Booth



Along the existing Road Along the PNR Line

Figure 1-2 Typical Cross Sections

6. Scope of the Preparatory Survey

The Preparatory Survey shall cover the following items:

(1) Preparation for implementing the preparatory survey

(2) Review and analysis of the result of information gathering and previous implemented survey

(3) Examination of the plan of connector roads and the outline of this plan

(4) Evaluation of environmental and social impacts

(5) Feasibility analysis of construction, operation and maintenance for connector roads and facilities.

The other related studies are as following:

(1) Pre-Feasibility Study

Study on Private-Initiative Infrastructure Projects in Developing Countries in FY2009

Study on PPP Project Development of the NLEX-SKYWAY/SLEX Connector Road in Metro Manila, Republic of the Philippines, March 2010, The Ministry of Economy, Trade and Industry (METI), JAPAN

(2) Other Related Information

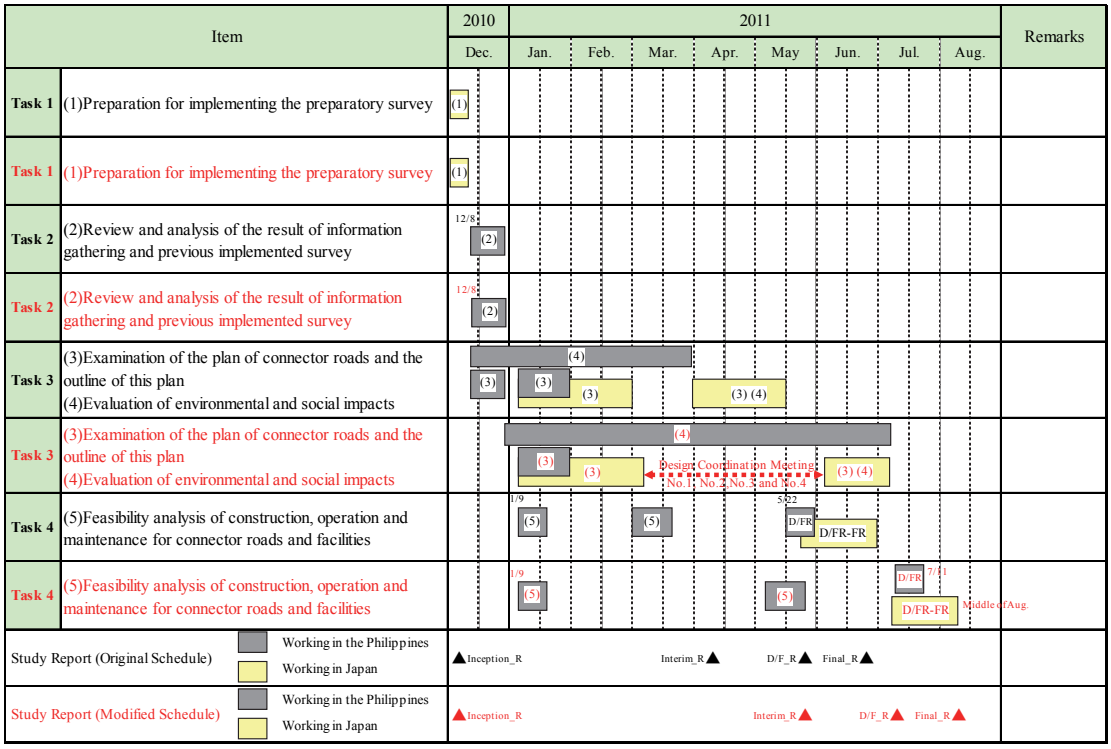
(Study Report) Technical Advisory Services for the Connector Road Project, April 2010, Metro Pacific Tollways Corporation (MPTC)

(2) Schedule of Study

1. Schedule of the Preparatory Survey

The study is carried out from December 7, 2010 to August 22, 2011 and study schedule including local investigation for each work assignment is shown in Table 1-2.

Table 1-2 Schedule of the Study



(3) Study Team

1. Survey Team (Assignment)

Table 1-3 Study Team

No.	Assignment	Name	Company
1	Team Leader	Masaaki GOTO	
2	Sub-Team Leader /Road Plan (1)	Takayuki TSUCHIDA	
3	Road Plan (2)	Jovito C. Santos	
4	Elevated Structure	Hidetoshi MIYAUCHI	
5	Structure Engineer (1)	Shunji YOSHIHARA	
6	Structure Engineer (2)	Shigeru KISO	
7	Structure Engineer (3)	Kunio AKIRA	
8	Construction Method (1) and Cost Estimate	Yoshito MAEDA	
9	Construction Method (2)	Akihide MORISHITA	
10	Construction Method (3)	Kenichiro ASHIZUKA	
11	Railway Plan	Nobuyoshi KAWAI	
12	Traffic Demand Forecast and Traffic Plan	Hisashi NOMIYAMA	
13	Environmental and Social Consideration	Kazuyoshi KAGEYAMA	
14	Present Condition Survey	Hiroshi KANEKO	
15	Land Acquisition and Resettlement	Annabelle N. Herrera	
16	Economic and Financial Analysis (1)	Yusaku TANAKA Yosuke YAMADA	
17	Economic and Financial Analysis (2)	Hiromichi MIYAKE	
18	Economic and Financial Analysis (3)	Kensuke NISHIDA	
19	Facility Engineer (1) -Electrical-	Masashi IWAMOTO	
20	Facility Engineer (2) -Architectural-	Yoshinori YAMAZAKI	
21	Operation and Maintenance (1)	Nobuhiko KITAMURA Yasushi TANIGUCHI	
22	Operation and Maintenance (2)	Hiroshi SHIMIZU	

Chapter 2

Country Brief and Sector Summary

(1) Philippine Economy

The Republic of the Philippines economy had experienced difficulty during the financial crisis in 1998 however made a remarkable recovery in 2002 where the growth of GDP has stabilizes between 4% and 5%. This can be attributed to the efforts made by the president Gloria Macapagal Arroyo administration in securing government expenditure through reforming taxing system and improving efficiency of tax collection. Taking into account the country's economic performance, the following were budget deficits were recorded: 146.4 billion pesos deficits in 2005(2.7% of GDP), 64.8 billion pesos deficits in 2006 (1.0% of GDP), 12.4 billion pesos in 2007 (0.1% of GDP) and 68.1 billion pesos in 2008 (0.9% of GDP). Balancing the budget was top priority of the Arroyo administration which was originally set for 2008; this target however was moved to 2010 after unfavorable economic climate such as souring price of crude oil and additional fiscal expenditure the past years. Further, the government intended to strengthen tax collections and new sin taxes which come from alcohol and tobacco.

An economic growth of 7.3% was registered in 2007 which was the highest growth in the last 31 years. This growth was primarily driven by the service sector although positive contributions from the agriculture and mining sector were observed. However growth rate in 2008 was limited to only 4.6% mainly due to the impact of the financial crisis while 2009 growth is expected to be around 2%.

Inflation rate in 2007 was in low level at 2.8% but was observed to advance rapidly at the beginning of 2008 which was attributed to the worldwide rising price of crude oil. As a result, price of rice was temporarily higher by 40% compared to the price in the previous year. Inflation rate in 2008 was recorded at 9.3% which brought considerable difficulty to the lives of citizens.

Regarding the public debt, in 2008 around 57% of 4.2 trillion pesos (approximately 89.0 billion US dollar, around 56.3% of GDP) debt is composed of foreign debt while the remaining 43% is external debt.

As for the amount gained from trade of semi-finished electronic products, in 2008, the total export is recorded at 49.0 billion USD (2.8% less than the previous year) of which 58.1% occupied by electronic equipment and 47% is occupied by semiconductor. In addition, of the 56.7 billion USD total import in 2008, 35.3% represents electronic equipments and 21.8%

composes of mineral resources. It should be noted that 2008 import decreases by 2.8% compared to the previous year while trade deficit in 2008 against the previous year has increased by 51.9% (7.6 billion USD).

Concerning trading partner (both import and export), the most important country is the United States, followed by Japan and recently, the volume of trades with China is also increasing. Values of export in 2008 are: 5.5 billion USD for China with 5.0 billion USD for Hong Kong, 8.2 billion USD for United States (16.7%), and 7.7 billion USD for Japan (15.7%). As a background, the industrial establishment that has established semiconductor as its main export has their personal computers assembled in China. Concerning import, 7.2 billion USD comes from the United States (12.7%), 6.6 billion USD from Japan (10.5%), 5.9 billion USD from Singapore (10.5%), and 5.0 billion USD from Saudi Arabia (8.9%).

The number of Philippines Overseas Workers is around 8.7 million in 2007 according to the Department of Foreign Affairs. Of these, around 2.8 million are in the United States, 2.0 million are in Middle East and the rest are scattered around the world (as of December 2007, Ministry of Foreign Affairs). But total remittances in 2008 were a record 16.4 billion USD, a rise of 4.5 percent from 2007. The remittance from the United States which occupies approximately half is expected to continue however impact of global economic downturn might have impact in the future like the 3,000 Filipino workers who have lost their jobs in Taiwan.

Direct Investment in 2007 is slightly higher than the previous year and registered at 2.9 billion USD. Among these, BPOs (Business Processing Outsourcing) like call center is among the recipient of noticeable amount of investment.

Basic economic indicators of the country are presented in Table 2-1.

(Source: Ministry of Foreign Affairs, 2009)

Table 2-1 Economic Indicators

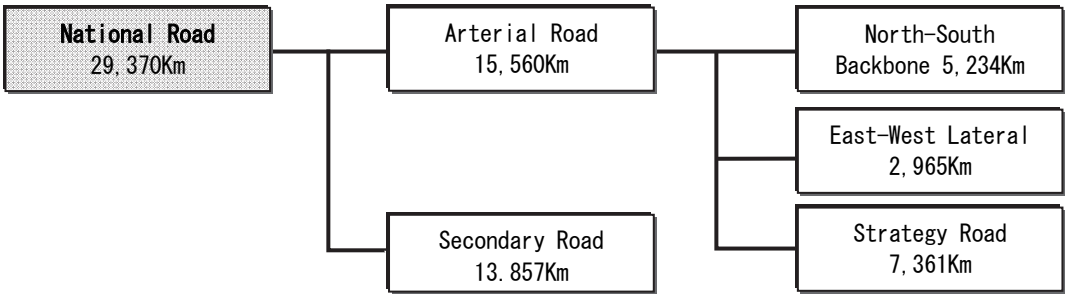
Item		2006	2007	2008
GDP	GDP Growth Rate (%)	5.3%	7.1%	3.8%
	GDP Total (Peso)	6.3 trillion	6.6trillion	7.4trillion
	Nominal GDP Total (USD)	117.5 billion	144.0 billion	166.9 billion
	GDP per person (Nominal)(USD)	1,351.8	1,626.5	1,866.0
Consumer price index	Rate of increase in consumer price index	6.2%	2.8%	9.3%
	Consumer price index	137.9 2000=100	141.8 2000=100	155.0 2000=100
	Jobless rate	8.00%	7.30%	7.40%
Industrials index number of production/Energy	Manufacture index number of production	147.4 2000=100	142.4 2000=100	148.8 2000=100
Balance of international payments	Balance of current account (Balance of international payments)－USD	5.4 billion	7.1 billion	4.2 billion
	Account balance (Balance of international payments)－USD	- 6.7 billion	- 8.3 billion	- 12.5 billion
	Foreign currency exchange reserves	20.2 billion	30.2 billion	33.1 billion
	Outstanding amount of external debt －USD	53.3 billion	54.9 billion	53.8 billion
	Currency exchange rates（Average rates、Against the dollar rate）(Peso)	51.3143	46.1484	44.4746
	Currency exchange rates（End-of-period rates、Against the dollar rate）(Peso)	49.1	41.4	47.5
	Budget deficit (Share of GDP)	1.07%	0.19%	0.92%
	The rates of increase of monetary aggregate	19.6% M2	5.4% M2	n.a. —
Balance of international payments	Export value (USD)	47.3 billion FOB	50.2 billion FOB	49.0 billion FOB
	The Value of shipment to Japan (USD)	7.8 billion FOB	7.3 billion FOB	7.7 billion FOB
	Import value (USD)	51.5 billion FOB	55.3 billion FOB	56.6 billion FOB
	The Value of import to Japan (USD)	7.0 billion FOB	6.7 billion FOB	6.6 billion FOB
	Accession value of direct equity investment (Peso)	165.9 billion	214.1 billion	182.7 billion
	Accession value of direct equity investment (USD)	3.2 billion Approval basis	4.6 billion Approval basis	4.2 billion Approval basis

Source: Department of Foreign Affairs (2009)
Note : GDP: Gross Domestic Product
FOB: Free on Board
JETRO: Japan External Trade Organization

(2) Project Background

1. Road Administration, Organization and Road Classification

The Department of Public Works and Highways (DPWH) is responsible for planning, design and maintenance of the national road in the Philippines. Local roads like provincial road, city road, and municipal road are administered by the provincial government, city government, and municipal government respectively. The length of national road is about 29,370 km which are classified in Figure 2-1.



Source: DPWH Atlas, 2008

Figure2-1 Classification of national highway

2. Present Road Condition

The DPWH have received several types of assistance both from the World Bank (WB) and Asian Development Bank (ADB) as support to government's effort to extend the highway network and maintain its condition. As shown in Table 2-2, the North-South Backbone's surface is almost all paved although considerable segments (24.5%) are still in bad condition. Compared to North-South Backbone, the East-West lateral still have substantial unpaved portions (32%)

Table 2-2 Road Condition

Road Class		Pavement Ratio	Road Condition				
			Good	Fair	Poor	Bad	No data
Arterial Road	N-S Backbone	95.9%	28.8%	28.4%	14.4%	24.5%	3.9%
	E-W Lateral	67.8%	21.4%	37.0%	17.5%	21.2%	2.9%
	Strategic Road	77.7%	23.3%	33.8%	18.2%	19.7%	5.0%
Secondary Road		59.8%	18.6%	34.6%	19.6%	17.8%	9.4%
Total		71.5%	21.9%	33.5%	18.1%	19.8%	6.7%

Source: DPWH-Atlas (2008)

3. Brief History of Toll Road in the Philippines

The first toll road in the Philippines was constructed in 1970's which is the South Luzon Expressway (SLEX). This highway opened to traffic in 1974 and toll fee collection was introduced in 1977. In 1980's-1990's, there was no significant development related to toll road in the country and it only became active again in the 2000's. Figure 2-2 shows express ways under operation, on going/committed and proposed road.

Currently, there are seven toll roads in the Philippines with a total length of 287 km. All of these roads are located in the mainland Luzon (Table 2-3).

Figure2-2 Proposed, On-going and Operational Expressways in the Philippines

Table 2-3 Toll Roads in the Philippines

Location	Toll Road Name	Section	Length (km)
①	North Luzon Expressway（NLEX）	Balintawak – Sta. Ines	84.0
⑯	South Luzon Expressway（SLEX）	Magallanes - Alabang	13.4
Southside of ⑯	- ditto -	Alabang - Calamba	28.5
㉔	Metro Manila Skyway（M.M.Skyway）	Buendia - Bicutan	9.4
Outside the Area	Subic – Tipo Expressway	Subic - Tipo	8.5
⑬	Manila – Cavite Expressway	Seaside Drive - Bacoor	6.6
Outside the Area	Southern Tagalog Arterial Road（STAR）	Sto. Tomas - Lipa	22.2
Outside the Area	- ditto -	Lipa – Batangas *	19.7
Outside the Area	Subic-Clark-Tarlac Expressway	Tipo, Subic, Lapus, Tarlac	94.7
Total			287.0

- Two lanes are in service; 4 lanes are under repair.

4. On-going/Planned Toll Roads

There are five routes planned as toll road currently under construction as shown in Table 2-4. In addition, there are a total of 14 routes proposed for construction as toll road which are mostly come from the private sector as unsolicited proposals. It should be noted that there are also routes proposed by the DWPH as shown in Table 2-5.

Table 2-4 Toll Roads under Construction/Planned

Location	Toll Road Name	Length (km)
Outside the Area	South Luzon Expressway Ext.（Calamba – Sto. Tomas）	7.8
⑭	North Luzon Expressway（C-5 Link）	3.5
②	North Luzon Expressway（Segment 8-10）	22.3
⑮	Manila – Cavite Extension	7.0
㉕	Metro Manila Skyway Phase-2	6.9
Outside the Area	Sto. Tomas - Batangas (Lipa – Batangas widening to 4 lanes)	19.7

Table 2-5 Planned Toll Roads by the DPWH

Location	Toll Road Name	Status
Outside the Area	Tarlac－La Union Expressway	Study conducted by the DPWH using local fund
⑳	CALA Expressway (Tollway)	FS is prepared already by JICA
㉙	NAIA Expressway	FS is prepared already by JICA
㉗	Metro Manila C6 Expressway	FS is prepared already by JETRO; KOICA is conducting full-scale FS

Note: JICA: Japan International Cooperation Agency
JETRO: Japan External Trade Organization
KOICA: Korean International Cooperation Agency

5. Entities Related to Toll Road Construction and Maintenance

Planning, construction, operation and maintenance of toll roads normally required involve several entities which are shown in Table 2-6.

Table 2-6 Entities related to Toll Road Construction, Operation and Maintenance

Item	Description
DPWH	Securing ODA assistance, execute plan, design and construction, awarding of franchise, maintenance of expressways.
Public Sector	BCDA：Subic – Clark – Tarlac (Yean Loan) PEA: Manila – Cavite (Fund comes from private sector) NDC：South Luzon Expressway (Fund comes from private sector)
Private Sector	PNCC, Manila North Tollway Corp.、South Luzon Tollway Corp., CITRA Metro Manila Tollway Corp.,UEM-MARA Philippines Corp.

6. Various PPP Schemes

Various PPP schemes that might be adopted in constructing toll roads in the Philippines are shown in Table 2-7.

Table 2-7 Various PPP Schemes adoptable in the Philippines

Option	Role of Public Sector	Role of Private Sector
Option 1 (BOT Method)	• R.O.W. acquisition	• Construction, operation and maintenance
Option 2 (Shadow Toll Method)	• R.O.W. acquisition • Subsidy for shortage in toll revenue	• Construction, operation and maintenance
Option 3 (Subsidy Method)	• R.O.W. acquisition • Sharing of construction cost	• Sharing of construction cost • Construction, operation and maintenance
Option 4 (Segment Dividing Method)	• R.O.W. acquisition for entire road section • Construction of a certain section	• Construction of remaining section • Operation and maintenance for entire section
Option 5 (Purchase Method)	• R.O.W. acquisition • Construction	• Purchasing after completion of the project • Operation and maintenance
Option 6 (O & M Method)	• R.O.W. acquisition • Construction	• Operation and maintenance

7. PPP Related Laws and Regulations

In 1990, Republic Act (RA) No. 6957, otherwise known as the BOT Law, authorized the financing, construction, operation and maintenance of infrastructure projects by the private sector. In 1994, RA No. 6957 was amended by RA No. 7718, which, among other things, allows more BOT variants, recognizes the need for private investors to realize rates of return reflecting market conditions, allows government support for BOT projects and allows unsolicited proposals. The Revised Implementing Rules and Regulations (Revised IRR) for the BOT Law, as amended, have been prescribed to cover all private sector infrastructure or development projects. Table 1-8 shows PPP related lows.

As mentioned, the concept of unsolicited proposals in BOT projects was introduced in Republic Act No. 7718 of 1994 and its Implementing Rules and Regulations (IRR). Two key government bodies are currently involved in managing unsolicited proposals in the Philippines. The BOT Center, as an attached unit to the Department of Trade and Industry, is mandated to provide project development assistance and monitoring functions in addition to marketing the BOT/PSP program to prospective investors, developers, and government agencies. In addition, the Investment Coordination Committee (ICC) of the National Economic and Development Authority (NEDA) Board is mandated to review and approve private sector projects under BOT schemes and its variants in the context of investment planning, financing, and monitoring of balance-of-payments implications of major national projects. Unsolicited proposals are first channeled through line ministries and local government units. Unsolicited proposals only reach central agencies such as the BOT Center and NEDA-ICC Secretariat if they are found to have sufficient merit to be sponsored.

Table 2-8 PPP Related Laws

Decrees/Orders Date	Main Subject	Outlines
PD No. 1112 31st March, 1977	Toll Operation Decree	• Authorized the establishment of toll facilities on public improvements, • Created the Toll Regulatory Board (TRB) with the following powers and duties - Enter into contracts for the construction, operation and maintenance of toll facilities. - Determine the kind, type and nature public improvements that can be constructed and operated as toll facilities. - Condemn private property for public use - Promulgate the rates of toll - Grant authority to operate a toll facility and issue "Toll Operation Certificate"
PD No. 1113 31st March, 1977	CDCP Franchise (North and South Luzon Toll Expressways)	• Granted the Construction and Development Corporation of the Philippines (CDCP) a franchise to operate, construct and maintain toll facilities in the North Luzon Toll Expressway (Balintawak-Rosales) and South LuzonToll expressway (Nichols-Lucena). • Franchise was for 30 years from May 1, 1977.
PD No. 1894 22nd December, 1983	Amendment of PNCC Franchise	• Amended the franchise of the Philippine National Construction Corporation (PNCC, formerly CDCP) • Included the Metro Manila Expressway to link the North and South Luzon Expressways. • Granted PNCC the right to construct, maintain and operate any and all such extensions, linkages or stretches. • Franchise shall have a term of 30 years from the date of completion of the project.
RA No. 6957 9th July, 1990	Implementation of Infrastructure Projects by the Private Sector (BOT Law)	• Authorized the financing, construction, operation and maintenance of Infrastructure projects by the private sector.
RA 7718 5th May, 1994	Amendment of BOT Law and its Implementing Rules and Regulations	• Amended RA No. 6957 by, among others, - Allowing more variants of BOT scheme - Recognizing the need of private investors for rates of return reflecting market conditions - Authorizing government support for BOT projects - Allowing unsolicited proposals
EO No. 380, 2004	- Transformation of the PEA - Transfer of assets and liabilities of the PEA	• Transforming the Public States Authority into the Philippine Reclamation Authority, • Transferring Its Non-Reclamation Assets And Liabilities to the Department of Finance • And Separating the from the PEA-Tollway Corporation For Purposes of Management
R A No. 7227 13th March, 1992	Bases Conversion and Development Authority (BCDA)	• Created the Bases Conversion and Development Authority to construct, own, lease, operate and maintain public utilities as well as infrastructure facilities to support the productive uses of the Clark and Subic Bay reservations.

Note:
PD: Presidential Decree
EO: Executive Order
CDCP: Construction Development Corporation of the Philippines
PNCC: Philippine National Construction Corporation
BOT: Built-Operate-Transfer

8. Role of DPWH in the Toll Road Development

The DPWH by virtue of Executive Order No. 124, dated January 30, 1987, is the primary engineering and construction arm of the government. It is responsible for the planning, design, construction and maintenance of infrastructures such as roads and bridges, flood control systems, water resource development projects and other public works in accordance with national objectives. In particular, the Planning Services, Project Management Office – Feasibility Study (PMO-FS), and Project Management Office – Built Operate Transfer (PMO-BOT) are the units with large involvement with toll road development. It should be noted that currently, capacity development and organizational strengthening are needed to these organizations to reinforce the staff's ability to perform their functions effectively.

9. Toll Fee System

The Metro Manila Skyway has adopted flat rate system while the rest have adopted distanced-based toll system. Table 2-9 shows the details of toll rate based on vehicle class. In addition, Skyway toll fee is higher than other highways, cheap prices for the South Luzon Expressway in parallel, and that traffic is currently low.

Table 2-9 Toll Rate System

	Class 1 (Cars, Motorcycle, SUVs, Jeepneys)*1	Class 2 (Buses, Light Trucks) *1	Class 3 (Heavy Trucks) *1	Traffic Volume (Veh/Day) *2
North Luzon Expressway (NLEX) L = 79.2km	2.20 pesos/km	5.49 pesos/km	6.59 pesos/km	54,010 San Simon – Bocaue
South Luzon Expressway (SLEX) L = 36.0km	0.56 pesos/km	1.12 pesos/km	1.68 pesos/km	95,378 Calamba – Manila
Sto. Tomas – Batangay Expressway L = 22.2km	0.73 pesos/km	1.68 pesos/km	2.59 pesos/km	9,181 Batangas – Tomas
Subic – Clark – Tarlac Exressway L = 90.7km	2.00 pesos/km	4.00 pesos/km	6.00 pesos/km	9,039 Porac – Florida Blanca
Metro Manila Skyway (Flat rate) L = 9.38km	85 pesos (9.1 pesos/km)	170 pesos (18.1 pesos/km)	255 pesos (27.2 pesos/km)	32,000*3

(*1) Toll Fee in 2009

(*2) Traffic Survey Result in 2009（HSH）

(*3) Average Daily Traffic Volume（April 2011、Citra reseach）

10. Issues on Toll Road Development

Current issues on toll road development in the Philippines are as follows:

- Government-related corporations or private companies are construction toll road although they are not road authority.
- Reasons on why DPWH is not proactive.
  - Lack of master plan with project prioritization
  - Limited capability of Planning Services
  - Private companies are recommending new road projects for the purpose of acquisition of right but they don't have enough funds to construct the road.
  - Delay of project implementation due to shortage of investment fund and shortage of procurement of private fund.
- Network of expressways is not formed because several private companies are interested only in profitable lines.
- There are many toll gates on each organization and payment has to be made differently due to lack of uniform system. This reduces the level of service of the expressway.
- Difficulty in controlling government-related corporations and private companies on toll road related activities due to inadequate capacity of the DPWH to manage or plan the whole toll road.

11. Summary of the local partner companies

The corporate profile of MPTC/MNTC which cooperates with Japanese 3-company is as follows.

11.1 MPTC (Metro Pacific Tollways Corporation)

Metro Pacific Tollways Corporation (MPTC) was incorporated on February 24, 1970 originally under the corporate name, City Resources Corporation (CRC), in the Philippine.
MPTC is a publicly listed infrastructure company focusing on developing toll roads in the Philippines through public-private partnerships. With the North Luzon Expressway and the Subic-Clark-Tarlac Expressway in its toll road portfolio, MPTC is currently the biggest toll road developer in the country with more than 800 lane-kilometers of toll roads under its management. In addition, it is assumed that MPTC becomes one of the financing companies to the SPC for this project.

The MPTC's market capitalization is approximately Php37,339 million (US$852 million) as at February 28, 2010. For the year ended December 31, 2010, revenues totaled Php5,858 million and net income attributable to equity holders of Php1,427 million.

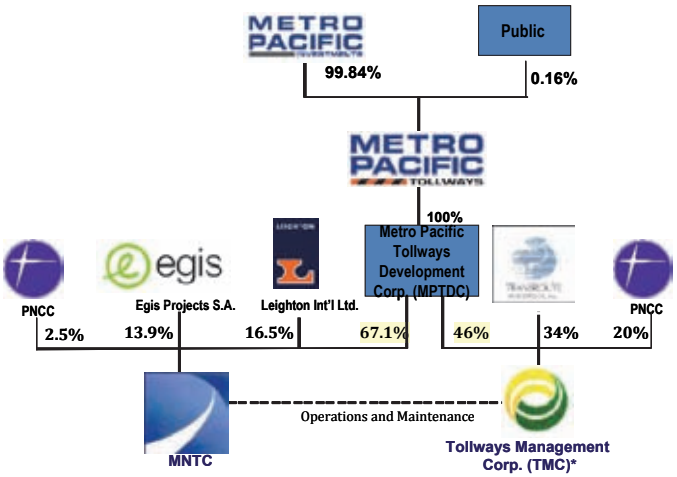


Figure2-3 Shareholding Structure of MPTC/MNTC

11.2 MNTC (Manila North Tollways Corporation)

Manila North Tollways Corporation (MNTC) was incorporated in the Philippines on February 4, 1997. It is 67.1% owned by MPTDC, 16.5% by Leighton International Ltd., 13.9% by Egis Projects SA and 2.5% by the Philippine National Construction Corporation (PNCC).
The MNTC's main Project is as follows:

✓Phase I
Rehabilitation and expansion of approximately 84 kilometers (km) of the existing NLEX and an 8.8-km stretch of a Greenfield expressway

✓Phase II
Construction of the northern parts of the 17-km circumferential road C-5 which connects the current C-5 expressway to the NLE and the 5.85-km road from McArthur to Letre

✓Phase III
Construction of the 57-km Subic arm of the NLEX to Subic Expressway

(Source: Annual Report for the year 2010 / Business and General Information of MPTC)

In this connection road project, MPTC has managed the whole project including the financial management scheme. On the other hand, MNTC and TMC have taken charge of the technical fields, such as a highway design, a facility design, a road highway management plan and O&M management.

(3) Present Condition of Project Area

Metro Manila is the political, economic, social, and cultural center of the Philippines. It is composed of 14 cities and 3 municipalities which include Manila City which is the designated capital. Manila City has an area of 636 sq. km. and has an estimated population of 11.6million (2007 census).

Socio-economic indicators of the country as well as of Metro Manila are shown in Table 2-10. Thirteen percent (13%) of the country's population is living in Metro Manila and the region contributes 37% to the GDP of the country.

The rapid rise of large-scale commercial areas (shopping malls), business centers, and high rise office buildings particularly in Manila City, Makati City and Pasig City generates considerable traffic that overwhelmed the transportation service.

Table 2-10 Socio-economic Indicators

	Population in 2007 (Million people)	Population growth rate-annual average(%) (2000-2007)	GPDP in 2007 (hundred-millions peso)	GRDP by industries (2007)			Economic growth rate 2003-2007 (Average rate of increase, %)			
				Primary	Secondary	Tertiary	Primary	Secondary	Tertiary	Total
Philippines	88.5 (100.0 %)	2.0	66,482 (100.0 %)	9,364 (100.0 %)	21,073 (100.0 %)	36,045 (100.0 %)	3.9	5.2	7.3	6.0
Metro Manila	11.6 (13.1 %)	2.1	24,789 (37.3 %)	-	7,500 (35.6 %)	17,289 (48.0 %)	-	6.0	8.6	7.7

Chapter 3

Traffic Demand Forecast

(1) Traffic Assignment

1. Outline

This Chapter focuses on the traffic demand forecast for the NLEX - SLEX Connector Road (NS Link) to project future traffic demand requirements to be used for the design of the facilities. This Study is based on the results of two previous studies of traffic demand forecast, as follows:

a; "STUDY ON PPP PROJECT DEVELOPMENT OF THE NLEX-SKYWAY/SLEX CONNECTOR ROAD IN METRO MANILA, REPUBLIC OF THE PHILIPPINES" (METI), which was done by Ministry of Economy, Trade and Industry in the year 2009

b; "THE STUDY OF MASTER PLAN ON HIGH STANDARD HIGHWAY NETWORK DEVELOPMENT IN THE REPUBLIC OF THE PHILIPPINES" (HSH), which was done by JICA in April 2009.

2. Provision of Traffic Assignment

2.1 Flow Diagram of Traffic assignment

As illustrated in the Traffic Assignment flow diagram of Figure 3-1, the Study first considered and utilized the data and results of the METI Survey including the present OD Table, the future OD Table and the road network. Then the data sheet of traffic assignment was prepared under this Study considering the future plan. Traffic assignments between the case of with NS Link and without NS Link are then compared.

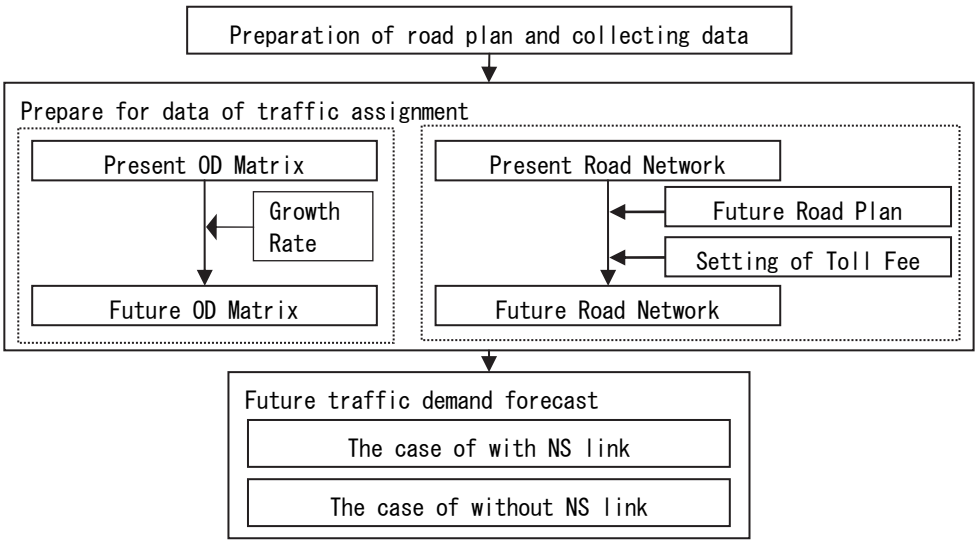


Figure 3-1 Flow diagram of Traffic assignment

2.2 Method of Traffic Demand Forecast

The traffic demand forecast is conducted in four (4)-step procedure which includes Generation and Attraction, Distribution, Modal Split and Traffic Assignment, as shown in Figure 3-2.

i) Projection of traffic generation volume and traffic attraction volume

The traffic volume generated by each zone is assumed using zonal population and zonal logistics volume in the socio-economic framework. The traffic attraction volume is assumed using model formula.

ii) Projection of traffic distribution volume

The projected traffic volume as a first step is divided into traffic volume between zones. A model formula is used to assume volume distribution which uses the traffic generation volume, the traffic attraction volume and the shortest trip length between zones.

iii) Projection of modal split traffic volume

The assumed traffic volume between zones of the second step is divided into modal split. Modal split of passenger transport is assumed from the usage rate in each trip length. Modal split of logistics transport is assumed using the average carrying capacity.

iv) Projection of traffic assignment volume

The assignment volume is projected using assumed OD table of the third step, the present road network, the future road network, the time value, and the toll rate.

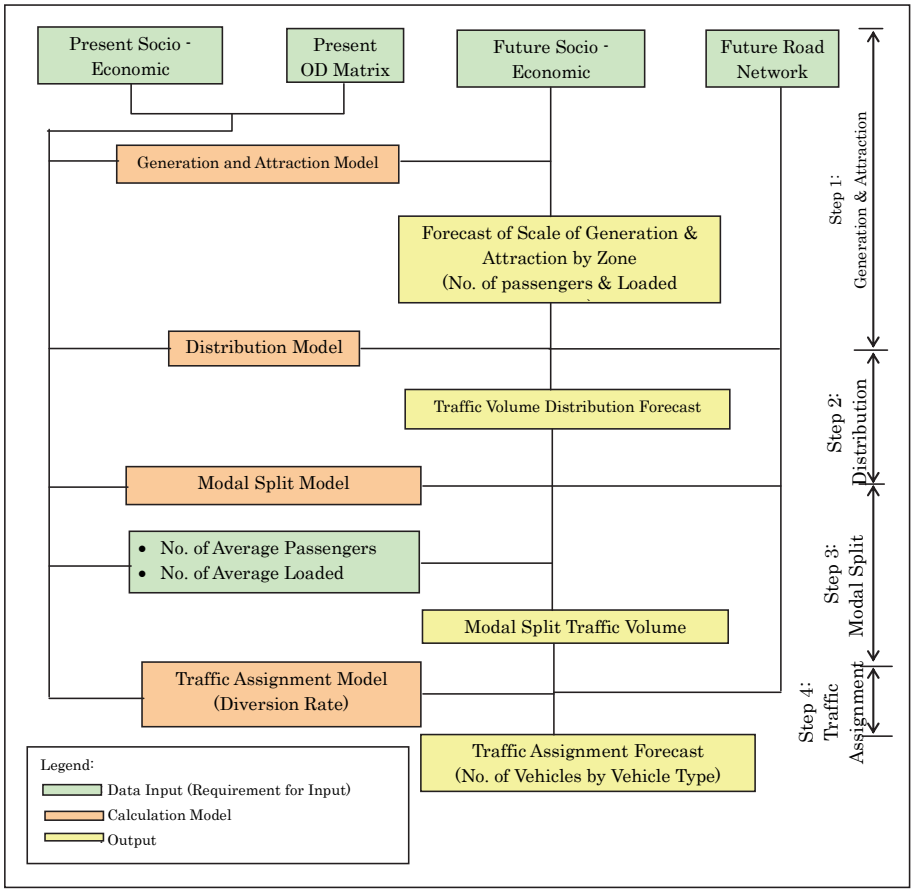


Figure 3-2 Flow Diagram of Traffic Demand Forecast

2.3 Socio Economic Framework

The Socio Economic Framework of this Study is shown in the following tables below. Table 3-1 shows the population and growth rate, Table 3-2 shows the growth rate of GDP, and Table 3-3 shows the number of employed workforce. These are the fundamental information used to make the future OD table.

Referring to Table 3-1 (Population and Growth Rate), NSCB estimated the population of Metro Manila area in 2010 to be approximately 11.5 million and in 2030 projected to be approximately 13.5 million. The population growth rate of Metro Manila area is considered lower than that of all the Philippines.

The growth rate of GDP is estimated at 3.1% in 2010 and will grow to 5.0% in 2030. Inflation rate in Philippines is estimated at approximately 4.0% after 2011 (Refer for Chapter 9 for the details of deciding of inflation rate.). In addition, this inflation is different from the results value before 2010, it uses to assume the work of HSH to be a framework.

Table 3-1 Population and Growth Rate

Contents		2010	2015	2020	2025	2030
Population (1,000 persons)	Philippines	94,013	102,965	111,785	120,225	128,110
	Metro Manila	11,552	12,221	12,776	13,217	13,546
		-	2015/10	2020/15	2025/20	2030/25
Growth Rate	Philippines	-	1.8%	1.6%	1.5%	1.3%
	Metro Manila	-	1.1%	0.9%	0.7%	0.5%

Source: NSCB

Table 3-2 Growth Rate of GDP

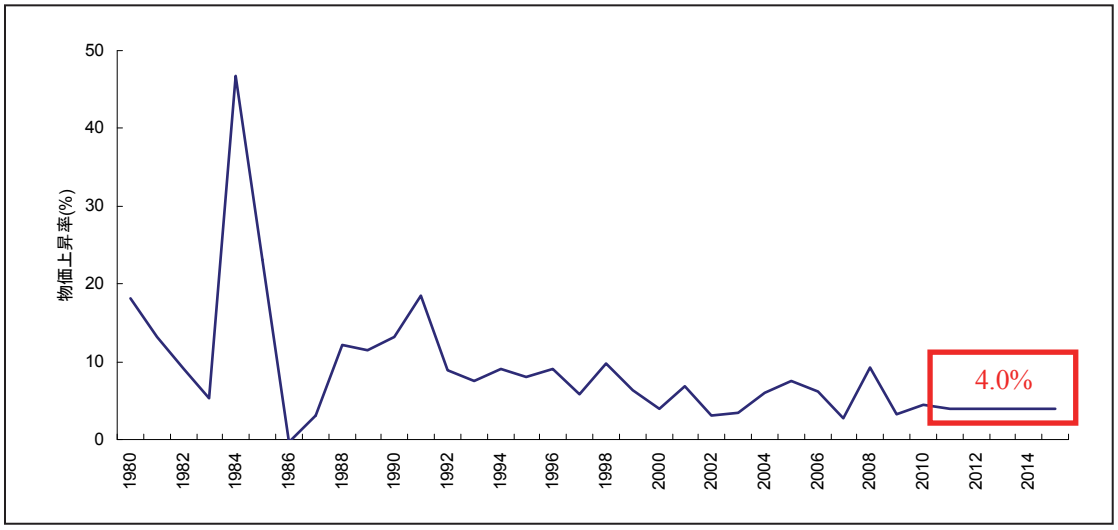
	2008	2009	2010	2011	2012-2014	2015-2020	2021-2025	2026-2030
GDP	3.8%	1.3%	3.1%	4.5%	5.0%	5.5%	5.5%	5.0%

Source: JICA Study Team (HSH)

Table 3-3 Employed Workforce

(1,000 persons)	2009	2010	2015	2020	2025	2030	2030/2009
Philippines	22,881	23,443	26,524	29,645	32,730	35,696	1.56
Metro Manila	4,581	4,710	5,422	6,105	6,721	7,380	1.61

Source: JICA Study Team (HSH)



Source: International Monetary Fund

Figure 3-3 Secular Distortion of Inflation in Philippines

2.4 Soft Enforcement of Policy (Traffic Demand Management Measure in the Philippines)

Conducting soft enforcement of policy in Philippines is "Strengthening of Regulation on Private Cars (Unified Vehicular Volume Reduction Program- UVVRP or Color Coding)" and "Strengthening of Truck Ban Regulation". Each of enforcement policy is shown in below. In addition, strengthening of truck ban regulation is including traffic demand forecast, but strengthening of regulation on private cars is not considered because it is not possible to reflect traffic demand forecast in chapter 3. And, soft enforcement of policy is not proposed regarding this project which is an investigation in the NLEX - SLEX Connector Road Project, and it is difficult to establish.

a. Strengthening of Regulation on Private Cars (Unified Vehicular Volume Reduction Program - UVVRP or Color Coding)

Uniform Vehicular Volume Reduction Scheme (UVVRS), more popularly known as "color coding" regulates the operation of certain vehicles on all roads in Metro Manila from 7:00AM to 7:00PM. Strengthening of Regulation on Private Cars provide relief to the chronic traffic congestion in Metro Manila. Passage prohibition step strengthening measure is thought of as to secure smooth traffic. The severe measure is conducted, and the controlling effect of the inflow traffic is performed in the Makati city that a lot of enterprises concentrate now. But these have the possibility to influence the socioeconomic activity.

b. Strengthening of Truck Ban Regulation

As mentioned, the truck ban prohibits trucks from using 10 major thoroughfares from 6 AM to 9 AM and from 5 PM to 9 PM except Saturdays, Sundays and holidays while "all-day" truck ban covers the lone stretch of EDSA.

The congestion of the trunk road in Metro Manila is eased by strengthening this restriction which is exerted on an increase in logistics cost by transportation and safety of public highway, because truck detour to the public highway.

2.5 Preparation of Future OD Table

2.5.1 Configuration of Traffic Zone

Traffic zone of the present and future OD tables are shown from Table 3-4 to Table 3-7 and from Figure 3-4 to Figure 3-5. Metro Manila area is divided into 94 zones and including Region III and Region IV-A is set it in 320 zones.

Table 3-4 Traffic Zone Table (1/4)

Small Zone	Barangay	Medium Zone	City/Municipality	Large Zone	Province	Region
1	City of Manila 1 - Barangay 20	1	City of Manila	1	Metro Manila	NCR
2	City of Manila 2 - Barangay 105					
3	City of Manila 3 - Barangay 375					
4	City of Manila 4 - Barangay 48					
5	City of Manila 5 - San Nicolas					
6	City of Manila 6 - Binondo					
7	City of Manila 7 - Barangay 310					
8	City of Manila 8 - Quiapo					
9	City of Manila 9 - Barangay 413					
10	City of Manila 10 - San Miguel					
11	City of Manila 11 - Barangay 570					
12	City of Manila 12 - Barangay 450					
13	City of Manila 13 - Port Area					
14	City of Manila 14 - Intramuros, Ermita					
15	City of Manila 15 - Paco					
16	City of Manila 16 - Malate					
17	City of Manila 17 - Santa Ana					
18	City of Manila 18 - Barangay 601					
19	City of Manila 19 - Pandacan					
20	Pasay City 1 - Barangay 46	2	Pasay City			
21	Pasay City 2 - Barangay 132					
22	Pasay City 3 - Barangay 183					
24	Pasay City 4 - Barangay 1					
82	Pasay City 5 - Barangay 76					
23	Parañaque City 1 - Don Bosco	3	Parañaque City			
25	Paranaque City 2 - Baclaran					
84	Parañaque City 2 - Sun Valley, San Martin De					
85	Parañaque City 3 - Marcelo Green Village					
86	Parañaque City 4 - B.F. Homes					
92	Parañaque City 5 - San Isidro					
93	Parañaque City 6 - San Dionisio					
26	Makati City 1 - Bangkal, San Lorenzo	4	Makati City			
27	Makati City 2 - Palanan					
28	Makati City 3 - Olympia					
29	Makati City 4 - Guadalupe Viejo					
30	Makati City 5 - Bel-Air					
31	Makati City 6 - Rizal, Pembo					
34	Makati City 7 - Magallanes					
32	Santa Ana		Pateros			
33	Taguig 1 - Western Bicutan	5	Taguig			
81	Taguig 2 - Upper Bicutan					
83	Taguig 3 - Signal Village, Lower Bicutan					
35	Mandaluyong City 1 - Poblacion	6	Mandaluyong City			
36	Mandaluyong City 2 - Plainview					
37	Mandaluyong City 3 - Mauway					
39	Mandaluyong City 4 - Wack-wack Greenhills					
40	San Juan 1 - West Crame		San Juan			
41	San Juan 2 - Corazon de Jesus					
38	Pasig City 1 - Ugong	7	Pasig City			
78	Pasig City 2 - Santolan					
79	Pasig City 3 - Santa Lucia					
80	Pasig City 4 - Pinagbuhatan					
42	Quezon City 1 - Tatalon, Damayang Lagi	8	Quezon City			
43	Quezon City 2 - Santo Domingo (Matalahib)					
44	Quezon City 3 - Baesa, Sangandaan					
45	Quezon City 4 - Bagong Pag-asa					
46	Quezon City 5 - Pinyahan, (Trinoma/SM West)					
47	Quezon City 6 - Paltok, Del Monte					
48	Quezon City 7 - Kamuning					
49	Quezon City 8 - E. Rodriguez, Crame					
50	Quezon City 9 - Camp Aguinaldo					
51	Quezon City 10 - Kamias (East/West)					
52	Quezon City 11 - U.P. Campus					
53	Quezon City 12 - Pasong Tamo					
54	Quezon City 13 - Batasan Hills					
55	Quezon City 14 - Commonwealth					
56	Quezon City 15 - Payatas					
57	Quezon City 16 - North Fairview					
61	Quezon City 17 - Greater Lagro, Novaliches Pr					
62	Quezon City 18 - Tandang Sora					
75	Quezon City 19 - Pansol, Loyola Heights					
77	Quezon City 20 - White Plains, Libis (Eastwood					
58	Kalookan City (North) 1 - Barangay 178	9	Kalookan City (North)			
59	Kalookan City (North) 2 - Barangay 176					
60	Kalookan City (North) 3 - Barangay 171					
63	Valenzuela City 1 - Ugong	10	Valenzuela City			
64	Valenzuela City 2 - Canumay, Maysan					
65	Valenzuela City 3 - Malinta					
66	Valenzuela City 4 - Malanday					
71	Valenzuela City 5 - Marulas					

Source: JICA Study Team (HSH)

Table 3-5 Traffic Zone Table (2/4)

Small Zone	Barangay	Medium Zone	City/Municipality	Large Zone	Province	Region
67	Malabon 1 - Concepcion	11	Malabon	1	Metro Manila	NCR
70	Malabon 2 - Potrero					
68	Navotas - North Bay Blvd South		Navotas			
69	Kalookan City (South) 1 - Barangay 12		Kalookan City (South)			
72	Kalookan City (South) 2 - Baranagay 132					
73	Kalookan City (South) 3 - Barangay 120					
74	Marikina City 1 - Concepcion Uno, Parang	12	Marikina City			
76	Marikina City 2 - Malanday					
87	Muntinlupa City 1 - Sucat		Muntinlupa City			
88	Muntinlupa City 2 - Alabang					
89	Muntinlupa City 3 - Putatan					
90	Las Pinas City 1 - Almanza (Uno, Dos)	13	Las Pinas City			
91	Las Pinas City 2 - B.F. International Village					
94	Las Pinas City 3 - Zapote					
133		24	BACOOR	2	CAVITE	Region IV-A
134			IMUS			
135			CAVITE CITY			
136			KAWIT			
137			NOVELETA			
138		25	ROSARIO			
139	Tejero		GENERAL TRIAS			
140	Pasong Camachile II					
141	San Francisco					
142	Amaya		TANZA			
143	Halayhay					
144	Bagtas					
146	Ibayo Silangan	26	NAIC			
147	Palangue 2 & 3					
161			GENERAL EMILIO AGUINALDO			
145		27	TRECE MARTIRES CITY (Capital)			
148	Datu Esmael (Bago-a-ingud)		DASMARIÑAS			
149	Paliparan III					
150	Langkaan II					
151		28	SILANG			
153			GEN. MARIANO ALVAREZ			
154			CARMONA			
162			AMADEO			
163			ALFONSO			
164			TAGAYTAY CITY			
152		29	SAN PEDRO	3	LAGUNA	
155			BIÑAN			
156			CITY OF SANTA ROSA			
157		30	CABUYAO			
158	Pansol, Parian		CITY OF CALAMBA			
159	Canlubang					
160			BAY			
165		31	SANTA MARIA			
166			MABITAC			
167			FAMY			
168		32	KALAYAAN			
169			CAVINTI			
170		33	LILIW			
171			PAGSANJAN			
172		34	ALAMINOS			
173	Del Remedio		SAN PABLO CITY			
174	Santisimo Rosario					
175	San Francisco					
176	Santo Angel					
116	San Jose	19	RODRIGUEZ (MONTALBAN)	4	RIZAL	
117	Burgos					
118		20	SAN MATEO			
119	Cupang		CITY OF ANTIPOLO (Capital)			
120	San Jose (Pob.)					
121	Inarawan					
122		21	CAINTA			
123			TAYTAY			
124			ANGONO			
125		22	BINANGONAN			
126			TERESA			
127			MORONG			
128			CARDONA			
129		23	BARAS			
130			TANAY			
131			PILILLA			
132			JALA-JALA			
95		14	CITY OF MEYCAUAYAN	5	BULACAN	Region III
96			MARILAO			
97			OBANDO			
98		15	BULACAN			
99			BOCAUE			

Source: JICA Study Team (HSH)

Table 3-6 Traffic Zone Table (3/4)

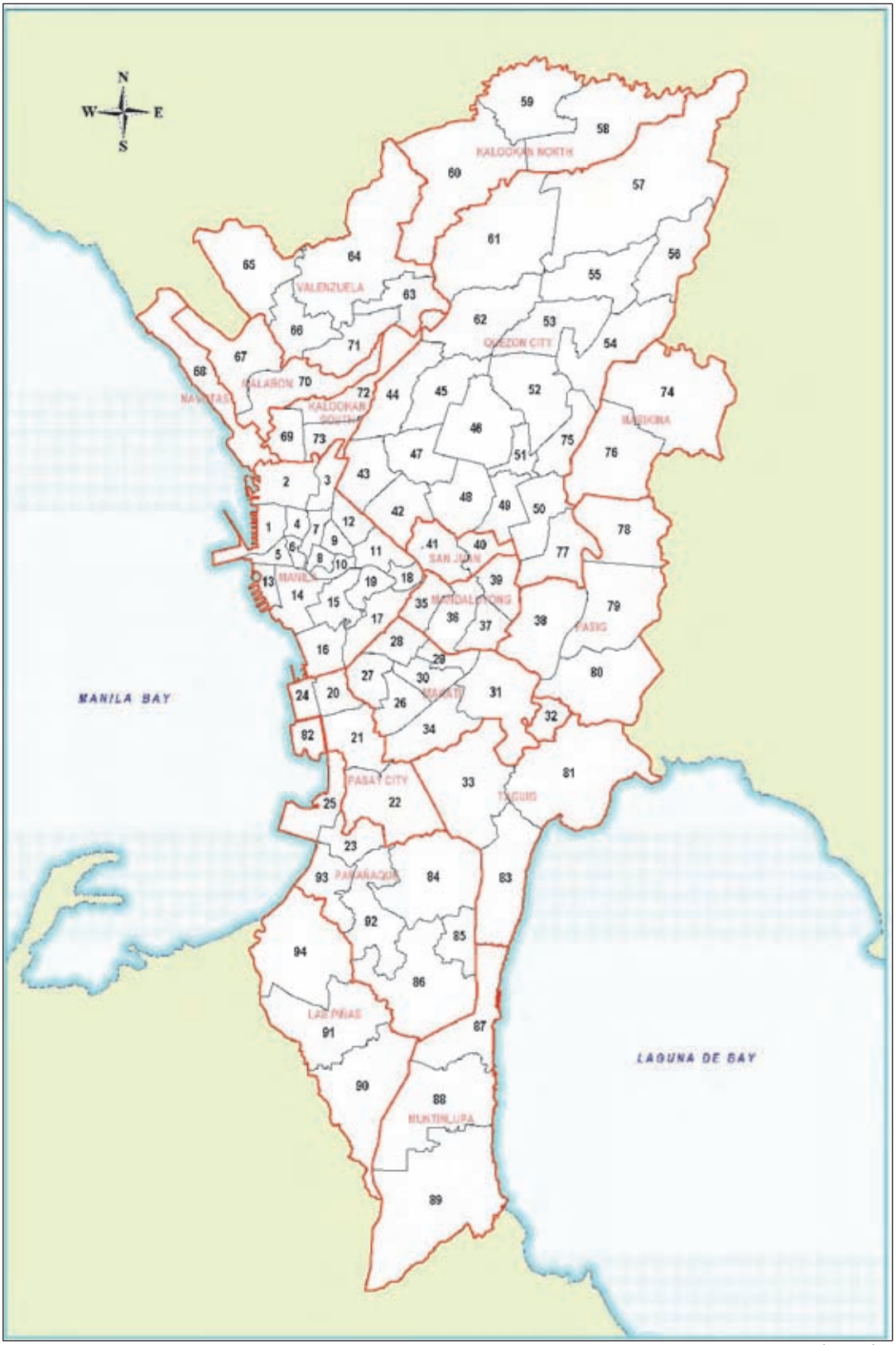
Small Zone	Barangay	Medium Zone	City/Municipality	Large Zone	Province	Region
100		15	BALAGTAS (BIGAA)	5	BULACAN	Region III
101			GUIGUINTO			
102			CITY OF MALOLOS (Capital) 1			
103		16	PAOMBONG			
104			HAGONOY			
105			CALUMPIT			
106			PULILAN			
107			PLARIDEL			
108		17	PANDI			
109	Poblacion, Guyong		SANTA MARIA			
110	Pulong Buhangin					
111	Muzon	18	SAN JOSE DEL MONTE			
112	Gumaoc					
113	Kaypian					
114	Tigbe		NORZAGARAY			
115	San Mateo					
205		43	BALIUAG			
206			BUSTOS			
207			ANGAT			
208		44	SAN ILDEFONSO			
209			DOÑA REMEDIOS TRINIDAD			
214		46	APALIT	6	PAMPANGA	
220			CANDABA			
215		47	MINALIN			
219			BACOLOR			
224	Dolores		CITY OF SAN FERNANDO			
225	Bulaon					
216		48	MASANTOL			
217			LUBAO			
218			FLORIDABLANCA			
221		49	ARAYAT			
222			MAGALANG			
223		50	PORAC			
226	Dau		MABALACAT			
227	Mabiga, Calumpang					
228	Cutcut		ANGELES CITY			
229	Santo Domingo					
230	Balibago					
231	Malabanias					
177		35	BALAYAN	7	BATANGAS	Region IV-A
178			AGONCILLO			
179			LAUREL			
180		36	CITY OF TANAUAN			
181			SANTO TOMAS			
182			BALETE			
188	Marauoy		LIPA CITY			
189	Antipolo Del Norte					
190	Lodlod					
191	San Jose					
183		37	CUENCA			
187			ALITAGTAG			
184		38	PADRE GARCIA			
185			SAN JUAN			
186			LOBO			
192	Santa Rita Karsada	39	BATANGAS CITY (Capital)			
193	Gulod Itaas					
194	Libjo					
195	Pinamucan					
196		40	GENERAL NAKAR	8	QUEZON	
197			LUCBAN			
198		41	CITY OF TAYABAS			
203			LUCENA CITY (Capital)			
204			AGDANGAN			
199		42	SARIAYA			
200			CANDELARIA			
201			DOLORES			
202			SAN ANTONIO			
210		45	LIMAY	9	BATAAN	Region III
211			ABUCAY			
212			BAGAC			
213			DINALUPIHAN			
249	Barreto	56	OLONGAPO CITY	10	ZAMBALES	
250	East Bajac-bajac					
251	Santa Rita					
252	New Cabalan					
253	Calapacuan	57	SUBIC			
254	Cawag					
255	Pamatawan					
256	Naugsol					
257		58	CASTILLEJOS			

Source: JICA Study Team (HSH)

Table 3-7 Traffic Zone Table (4/4)

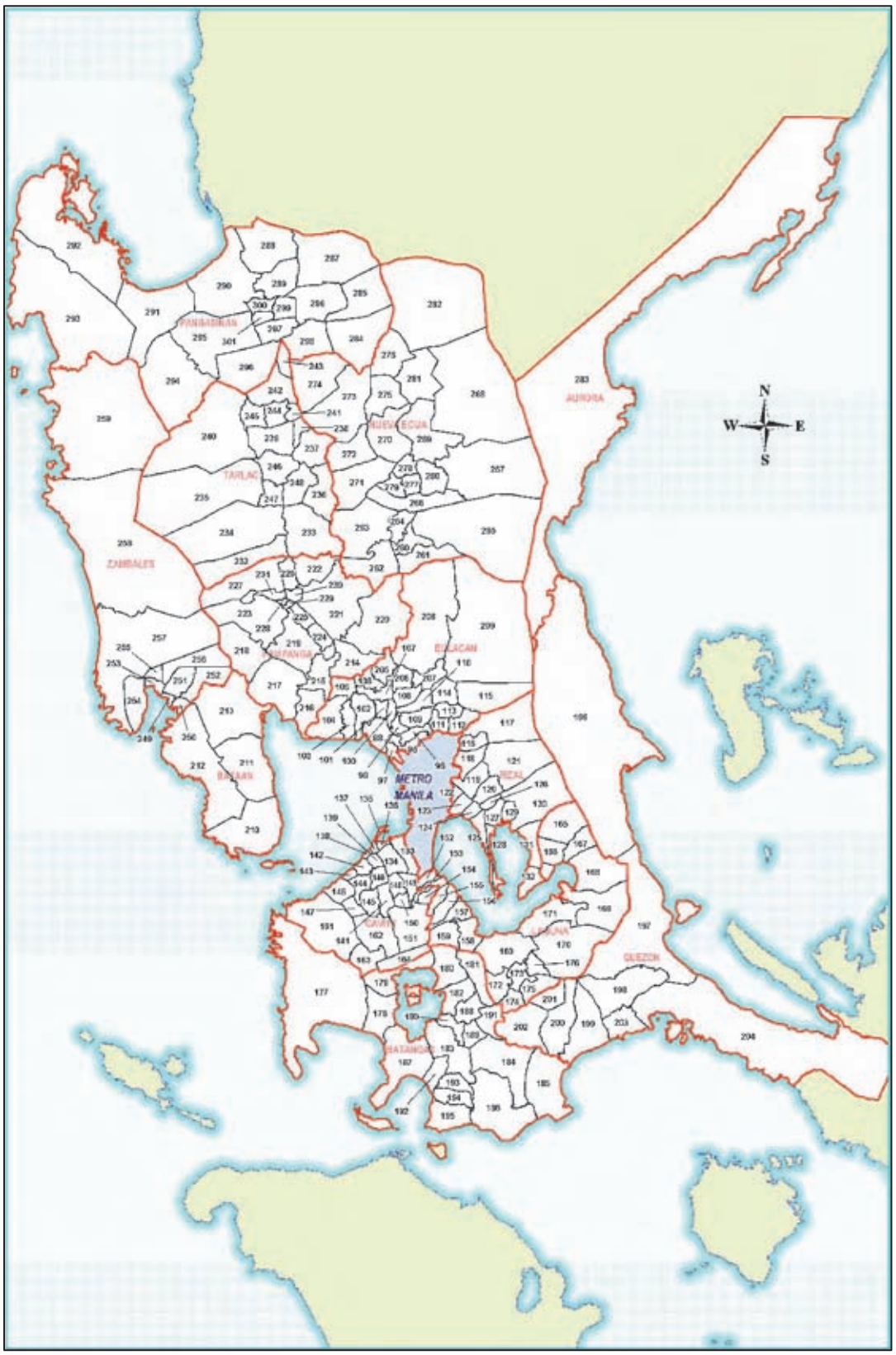
Small Zone	Barangay	Medium Zone	City/Municipality	Large Zone	Province	Region
258		59	BOTOLAN	10	ZAMBALES	
259		60	CANDELARIA			
232		51	BAMBAN			
234			CAPAS			
233		52	CONCEPCION			
236			LA PAZ			
246	Matatalaib		CITY OF TARLAC			
247	San Rafael					
248	Maliwalo					
235		53	SAN JOSE			
240			CAMILING	11	TARLAC	
237		54	VICTORIA			
238			PURA			
239			GERONA			
241		55	RAMOS			
242			ANAO			
243			SAN MANUEL			
244	Poblacion Norte		PANIQUI			
245	Balaoang					
260	San Nicolas	61	CITY OF GAPAN			Region III
261	San Roque					
262			CABIAO			
263			JAEN			
264			SAN LEONARDO			
265			GENERAL TINIO (PAPAYA)			
266			SANTA ROSA			
267		62	GABALDON (BITULOK & SABANI)			
268			BONGABON			
282			CARRANGLAN			
269		63	GENERAL MAMERTO NATIVIDAD			
270			SANTO DOMINGO	12	NUEVA ECIJA	
275			SCIENCE CITY OF MUÑOZ			
276			LUPAO			
281			SAN JOSE CITY			
271		64	ALIAGA			
272			LICAB			
277	Bantug Norte	65	CABANATUAN CITY			
278	Caalibangbangan					
279	San Josef Norte					
280	Campo Tinio					
273		66	GUIMBA			
274			CUYAPO			
284		68	UMINGAN			
285			NATIVIDAD			
286			ASINGAN			
287			SAN MANUEL			
298			BALUNGAO			
288		69	POZZORUBIO			
289			BUGALLON			
290			CALASIAO			
291			BINMALEY	13	PANGASINAN	Region I
294		70	AGUILAR			
295			BASISTA			
296			BAUTISTA			
297			VILLASIS			
299	Bayaoas		CITY OF URDANETA			
300	Pinmaludpod					
301	Palina East					
292		71	CITY OF ALAMINOS			
293			AGNO			
283		67	All Municipalities	14	AURORA	Region III
302	Zone 302-319 Out of Study Area.	72		15	Benguet	CAR
303						
308					Ifugao	
309						
312					Mt. Province	
313					Kalinga	
314					Abra	
316					Apayao	
304					Nueva Vizcaya	Region II
305						
306					Quirino	
307					Isabela	
317					CAGAYAN	
310					LA UNION	Region I
311					ILOCOS SUR	
315					ILOCOS NORTE	
318					All Provinces	Region IV-B
319					All Provinces	Region V
320	Port Terminal	73		1	City of Manila	NCR

Source: JICA Study Team (HSH)



Source: JICA Study Team（HSH）

Figure 3-4　Traffic Zone（Metro Manila）



Source: JICA Study Team（HSH）

Figure 3-5　Traffic Zone（Luzon）

2.5.2 Configuration of Future OD Table

The Traffic OD Tables in 2009 are shown in Table 3-8 to Table 3-10. The total OD volume of about 5.56 million veh/day is based on the traffic interview survey results. The desired line as shown in Figure 3-6 was prepared based on the present OD Table. The movement of total vehicle is huge from Metro Manila to the North and the South directions.

The future OD Table for years 2015, 2020 and 2030 are already prepared on the HSH Study. In this Study, the OD table for year 2016 is based on the OD table for year 2015 and 2020.

Table 3-8 Present OD Table (All Vehicle)

Unit: veh/day

	Metro Manila	Cavite	Laguna	Rizal	Bulacan	Pampanga	Batangas	Quezon	Bataan	Zambales	Tarlac	Nueva Ecija	Pangasinan	Aurora	Out of study area	Total
Metro Manila	3,254,346	59,633	59,707	89,046	52,132	2,870	8,437	2,345	1,253	1,289	467	1,578	1,571	352	3,012	3,538,038
Cavite	61,345	421,162	15,190	700	1,579	144	1,744	495	23	50	4	21	23	0	372	502,852
Laguna	33,231	19,631	280,336	6,668	752	128	5,155	552	76	15	19	21	27	0	454	347,065
Rizal	89,090	1,534	4,176	330,585	1,452	36	308	273	8	19	0	24	89	155	195	427,944
Bulacan	47,452	1,719	1,446	1,539	494,687	7,307	218	41	515	580	131	5,203	296	0	618	561,752
Pampanga	2,725	145	37	30	5,640	26,077	25	18	1,740	1,768	846	310	1,763	0	563	41,687
Batangas	6,409	2,434	5,361	73	254	40	19,313	3,416	46	19	10	30	46	0	328	37,779
Quezon	2,664	437	1,158	442	15	17	2,557	9,837	0	4	388	0	44	0	99	17,662
Bataan	1,362	30	25	49	839	1,735	82	0	12,753	1,293	479	200	93	2	162	19,104
Zambales	1,007	52	37	9	536	825	24	12	759	43	42	136	47	0	82	3,611
Tarlac	771	15	56	0	302	930	3	6	64	137	8,909	627	341	1	300	12,462
Nueva Ecija	2,435	7	8	17	3,188	165	164	0	237	85	1,016	11,749	620	0	2,039	21,730
Pangasinan	1,351	38	40	9	264	2,463	8	25	111	27	324	3,692	6,022	0	2,276	16,650
Aurora	165	0	0	0	7	2	0	0	0	168	0	3	0	0	2	347
Out of study area	2,619	165	300	93	976	447	465	68	53	135	220	1,766	2,615	14	313	10,249
Total	3,506,972	507,002	367,877	429,260	562,623	43,186	38,503	17,088	17,638	5,632	12,855	25,360	13,597	524	10,815	5,558,932

Table 3-9 Present OD Table (Passenger Car including Bus and Jeepney)

Unit: veh/day

	Metro Manila	Cavite	Laguna	Rizal	Bulacan	Pampanga	Batangas	Quezon	Bataan	Zambales	Tarlac	Nueva Ecija	Pangasinan	Aurora	Out of study area	Total
Metro Manila	2,885,690	58,197	46,884	83,154	45,964	2,061	6,827	2,116	953	1,080	357	1,445	1,317	352	2,450	3,138,847
Cavite	58,782	402,900	14,088	687	597	66	1,282	449	21	48	2	12	17	0	349	479,300
Laguna	27,171	18,079	248,014	5,016	711	45	3,203	434	57	3	17	16	18	0	417	303,201
Rizal	84,079	1,483	3,014	274,262	1,280	14	219	250	0	17	0	24	89	155	188	365,074
Bulacan	41,691	702	1,197	1,420	421,856	4,387	71	9	361	431	88	4,797	223	0	263	477,496
Pampanga	1,970	137	15	16	4,372	24,332	15	9	1,448	1,429	657	278	1,664	0	527	36,869
Batangas	4,793	1,725	4,040	46	46	19	17,239	3,246	27	19	10	30	39	0	244	31,523
Quezon	2,154	403	971	379	3	3	2,411	8,383	0	0	386	0	39	0	18	15,150
Bataan	1,009	22	17	43	669	1,483	71	0	12,493	1,063	469	180	83	0	152	17,754
Zambales	765	41	7	6	233	669	11	7	644	28	31	131	43	0	78	2,694
Tarlac	483	8	48	0	222	791	0	4	49	133	7,716	569	258	0	269	10,550
Nueva Ecija	2,296	1	3	14	2,842	153	152	0	214	74	977	11,541	385	0	1,713	20,365
Pangasinan	1,185	30	33	7	93	2,331	0	25	101	26	261	3,550	5,625	0	1,853	15,120
Aurora	151	0	0	0	0	0	0	0	0	167	0	0	0	0	2	320
Out of study area	2,301	161	263	89	689	421	255	11	40	132	203	1,505	2,206	14	243	8,533
Total	3,114,520	483,889	318,594	365,139	479,577	36,775	31,756	14,943	16,408	4,650	11,174	24,078	12,006	521	8,766	4,922,796

Table 3-10 Present OD Table (Truck)

Unit: veh/day

	Metro Manila	Cavite	Laguna	Rizal	Bulacan	Pampanga	Batangas	Quezon	Bataan	Zambales	Tarlac	Nueva Ecija	Pangasinan	Aurora	Out of study area	Total
Metro Manila	368,656	1,436	12,823	5,892	6,168	809	1,610	229	300	209	110	133	254	0	562	399,191
Cavite	2,563	18,262	1,102	13	982	78	462	46	2	2	2	9	6		23	23,552
Laguna	6,060	1,552	32,322	1,652	41	83	1,952	118	19	12	2	5	9		37	43,864
Rizal	5,011	51	1,162	56,323	172	22	89	23	8	2		0	0	0	7	62,870
Bulacan	5,761	1,017	249	119	72,831	2,920	147	32	154	149	43	406	73		355	84,256
Pampanga	755	8	22	14	1,268	1,745	10	9	292	339	189	32	99		36	4,818
Batangas	1,616	709	1,321	27	208	21	2,074	170	19	0	0	0	7		84	6,256
Quezon	510	34	187	63	12	14	146	1,454		4	2		5		81	2,512
Bataan	353	8	8	6	170	252	11		260	230	10	20	10	2	10	1,350
Zambales	242	11	30	3	303	156	13	5	115	15	11	5	4		4	917
Tarlac	288	7	8		80	139	3	2	15	4	1,193	58	83	1	31	1,912
Nueva Ecija	139	6	5	3	346	12	12		23	11	39	208	235		326	1,365
Pangasinan	166	8	7	2	171	132	8	0	10	1	63	142	397		423	1,530
Aurora	14				7	2				1		3			0	27
Out of study area	318	4	37	4	287	26	210	57	13	3	17	261	409	0	70	1,716
Total	392,452	23,113	49,283	64,121	83,046	6,411	6,747	2,145	1,230	982	1,681	1,282	1,591	3	2,049	636,136

Unit: 100 veh/day

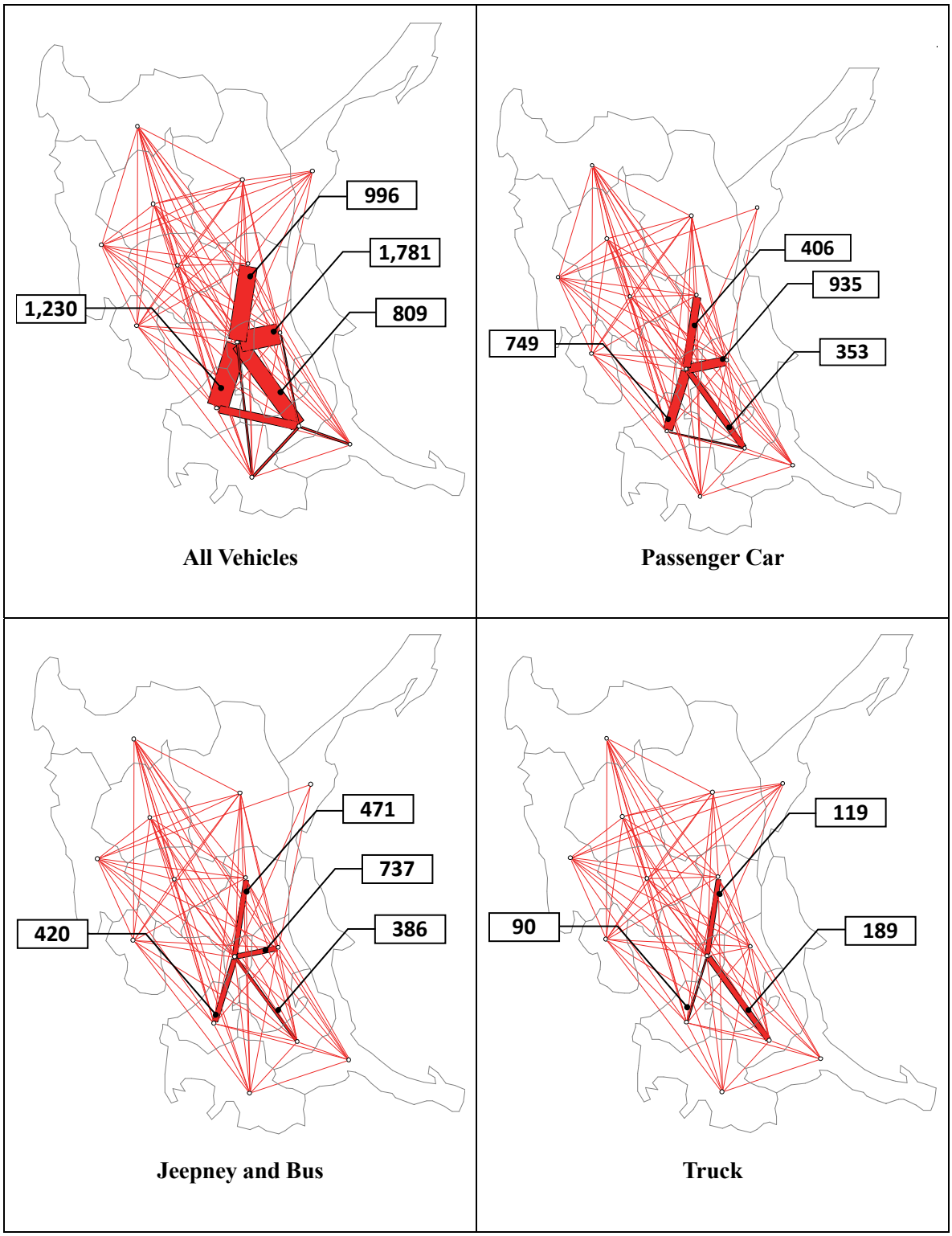
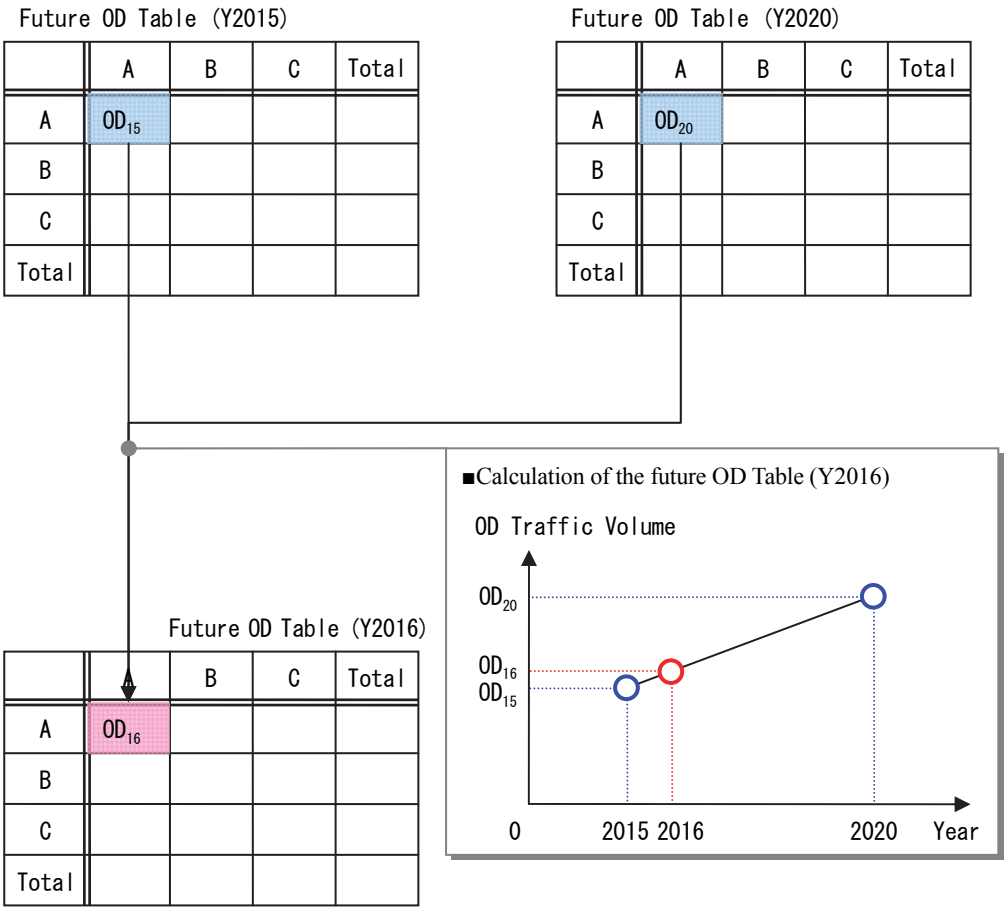


Figure 3-6　Desired Line（Year 2009）



Source: JICA STUDY TEAM (HSH)

Figure 3-7 Calculation of Future OD Table for Year 2016

2.6 Prerequisite for NLEX - SLEX Connector Road

Table 3-11 shows the parameters of NLEX - SLEX Connector Road. NLEX - SLEX Connector Road has four lanes and the design speed is planned at 80km/h. There are four interchanges which provide access to the NLEX - SLEX Connector Road - the beginning point at C-3 Road intersection, the connection point to España Ave. and Quirino Avenue and the interchange at Buendia Ave. These interchanges are shown in Figure 3-8.

Table 3-12 presents the PCU rate which is adopted by the Philippine DPWH. Table 3-13 shows the value of time which is adopted by the HSH.

Table 3-11 Setting of Parameter of NLEX - SLEX Connector Road

Category	Parameter
Length	13.5km
Number of lane	4 Lane
Capacity	20,000 PCU/Lane*day[1)] (80,000 PCU/4Lane*day)
Speed	80km/h

1) PCU: Passenger Car Unit

Table 3-12 PCU Conversion Factor

Classification	PCU (PCU/veh)
Passenger Car	1.0
Jeepney	1.5
Bus	2.2
Truck	2.5

Table 3-13 Value of Time

Unit: Peso/Hour

Classification	2016	2020	2030
Passenger Car	507	645	1,177
Jeepney	716	910	1,661
Bus	2,355	2,996	5,467
Truck	1,334	1,697	3,096

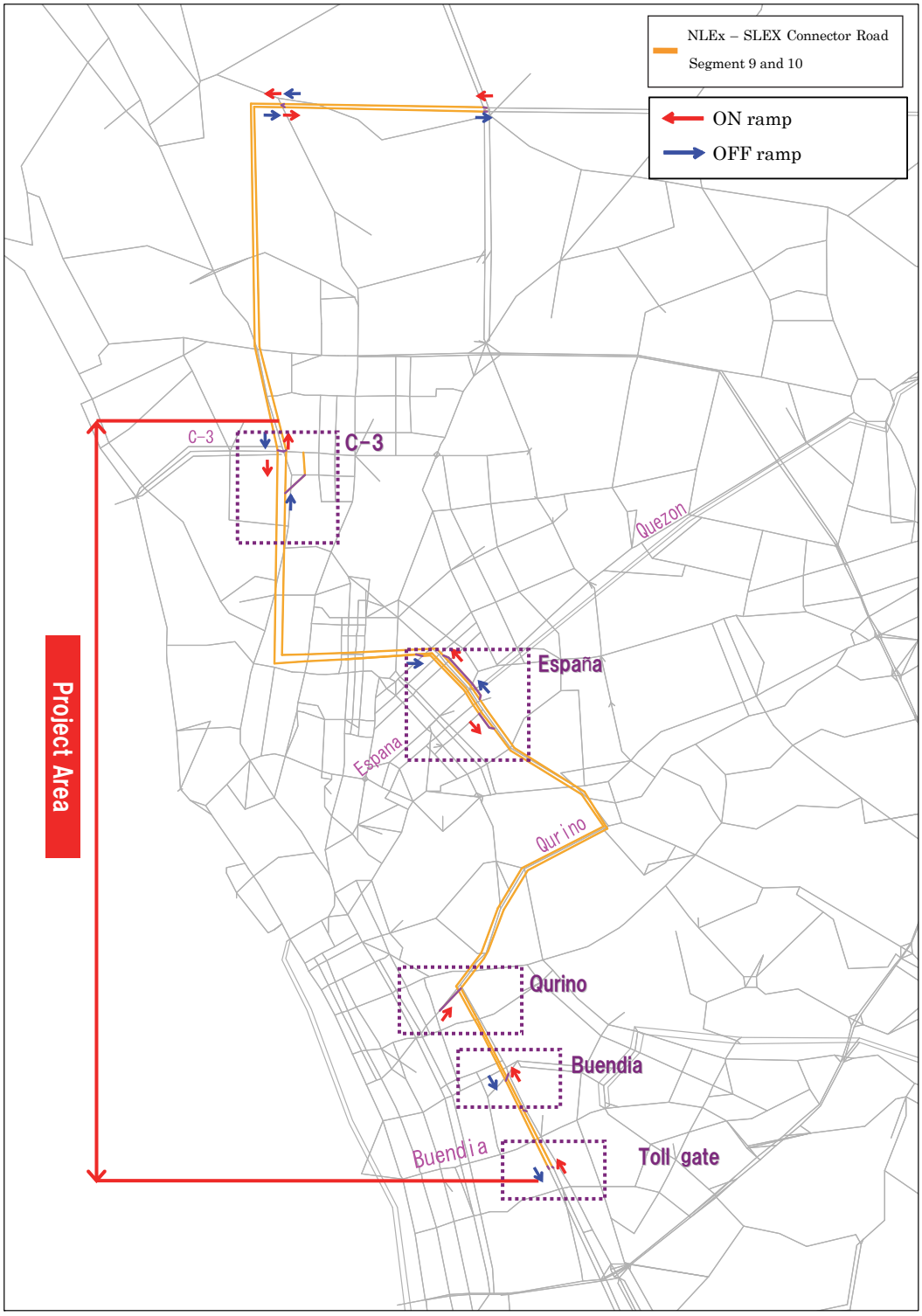


Figure 3-8　NLEX - SLEX Connector Road（IC/Ramp）

2.7 Road Network Preparation

2.7.1 Preparing the Future Road Network

In this Study, the present road network prepared by METI Study is adopted. The future road network for years 2020 and 2030, however, are prepared through using the HSH Master Plan. Figure 3-10 illustrates the future road network of 2020 and 2030. In case of year 2016, the present road network is adopted and the highway which is in use at 2011 will be able to pass.

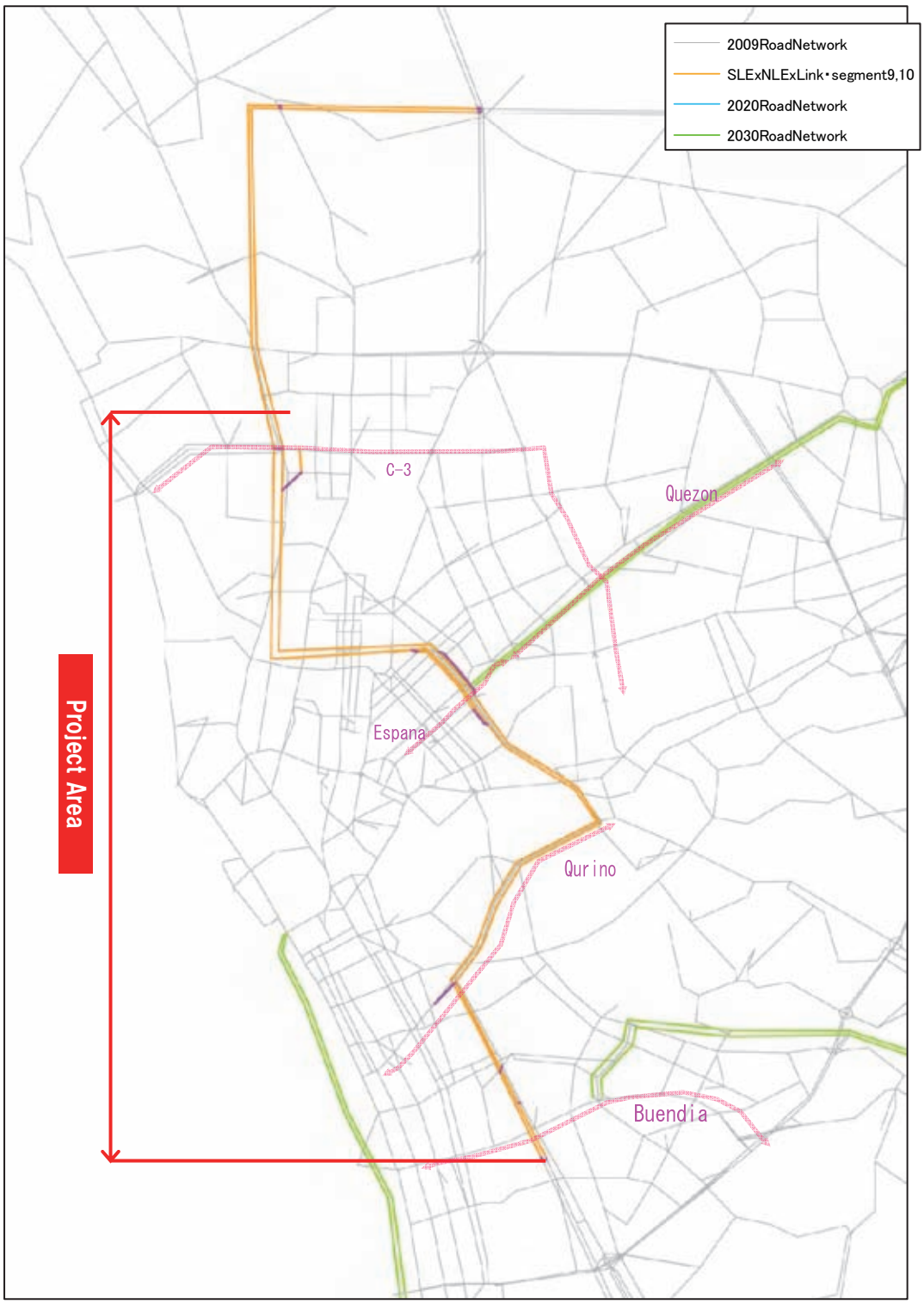


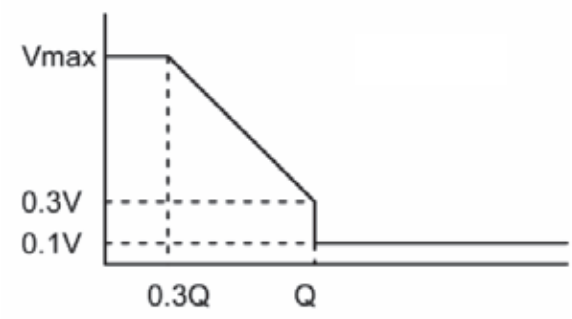
Figure 3-9　Road Network（around of NLEX - SLEX Connector Road）

Figure 3-10　Road Network（Luzon）

2.7.2 QV

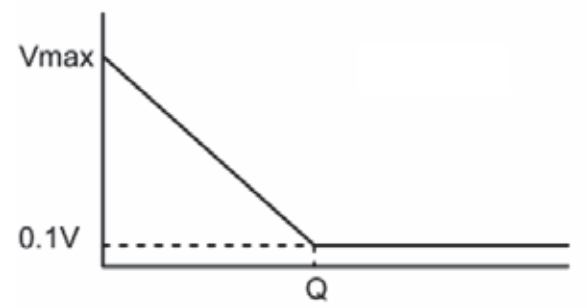
As shown below, we set the velocity - traffic quantity relational expression (hereinafter referred to as QV) for each links composed of road network.

TYPE-4 and TYPE-1 assumes that velocity become constant (0.1Vmax) when traffic quantity reaches Q max. On the other hand, TYPE-3 is assumes that velocity becomes zero when traffic quantity reaches Q max.



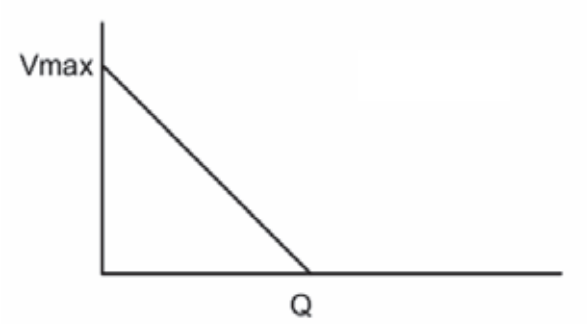
Source: JICA STRADA

Figure 3-11 Pattern of QV（At-grade）



Source: JICA STRADA

Figure 3-12 Pattern of QV（Expressway）



Source: JICA STRADA

Figure 3-13 Pattern of QV（Interchange/Ramp）

Chapter 4

Road Design

(1) Road Outline Design

1. Background

This section focuses on the determination of the Connector Road alignment based on the previous studies conducted and the additional topographic and geotechnical surveys and traffic study done during the conduct of this Study. The project objective would be to connect the North Luzon Expressway （NLEX） and the South Luzon Expressway (SLEX/Skyway） utilizing the existing Philippine National Railways (PNR) route corridor with an elevated structure of approximately 13.5 km long. In this regard, the Connector Route alignment determination is presented under this section with the aim of minimizing the right-of-way acquisition and costs of the project.

1.1 The Ministry of Economy, Trade and Industry (METI) Study

In March 2010, the Ministry of Economy, Trade and Industry (METI) conducted a Study to confirm the rationality and feasibility of Public Private Partnership (PPP) for the Connector Road Project, entitled the "Study on PPP Project Development of the NLEX - SLEX Connector Road in Metro Manila". The Study is part of Japan's Private - Initiative Infrastructure Projects in Developing Countries and examined the possibility of utilizing JBIC's and JICA's investment and financing scheme.

The Study identified three possible routes to connect SLEX with NLEX, as illustrated in Figure 4-1 and summarized in Table 4-1.

Table4-1 Summary of Connector Road Alternative Routes

Routes	Description
Alternative 1 (PNR Alignment)	The alignment follows the PNR railroad track alignment and starts from C-3 moving south towards Bonifacio Ave. (R-8). It then proceeds south-east parallel with C-2 until it meets C-3 and crosses Pasig River beside Pandacan Bridge towards Quirino Ave. The alignment then moves southward above Osmeña Ave. and connects with the terminal of Skyway Expressway after the Buendia Flyover.
Alternative 2 (C-2 Alignment)	The alignment follows Bonifacio Ave. until it reaches C-2 and moves south, crossing Pasig River via Nagtahan Bridge and follows Osmeña Ave. and Osmeña Ave. until it reaches and joins Skyway Expressway.
Alternative 3 (C-3 Alignment)	This alignment can connect with NLEX either via Bonifacio Ave. or Segments 9 or 10 of the NLEX. The alignment follows C-3 and crosses Pasig River via Pandacan Bridge and follows Osmeña Ave. and Osmeña Ave. until it reaches and joins Skyway Expressway.

Figure 4-1 Connector Road Alternative Routes

Alternative 1, following the PNR railroad corridor, is recommended as the optimum route among the three alternatives due to:

- smooth alignment suitable for an expressway without requiring double-deck structures as opposed to the other two alternatives,
- highest traffic demand and toll revenue among the three alternatives,
- lowest construction cost,
- least land acquisition area and cost, although affecting more small scale houses, and
- highest economic and financial evaluation.

In this regard, this Study will focus on the PNR railroad route corridor as the basis of the Connector Road alignment.

1.2 Metro Pacific Tollways Corporation's Detailed Feasibility Study (MPTC-DFS)

Metro Pacific Tollways Corporation (MPTC) proposes to extend the Manila North Expressway Project (MNEP) called the "Connector Road Project" from the end of Segment 10 at C-3 Road following the PNR railroad corridor to provide a seamless traffic route between the NLEX and the SLEX (via the Skyway Expressway). In April 2010, MPTC completed the Detailed Feasibility Study (DFS) for the Connector Road Project to confirm the project viability and to support requests for project finance.

Four options utilizing the PNR railroad corridor were developed under the Study, as presented in Table 4-2.

Table 4-2 Connector Road DFS Alternative Options

Option	Description
Option 1	All elevated structure 2x3 lanes ultimate configuration
Option 1A	All elevated structures 2x2 lanes initial configuration expandable to 2x3 lanes. Substructures will be for 2x3 configuration but the decking will be wide enough for a 2x2 lanes configuration.
Option 2	Combination of at-grade and elevated structures for a 2x3 lanes configuration: including a flyover and pedestrian overpass at Hermosa, reconstruction of Ramon Magsaysay Flyover Bridge with pedestrian over pass and re-alignment of PNR lines at these locations.
Option 2A	Same as Option 2 but utilizing a 2x2 lanes initial deck configuration expandable to 2x3 lanes at the ultimate stage.
Option 3	Generally elevated structures with at-grade section at Ramon Magsaysay Flyover Bridge for a 2x2 ultimate design. The horizontal centerline alignment was adjusted to minimize additional land take outside PNR right-of-way with the Connector road running side by side with PNR at Magsaysay section. There is no provision for future widening.
Option 4	Similar to Option 3 but eliminating Abad Santos Interchange, the exit ramp at Quirino Interchange and the entry ramp at San Andres.

Initially, Option 3 is evaluated as the scheme with the optimal configuration based on the traffic studies and the best engineering option in terms of safety and economy. However, even with this option, the right-of-way costs are still relatively high which led to Option 4 with the objective of reducing the right-of-way costs as well as the project costs.

The DFS recommended that MPTC adopts the 2x2 lanes configuration for the Connector Road Project which makes Options 3 and 4 suitable alternatives. Although Option 3 has the advantage of higher revenue, project realization maybe more practical with Option 4 with lower revenue but lesser right-of-way acquisition and costs.

In this regard, this Study focuses on the recommended scheme and alignment for Option 4 as the basis of the Connector Road alignment.

Figure 4-2 Option 4 : Connector Road Alignment Utilizing the PNR Corridor

2. Design Conditions

2.1 PNR Route Corridor

The proposed Connector Road Project which is aimed at providing a seamless connection between the SLEX/Skyway and the NLEX continues from Segment 10 of the NLEX at C-3 Road section and connects with the end section of the Skyway along Osmeña Blvd. To attain such alignment, Option 4 of the MPTC DFS utilized the 2nd level of the existing PNR railroad corridor in most of the areas. It is further taken that MPTC and the Manila North Tollways Corporation (MNTC) will settle the issues regarding the use of the PNR route corridor for the Connector Road Project.

This Study then focuses on Option 4 of the DFS utilizing mostly the PNR route corridor while amending the alignment where there are possibilities of reducing the right-of-way acquisition and affected houses and structures.

Since there is no definite development plan for PNR, the Connector Road alignment is assumed to take the existing PNR ROW as indicated in Table 4-3 and shown in the ROW Plan illustrated in Appendix 2. When the alignment goes beyond these ROW limits, it is taken that additional ROW acquisition will be required in that section. Moreover, the vertical profile for the Connector Road assumes the PNR vertical clearance requirement of 6.60m similar to that of the DFS which utilizes the clearance requirement required by the North Rail and the Segment 10 projects.

Table 4-3 PNR ROW

Location	PNR Existing ROW Width [1)]
C3 Rd to Hermosa St	30m±
Hermosa St to Jose Abad Santos Ave	20m to 30m
Jose Abad Santos Ave to Leonor Rivera St	15m to 20m (PNR) 45m± (including Old and New Antipolo Sts ROW)
Leonor Rivera St to Simon St	15m±
Simon St to Dapitan St	25m±(PNR) 50m±(including Antipolo and Algericas Sts ROW)
Dapitan St to España Blvd	15m±(avoiding the properties leased to the Ministry of Human Settlements) 25m±(PNR) 50m±(including Antipolo and Algericas Sts ROW)
España Blvd to G. Tuazon St	25m± 50m±(including Antipolo and Algericas Sts ROW)
G. Tuazon St to Ramon Magsaysay Blvd	25m to 30m
PNR Sta Mesa Station Yard	25m to 38m
Pasig River Area	40m to 120m
PNR Pandacan Station Yard	20m±
PNR Pandacan Station Yard to Paco Station Yard	30m±
PNR Paco Station Yard	50m±
Pedro Gil to Buendia Ave.	30m±

Note:
[1)] Source: "Technical Advisory Services for the Connector Road Project (Detailed Feasibility Study) Final Report", April 2010.

In some sections, the Connector Road passes and crosses above existing national and local roads thus utilizing the available ROW corridor of these roads. In this case, the vertical profile satisfies the minimum 5.10m clear height required by the Department of Public Works and Highways (DPWH).

2.2 Number of Traffic Lanes

2.2.1 Main Carriageway

MPTC's DFS Traffic Study indicated that the 2 x 2 lanes for the main carriageway is preferable but planning for 2 x 3 lanes was considered in the alternative options. However, the DFS then recommended, in view of least construction cost and right-of-way acquisition, the 2 x 2 lane scheme for the main carriageway throughway of the Connector Road.

The METI Study likewise utilizes the 2 x 2 lane scheme in its evaluation of the project based on the traffic demand forecast.

Under this Study, the Traffic Projection Study conducted indicated that the 2 x 2 lane configuration for the main carriageway through lanes is sufficient under the projected years considered (until year 2030).

The Connector Road will provide the link between the Skyway Expressway and the Segment 10 (NLEX) for a continuous connection of the south and north expressways. Figure 4-3 illustrates the cross-sections of the 2 x 3 lanes Skyway, the 2 x 2 lanes (with provision for 2 x 3 expansion) Segment 10 and the 2 x 2 lanes proposed Connector Road.

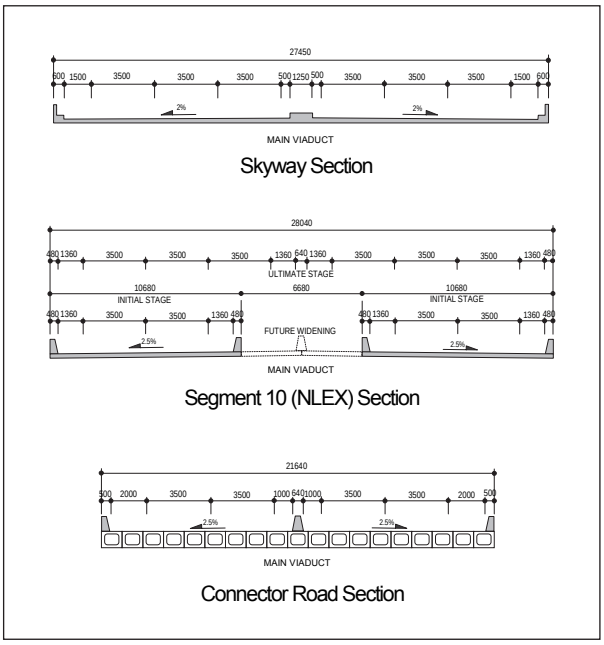


Figure 4-3 Main Carriageway (Through way) Deck Sections

2.2.2 Ramps

The present Study follows the recommendations of MPTC's DFS for the ramp locations and cross-sections. A 2-lane ramp section is proposed for both the entry and exit ramps at the different interchange locations which are found sufficient for the traffic demand projected. The cross-sectional dimensions for the Skyway, Segment 10 and the Connector Road entry/exit ramps are shown in Figure 4-4. At this stage of the Study, the 2-lane ramps are recommended in view of the capacities of the local

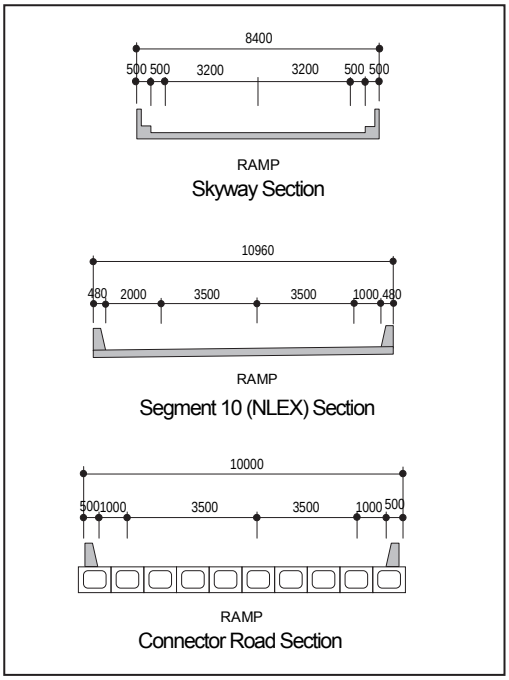


Figure 4-4 Ramp Cross-Sections

road intersections where the ramps begin/end. A detailed analysis of ramp entry and exit intersections is recommended to finalize the ramp cross-sectional requirements.

2.3 Toll Plazas and Toll Barriers

The Toll Collection System is described in Chapter 6-(3) of this report. However, the locations and the number of lanes of toll plazas and barrier are indicated in Figure 4-5 with three on-ramp toll plazas and one toll barrier for the northbound traffic direction and two on-ramp toll plazas for the southbound traffic direction. All facilities for the toll barrier and toll plazas are 2nd level elevated with the Connector Road except for the Quirino toll plaza which is at the 3rd level. However, the locations and configurations of the toll plazas and the ramps are directly influenced by the limitations in the available ROW.

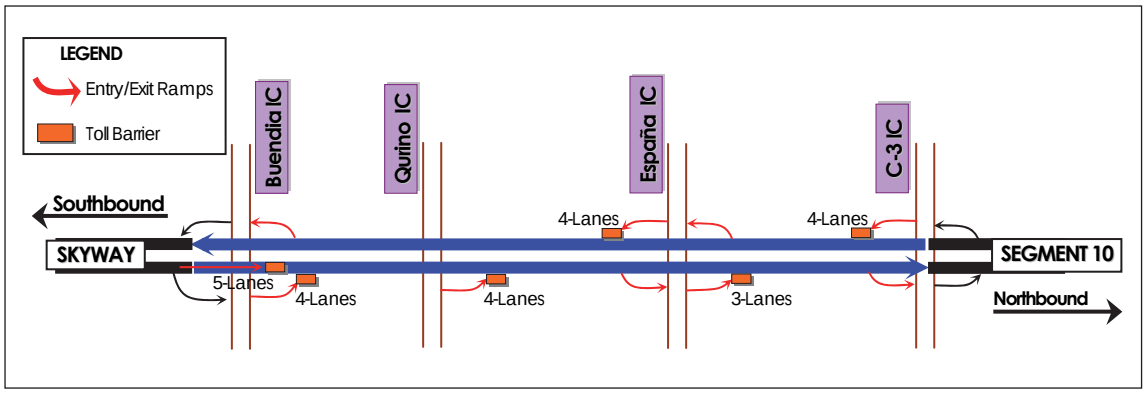


Figure 4-5 Location of Toll Barriers

It should be noted that the Connector Road Project will have an impact on the local traffic patterns, especially in the vicinity of the entry and exit ramps, by attracting traffic that wish to enter or exit the tollway. In this regard, there is a need for a more thorough and wider study of the local road network and the necessary traffic countermeasures considering the impact of the Connector Road.

2.4 Pasig River

The PNR route alignment crosses a major river which is the Pasig River at the Pandacan area between P. Jacinto Zamora Bridge and the ϕ1.5m water pipeline bridge. As such, the Connector Road Pasig River crossing shall be above the PNR corridor maintaining the vertical clearance of 6.6m for the PNR railroad. The river is undergoing an improvement and rehabilitation under the Pasig-Marikina River Improvement Project (JICA).

Table 4-4 Pasig River Bridge Design Condition

Item	Design Condition
Design Discharge	550 – 1,300 m^3/sec
Design High Water Level	DL + 13.166m
Minimum Pier Interval	43m (60m Desirable)
Freeboard	3.75m (5.0m Desirable)

2.5 Topography and Natural Drainage System

Metro Manila is a low-lying area that extends along the Manila bay. It is divided into the northern part district and the southern part district of the Pasig River. The northern part district is a highland where the boundary with another river is made from north side to east side. The highland areas serve as natural embankment along the Manila bay and the Pasig River. The Coastal Lowland is a flat low plain facing Manila Bay. This morphological unit can be subdivided into sand bar, back-marsh including tidal flat, Pasig River delta and reclaimed land. On the other hand, the southern part district composes of mountain range and valley boundary with the Pasig River. The southern part district is a highland area in relation to the northern part district and the lowland area is only along the river. The elevation is about 10m-30m from sea level.

Pasig River serves as the major natural drainage system along the route corridor and divides Metro Manila into two areas. The river connects the Laguna de Bay with Manila Bay stretching to about 25 kilometers. The river is a tidal estuary with flow direction dictated by the water level difference between Manila Bay and Laguna de Bay. All throughout the dry season, the water from Manila Bay flow inland when the water level in Laguna de Bay is low. During the wet season, when the water level of Laguna de Bay is high, the flow is normally from Laguna de Bay towards Manila Bay.

Other natural drainage channels within Manila area are the Estero de la Reina, Estero de Binondo and Estero de San Miguel which all flows south towards the Pasig River. Engineered drainage systems were integrated during the construction of the existing road network by the Manila City Engineers Office and the DPWH. In general, these canals directly empty into the Pasig River either by gravity or flood gates.

Chapter 5
Bridge Structures Design

(1) Design Condition of Bridges

1. Current Situation of Construction Machineries and Materials

1.1 Supply of Concrete

It is recognized that there is no significant issue of supply of concrete for the Project since enough ready mixed concrete has been supplied to many infrastructure projects including road construction and private construction such as Hotels construction.
With regard to materials of concrete, cement is domestic production and aggregates, course and fine, have also been quarried in the Philippines. River sand mixed with crushed stone has been using for small gain of fine aggregate.
As for concrete strength, 50 MPa concrete is used for pre-cast products in the factories, 40 MPa concrete for cast-in-place PC girder and 28 MPa concrete for substructures and foundations.

1.2 Reinforcing Bar and PC Tendon

Reinforcing bars for structures are imported from other countries such as Korea and Taiwan. Standard for reinforcing bars for structures is according to ASTM standard. Namely, grade 60 according to ASTM A615, which has a yield strength of 420 MPa.
PC tendons are imported from Indonesia and other countries and VSL anchorage system is widely used in Philippines. Anderson method is applied to pier rotation construction method (SOSROBAHU), which has been developed in Indonesia and was applied to Manila Skyway Express.

1.3 Structural Steel

Structural steel plate, which is used for steel girders, is imported from Korea, Japan and India. In case the contract is under the Japanese contractors, steel plated is imported from Japan.
There are five (5) manufactures in Philippines. Result of factory visit of two (2) of 5 manufactures are summarized as below;

1.3.1 Factory A

- Establishment: 1979
- Capacity: 150 ton/day (max 200 ton/day)
- Production line is computerized and major equipment is made in Japan.

Experience for thickness of and semi-automatic welding system has been introduced. Finishing for welding bead seems to be in good condition.

- Quality control system has been authorized by ISO 9000 and ISO 14000.
- Factory experiences for production of steel girders: 11 bridges with 7,334 ton in Subic-Tarlac Expressway Project, I-girders, Box-girders, Truss, Arch and Cable Styed, and Contracts under Marubeni, Sumitomo, Mitsubishi in Manila LRT 1 Project, and under Hanjin, Itochu in Manila LRT 2 Project.
- Experiences in overseas; China, Hong Kong, Cambodia, PNG, Uzbekistan, and the contracts with Yokokawa, Miyaji, JFE, Kawada and Takenaka.
- Currently, Nippon Steel has ordered production of steel girder and steel plate for this products is imported from Nippon steel – Sakai factory.
- It is recognized that this factory has enough capacity for fabrication of steel bridges for the Project.

1.3.2 Factory B

- Establishment: 1968
- There are a few experiences for fabrication of Steel Bridge for Highway. However, more than 1,000 ton steel girder had fabricated for PNR.
- Steel plate is imported from China.
- Production line is computerized but their equipment is relatively aged, and some defects in welding have been recognized. They said that automatic welding system will be introduced soon.
- Major production is for maritime structures and factory products, and in overseas, the contracts with USA and Australia. As for Japan, experience is the contract with Mitsubishi Heavy Industry.
- This factory will be available in condition of strict quality check before handing over, improvement of equipment and technical transfer

1.4 Construction Machineries for Pile Foundation

Foundations for the viaduct for the Project should be a pile foundation due to deep bearing layer. Structures for the Project are located close to existing road, railway, buildings and houses due to the characteristics of alignment, which is mainly proposed on the existing PNR alignment. Therefore, adjacent construction can not be avoided and construction yard for piling work is to become restricted.

Under the above restricted conditions, single pile foundation, which is composed of large diameter cast-in-place concrete bored pile, has an advantage in constructability. In Philippines, earth drill construction method for cast-in-place concrete bored pile is widely applied. Earth Drill method has an advantage in condition that bored hole

will not be collapse without casing and available for around 20m-long piles. This construction method is very common in the world. Therefore, equipment for pile construction for the Project will be easily provided even though numbers of equipment will be necessary.

2. Supplementary Geological Investigation

2.1 Supplementary Boring Survey

There have been 12 locations of boring survey results. Supplementary investigation were carried out at the following five (5) locations; the Locations,

(1) where the bearing layer depth between 2 boreholes can not be estimated,

(2) where the previous boring could not recognize the bearing layer,

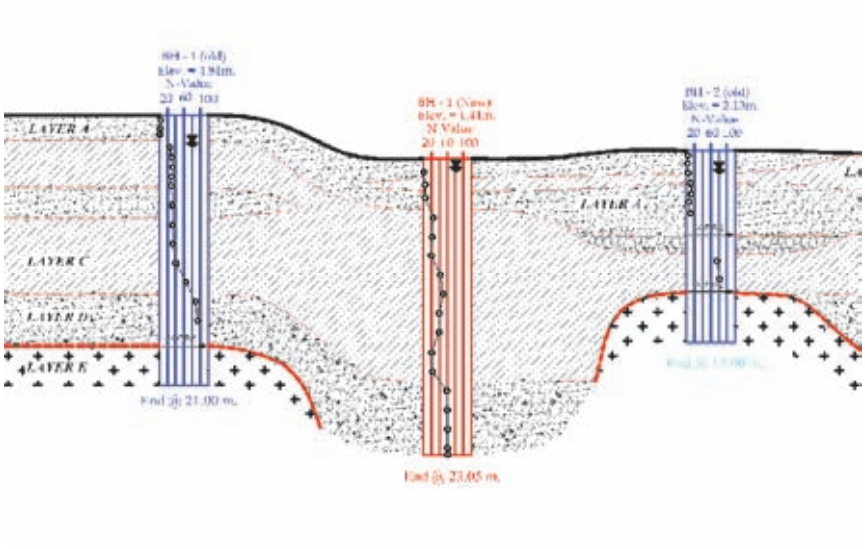
(3) near Passig River, 3 locations

2.2 Result of Boring Survey

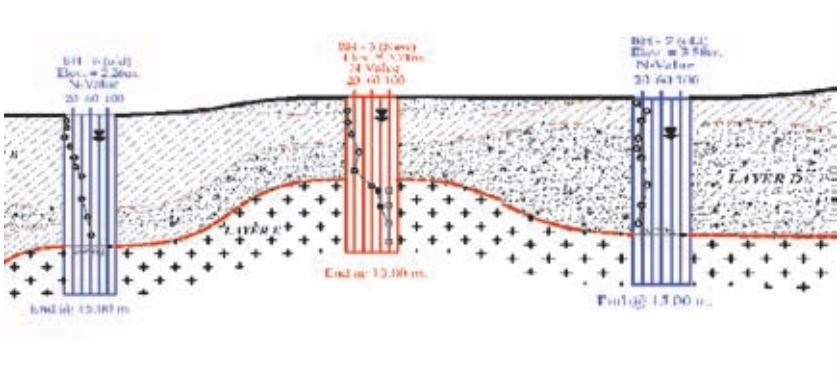
It is 1.5km length between the existing BH-1and BH-2. In order to confirm whether the depth of bearing layer is distributed proportionally or not, a supplementary boring at intermediate between 2 existing boring was carries out and the result shows the depth of bearing layer is deeper than existing boring data.

A supplementary boring near the existing BH-7 was carried out in order to confirm the depth of bearing layer since BH-7 had not reached the depth of bearing layer. The latest boring data shows a bearing layer, sandstone, was found at 8 m under the existing ground.

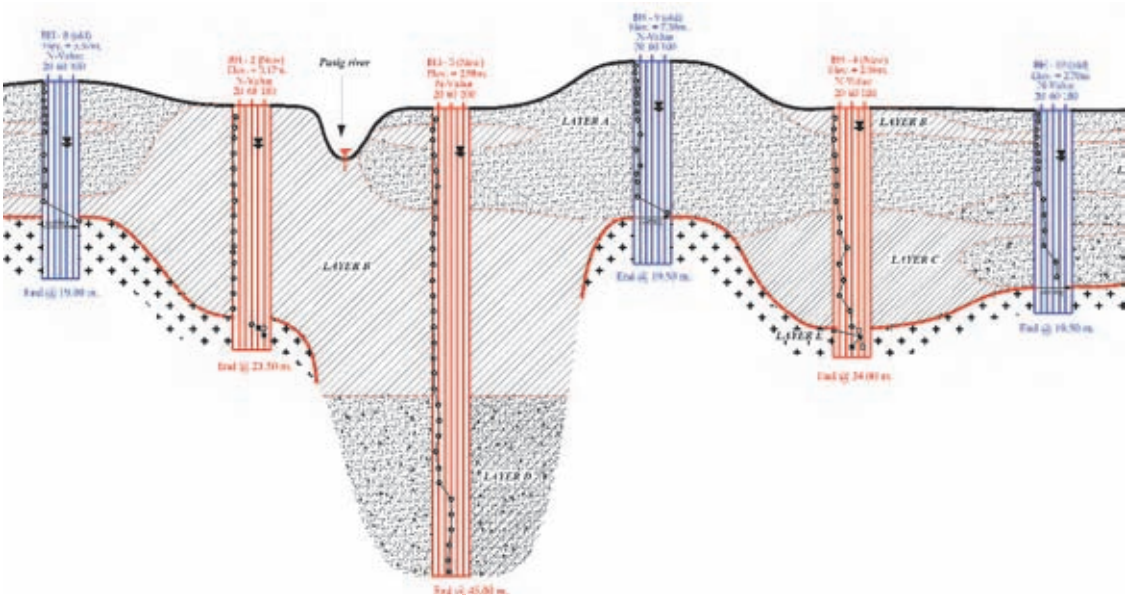
In order to confirm the river flow movement of the Passig River, a supplementary boring was carried out on the left bank of Passig River. Based on the result, the possibility of the river flow movement has been considered.



(a) Between the existing BH-1 and BH-2



(b) Near the existing BH-7



(c) Near Passig River

Figure5-1 Result of Supplementary Boring Survey

(2) Study on Bridge Structures

1. Investigation Result of Bridges in Philippines

In Philippines, concrete structure is generally applied to viaducts and flyovers for roads, highways, railways and intra-urban light rails. For the superstructure, prestressed concrete (PC) I shaped girder (I-girder) or T shaped girder (T-girder) defined by AASHTO are widely adopted. In Metro Manila, PC girder with dapped end is generally used in consideration of aesthetic of connection with substructure. Reinforced concrete (RC) slab is constructed on girder by using concrete plate or corrugated steel plate as scaffolding. In case of more than 40m span, PC box-girder has also been adopted for the superstructure.

Steel girder type is not too often adopted for bridge structures except for special case such as ramp bridge with small radius due to high price of imported material. Recently, application of steel structures has been increasing due to increase of bridge construction in urban area.

As for substructure type, RC T-shaped, which is composed of one center column with cross beam (head), is used in general. Long cross head is to be a prestressed concrete beam. In case of restriction of column location and quite long cross head, rigid frame type, which is composed of multi-column with PC or RC beam, is applied. Depend on traffic condition under viaduct, SOSROBAHU method that cross head is rotated into perpendicular direction after completion of cross head in longitudinal direction. Steel pier is also adopted at some locations due to limitation of dimension in narrow space.

In urban area in Philippines, PC box-girder by cantilever erection and arch bridge by using weathering steel has been also constructed.

(a) PC I-girder (b) PC Box-girder

Photograph 5-1 Flyovers in Manila

Photograph 5-2 PC I-girder with Dapped End and corrugated steel plate

(a) Corrugated Steel Plate Work (b) Re-bars on Corrrugated Steel Plate

Photograph 5-3 Slab Construction Work

Photograph 5-4 Steel Pier and Steel Plate Girder

2. Basic Policy on Structural Study

Types of viaduct structures should be determined in consideration of the following view points;

a) to satisfy the restrictions such as crossing conditions,
b) to assure the structural stability (safety) and economy,
c) to have an advantage in constructability.
d) to be standardized,
e) to be a easy maintenance structure,
f) to be designed with aesthetical aspect, and
g) to consider serviceability for users

a) Locations of piers and span length will be determined based on the conditions by authorities for roads and highways, railway and river. Standard span length is to be applied to other sections than the above restricted section.

b) To assure the structural stability (safety) is also one of the most important factors, especially for seismic safety. Philippines, as well as Japan, are located between Philippine Trench and Mariana Trench, and active faults are distributed. Table 5-1 shows previous earthquakes in Philippines. Earthquakes with about magnitude 7 were occurred frequently.

c) Current construction schedule is estimated relatively shorter than usual construction schedule considering the scale of construction. Therefore, consideration of Construction speed is also important.

e) – g) these will be considered in the detailed design work. The followings are to be considered;

- not only Initial Construction Cost, but also Maintenance Cost
- less accessory, reducing maintenance issues
- aesthetics
- serviceability, less expansion joint
- seismic performance

In general, standard span length should be considered from the economic view point for span arrangement for long distance viaduct. Span length should be carefully studied based on structural calculation and cost estimates. Formla5-1 will introduce general consideration of economic span length based on depth of foundations and height of piers. Economic span length of the Project based on Formula5-1 and parameter listed in Table5-2 becomes from 17.0 m to 25.0 m. Around 25m span length may be suitable for standard span length of the Project.

Suitable Span length ＝1.0～1.5×（height of piers＋depth of foundations ×1/3）

・・・Formla5-1

Table5-1 Earthquakes in Philippines

Date	Depth(km)	Magnitude	Death(person)
05.03.2002	31	7.2	15
11.12.1999	33	7.1	1
14.11.1994	32	7.1	78
16.07.1990	25	7.8	2,430
14.06.1990	18	7.1	4
16.08.1976	33	7.9	8,000
01.08.1968	37	7.3	207
31.03.1955	55	7.6	465

Table5-2 Pile Length and Pier Height of the Project Viaduct

STA			Distance (km)	Pile Length (m)	Pier Height (m)	Remarks
05+500	～	08+200	2.7	11.5	11.5	
08+200	～	09+700	1.5	11.0	17.0	
09+700	～	11+500	1.8	10.0	11.0	
13+600	～	15+000	1.4	14.0	17.0	
15+000	～	18+200	3.2	14.0	11.0	
18+200	～	18+800	0.6	13.5	14.5	
Average				12.5	13.0	

3. Design and Construction Criteria

The Design and Construction Criteria is the following:

Table 5-3 Design Criteria

ITEMS	Contents		Remarks
Design Standard	DPWH Design Guidelines Part6 AASHTO Standard Specifications for Highway Bridges, 17th Edition		
Concrete	foundation	Design Strength: 28MPa	
	substructure	Design Strength: 28MPa	
	superstructure	Design Strength: 40Mpa	
PC Tendon	Grade 1860		ASTM A416
Re-bar	Grade 60		ASTM A615

4. Selection of Structural Types of Viaduct

The Connector Road is a 13.35km-long Expressway connecting between C-3 intersection from NLEX at STA 5+500 and SLEX at STA 18+850, mainly composed of viaduct.

4.1 Beginning Point – STA 7+600

The proposed alignment (hereinafter referred to as “the Alignment”) runs along PNR from the beginning point until STA 6+000 and after that shifts to west and runs

above the PNR. In this section, at Laogn-Laan, Hermosa and Maypaho River, pier locations are restricted but for other location, standard span arrangement can be adopted. Until STA 6+000, 3-column pier is suitable because the alignment is on east side of PNR and has no restriction. 2-column pier with PC beams should be adopted from STA 6+200 to STA 7+600 because the alignment runs above PNR.

4.2 STA.7+600 - STA.9+000

The alignment runs along PNR to west from STA 7+600. After crossed JOBE ABAD SANTOS, the alignment runs above LRT BLUMENTRITT Station and RIZAL Avenue. Length of cross head of pier will become longer due to parallel water ditch around STA 8+000. Steel box-girder should be applied to crossing section at JOBE ABAD SANTOS and LRT BLUMENTRIT Station. Moreover, these points are the control points for vertical alignment.

4.3 STA.9+000 - STA.11+500

The Alignment runs toward south-east along PNR with crossing section at DIMASALANG Flyover, MAGSAISAI Flyover, MARIA CLARA, LAONG-LAAN, DAPITAN, ESPANA BLVD, SERGIO H.LOYOLA, G.TUAZON.

4.4 STA.11+500 - STA.13+300

The Alignment runs at grade from around STA 11+500 and under MAGSAISAI Flyover separating North and South bound lanes. After crossing MAGSAISAI Flyover, the alignment runs above PNR toward South-west.

4.5 STA.13+300 - STA.13+500

The alignment will pass over PASSIG River. In this section, PNR also runs on the existing PNR bridges. The alignment should run above PNR bridge by bridge with steel girder superstructure and single large diameter pile foundation beside the existing PNR bridges.

4.6 STA.13+500 - STA.15+500

In this section, height of piers will become more than 17m since the alignment runs above existing major roads such as PACO-STA.MESARO and TOMAS CLAUDIO.

4.7 STA.15+500 - Ending Point（STA.18+849）

The alignment runs along beside PNR, above OSMENIA Highway by viaduct with single column pier located in the median of the highway. Near ending point, which is connecting to existing Skyway/SLEX, the alignment runs so as to avoid existing BUENDIA Flyover.

Chapter 6

Facility Plan and Operation & Management Plan

(1) Road Facility Plan

1. Consideration of Deployment Facility Plan

Since Metro Manila NLEX –NLEX Connector road (hereinafter referred to as “the Connector road”) is approximately 13.5 km and planned to directly connect with NLEX and SLEX/Skyway, this study should be carried out to make an efficient Road Facility Plan which is taken the operation system of the existing expressway and its level into account.
The following two previous reports are relating to this study. However, those reports have no detailed description about Road Facility Plan. Furthermore, that cost was mentioned by 2% of total cost of Main Alignment and Interchanges without detailed estimate sheet.
Therefore, this study proceeded based on these report and by collecting information with on-site survey.

(Previous Studies)

a. Study on PPP Project Development of the NLEX-Skyway/SLEX Connector Road in Metro Manila, Republic of the Philippines.
b. Technical Advisory Services for the Connector Road Project

To keep constantly smooth and safe traffic flow on expressway, Traffic Management Room, Center Toll Collection Room and on-site Management Office are the most prominent organization and system, and these are essential for the Connector Road. Similarly, the maintenance office with parking area and warehouses of materials for the emergency are essential. Besides, from a user perspective, approximately equivalent facilities on NLEX/SLEX are required for the Connector Road.
However, it is uneconomical to deploy above those organization and facilities independently for the expressway section of 13.5 km.
Consequently, the survey was carried out to check the case if the existing facilities (Traffic control center, Onsite management office, Center toll collection room, Maintenance office and Warehouses) on NLEX would be exploited for the Connector Road.

1.1 On-site Facility Survey

The following Table6-1 shows buildings of Toll Barrier, Toll Plaza for the Connector Road. It is on the basis of the past studies.

Table 6-1 Facilities on the Connector Road on the basis of the past studies

Road Facility	Unit	Quantity	Notes
Toll Barrier	Place	1	Buendia
Toll Plaza	Place	4	Buendia, Quirino, Espana,C3
Toll supervision building	Building	1	Buendia
Mini building	Building	5	Buendia, Quirino, Espana,C3

The result of survey for the facility and its operation, NLEX is found to conduct proper management in terms of smooth and safe traffic flow.
The NLEX management criteria provides that patrol car round regularly and must arrive at the place in 30 minutes (mean time: 20 minutes) in case of the accident happened. Then the Traffic Management Room in MNTC's headquarters building implements adequate operation to patrol vehicles and the Maintenance Office at Sta.Rita to carry some materials and equipment to the point. Furthermore, the existing maintenance office is located from the Connector Road within operation range.
Therefore, this study will be carried out facility plan as same as NLEX level by exploiting those existing facilities (traffic control center, center toll collection system, maintenance office).

Note that next section 6.2 state verification of "Road Facility Construction Cost" because it is recognized total amount cost of Fixed Operation Equipment (hereinafter referred to as "FOE").

Table 6-2 Subject facilities of onsite survey on NLEX

Place	Subject
Headquarter building	Facilities of Traffic control room and Center Toll collection Computer System room, Organization and operation
Maintenance office	Maintenance office, Base-camp for emergency vehicles, warehouses of materials and equipment. organization and operation
Toll Plaza/Toll Barrier	Toll supervision building, Toll building Toll collection equipment, Equipment on the lane, ETC facility, organization and operation
Expressway roadside	Variable message sign, Emergency telephone, CCTV, Other equipment on the roadside

Photograph 6-1
Maintenance office

Photograph 6-2
Vehicles for maintenance

Photograph 6-3
Materials in warehouse

1.2 Traffic Management Facility

Traffic Control room is the core of traffic management and the operation method is consisted of the decision-making by gathering information and dissemination of information for adequate traffic management.

To be concrete, Traffic Management Room makes prompt decision by emergency call or the information from patrol cars and implement operation that instructing to Maintenance Office and patrol vehicles member, coping with the expressway drivers and arrangement of ambulance and so on.

Due to the exchange of views with MNTC, table 6-3 shows the sorts of equipment and its quantity for traffic management as same as NLEX level.

Therefore, incorporating traffic management equipment of the Connector Road to NLEX center computer system is not hinder.

Table 6-3 Roadside Traffic Management Equipment

Equipment	Northbound	Southbound	Total	Notes
VMS Type 1	1	1	2	1 set / Interchange
VMS Type 2	4	4	8	1 set / Interchange
TCS 2*3 Lane	5	5	10	1 set / VMS
Technical shelter	5	0	5	1 building / Interchange
Camera Completely equipped	6	0	6	1 set / building
Digital Video Recorders	6	0	6	1 set / building
UPS for Technical Shelters	5	0	5	1 set / building

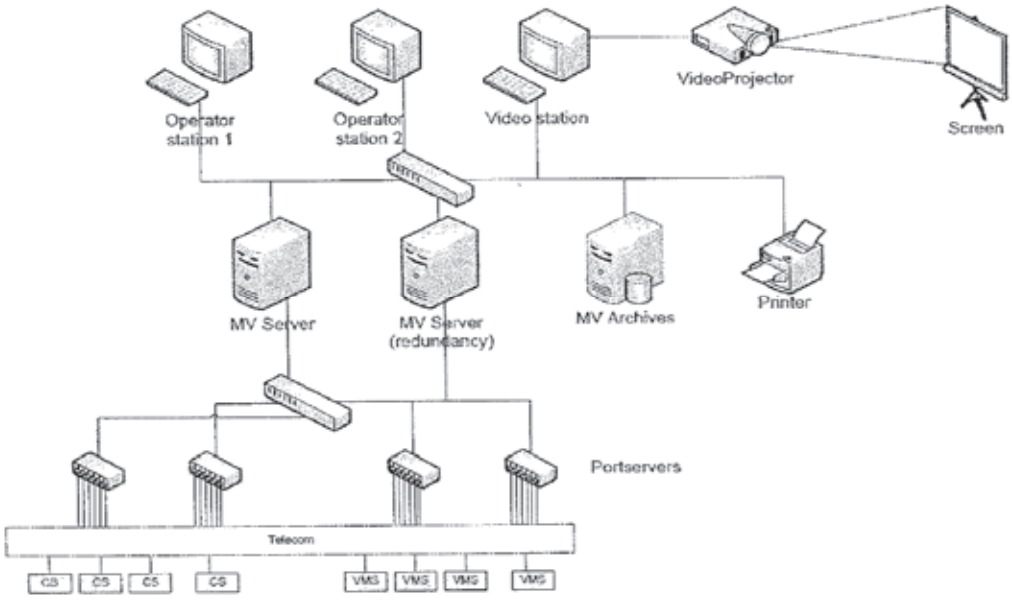


Figure 6-1 NLEX Traffic Management System

1.3 Road Communication Facility

To keep stable operation, the system in the preceding item is required the high speed Network. As a result of survey, the communication system of NLEX consists of optical fiber cable network. In case of the road communication equipment, it is also economical to use the existing network communication system. The control equipment of VMS and CCTV are installed in the Toll Supervision building and the Toll barrier building. And Emergency Call Box (ECB) is installed on 1km apart.
Table 6-4 shows road communication equipment and its quantity for the Connector Road

Note: In consideration of the margin of road alignment and structure, this study use 20km for the cable length of the Connector Road.

Photograph 6-4 VMS Type1

Photograph 6-5 VMS Type2

Photograph 6-6 ECB

Table 6-4 Road Communication Equipment

Equipment	Unit	Quantity	Notes
Secondary PABX	set	6	1 set / building
Standard Phone set	set	60	1 set / building
Intelligent Phone set	set	60	1 set / building
Optical Fiber Cable	km	20	
Copper Cable	km	20	
SDH Equipment	set	6	1 set / building
Data Communication Equipment	set	6	1 set / building
Telecommunication Link for VMS	set	6	1 set / building
Telecommunication Link for TCS	set	6	1 set / building
Interface for CCTV	set	6	1 set / building
Main ECB	set	14	1 set / km
Secondary ECB	set	14	1 set / km
Base/repeater station	set	1	
Portable/Mobile Radio	set	6	1 set / building

1.4 Road lighting Facility

As the result of the survey of MNTC's operation on NLEX and due to the exchange of views, the layout plan of road lighting equipment for the Connector Road in the previous study report was found out to be designed as same as NLEX level. Therefore, this amount of quantity is valid.

Table 6-5 Road Lighting Equipment and Pole

Location	Unit	Quantity
Mainline	set	291
C-3 Interchange	set	51
Espana Interchange	set	37
Magsaysay Flyover	set	55
Quirino Interchange	set	15

1.5 Other Equipment

To keep good condition of expressway, exploiting the Vehicle Weight Measurement Equipment is an effective way. However, MNTC put effort into controlling heavy trucks on NLEX and it is impractical to design the structure and width for that equipment.

Therefore, Vehicle Weight Measurement Equipment is unnecessary for the Connector Road.

Photograph 6-7 Vehicle Weight Measurement Equipment

2. Study of Toll Collection Facility

NLEX Toll Collection Facilities consists of Center Toll Collection room, Toll supervision building, Toll Building at Toll Plaza and Toll Barrier, Mini building on the lane and ETC lane. Those facilities are operated properly.
As the following section 6.3, Facilities for Toll collection are designed that 5 Toll building and 1 supervision building are deployed on this expressway.
As the Traffic Management Facility, designing Toll Collection System Facility as same as NLEX level by exploiting the existing Center Toll Collection Computer Room is valid.

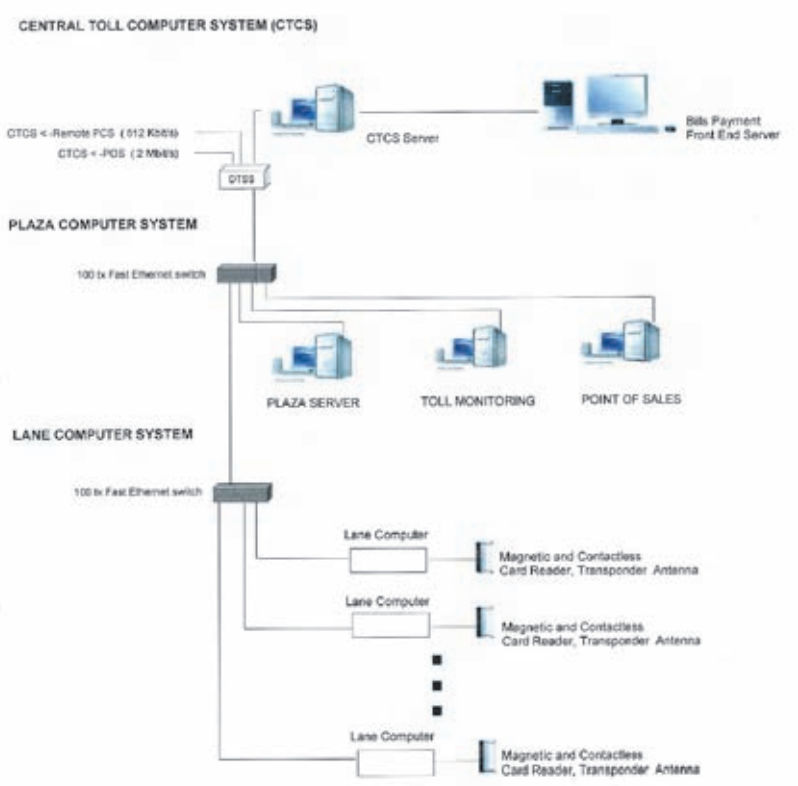


Figure 6-2 Toll Collection Equipment System (Central Toll Computer System)

2.1 Toll collection equipment

This study conducted the survey of Toll Collection System Equipment at NLEX Toll Plaza. Figure 6-3 to Photograph 6-9 are current Toll collection system equipment of NLEX. Table 6-6 shows the sorts of equipment and quantity by designing the Toll collection system equipment on this expressway as same as NLEX level.

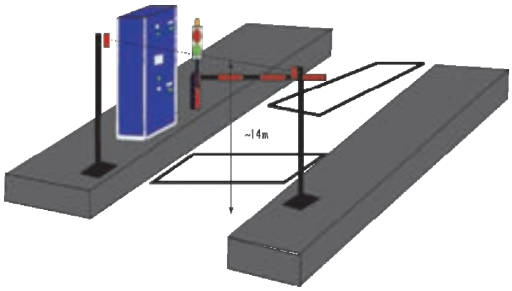


Figure 6-3 Entrance lane (Auto)

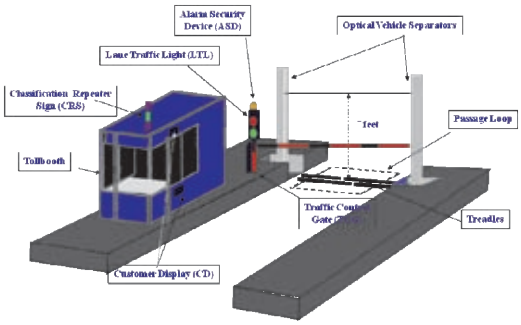


Figure 6-4 EXIT lane (Manual)

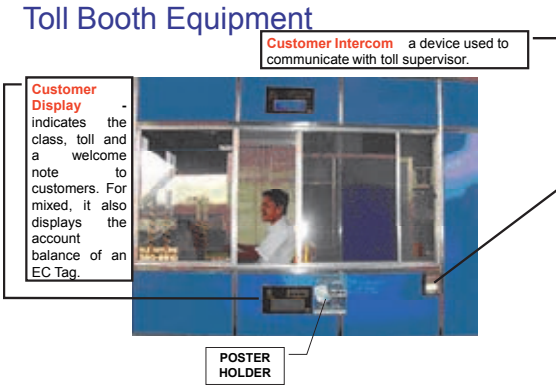


Figure 6-5 Toll Booth

Photograph 6-8 Toll collection tool in booth

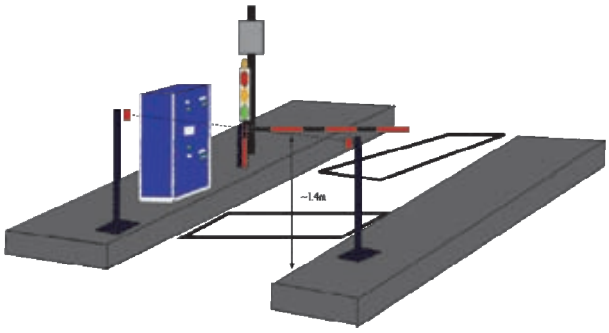


Figure 6-6 ETC lane

Photograph 6-9 ETC antenna

Table 6-6 Toll collection equipment for the Connector Road

Equipment	Toll Barrier	Toll Plaza	Total
Lane Controller	6	21	27
Lane status Indicator	7	27	34
Top Up Sign	1	5	6
Traffic control Gate, Loop and Sensor	7	27	34
Lane Traffic light-Manual	4	11	15
Lane Traffic light-ETC	2	10	12
Intercom	6	21	27
Classification Repeater Sign	5	16	21
Manual Lane Terminal and Peripherals	5	16	21
Customer Display	5	16	21
Classification System	6	21	27
Violation Alarm (siren and light)	6	21	27
ETC Antenna	2	10	12
ETC Communicator	2	10	12
ETC Cables, Masts, and Accessories	2	10	12

Equipment	Toll Barrier	Toll Plaza	Total
ETC Lane Equipped Cabinet	1	5	6
LAN Equipment	6	21	27
Removable Gauge Gantry	2	10	12
Toll Plaza Computer and Peripherals	1	4	5
Workstation	2	4	6
Master Intercom	1	4	5
Point of Sales Equipment and Peripherals	2	0	2
Tag Encoding Machine	2	0	2
Magnetic Card Encoding Machine	2	0	2
CTCS Modification	1	1	2
Camera completely equipped	1	1	2
UPS for Toll Lane	6	21	27
UPS for Toll Plaza Computer	1	4	2
UPS for Toll Work Station	2	4	6
UPS for Point of Sales	2	0	2

3. Review of Location and Scale of Toll Buildings

As the result of Chapter3 Traffic Demand Forecast, each 1-lane of Espana (Northbound) and C-3(Southbound) can be reduced from previous study. In this study, the research of the actual situation of toll collection in the Philippines was excused, and then volume and scale of toll facilities was reviewed. In NLEX, one Toll Supervision Building manages 3 to 4 Toll Plazas. Toll Plaza has Toll Booths and a Mini Building with cash counting room and strong room. And the collection of cash kept in strong room is operated by local bank. In previous study, one Toll Supervision Building that manages Toll Barrier and 4 Toll Plazas was designed. That is considered to be appropriate on the survey of NLEX. Scale of Toll Supervision Building is as large as one of Sta.Lita Toll Plaza on NLEX, therefore it has rooms to be necessary and enough scale. But location of Toll Supervision Building in previous study needs to be reconsidered. The detail is described in the following section. From the above-mentioned, summary of Toll Facilities is as follows;

Table 6-7 Summary of Toll Facilities

Interchange	Direction	No. of Lane	Inclusive Facilities
Buendia Toll Barrier (Skyway)	Northbound	5	Toll Gate, Toll Booth, Mini Building
Buendia Toll Plaza	Northbound	4	Toll Gate, Toll Booth, Mini Building
Quirino Toll Plaza	Northbound	4	Toll Gate, Toll Booth, Mini Building
Espana Toll Plaza	Northbound	3	Toll Gate, Toll Booth, Mini Building
	Southbound	4	Toll Gate, Toll Booth, Mini Building
C3 Toll Plaza	Southbound	4	(On The Connector Road) Toll Gate, Toll Booth, Mini Building (Out of The Connector Road) Toll Supervision Building, Guard House, Electrical Service Center, Pump House

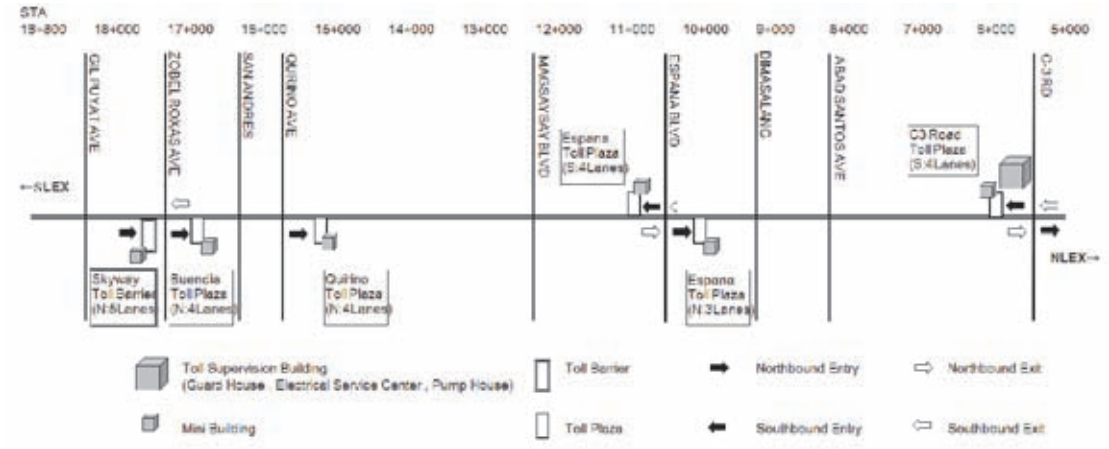


Figure 6-7 Location of Toll Facilities

3.1 Proposal and Consideration of Facility Plan

Location, scale and construction cost are the above-mentioned in preceding item. In this section, consideration to be necessary is clarified in detailed design and directionality of the consideration is proposed.

3.1.1 Relocation of Toll Supervision Building

In previous study, location of Toll Supervision Building was not considered in detail and there was only the description; “Toll Supervision building is in

Buendia.“ However, it is impossible to build Toll Supervision Building without additional land acquisition because Osmenia highway and PNR run under the Connector road around Buendia Interchange. On the other hand, there is enough space to build it around C3 Interchange. As the result of proposal of relocation of Toll Supervision Building from Buendia to C-3, MNTC agreed on this recommendation.

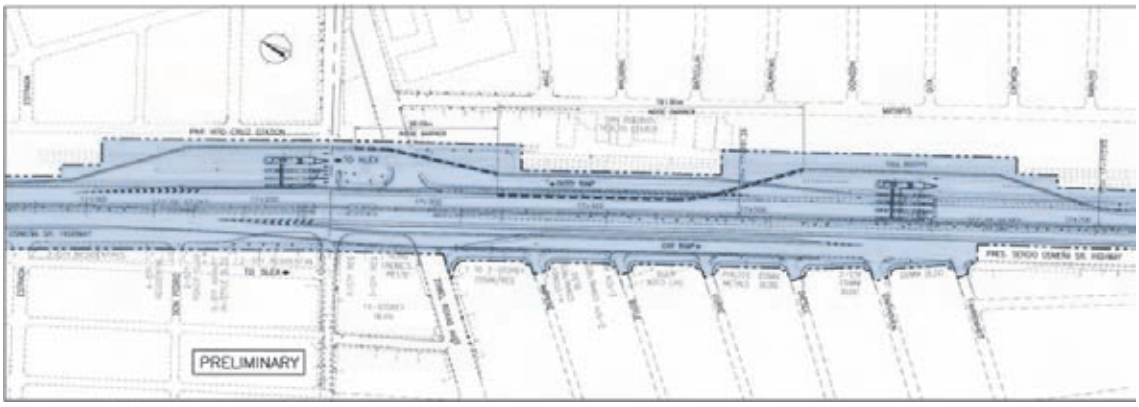


Figure 6-8 Buendia Interchange

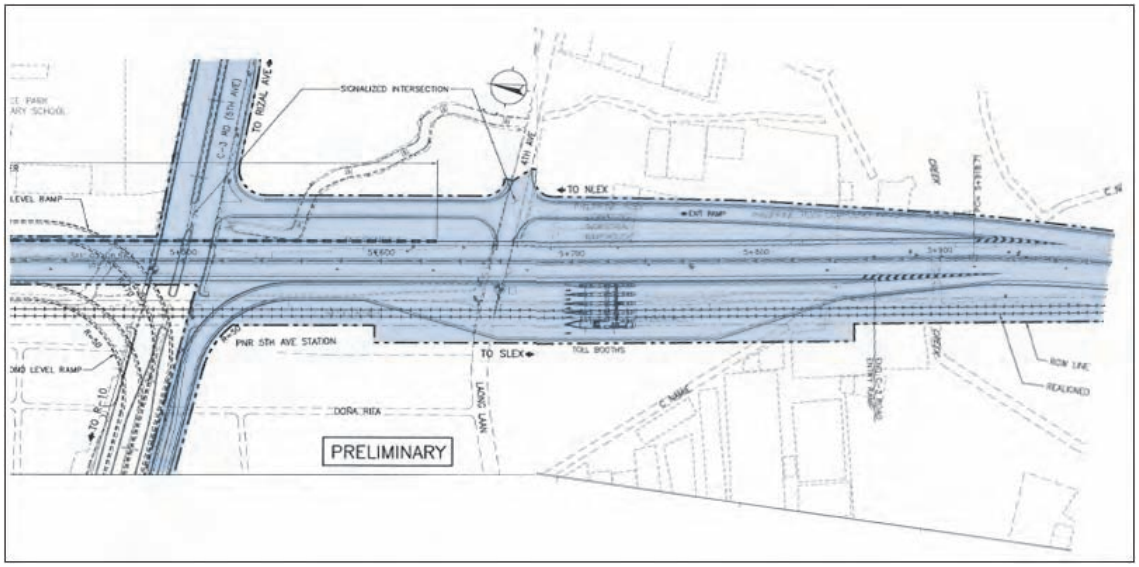


Figure 6-9 C-3 Interchange

3.1.2 Access of Toll Plaza

In previous study, All Toll Plaza of the Connector road is installed on the bridge and the staff of toll collection commutes from the outside of the Connector road by stairs. This study found one Toll Plaza on the bridge on the Skyway during the on-site survey in the Philippines. That is Doctor A.Santos Toll Plaza. That has 2 entry lanes

and 2 exit lanes and a Mini Building but doesn't have the outside stairs to access there. Perhaps the staff commutes by using the Skyway. Then if the staff in the Connector road regularly is transported by commuter bus, it isn't necessary to build the outside stairs and to acquire land of it. Therefore that is considered to be valid.

Photograph 6-10 Doctor A.Santos Toll Plaza

(2) Examination of O&M Operations for Connector Road

1. Previous Studies for the Project

There are 2 related previous studies for this project:

① Study on Private-Initiative Infrastructure Projects in Developing Countries in FY2009: Study on PPP Project Development of NLEX-Skyway/SLEX Connector Road in Metro Manila, Republic of the Philippines

② Technical Advisory Services for the Connector Road Project

The reviewing of each study related to road operation and maintenance (hereinafter referred to as "O&M") shows that the O&M costs are calculated by multiplying the construction costs by a constant ratio based on previous case, but there is no concrete description about the structure and standards in regards to O&M. In the study ② mentioned above, there is even no reference to O&M.
In this study, therefore, we have started our work by gathering the basic information about expressways in the Philippines first.

2. Structure of O&M for Connector Road

We asked MNTC about the O&M contractor for the North-South Connector Road (hereinafter referred to as "Connector Road") and confirmed the following:

- MNTC has not officially been contracted yet
- TMC, which is a contractor for NLEX and SCTEX, however, is a powerful candidate as it belongs to MPTC group, as with MNTC. Assumed contracting system for the O&M of NLEX can be illustrated as below:

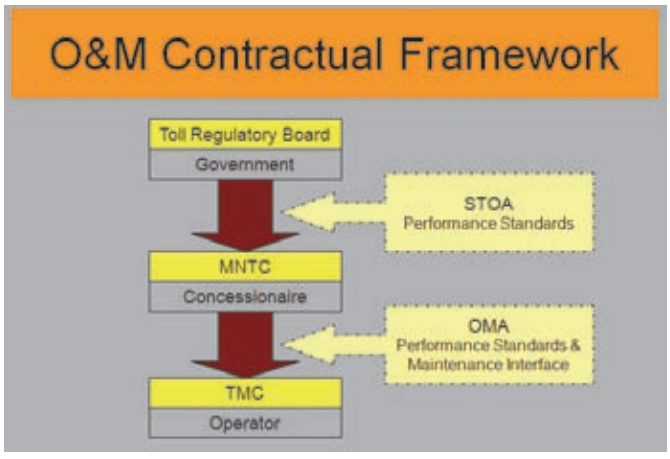


Figure 6-10 O&M Contract Framework; assumption

In the Unsolicited Proposal submitted from MNTC to DPWH, there was a reference to TMC in the chapter, "6.0 Operation and Maintenance". Therefore, we have conducted our study under the assumption that the SPC for this Project would conclude O&M contract with TMC.

TMC is one of the group businesses of MNTC, which was established in 2000. It started operation of the NLEX in 2000, the Subic-Tipo Expressway in 2006 and the SCTEX in 2008. Its wide scope of work includes toll collection, money handling, repairs, maintenance and traffic management over the below roads. And TMC shows enough capabilities for performing a task. For instance, it is practically handling the traffic management according to the regulation in the contract of NLEX with MNTC, that "O&M contractor must deal the incident within 20 minutes of discovery."

- NLEX （84km, 16 Interchanges, 5 Toll Barriers）
- SCTEX（94km, 10 Interchanges, 2 Toll Barriers）
- Subic-Tipo Expressway (8.8km, 3 Interchanges, 2 Toll Barriers)

The following persons from MNTC are in charge of O&M:

- Mr. Raul L. Ignacio (Vice President)
- Mr. Grenn G. Campos (Assistant Vice President)
- Mrs. Jennifer Jane T. Go (Senior Manager)
- Mr. Romel C. Langcauon (Manager)

3. O&M Standard

We have found out from MNTC that the TOA（toll road operation agreement） signed between the Toll Regulatory Board (TRB) and each road operator regulates a minimum service level required for the expressway O&M in the Philippines. For instance, as illustrated in figure 6-10 above, STOA, an equivalent of TOA contract, has been concluded for the MNTC-operated NLEX.

Generally, TOA only stipulates general matters; the TOA attached to the Unsolicited Proposal for the concession of the Connector Road, which is submitted from MNTC to DPWH, is drafted by referring to the NLEX's STOA, but there is not much stipulation about the service level for O&M. Since the detail is not sufficiently laid out as to the implementation of the actual O&M, MNTC is working with TMC on drafting more specific O&M plan for the NLEX.

There is a national standard called Philippine Highway Maintenance and Management Standard (PHMMS), but according to MNTC, it only defines the specifications for civil work conducted for maintenance purpose and does not specify the minimum service level. To confirm this information, we have sent a

formal letter to DPWH to request a copy of PHMS but we could not get any reply from them during the contract period despite several attempts to contact them.

4. Current Condition of O&M for Existing Expressways

We interviewed MNTC and TMC, and conducted some site studies to find out further about the O&M operations on the NLEX, which TMC is undertaking as an O&M contractor.

The following table shows part of the maintenance standards for the NLEX, which is to be connected to the northern end of the Connector Road. This table shows the examples of the minimum O&M service level specified in OMA for the NLEX, and the annual implementation plan, which MNTC has established based on the contract signed with TMC.

Table 6-8 Maintenance service level

Item	Maintenance work	Minimum service level	Implementation plan for 2011
Pavement	Cut and overlay	Based on 7-year plan	---
	Sub-grade replacement	Based on 7-year plan	---
	Crack sealing, Pothole patching	Yearly, Or as required	---
	Cleaning, Accident clearance	At times of accident and other incidents	5 times/year
Drainage	Upgrade, De-clogging/silting	Based on 7-year plan	---
	Cleaning	Based on annual plan, Or as required	5 times/year
Landscaping, vegetation	Grass cutting and mowing (in median strip, roadside, interior of interchanges)	Twice/ month	---
	Trimming, pruning, removal of dead/decaying trees	Yearly, Or as required	---
Fences	Spot repair, replacement	As required	---
	Removal of vine	Twice/year	---
Slope, Shoulder	Repair of potholes blowups, subsidence, collapse	As required	---
Bridge superstructure and	Reinforcement, retrofitting, Replacement of bearing	Based on 7-year plan	---

substructure	Minor repair to concrete and steel structures	As required	---
	Removal of graffiti, Cleaning of drain systems	As required	---
	Cleaning of river bridge parapet	Yearly, Or as required	---
Traffic management facilities	Removal of obstacles and graffiti; Minor repair to signboard, guardrails, concrete barriers, road markings	As required	2 to 5 tunes/year (Toll booth cleaning)
	Cleaning of metal beams and concrete barriers	Yearly, Or as required	---
Inspection	Routine inspection	Weekly	One week/month (sectional basis)
	Detailed inspection	As required	---
	Independent inspection	As required	---
	Joint inspection	As required	---

As for the results of site studies, we could see that slope, embankment, road shoulder and median strips were generally kept in fine conditions; hence it can be concluded that the maintenance standard shown in Table 6-9 is set at an appropriate level.

Photograph 6-11 Present Condition of the NLEX

We have also visited some relevant facilities (traffic control center, toll office and maintenance office). Having interviewed some people at each place, we were able to confirm that the whole O&M operations were systematically conducted, including toll collection systems, measures to prevent toll collectors' embezzlement, traffic management, maintenance work and inventory management. It was also confirmed that the MNTC and TMC have a sufficient level of experience and management skills.

5. O&M Standard for the Connector Road

Currently, the situation of the Connector Road project is under the evaluation process for concession acquisition, and the content of TOA to be signed with TRB has not been finalized yet. As the relevant standards and manuals for the O&M operations are now being examined as part of DED ordered by MPTC, we were not able to confirm the actual plans for the O&M of the Connector Road.

However, MNTC estimates the content of TOA for the Connector Road to be signed with TRB will not be largely different from the STOA for the NLEX. If this is the case, the general concept for the O&M of the Connector Road would basically follow the NLEX's concept; therefore the standard to be established by the Connector Road's SPC would be expected to be similar to the NLEX's standards.

Chapter 7
Environmental and Social Considerations

(1) Environmental Impact Assessment

1. Procedures of Environmental Impact Assessment (EIA)

Department of Environment and Natural Resources (DENR), a responsible organization for environmental administration and management in the Philippines, was established in 1987 to protect and preserve natural resources from uncontrolled exploitation with the aim of promoting sustainable development. Environmental Management Bureau (EMB) was created under DENR as a core body to deal with practical works for various environmental issues, such as control and analysis of air/water quality and chemical substance, pollution control, conservation of nature, environmental education, environmental impact assessment, etc.

Environmental Impact Assessment system is established under Presidential Decree 1586 and it will need to follow the procedure according to Revised Procedural Manual for DAO 2003-30 issued by DENR in August 2007. In this regard, EMB will be deeply involved in processing and endorsing documents. There is a system of sharing responsibility in EMB between Central Office and Regional Office that will be decided depending upon the project scale or nature, which means the Central Office will take charge of large scale of projects or environmentally critical projects. The Regional Office will assume the responsibility for other types of projects so that EIA section is placed in every Regional Office to cope with the situation.

EIA procedure can be divided into 6 major steps as shown in Table 7-1. Items 1, 2, 3 and 6 shall be undertaken by the project proponent, and items 4, 5 and 6 shall be conducted by DENR or EMB.

Table 7-1 Procedural Items for EIA and Responsible Organization

Item	Relevant Organization	
	Project Proponent	DENR/EMB
1. Screening	✓	
2. Scoping	✓	
3. Study and EIA Report Preparation	✓	
4. Review and Evaluation of EIA		✓
5. Issuance of ECC		✓
6. Monitoring and Auditing	✓	✓

Remark : ✓ Responsible
DENR : Department of Environment and Natural Resources
EMB : Environmental Management Bureau

EIA should be undertaken by the project proponent according to the scoping and for any project affecting environment, the required report shall be prepared in compliance with rules and regulations and subsequently submitted to DENR or EMB for being reviewed and properly evaluated. The project proponent is required to obtain Environmental Compliance Certificate (ECC) from DENR or EMB as a precondition of project implementation. Schematic process of EIA system is shown in Figure 7-1.

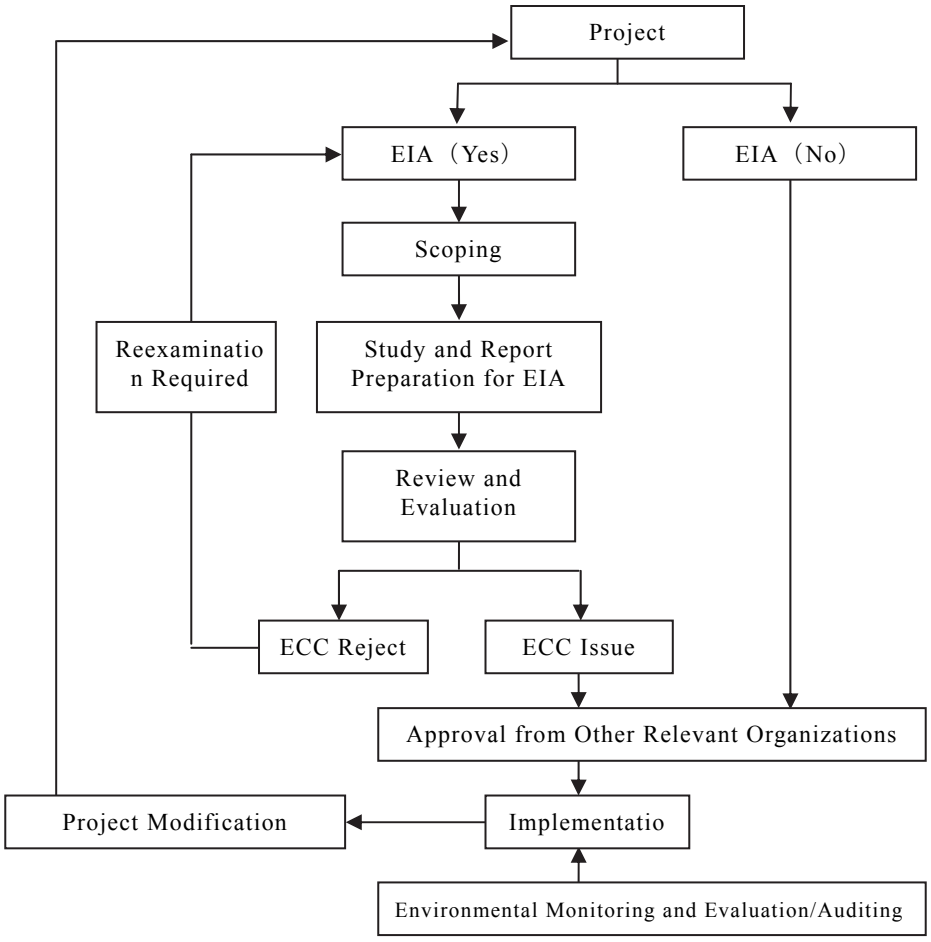


Figure 7-1 Schematic Process of EIA system

2. Project Grouping and EIA Report Type

As a general rule, the project classification is provided in Presidential Proclamation No.2146 according to its nature. It is basically split into two types described as (1) environmentally critical projects and (2) those located in environmentally critical areas and may be further categorized in the following five groups:

I. Environmentally critical project in environmentally critical area or non-environmentally critical area.
II. Non-environmentally critical project in environmentally critical area.

III. Non-environmentally critical projects in non-environmentally critical area.
IV. Projects located in both environmentally critical area and non-environmentally critical area.
V. Unclassified projects.

Environmentally critical projects are represented as heavy industries (non-ferrous metal industries, iron and steel mills, petrochemical industries, smelting plants, etc), resource extractive industries (major mining and quarrying, fishery and forestry projects), and infrastructure projects (major dams and power plants, land reclamation, major road and bridge, etc). In addition, it should be noted that the following will also be categorized as environmentally critical projects such as agriculture, water supply and sewage system, solid waste management and golf course and so on.

The environmentally critical project is clearly defined in DENR standard for the new project, as it is over 20 km in total length for roads and over 10 km for bridges and viaducts. From the above considerations, this project will fall in group I as it is practically viaduct extending for 13.5 km. Documents required for the group I project is given in Table 7-2 for ECC application.

Table 7-2 Documents Required for Group I

Project Type	Report	ECC	Endorsing Office	Deciding Authority	Max. Time to grant ECC
New Project	EIS	Required	CO: EIAMD Chief /EMB Director	EMB Director /DENR Secretary	120 days
Existing project for restart-up	EPRMP	Required	CO: EIAMD Chief /EMB Director	EMB Director /DENR Secretary	90 days
Operating without ECC	EPRMP	Required	CO: EIAMD Chief /EMB Director	EMB Director /DENR Secretary	90 days

EIS: Environmental Impact Statement,
EPRMP: Environmental Performance Report & Management Plan

Environmental Impact Statement (EIS) is required for the new project. EMB Central Office will be in charge of evaluating such report and taking necessary steps for the issuance of ECC which is subject to the approval of DENR Secretary. Time to grant ECC will generally require 4 months. EIA shall be conducted by the eligible consultant according to TOR that contains the following:

(1) Definition of Scoping.
(2) Study of the present conditions of items described below
- Climate
- Terrestrial fauna and flora
- Baseline survey for the following items;

a) Ambient air quality (SO_2, NO_2, TSP, CO, lead).
b) River water quality (pH, DO, TSS, BOD, COD, grease and oil, E. coli).
c) Aquatic biota (plankton, nekton, benthos, aquatic plant).
d) Noise.
e) Vibration.

- Inventory survey for trees existing in Right-of-Way.
- Present conditions of land use in the project areas.
- Socioeconomic survey for the project area.

(3) Conduct of public hearings, meetings and consultations
(4) Prediction and evaluation of all direct and indirect significant impacts in every stage (pre-construction, construction and post-construction).
(5) Suggestion of mitigation measures to address adverse significant impacts.
(6) Preparation of environmental management plan and monitoring plan (incl. relevant institutions and financial resources).
(7) Preparation of EIA report (incl. supporting documents such as socioeconomic survey data, stakeholder meeting program/schedule and attendants list, etc).

3. Environmental and Social Impacts

3.1 Scoping

It is important to note that currently Feasibility Study is being conducted by JICA, whereas Detailed Engineering Design (DED) is also in process at the same time by MPTC/MNTC, so that particular attention should be drawn in a bid to harmonize the design concept with each other and to avoid any discrepancy and miscarriage between them. EIA will be conducted as part of DED. However, current stage seems to be not as easy as expected, because as of the end of May, a local consultant is not selected yet to deal with EIA so scoping will be finalized soon after the selection of the consultant, which may be in July-August period.

In the meantime, a draft scoping was prepared by JICA study team in February 2011 and updated in March based on comments and observations given by the Advisory Committee for Environmental and Social Considerations (refer to Table 7-3). Items categorized as A, B and C will need particular attention to be paid to environmental impacts. In this regard, a letter dated April 28 addressed to MPTC was delivered to inform them of items required for EIA and RAP.

Table 7-3 Scoping

Project Proponent		Manila North Tollways Corporation（MNTC）		
No.	Environmental Item	Rating		Brief Description
		Stage 1	Stage 2	
【**Social Environment**】 Impacts on Gender and Children's Right shall be related to all criteria.				
1	Involuntary resettlement	A-	C-	737 houses existing along the design route will be affected, out of which 91 are considered as informal settlers. Basically almost all required lands belong to PNR. However, more land will be required for the construction of interchanges and ramps. Negotiations with owners are expected to compensate for such affected land and houses through legal procedures. After the construction, informal settlers are likely to appear and stay in the space under the viaduct.
2	Local economy such as employment & livelihood	B+	B+	Job opportunities will be increased during construction and economic activities will also be increased after construction.
3	Travelling and move	B-	B+	Travelling is temporarily restricted for people during construction period. However, it will become smooth in post-construction stage due to the improvement of traffic conditions.
4	Relocation of existing facilities	B-	D	Some negative impact may be expected for people's life temporarily in construction period due to the relocation of existing facilities such as power and telecommunication cables and railway station, but these can be recovered in post-construction for the service to be rendered.
5	Land use and utilization of local resources	D	D	Currently affected land is used as residential areas for low income families, and no impact is expected on existing land use and local resources.
6	Social system i.e. social infrastructure and local decision-making system	D-	D	No impact is expected on local social system.
7	Existing social infrastructure and services	D	B+	Elevated toll road (viaduct) will not affect existing social infrastructure during construction. However, it is expected to improve social services after construction.
8	The poor, indigenous and ethnic people	C-	D	The poor exist but no indigenous and ethnic people are living in the vicinity of route. Follow-up action is required to observe whether the affected families will get compensated in proper manner.
9	Misdistribution of benefit and damage	D	D	Benefit and damage will be shared among all local residents.
10	Cultural heritage	D	D	No cultural heritage exist in the area so no impact is expected.
11	Local conflict of interests	C-	D	Land acquisition and resettlement are unavoidable for project implementation, so local conflict may arise from negotiations with Barangay people in pre-construction stage.
12	Water usage or water right and membership	D	D	No impact is expected on water usage and water right.
13	Sanitation	D	D	No impact is expected on local sanitation.
14	Hazardous risk, infectious disease	B-	D	Some risk will need to be considered during construction because of inflow of workers to the site and nearby areas.

【Natural Environment】				
15	Topography & geographical features	D	D	No impact is expected on topography and geographical features.
16	Soil erosion	B-	D	Small impact is anticipated during the construction of bridge.
17	Groundwater	C-	D	There are few people who use groundwater for drinking, but it could be used for washing or bathing and also for industry, of which impact will need to be studied.
18	Hydrological situation	C	B+	Hydrological study is required to improve drainage system for the project area.
19	Coastal zone (mangroves, coral reefs, tidal flats, etc.)	D	D	No impact is expected on coastal zone.
20	Fauna, flora and biodiversity	C-	D	No impact is expected as the project site is located in manmade biosphere (urbanized area). However, monitoring is required for aquatic biota in the Pasig River as it is likely to be affected by the foundation works for the bridge construction.
21	Meteorology	D	D	No impact is expected on meteorology.
22	Landscape	B-	B-	Bridge and concrete-made viaduct may give some negative impact on landscape.
23	Global warming	B-	B+	Emission of CO_2 will be increased during construction. However, if impact will be assessed from both negative and positive effects after construction, positive impact will be predominant in terms of volume of GHG emission.
【Pollution】				
24	Air pollution	B-	B+/-	Air will be polluted during construction due to exhaust gas and dust from the equipment. On the one hand, the pollution will be less after construction due to the mitigation of traffic congestion, but on the other, it will be worse as a result of increase of traffic volume and impractical emission control.
25	Water pollution	B-	D	Water may be polluted temporarily during the foundation work of the bridge, but no impact is expected after construction.
26	Soil contamination	D-	D	No toxic chemicals are used so that no impact is expected.
27	Waste	B-	D	Some waste and refuse may be generated during construction, but can be properly managed by supervisor or inspector.
28	Noise and vibration	B-	B-	Some impacts are expected to the residents during and after construction.
29	Ground subsidence	D	D	No impact is expected on land subsidence.
30	Offensive odor	D	D	There is no potential source of offensive odor during and after construction.
31	Riverbed sediment	D	D	The project will not affect river hydrology so no impact is expected.
32	Accident	B-	D	The probability of traffic accident will be high during construction unless proper safety measure is taken.

Note: A+/-: Serious impact (positive or negative) is expected. B+/-: Some impact (positive or negative) is expected. C+/-: Extent of impact (positive or negative) is unknown（Study may be required to clarify impact）. D: No impact is expected. Stage 1: Before or during construction stage. Stage 2: After construction stage

3.2 Matrix of Environmental and Social Considerations

Following the above scoping, expected project impacts in each stage are summarized in matrix as presented in Table 7-4.

"X" in the matrix represents negative impact and its magnitude is expressed by the number of X. In the meantime, positive impact is marked simply as "+". Rating "A" shown in Table 7-3 will correspond to XX or XXX in Table 7-4. As such, rating "B" will be equal to X. However, "D" which means no impact is expected will be blank in Table 7-4. Likewise, "C" without +/- will not be required for match-making with items in Table 7-4.

Table 7-4 Environmental and Social Considerations

Environmental concerns \ Activities			Pre-Const.	During Construction										Post-Construction			
			Field survey	Recruitment of job opportunity	Mobilization of equipment and materials	Site clearance	Setting up of base camp	Soft ground treatment	Earth works	Construction of bridge	Piling	Paving work	Construction of other relevant facilities	Installation of computer system	Recruitment of job opportunity	Maintenance of toll road	Operation of toll road and gates	Traffic
Social Environment	1	Land acquisition & resettlement	XXX															
	2	Economic activities		+			+								+			+
	3	Travelling and move			X				X	X	X	X				+		+
	4	Relocation of facilities							X	X			X					
	5	Split of communities																
	6	Cultural property																
	7	Water right																
	8	Public health and sanitation																
	9	Hazards (risk)			X	X	X	X			X	X	X				+	
Natural Environment	1	Topography/geography																
	2	Soil erosion				X			X	X								
	3	Groundwater						XX			XX							
	4	Hydrological situation(drainage)														+		
	5	Coastal zone																
	6	Fauna and flora								X								
	7	Meteorology																
	8	Landscape								X			X				X	
	9	Global warming			X	X		X	X	X	X	X				X		+
Pollution	1	Air pollution			XX			X	XX	X		X	X					X
	2	Water pollution					X	XX		X	X							
	3	Soil contamination																
	4	Wastes				X	X		X	X		X						
	5	Noise and vibration			XX		X	X	X	X	XX	X	X				X	XX
	6	Land subsidence																
	7	Offensive odor																

Note: +: Positive impact X: Negative impact but its magnitude is not significant. XX、XXX: Negative impact, to which special attention has to be paid.

4. Environmental Management Plan and Mitigation Measures

4.1 Conceptual Approach to Social Environment

4.1.1 Land acquisition and involuntary resettlement

In view of the fact that land acquisition and resettlement are unavoidable for road project in Metro Manila, optimum alignment and facilities should be designed in an effort to minimize project-affected land and families.

As a general rule, land acquisition for public works is implemented by DPWH through cash compensation to the land owners. However, in case of unsolicited proposal, such direct Government support can not be expected. In addition, it should be noted that there is financial constraint in the Philippine Government, As a result, DPWH will execute the land acquisition but the project proponent is likely to shoulder its compensation cost.

Involuntary resettlement will be conducted in a joint effort between NHA and LGU according to relevant laws and regulations. To make further approach to the resettlement, EIA and RAP will definitely need to be prepared in DED stage which is currently in process, and stakeholder meetings as well as public consultations will take place in an effort to reach an agreement on the project.

4.1.2 Traffic safety during construction period

Temporary detour will need to be provided during construction period to facilitate traffic. Should traffic congestion be predicted, the contractor has to consult with the client and local police to take appropriate mitigation measure. It is also important to note that speed limit should be imposed for the construction equipment and machine, and traffic sign board, fence and guards should also be placed in adequate area for the protection and safety of residents. Furthermore, information system will need to be established by media such as TV and radio to let people know the working area, type of work, working hours, etc.

4.1.3 Relocation of existing facilities

The relocation of railway station and other existing facilities such as power line, telecommunication cable, etc may be required during construction period, which may affect temporarily daily life of residents caused by power failure or discomfort for the use of railway station. Therefore, particular attention will be drawn to the relocation sites and construction planning in an effort to minimize adverse effect.

4.1.4 Hazard and infectious disease

A great number of people will inflow from outside area to join the work during construction period, so the contractor will assume responsibility for labour

management as well as health management to protect labour camps and nearby Barangays from the outbreak of infectious disease.

4.2 Conceptual Approach to Natural Environment

4.2.1 Soil erosion

The proposed highway is designed to be elevated structure which basically requires neither embankment nor soil cutting so that there will be no need to pay much attention to the slope erosion. As to bank protection of the Pasig River, block-mat or vegetation cover shall be provided for erosion control.

4.2.2 Groundwater

Groundwater is being used by people living along the designed route in the right bank of Pasig river (Caloocan and Manila) for domestic use and not for drinking because water of shallow well (upper aquifer) is polluted so that bottled filter water is used for drinking instead. Piles driven for foundation work will not prevent groundwater from flowing, but piling method should be carefully selected through comparative study so as not to pollute lower aquifer.

4.2.3 Fauna and flora

Aquatic biota may be affected temporarily by the foundation work for the bridge construction. However, it will not be serious impact to ecosystem as coffering will be partially installed not to disturb river flow.

4.2.4 Landscape

Speaking of landscape of urban highway, road alignment and structural design are the points to be specially considered, and it should be well harmonized with peripheral structures and facilities. It is not always easy to make practical approach to landscaping from the viewpoint of safety and cost that may impede the implementation, so this issue will be discussed in DED taking account of other similar projects for reference. Tree planting in central zone will contribute to the promotion of highway landscape, but it is desirable to progress this move step by step.

4.2.5 Global warming

For the evaluation of impacts on global warming, it will require to estimate total greenhouse gas emission produced in a road network that should be established to cover the project-affected area. If only project area is the focus of attention in this respect, it will certainly show a net increase of greenhouse gas (GHG) resulting in negative impact on environment. However, there may be some positive impacts as well such as decrease in traffic and mitigation of traffic jam in and around project

area, so it is absolutely necessary to consider the impact in a comprehensive way. GHG emission can be estimated for construction stage and after construction stage respectively. For construction stage, it will largely depend on highway structure and type of facilities to be installed, whereas for post-construction stage it can be calculated based on future traffic demand predicted in master plan for short tem (2016), mid-term (2020) and long term (2030).

1) Estimation of GHG emission for construction stage

Under the present circumstances, no information is available about types of work and equipment to be used for the project since detailed construction plan is not ready yet, so referring to the data and information provided by "Proposal of CO_2 Estimation Method for Highway Project" prepared by Highway Research Center, Japan in December 2004, primary unit will be used for the estimation of CO_2 produced by the mobilization of construction equipment and machinery.

(a) CO_2 emission for highway construction

As viaduct is proposed for the project, the emission rate shall be based on the structure of PC bridge/viaduct. In model work presented in the above-mentioned proposal, the primary unit for CO_2 emission is given for material and equipment to be used for the construction of one kilometer highway with four lanes (refer to Table 7-5)..

Table 7-5 CO_2 Emission Rate for Highway Construction

PC Bridge/Viaduct	t-C/km	t-CO_2/km
Material	6,484	23,775
Equipment	464	1,701
Total	6,948	25,476

From the above Table, The total CO_2 emission is estimated at 344,436 tons for the highway construction as it is calculated by multiplying the primary unit and 13.5 km, the total length of the proposed highway.

(b) CO_2 emission for facility construction

The primary unit of CO_2 emission for facility construction can be referred to empirical value which is given by the above proposal. Interchange as a facility of this project will be constructed in 4 locations. At each location, an office must be constructed, and it will need to be equipped with various systems such as lighting, telecommunications, information, ventilation, etc. The primary unit of CO_2 emission should include all these installation works for the construction of a single interchange, and it is estimated at 1,615 tons. For 4 interchanges, it will be 8,075 tons.

As a result of the above (a) and (b), GHG emission for the construction stage will amount to 352,511 t-CO_2.

2) Estimation of GHG emission after construction

In the Philippines, a master plan for national highway network was prepared in 2010 emphasizing the necessity of establishing arterial road network to comply with future transportation planning. Therefore, GHG emission for this project is estimated based on the prediction of future traffic demand in line with this master plan. Annual emission rate can be calculated in the following formula:

Emission factor (kg/km・car) x Traffic volume (cars/day) x Traveling distance (km) x 365 days

For the estimation of gas emission, the following should be taken into account: (1) sorting of vehicles according to their size, large or small, (2) covering all network roads concerned with the project, and (3) drawing a comparison of output of the two cases between "With Project" and "Without Project", from which the project can be easily evaluated by either rise or fall of the emission.

3 types of gases are considered as GHG for the road project. These are Carbon Dioxide (CO_2), Methane (CH_4) and Nitrous Oxide (N_2O), and for the calculation of GHG, the following Global Warning Potential shall be used to estimate CO_2 equivalent for their respective gas.

Table 7-6 GHG and Global Warning Potential

GHG	Global Warning Potential
Carbon Dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous Oxide (N_2O)	310

The emission factors for CH4 and N2O shall be based on Ordinance for Law Enforcement on Global Warming Countermeasure, revised version in March 2006, and the emission rate will be calculated by multiplying traffic volume and emission factor for each size of vehicle.

Should the project be implemented, it will contribute to the reduction of GHG emission by 27,076 t-CO_2/year for 2016, likewise, the reduction rate in operation stage will be 76,575 t-CO_2/year for 2020 and 101,683 t-CO_2/year for 2030. Further details are presented in the following Tables.

Table 7-7 Estimation of GHG Emission for 2016

	① With Project		② Without Project		①-②
	Emission Rate (ton/Y)	CO_2 Equiv (t-CO_2/Y)	Emission Rate (ton/Y)	CO_2 Equiv (t-CO_2/Y)	(t-CO_2/Y)
CO_2	13,079,410	13,079,410	13,108,245	13,108,245	- 28,835
CH_4	663	13,920	660	13,858	61
N_2O	1,277	395,912	1,272	394,215	1,697
Total	-	13,489,242	-	13,516,318	- 27,076

Table 7-8 Estimation of GHG Emission for 2020

	① With Project		② Without Project		①-②
	Emission Rate (ton/Y)	CO_2 Equiv (t-CO_2/Y)	Emission Rate (ton/Y)	CO_2 Equiv (t-CO_2/Y)	(t-CO_2/Y)
CO_2	15,818,370	15,818,370	15,896,115	15,896,115	- 77,745
CH_4	773	16,234	771	16,196	38
N_2O	1,477	457,805	1,473	456,673	1,131
Total	-	16,292,409	-	16,368,985	- 76,576

Table 7-9 Estimation of GHG Emission for 2030

	① With Project		②Without Project		①-②
	Emission Rate (ton/Y)	CO_2 Equiv (t-CO_2/Y)	Emission Rate (ton/Y)	CO_2 Equiv (t-CO_2/Y)	(t-CO_2/Y)
CO_2	19,467,640	19,467,640	19,571,300	19,571,300	-103,660
CH_4	947	19,891	945	19,837	54
N_2O	1,809	560,658	1,802	558,735	1,924
Total	-	20,048,189	-	20,149,872	-101,683

However, if GHG emission is estimated for design route area and not based on the road network, it will be considered as net increase every year showing 81,955 t-CO_2/year for 2016, 85,453 t-CO_2/year for 2020 and 98,683 t-CO2/year for 2030 respectively. Details are as given in Table below.

Table 7-10 Variation of GHG Emission along the Project Route Area

	2016		2020		2030	
	Emission Rate (ton/Y)	CO_2 Equiv (t-CO_2/Y)	Emission Rate (ton/Y)	CO_2 Equiv (t-CO_2/Y)	Emission Rate (ton/Y)	CO_2 Equiv (t-CO_2/Y)
CO_2	61,320	61,320	65,700	65,700	75,920	75,920
CH_4	34	721	35	744	39	812
N_2O	64	19,914	61	19,009	71	21,951
Total	-	81,955	-	85,453	-	98,683

4.3 Pollution

4.3.1 Air pollution

The contractor shall have a responsibility to make regular maintenance of all equipment and vehicles to be used for the project and will be required to reduce exhaust gas by avoiding the use of outdated machinery. It is important to note that the equipment should comply with national emission standard. In addition, care should be taken to minimize dust production by sprinkling water on the road and covering material with sheet for the transportation.

Air pollution in Metro Manila tends to be serious due to incontrollable exhaust gas from vehicles as it is assumed that the vehicle emissions contribute to 83% of NOx, 99% of CO, 12% of SOx and 21% of SPM. In view of these circumstances, traffic control (by either vehicle type or driving time) and installation of green buffer zone will need to be considered in association with other relevant agencies or institutions.

4.3.2 Water pollution

Project area on the right bank of the Pasig river is practically lowland so it is vulnerable to flooding. In addition to inland inundation by heavy rains, Maypalo river, which usually appears as a small creek, overflows its banks causing flooding in some residential areas. Meanwhile, on the left bank of the Pasig river, street crossing with Buendia Ave. located in office area is flood-prone area due to the lack of storm water drainage system. Taking the above into consideration, hydrological study is conducted under DED in an effort to improve present drainage system.

4.3.3 Wastes

Recycle use is recommendable for construction wastes, but non-recyclable items should be properly scraped and disposed of in the place designated by the local government. As to garbage and trash generated in worker's camp, it should be collected and disposed of every day under the responsibility of the contractor. For the installation of sanitary system, the contractor is required to provide management plan to the engineer for his approval.

4.3.4 Noise and vibration

Construction plan will be prepared in such a way that heavy equipment and machinery should not be used in night work so as not to make trouble to the residents. Construction method has to be carefully selected from the viewpoint of mitigation of noise and vibration. For example, foundation piles are not installed by driving machine (by means of hammer or vibration).

A noise reduction measure is under consideration in DED to install noise barrier in some required areas, but it is desirable to be reviewed after taking account of landscape and in response to public opinions.

5. Environmental Monitoring Plan

Knowing the fact that the project site is located at urban area, no specific life which is environmentally vulnerable can be observed in this area. However, it is absolutely necessary to monitor natural environmental impact as well as social environmental impact through observation, measurement and analysis of required items.

In pre-construction stage, sampling will take place to analyze present environmental conditions which may be used as baseline data, and careful watch is required to observe the variation of such analysis data during and post-construction stages as compared to national standard. Pursuant to EIA for NLEX phase-II regarding Segment 8.1, 8.2 and 9, quarterly-based monitoring operation will be required for ambient air, water and noise.

Monitoring for ambient air will be conducted at 4 locations that should be selected from existing intersections along the alignment while it will be just downstream from the proposed location of bridge construction over the Pasig river for aquatic biota. With regard to water quality of the Pasig river, monitoring is taking place by DENR under its River Rehabilitation Program, so that data will be available for reference. As for noise and vibration, it is desirable to decide the monitoring locations in coordination with DED.

From the above considerations, environmental monitoring plan is summarized as shown in Table 7-11.

Table 7-11 Environmental Monitoring Plan

Classification	Monitoring Item	Monitoring Frequency		
		Pre-Const.	Construction	Post-Const.
Resettlement	Informal settlers, development of re-location site, employment opportunity, social service, etc.	Once	Monthly	Quarterly
Ambient air	SPM, SO_2, NO_2, CO	Once	Quarterly	Quarterly
Water	pH, DO, TSS, BOD, COD, oil & grease, E.Coli	Once	Quarterly	Quarterly
Aquatic biota	Plankton, Benthos, Necton, Aquatic plant	Once	Once	Once
Noise	Noise level	Once	Monthly	Monthly
Vibration	Vibration level	Once	Monthly	Monthly

Data and information collected from monitoring can be used to judge whether the current conditions of the measured parameter will satisfy the environmental standard, and if compared to baseline data, the project impact will be analyzed and evaluated scientifically from the data variation and tendency. With regard to environmental standard, air quality shall be referred to the Philippine Clean Air Act, 1999 under the

Republic Act No.8749, whereas water quality will be applied to Class C according to fresh surface water classification under DENR Administrative Order (DAO).No.34. Table 7-12 shows environmental standards of the Philippines compared to those of Japan for reference.

Table 7-12 Comparative Environmental Standards between Philippines and Japan

Parameter	Unit	Philippine Standard	Japan's Standard	Remarks
Air Quality				
SPM	µg/NCM	150	100	PM10
SO_2	ppm	0.07	0.04	One hour value of daily average
NO_2	ppm	0.08	0.06	
CO	ppm	30	10	
River Water Quality				Class C of Fresh Surface Water Classification under DAO34
pH	-	6.5 – 8.5	6.5 – 8.5	
SS	mg/l	<30	<50	
DO	mg/l	>5	>5	
BOD	mg/l	-	<5	
Noise	dBA	55 - 65	45 -55	Mainly residential area

(2) Land Acquisition and Resettlement Plan

1. Relevant Laws/Regulations and Responsible Organizations

The first part of this section enumerates and briefly discusses the relevant laws, implementing rules and regulations, and other guidelines governing land acquisition and resettlement in the Philippine setting. This is followed by a presentation and discussion of the organizations/institutions that are responsible for implementing the Land Acquisition and Resettlement Plan.

Among statutes and guidelines listed in Table 7-13, the most relevant is the Land Acquisition, Resettlement, Rehabilitation and Indigenous Peoples Policy (LARRIP) of the Department of Public Works ad Highways (DPWH). Patterned after the World Bank's, ADB's, and JICA's Involuntary Resettlement Policy, it embodies the Department's basic principles pertaining to Infrastructure Right-of-Way (IROW) acquisition-related socio-economic impacts.

Table 7-13 Relevant Laws and Regulations

Year	Policy	Title／Salient Features
2007	LARRIP Policy, 3rd Ed	Land Acquisition, Resettlement, Rehabilitation and Indigenous Peoples' Policy • Serves as a social safeguards instrument that embody the Department's policies on land valuation, eligibility and entitlements of affected persons that meet international standards such as those of the World Bank, Asian Development Bank, and Japan International Cooperation Agency (JICA). • Includes the DPWH's Indigenous Peoples' Policy based on the Indigenous Peoples' Rights Act (IPRA) and the National Commission on Indigenous Peoples (NCIP) Administrative Order No. 1, series of 2006, or the Free and Prior Informed Consent Guidelines of 2006
2003	D.O. 327	"Guidelines for Land Acquisition and Resettlement Action Plans (LAPRAPs) for Infrastructure Projects" • LAPRAP document describes the project, expected impacts and mitigating measures, socio-economic profile of APs, compensation package, timetable of implementation, institutional arrangements, participation, consultation, and grievance procedures.

		• LAPRAP is prepared using inputs from the IROW Action Plan, the census and socioeconomic survey conducted, detailed engineering study, and parcellary survey results. • LAPRAP is the basis for qualifying and compensating APs for lands, structures and/or improvements, that are marginally or severely affected by the Department's infrastructure projects. • Provision of resettlement sites is the responsibility of the Local Government Unit (LGU) concerned, with assistance from the concerned government agencies tasked with providing housing. • An Indigenous People's Action Plan (IPAP) is formulated for indigenous peoples (IP) if they are affected by the Department's infrastructure projects.
2003	D.O. 5	"Creation of the Infrastructure Right of Way and Resettlement Project Management Office (IROW-PMO) and the Implementation of the Improved IROW Process" IROW. • Implementing Office (IO) ensures that IROW costs are always included in project budgets. • The IO provides an estimated cost breakdown of each project to the IROW and Resettlement PMO and the CFMS prior to any disbursement of funds. The first priority of budget for projects are all costs prior to construction. • If ROW costs differ from the approved ROW budget after detailed design has been finalized, a budget adjustment is approved. • A Land Acquisition Plan and Resettlement Action Plan (LAPRAP) is prepared for all projects, whether local or foreign funded, that will require Right-of-Way (ROW) acquisitions, using a standardized compensation package. • The determination of Affected Persons (APs) and improvements is based on a cut-off date, which is the start of the census of APs and tagging for improvements. • The IO prepares the final as-built IROW Plan upon completion of the project, for submission to the IROW and Resettlement PMO.

2000	I.R.R. of R.A. 8974	"Implementing Rules and Regulations of R.A. 8974 (An Act to Facilitate the Acquisition of Right-of-Way, Site, or Location for National Government Infrastructure Projects and for Other Purposes) • Sets the 1st offer for negotiated sale of land (just compensation) as the price indicated in the current BIR zonal valuation for the area where the property is located. • Sets the valuation of improvements on the land to be acquired using the "replacement cost method", which is defined as the "amount necessary to replace the improvements/structures based on the current market prices for materials, equipment, labor, contractor's profit and overhead, and all other attendant costs associated with the acquisition". • Provides for the engagement of government financing institutions or private appraisers to undertake appraisal of the land and/or improvements/structures, to determine its fair market value. • Tasks the NHA to establish and develop squatter relocation sites, including provision of adequate utilities and services, in anticipation of squatters that have to be removed from the ROW in the site of future infrastructure projects.
2000	R. A. 8974	"An Act to Facilitate the Acquisition of Right-of-Way, Site, or Location for National Government Infrastructure Projects and for Other Purposes" • Prescribed new standards for the assessment of the value of the land subject of expropriation proceedings or negotiated sale, namely: o The classification and used for which the property is suited. o The size, shape or location, tax declaration and zonal valuation of the land. o The price of the land as manifested in the ocular findings, oral, as well as documentary evidence presented. o The reasonable disturbance compensation for the removal and/or demolition of certain improvement on the land and for the value of improvements thereon. o The developmental costs for improving the land.

		○ The value declared by the owners. ○ The current price of similar lands in the vicinity; and ○ Such facts and events as to enable the affected property owners to have sufficient funds to acquire similarly-situated lands of approximate areas as those required from them by the government, and thereby rehabilitate themselves as early as possible. • Mandates the BIR to come up with updated zonal valuation for areas subject to expropriation proceedings, within 60 days from the date of expropriation case.
1999	DPWH Policy Framework for LARR	"Policy Framework for Land Acquisition, Resettlement and Rehabilitation" • Government projects must serve the common good. • All efforts must be exercised to ensure that: ○ Adverse social impacts are avoided, minimized, and/or mitigated. ○ Everybody, including Affected Persons (APs), benefit from projects. ○ APs are provided with sufficient compensation and assistance for lost assets which will assist them to improve or at least maintain their pre-project standard of living; ○ Project stakeholders (which include APs) are consulted regarding the projects' design, implantation, and operation. • Only those APs found to be residing in, doing business, or cultivating land or having rights over resources within, the project area as of the date of the census surveys (i.e., cut-off date) are eligible for compensation for lost assets.
1997	Rule 67, Rules of Civil Procedure	"Rule 67 – Expropriation" • Gives the plaintiff (DPWH) the right to take or enter upon the possession of a real property involved if a deposit is made with an authorized government depositary an amount equivalent to the assessed value of the property for purposes of taxation to be held by such bank subject to the orders of the court.

1992	R.A. 7279	”Urban Development and Housing Act of 1992” • Uplift the conditions of the underprivileged and homeless citizens in urban areas and in resettlement areas by making available to them decent housing at affordable cost, basic services, and employment opportunities. • Provide for an equitable land tenure system that shall guarantee security of tenure to Program beneficiaries but shall respect the rights of small property owners and ensure the payment of just compensation. • Eviction or demolition may be allowed under the following situations: o When persons or entity occupy danger areas such as esteros, railroad tracks, garbage dumps, riverbanks, shorelines, waterways, and other public places such as sidewalks, roads, parks, and playground. o When government infrastructure project with available funding are about to be implemented. o When there is a court order for eviction and demolition. • If eviction or demolition will involve underprivileged and homeless citizens, as defined in the same law, they should be properly relocated prior to any dismantling of properties. • Section 5 of the IRR directs the LGU or the government agency authorized to demolish to create a Task Force on Relocation and Resettlement to ensure smooth and effective implementation of all relocation and resettlement operations. • After effectivity of R.A.7279, barangay, municipal or city government shall prevent construction of any kind of illegal dwelling units or structures within danger areas. • LGUs shall prepare a comprehensive land use plan for their respective localities in accordance with the provisions of the Act.
1991	R.A. 7160	“Local Government Code of 1991” • An LGU may exercise the power of eminent domain for public use, purpose, or welfare of the poor and the landless such as for socialized housing, upon payment of just compensation pursuant to the provisions of the Constitution and pertinent laws.

1988	E.O. 239	"Creating Appraisal Committees in Metropolitan Manila Area" • Created the City Appraisal Committee and Municipal Appraisal Committees in the Metropolitan Manila area for assessment of fair market value of real property in Metro Manila. • The government shall deposit 10% of the amount of just compensation provided under 1533, five (5) days after which the court shall issue Writ of Possession (WOP). • Payment for improvement shall be based on the physical inventory report proposed and certified by an affidavit of the claimant and affidavit of two (2) adjoining landowners.
1978	P.D. 1533	Establishing Uniform Basis for Determining Compensation. • The government is entitled to immediate possession of properties and improvements and the power of demolition upon filing of the petition for expropriation and the deposit of 10% of compensation amount determined by this decree in the Philippine National Bank (PNB).
1936	C.A. 141	"Commonwealth Act 141" • Citizens of the Philippines acquire public land through public auction. Article of free patent is provided for natural born citizen of the Philippines who continuously occupied and cultivated the land since 1926 or before. • Land acquired through this law is subject to a Right-of-Way not exceeding 20 m in width for public use with damages paid for improvements only; This ROW limit is further expanded to 60 m by P.D. 635.

Note:

R.A. – Republic Act

P. D. – Presidential Decree

E.O. – Executive Order

I.R.R. – Implementing Rules and Regulations

D.O. – Department Order

Source: DPWH ESSO, 2007. Land Acquisition, Resettlement, Rehabilitation and Indigenous Peoples Policy, 3rd Edition

Herrera, A.N. 2003. IROW Process Design Report. National Roads Improvement and Management Program Phase I.

2. Process of Development of Resettlement Plan

Considering the fact that the NLEX-Skyway/SLEX Connector Road traverses areas that are located at urban centers of Metro Manila, physical displacement as a result of involuntary resettlement is unavoidable. As such, it is envisaged that the Resettlement Plan (RP) to be developed shall be a full-blown document that will embody all the measures to ensure that pre-project socio-economic conditions of affected persons are restored, or improved. Using the above-mentioned legislations as guide, the RP shall consist of the following:

(a) Initial categorization/screening of alternative alignments (sections only) based on anticipated impacts from resettlement.

(b) Disclosure and explanation of policy and legal frameworks for resettlement to Affected Persons (APs).

(c) Consultation with potential APs to obtain their inputs on avoiding or mitigating involuntary resettlement and determine their concerns, needs and preferences.

(d) Census and socioeconomic survey of all APs and complete inventories of their assets, including estimation of compensation for structures and improvements.

(e) Social impact assessment and validation that the entitlement matrix has covered all resettlement entitlements.

(f) Consultation meetings with APs to explain relocation plans and rehabilitation strategy, including income restoration (if necessary) and improvement of their living conditions.

(g) Prior agreement of APs for resettlement.

(h) Particular attention to be paid to socially vulnerable groups such as those below the poverty line, women, children, the elderly, ethnic minorities, etc.

(i) Inclusion of itemized budget for all resettlement activities in the total project cost.

(j) Formulation of implementation schedule for the RP.

(k) Detailed and comprehensive procedures for grievance redress mechanism.

(l) Conceptualization of Institutional Framework for resettlement activities.

(m) Recommendation of internal and external monitoring program and final evaluation.

3. Procedure of Budget Allocation for the Implementation of Resettlement Plan

Allocation of budget for resettlement would be based on the DPWH IROW acquisition procedures stipulated in Department Order No. 5, Series of 2003, strengthened through its revised resettlement policy (LARRIPP, 2007). Detailed steps for acquiring the needed ROW are described in detail in the Department's IROW Procedural Manual. The RP will need to be prepared in accordance with WB Operational Policies 4.12 and ADB or JICA guideline. It is expected that compensation to APs will be made based on full replacement cost for losses of assets attributable directly to the project. In addition, eligibility for compensation and timetable of public consultations should meet international standard.

It is important to note that under Rule 13, Section 13.3 of the Implementing Rules and Regulations (IRR) for R.A. 7718, the Government may provide any form of direct or indirect financial support or contribution to the Project. However for unsolicited proposals such support excludes direct government guarantee, subsidy or equity, and is limited to cost sharing.

As described in the IRR, "cost sharing" can be in terms of "the provision of access infrastructure, right-of-way, transfer of ownership over, or usufruct, or possession of land, building or any other real or personal property for direct use in the project and/or any partial financing of the project, or components thereof, Provided, that such shall not exceed fifty percent (50%) of the Project Cost. Further, such government share can either be through direct government appropriations and /or from Official Development Assistance or ODA.

4. Consultation with Local Stakeholders

Consultation with local stakeholders were not held under the present study so as not to preempt the community engagement activities that will be undertaken by the EIA and RAP Consultants who shall be engaged by the Original Proponent of the Unsolicited Proposal, and to avoid confusion among project affected persons. Instead the procedures and important components of the consultation process to be undertaken are described below.

Consultation with stakeholders shall be undertaken in at least two (2) occasions, namely: (i) as part of the Environmental Impact Assessment (EIA) process, and (ii) during the preparation of the Resettlement Action Plan (RAP).

The EIA public consultation process shall come first considering that under DENR guidelines, ECC applications are best done during the Feasibility Study stage or at the latest at the onset of the Detailed Engineering Design (DED). Subsequently after Parcellary Survey Plans have been completed, consultation meetings pertaining

to RAP preparation shall take place.

Consultation during RAP preparation shall commence with an Information, Education and Communication (IEC) among the respective Local Government officials starting from the City/Municipal level down to the Barangay level. During these IEC meetings, impacts of the proposed project to affected persons in terms of physical and/or economic displacement shall be presented. After project presentation, an open forum shall follow.

After the IEC process, public disclosure and consultation for each Barangay shall be conducted among project-affected persons. During these meetings, the following are explained:

(a) General description of the project and the necessity for involuntary resettlement.

(b) Legal framework for R-O-W acquisition.

(c) Concept of cut-off date.

(d) Conduct of census and socio-economic survey.

(e) Linear mapping and tagging of structures.

(f) Land and assets valuation process.

(g) Eligibility and entitlements of affected persons.

(h) Grievance redress procedures.

(i) Implementation Schedule.

At the end of each meeting, an open forum shall be held. This allows the affected persons to express their opinions, suggestions, and apprehensions regarding the Project. All these meetings shall be properly documented using attendance sheets, photographs, recordings of the procedure, and minutes of the meeting.

Chapter 8

Estimation of Project Cost

(1) Project Cost

1. Construction and Land acquisition cost

The estimation of construction was investigated by MPTC's unsolicited proposal, gathering data from consultant and constructor in Philippines.
We assume the Connector Road has constructed for standard construction method and standard term of construction work, because the construction on PNR and existing road area has not restriction. So the estimation of construction is based on standard price.
The estimation of land acquisition cost and number of affected houses were calculated after that settled road alignment.
Table8-1 shows the estimation of construction and land acquisition cost for each item. The detailed project cost is attached in annex.

(2) Operation and Maintenance Cost

Operation and maintenance cost estimated by existing data of MNTC/TMC.

(3) PNR Line Right of Way

The most part of the Connector Road will be built over the existing PNR line right of way in Metro Manila and it is therefore necessary to acquire the PNR line right of way. According to MPTC, though they have concluded a MOU with PNR that they can use the right of way, it is subject to further negotiation of commercial terms. To date the negotiation between MPTC and PNR is not started.

Furthermore, PNR air rights starting from the junction of Samson Road in Caloocan City and ending at the Gil Puyat Avenue in Makati City for the part 10.2m over the ground level are possessed by Home Guarantee Corporation (HGC). According to some information, it appears that PNR, National Housing Authority (NHA), San Jose Builders and Housing & Urban Development Coordinating Council (HUDCC) entered into a Joint Venture Agreement ("JVA"). One of the objectives of the said

JVA is to build Medium Rise Buildings ("MRB"), the primary beneficiaries of which were the existing informal settlers along the PNR lines at that time. HGC acted as the guarantor of the said project and issued certificates of guarantee to investors, with the property serving as collateral. Considering that the project partially defaulted for one reason or another, HGC, acting as guarantor, was called upon to pay the investors. Thus, HGC ended up owning the property.

Chapter 9
Economic and Financial Analysis

(1) Financial Analysis

1. Basis of Analysis

The financial analysis in this chapter is based on the results of this study currently available. We have made certain assumptions for unknown factors.
Then the financial IRR (FIRR) is calculated based on the estimated cash flow of the project and income statements, balance sheets and cash flow statements of the project have been made for analysis.

(2) Economic Analysis

1. Basis of Analysis

The economic analysis in this chapter is based on the results of this study currently available. We have made certain assumptions for unknown factors.
Then the economic internal rate of return (EIRR), benefit / cost ratio (B/C) and economic net present value (NPV) are calculated based on the estimated social benefit and economic cost of the project.

Chapter 10

Action Plan for Project Implementation and Agendas

(1) Agendas

1. Topics not Consistent between Detailed Design (DED)

MPTC/MNTC is now implementing the Detailed Engineering Design (DED) of Connector Road. Completion of the DED is scheduled to be in December, 2011. Under this study, a meeting was held on June 6th, 2011 to harmonize the Technical Aspects of JICA study and DED in traffic planning, road design, structure design and economic and finance evaluation.

Table 10-5 - Table 10-10 of the main report presents the Items that are not consistent between DED and this study under the following headings: traffic planning, road design, structure design, environmental impact assessment, and economic and finance evaluation.

Study team submitted the outline of the preparatory survey in the coordination meeting of the draft final report on August 2nd, 2011.
After that, study team received the MPTC/MNTC's reply on September 12th, 2011. According to the reply, there is no objection for the JICA's draft final report. And the final work of preparing the final report was started.