CHAPTER 5

PREPARATION OF IMPLEMENTATION SCHEDULE

5.1 STUDY OF CONTRACT PACKAGE ARRANGEMENT

Contract packaging is studied as following conditions:

(1) Size of Contract Package

The present condition of MMICP is as follows:

1) Classification of Qualified Contractors in the Philippines

Rank AAA : Contract Amount has no limitation
Rank AA : Contract Amount is less than PHP500 million
Rank A : Contract Amount is more than PHP300 million

2) Estimated Contract Amount of each Interchange

EDSA/North/West/Mindanao Interchange : PHP1,133 million
C-5/Green Meadows Interchange : PHP1,066 million
EDSA/Roosevelt/Congressional Interchange : PHP 612 million
C-3/E. Rodriguez Interchange : PHP 477 million

C-3/E. Rodriguez Interchange was canceled due to conflict with on-going project of Skyway Stage-3.

(2) Contract Amount and Location

Each package considered the contract amount and location. As a Yen Loan normally requires good quality of construction and its completion within the contract period, it is imperative to select an AAA Contractor.

Based on the above condition, the proposed packaging of the project is as follows:

Package 1 : EDSA/North/West/Mindanao Interchange : PHP1,133 million
Package 2 : C-5/Green Meadows Interchange : PHP1,066 million
Package 3 : EDSA/Roosevelt/Congressional Interchange : PHP 612 million

5.2 STUDY OF CONSULTANCY SERVICES

Consultancy services are required in the following stages of the project:

1) Detailed Design Stage
2) Tender Assistance Stage for selection of Civil Works Contractor
3) Construction Supervision Stage for supervise of Civil Works of Contractor

The study of the requirement for consultancy services was focused on the following:

(1) Detailed Design Stage

Duration of detailed design is recommended at 12 months based on the scale of design work required and previous experience. The proposed Consultant's organization for this stage is shown in **Figure 5.2-1**.

(2) Tender Assistance Stage

Duration of tender assistance is normally 12 months based on bidding process in the Philippines. The proposed Consultant's organization for tender assistance is shown in **Figure 5.2-2**.

(3) Construction Supervision Stage

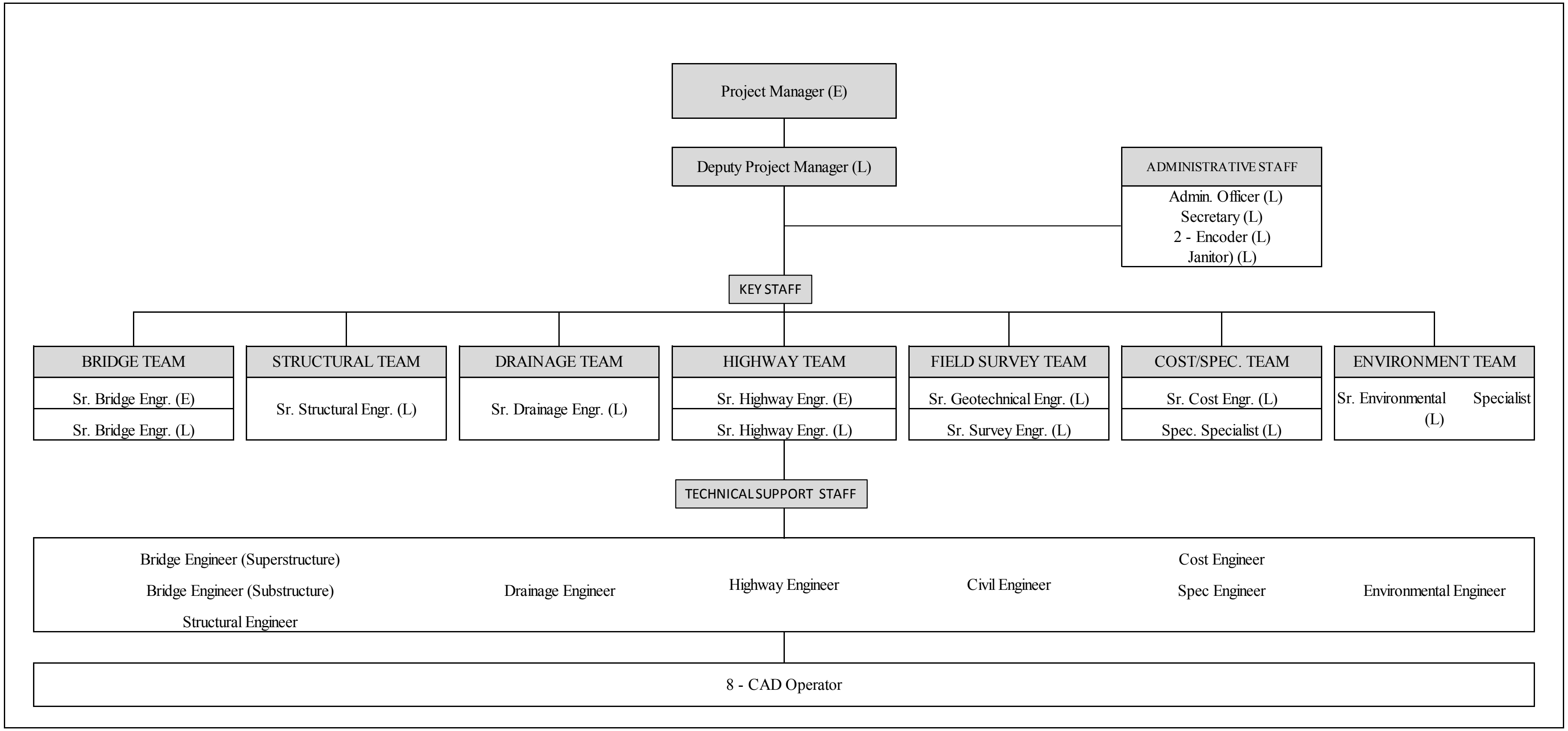
Based on construction schedule, duration of construction supervision is recommended to be 26 months. The proposed Consultant's organization for this stage is shown in **Figure 5.2-3**.

(4) Consultant's Manning Schedule

Proposed Consultant's Manning Schedule is shown in **Figure 5.2-4**.

(5) Cost Estimate for Consultancy Services

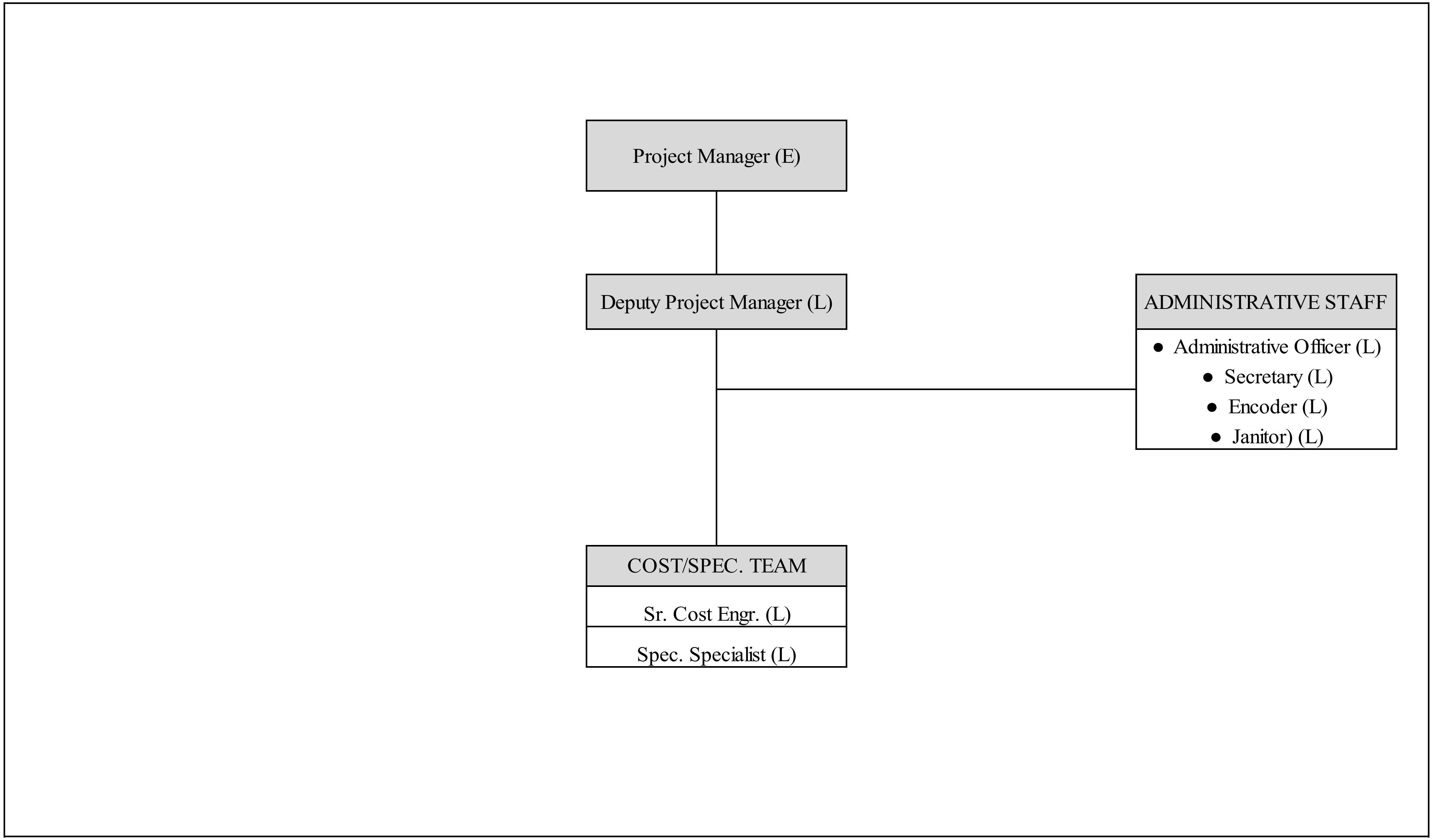
Cost Estimate for Consultancy Services is shown in **Table 5.2-1**



Note: (E) Expatriate
(L) Local

Source: JICA Study Team

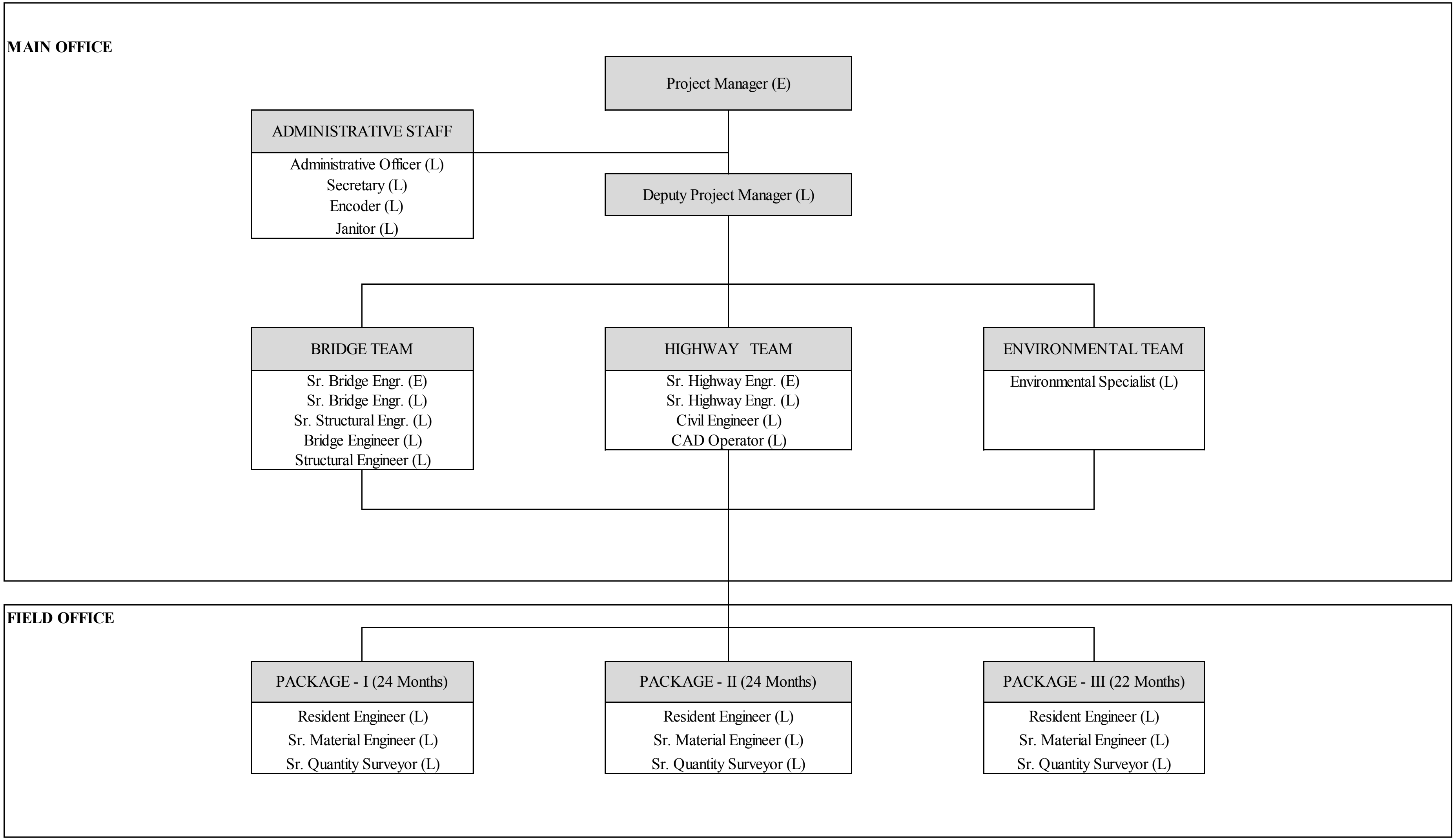
Figure 5.2-1 Proposed Consultant's Organization in the Detailed Engineering Design Stage



Note: (E) Expatriate
(L) Local

Source: JICA Study Team

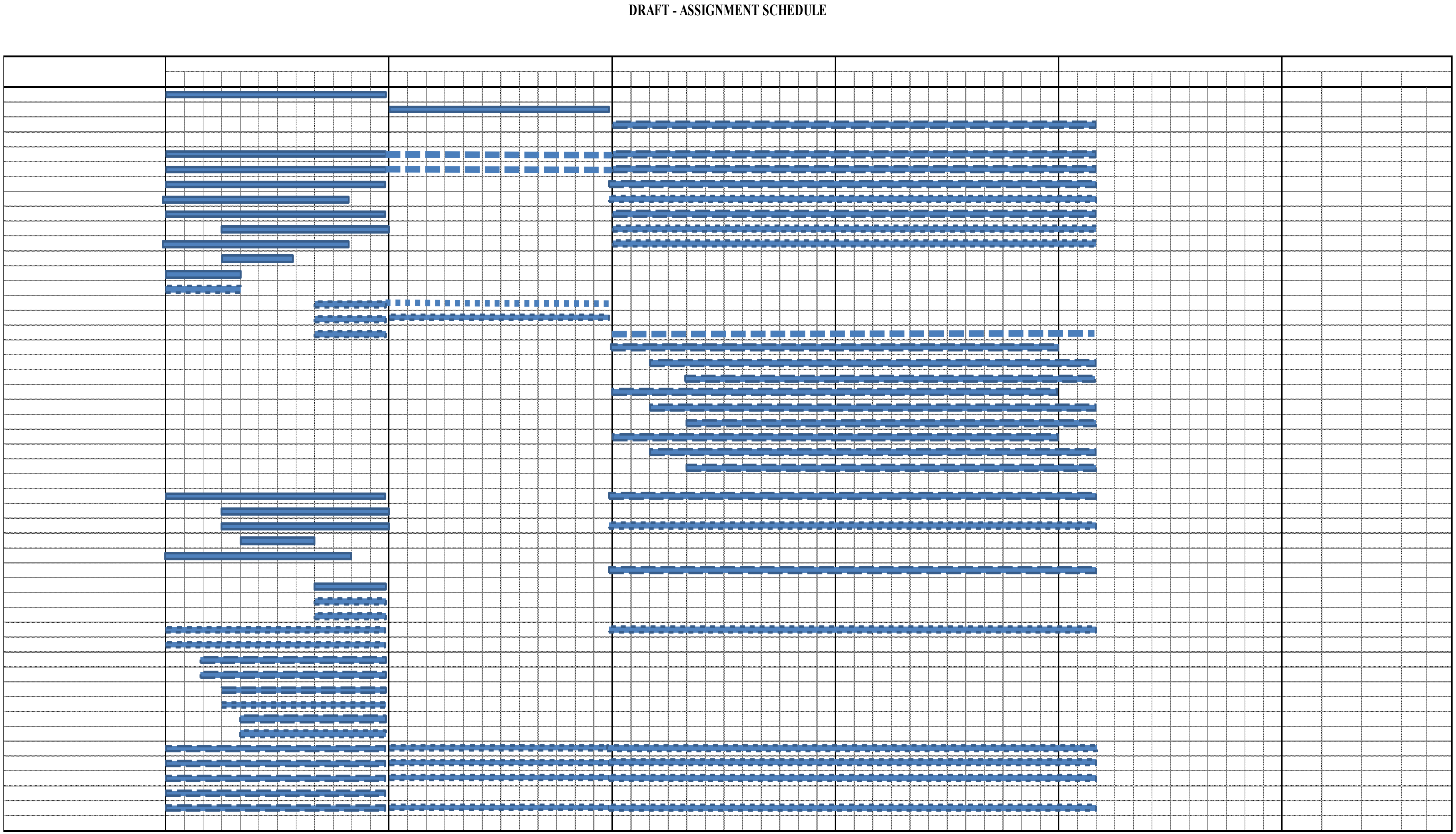
Figure 5.2-2 Proposed Consultant's Organization in the Pre-construction Stage



Note: (E) Expatriate
(L) Local

Source: JICA Study Team

Figure 5.2-3 Proposed Consultant's Organization in the Construction Supervision Stage



Source: JICA Study Team

Figure 5.2-4 Consultant Manning Schedule

Table 5.2-1 Cost Estimate for Consultancy Services

DESCRIPTION	FOREIGN CURRENCY		LOCAL CURRENCY (PESO)
	YEN COMPONENT	PESO COMPONENT	
I. DETAILED DESIGN STAGE			
A. Yen Component			
A.1 Remuneration Cost	¥ 87,108,000		
A.2 Reimbursable Cost	¥ 13,770,000		
B. Peso Component			
Remuneration Cost		₱ 21,690,000	
Reimbursable Cost		₱ 16,820,000	
TOTAL	**¥ 100,878,000**	**₱ 38,510,000**	**₱ 2,602,800**
II. PRE-CONSTRUCTION STAGE			
A. Yen Component			
A.1 Remuneration Cost	¥ 15,372,000		
A.2 Reimbursable Cost	¥ 2,600,000		
B. Peso Component			
Remuneration Cost		₱ 6,330,000	
Reimbursable Cost		₱ 2,760,000	
TOTAL	**¥ 17,972,000**	**₱ 9,090,000**	**₱ 759,600**
III. CONSTRUCTION SUPERVISION STAGE			
A. Yen Component			
A.1 Remuneration Cost	¥ 199,836,000		
A.2 Reimbursable Cost	¥ 26,700,000		
B. Peso Component			
Remuneration Cost		₱ 61,680,000	
Reimbursable Cost		₱ 43,180,000	
TOTAL	**¥ 226,536,000**	**₱ 104,860,000**	**₱ 7,401,600**
SUB-TOTAL (I + II + III)	**¥ 345,386,000**	**₱ 152,460,000**	**₱ 10,764,000**
VAT	¥	₱	**₱ 10,764,000**
Contingency (2.0%)	**¥ 6,907,720**	**₱ 7,623,000**	
TOTAL CONSULTANCY COST	**¥ 352,293,720**	**₱ 160,083,000**	**₱ 10,764,000**
	¥ 651,648,930		
	₱ 348,475,364		

Source: JICA Study Team

5.3 PREPARATION OF PROJECT COST, INCLUDING COST OF RROW

(1) Project Cost Estimate

Project cost for Metro Manila Interchange Construction Project was estimated. Total project cost is 3,266.51 million Pesos in which Japanese Yen Loan is proposed to be utilized. Loan amount will be 5,336.75 million Yen and government of the Philippines equity is 412.64 million Pesos. Summary and breakdown of the project cost is shown in **Table 5.3-1** and **Table5.3-2**, respectively.

Table 5.3-1 Summary of Project Cost

Unit: *Million Pesos*

Item		Total	GOP	ODA	Remarks
1.	**Total Cvil Work Cost**	**2,811.17**	**301.20**	**2,509.97**	
	Civil Work Cost	2,756.05			
	Physical Contingency (2%)	55.12			
	Package-1 EDSA/North/West and North/Mindanao IC Civil Work Cost	**1,132.59**	**121.35**	**1,011.24**	
	Civil Work Cost	1,110.38			
	Physical Contingency (2%)	22.21			
	Package-2 C5/Green Meadows IC Civil Work Cost	**1066.33**	**114.25**	**952.08**	
	Civil Work Cost	1045.42			
	Physical Contingency (2%)	20.91			
	Package-3 EDSA/Roosevelt IC	**612.25**	**65.60**	**546.65**	
	Civil Work Cost	600.24			
	Physical Contingency (2%)	12.00			
2.	**ROW Acquisition Cost**	**4.00**	**4.00**		
3.	**Detailed Engineering Design (DED) Cost Total**	**116.81**	**3.43**	**113.38**	
	Detailed Engineering Design Cost	114.52			
	Physical Contingency (2%)	2.29			
4.	**Construction Supervision Cost Total**	**238.07**	**7.55**	**230.52**	
	Construction Supervision Cost	233.40			
	Physical Contingency (2%)	4.67			
5.	**Project Administrative Cost Total**	**96.46**	**96.46**		
	Detailed Design Stage, Construction Supervision Stage (3.5%)	96.46			
Grand Total in Pesos		**3,266.51**	**412.64**	**2,853.88**	
Grand Total in Yen		**6,108.38**	**771.63**	**5,336.75**	

Source: JICA Study Team

Notes: Deletion of implementation of the C-3-E. Rodriguez Interchange was cancelled by the DPWH to give priority to the construction of Skyway Stage 3, second level, along C-3 under BOT scheme.

Table 5.3-2 Breakdown of Project Cost

Unit: *Million Pesos*

	Item	Total	CURRENCY COMPONENT		
			Foreign	Local	Tax
1.	**Total Cvil Work Cost**	**2,811.17**	**1,003.99**	**1,505.98**	**301.20**
	Civil Work Cost	2,756.05	984.30	1,476.46	295.29
	Physical Contingency (2%)	55.12	19.69	29.53	5.91
	Package-1 EDSA/North/West and North/Mindanao IC Civil Work Cost	**1,132.59**	**404.50**	**606.75**	**121.35**
	Civil Work Cost	1,110.38	396.57	594.85	118.97
	Physical Contingency (2%)	22.21	7.93	11.90	2.38
	Package-2 C5/Green Meadows IC Civil Work Cost	**1,066.33**	**380.83**	**571.25**	**114.25**
	Civil Work Cost	1,045.42	373.37	560.05	112.01
	Physical Contingency (2%)	20.91	7.47	11.20	2.24
	Package-3 EDSA/Roosevelt IC	**612.25**	**218.66**	**327.99**	**65.60**
	Civil Work Cost	600.24	214.37	321.56	64.31
	Physical Contingency (2%)	12.00	4.29	6.43	1.29
2.	**ROW Acquisition Cost**	**4.00**	**0.00**	**4.00**	**0.00**
		4.00		4.00	
3.	**Detailed Engineering Design (DED) Cost Total**	**116.81**	**64.83**	**48.55**	**3.43**
	Detailed Engineering Design Cost	114.52	63.56	47.60	3.36
	Physical Contingency (2%)	2.29	1.27	0.95	0.07
4.	**Construction Supervision Cost Total**	**238.07**	**123.57**	**106.96**	**7.55**
	Construction Supervision Cost	233.40	121.14	104.86	7.40
	Physical Contingency (2%)	4.67	2.42	2.10	0.15
5.	**Project Administration Cost Total**	**96.46**		**96.46**	
	Detailed Design Stage, Construction Supervision Stage (3.5%)	96.46		96.46	
	Grand Total	**3,266.51**	**1,192.38**	**1,761.96**	**312.18**

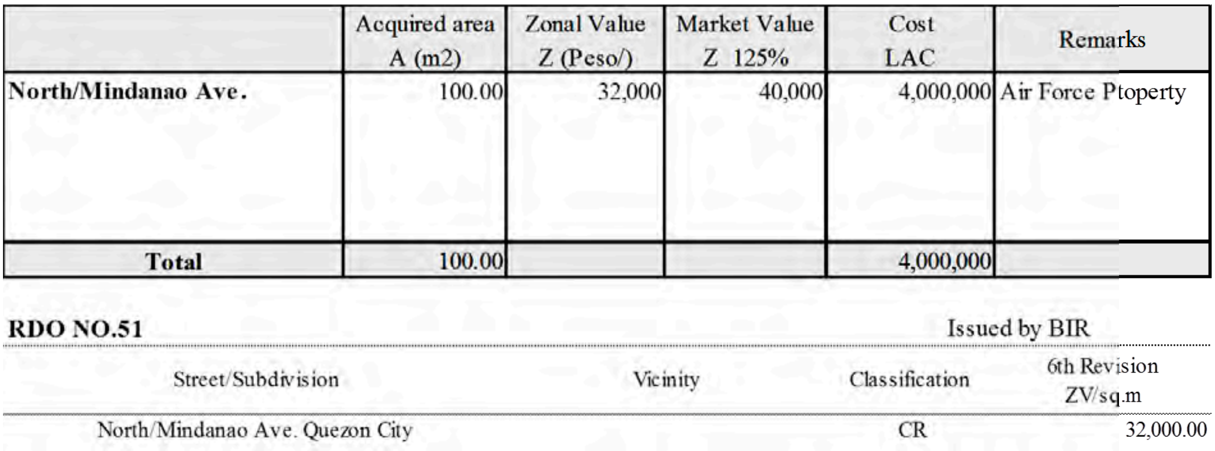
Source: JICA Study Team

Notes: Deletion of implementation of the C-3-E. Rodriguez Interchange was cancelled by the DPWH to give priority to the construction of Skyway Stage 3, second level, along C-3 under BOT scheme.

(2) Road Right-of-Way (RROW)

Road right-of-way is required only at the North/Mindanao Interchange. 100 m^2 of the area needs to be acquired. Cost of RROW is shown in **Table 5.3-3**.

Table 5.3-3 Estimate for Road Right-of-Way Acquisition



	Acquired area A (m2)	Zonal Value Z (Peso/)	Market Value Z 125%	Cost LAC	Remarks
North/Mindanao Ave.	100.00	32,000	40,000	4,000,000	Air Force Ptoperty
Total	100.00			4,000,000	

RDO NO.51 Issued by BIR

Street/Subdivision	Vicinity	Classification	6th Revision ZV/sq.m
North/Mindanao Ave. Quezon City		CR	32,000.00

5.4 PREPARATION OF PROJECT IMPLEMENTATION SCHEDULE

Preparatory activities by both governments for the approval of the project implementation are in progress. Total implementation schedule considers the following items:

(1) Processing in NEDA for ICC-CC approval

Based on previous experience on projects in the same nature, a 3-step processing is required in NEDA for which 6 months duration is considered.

(2) Loan Negotiation and Approval

A duration of 5 months is considered based on previous experience.

(3) ECC and RAP

For each interchange project, the Initial Environmental Examination (IEE) report shall be submitted to DENR EMB from DPWH, as explained in Chapter 6. The RAP report shall be attached with the IEE report if land acquisition and resettlement is unavoidable. According to DENR Administrative Order No. 30 series of 2003 (DAO 03-30), Revised Procedural Manual (2007), in the case of IEE-based application for Environmental Compliance Certificate (ECC), the steps (see Figure 6.1-1) and their maximum workdays are shown in **Table 5.4-1**.

Table 5.4-1 IEER Review Duration in DENR–EMB

Review and Evaluation Steps	Estimated/Maximum in DENR–EMB
EMB-Controlled Review Process	40 days
Endorsement of Recommendation	10 days
Sign-off/Issuance of Decision Document	10 days

Source: DENR Administrative Order No. 30 Series of 2003 (DAO 03-30), Revised Procedural Manual (2007)

Therefore, the total duration of DENR–EMB controlled review process may take 60 days. However, according to DPWH Environmental and Social Services Office (ESSO), in a normal case, ECC used to be issued by DENR-EMB at least 30 days after receipt of IEER and payment of the filing fee. The proponent must sign the Sworn Statement of Full Responsibility on ECC Conditions prior to the official release of the ECC.

(4) Contract Packages

Considering the nature of the project such as the scale of the package, quality effectiveness, location of the proposed flyover, the proposed five flyovers are divided into three packages as follows:

Package 1 : EDSA/West Avenue/North Avenue Interchange and North Avenue/ Mindanao Avenue Interchange
Package 2 : C-5/Green Meadows Avenue/Calle Industria Interchange
Package 3 : EDSA/Roosevelt Avenue/Congressional Avenue Interchange

(5) Selection of Consultant for Detailed Design and Construction Supervision

Based on previous experience, 12 months each is considered for the detailed design and construction supervision.

(6) Detailed Design

Based on previous experience on projects of the same scale and nature and the condition of project preparation, a period of 12 months is considered.

(7) ROW Acquisition

ROW acquisition activities will commence once the detailed design is finalized. The duration of these activities depends on how many houses and people will be affected. In the location of the proposed flyovers, only few houses and people will be affected, hence there is no need for adding time for this activity in the total implementation schedule.

(8) Bidding for Selection of Contractors

Based on previous experience under the same scale and nature of the projects, 12months for bidding and 3 months for contract preparation are considered and there is also a gap of 2 months considered between the biddings.

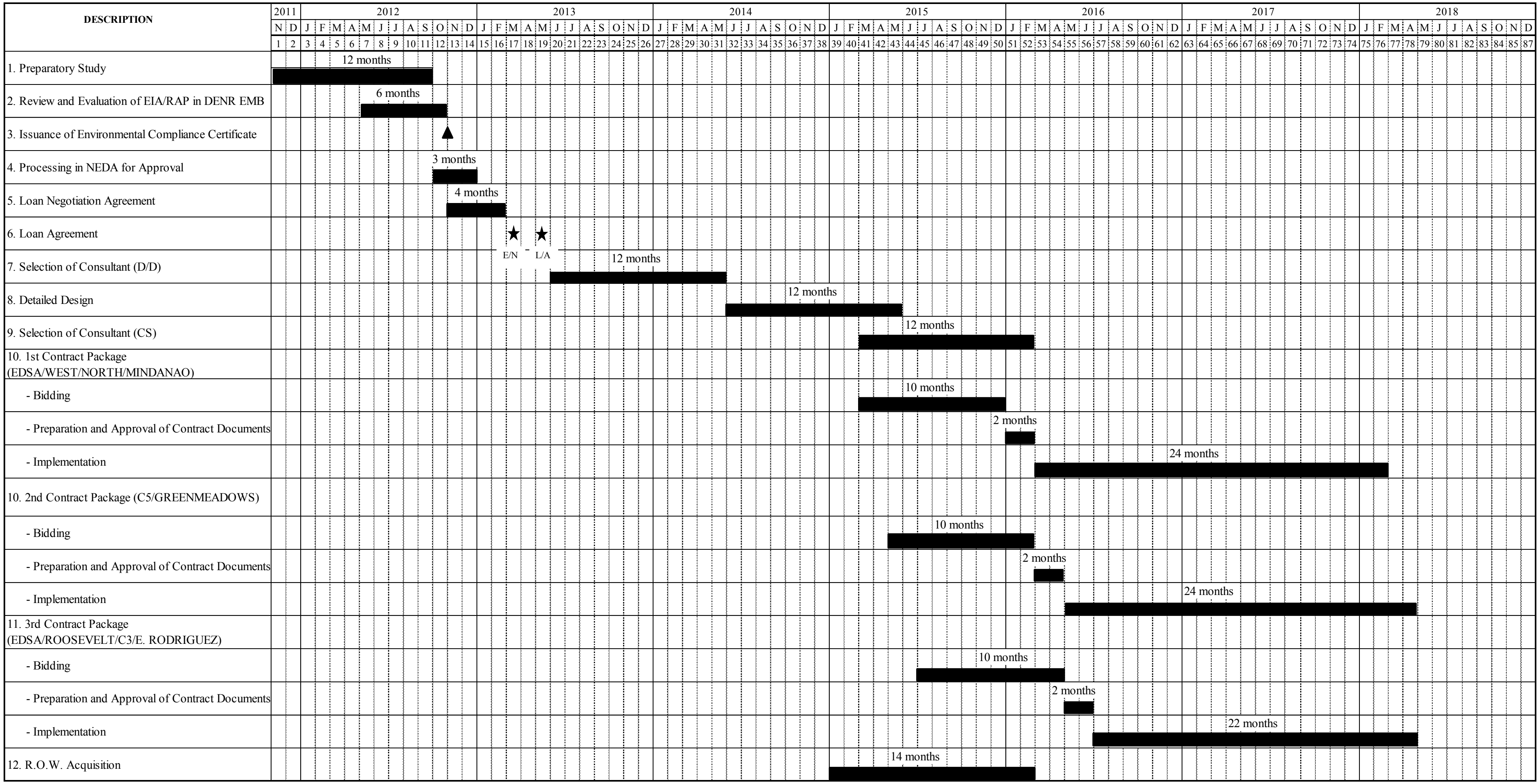
(9) Implementation of Civil Works

Based on previous experience, under the same scale and nature of project and preparation of (PERT/CPM), each package needs the following construction periods:

Package 1 : 24 months
Package 2 : 24 months
Package 3 : 22months

Based on the above items, the total implementation schedule is shown in the **Figure 5.4-1**.

Table 5.4-2 Draft Implementation Schedule of MMICP



1. Preparatory Study	12 months
2. Review and Evaluation of EIA/RAP in DENR EMB	6 months
3. Issuance of Environmental Compliance Certificate	▲
4. Processing in NEDA for Approval	3 months
5. Loan Negotiation Agreement	4 months
6. Loan Agreement	★ E/N ★ L/A
7. Selection of Consultant (D/D)	12 months
8. Detailed Design	12 months
9. Selection of Consultant (CS)	12 months
10. 1st Contract Package (EDSA/WEST/NORTH/MINDANAO)	
- Bidding	10 months
- Preparation and Approval of Contract Documents	2 months
- Implementation	24 months
10. 2nd Contract Package (C5/GREENMEADOWS)	
- Bidding	10 months
- Preparation and Approval of Contract Documents	2 months
- Implementation	24 months
11. 3rd Contract Package (EDSA/ROOSEVELT/C3/E. RODRIGUEZ)	
- Bidding	10 months
- Preparation and Approval of Contract Documents	2 months
- Implementation	22 months
12. R.O.W. Acquisition	14 months

Source: JICA Study Team

5.5 IDEA AND BASIC CONCEPT FOR STEP SCHEME

5.5.1 Possibility of Adoption of STEP Scheme

Taking into account the scheme repayment conditions of ODA loans of both STEP loan schemes and regular loan condition schemes, the total repayment amount of the loan will become the same for both schemes when the loan amount of the STEP scheme is 12% more costly than the regular loan condition scheme. Notwithstanding the above, a project with a lower increase in cost under STEP scheme when compared to regular loan condition scheme is much appreciated by the borrower.

In view of the above, the STEP loan scheme requires proper arrangement that should utilize Japanese technology with lower investment cost as much as possible.

(1) Adoption of Japanese Technologies for This Project

The proposed project is to construct flyovers to mitigate traffic congestion at intersections with heavy traffic conditions in urban areas. Therefore, the focus is to minimize impact on traffic during construction and to complete the project within the shortest possible construction duration. Proposed items to investigate under the project to facilitate a STEP loan scheme are the type of flyover superstructure at the intersection and type of retaining wall along the approach sections.

(2) Proposal of Steel Box and Slab Type Bridge for the type of superstructure at the Intersection

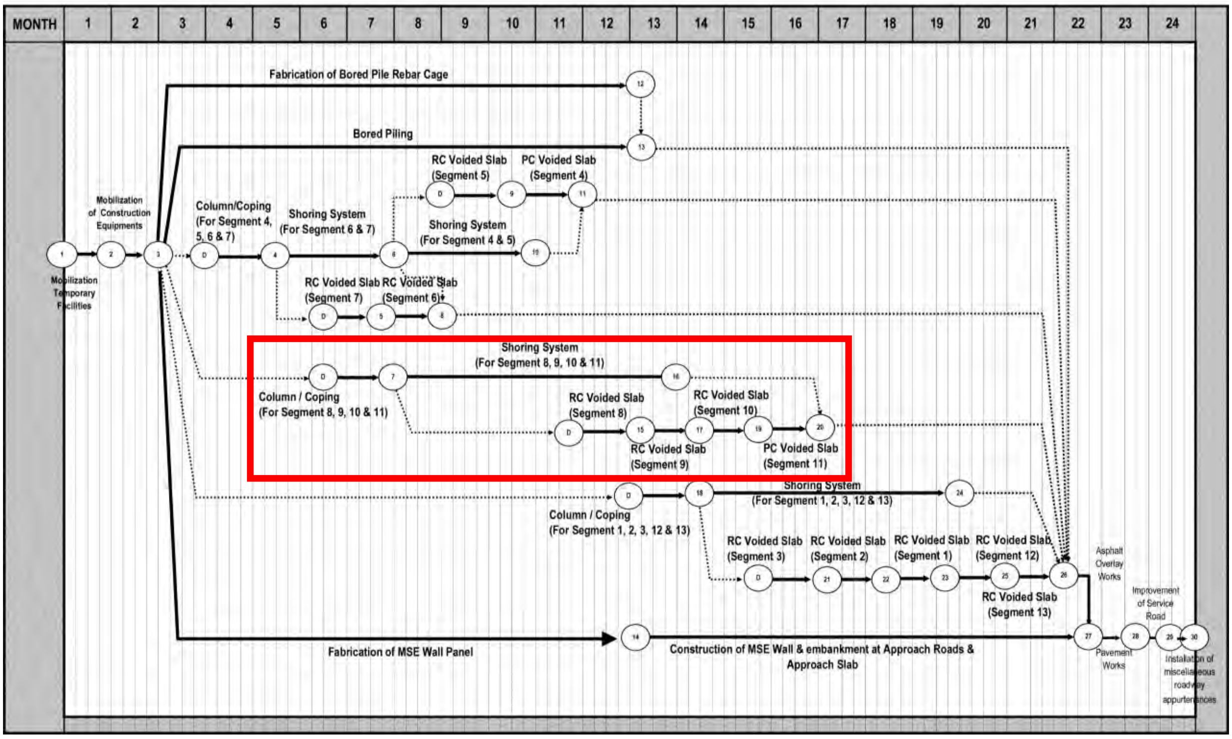
1) Original Detailed Design

The original detailed design proposed PC voided slab type superstructure at the intersection. This superstructure type is economical type but requires the erection of special type of shoring, scaffolding, form works and dismantling of those materials following construction. Such works will very much adversely influence the traffic flow during construction and be the cause of heavy traffic congestion. (Refer to **Figure 5.5-1** special type of frame support).

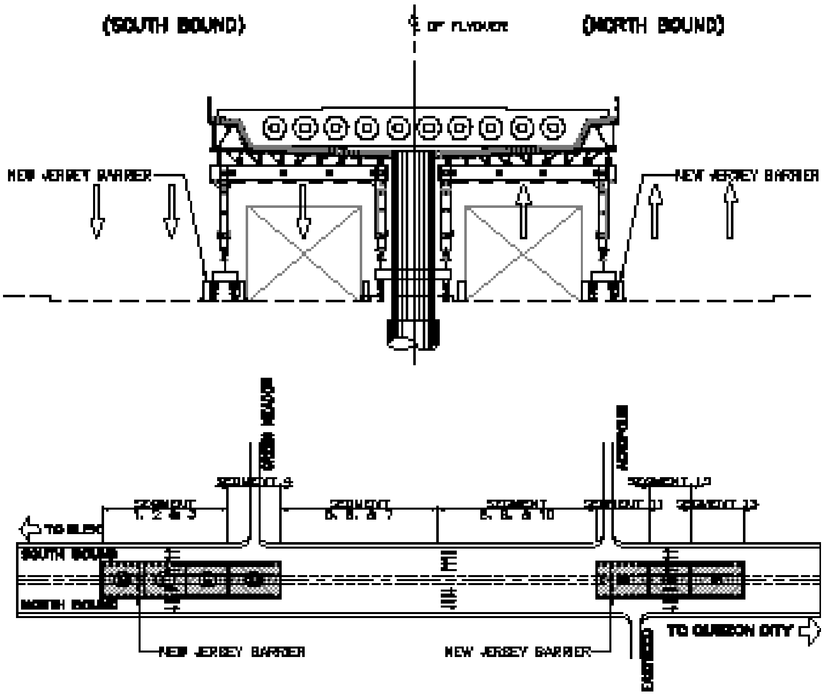
Enclosed by red line in the **Table 5.5-1** is the implementation schedule of such an intersection which shows that the installation of the special type of shoring/scaffolding requires 11 months and that there is a need to temporarily close the road to traffic during dismantling of the shoring/scaffolding. In addition there is high risk of damage to the main body of the structure, in the event of vehicle collision with the special type of shoring and scaffolding.

Moreover, this type of special shoring/scaffolding is also at risk of collapse from vibration during the concrete pouring, which will result in serious damage once collapse occurs. (In fact, the same type of frame support suffered collapse during the concrete pouring for the construction of an expressway in Japan).

Table 5.5-1 Implementation Schedule of Original Plan (C-5/Green Meadows)



Source: JICA Study Team



Source: JICA Study Team

Figure 5.5-1 Special Type of Frame Support

2) Proposal of steel box and steel deck slab type bridge and steel pier

Proposed use of steel bridge, with steel box girder, steel slab deck and steel piers utilizing Japanese technology, as shown in **Figure 5.5-2**, will remove the risks of the original detailed design plan mentioned above and minimize traffic congestion during the construction of superstructure.

Merit of steel box and steel deck slab type bridges

a) 70m long maximum span steel box and slab type bridge, which is much longer than the 30m long maximum span length of PC voided slab bridge, can provide wider available space for proper arrangement of the at grade intersection.

b) Affect to existing traffic is only from the girder launching operations during night works given that the steel type structures of the substructure and superstructure are fabricated at off-site yards (refer to **Figure 5.5-3** to **5.5-4**). In addition the erection duration for launching girders is only nine (9) days, indicated by red line in the implementation schedule of the original plan as shown in **Table 5.5-2**. Therefore, the impact on traffic during construction can be minimized.

c) Construction duration at the site can be minimized to 6.5 months instead of the original plan of 9 months.

d) Steel box and steel deck slab type bridge is superior to PC voided slab with regard to reduced seismic demand given that steel structures are less heavy.

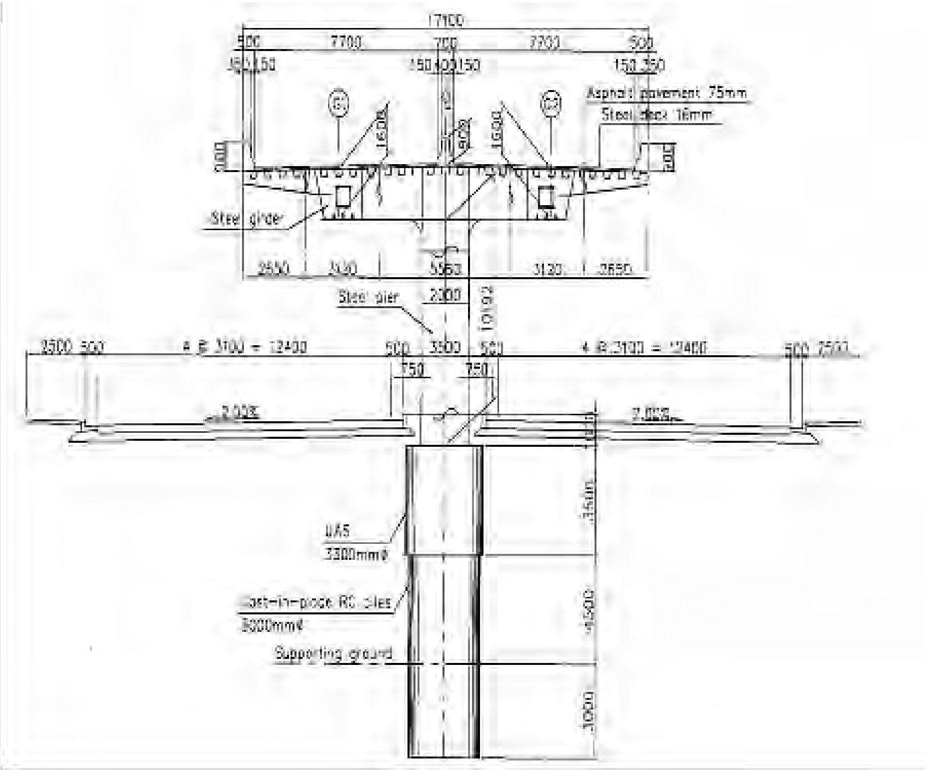
e) No concrete slab. The steel deck plate construction is overlaid with guss or stone mastic asphalt as first layer and regular asphalt on top of guss or stone mastick asphalt following launching of the girders.

f) Allows transfer of Japanese technology.

g) Demerit of steel box and steel deck slab type bridge

h) Cannot adopt steel deck form for entire length of flyover given that the steel box and steel deck slab type bridge is more expensive than PC voided slab type.

Comparison between original plan and steel box and slab type bridge is shown in **Table 5.5-3**.

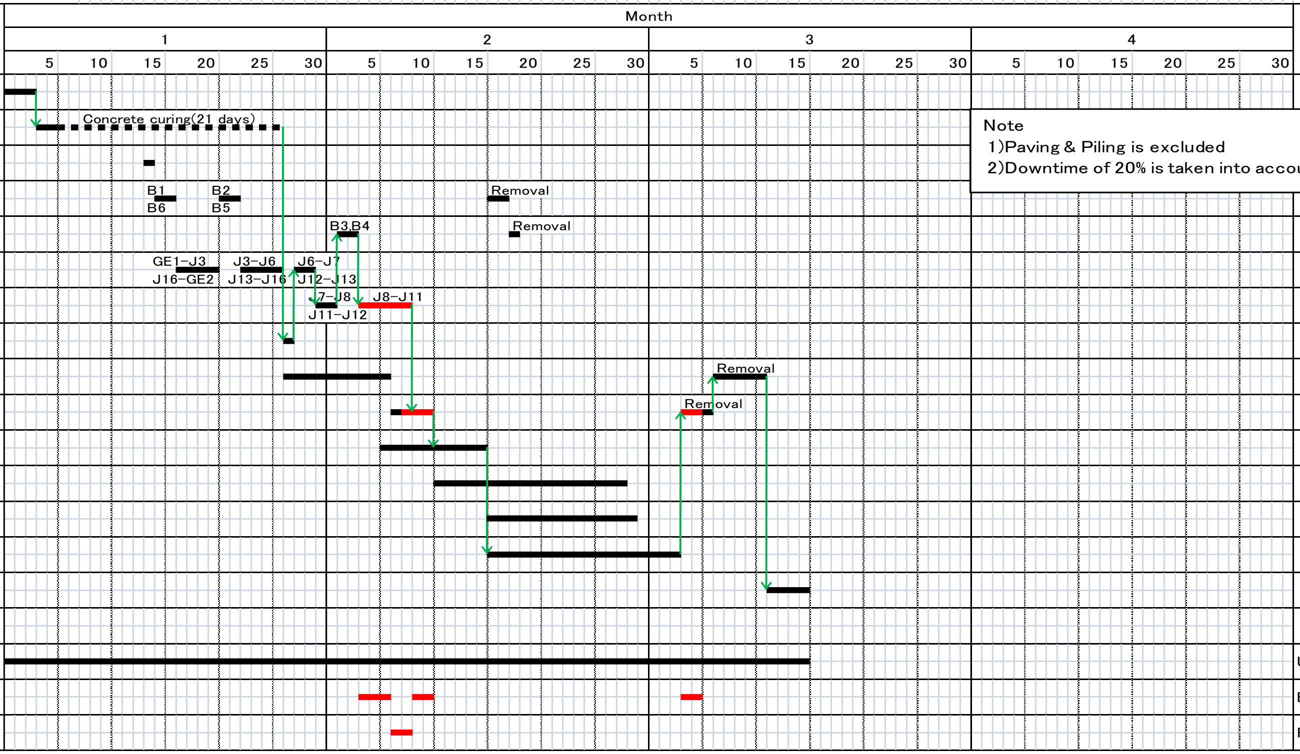


Source: JICA Study Team

Figure 5.5-2 General View of Steel Box and Slab Type Bridge

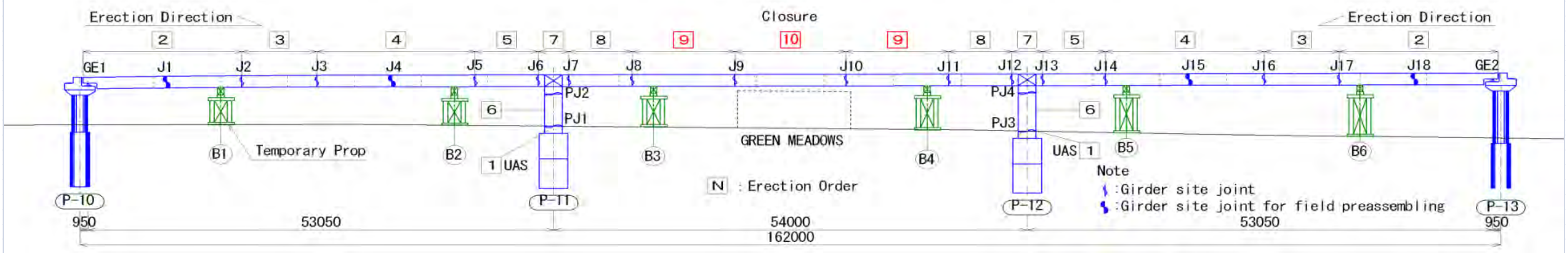
Table 5.5-2 Implementation Schedule of Steel Box and Slab Type Bridge for C5/Green Meadows Interchange

ERECTION SCHEDULE（C5/GREEN MEADOWS）

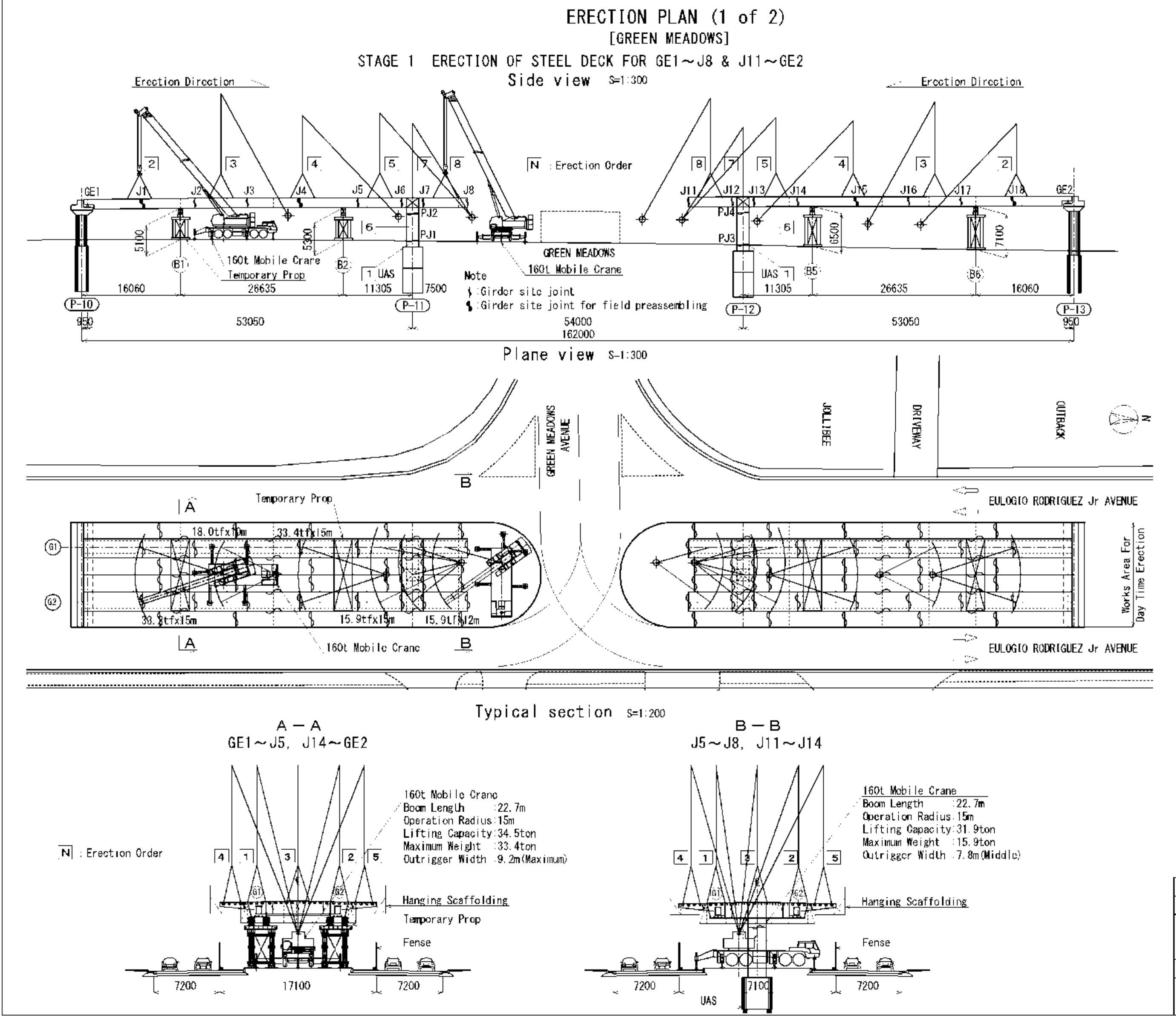


Work Item	Works Scope	Work Days	Remarks
Preliminary		3	
UAS Installation	P11,P12	2	
Bearing Installation	P10,P13	1	
Temporary Props	P10−P11 P12−P13	6	
	P11−P12	3	
Steel Deck Erection	P10−P11 P12−P13	10	
	P11−P12	7	
Steel Pier Erection	P11,P12	1	
Scaffolding	P10−P11 P12−P13	15	
	P11−P12	7	
HSFG Bolt		10	
In Situ Painting		18	
Steel Pier Filling & Protection Concrete	P11,P12	14	
Vehicle Clash Barrier		18	
Site Cleaning		4	
Temporary Traffic Arrangement	Day long Arrangement	75	Used as Works Area
	Night time Arrangement①	7	Erection of J8～J11
	Night time Arrangement②	2	For Deck Closure

Note
1)Paving & Piling is excluded
2)Downtime of 20% is taken into account



Source: JICA Study Team



160t Mobile Crane
Lifting Capacities

Counterweight:37ton(Maximum)
Outrigger Width:9.2m(Maximum)

(Unit:ton)

		Boom Length (m)		
		18.15	22.7	31.8
Operation Radius (m)	10.0	60.1	52.6	45.5
	11.0	54.1	47.8	41.4
	12.0	49.4	43.7	37.9
	13.0	45.4	40.3	35.1
	14.0	41.4	37.1	32.2
	15.0	32.3	34.5	30.0
	16.0	23.1	31.9	27.8
	18.0		27.8	24.4
	20.0		19.5	21.4
	22.0			18.9

Counterweight:37ton(Maximum)
Outrigger Width:7.8m(Middle)

(Unit:ton)

		Boom Length (m)		
		18.15	22.7	31.8
Operation Radius (m)	10.0	60.1	52.6	45.5
	11.0	53.3	47.8	41.4
	12.0	47.3	43.7	37.9
	13.0	42.1	39.8	35.1
	14.0	36.8	35.8	32.2
	15.0	30.0	31.9	30.0
	16.0	23.1	27.9	27.8
	18.0		22.3	24.4
	20.0		18.1	19.8
	22.0			16.5
	24.0			13.8

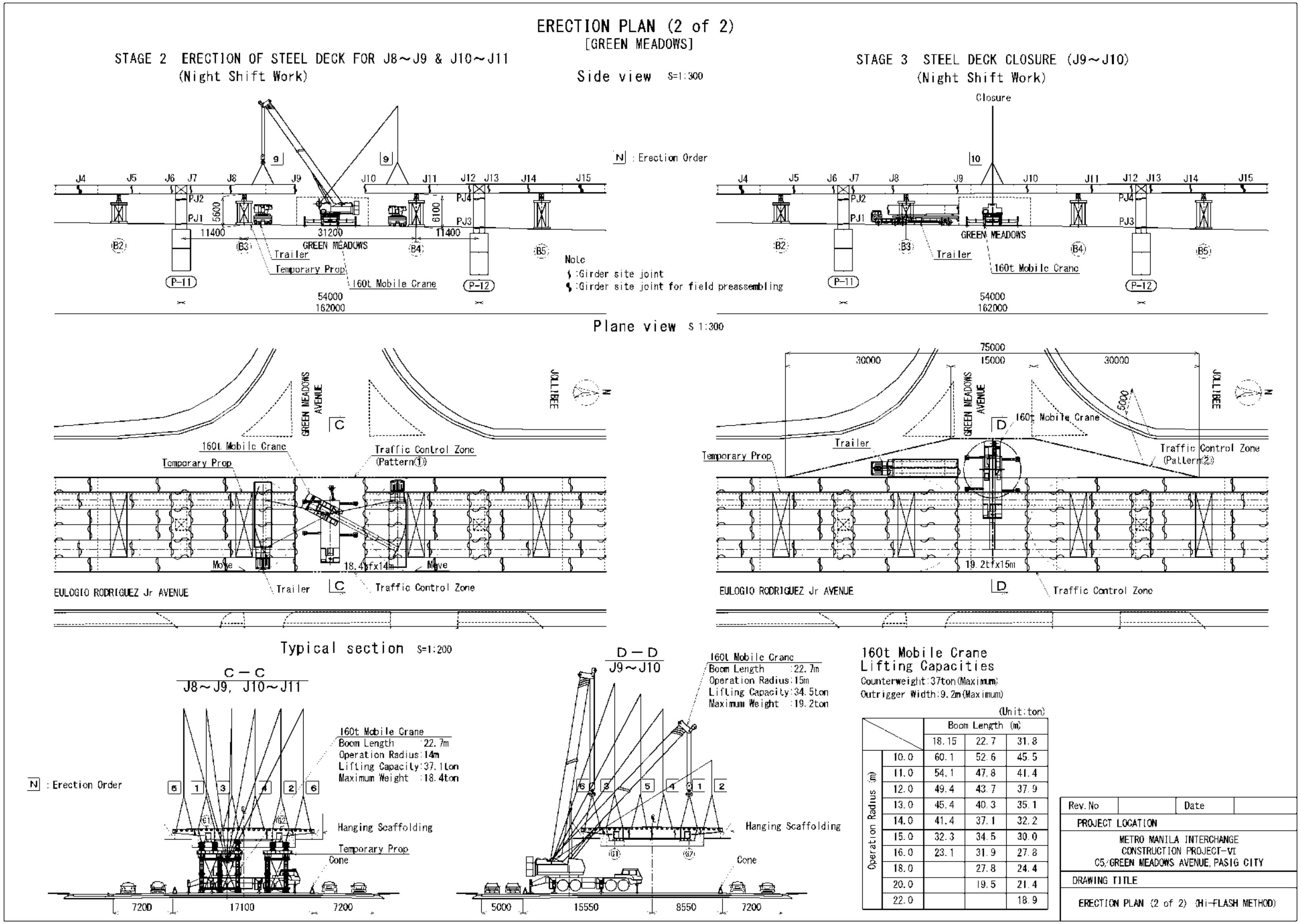
Rev. No		Date	

PROJECT LOCATION
METRO MANILA INTERCHANGE
CONSTRUCTION PROJECT-VI
C5/GREEN MEADOWS AVENUE, PASIG CITY

DRAWING TITLE
ERECTION PLAN (1 of 2) (Hi-FLASH METHOD)

Source: JICA Study Team

Figure 5.5-3 Elevation Plan (1/2)



160t Mobile Crane
Lifting Capacities
Counterweight:37ton(Maximum)
Outrigger Width:9.2m(Maximum)

(Unit:ton)

		Boom Length (m)		
		18.15	22.7	31.8
Operation Radius (m)	10.0	60.1	52.6	45.5
	11.0	54.1	47.8	41.4
	12.0	49.4	43.7	37.9
	13.0	45.4	40.3	35.1
	14.0	41.4	37.1	32.2
	15.0	32.3	34.5	30.0
	16.0	23.1	31.9	27.8
	18.0		27.8	24.4
	20.0		19.5	21.4
	22.0			18.9

Rev.No		Date	
PROJECT LOCATION			
METRO MANILA INTERCHANGE CONSTRUCTION PROJECT-VI C5/GREEN MEADOWS AVENUE, PASIG CITY			
DRAWING TITLE			
ERECTION PLAN (2 of 2) (Hi-FLASH METHOD)			

Source: JICA Study Team

Figure 5.5-4 Elevation Plan (2/2)

Table 5.5-3 Comparison between Original Plan and Steel Box and Slab Type Bridge

	Steel box and slab type bridge Maximum Span L=70m	Original Plan Maximum Span L=30m
Merit	・70m long maximum span of steel box and slab type bridge is much longer than 30m long maximum span length of PC voided slab which can provide wider available space for proper arrangement of at grade intersection. ・Affect to existing traffic is only from launching of girders during night works given that steel type structures of substructure and superstructure are fabricated at off-site yards. In addition the duration of launching girders is only nine (9) days. Therefore, impact on existing traffic can be minimized. ・Construction duration at site can be minimized to 6.5 months instead of original plan of 9 month. ・Steel box and slab type bridge is superior to PC voided slab with regard to reduced seismic demand given that steel structures are less heavy. ・No concrete slab. The steel deck plate construction is overlaid with guss asphalt as first layer and regular asphalt on top of guss asphalt following launching of the girders. ・Allows transfer of Japanese technology.	・Economical given construction cost is lower ・Can be constructed by local regular contractor due to common type of super structure.
Demerit	・Cannot adopt steel deck form for entire length of flyover given that the steel box and slab type bridge is more expensive than PC voided slab type.	・Requires erection and dismantling of special type of shoring/scaffolding and formworks for voided slab at the intersection, these activities will affect the existing traffic and cause heavy traffic congestion. ・The erected shoring/scaffolding will reduce the number of available traffic lanes which will cause heavy traffic congestion until the shoring/scaffolding is dismantled. ・There is a risk of damage or collapse of the voided slab in the event of passing vehicle collision with the shoring/scaffolding which will result in great damage to the structure. ・There is a risk of collapse of the voided slab due to vibration during the concrete pouring leading to loss of stability of the shoring/scaffolding.
Construction Duration	24 Month	26 Month
Construction Cost	JPMY 6,319 <1.149>	JPMY 5,498 <1.000>

Source: JICA Study Team

Note: Not included C3/E. Rodrigeuz Flyover for Construction Cost

(3) Proposal for Earthquake Resistant Type Mechanically Stabilized Earth Wall (ERMSE) at the flyover approach section

Earthquake resistant MSE wall at the flyovers approach sections is proposed instead of the prevailing type MSE wall. This new type MSE wall (ERMSE) provides high seismic resistance utilizing new wide strips and an improved attachment system between the new wide strip and the concrete skin wall. The proposed use of ERMSE is also an opportunity for Japanese technology transfer. The material cost of ERMSE wall is about 5% only of the total Japanese content. The outline of the proposed ERMSE wall is explained below.

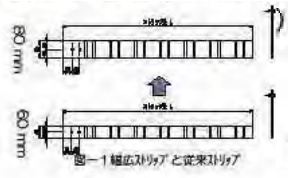
New ERMSE wall provides improved effectiveness of embankment reinforcement

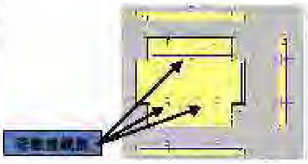
1) Outline of proposed new ERMSE

To improve the reinforcement mechanism inside the embankment with core technology, without change to the exterior appearance of the prevailing type, the system:

a) Utilizes new wide strip

b) Utilizes new concrete skin





2) Difference between new type and prevailing type

a) Improvement of friction resistance and ease of construction. (Prevailing type used 60mm width of strip with ribs.)

The development of 80mm wide strip with ribs improves friction resistance by approximately 30% in comparison with the prevailing type. Construction will also be easier due to the reduction in the number of strips to be installed.

b) High efficiency in use of material for embankment reinforcement

The strips that connect to the concrete skin with the prevailing type are fixed in four configurations of 4, 6, 8 and 12 pieces. However the new type allows seven configurations with the possibility to also connect 3, 5 and 7 pieces strips. This improves the efficiency of the design and optimizes use of materials.

c) To improve effectiveness through the combination the above two factors

The proposed ERMSE type provides superior seismic resistance. The effectiveness of this proposed type (no embankment type) was safely confirmed for a similar application during the Higashi Nihon earthquake (Japanese intensity level 6~7).

The construction of ERMSE in urbanized areas is especially effective due to high seismic resistance and attractive appearance. The investigation report shown in **Figure 5.5-5** is one out of 1,423 reports which have confirmed the safety for all of the no embankment type walls.

Place : Iwate Prefecture

Damage level : No damage

Construction date : April 2006, ERMSE(t=14cm)

Higashi Nihon Earthquake :

March 2011, Japanese intensity level 6 plus

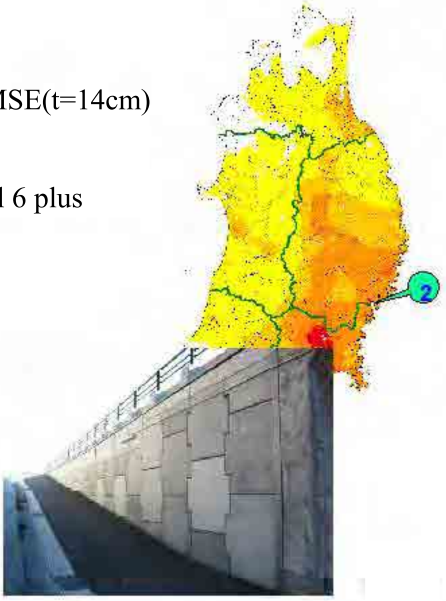
Data of ERMSE

Height of wall : 4.8m

Height of embankment : 0m

Length : 36m

Area : $90m^2$



Source: Japan Terre Armee Association

Figure 5.5-5 Investigation Report

(4) Achievement of 30% Japanese Content

<u>Japanese content in the Philippines</u>

- ✓ **Cement** : Japanese corporate alliance company Taiheiyo Cement Philippine Inc. is in business in the Philippines.
- ✓ **Reinforcing steel bar** : The Philippines is producing reinforcing steel bars using electric blast furnace methods. However large scale infrastructure projects rely upon imported reinforcing steel bars because of local low production capacity and quality. Japanese Contractor is involved STEP Loan scheme, therefore considering the steel bar to be imported from Japan.
- ✓ **Procurement of structural steel members** (steel box and slab type bridge elements) from Japan.
- ✓ **Materials for high seismic resistance reinforced type ERMSE Wall** imported from Japan.
- ✓ **Over head of Japanese contractor** (7.22%)

Amount procured from Japan for the Project is shown in **Table 5.5-4** in the case of procurement of all of the above items.

Table 5.5-4 Procurement Amount from Japan for the Project

(Unit: Pesos)

No.	Description	Amount	Percentage (%)
1.	Cement (Material Only)	82,631,608	2.61
2.	Reinforcing Steel Bar (Material Only)	414,488,550	13.08
3.	Procurement of structural steel members (Material Only)	16,017,322	0.51
4.	Structural Steel (Material Only)	603,502,451	19.05
5.	ERMSE Wall (Material Only)	36,226,866	1.14
6.	Service of Japanese Contractor	228,729,600	7.22
	TOTAL	**1,381,596,397**	**43.61**

Source: JICA Study Team

The total amount of Japanese content, at 2,155 million yen, is **36.39%** of the total 5,572 million yen construction cost under STEP scheme. Furthermore, procurement ratio becomes **43.61%** once the **7.22%** of overhead of the Japanese contractor is added. The Japanese content proposed above therefore is adequate to satisfy the required 30% procurement ratio under STEP scheme condition.

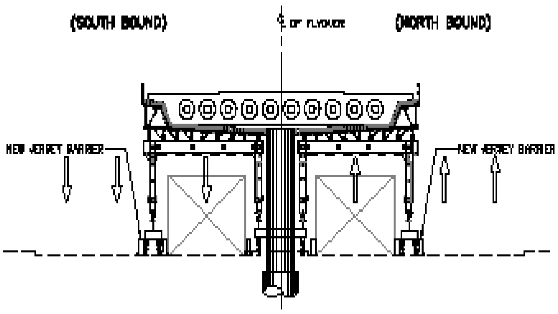
5.5.2 Advanced Technology and Know-How of Japanese Firms

(1) Steel box-girder bridge with steel decks for overpasses at intersections (Non concrete deck slab type)

Conventional method for Original Plan

PC voided slab type viaduct at intersection

- ✓ On-site construction work is time consuming as cast-in place concrete is used.
- ✓ Maximum Length of Span is 30m.
- ✓ Construction duration at site is 9 month at intersection site.
- ✓ Required erection and dismantling of special type of shoring/scaffolding and formworks for superstructure construction at intersection and these activities will be affected the existing traffic and cause of heavy traffic congestion
- ✓ The erected shoring/scaffolding will reduce the number of available traffic lanes which will cause of heavy traffic congestion until the shoring/scaffolding is dismantled.
- ✓ There is a risk of damage or collapse of the voided slab in the event of passing vehicle collision with the shoring/scaffolding which will result in great damage to the structure.

Conventional Method	Temporary Works during Construction
	

Above cross section and picture is shown for ordinary type of shoring/scaffolding for voided slab.

Traffic Congestion during construction	
	

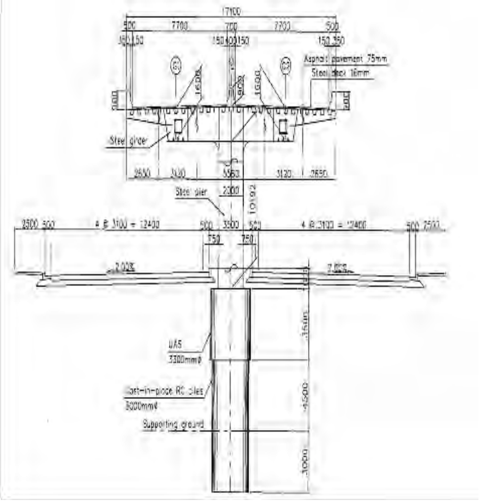
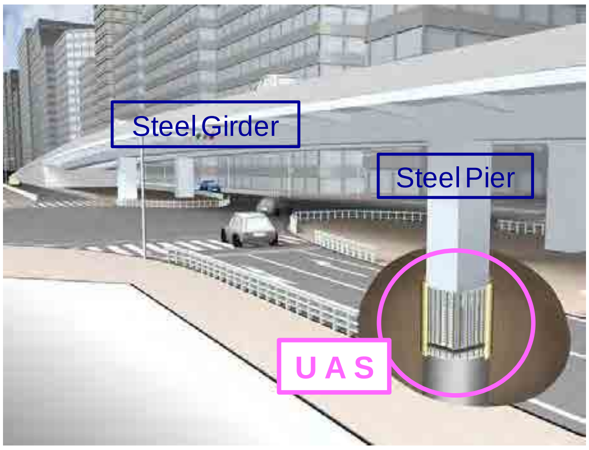
Above picture is shown for shoring/scaffolding of voided slab during construction for similar project. Traffic lane become 2 lanes from existing 3 lanes and cause of heavy traffic jam during construction

Proposal method

Rigid-frame box-girder bridge with steel decks and steel Pier at intersection

- ✓ Prefabricated steel members mainly used
- ✓ No concrete slab and reduction of dead load. The steel deck plate construction is overlaid
- ✓ With special asphalt such as guss asphalt as first layer and overlaid regular asphalt.
- ✓ Improvement of seismic resistance.
- ✓ Maximum length of span is 70m.
- ✓ Affect existing traffic is only from launching of girders during night time works given that steel substructure and superstructure are fabricated at off-site yards.

- ✓ Duration of launching girders is only 9 days and impact on existing traffic can be minimized
- ✓ On-site construction period is 2.5 months
- ✓ No form works and no shoring/scaffolding after launching girders.
- ✓ Reduction of number of bearings, resulting in maintenance cost and noise reduction

Proposal Method	
	

Above cress section and prospective drawing are proposed Rigid Frame Box Girder with Steel Deck and Steel Pire at intersection.

Erection Method	
Day Time	Night Time Erection
	

Above picture is shown for day time and night time condition during erection of superstructure and this erection work is takes only 9 days at intersection.

After Completion


(2) Steel piers and connection of pile foundation for Special Method in Japan

Conventional method

Combination of RC footing and anchor frame as cast-in place concrete is used.

✓ On-site construction work is time consuming.

✓ Large work yard is required.

Proposal method

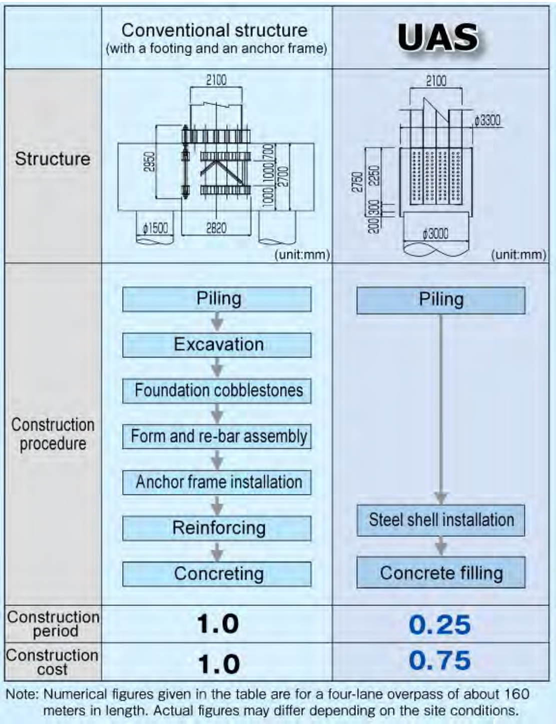
✓ UAS (Uni-Anchor System) (Japanese patent technology)

✓ UAS is simpler and more compact than the conventional connection system

✓ The use of a steel shell reduces the amount of on-site construction work required, such as that involved in form and re-bar assembly

✓ Reduction of the on-site construction period and the area of the work yard

✓ Squeeze of construction costs

Structure	Comparison of conventional connecting structures
	

Characteristics

1. UAS is simpler and more compact than the conventional connecting system.
2. The use of external steel plates means that there is no need for hoop bars.
3. The use of a steel shell reduces the amount of on-site construction work required, such as that involved in form and re-bar assembly work.
4. PBL can reliably transmit the force exerted by the pier on the pile.

	Conventional structure (with a footing and an anchor frame)	UAS
Structure		
Construction procedure	Piling ↓ Excavation ↓ Foundation cobblestones ↓ Form and re-bar assembly ↓ Anchor frame installation ↓ Reinforcing ↓ Concreting	Piling ↓ Steel shell installation ↓ Concrete filling
Construction period	1.0	0.25
Construction cost	1.0	0.75

Note: Numerical figures given in the table are for a four-lane overpass of about 160 meters in length. Actual figures may differ depending on the site conditions.

5.5.3 Outline of STEP Scheme

Scope of the works for four intersections under STEP scheme as follows;

(1) EDSA/Roosevelt/Congressional

Structural type : 3 lane individual flyover

(South and north directions are same type and same length)

Span and bridge length : 7@28.0m+56.0m+58.0m+2@28.0m=366.0m

Type of flyovers : PC voided slab and Steel box girder and Steel column

Approach roads : 3 lane and total 207.5m

Pedestrian Bridge : 3 direction

(Except near side of Munoz station side), total length 95m

RROW : no ROW acquisition

(2) EDSA/North/West/Mindanao

Interchange plan for this intersection will be plan to construct individually due to new plan of MRT-7 station in-front of SM north and new development that Mindanao Ave. direct connected to North Luzon Expressway.

1) EDSA/North/West

Structural type : 3 lane individual flyover

(South and north directions are same type but different length)

Span and bridge length : North direction : 5@28.0m+59.0m+59.0m+3@28.0m=342.0m

South direction : 6@28.0m+53.0m+53.0m+2@22.5m=319.0m

Type of flyovers : PC voided slab and Steel box girder and Steel column

Approach roads : North direction : 3 lane and total 226.6m

South direction : 3 lane and total 244.6m

RROW : no ROW acquisition

2) North/Mindanao

Structural type : North to Mindanao : 2 lane under pass

Mindanao to North : 2 lane flyover

Span and bridge length : North to Mindanao : 95m under pass + 363.5m open cut=458.5m

Mindanao to North : 6@18.0m+2@60.0m+5@18.0m=318.0m

Type of flyovers : North to Mindanao : cut & cover tunnel

Mindanao to North : RC voided slab and Steel box girder and Steel column

Approach roads : North to Mindanao : included 363.5m of open cut section

Mindanao to North : 2 lane and total 205.4m

RROW : required 100m2 ROW acquisition at the corner of Veterans Golf Club

(3) C5-Green Meadows/Acropolis/Calle Industria.

Structural type : 4 lane divided flyover

Span and bridge length :

10@18.0m+3@54.0m+25@18.0m+49.0m+2@50.0m+49.0m+6@18.0m=1,098.0m

Type of flyovers : RC voided slab and steel box girder and Steel column

Approach roads : 4 lane and total 276.4m

RROW : no ROW acquisition

5.5.4 Estimated Cost

Estimated costs under STEP scheme are shown in **Table 5.5-5** and **Table 5.5-6**.

Table 5.5-5 Summary of Project Cost (STEP Loan)

Unit: *Million Pesos*

Item		Total	GOP	ODA	Remarks
1.	**Total Cvil Work Cost**	**3,231.36**	**346.22**	**2,885.14**	
	Civil Work Cost	3,168.00			
	Physical Contingency (2%)	63.36			
	1. EDSA/North/West IC Civil Work Cost	**640.94**	**68.67**	**572.27**	
	Civil Work Cost	628.38			
	Physical Contingency (2%)	12.57			
	2. North/Mindanao IC Civil Work Cost	**592.77**	**63.51**	**529.26**	
	Civil Work Cost	581.15			
	Physical Contingency (2%)	11.62			
	3. C5/Green Meadows IC Civil Work Cost	**1296.54**	**138.91**	**1,157.62**	
	Civil Work Cost	1271.11			
	Physical Contingency (2%)	25.42			
	4. EDSA/Roosevelt IC Civil Work Cost	**701.11**	**75.12**	**625.99**	
	Civil Work Cost	687.36			
	Physical Contingency (2%)	13.75			
2.	**ROW Acquisition Cost**	**4.00**	**4.00**		
3.	**Construction Supervision Cost Total**	**245.37**	**8.16**	**237.21**	
	Construction Supervision Cost	240.56			
	Physical Contingency (2%)	4.81			
4.	**Project Administrative Cost Total**	**110.88**	**110.88**		
	Detailed Design Stage, Construction Supervision Stage (3.5%)	110.88			
Grand Total in Pesos		**3,591.61**	**469.26**	**3,122.36**	
Grand Total in Yen		**6,716.31**	**877.51**	**5,838.80**	

Source: JICA Study Team

Table 5.5-6 Breakdown of Project Cost (STEP Loan)

Unit: *Million Pesos*

Item		Total	CURRENCY COMPONENT		
			Foreign	Local	Tax
1.	**Total Cvil Work Cost**	**3,231.36**	**1,300.46**	**1,584.68**	**346.22**
	Civil Work Cost	3,168.00	1,274.96	1,553.61	339.43
	Physical Contingency (2%)	63.36	25.50	31.07	6.79
	1. EDSA/North/West IC Civil Work Cost	**640.94**	**228.91**	**343.36**	**68.67**
	Civil Work Cost	628.38	224.42	336.63	67.33
	Physical Contingency (2%)	12.57	4.49	6.73	1.35
	2. North/Mindanao IC Civil Work Cost	**592.77**	**211.70**	**317.56**	**63.51**
	Civil Work Cost	581.15	207.55	311.33	62.27
	Physical Contingency (2%)	11.62	4.15	6.23	1.25
	3. C5/Green Meadows IC Civil Work Cost	**1,296.54**	**564.01**	**593.61**	**138.91**
	Civil Work Cost	1,271.11	552.95	581.97	136.19
	Physical Contingency (2%)	25.42	11.06	11.64	2.72
	4. EDSA/Roosevelt IC Civil Work Cost	**701.11**	**295.84**	**330.15**	**75.12**
	Civil Work Cost	687.36	290.04	323.68	73.65
	Physical Contingency (2%)	13.75	5.80	6.47	1.47
2.	**ROW Acquisition Cost**	**4.00**	**0.00**	**4.00**	**0.00**
		4.00		4.00	
3.	**Construction Supervision Cost Total**	**245.37**	**123.94**	**113.27**	**8.16**
	Construction Supervision Cost	240.56	121.51	111.05	8.00
	Physical Contingency (2%)	4.81	2.43	2.22	0.16
4.	**Project Administration Cost Total**	**110.88**		**110.88**	
	Detailed Design Stage, Construction Supervision Stage (3.5%)	110.88		110.88	
Grand Total		**3,591.61**	**1,424.40**	**1,812.84**	**354.38**

Source: JICA Study Team

5.5.5 Draft Estimated Cost for the Consultancy Services for Detailed Engineering Design and Construction Supervision

Recapitulation of Draft Estimated Cost for the Consultancy Services for Detailed Engineering Design and Construction Supervision is shown in **Table 5.5-7.**

Table 5.5-7 Recapitulation of Draft Estimated Cost for the Consultancy Services for Pre-Construction and Construction Supervision

DESCRIPTION	FOREIGN CURRENCY		VAT LOCAL CURRENCY (PESO)
	YEN COMPONENT	PESO COMPONENT	
I. PRE-CONSTRUCTION STAGE			
A. Yen Component			
A.1 Remuneration Cost	¥ 20,496,000		
A.2 Reimbursable Cost	¥ 3,140,000		
B. Peso Component			
Remuneration Cost		₱ 8,310,000	
Reimbursable Cost		₱ 3,220,000	
TOTAL	**¥ 23,636,000**	**₱ 11,530,000**	**₱ 997,200**
II. CONSTRUCTION SUPERVISION STAGE			
A. Yen Component			
A.1 Remuneration Cost	¥ 179,340,000		
A.2 Reimbursable Cost	¥ 24,250,000		
B. Peso Component			
Remuneration Cost		₱ 58,350,000	
Reimbursable Cost		₱ 41,172,000	
TOTAL	**¥ 203,590,000**	**₱ 99,522,000**	**₱ 7,002,000**
SUB-TOTAL (I + II)	**¥ 227,226,000**	**₱ 111,052,000**	**₱ 7,999,200**
VAT	**¥**	**₱**	**₱ 7,999,200**
Contingency (2.0%)	**¥ 4,544,520**	**₱ 2,221,040**	
TOTAL CONSULTANCY COST	**¥ 231,770,520**	**₱ 113,273,040**	**₱ 7,999,200**
	¥ 443,591,105		
	₱ 237,214,495		

Source: JICA Study Team

5.5.6 Proposed Implementation Plan for STEP Scheme

Proposed implementation schedule is shown in **Table 5.5-8.**

Table 5.5-8 Proposed Implementation Plan for STEP Scheme

	2013												2014												2015												2016												2017												2018											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Pledge	■																																																																							
Signing of Loan Agreement			■																																																																				
				DD consulting service																																																																				
														CS consulting service																																																									
Procurement of DD Consultants (2)																																																																							
Detailed Design (12)				1	1	1	1	1	1	1	1	1	1	1	1																																																									
Selection of CS Consultant (12)		1	1	1	1	1	1	1	1	1	1	1	1																																																											
Selection of Contractor (ICB with P/Q) (14)														1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
- Document creation and JICA Concurrence (3)														1	1	1																																																								
- Prequalification (3)																	1	1	1																																																					
- Bidding (2)																				1	1																																																			
- Evaluation of Bidding Documents (2)																						1	1																																																	
- JICA Concurrence (1)																								1																																																
- Negotiation (2)																									1	1																																														
- JICA Concurrence on Contract (1)																											1																																													
Construction Supervision (23)																												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																						
																																																				Defect Liability Period																						
Land Acquisition (4)	0												4												0												0												0												0											
																1	1	1	1																																																				
Construction	0												0												9												12												2												0											
																												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																						
- EDSA/North-West IC	0												0												9												12												0												0											
																												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																								
- North/Mindanao IC	0												0												9												12												2												0											
																												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																						
- C5/Green Meadows IC	0												0												9												12												2												0											
																												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																						
- EDSA/Roosevelt IC	0												0												9												12												0												0											
																												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																								

Source: JICA Study Team

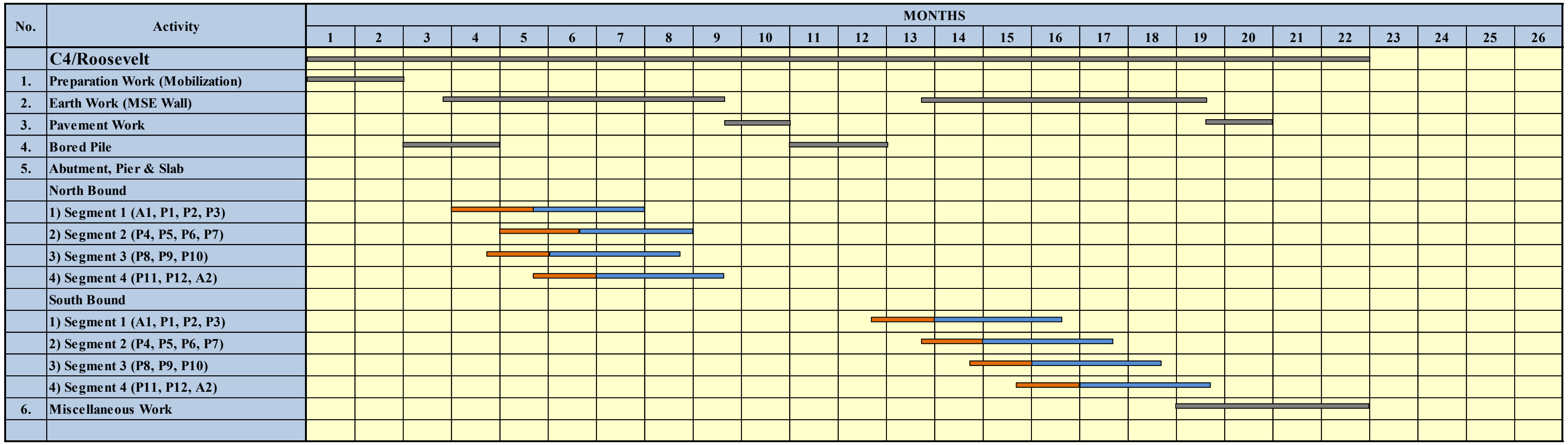
5.5.7 Proposed Implementation Schedule for Each Interchange

(1) EDSA/Roosevelt/Congressional

Proposed implementation schedule is shown in **Table 5.5-9**.

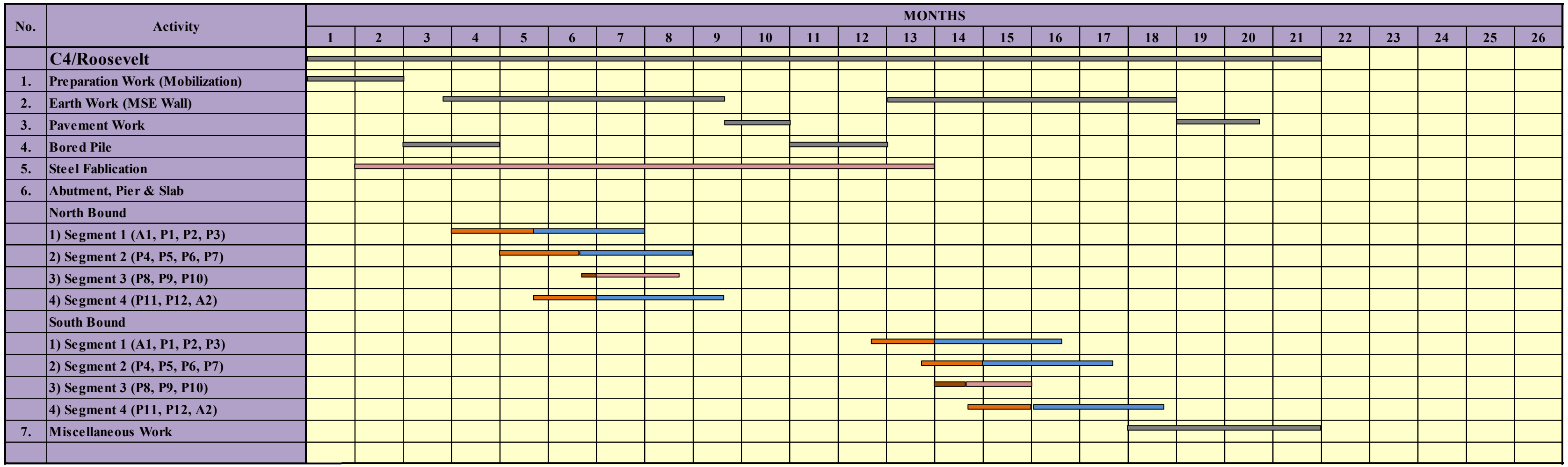
Table 5.5-9 Proposed Implementation Schedule for EDSA/Roosevelt/Congressional

1. GENERAL YEN LOAN



No.	Activity
	C4/Roosevelt
1.	Preparation Work (Mobilization)
2.	Earth Work (MSE Wall)
3.	Pavement Work
4.	Bored Pile
5.	Abutment, Pier & Slab
	North Bound
	1) Segment 1 (A1, P1, P2, P3)
	2) Segment 2 (P4, P5, P6, P7)
	3) Segment 3 (P8, P9, P10)
	4) Segment 4 (P11, P12, A2)
	South Bound
	1) Segment 1 (A1, P1, P2, P3)
	2) Segment 2 (P4, P5, P6, P7)
	3) Segment 3 (P8, P9, P10)
	4) Segment 4 (P11, P12, A2)
6.	Miscellaneous Work

2. STEP LOAN



No.	Activity
	C4/Roosevelt
1.	Preparation Work (Mobilization)
2.	Earth Work (MSE Wall)
3.	Pavement Work
4.	Bored Pile
5.	Steel Fablication
6.	Abutment, Pier & Slab
	North Bound
	1) Segment 1 (A1, P1, P2, P3)
	2) Segment 2 (P4, P5, P6, P7)
	3) Segment 3 (P8, P9, P10)
	4) Segment 4 (P11, P12, A2)
	South Bound
	1) Segment 1 (A1, P1, P2, P3)
	2) Segment 2 (P4, P5, P6, P7)
	3) Segment 3 (P8, P9, P10)
	4) Segment 4 (P11, P12, A2)
7.	Miscellaneous Work

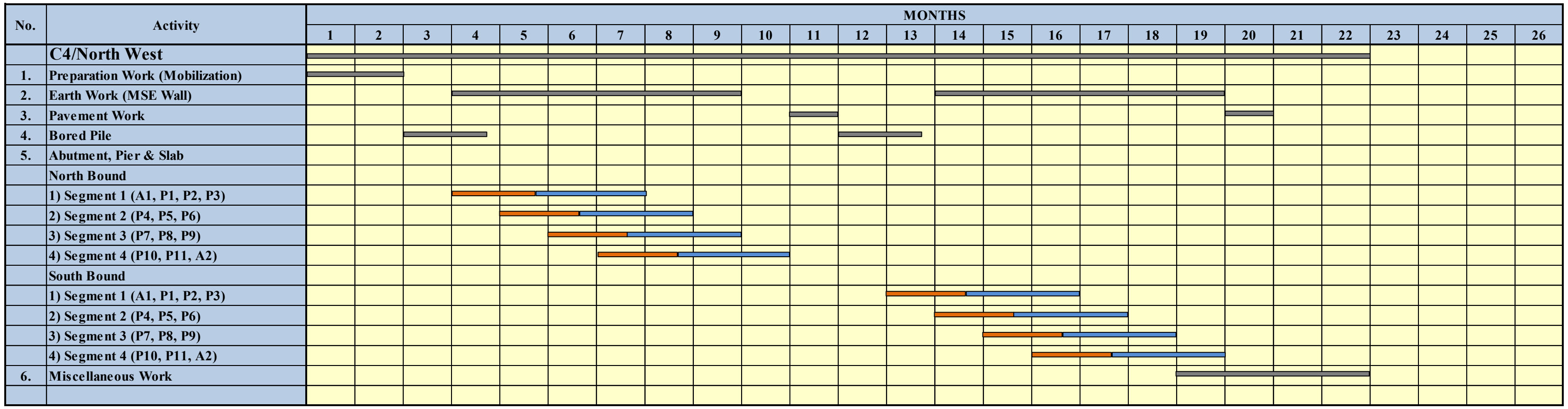
Source: JICA Study Team

(2) EDSA/North/West

Proposed implementation schedule is shown in **Table 5.5-10**.

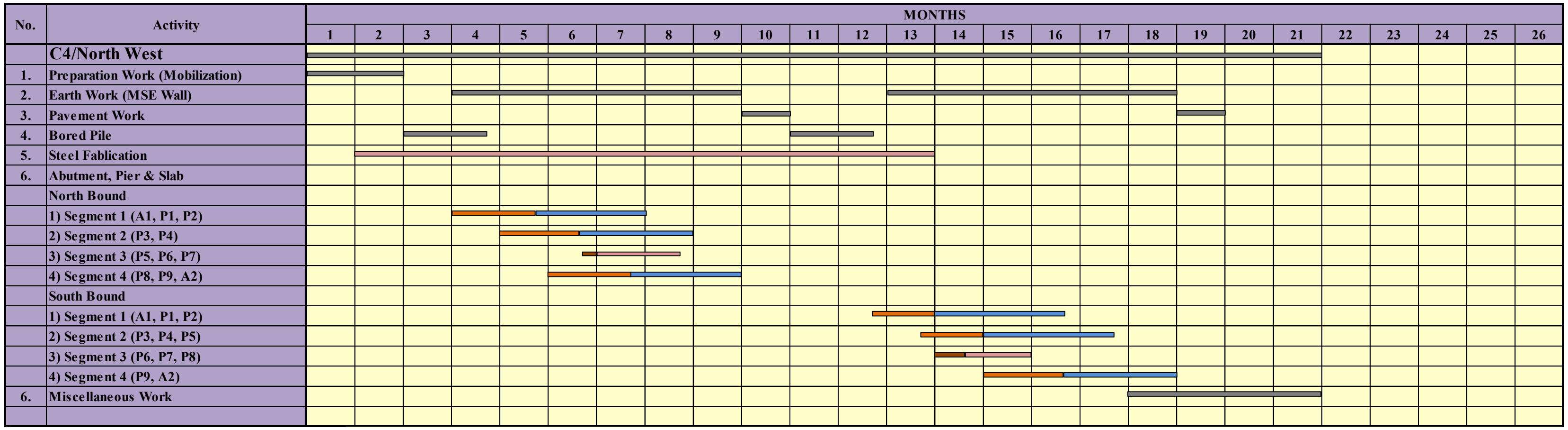
Table 5.5-10 Proposed Implementation Schedule for EDSA/North/West

1. GENERAL YEN LOAN



No.	Activity	MONTHS																									
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
	C4/North West	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬				
1.	Preparation Work (Mobilization)	▬	▬																								
2.	Earth Work (MSE Wall)				▬	▬	▬	▬	▬	▬					▬	▬	▬	▬	▬	▬							
3.	Pavement Work											▬									▬						
4.	Bored Pile			▬	▬								▬	▬													
5.	Abutment, Pier & Slab																										
	North Bound																										
	1) Segment 1 (A1, P1, P2, P3)				🟧	🟧🟦	🟦	🟦																			
	2) Segment 2 (P4, P5, P6)					🟧	🟧🟦	🟦	🟦																		
	3) Segment 3 (P7, P8, P9)						🟧	🟧🟦	🟦	🟦																	
	4) Segment 4 (P10, P11, A2)							🟧	🟧🟦	🟦	🟦																
	South Bound																										
	1) Segment 1 (A1, P1, P2, P3)													🟧	🟧🟦	🟦	🟦										
	2) Segment 2 (P4, P5, P6)														🟧	🟧🟦	🟦	🟦									
	3) Segment 3 (P7, P8, P9)															🟧	🟧🟦	🟦	🟦								
	4) Segment 4 (P10, P11, A2)																🟧	🟧🟦	🟦	🟦							
6.	Miscellaneous Work																			▬	▬	▬	▬				

2. STEP LOAN



No.	Activity	MONTHS																									
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
	C4/North West	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬					
1.	Preparation Work (Mobilization)	▬	▬																								
2.	Earth Work (MSE Wall)				▬	▬	▬	▬	▬	▬				▬	▬	▬	▬	▬	▬								
3.	Pavement Work										▬									▬							
4.	Bored Pile			▬	▬							▬	▬														
5.	Steel Fablication		🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥													
6.	Abutment, Pier & Slab																										
	North Bound																										
	1) Segment 1 (A1, P1, P2)				🟧	🟧🟦	🟦	🟦																			
	2) Segment 2 (P3, P4)					🟧	🟧🟦	🟦	🟦																		
	3) Segment 3 (P5, P6, P7)						🟫	🟥	🟥																		
	4) Segment 4 (P8, P9, A2)						🟧	🟧🟦	🟦	🟦																	
	South Bound																										
	1) Segment 1 (A1, P1, P2)												🟧	🟧	🟦	🟦	🟦										
	2) Segment 2 (P3, P4, P5)													🟧	🟧	🟦	🟦	🟦									
	3) Segment 3 (P6, P7, P8)														🟫🟥	🟥											
	4) Segment 4 (P9, A2)															🟧	🟧🟦	🟦	🟦								
6.	Miscellaneous Work																		▬	▬	▬	▬					

Source: JICA Study Team

(3) North/Mindanao

Proposed implementation schedule is shown in **Table 5.5-11**.

Table 5.5-11 Proposed Implementation Schedule for West/Mindanao

1. GENERAL YEN LOAN

No.	Activity	MONTHS																									
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
	North Mindanao	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬		
1.	Preparation Work (Mobilization)	▬	▬																								
2.	Earth Work (MSE Wall)														▬	▬	▬	▬	▬	▬	▬	▬					
3.	Pavement Work																						▬				
4.	Bored Pile												▬	▬													
5.	Tunnel, Abutment, Pier & Slab																										
	Depressed (Tunnel)																										
	1) Bored Pile, Beam & Tunnel					🟦	🟦	🟦	🟦																		
	2) Excavation									🟦	🟦																
	3) PC Beam											🟦															
	Flyover																										
	1) Segment 1 (A1, P1, P2, P3)														🟧	🟧🟦	🟦	🟦									
	2) Segment 2 (P4, P5, P6, P7, P8)															🟧	🟧🟦	🟦	🟦								
	3) Segment 3 (P9, P10, P11, P12)																🟧	🟧🟦	🟦	🟦	🟦						
	4) Segment 4 (P13, P14, P15, A2)																	🟧	🟧🟦	🟦	🟦	🟦					
6.	Miscellaneous Work			▬	▬																	▬	▬	▬	▬		

2. STEP LOAN

No.	Activity	MONTHS																									
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
	North Mindanao	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬			
1.	Preparation Work (Mobilization)	▬	▬																								
2.	Earth Work (MSE Wall)														▬	▬	▬	▬	▬	▬	▬						
3.	Pavement Work																					▬					
4.	Bored Pile												▬	▬													
5.	Steel Fablication						▭	▭	▭	▭	▭	▭	▭	▭	▭	▭											
6.	Tunnel, Abutment, Pier & Slab																										
	A. Depressed (Tunnel)																										
	1) Bored Pile, Beam & Tunnel					🟦	🟦	🟦	🟦																		
	2) Excavation									🟦	🟦																
	3) PC Beam											🟦															
	B. Flyover																										
	1) Segment 1 (A1, P1, P2)														🟧	🟧🟦	🟦	🟦									
	2) Segment 2 (P3, P4, P5)															🟧	🟧🟦	🟦	🟦								
	3) Segment 3 (P6, P17, P8)																🟫▭	▭									
	4) Segment 4 (P9, P10, P11, P12, A2)																🟧	🟧🟦	🟦	🟦	🟦						
7.	Miscellaneous Work			▬	▬																▬	▬	▬	▬			

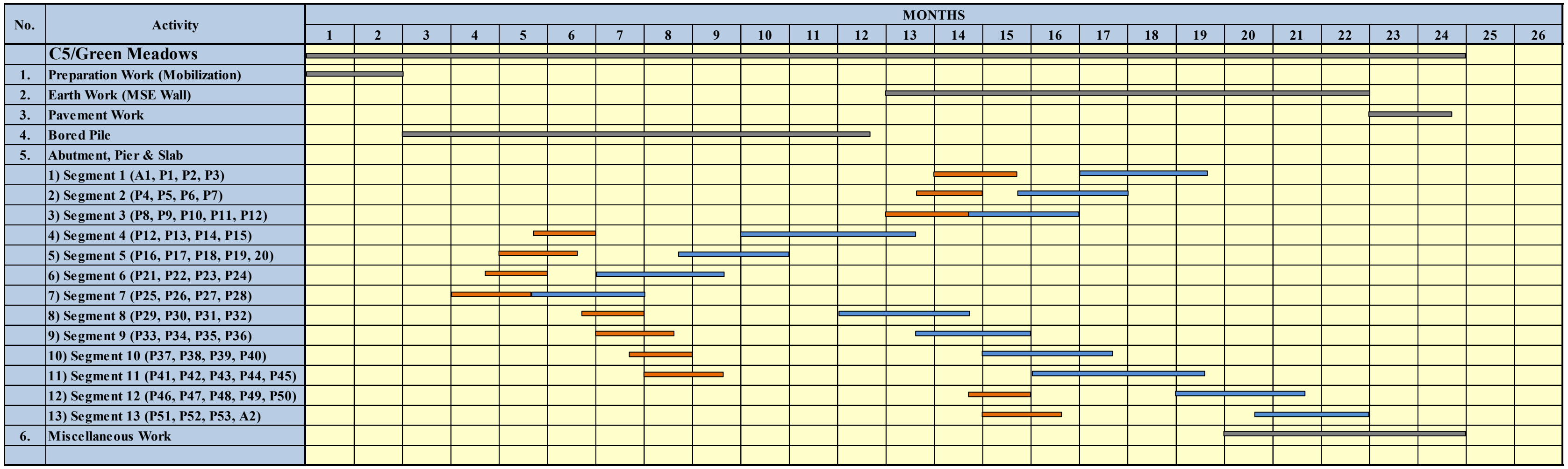
Source: JICA Study Team

(4) C5-Green Meadows/Acropolis/Calle Industria.

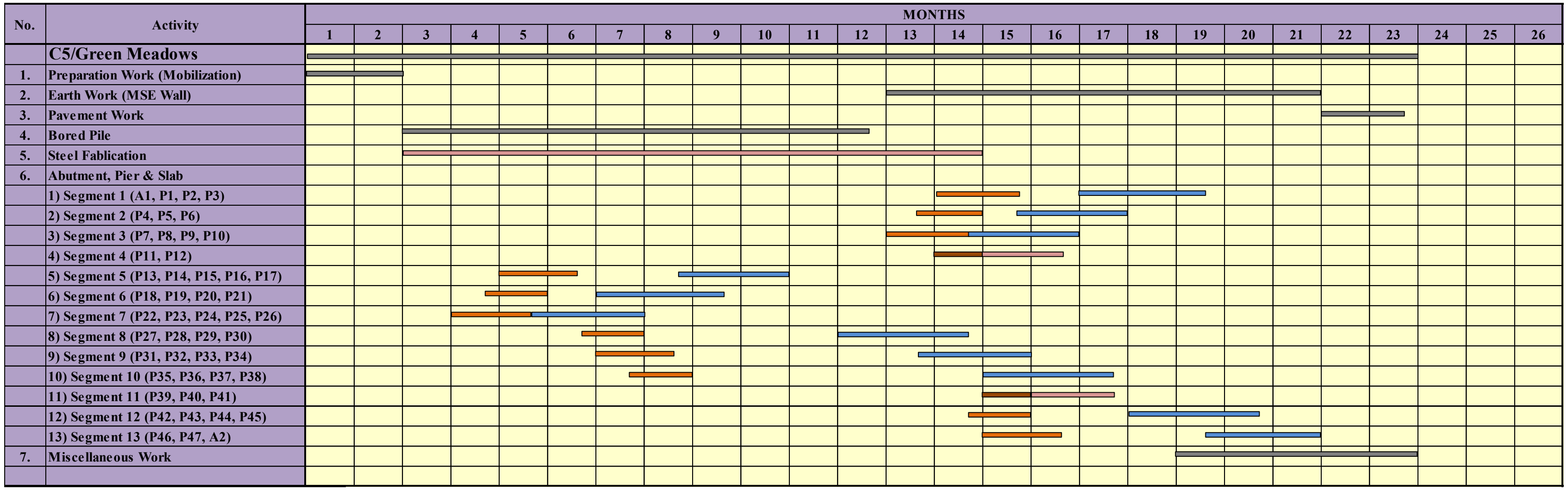
Proposed implementation schedule is shown in **Table 5.5-12**.

Table 5.5-12 Proposed Implementation Schedule for C-5/Green Meadows/Acropolis/Calle Industria

1. GENERAL YEN LOAN



2. STEP LOAN



Source: JICA Study Team

5.6 Summary of Comparison between STEP Loan and Regular Yen Loan

The characteristics and advantages of both types of loans are shown in the table below.

Description		**STEP Loan**	**Regular Yen Loan**	**Remarks**
1. Bridge Type		PC Voided Slab Bridge + Steel Box and Steel Deck-Slab Bridge	PC Voided Slab Bridge	
2. Total Construction Cost		PHP 3,231 M	PHP 2,811 M	Cost is PHP 420 M or 14.9% higher under STEP
3. EIRR (%)	EDSA/North/West	37.4	68.0	
	North/Mindanao	15.7	23.6	
	EDSA/ Roosevelt	22.5	35.9	
	C-5/Greenmeadows	16.4	25.1	
4. Construction Duration (per Flyover)		22~23 months	23~24 months	Reduce 1 month
5. Period of Traffic Control at Intersection		10 days	270 days	
6. Detailed Design		Under JICA Grant	Under Loan	Estimated Detailed Design Cost is PHP 92 M
7. Interest Rate of Loan		0.2% p.a.	1.4% p.a.	
8. Grace Period and Repayment Duration		10 years and 40 years	7 years and 30 years	

Initial investment is high under STEP loan and, correspondingly, low EIRR, but it has the following advantages:

1) Relatively shorter duration of construction per flyover;

2) Traffic control at intersection is much shorter;

3) PHP 92 M estimated cost of detailed design will be undertaken under JICA Grant;

4) Very low and fixed interest rate (0.2%) and long-term repayment period.

CHAPTER 6

EVALUATION OF PROJECT EFFECTIVENESS

6.1 QUANTITATIVE ANALYSIS OF PROJECT EFFECTIVENESS

The overall objective of the economic analysis is to numerically measure and qualitatively assess the allocative efficiency of scarce resources in the economy, with the estimated cost and benefit streams laid down over the period of project life in view. With this, concerned intersections in Metro Manila include: (i) EDSA/West/North, (ii) North/Mindanao, (iii) C-5/Green Meadows, (iv) EDSA/Roosevelt/Congressional, and (v) C-3/ E. Rodriguez, in the proposed order of Contract Package commencement. In carrying out the economic analysis of each of these, analytical methodology adopted is in compliance with the guidelines for economic analysis of road projects prepared by the Japan International Cooperation Agency (JICA 2002), the Government of the Philippines (DPWH/NEDA), and international financing institutions inclusive of the Asian Development Bank (ADB, 1988), the World Bank (WB 1998), and others of relevance. Close consultation meetings took place between the DPWH and the consultant in the preparation of the report. The DPWH reports relative to the said road projects have also been closely referred to[1].

Following the estimation of economic impacts, sensitivity analysis were undertaken to numerically indicate resiliency of the intersection projects against risks. In consultation with DPWH, feasibility risks were set forth as: (i) lower benefit by 15 percent, (ii) cost overrun by 15 percent, and (iii) combination of (i) and (ii).

It should be noted that implementation of the C-3/E. Rodriguez Interchange was cancelled by the DPWH to give priority to the construction of Skyway Stage 3, second level, along C-3 under BOT scheme.

Debt analysis was carried out taking into account of the two types of financial source, namely; (i) Middle Income Countries[2] General Condition (GC) loan and (ii) STEP loan, with the aggregate financial costs of PhP 6,239.7 million (JPY11,668 million) and PhP 7,502.7 million (JPY 14,030 million), respectively. As mentioned above, these financial costs for debt analysis do not include the C-3/E. Rodriguez Interchange.

Debt analysis for both cases of GC and STEP loans is incorporated in **Appendix 6**.

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[1] References: DPWH Urban Road Project Office, Implementation Program for Metro Manila Major Intersections Upgrading Projects, June 2009,September 2010, The Asian Development Bank (ADB), Republic of the Philippines: Road Sector Improvement Project, TA Consultant's Report (Feb 2011), and Report and Recommendation to President (Nov 2011) pp. 11-1-9, annexes 7.

[2] Middle Income Countries are defines as those with Gross National Income (GNI) per capita in 2010 falling between USD 1,916 and 2,975. (Source: The Ministry of Foreign Affairs)

6.1.1 Analytical Methodology

(1) Overall Model Configuration

Economic Internal Rate of Return (EIRR) will be a major index to measure investment feasibility, while taking in view the following prepositions of (i) **"with** and **without"** the project analysis (incremental analysis), (ii) **time discount** method converting all of costs and future benefit streams to their present value, and (iii) **cash-flow analysis**. Variables and assumptive parameters applied to the analysis are summarized in the following set of model configuration. (**Table 6.1-1**):

Table 6.1-1 Model Configuration

	Variables	**C-3/ E. Rodriguez**	**EDSA/ Roosevelt/ Congressional**	**EDSA/North/ West**	**North/ Mindanao**	**C-5/Green Meadows**
1	Project Life (construction years)	25 (6)				
2	Exchange rate (JPY/PhP)	1.87				
3	Exchange rate (PhP/EUR)	58.5				
4	Physical Contingency (%)	2.0				
5	Price Contingency (Foreign, %)	2.1 (Nov. 2012, JICA)				
6	Price Contingency (Local, %)	2.6 (Nov. 2012, JICA)				
7	OM cost (% of BC + Phy Con)	0.5*1				
8	Standard Conversion Factor	0.83 (1/1.2)				
9	Economic Feasibility Cut-off Rate	15.0 % (Social Discount Rate)				
	Economic Benefit					
10	Basic Vehicle Operation Cost by type	**Tables 6.1-5**				
11	VOC (Running/Time) Cost Saved	**Table 6.1-9**	**Table 6.1-11**	**Table 6.1-13**	**Table 6.1-15**	**Table 6.1-17**
	Economic Cost					
12	Aggregate Financial Cost (PhP Mil)[3]	**Table 6.1-8**	**Table 6.1-10**	**Table 6.1-12**	**Table 6.1-14**	**Table 6.1-16**
13	Economic Cost (Base Cost + Physical Contingency, PhP Mil)	**Table 6.1-8**	**Table 6.1-10**	**Table 6.1-12**	**Table 6.1-14**	**Table 6.1-16**
14	Annual Investment Schedule	**Table 6.1-7**				
	Sensitivity Analysis					
15	Benefits	15 % decrease				
16	Costs	15 % increase				
17	Combination of Ben and Cost	2 variable-simultaneous simulation				

Source: JICA Study Team
Note: 1) OM cost % is based on past performance.

(2) Economic Benefits (common to every intersection)

Economic benefits were valued at Border (international) prices of the incremental vehicle operation and time saved emanating from the concerned MMIC project over the period of 20 years after the completion of construction. Note that benefits and associated OM cost partially

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[3] Including Base cost, physical contingency and price contingency

emanate in 2018, once the construction works have ended for servicing in the early middle of the year. Specific sources of benefits include, among others, the following:

1) Vehicle Operation Cost (VOC): Running Cost Saving

2) VOC: Time Cost Saving

In the estimation of VOC reduction effects, DPWH *Basic Vehicle operation Cost (2008)* based on HDM-4 toolkit (The World Bank, version 2.05 in 2006) was applied to quantify the running and time costs, as guided by DPWH and NEDA. In so doing, road condition was intuitively set at "Paved Good/Fair condition"[4]. BVOC (Running and time costs) by type of vehicle (10) are shown in **Tables 6.1-2** and **6.1-3**.

Table 6.1-2 Economic Benefit- Running and Time Cost Saved (1) (2008, PhP)

	Passenger Car	Jeepney	Utility Vehicle	Small Bus	Large Bus
Running Cost (V-km)	8.63	7.06	7.54	16.76	23.10
Time Cost (V-min)	6.81	7.44	2.57	12.59	27.82

Source: DPWH Basic Vehicle Operation Cost, 2008

Table 6.1-3 Economic Benefit- Running and Time Costs Saved (2) (2008, PhP)

	Rigid Truck 2ax	Rigid Truck 3ax	Semi-Trailer 4ax	Motorcycle	Tricycle
Running Cost (V-km)	17.60	29.24	35.66	1.54	2.46
Time Cost (V-min)	1.02	1.46	2.09	1.50	2.13

Source: DPWH Basic Vehicle Operation Cost, 2008

3) Realignment of Vehicle types from DPWH/HDM-4 to JICA Study Format

In the meantime, the type of vehicles was assumed to be 6 in the traffic survey and demand fore casting study undertaken by the JICA study team while the one enlisted in the Basic vehicle Operating Cost Table calculated based on HDM-4, dove by DPWH was 10, Thus, the latter was converted to 6 in the process as follows:

<u>Realignment Process</u>

4 categories (Passenger cars/Jeepneys/Utility vans/Motorcycles) remain as they are;

Of the two categories of Buses (small and large), only large buses were considered because of little availability of small buses in Metro Manila;

Likewise, tricycles were eliminated will be eradicated because of the same reason above; and.

Trucks: Weighed average of trucks/trailer (Rigid Truck 2ax, Rigid Truck 3ax, and Semi-Trailer 4ax) in the DPWH BVOC was considered, with HDM-4 data of unit costs in the above (**Table**

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[4] This road condition assumes 60 km/hour of traffic speed on general condition.

6.1-3) and Annual vehicle running length and working hours as weights (**Table 6.1-4**). With this, unit VOC cost of running and time for "Trucks" were estimated at PhP 31.6 per vehicle-km and PhP 109.7 per vehicle-hour, respectively[5].

Table 6.1-4 Weighted Average of Truck Running and Time Costs

	Rigid Truck 2 ax	Rigid Truck 3 ax	Semi-Trailer 4 ax	Semi-Trailer 5 ax	Trailer 4 ax	Trailer 5 ax	Total
Annual Vehicle kilometers	50,000	50,000	60,000	60,000	40,000	40,000	300,000
Annual Working Hours	1,500	1,500	1,800	1,800	1,500	1,500	9,600

Source: DPWH Basic Vehicle Operation Cost, HDM-4 Table 19, 2008

With the above in view, the unit economic benefits of running and time cost-savings by vehicle type are summarized and presented in **Tables 6.1-5** and **6.1-6**, Note that unit running costs in the Philippines stand by and large similar as those of Japan, whereas time costs are deemed much lower[6].

Table 6.1-5 Economic Benefit - DPWH BVOC Table (PhP)

	Passenger Car	Jeepney	Utility Vehicle	Bus	Truck	Motorcycle
Running Cost (V-km)	8.6	7.1	7.5	23.1	31.6	1.5
Time Cost (V-Hr)	408.4	446.6	154.2	1,669.2	109.7	89.9

Source: DPWH BVOC 2008 and JICA Team

Table 6.1-6 Running Cost and Time Cost Savings by Vehicle Type - DPWH BVOC Table

DPWH Classification		JICA Team Demand Study	Unit running cost (PhP)	Unit time cost (PhP)	Total VOC (PhP)
Passenger Cars	⇨	Passenger Cars	8.63	6.81	15.44
Jeepney	⇨	Jeepney	7.05	7.45	14.50
Goods Utility (van, small trucks)	⇨	Utility Vehicles	7.54	2.57	10.11
Small Buses					
Large Buses	}	Buses	23.10	27.82	50.92
Rigid Trucks (2 axle)					
Rigid Trucks (3 axle)	}	Trucks	29.24	1.46	30.70
Semi-Trailers (4 axle)					
Motor Cycles	⇨	Motor Cycles	1.54	1.50	3.04
Tricycles		NA			

Source: DPWH BVOC 2008 and JICA Team 1

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[5] Numerically weighed average running cost, for instance, is estimated by PhP 17.60×(50,000÷300,000) + 29.24×(50,000÷300,000) + 35.66×((60,000+60,000+40,000+40,000)÷300,000)

[6] For reference, in Japan, the unit running costs (per vehicle-km) of passenger cars, bus, utility vehicle (small trucks), and regular sized trucks are legally set at JPY 16.46 (PhP 8.8), JPY 35.90 (PhP 19.2), JPY 18.89 (PhP 10.1), and JPY 36.65 (PhP 19.6), in that order. Likewise, time costs (per vehicle hour) of passenger cars, bus, utility vehicle (small trucks), and regular sized trucks are set at JPY 2,393.23 (PhP 1,279.8), JPY 22,336.8 (PhP 11,944.8), JPY 2,859.2 (PhP 1,529.0), and JPY 3,830.3 (PhP 2,048.3), in that order. (Source: The Ministry of Land and Transportation, *Manual of Cost Benefit Analysis,* 2009

(3) Economic Costing Procedure

Economic costs are the opportunity costs of goods and services depleted (or benefit foregone) by implementation. As previously noted, all of these costs are valued at 2012.

The local cost portion of the Project valued by market price is converted to border prices in economic analysis by way of applying Conversion Factors (Standard CF and CF for Unskilled labor). Foreign cost portion or component in the Project are now proxy to their real cost to the economy (idealized concept of *perfect competitive market*), while representing their true value for corresponding goods and services employed during project implementation.

(4) Estimates of Economic Costs and Benefits

In the light of preceding sections, the demand forecast (**Section 3.3**) and engineering costs incurred at each of the intersections (**Chapter 4**), economic benefits and costs for the estimation of EIRR were determined in the subsequent sections. In carrying out the analysis, annual investment rates for all of the intersections were assumed as follows (**Table 6.1-7**):

Table 6.1-7 Annual Investment Schedule (%)

1	2	3	4	5	6
0.26	2.92	1.35	28.35	57.22	9.89

Source: JICA Study Team

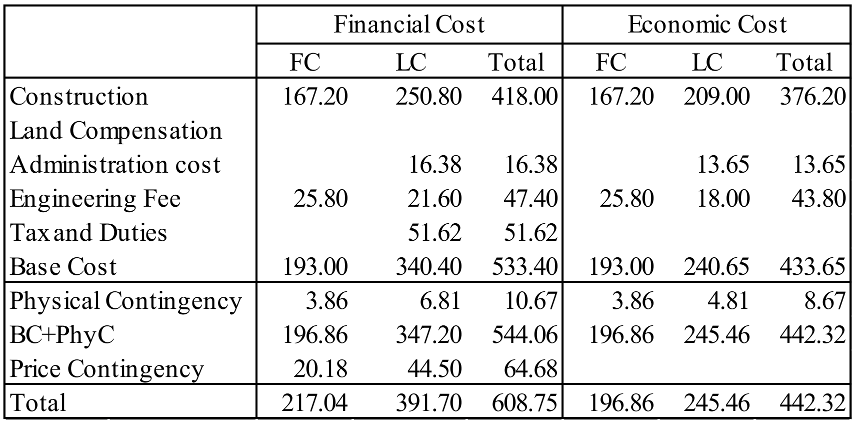
Note: 1) Annual investment schedule is made up by allocating the project cost in accordance with the project implementation schedule

(5) Estimates of Economic Costs and Benefits by Intersection

1) C-3/ E. Rodriguez

Economic costs, initial investment schedule, and benefits are specifically presented in **Tables 6.1-8** and **6.1-9**. Economic benefits from Vehicle Operation Cost (VOC) savings are shown by quantity and value in **Figures 6.1-1** and **6.1-2**.

Table 6.1-8 Financial and Economic Costs of C-3/E. Rodriguez (PhP million)



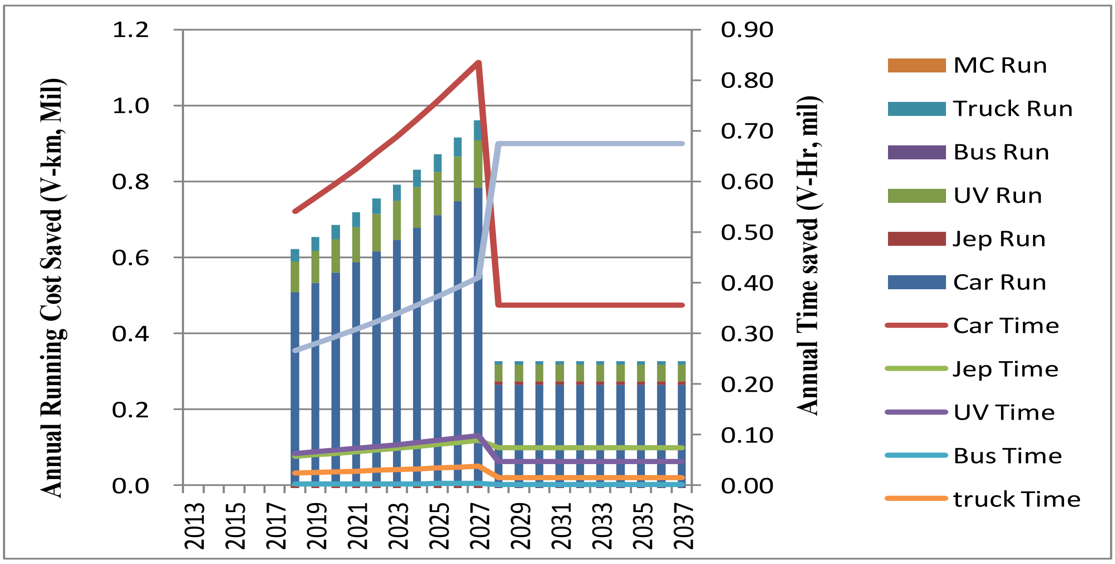
	Financial Cost			Economic Cost		
	FC	LC	Total	FC	LC	Total
Construction	167.20	250.80	418.00	167.20	209.00	376.20
Land Compensation						
Administration cost		16.38	16.38		13.65	13.65
Engineering Fee	25.80	21.60	47.40	25.80	18.00	43.80
Tax and Duties		51.62	51.62			
Base Cost	193.00	340.40	533.40	193.00	240.65	433.65
Physical Contingency	3.86	6.81	10.67	3.86	4.81	8.67
BC+PhyC	196.86	347.20	544.06	196.86	245.46	442.32
Price Contingency	20.18	44.50	64.68			
Total	217.04	391.70	608.75	196.86	245.46	442.32

Source: JICA Study Team

Table 6.1-9 Economic Benefit - VOC Saved of C-3/E. Rodriguez (PhPmillion, 2018-37)

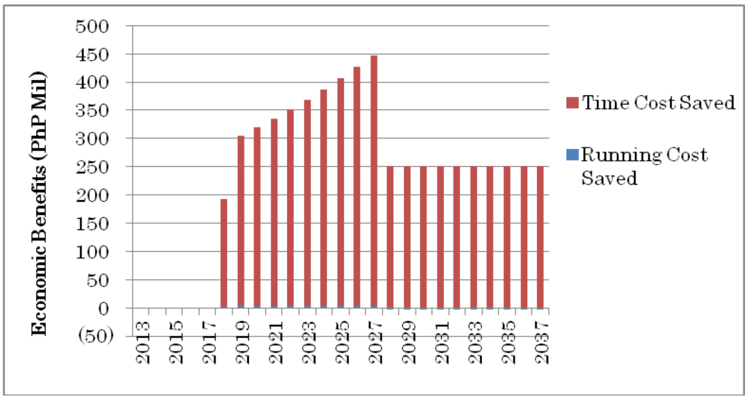
	Passenger Car	Jeepney	Utility Vehicle	Bus	Truck	Motorcycle	Total
Running Cost Saved (v-km, mil)	9.0	0.0005	1.5	-0.2	0.51	-59.7	-49.0
BVOC (PhP/v-km)	8.63	7.05	7.54	23.10	31.58	1.54	-
Running Cost saving (PhP mil)	77.8	0.004	11.0	-5.3	16.1	-92.0	7.6
Time Saved (v-hr mil)	10.4	1.5	1.3	0.04	0.5	10.1	23.7
BVOC (k-hr)	408.4	446.6	154.2	1,669.2	109.7	89.9	-
Time Cost Saving (PhP mil)	4,230.3	656.3	195.0	69.7	50.3	907.5	6,109.0
Total VOC Benefit	4,308.1	656.3	205.9	64.3	66.4	815.5	6,116.6

Source: JICA Study Team



Source: JICA Study Team

Figure 6.1-1 Economic Benefits by Quantity of C-3/E. Rodriguez (2018-2037)



Source: JICA Study Team

Figure 6.1-2 Economic Benefits by Value of C-3/E. Rodriguez (2018-2037)

2) EDSA/Roosevelt/Congressional

Economic costs, initial investment schedule, and benefits are shown in **Tables 6.1-10** through **6.1-11.** Economic benefits from Vehicle Operation Cost (VOC) savings by quantity and value are shown in **Figures 6.1-3** and **6.1-4**.

Table 6.1-10 Financial and Economic Costs of EDSA/Roosevelt/Congressional (PhP million)

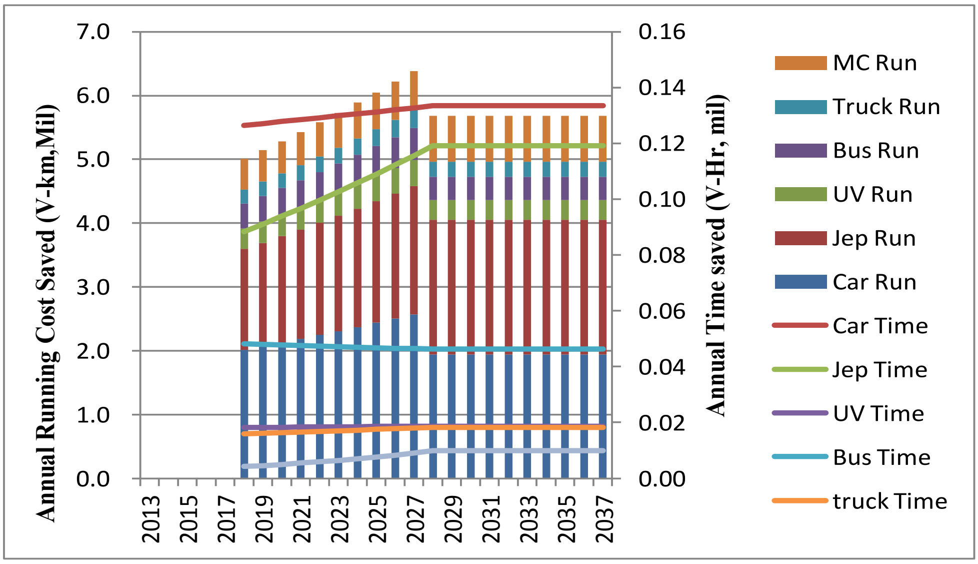
	Financial Cost			Economic Cost		
	FC	LC	Total	FC	LC	Total
Construction	214.37	321.56	535.93	214.37	267.97	482.34
Land Acquisition						
Administration cost		21.01	21.01		17.51	17.51
Engineering Fee	39.35	32.28	71.62	39.35	26.90	66.24
Tax and Duties	0.00	76.32	76.32			
Base Cost	253.72	451.17	704.89	253.72	312.37	566.09
Physical Contingency	5.07	9.02	14.10	5.07	6.25	11.32
BC+PhyC	258.79	460.19	718.99	258.79	318.62	577.41
Price Contingency	26.53	58.98	85.52			
Total	285.33	519.18	804.50	258.79	318.62	577.41

Source: JICA Study Team

Table 6.1-11 Economic Benefit - VOC Saved of EDSA/Roosevelt/Congressional (PhP million, 2018-37)

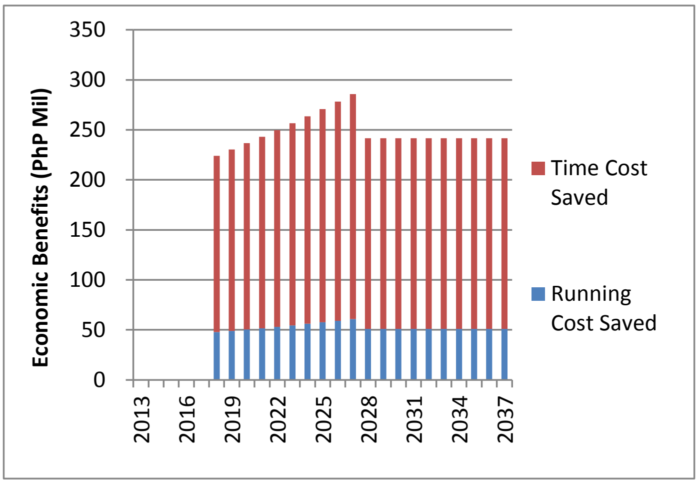
	Passenger Car	Jeepney	Utility Vehicle	Bus	Truck	Motorcycle	Total
Running Cost Saved (v-km, mil)	42.3	38.9	6.8	8.1	4.8	12.6	113.5
BVOC (PhP/v-km)	8.63	7.05	7.54	23.10	31.58	1.54	-
Running Cost saving (PhP mil)	364.9	274.7	51.2	186.7	152.3	19.4	1,049.3
Time Saved (v-hr mil)	2.8	2.2	0.4	1.0	0.36	0.15	6.9
BVOC (k-hr)	408.4	446.6	154.2	1,669.2	109.7	89.9	-
Time Cost Saving (PhP mil)	1,130.1	970.6	60.7	1,682.5	39.7	131.1	3,905.6
Total VOC Benefit	1,495.0	1,254.3	118.5	1,869.2	192.0	32.5	4,954.9

Source: JICA Study Team



Source: JICA Study Team

Figure 6.1-3 Economic Benefits by Quantity of EDSA/Roosevelt/Congressional (V-km and V-Hr per Annum 2018-2037)



Source: JICA Study Team

Figure 6.1-4 Economic Benefits by Value of EDSA/Roosevelt/Congressional (2018-2037)

3) EDSA/North/West

Economic costs, initial investment schedule, and benefits are presented in **Tables 6.1-12** through **6.1-13**. Economic benefits from Vehicle Operation Cost (VOC) savings in terms of quantity and value are shown in **Figures 6.1-5** and **Figures 6.1-6**.

Table 6.1-12 Financial and Economic Costs of EDSA/North/West (PhP million)

	Financial Cost			Economic Cost		
	FC	LC	Total	FC	LC	Total
Construction	200.66	301.00	501.66	200.66	250.83	451.49
Land Acquisition		0.00	0.00		0.00	0.00
Administration cost		19.67	19.67		16.39	16.39
Engineering Fee	36.83	30.21	67.04	36.83	25.18	62.01
Tax and Duties		71.44	71.44			
Base Cost	237.49	422.32	659.81	237.49	292.40	529.89
Physical Contingency	4.75	8.45	13.20	4.75	5.85	10.60
BC+PhyC	242.24	430.76	673.01	242.24	298.24	540.49
Price Contingency	24.89	55.32	80.21			
Total	267.13	486.09	753.22	242.24	298.24	540.49

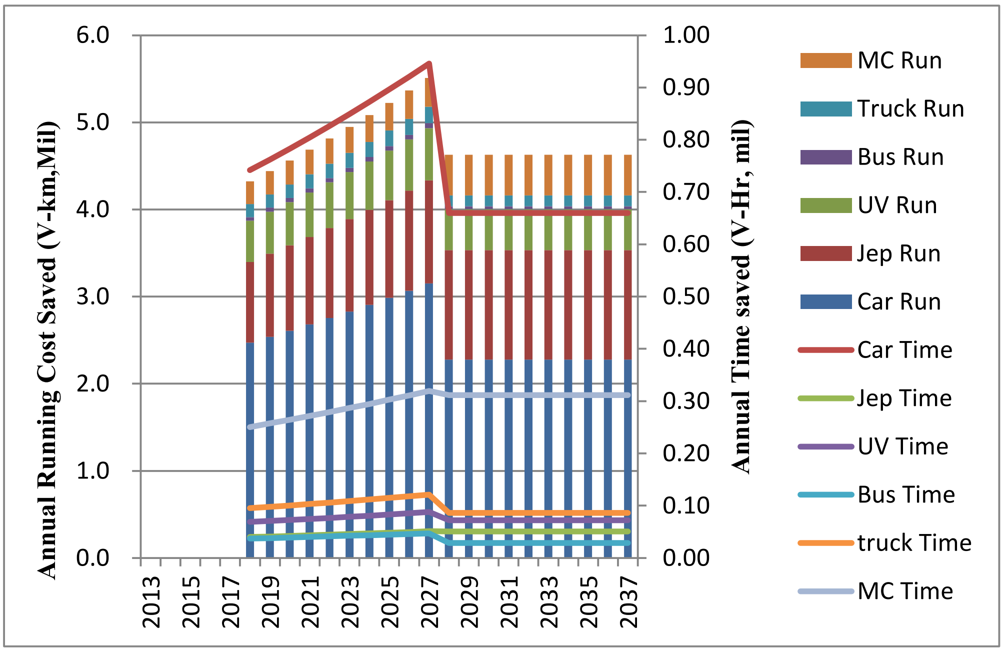
Source: JICA Study Team

Table 6.1-13 Economic Benefit - VOC Saved of EDSA/North/West

(PhP million, 2018-37)

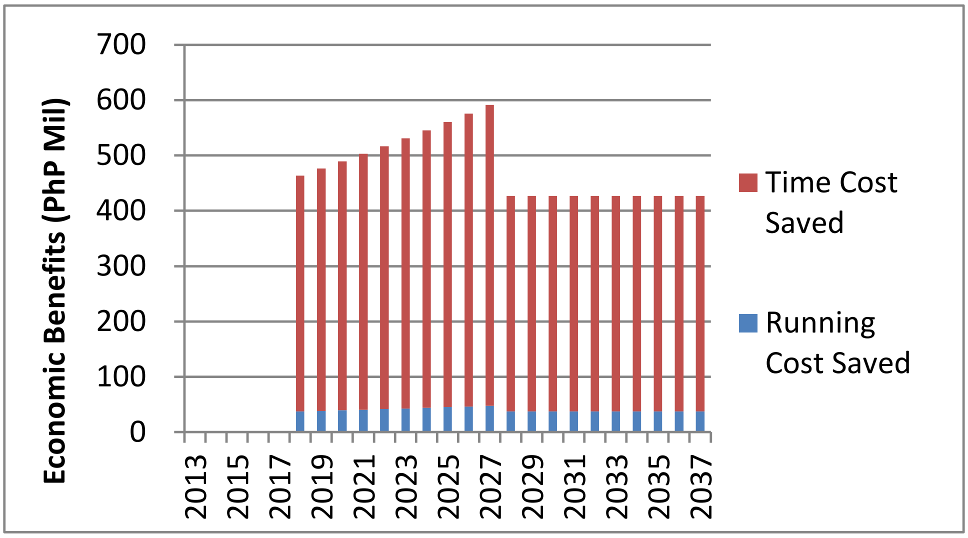
	Passenger Car	**Jeepney**	**Utility Vehicle**	**Bus**	**Truck**	**Motorcycle**	**Total**
Running Cost Saved (v-km, mil)	50.8	23.1	10.0	0.9	2.9	7.6	95.22
BVOC (PhP/v-km)	8.63	7.05	7.54	23.10	31.58	1.54	-
Running Cost saving (PhP mil)	438.3	162.7	75.5	19.6	92.7	11.7	800.5
Time Saved (v-hr mil)	15.00	0.96	1.50	0.71	1.94	5.95	26.1
BVOC (k-hr)	408.4	446.6	154.2	1,669.2	109.7	89.9	-
Time Cost Saving (PhP mil)	6,127.2	429.6	231.8	1,183.4	212.8	535.3	8,720.23
Total VOC Benefit	6,565.5	592.3	307.3	1,203.1	305.5	547.0	9,520.7

Source: JICA Study Team



Source: JICA Study Team

Figure 6.1-5 Economic Benefits by Quantity of EDSA/North/West (V-km and V-Hr per Annum 2018-2037)



Source: JICA Study Team

Figure 6.1-6 Economic Benefits by Value of EDSA/North/West (2018-2037)

4) North/ Mindanao

Economic costs, initial investment schedule, and benefits are presented in **Tables 6.1-14** through **6.1-15**. Economic benefits from Vehicle Operation Cost (VOC) savings in terms of quantity and value are shown in **Figures 6.1-7** and **Figures 6.1-8**.

Table 6.1-14 Financial and Economic Costs of North/Mindanao (PhP Million)

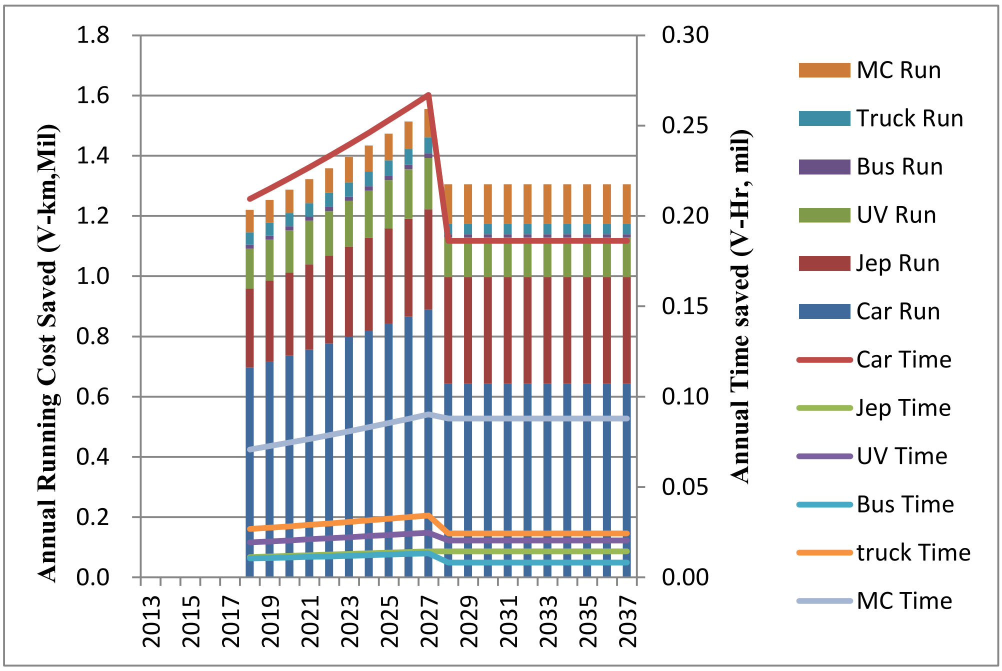
	Financial Cost			Economic Cost		
	FC	LC	Total	FC	LC	Total
Construction	195.90	293.85	489.75	195.90	244.88	440.78
Land Acquisition		4.00	4.00		3.33	3.33
Administration cost		19.20	19.20		16.00	16.00
Engineering Fee	35.96	29.50	65.45	35.96	24.58	60.54
Tax and Duties		69.75	69.75			
Base Cost	231.86	416.30	648.15	231.86	288.79	520.65
Physical Contingency	4.64	8.33	12.96	4.64	5.78	10.41
BC+PhyC	236.49	424.62	661.12	236.49	294.57	531.06
Price Contingency	24.25	54.42	78.67			
Total	260.74	479.05	739.79	236.49	294.57	531.06

Source: JICA Study Team

Table 6.1-15 Economic Benefit - VOC Saved of North/Mindanao (PhP million, 2018-37)

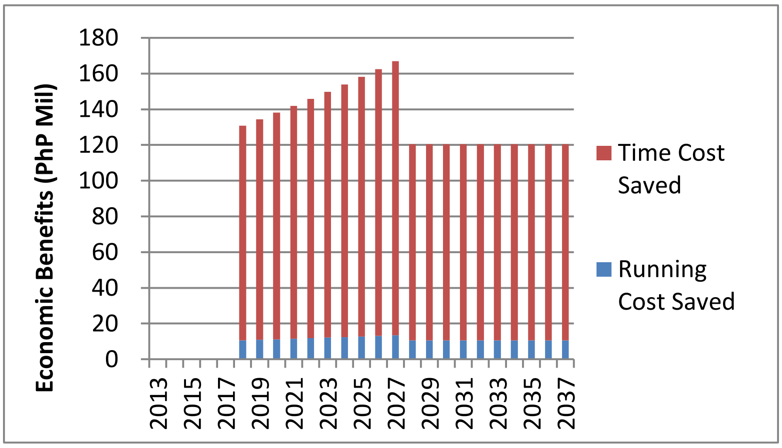
	Passenger Car	**Jeepney**	**Utility Vehicle**	**Bus**	**Truck**	**Motorcycle**	**Total**
Running Cost Saved (v-km, mil)	14.3	6.5	2.8	0.2	0.8	2.1	26.9
BVOC (PhP/v-km)	8.63	7.05	7.54	23.10	31.58	1.54	-
Running Cost saving (PhP mil)	123.7	45.9	21.3	5.5	26.2	3.3	225.9
Time Saved (v-hr mil)	4.23	0.27	0.42	0.20	0.55	1.68	7.36
BVOC (k-hr)	408.4	446.6	154.2	1,669.2	109.7	89.9	-
Time Cost Saving (PhP mil)	1,729.2	121.3	65.4	334.0	60.0	151.1	2,461.0
Total VOC Benefit	1,852.9	167.2	86.7	339.5	86.2	154.4	2,686.9

Source: JICA Study Team



Source: JICA Study Team

Figure 6.1-7 Economic Benefits by Quantity of North/Mindanao (V-km and V-Hr per Annum 2018-2037)



Source: JICA Study Team

Figure 6.1-8 Economic Benefits by Value of North/Mindanao (2018-2037)

5) C-5/Green Meadows

Economic costs, initial investment schedule, and benefits are presented in **Tables 6.1-16** through **6.1-17**. Economic benefits from Vehicle Operation Cost (VOC) savings by quantity and value are shown in **Figures 6.1-9** and **6.1-10**.

Table 6.1-16 Financial and Economic Costs of C-5/Green Meadows (PhP million)

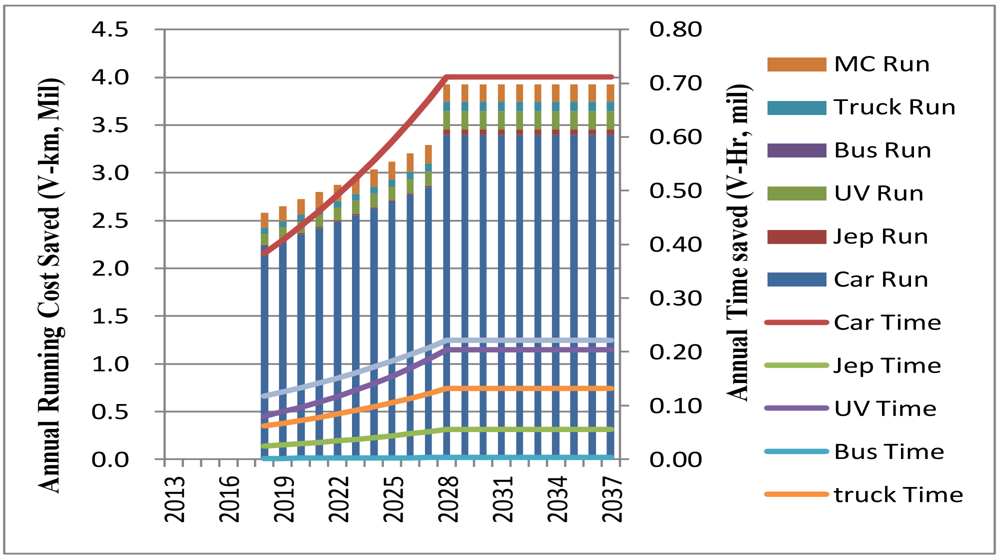
	Financial Cost			Economic Cost		
	FC	LC	Total	FC	LC	Total
Construction	373.37	560.05	933.41	373.37	466.71	840.07
Land Acquisition						
Administration cost		36.59	36.59		30.49	30.49
Engineering Fee	68.53	56.22	124.75	68.53	46.85	115.38
Tax and Duties		132.93	132.93			
Base Cost	441.89	785.79	1,227.68	441.89	544.05	985.94
Physical Contingency	8.84	15.72	24.55	8.84	10.88	19.72
BC+PhyC	450.73	801.50	1,252.23	450.73	554.93	1,005.66
Price Contingency	46.21	102.73	148.94			
Total	496.94	904.23	1,401.17	450.73	554.93	1,005.66

Source: JICA Study Team

Table 6.1-17 Economic Benefit - VOC Saved of C-5/Green Meadows (PhP million, 2018-37)

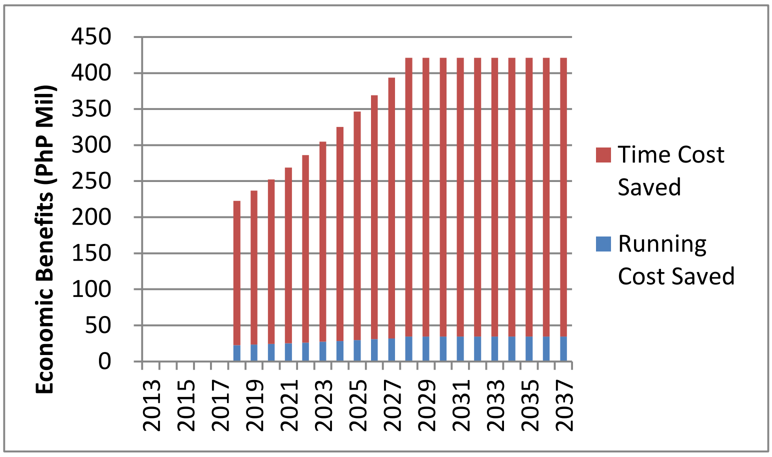
	Passenger Car	Jeepney	Utility Vehicle	Bus	Truck	Motorcycle	Total
Running Cost Saved (v-km, mil)	60.8	0.7	3.4	0.003	1.7	3.7	70.3
BVOC (PhP/v-km)	8.63	7.05	7.54	23.10	31.58	1.54	-
Running Cost (PhP mil)	524.9	4.8	25.6	0.6	53.1	5.7	614.7
Time Saved (v-hr mil)	12.4	0.9	3.3	0.05	2.2	3.8	22.5
BVOC (k-hr)	408.4	446.6	154.2	1,669.2	109.7	89.9	-
Time Cost Saving (PhP mil)	5,007.4	411.5	510.3	88.0	241.7	341.2	6,600.1
Total VOC Benefit	5,532.3	416.2	535.9	88.6	294.9	346.9	7,214.8

Source: JICA Study Team



Source: JICA Study Team

Figure 6.1-9 Economic Benefits by Quantity of C-5/Green Meadows (V-km and V-Hr per Annum 2018-2037)



Source: JICA Study Team

Figure 6.1-10 Economic Benefits by Value of C-5/Green Meadows (2018-2037)

6) Aggregate

Implementation of the C-3/E. Rodriguez Interchange was cancelled by the DPWH to give priority to the construction of Skyway Stage 3, second level, along C-3 under BOT scheme. However, the following analysis was conducted for aggregation of five interchanges including C-3/E. Rodriguez.

Aggregate economic costs and benefits are shown in **Tables 6.1-18** and **6.1-19**. The value of Economic Benefits are shown in **Figure 6.1-11**.

Table 6.1-18 Financial and Economic Costs: Aggregate (PhP million)

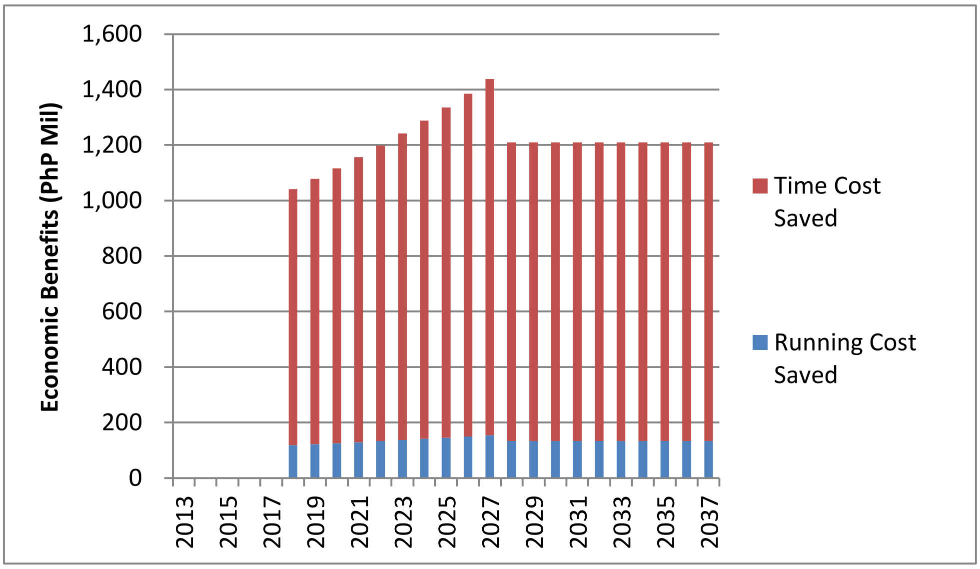
	Financial Cost			Economic Cost		
	FC	LC	Total	FC	LC	Total
Construction	1,151.50	1,727.26	2,878.76	1,151.50	1,439.38	2,590.88
Land Acquisition		4.00	4.00		3.33	3.33
Administration cost		112.84	112.84		94.03	94.03
Engineering Fee	206.46	169.81	376.27	206.46	141.51	347.97
Tax and Duties		402.06	402.06			
Base Cost	1,357.96	2,415.97	3,773.93	1,357.96	1,678.26	3,036.22
Physical Contingency	27.16	48.32	75.48	27.16	33.57	60.72
BC+PhyC	1,385.12	2,464.29	3,849.41	1,385.12	1,711.82	3,096.94
Price Contingency	123.82	275.26	399.08			
Total	1,508.95	2,739.55	4,248.49	1,385.12	1,711.82	3,096.94

Source: JICA Study Team

Table 6.1-19 Economic Benefit - VOC Saved (PhP million, 2018-37)

	Passenger Car	Jeepney	Utility Vehicle	Bus	Truck	Motorcycle	Total
Running Cost saving (PhP mil)	1,451.8	488.1	173.6	212.5	324.4	40.1	2,690.4
Time Cost Saving (PhP mil)	13,993.9	1,941.9	868.2	3,287.9	554.3	1,040.7	21,686.9
Total VOC Benefit	15,445.7	2,430.0	1,041.8	3,500.4	878.6	1,080.8	24,377.3

Source: JICA Study Team



Source: JICA Study Team

Figure 6.1-11 Economic Benefits by Value (2018-2037)

6.1.2 Results

The Economic Internal Rate of Return (EIRR) and Economic Net Present Value (ENPVs) by intersection are presented in **Table 6.1-20**. The following sections present the summary cashflow tables, figures depicting cost-benefit streams, and two-variable-simultaneous simulation tables for EIRR and ENPV for each intersection or project. In the estimation of ENPV, a 15 percent social discount rate was applied as guided by NEDA.

Table 6.1-20 EIRR and ENPV by Intersection

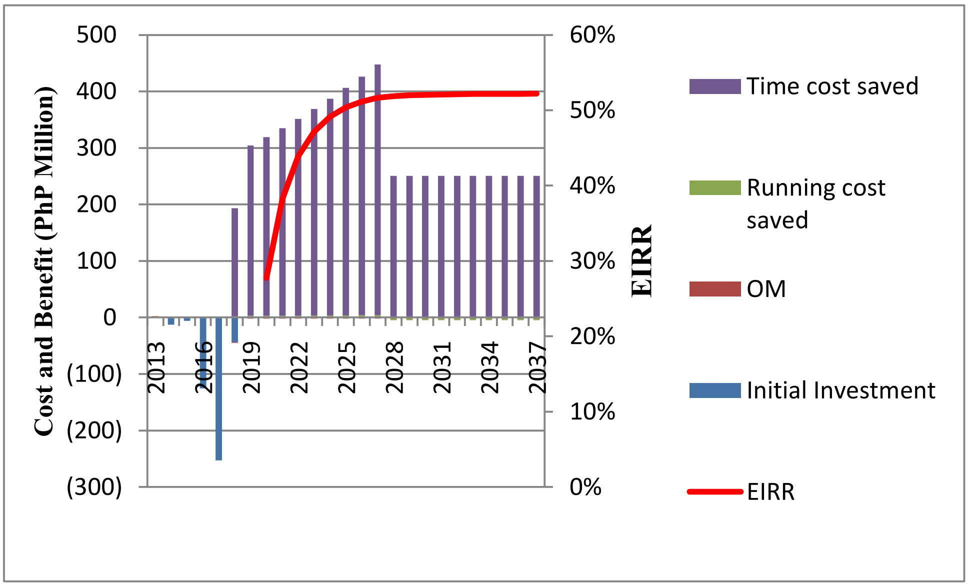
	C-3/Rodriguez	EDSA/ Roosevelt	EDSA/ North/West/	North/ Mindanao	C-5/Green Meadows	Aggregate[*1]
EIRR (%)	52.2	35.9	68.3	23.4	25.1	41.4
ENPV (PhP mill)	732.6	452.8	1,244.2	147.3	416.4	3124.9

Source: JICA Study Team

Note: 1) Aggregation of three interchanges except C-3/E. Rodriguez.

(1) C-3/ E. Rodriguez

EIRR and ENPV stand at 52.2 percent and PhP 732.6 million, respectively. The chronological input and output streams of economic resources are shown in **Figure 6.1-12**. The Summary Cashflow table pertaining to annual costs and benefits over the project's economic life period is presented in **Table 6.1-21**.



Source: JICA Study Team

Figure 6.1-12 Cost and Benefit Streams, and EIRR (C-3/ E. Rodriguez)

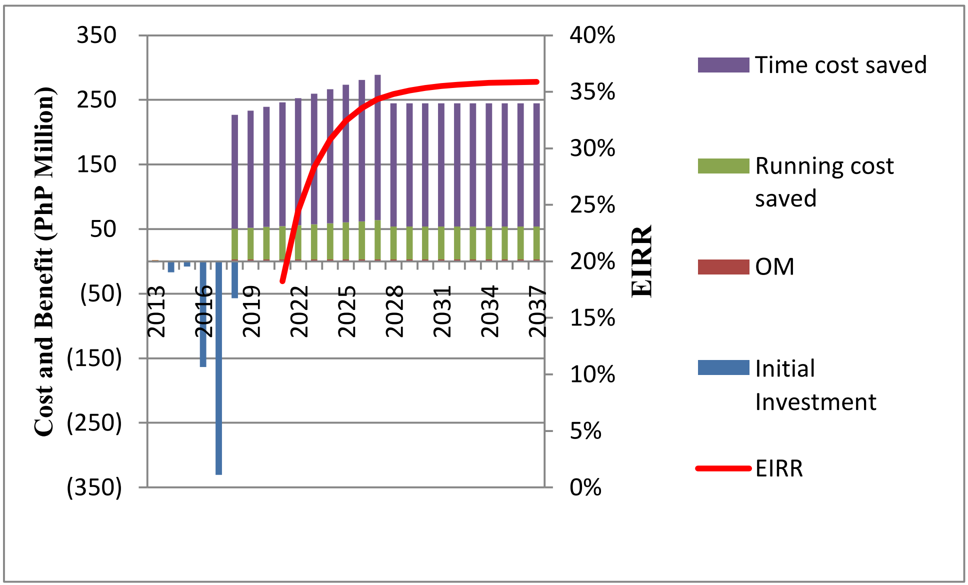
Table 6.1-21 Summary EIRR Cashflow (C-3/E. Rodriguez, PhP million)

		Cost			Benefit			Net Benefit
		CAPEX	OM	Total	Running Cost Saved	Time Cost Saved	Total	
1	2013	1.17		1.17				-1.17
2	2014	12.92		12.92				-12.92
3	2015	5.99		5.99				-5.99
4	2016	125.40		125.40				-125.40
5	2017	253.08		253.08				-253.08
6	2018	43.75	1.47	45.23	1.80	191.43	193.23	148.01
7	2019		2.21	2.21	2.83	301.34	304.18	301.97
8	2020		2.21	2.21	2.97	316.24	319.21	317.00
9	2021		2.21	2.21	3.12	331.87	334.99	332.78
10	2022		2.21	2.21	3.27	348.27	351.55	349.34
11	2023		2.21	2.21	3.44	365.49	368.92	366.71
12	2024		2.21	2.21	3.61	383.55	387.16	384.94
13	2025		2.21	2.21	3.78	402.51	406.29	404.08
14	2026		2.21	2.21	3.97	422.40	426.37	424.16
15	2027		2.21	2.21	4.17	443.28	447.45	445.23
16	2028		2.21	2.21	-2.6	250.69	248.07	245.85
•	•		•	•	•	•	•	•
•	•		•	•	•	•	•	•
22	2033		2.21	2.21	-2.6	250.69	248.07	245.85
23	2034		2.21	2.21	-2.6	250.69	248.07	245.85
24	2035		2.21	2.21	-2.6	250.69	248.07	245.85
25	2036		2.21	2.21	-2.6	250.69	248.07	245.85
	Total	442.32	43.50	485.82	6.71	6,013.31	6,020.01	5,534.20

Source: JICA Study Team

(2) EDSA/Roosevelt/Congressional

EIRR and ENPV were evaluated at 35.9 percent and PhP 452.8 million, respectively. It would be noteworthy that the completion of C-3 Expressway (2028) will have little effect on traffic diversion on the concerned intersection. The chronological input and output streams of economic resources are shown in **Figure 6.1-13**. The Summary Cashflow table pertaining to annual costs and benefit over the project's economic life period is presented in **Table 6.1-22**.



Source: JICA Study Team

Figure 6.1-13 Economic Cost and Benefit Streams, and EIRR (EDSA/Roosevelt/Congressional)

Table 6.1-22 Summary EIRR Cashflow (EDSA/Roosevelt/Congressional, PhP million)

		Cost			Benefit			Net Benefit
		CAPEX	OM	Total	Running Cost Saved	Time Cost Saved	Total	
1	2013	1.53		1.53				-1.53
2	2014	16.87		16.87				-16.87
3	2015	7.82		7.82				-7.82
4	2016	163.70		163.70				-163.70
5	2017	330.37		330.37				-330.37
6	2018	57.12	2.89	60.00	47.66	176.50	224.16	164.15
7	2019		2.89	2.89	48.96	181.33	230.29	227.41
8	2020		2.89	2.89	50.30	186.29	236.60	233.71
9	2021		2.89	2.89	51.68	191.39	243.07	240.19
10	2022		2.89	2.89	53.10	196.63	249.73	246.84
11	2023		2.89	2.89	54.55	202.01	256.56	253.67
12	2024		2.89	2.89	56.04	207.54	263.58	260.70
13	2025		2.89	2.89	57.58	213.22	270.80	267.91
14	2026		2.89	2.89	59.15	219.06	278.21	275.32
15	2027		2.89	2.89	60.77	225.05	285.82	282.94
16	2028		2.89	2.89	50.95	190.66	241.61	238.72
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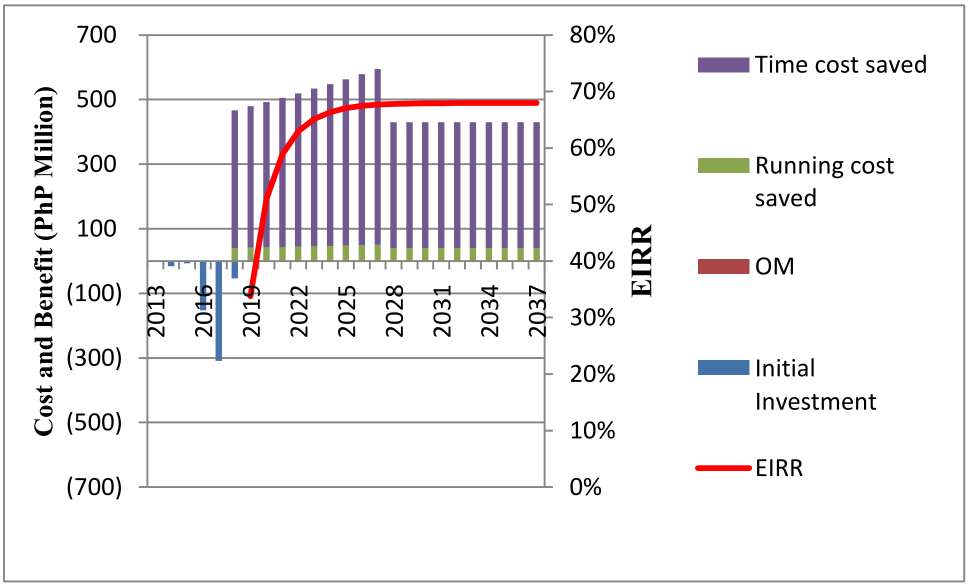
22	2033		2.89	2.89	50.95	190.66	241.61	238.72
23	2034		2.89	2.89	50.95	190.66	241.61	238.72
24	2035		2.89	2.89	50.95	190.66	241.61	238.72
25	2036		2.89	2.89	50.95	190.66	241.61	238.72
	Total	577.41	57.74	635.15	1,049.28	3,905.60	4,954.88	4,319.73

Source: JICA Study Team

(3) EDSA/North/West

EIRR and ENPV were evaluated at 68.3 percent and PhP 1,244.2 million, respectively. The chronological input and output streams of economic resources are shown in **Figures 6.1-14**, followed by the project's summary cashflow table presented in **Table 6.1-23**.



Source: JICA Study Team

Figure 6.1-14 Economic Cost and Export Parity Benefit, and EIRR (EDSA/North/West/Mindanao)

Table 6.1-23 Summary EIRR Cashflow (EDSA/North/West, PhP million)

		Cost			Benefit			Net Benefit
		CAPEX	OM	Total	Running Cost Saved	Time Cost Saved	Total	
1	2013	1.43		1.43				-1.43
2	2014	15.79		15.79				-15.79
3	2015	7.32		7.32				-7.32
4	2016	153.23		153.23				-153.23
5	2017	309.24		309.24				-309.24
6	2018	53.46	2.70	56.17	37.51	426.27	463.78	407.61
7	2019		2.70	2.70	38.54	437.93	476.47	473.77
8	2020		2.70	2.70	39.59	449.92	489.51	486.81
9	2021		2.70	2.70	40.68	462.23	502.91	500.21
10	2022		2.70	2.70	41.79	474.88	516.67	513.97
11	2023		2.70	2.70	42.93	487.88	530.82	528.11
12	2024		2.70	2.70	44.11	501.24	545.34	542.64
13	2025		2.70	2.70	45.32	514.96	560.27	557.57
14	2026		2.70	2.70	46.56	529.05	575.61	572.90
15	2027		2.70	2.70	47.83	543.53	591.36	588.66
16	2028		2.70	2.70	37.56	389.23	426.80	424.10
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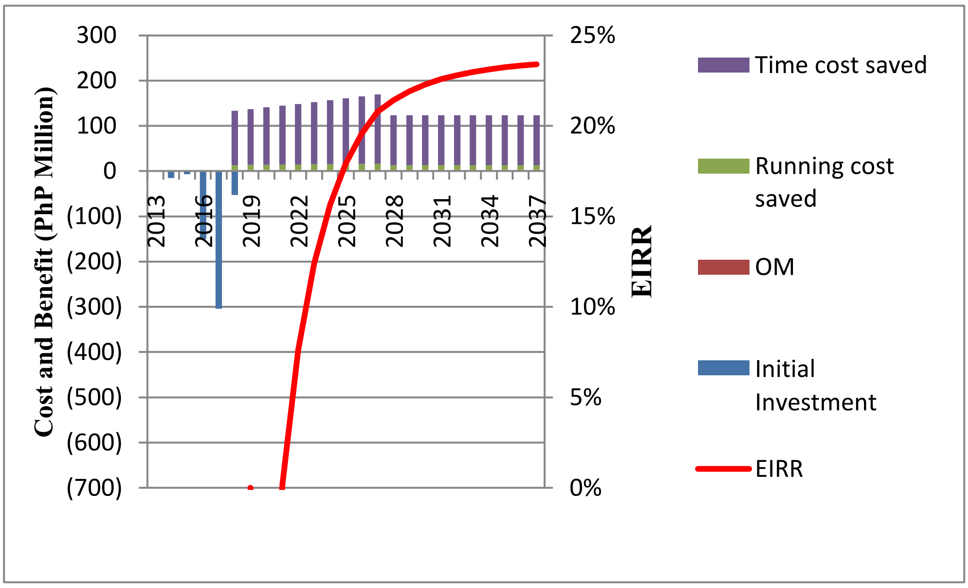
22	2033		2.70	2.70	37.56	389.23	426.80	424.10
23	2034		2.70	2.70	37.56	389.23	426.80	424.10
24	2035		2.70	2.70	37.56	389.23	426.80	424.10
25	2036		2.70	2.70	37.56	389.23	426.80	424.10
	Total	540.49	54.05	594.54	800.49	8,720.23	9,520.73	8,926.19

Source: JICA Study Team

(4) North/ Mindanao

EIRR and ENPV were evaluated at 23.4 percent and PhP 147.3 million, respectively. The chronological input and output streams of economic resources are shown in **Figures 6.1-15**, followed by the project's summary cashflow table presented in **Table 6.1-24**.



Source: JICA Study Team

Figure 6.1-15 Economic Cost and Export Parity Benefit, and EIRR (North/Mindanao)

Table 6.1-24 Summary EIRR Cashflow (North/Mindanao, PhP million)

		Cost			Benefit			Net Benefit
		CAPEX	OM	Total	Running Cost Saved	Time Cost Saved	Total	
1	2013	1.41		1.41				-1.41
2	2014	15.53		15.53				-15.53
3	2015	7.21		7.21				-7.21
4	2016	150.75		150.75				-150.75
5	2017	304.24		304.24				-304.24
6	2018	52.60	2.66	55.26	10.59	120.30	130.88	75.63
7	2019		2.66	2.66	10.88	123.59	134.47	131.81
8	2020		2.66	2.66	11.17	126.97	138.15	135.49
9	2021		2.66	2.66	11.48	130.45	141.93	139.27
10	2022		2.66	2.66	11.79	134.02	145.81	143.15
11	2023		2.66	2.66	12.12	137.69	149.80	147.15
12	2024		2.66	2.66	12.45	141.46	153.90	151.25
13	2025		2.66	2.66	12.79	145.33	158.12	155.46
14	2026		2.66	2.66	13.14	149.31	162.45	159.79
15	2027		2.66	2.66	13.50	153.39	166.89	164.23
16	2028		2.66	2.66	10.60	109.85	120.45	117.79
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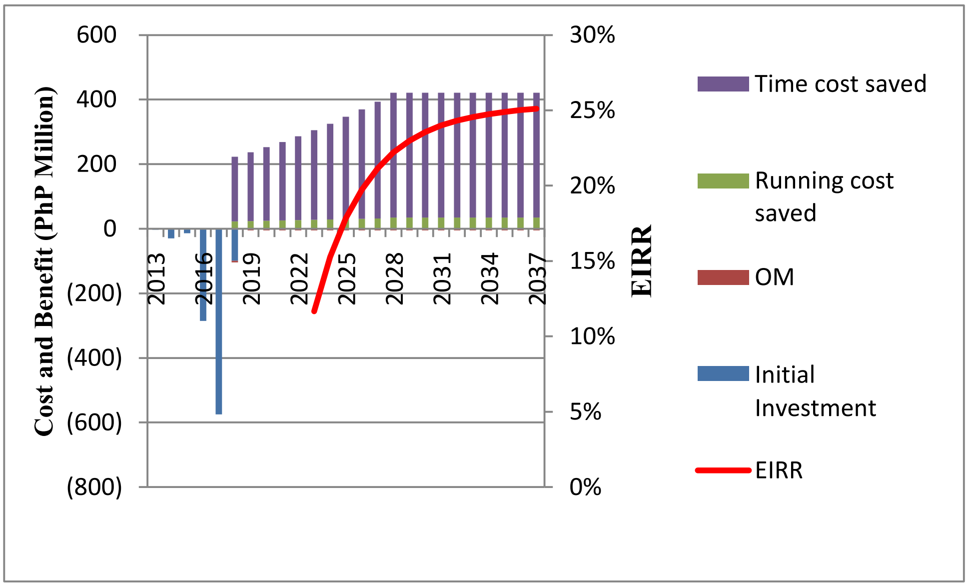
.	.		.	.	.	.	.	.
22	2033		2.66	2.66	10.60	109.85	120.45	117.79
23	2034		2.66	2.66	10.60	109.85	120.45	117.79
24	2035		2.66	2.66	10.60	109.85	120.45	117.79
25	2036		2.66	2.66	10.60	109.85	120.45	117.79
	Total	531.74	53.17	584.92	225.91	2,460.99	2,686.90	2,101.98

Source: JICA Study Team

(5) C-5/Green Meadows

EIRR and ENPV were evaluated at 25.1 percent and PhP 416.4 million, respectively. The chronological economic input and output streams of economic resources are shown in **Figure 6.1-16**, followed by a summary cashflow table for the project as presented in-**Table 6.1-25**.



Source: JICA Study Team

Figure 6.1-16 Economic Cost and Benefit Streams, and EIRR (C-5/Green Meadows)

Table 6.1-25 Summary EIRR Cashflow (C-5/Green Meadows, PhP million)

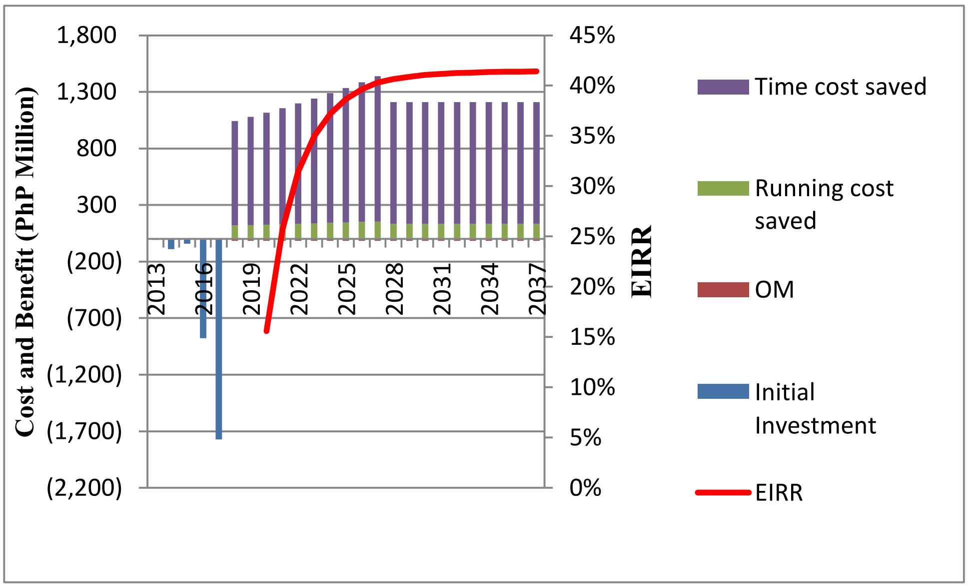
		Cost			Benefit			Net Benefit
		CAPEX	OM	Total	Running Cost Saved	Time Cost Saved	Total	
1	2013	2.66		2.66				-2.66
2	2014	29.38		29.38				-29.38
3	2015	13.63		13.63				-13.63
4	2016	285.12		285.12				-285.12
5	2017	575.40		575.40				-575.40
6	2018	99.48	5.03	104.51	22.45	200.01	222.47	117.96
7	2019		5.03	5.03	23.35	213.55	236.90	231.87
8	2020		5.03	5.03	24.29	228.01	252.30	247.27
9	2021		5.03	5.03	25.26	243.48	268.74	263.71
10	2022		5.03	5.03	26.27	260.02	286.28	281.25
11	2023		5.03	5.03	27.32	277.70	305.02	299.99
12	2024		5.03	5.03	28.41	296.61	325.02	319.99
13	2025		5.03	5.03	29.55	316.83	346.38	341.35
14	2026		5.03	5.03	30.73	338.47	369.20	364.17
15	2027		5.03	5.03	31.96	361.62	393.57	388.54
16	2028		5.03	5.03	34.51	386.38	420.89	415.87
•	•		•	•	•	•	•	•
•	•		•	•	•	•	•	•
22	2033		5.03	5.03	34.51	386.38	420.89	415.87
23	2034		5.03	5.03	34.51	386.38	420.89	415.87
24	2035		5.03	5.03	34.51	386.38	420.89	415.87
25	2036		5.03	5.03	34.51	386.38	420.89	415.87
	Total	1,005.66	100.57	1,106.22	614.71	6,600.09	7,214.80	6,108.58

Source: JICA Study Team

(6) Aggregate

Implementation of the C-3/E. Rodriguez Interchange was cancelled by the DPWH to give priority to the construction of Skyway Stage 3, second level, along C-3 under BOT scheme. However, the following analysis was conducted for aggregation of five interchanges including C-3/E. Rodriguez.

Aggregate EIRR and ENPV were estimated at 41.4 percent and PhP 3,124.9 million, respectively. The aggregate chronological streams input and output of economic resources and EIRR schedule is shown in **Figure 6.1-17**. The Summary or overall Cashflow table presenting annual costs and benefit streams over the aggregate project's economic life period is presented in **Table 6.1-26**.



Source: JICA Study Team

Figure 6.1-17 Cost and Benefit Streams and EIRR

Table 6.1-26 Summary EIRR Cashflow (PhP million)

		Cost			Benefit			Net Benefit
		CAPEX	OM	Total	Running Cost Saved	Time Cost Saved	Total	
1	2013	8.21		8.21				-8.21
2	2014	90.49		90.49				-90.49
3	2015	41.97		41.97				-41.97
4	2016	878.21		878.21				-878.21
5	2017	1,772.33		1,772.33				-1,772.33
6	2018	0.00	15.49	15.49	118.21	923.08	1,041.29	1,025.80
7	2019		15.49	15.49	121.73	956.40	1,078.13	1,062.64
8	2020		15.49	15.49	125.36	991.20	1,116.55	1,101.07
9	2021		15.49	15.49	129.09	1,027.55	1,156.65	1,141.16
10	2022		15.49	15.49	132.95	1,065.55	1,198.50	1,183.01
11	2023		15.49	15.49	136.92	1,105.28	1,242.20	1,226.71
12	2024		15.49	15.49	141.01	1,146.84	1,287.85	1,272.36
13	2025		15.49	15.49	145.23	1,190.34	1,335.57	1,320.08
14	2026		15.49	15.49	149.57	1,235.88	1,385.46	1,369.97
15	2027		15.49	15.49	154.05	1,283.59	1,437.65	1,422.16
16	2028		15.49	15.49	133.63	1,076.12	1,209.75	1,194.26
.	.		.	.	.	.	.	.
.	.		.	.	.	.	.	.
22	2033		15.49	15.49	133.63	1,076.12	1,209.75	1,194.26
23	2034		15.49	15.49	133.63	1,076.12	1,209.75	1,194.26
24	2035		15.49	15.49	133.63	1,076.12	1,209.75	1,194.26
25	2036		15.49	15.49	133.63	1,076.12	1,209.75	1,194.26
	Total	2,791.21	309.76	3,100.97	2,690.39	21,686.91	24,377.31	21,276.34

Source: JICA Study Team

6.1.3 Sensitivity Analysis

Sensitivity analysis had been undertaken to indicate resiliency against risks of the concerned intersection projects, specifically, (i) downsizing benefit by 15 percent, (ii) cost increase or overrun by 15 percent, and (iii) combination of (i) and (ii). The results are presented in **Table 6.1-27**. The results reveal profoundly robust viability and resiliency of each of the MMICP against project risks that would take place during their construction and operation period.

Table 6.1-27 Sensitivity Analysis

	Base Case	Cost 15% Up	Benefit 15% Down	Combination
C-3/E. Rodriguez	52.2	47.0	46.2	41.5
EDSA/Roosevelt/Congressional	35.9	35.9	31.1	27.4
EDSA/North/West	68.3	61.4	60.3	54.0
North/Mindanao	23.4	20.3	19.9	17.1
C-5/Green Meadows	25.1	25.1	22.3	21.9
Aggregate*1	41.4	37.0	36.3	32.3

Source: JICA Study Team

Note: 1) Aggregation of five interchanges including C-3/E. Rodriguez.

6.1.4 Issues and Conclusion

(1) A Bird's Eye View of the Analytical Deliverables

From the aforementioned assessments, all of the intersection construction projects are economically feasible, viable, and highly exceeding the cut-off rate of allocative-efficiency of 15 percent. Of this, EDSA/North/West intersections posted extremely high efficiency rates due largely to (i) large volume of aggregate traffic, (ii) high growth rate of traffic volume[7] (2018-27), and (iii) Low project cost. Major attributes affecting the size of efficiency (EIRR) of each of the intersections are summarized in **Table 6.1-28**.

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[7] Current analysis of demand forecast and sequential efficiency analysis assumes an increase (2018) and downsizing (2028) of traffic volume at each of the intersections taking in view the completion of C-3 missing link construction and C-3 Expressway, respectively. Note that Green Meadows was assumed to have little influence onf the C-3 expressway in the light of traffic volume.

Table 6.1-28 EIRR and Attributes of Scarce Resource (2018-37)

	EIRR	Traffic annual Growth Rate (2018-27)	Economic Cost (PhP mil)	VOC, PhP mil, 2018 (of which passenger car)	VOC Share of Time Cost Saving	Total Time Cost Saving (V-hr, mil)
C3/E. Rodriguez	52.2	4.9 %	442.32	6,116.6 (4,308.2)	99.9%	23.7
EDSA/Roosevelt/ Congressional	35.9	2.7 %	577.41	4,954.9 (Bus:1,869.2)	78.8%	6.9
EDSA/North/West/	68.3	2.7 %	540.49	9,520.7 (6,565.5)	91.6%	26.1
North/Mindanao	23.4	2.7 %	531.06	2,686.9 (1,852.9)	91.6%	7.4
C5/Green Meadows	25.1	4.0%	1,005.66	7,214.8 (5,532.3)	91.5%	22.5

Source: JICA Study Team

(2) Conclusion

EIRR analysis and sequential sensitivity analysis numerically proved the worthiness of MMICP in the light of the national economy. As such, the commencement of the project at an early stage of time would profoundly be recommendable by securing the financing facilities inclusive of the Japan's ODA loan as an option. Note that implementation of the C-3/E. Rodriguez Interchange was cancelled by the DPWH to give priority to the construction of Skyway Stage 3, second level, along C-3 under BOT scheme.

6.2 EIRR ANALYSIS UNDER STEP LOAN SCHEME

This section deals with economic analysis of the MMICP under the Japan's STEP loan scheme with EIRR as efficiency measurement index. Analytical framework and methodology are all identical to Japan's Middle Income Countries General Condition (GC) Loan in view. Note that the EIRR analyses assume different initial investment costs under the two loan schemes of GC Loan and STEP Loan.

Note that implementation of the C-3/E. Rodriguez Interchange was cancelled by the DPWH to give priority to the construction of Skyway Stage 3, second level, along C-3 under BOT scheme.

6.2.1 Analytical Methodology

(1) Overall Model Configuration

As previously noted in Section 6.1.1, prepositions of the analysis include (i) **"with** and **without"** the project analysis (*incremental analysis*), (ii) **time discount** method, and (iii) **cash-flow analysis**. Variables and assumptive parameters applied to the analysis are summarized in the following set of model configuration. (**Table 6.2-1**)

Table 6.2-1 Model Configuration (STEP Loan)

	Variables	EDSA/ Roosevelt/ Congressional	EDSA/North/ West	North/ Mindanao	C-5/Green Meadows
1	Project Life (construction years)	25 (6)			
2	Exchange rate (JPY/PhP)	1.87			
3	Exchange rate (PhP/EUR)	58.5			
4	Physical Contingency (%)	2.0			
5	Price Contingency (Foreign, %)	2.1 (Nov. 2012, JICA)			
6	Price Contingency (Local, %)	2.6 (Nov. 2012, JICA)			
7	OM cost (% of BC + Phy Con)	0.5^{*1}			
8	Standard Conversion Factor	0.83 (1/1.2)			
9	Economic Feasibility Cut-off Rate	15.0 % (Social Discount Rate)			
	Economic Benefit				
10	Basic Vehicle Operation Cost by type	**Tables 6.1-5**			
11	VOC (Running/Time) Cost Saved	**Table 6.2-4**	**Table 6.2-6**	**Table 6.2-8**	**Table 6.2-10**
	Economic Cost				
12	Aggregate Financial Cost (PhP Mil)[8]	**Table 6.2-3**	**Table 6.2-5**	**Table 6.2-7**	**Table 6.2-9**
13	Economic Cost (Base Cost + Physical Contingency, PhP Mil)	**Table 6.2-3**	**Table 6.2-5**	**Table 6.2-7**	**Table 6.2-9**
14	Annual Investment Schedule	**Table 6.2-2**			
	Sensitivity Analysis				
15	Benefits	15 % decrease			
16	Costs	15 % increase			
17	Combination of Ben and Cost	2 variable-simultaneous simulation			

Source: JICA Study Team

Note: 1) OM cost % is based on past performance.

(2) Economic Benefits (common to every intersection)

Economic benefit includes (i) Vehicle Operation Cost (VOC): Running cost saving and (ii) VOC: Time cost saving. All the benefits and costs are as per 2012 price.

DPWH *Basic Vehicle operation Cost (2008)* based on HDM-4 toolkit (The World Bank, version 2.05 in 2006) was applied to numerate the running and time costs, as guided by DPWH and NEDA. In so doing, 10 types of vehicles in DPWH basic Vehicle Operation Cost table have been realigned to 6 in line with the model of traffic and demand analysis in the current study. The VOC by vehicle type is given in **Table 6.1-5**. Meanwhile, annual investment schedule for all of the intersections are assumed as given in **Table 6.1-7**.

(3) Estimates of Economic Costs and Benefits

In accordance with the same methodology of the GC loan, economic benefits and costs for the estimation of EIRR were determined in the subsequent sections. In carrying out the analysis, annual investment rates for all of the intersections were assumed shown in **Table 6.2-2**.

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[8] Including Base cost, physical contingency and price contingency

Table 6.2-2 Annual Investment Schedule (%)

1	2	3	4	5	6
1.68	42.37	39.12	6.89	9.94	0.0

Source: JICA Study Team

Note: 1) Annual investment schedule is made up by allocating the project cost in accordance with the project implementation schedule

(4) Estimates of Economic Costs and Benefits by Intersection

1) EDSA/Roosevelt/Congressional

Economic cost and benefit are given in **Tables 6.2-3** and **6.2-4** below. Economic Benefit by value is depicted as **Figure 6.2-1**.

Table 6.2-3 Financial and Economic Costs of EDSA/Roosevelt/Congressional (STEP Loan, PhP million)

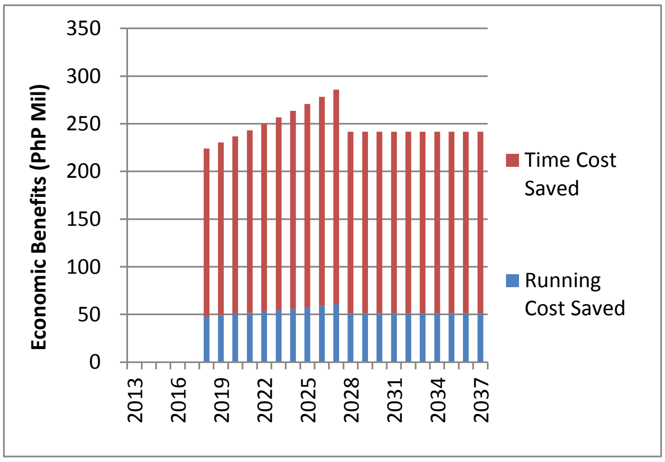
	Financial Cost			Economic Cost		
	FC	LC	Total	FC	LC	Total
Construction	290.04	323.68	613.71	290.04	269.73	559.77
Land Acquisition						
Administration cost		24.06	24.06		20.05	20.05
Engineering Fee	41.43	32.29	73.72	41.43	26.91	68.34
Tax and Duties	0.00	85.64	85.64			
Base Cost	331.47	465.66	797.13	331.47	316.69	648.15
Physical Contingency	6.63	9.31	15.94	6.63	6.33	12.96
BC+PhyC	338.10	474.98	813.07	338.10	323.02	661.12
Price Contingency	20.41	35.68	56.09			
Total	358.50	510.66	869.17	338.10	323.02	661.12

Source: JICA Study Team

Table 6.2-4 Economic Benefit - VOC Saved of EDSA/Roosevelt/Congressional (STEP Loan, PhP million, 2018-37)

	Passenger Car	Jeepney	Utility Vehicle	Bus	Truck	Motorcycle	Total
Running Cost Saved (v-km, mil)	42.3	38.9	6.8	8.1	4.8	12.6	113.5
BVOC (PhP/v-km)	8.63	7.05	7.54	23.10	31.58	1.54	-
Running Cost saving (PhP mil)	364.9	274.7	51.2	186.7	152.3	19.4	1,049.3
Time Saved (v-hr mil)	2.8	2.2	0.4	1.0	0.36	0.15	6.9
BVOC (k-hr)	408.4	446.6	154.2	1,669.2	109.7	89.9	-
Time Cost Saving (PhP mil)	1,130.1	970.6	60.7	1,682.5	39.7	131.1	3,905.6
Total VOC Benefit	1,495.0	1,254.3	118.5	1,869.2	192.0	32.5	4,954.9

Source: JICA Study Team



Source: JICA Study Team

Figure 6.2-1 Economic Benefits by Value of EDSA/Roosevelt/Congressional (STEP Loan, 2018-2037)

2) EDSA/North/West

Economic cost and benefit are given in **Tables 6.2-5** and **6.2-6** below. Economic Benefit by value is depicted as **Figure 6.2-2.**

Table 6.2-5 Financial and Economic Costs of EDSA/North/West (STEP Loan, PhP million)

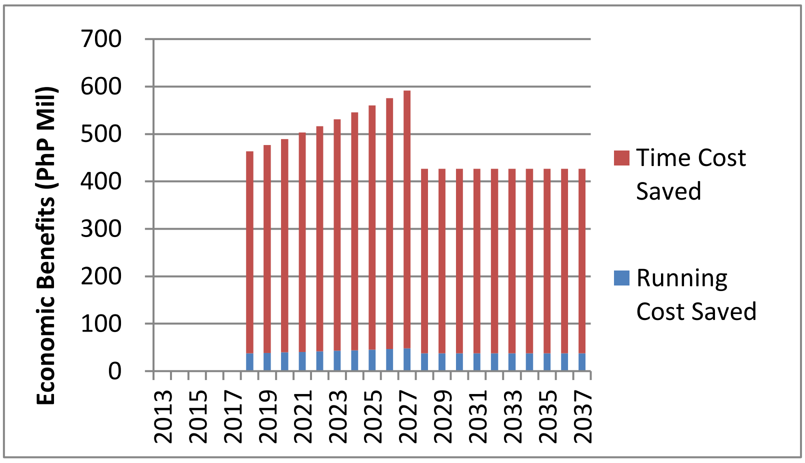
	Financial Cost			Economic Cost		
	FC	LC	Total	FC	LC	Total
Construction	224.42	392.16	616.58	224.42	326.80	551.22
Land Acquisition						
Administration cost						
Engineering Fee	37.88	29.52	67.39	37.88	24.60	62.47
Tax and Duties		78.45	78.45			
Base Cost	262.30	504.13	766.43	262.30	351.40	613.69
Physical Contingency	5.25	10.08	15.33	5.25	7.03	12.27
BC+PhyC	267.54	514.21	781.76	267.54	358.42	625.97
Price Contingency	16.15	38.63	54.78			
Total	283.69	552.84	836.54	267.54	358.42	625.97

Source: JICA Study Team

Table 6.2-6 Economic Benefit - VOC Saved of EDSA/North/West (STEP Loan, PhP million, 2018-37)

	Passenger Car	Jeepney	Utility Vehicle	Bus	Truck	Motorcycle	Total
Running Cost Saved (v-km, mil)	50.8	23.1	10.0	0.9	2.9	7.6	95.22
BVOC (PhP/v-km)	8.63	7.05	7.54	23.10	31.58	1.54	-
Running Cost saving (PhP mil)	438.3	162.7	75.5	19.6	92.7	11.7	800.5
Time Saved (v-hr mil)	15.00	0.96	1.50	0.71	1.94	5.95	26.1
BVOC (k-hr)	408.4	446.6	154.2	1,669.2	109.7	89.9	-
Time Cost Saving (PhP mil)	6,127.2	429.6	231.8	1,183.4	212.8	535.3	8,720.23
Total VOC Benefit	6,565.5	592.3	307.3	1,203.1	305.5	547.0	9,520.7

Source: JICA Study Team



Source: JICA Study Team

Figure 6.2-2 Economic Benefits by Value of EDSA/North/West (STEP Loan, 2018-2037)

3) North/Mindanao

Economic cost and benefit are given in **Tables 6.2-7** and **6.2-8** below. Economic Benefit by value is depicted as **Figure 6.2-3.**

Table 6.2-7 Financial and Economic Costs of North/Mindanao (STEP Loan, PhP million)

	Financial Cost			Economic Cost		
	FC	LC	Total	FC	LC	Total
Construction	207.55	364.13	571.68	207.55	303.44	511.00
Land Acquisition		4.00	4.00		3.33	3.33
Administration cost		20.34	20.34		16.95	16.95
Engineering Fee	35.03	27.30	62.33	35.03	22.75	57.78
Tax and Duties		72.56	72.56			
Base Cost	242.58	488.33	730.91	242.58	343.14	585.73
Physical Contingency	4.85	9.77	14.62	4.85	6.86	11.71
BC+PhyC	247.44	498.09	745.53	247.44	350.00	597.44
Price Contingency	14.93	37.42	52.36			
Total	262.37	535.51	797.88	247.44	350.00	597.44

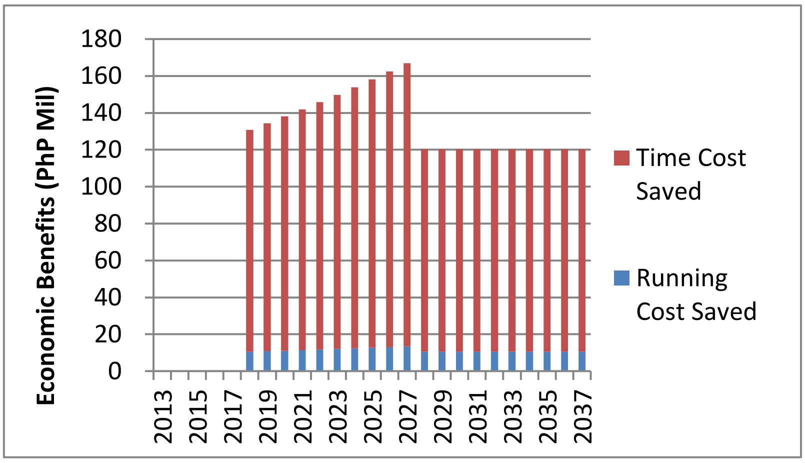
Source: JICA Study Team

Table 6.2-8 Economic Benefit - VOC Saved of North/Mindanao

(STEP Loan, PhP million, 2018-37)

	Passenger Car	Jeepney	Utility Vehicle	Bus	Truck	Motorcycle	Total
Running Cost Saved (v-km, mil)	14.3	6.5	2.8	0.2	0.8	2.1	26.9
BVOC (PhP/v-km)	8.63	7.05	7.54	23.10	31.58	1.54	-
Running Cost saving (PhP mil)	123.7	45.9	21.3	5.5	26.2	3.3	225.9
Time Saved (v-hr mil)	4.23	0.27	0.42	0.20	0.55	1.68	7.36
BVOC (k-hr)	408.4	446.6	154.2	1,669.2	109.7	89.9	-
Time Cost Saving (PhP mil)	1,729.2	121.3	65.4	334.0	60.0	151.1	2,461.0
Total VOC Benefit	1,852.9	167.2	86.7	339.5	86.2	154.4	2,686.9

Source: JICA Study Team



Source: JICA Study Team

Figure 6.2-3 Economic Benefits by Value of North/Mindanao (STEP Loan, 2018-2037)

4) C-5/Green Meadows

Economic cost and benefit are given in **Tables 6.2-9** and **6.2-10** below. Economic Benefit by value is depicted as **Figure 6.2-4.**

Table 6.2-9 Financial and Economic Costs of C-5/Green Meadows (STEP Loan, PhP million)

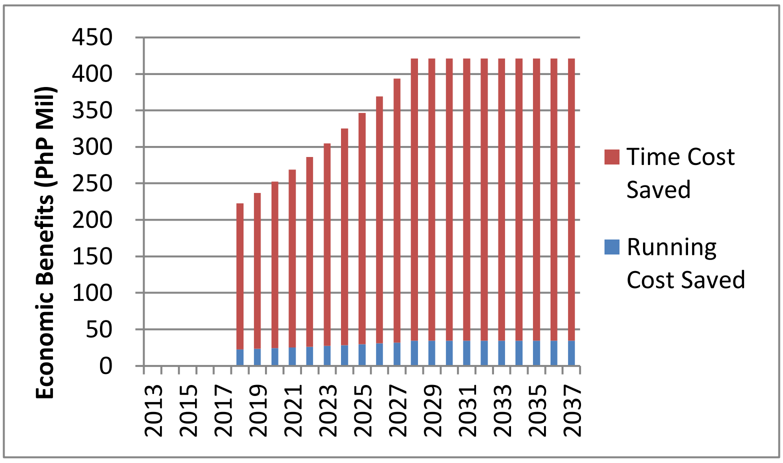
	Financial Cost			Economic Cost		
	FC	LC	Total	FC	LC	Total
Construction	552.95	581.97	1,134.92	552.95	484.98	1,037.93
Land Acquisition						
Administration cost		44.49	44.49		37.07	37.07
Engineering Fee	76.62	59.71	136.33	76.62	49.76	126.38
Tax and Duties		139.60	139.60			
Base Cost	629.57	825.77	1,455.34	629.57	571.81	1,201.38
Physical Contingency	12.59	16.52	29.11	12.59	11.44	24.03
BC+PhyC	642.16	842.29	1,484.45	642.16	583.25	1,225.41
Price Contingency	38.76	63.28	102.04			
Total	680.92	905.57	1,586.49	642.16	583.25	1,225.41

Source: JICA Study Team

Table 6.2-10 Economic Benefit - VOC Saved of C-5/Green Meadows (STEP Loan, PhP million, 2018-37)

	Passenger Car	**Jeepney**	**Utility Vehicle**	**Bus**	**Truck**	**Motorcycle**	**Total**
Running Cost Saved (v-km, mil)	60.8	0.7	3.4	0.003	1.7	3.7	70.3
BVOC (PhP/v-km)	8.63	7.05	7.54	23.10	31.58	1.54	-
Running Cost (PhP mil)	524.9	4.8	25.6	0.6	53.1	5.7	614.7
Time Saved (v-hr mil)	12.4	0.9	3.3	0.05	2.2	3.8	22.5
BVOC (k-hr)	408.4	446.6	154.2	1,669.2	109.7	89.9	-
Time Cost Saving (PhP mil)	5,007.4	411.5	510.3	88.0	241.7	341.2	6,600.1
Total VOC Benefit	5,532.3	416.2	535.9	88.6	294.9	346.9	7,214.8

Source: JICA Study Team



Source: JICA Study Team

Figure 6.2-4 Economic Benefits by Value of C-5/Green Meadows (STEP Loan, 2018-2037)

5) Aggregate

Implementation of the C-3/E. Rodriguez Interchange was cancelled by the DPWH to give priority to the construction of Skyway Stage 3, second level, along C-3 under BOT scheme. Therefore, the following analysis was conducted for aggregation of four interchanges except C-3/E. Rodriguez.

Economic cost and benefit are given in **Tables 6.2-11** and **6.2-12** below. Economic Benefit by value is depicted as **Figure 6.2-5**.

Table 6.2-11 Financial and Economic Costs (STEP Loan, PhP million)

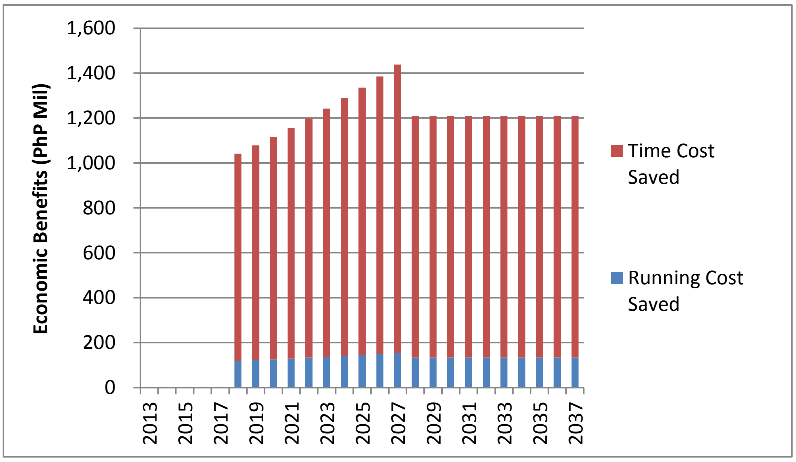
	Financial Cost			Economic Cost		
	FC	LC	Total	FC	LC	Total
Construction	1,274.96	1,553.61	2,828.57	1,274.96	1,294.68	2,569.63
Land Acquisition		4.00	4.00		3.33	3.33
Administration cost		110.88	110.88		92.40	92.40
Engineering Fee	190.96	148.81	339.77	190.96	124.01	314.97
Tax and Duties		395.52	395.52			
Base Cost	1,465.92	2,212.83	3,678.75	1,465.92	1,511.09	2,977.01
Physical Contingency	29.32	44.26	73.57	29.32	30.22	59.54
BC+PhyC	1,495.24	2,257.08	3,752.32	1,495.24	1,541.31	3,036.55
Price Contingency	90.25	169.57	259.82			
Total	1,585.49	2,426.65	4,012.14	1,495.24	1,541.31	3,036.55

Source: JICA Study Team

Table 6.2-12 Economic Benefit - VOC Saved (STEP Loan, PhP million, 2018-37)

	Passenger Car	Jeepney	Utility Vehicle	Bus	Truck	Motorcycle	Total
Running Cost saving (PhP mil)	1,451.8	488.1	173.6	212.4	324.3	40.1	2,690.4
Time Cost Saving (PhP mil)	13,993.9	1,933.0	868.2	3,287.9	554.2	1,158.7	21,686.9
Total VOC Benefit	15,445.7	2,421.1	1,041.8	3,500.3	878.5	1,198.8	24,377.3

Source: JICA Study Team



Source: JICA Study Team

Figure 6.2-5 Economic Benefits by Value (STEP Loan, 2018-2037)

6.2.2 Results

The Economic Internal Rate of Return (EIRR) and Economic Net Present Value (ENPV) by intersection are set forth herewith (**Table 6.2-13**). In the estimation of ENPV, 15 percent of social discount rate was applied, as guided by NEDA.

Table 6.2-13 EIRR and ENPV by Intersection (STEP Loan)

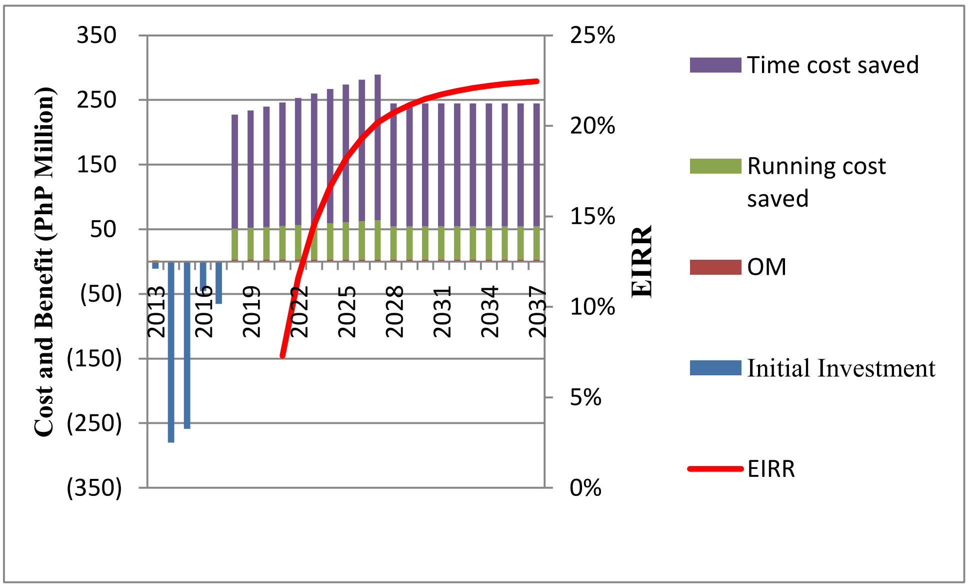
	EDSA/ Roosevelt/ Congressional	EDSA/North/ West	North/Mindanao	C-5/Green meadows	Aggregate[*1]
EIRR (%)	22.5	37.4	15.7	16.4	23.2
ENPV (PhP mill)	303.01	1,102.31	20.44	104.02	1573.71

Source: JICA Study Team

Note: 1) Aggregation of three interchanges except C-3/E. Rodriguez.

(1) EDSA/Roosevelt/Congressional

EIRR and ENPV were figured out at 22.5 percent and PhP 303.01 million, respectively. It would be noteworthy that the completion of C-3 Expressway (2028) has little effect of traffic diversion on the concerned intersection. Chronological inputs and outputs of economic resources are depicted as **Figures 6.2-6**. Summary cashflow table pertaining to annual costs and benefit over the project period is given in **Table 6.2-14.**



Source: JICA Study Team

Figure 6.2-6 Economic Cost and Benefit Streams, and EIRR (EDSA/Roosevelt/Congressional, STEP Loan)

Table 6.2-14 Summary EIRR Cashflow (EDSA/Roosevelt/Congressional, STEP Loan, PhP million)

		Cost			Benefit			Net Benefit
		CAPEX	OM	Total	Running Cost Saved	Time Cost Saved	Total	
1	2013	11.14		11.14				-11.14
2	2014	280.11		280.11				-280.11
3	2015	258.60		258.60				-258.60
4	2016	45.57		45.57				-45.57
5	2017	65.70		65.70				-65.70
6	2018	0.00	3.31	3.31	47.66	176.50	224.16	220.85
7	2019		3.31	3.31	48.96	181.33	230.29	226.99
8	2020		3.31	3.31	50.30	186.29	236.60	233.29
9	2021		3.31	3.31	51.68	191.39	243.07	239.77
10	2022		3.31	3.31	53.10	196.63	249.73	246.42
11	2023		3.31	3.31	54.55	202.01	256.56	253.25
12	2024		3.31	3.31	56.04	207.54	263.58	260.28
13	2025		3.31	3.31	57.58	213.22	270.80	267.49
14	2026		3.31	3.31	59.15	219.06	278.21	274.90
15	2027		3.31	3.31	60.77	225.05	285.82	282.52
16	2028		3.31	3.31	50.95	190.66	241.61	238.30
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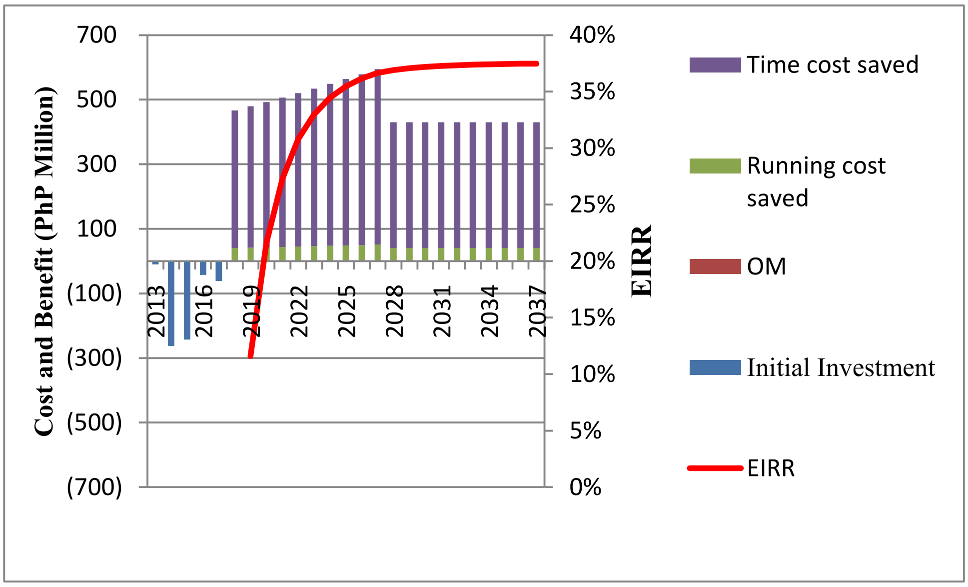
22	2033		3.31	3.31	50.95	190.66	241.61	238.30
23	2034		3.31	3.31	50.95	190.66	241.61	238.30
24	2035		3.31	3.31	50.95	190.66	241.61	238.30
25	2036		3.31	3.31	50.95	190.66	241.61	238.30
	Total	661.12	66.11	727.23	1,049.28	3,905.60	4,954.88	4,227.65

Source: JICA Study Team

(2) EDSA/North/West

EIRR and ENPV were figured out at 37.4 percent and PhP 1,102.31 million, respectively. Chronological inputs and outputs of economic resources are depicted as **Figures 6.2-7**. Summary cashflow table pertaining to annual costs and benefit over the project period is given in **Table 6.2-15**.



Source: JICA Study Team

Figure 6.2-7 Economic Cost and Export Parity Benefit, and EIRR (EDSA/North/West, STEP Loan)

Table 6.2-15 Summary EIRR Cashflow (EDSA/North/West, STEP Loan, PhP million)

		Cost			Benefit			Net Benefit
		CAPEX	OM	Total	Running Cost Saved	Time Cost Saved	Total	
1	2013	10.45		10.45				-10.45
2	2014	262.97		262.97				-262.97
3	2015	242.79		242.79				-242.79
4	2016	42.78		42.78				-42.78
5	2017	61.68		61.68				-61.68
6	2018	0.00	3.10	3.10	37.51	426.27	463.78	460.67
7	2019		3.10	3.10	38.54	437.93	476.47	473.37
8	2020		3.10	3.10	39.59	449.92	489.51	486.41
9	2021		3.10	3.10	40.68	462.23	502.91	499.81
10	2022		3.10	3.10	41.79	474.88	516.67	513.57
11	2023		3.10	3.10	42.93	487.88	530.82	527.71
12	2024		3.10	3.10	44.11	501.24	545.34	542.24
13	2025		3.10	3.10	45.32	514.96	560.27	557.17
14	2026		3.10	3.10	46.56	529.05	575.61	572.50
15	2027		3.10	3.10	47.83	543.53	591.36	588.26
16	2028		3.10	3.10	37.56	389.23	426.80	423.70
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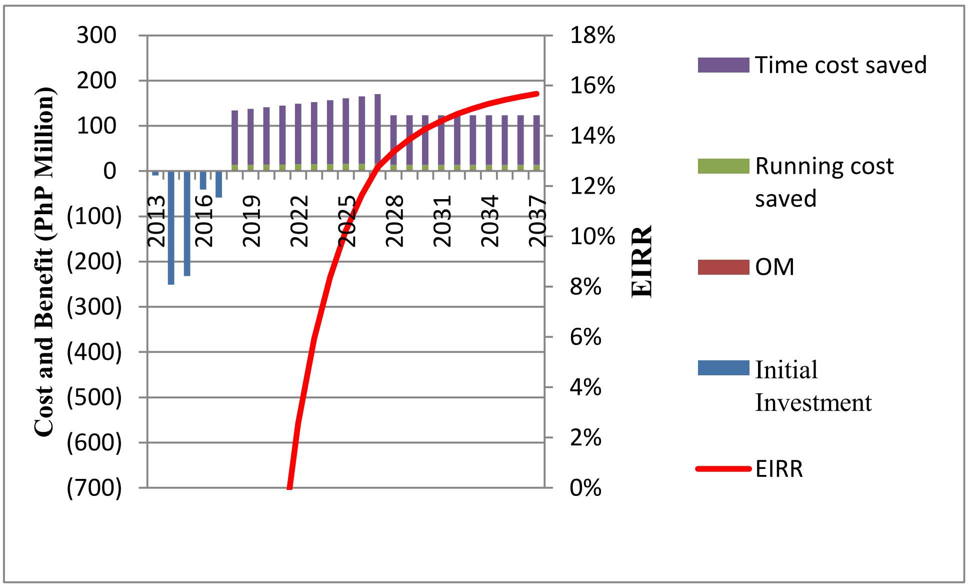
.	.		.	.	.	.	.	.
22	2033		3.10	3.10	37.56	389.23	426.80	423.70
23	2034		3.10	3.10	37.56	389.23	426.80	423.70
24	2035		3.10	3.10	37.56	389.23	426.80	423.70
25	2036		3.10	3.10	37.56	389.23	426.80	423.70
	Total	620.69	62.07	682.75	800.49	8,720.23	9,520.73	8,837.97

Source: JICA Study Team

(3) North/ Mindanao

EIRR and ENPV were figured out at 15.7 percent and PhP 20.44 million, respectively. Chronological inputs and outputs of economic resources are depicted as **Figures 6.2-8**. Summary cashflow table pertaining to annual costs and benefit over the project period is given in **Table 6.2-16**.



Source: JICA Study Team

Figure 6.2-8 Economic Cost and Export Parity Benefit, and EIRR (North/Mindanao, STEP Loan)

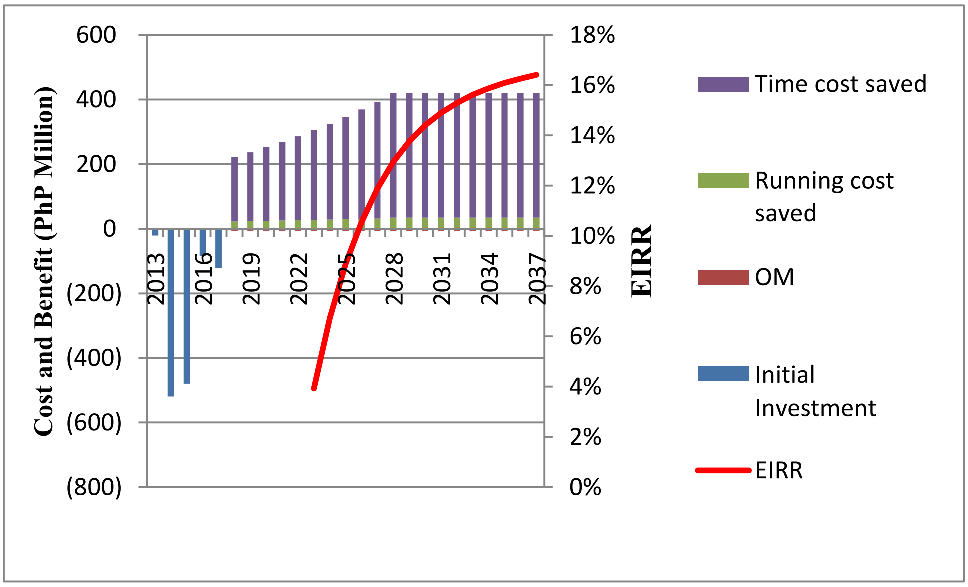
Table 6.2-16 Summary EIRR Cashflow (North/Mindanao, STEP Loan, PhP million)

		Cost			Benefit			Net Benefit
		CAPEX	OM	Total	Running Cost Saved	Time Cost Saved	Total	
1	2013	9.98		9.98				-9.98
2	2014	251.00		251.00				-251.00
3	2015	231.73		231.73				-231.73
4	2016	40.83		40.83				-40.83
5	2017	58.87		58.87				-58.87
6	2018	0.00	2.96	2.96	10.59	120.30	130.88	127.92
7	2019		2.96	2.96	10.88	123.59	134.47	131.51
8	2020		2.96	2.96	11.17	126.97	138.15	135.19
9	2021		2.96	2.96	11.48	130.45	141.93	138.97
10	2022		2.96	2.96	11.79	134.02	145.81	142.85
11	2023		2.96	2.96	12.12	137.69	149.80	146.84
12	2024		2.96	2.96	12.45	141.46	153.90	150.94
13	2025		2.96	2.96	12.79	145.33	158.12	155.16
14	2026		2.96	2.96	13.14	149.31	162.45	159.48
15	2027		2.96	2.96	13.50	153.39	166.89	163.93
16	2028		2.96	2.96	10.60	109.85	120.45	117.49
.	.		.	.	.	.	.	.
.	.		.	.	.	.	.	.
22	2033		2.96	2.96	10.60	109.85	120.45	117.49
23	2034		2.96	2.96	10.60	109.85	120.45	117.49
24	2035		2.96	2.96	10.60	109.85	120.45	117.49
25	2036		2.96	2.96	10.60	109.85	120.45	117.49
	Total	592.41	59.24	651.65	225.91	2,460.99	2,686.90	2,035.24

Source: JICA Study Team

(4) C-5/Green Meadows

EIRR and ENPV were figured out at 16.4 percent and PhP 104.02 million, respectively. It would be noteworthy that the completion of C-3 Expressway (2028) has little effect of traffic diversion on the concerned intersection. Chronological inputs and outputs of economic resources are depicted as **Figures 6.2-9**. Summary cashflow table pertaining to annual costs and benefit over the project period is given in **Table 6.2-17.**



Source: JICA Study Team

Figure 6.2-9 Economic Cost and Benefit Streams, and EIRR (C-5/Green Meadows, STEP Loan)

Table 6.2-17 Summary EIRR Cashflow (C-5/Green Meadows, STEP Loan, PhP million)

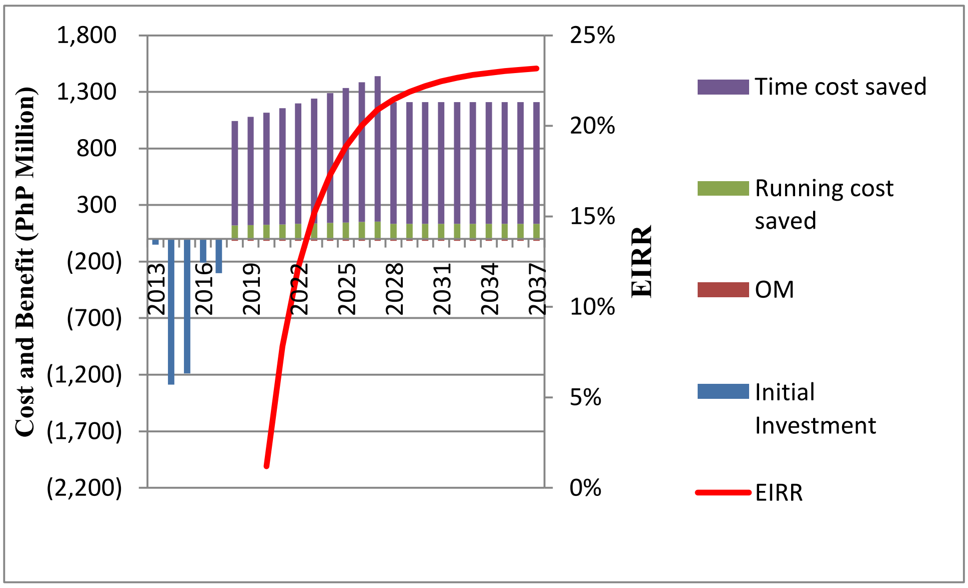
		Cost			Benefit			Net Benefit
		CAPEX	OM	Total	Running Cost Saved	Time Cost Saved	Total	
1	2013	20.64		20.64				-20.64
2	2014	519.19		519.19				-519.19
3	2015	479.33		479.33				-479.33
4	2016	84.47		84.47				-84.47
5	2017	121.78		121.78				-121.78
6	2018	0.00	6.13	6.13	22.45	200.01	222.47	216.34
7	2019		6.13	6.13	23.35	213.55	236.90	230.77
8	2020		6.13	6.13	24.29	228.01	252.30	246.17
9	2021		6.13	6.13	25.26	243.48	268.74	262.61
10	2022		6.13	6.13	26.27	260.02	286.28	280.16
11	2023		6.13	6.13	27.32	277.70	305.02	298.89
12	2024		6.13	6.13	28.41	296.61	325.02	318.89
13	2025		6.13	6.13	29.55	316.83	346.38	340.25
14	2026		6.13	6.13	30.73	338.47	369.20	363.07
15	2027		6.13	6.13	31.96	361.62	393.57	387.44
16	2028		6.13	6.13	34.51	386.38	420.89	414.77
•	•		•	•	•	•	•	•
•	•		•	•	•	•	•	•
22	2033		6.13	6.13	34.51	386.38	420.89	414.77
23	2034		6.13	6.13	34.51	386.38	420.89	414.77
24	2035		6.13	6.13	34.51	386.38	420.89	414.77
25	2036		6.13	6.13	34.51	386.38	420.89	414.77
	Total	1,225.41	122.54	1,347.95	614.71	6,600.09	7,214.80	5,866.85

Source: JICA Study Team

(5) Aggregate

Implementation of the C-3/E. Rodriguez Interchange was cancelled by the DPWH to give priority to the construction of Skyway Stage 3, second level, along C-3 under BOT scheme. Therefore, the following analysis was conducted for aggregation of four interchanges except C-3/E. Rodriguez.

EIRR and ENPV stood at 23.2 percent and PhP 1,573.7 million, respectively. Chronological economic input and output with EIRR schedule is depicted as **Figure 6.2-10**. Summary cashflow table pertaining to annual costs and benefit over the project period is given in **Table 6.2-18**.



Source: JICA Study Team

Figure 6.2-10 Cost and Benefit Streams and EIRR (STEP Loan)

Table 6.2-18 Summary EIRR Cashflow (STEP Loan, PhP million)

		Cost			Benefit			Net Benefit
		CAPEX	OM	Total	Running Cost Saved	Time Cost Saved	Total	
1	2013	51.15		51.15				-51.15
2	2014	1,286.54		1,286.54				-1,286.54
3	2015	1,187.79		1,187.79				-1,187.79
4	2016	209.31		209.31				-209.31
5	2017	301.77		301.77				-301.77
6	2018	0.00	15.18	15.18	118.21	923.08	1,041.29	1,026.10
7	2019		15.18	15.18	121.73	956.40	1,078.13	1,062.95
8	2020		15.18	15.18	125.36	991.20	1,116.55	1,101.37
9	2021		15.18	15.18	129.09	1,027.55	1,156.65	1,141.46
10	2022		15.18	15.18	132.95	1,065.55	1,198.50	1,183.31
11	2023		15.18	15.18	136.92	1,105.28	1,242.20	1,227.01
12	2024		15.18	15.18	141.01	1,146.84	1,287.85	1,272.67
13	2025		15.18	15.18	145.23	1,190.34	1,335.57	1,320.38
14	2026		15.18	15.18	149.57	1,235.88	1,385.46	1,370.27
15	2027		15.18	15.18	154.05	1,283.59	1,437.65	1,422.46
16	2028		15.18	15.18	133.63	1,076.12	1,209.75	1,194.56
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22	2033		15.18	15.18	133.63	1,076.12	1,209.75	1,194.56
23	2034		15.18	15.18	133.63	1,076.12	1,209.75	1,194.56
24	2035		15.18	15.18	133.63	1,076.12	1,209.75	1,194.56
25	2036		15.18	15.18	133.63	1,076.12	1,209.75	1,194.56
	Total	3,036.55	303.65	3,340.20	2,690.39	21,686.91	24,377.31	21,037.11

Source: JICA Study Team

6.2.3 Sensitivity Analysis

Sensitivity analysis has taken place to indicate resiliency of the concerned intersections against risks, specifically, (i) downsizing benefit by 15 percent, (ii) cost overrun by 15 percent, and (iii) combination of (i) and (ii). The results are given below **Table 6.2-19**. The results reveal profoundly robust resiliency of each of the MMICP against project risks that would take place during construction and operation period.

Table 6.2-19 Sensitivity Analysis (STEP Loan)

	Base Case	Cost 15% Up	Benefit 15% Down	Combination
EDSA/Roosevelt	22.5	20.2	19.9	17.8
EDSA/North/West	37.4	34.4	33.9	31.1
North/Mindanao	15.7	15.7	13.8	13.5
C-5/Green Meadows	16.4	14.7	14.4	12.8
Aggregate[*1]	23.2	20.9	20.6	18.5

Source: JICA Study Team

Note: 1) Aggregation of three interchanges except C-3/E. Rodriguez.

6.2.4 Conclusion

EIRR analysis and sequential sensitivity analysis under the STEP loan scheme also numerically proved the worthiness of MMICP in the light of the national economy. As such, the commencement of the project in an early stage of time would profoundly be commendable under the secure financing scheme inclusive of the Japan's ODA loan, either General Condition or STEP loans, as an option.

6.3 QUALITATIVE ANALYSIS OF PROJECT EFFECTIVENESS

Primarily, an improved accessibility of transport infrastructure and services at the congested intersections in downtown Manila will by and large benefit road users and surrounding communities. As numerated in the preceding section, road users will benefit directly from reduced vehicle operation cost, shorter travel time, and improved road safety. Likewise, surrounding communities and people therein will also benefit from improved environmental condition brought about by reduction of CO_2 emission and noise. As reflected in **Chapter 6 (6.4)**, these economic benefits will also benefit Japanese companies using subject traffic networks and intersections in their daily operations and conduct of business.

Besides the quantification of VOC, CO_2 emission reduction effects and improved road safety through the reduction of traffic accidents at the intersections are likewise envisaged. In Quezon City in three of concerned intersections, fatal and non-fatal injuries, and damages to facilities were recorded at 99, 3,668, and 15,396, in that order[9]. Conservatively assuming rate of accident of the project three intersections at 5 percent, and further assuming the cost of traffic accident at around

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[9] Source: Metro Manila Development Authority (MMDA), Metro Manila Accident Reporting and Analysis System (MMARAS), *Traffic Accident Report January to December 2009*

PhP 60,000[10], the social cost saved via the reduction of traffic accidents would be estimated at around PhP 57.5 million per year[11]. This figure, as well as air quality improvements, remains indicative and hence is not used in the quantitative analysis; nonetheless, MMICP profoundly implying economic benefits of social cost savings through the reduction of traffic accidents and air quality improvements.

Furthermore, with the current management transformation efforts of the DPWH, the project will generate greater economic benefits in the days to come from enhanced DPWH institutional and human resources capacity that will bring about lower cost and better quality of construction and maintenance works for road projects in the future.

6.4 OPERATION AND EFFECT INDICATORS

6.4.1 Project Objectives

The indicators to quantitatively monitor the operational condition and performance of the project and its effects should be based on the objectives and functional characteristics of the Project.

Objectives:

- ✓ To meet present and future road transport demand
- ✓ To solve road traffic congestion at project intersections
- ✓ To improve road transport efficiency
- ✓ To reduce traffic cost and travel time cost
- ✓ To improve environmental conditions by reducing CO2 emission

Based on the above mentioned objectives, performance indicators on the operation and effect of the project facilities in specific and measureable terms to be achieved at various stages in the project life cycle can be selected. The selected indicators can contribute to manage better performance of the Project.

6.4.2 Operation Indicators

The operation of Metro Manila Interchange Construction Project (VI) can be assessed based on a comparative analysis of indicators for traffic volumes in two cases of “without the project” and the “with the project”. The indicator of traffic volume refers annual average daily traffic of all vehicle types that passes through the intersections where monitoring can be easily undertaken by DPWH in the future.

6.4.3 Effect Indicators

Effect indicators are established and shown in **Table 6.4-1** in order to monitor the project’s

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[10] The World Bank, *The Bank Operation of Project Financing (Japanese),* 2007, p. 46, The case of PRC

[11] (99+3,668+15,396) x 0.05 x 60,000 = (around) PhP 57.5 million

performance and effectiveness.

Table 6.4-1 Effect Indicators

Objective of the Project	Indicators
To meet present and future road transport demand	Traffic volumes (Operation indicator) Additional vehicle lanes or lane-km
To solved road traffic congestion at project intersections	Travel speed Level of Service (LOS) and Volume Capacity Ratio (VCR)
To improve road transport efficiency	Vehicle-kilometer Vehicle-hour
To reduce traffic cost and travel time cost	Vehicle operation cost } Traffic cost Travel time cost
To improve environmental conditions	Noise level SPM emission, NOx emission, CO_2 emission

Source: JICA Study Team

Among the above mentioned performance indicators, three environmental indicators such as noise level, SPM emission and NOx emission are difficult to measure and forecast without appropriate apparatus; therefore, CO_2 emission was chosen as an indicator. Average travel speed that may be easy to monitor by DPWH with reliable accuracy was selected as effect indicator for this Project.

6.4.4 Operation and Effect Monitoring Plan

Operation and effect of the Project will be monitored by measuring of the above indicators. The targets of the indicators are estimated as of the planned monitoring timing (baseline data) as shown in **Table 6.4-2**. Location of monitoring indicators at each intersection is shown in **Figure 6.4-1** through **Figure 6.4-4.**

DPWH shall Conduct monitoring after 2017 (the opening year of interchanges), ideally in 2019 after 2 years operation and in 2020 after 2 years operation and in 2028 after 10 years operation of the project facilities. The C-3/E. Rodriguez Interchange is not included the table since implementation of the interchange was cancelled by the DPWH to give priority to the construction of Skyway Stage 3, second level, along C-3 under BOT scheme.

The method to derive present and future indicators is briefly discussed below.

(1) Traffic Volume

Traffic volume in base year (2011) was obtained from actual traffic count data surveyed by the JICA Study Team as presented in **Appendix 3-1**. The traffic volume in 2019 was estimated based on the following steps.

1) Obtain hourly traffic volume in 2018 at monitoring location from output of VISSIM analysis shown in **Appendix 3-3**.

2) Obtain hourly and daily total inflow traffic to the interchange in 2018 from output of VISSIM

analysis.

3) Calculated daily traffic volume in 2018 multiplying hourly traffic volume and expansion factor estimated from hourly and daily total inflow traffic to the intersections.

4) Calculate daily traffic volume in 2028 at monitoring location utilizing same procedure for obtaining 2018 daily traffic.

5) Obtain daily traffic volume in 2019 by interpolating 2018 and 2028 daily traffic volumes derived from above procedures.

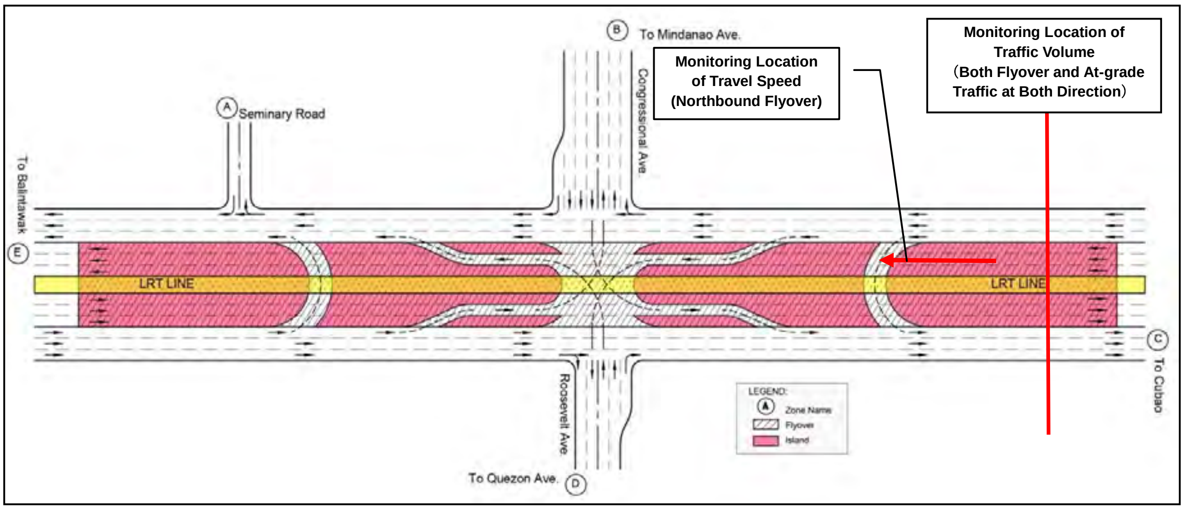
The estimation process of the above procedures is shown in **Table 6.4-3.**

Table 6.4-2 Monitoring Plan Operation and Effect Indicators

Indicators		Vehicle Type	Base Year (2011)	Target Year* (2019)	Monitoring Location
Traffic Volume (veh/day)	EDSA/Roosevelt/ Congressional Intersection	Car	65,107	69,126	Along EDSA: Cubao Side
		Jeepney	2,302	8,925	
		Utility Vehicle	8,064	6,524	
		Bus	10,134	12,415	
		Truck	7,035	2,968	
		Bicycle	7,171	18,210	
		Total	**99,813**	**118,167**	
	EDSA/West/North Intersection	Car	129,372	130,786	Along EDSA: Cubao Side
		Jeepney	2,119	0	
		Utility Vehicle	5,080	6,691	
		Bus	10,432	13,593	
		Truck	8,119	4,211	
		Bicycle	11,259	23,703	
		Total	**166,381**	**178,985**	
	North/Mindanao Intersection	Car	43,406	44,645	Along North Ave.: EDSA Side
		Jeepney	12,209	10,963	
		Utility Vehicle	4,240	5,733	
		Bus	58	0	
		Truck	2,089	1,435	
		Bicycle	7,390	13,818	
		Total	**69,392**	**76,593**	
	C-5/Green Meadows/ Acropolis/Calle Industria Intersection	Car	77,269	112,519	Along C-5: Pasig City Side
		Jeepney	3,727	5,820	
		Utility Vehicle	14,679	18,539	
		Bus	215	524	
		Truck	9,765	6,244	
		Bicycle	24,785	34,904	
		Total	**129,440**	**178,551**	
Average Travel Speed in PM Peak (km/h)	EDSA/Roosevelt/Congressional Intersection		16.2	62.2	Along EDSA: Northbound Flyover
	EDSA/West/North Intersection		19.9	33.6	Along EDSA: Northbound Flyover
	North/Mindanao Intersection		9.8	50.3	Along North Ave.: EDSA Side bound to Quezon Circle
	C-5/Green Meadows/Acropolis/Calle Industria Intersection		29.3	51.0	Along C-5: Northbound Flyover

* Target Year is two years after the completion of the Project, which is defined as the time when the Project is open to traffic.

Source: JICA Study Team

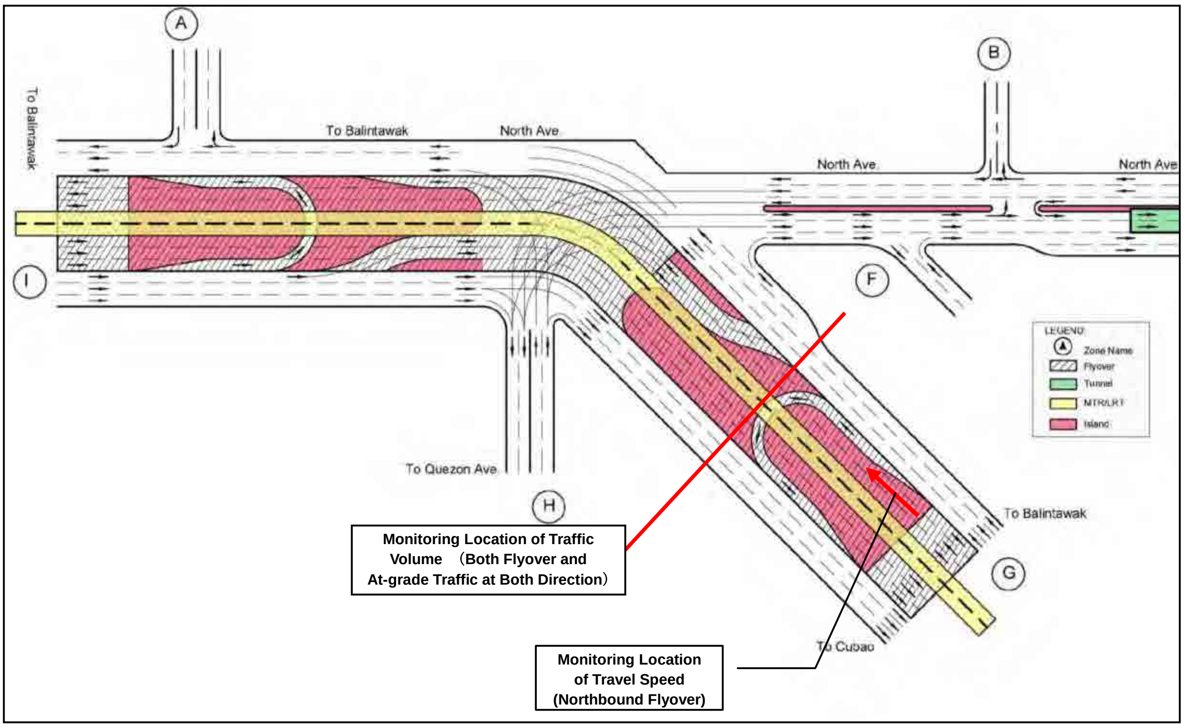


Monitoring Location of Travel Speed (Northbound Flyover)

Monitoring Location of Traffic Volume （Both Flyover and At-grade Traffic at Both Direction）

Source: JICA Study Team

Figure 6.4-1 Monitoring Location for Traffic Volume Count and Travel Speed (EDSA/Roosevelt/Congressional Ave. Intersection: Along EDSA – Cubao Side)

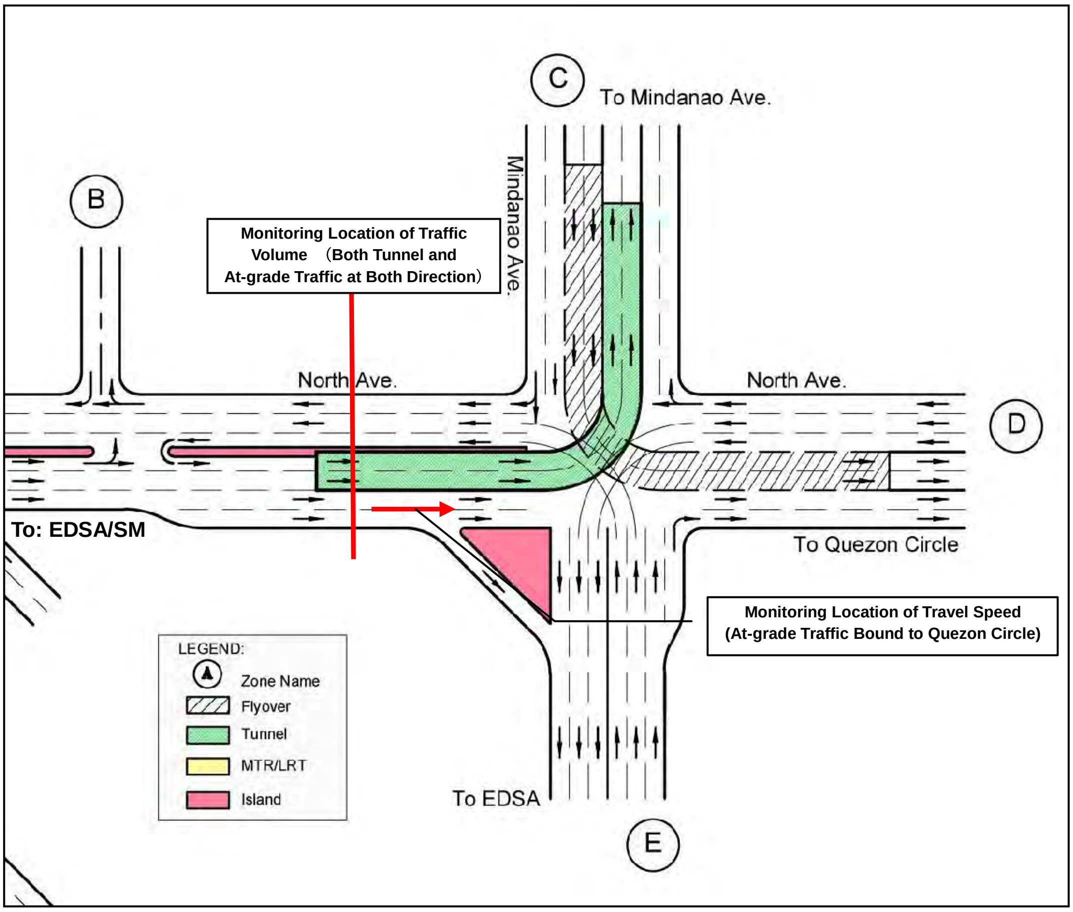


Monitoring Location of Traffic Volume （Both Flyover and At-grade Traffic at Both Direction）

Monitoring Location of Travel Speed (Northbound Flyover)

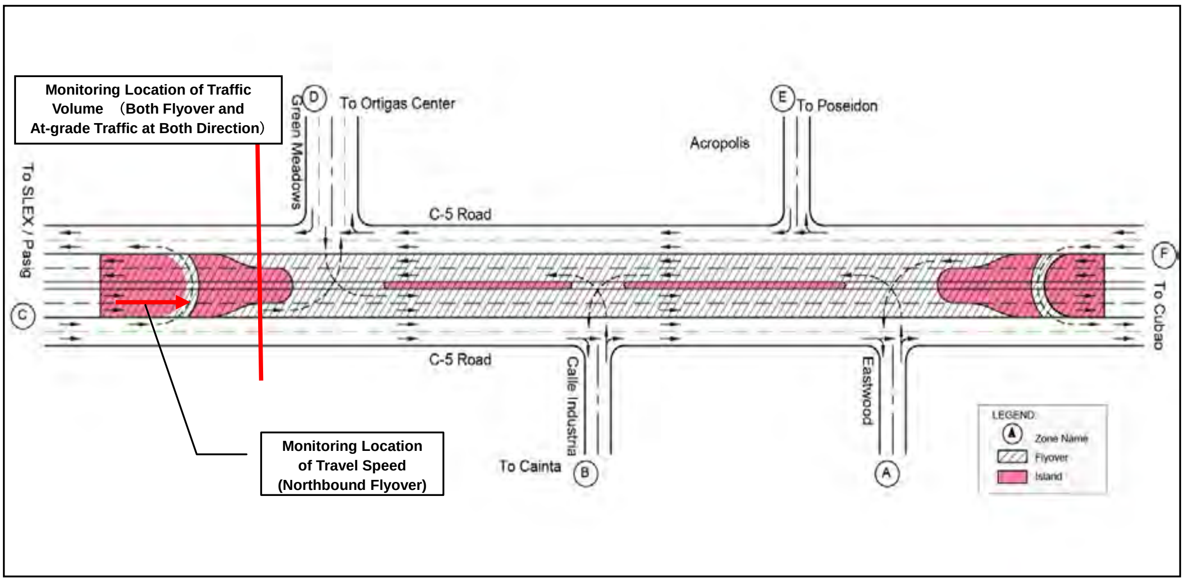
Source: JICA Study Team

Figure 6.4-2 Monitoring Location for Traffic Volume Count and Travel Speed (EDSA/North Ave./West Ave. Intersection: Along EDSA – Cubao Side)



Source: JICA Study Team

Figure 6.4-3 Monitoring Location for Traffic Volume Count and Travel Speed (North Ave./Mindanao Ave. Intersection: Along North Avenue – EDSA/SM Side)



Source: JICA Study Team

Figure 6.4-4 Monitoring Location for Traffic Volume Count and Travel Speed (C-5/Green Meadows/Acropolis/Galle Industria – Pasig City Side)

Table 6.4-3 Estimation of Future Traffic Volume (2019)

Vehicle Composition	2011	2018				2019	2028			
	Daily Volume at Monitoring Location	Hourly Volume at Monitoring Location	Hourly Volume Total Inflow to Interchange	Daily Volume Total Inflow to Interchange	Daily Volume at Monitoring Location	Daily Volume at Monitoring Location	Hourly Volume at Monitoring Location	Hourly Volume Total Inflow to Interchange	Daily Volume Total Inflow to Interchange	Daily Volume at Monitoring Location
	Obtained from Traffic Count Survey	Obtained from VISSIM Output	Obtained from VISSIM Output	Obtained from VISSIM Output	Expanded from Hourly Volume	Interpolated between 2018 and 2028	Obtained from VISSIM Output	Obtained from VISSIM Output	Obtained from VISSIM Output	Expanded from Hourly Volume
1. EDSA/Roosevelt/Congressional (Along EDSA-Cubao Side)										
Car	65,107	3,992			69,819	69,126	3,711			62,884
Jeep	2,302	497			8,692	8,925	650			11,015
UV	8,064	377			6,594	6,524	348			5,897
Bus	10,134	717			12,540	12,415	666			11,286
Truck	7,035	171			2,991	2,968	163			2,762
Bike	7,171	1,014			17,735	18,210	1,327			22,487
Total	**99,813**	**6,768**	**9,590**	**167,727**	**118,371**	**118,167**	**6,865**	**9,876**	**167,353**	**116,330**
2. EDSA/WEST/North (Along EDSA-Cubo Side)										
Car	129,372	7,019			132,001	130,786	6,529			119,852
Jeep	2,119	0			0	0	0			0
UV	5,080	359			6,751	6,691	335			6,150
Bus	10,432	731			13,747	13,593	665			12,207
Truck	8,119	226			4,250	4,211	210			3,855
Bike	11,259	1,228			23,094	23,703	1,590			29,187
Total	**166,381**	**9,563**	**16,159**	**303,890**	**179,844**	**178,985**	**9,329**	**16,266**	**298,592**	**171,251**
3. North/Mindanao (Along North-EDSA Side)										
Car	43,406	2,394			45,022	44,645	2,247			41,248
Jeep	12,209	577			10,851	10,963	652			11,969
UV	4,240	308			5,792	5,733	283			5,195
Bus	58	0			0	0	0			0
Truck	2,089	77			1,448	1,435	72			1,322
Bike	7,390	718			13,503	13,818	907			16,650
Total	**69,392**	**4,074**	**16,159**	**303,890**	**76,617**	**76,593**	**4,161**	**16,266**	**298,592**	**76,383**
4. C5/Greenmeadows (Along C5 - Pasig Side)										
Car	77,269	6,841			107,383	112,519	10,097			158,747
Jeep	3,727	354			5,557	5,820	521			8,191
UV	14,679	1,128			17,706	18,539	1,656			26,036
Bus	215	32			502	524	46			723
Truck	9,765	380			5,965	6,244	557			8,757
Bike	24,785	2,122			33,309	34,904	3,133			49,258
Total	**129,440**	**10,857**	**13,206**	**207,294**	**170,422**	**178,551**	**16,010**	**19,496**	**306,520**	**251,712**

Source: JICA Study Team

(2) Average Travel Speed

Average travel speed in base year (2011) was obtained from result of travel speed survey conducted by the JICA Study Team as presented in **Section 3.1.5**. Future travel speed (2019) was obtained based on the following procedures.

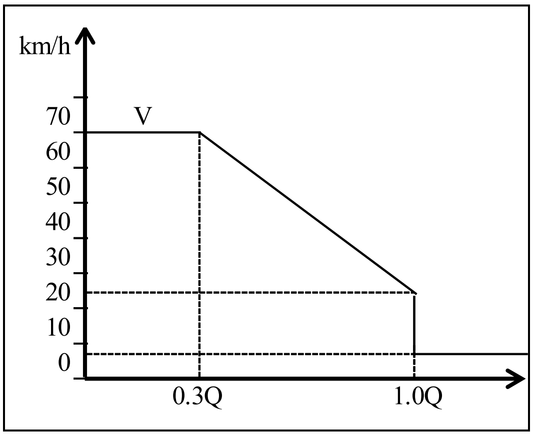
1) Obtain traffic volume in 2018 at monitoring location of each interchange from VISSIM output as presented in **Appendix 3-3** as convert it to PCU by multiplying PCU conversion factor.

2) Calculate travel speed in 2018 using above traffic volume and Q-V (Capacity - Speed) diagram shown in **Figure 6.4-5**.

3) Calculate travel speed in 2028 following same procedure for travel speed in 2018.

4) Obtain travel speed in 2019 by interpolating 2018 and 2028 travel speed derived from above procedures.

Estimation process of the above procedure is shown in **Table 6.4-4**.



Source: JICA Study Team

Figure 6.4-5 Q-V Diagram for Estimation of Travel Speed

Table 6.4-4 Estimation of Future Average Travel Speed (2019)

Direction	2011	2018				2019	2028			
	Travel Speed (km/h)	Volume (PCU)	Capacity (PCU)	V/C Ratio	Travel Speed (km/h)	Travel Speed (km/h)	Volume (PCU)	Capacity (PCU)	V/C Ratio	Travel Speed (km/h)
1. EDSA/Roosevelt Intersection										
Northbound Flyover (from Qubao)	16.2	2,282	5,400	0.42	62.1	62.2	2,208	5,400	0.41	63.0
2. EDSA/North Intersection										
Northbound Flyover (from Qubao)	19.9	4,702	5,400	0.87	33.3	33.6	4,419	5,400	0.82	36.7
3.North/Mindanao Intersection										
At Grade Lanes (from EDSA)	9.8	968	1,600	0.61	50.4	50.3	978	1,600	0.61	50.0
4. C5/Greenmeadows Intersection										
Northbound Flyover (from Pasig)	29.3	3,187	5,400	0.59	51.3	51.0	3,485	5,400	0.65	47.8

Source: JICA Study Team

6.5 SURVEY ON BENEFIT FOR JAPANESE COMPANIES IN THE PHILIPPINES

6.5.1 Purpose of the Survey

The purpose of the survey is to verify positive impacts and benefits brought about by the project implementation on Japanese companies that are operating in Metro Manila and adjacent provinces. Expected benefits are mostly reduction of transportation cost for delivery of goods and services passing the project interchanges and adjacent roads within influenced area.

6.5.2 General Overview of Japanese Affiliated Firms in the Philippines[12]

Prior to the selection of Japanese firms for interview, general information about Japanese firms in the Philippines were obtained and reviewed. This section presents general overview of Japanese firms operating in the Philippines.

As of October 1, 2010, there are 1,075 Japanese affiliated firms in the Philippines, of these 938 firms (87%) are operating in Luzon area, 125 firms (12%) in Visayas area and 12 firms (1%) are also operating in the Mindanao area as shown in **Table 6.5-1**.

Table 6.5-1 Number of Japanese Firms in the Philippines

Type of Firm	Luzon Area	Visayas Area	Mindanao Area	Total
1. Japanese Firms	109	4	0	113
1.1 Branch	40	0	0	40
1.2 Liaison & Detached Office	69	4	0	73
2. Locally Incorporated Firms	829	121	12	962
2.1 100% Owned by Japanese Firms	466	89	8	563
a. Heed Office	410	69	5	484
b. Branch, Liaison & Detached Office	56	20	3	79
2.2 Joint Corporation	236	24	4	264
2.3 Established by Migrant Japanese	127	8	0	135
Total	**938**	**125**	**12**	**1,075**
	87.3%	11.6%	1.1%	100%

Source: Consulate General of Japanese Embassy in the Philippines

Table 6.5-2 shows the number of Japanese staff in the firm. 77% or 829 firms have Japanese staff at “1~4” only and 13% or 138 firms have “5~9” staff, while 6% or 64 firms have reported that they have no Japanese staff. Firms with less than 5 Japanese staff share almost 96% the total. This implies that a substantial part of their business transactions are handled by Filipino staff and that Japanese staff are mainly involved in supervisory/advisory works.

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[12] Data enumerated this section was taken from web site of Japanese Embassy in the Philippines

Table 6.5-2 Number of Japanese Staff in the Firm

No. of Japanese Staff	Luzon Area	Visayas Area	Mindanao Area	Total
More than 50	0	0	0	0
45~49	0	1	0	1
40~44	0	0	0	0
35~39	0	0	0	0
30~34	1	1	0	2
25~29	4	0	0	4
20~24	6	2	0	8
15~19	5	2	0	7
10~14	17	5	0	22
5~9	124	13	1	138
1~4	728	90	11	829
0	53	11	0	64
Total	**938**	**125**	**12**	**1,075**

Source: Consulate General of Japanese Embassy in the Philippines

Table 6.5-3 shows the number of firms by province. Metro Manila has a share of 47% or 531 firms, followed by Laguna with 187 firms or 17%, and Cavite with 150 firms or 13%. Most firms prefer to open business in the southern area of Manila rather than in northern area because of easy access to Manila Port and Airport.

Table 6.5-4 shows the number of firms by business categories in Luzon Area. 42% or 399 firms are engaged in manufacturing, followed by 116 firms or 12% offering various services, and 109 firms or 12% operating in wholesale or retailing.

Table 6.5-5 shows the number of firms in industrial estates in which a total of 970 firms are located in this industrial estates where 80% of firms are operating in Luzon area and most of them are located in industrial estates in Southern Manila, while few firms are engaged in business in the northern area of Metro Manila.

Table 6.5-3 Number of Firms by Province

Province	No. of Firms	Province	No. of Firms
1. Luzon Area		15. Camarines Sur	1
1. Metro Manila	531	16. Oriental Mindoro	1
2. Laguna	187	**Sub-total**	**980**
3. Cavite	140	**2. Visayan Area**	
4. Batangas	44	1. Cebu	125
5. Zambales	31	2. Aklan	1
6. Pampanga	18	3. Leyte	1
7. Bulacan	8	**Sub-total**	**127**
8. Tarlac	5	**3. Mindanao Area**	
9. Bataan	3	1. Davao Del Sur	7
10. Rizal	5	2. Misamis Oriental	3
11. Benguet	2	3. South Cotabato	1
12. Palawan	2	4. Agusan Del Norte	1
13. Quezon	1	**Sub-total**	**12**
14. Albay	1	**Total**	**1,119**

Source: Consulate General of Japanese Embassy in the Philippines

Note: Total number of firms is not consistent with other tables due to different sources of data

Table 6.5-4 Number of Firm by Business Categories

Industry Category	Business Category	No. of Firms
Primary	Agriculture	9
	Forestry	0
	Fishery	0
	Sub-total	**9**
Secondary	Mining	1
	Construction	67
	Manufacturing	399
	Sub-total	**467**
Tertiary	Public Utility Service	8
	Information and Communication	39
	Transportation	57
	Wholesale and Retailing	109
	Financing and Insurance	21
	Real Estate	7
	Hotel and Restaurant	24
	Health and Welfare	8
	Education	15
	Combined Service	27
	Other Services (other than above)	116
	Official Service	2
	Sub-total	**433**
Others	Not categorized	29
Total		**938**

Source: Consulate General of Japanese Embassy in the Philippines

Table 6.5-5 Number of Firms Located in Industrial Estate

Name of Industrial Estate	Number of Firms	Location
1. Luzon Area		
1. Laguna Technopark (LT)	86	Binan, Laguna (80firms) Bo. Don Jose, Sta. Rosa City, Laguna (6firms)
2. Cavite Economic Zone (CEZ)	68	Rosario, Cavite
3. First Cavite Industrial Estate	37	Brgy. Langkaan, Dasmarinas, Cavite
4. First Philippines Industrial Park (FPIP)	26	Brgy. Sta. Anastacia, Sto.Tomas, Batangas (21firms) San Rafael, Sto. Tomas, Batangas (1firms) Tanauan City, Batangas (4firms)
5. Madrigal Business Park	23	Ayala Alabang, Muntinlupa City, Metro Manila
6. Carmelray Industrial Park (CIP) 1	17	Canlubang, Calamba City, Laguna
7. Light Industry & Science Park (LISP) 2	15	Brgy. La Mesa, Calamba City, Laguna (13firms) Brgy. Real, Calamba City, Laguna (2firms)
8.Light Industry & Science Park (LISP) 1	13	Brgy. Diezmo, Cabuyao, Laguna
9. Lima Technology Center	13	Lipa City, Batangas (10firms) Malvar, Batangas (3frims)
10. Subic Technopark	11	Argonaut Highway, Boton Area, Subic Bay Freeport Zone
11. People's Technology Complex (PTC)	11	Carmona, Cavite
12. Carmelray Industrial Park (CIP) 2	8	Brgy. Punta, Calamba City, Laguna (5firms) Brgy. Tulo, Calamba City, Laguna (3firms)
13. Gateway Business Park (GBP)	6	Btgy. Javalera, General Trias, Cavite
14. Other Industrial Estate	43	
Sub-total	**377**	
2. Visayas Area		
1. Mactan Economic Zone (MEZ) 1	48	Brgy. Ibo, Lapu-Lapu City, Cebu
2. Mactan Economic Zone (MEZ) 2	18	Brgy. Basak, Lapu-Lapu City, Cebu
3. West Cebu Industrial Park	8	Buanoy, Balamban, Cebu
4. Asiatown I.T. Park	7	Brgy. Apas, Cebu City (6firms) Lahug, Cebu City (1firms)
5. Other Industrial Estate	9	
Sub-total	**90**	
3. Mindanao Area	**3**	
Total	**470**	

Source: Consulate General of Japanese Embassy in the Philippines

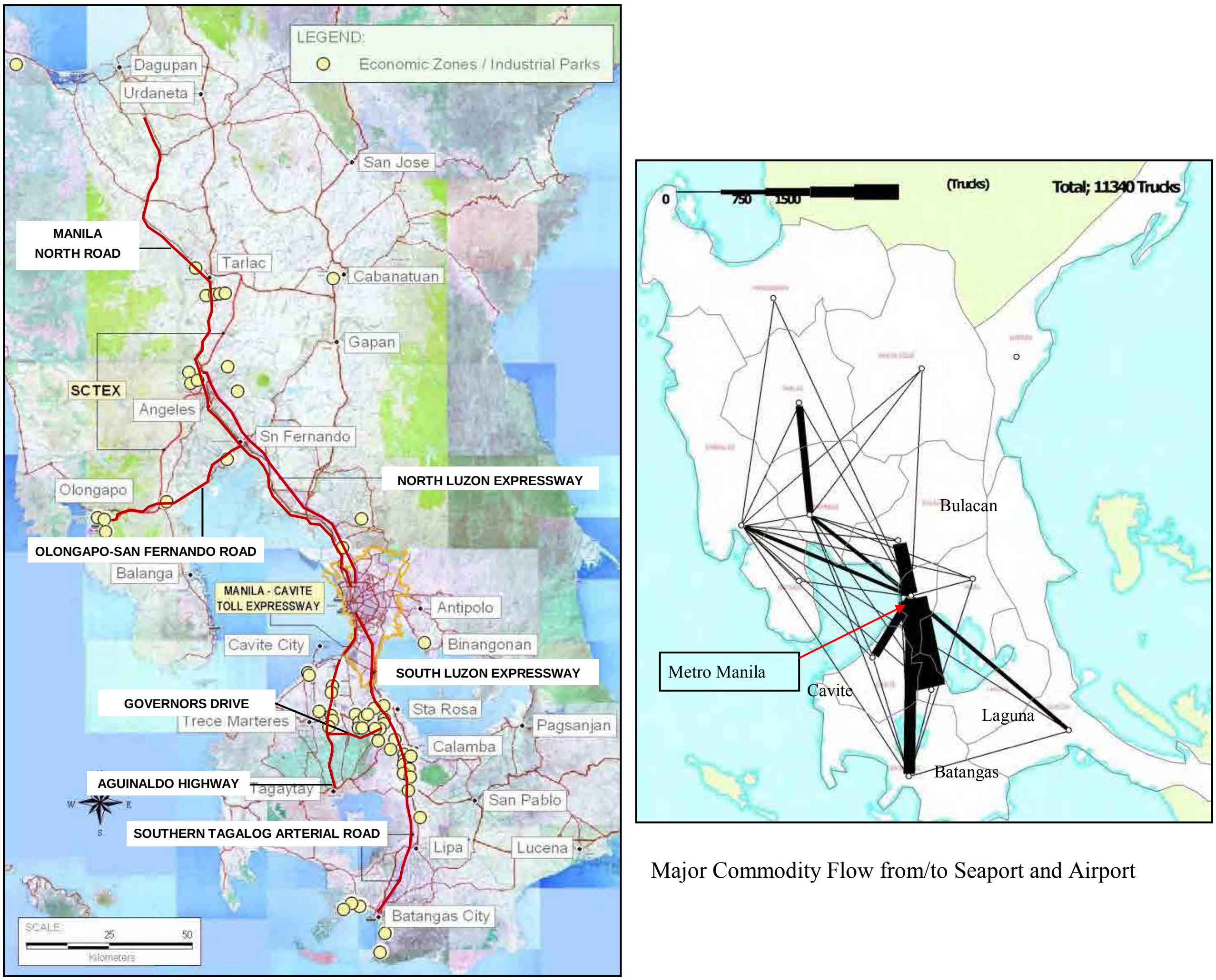
6.5.3 Major Transport Routes in Metro Manila Economic Area

Table 6.5-6 and **Figure 6.5-1** show the major transport corridors together with commodity flows that may be used by Japanese affiliated firms in Luzon Area. As indicated in **Figure 6.5-1** industrial parks and economic zones are located in southern and northern area of Metro Manila.

Table 6.5-6 Major Transport Routes that may be Used by Japanese Affiliated Firms

1. Transport Routes for Industrial Parks	
1.1 Metro Manila Southern Area	**1.2 Metro Manila Northern Area**
・South Luzon Expressway (SLEX)	・North Luzon Expressway(NLEX)
・Manila – Cavite Coastal Road	・Manila North Road (MNR)
・Southern Tagalog Arterial Road	・Olongapo – San Fernando Road
・Aguinardo Highway (Cavite)	
・Governor's Drive (Cavite)	
2. Major Commodity Flow from/to Seaport and Airport	
・Metro Manila ⇔ Laguna	・Metro Manila ⇔ Batangas
・Metro Manila ⇔ Bulacan	・Metro Manila ⇔ Cavite

Source: Metro Manila Urban Transportation Integration Study, JICA, March 1999



Major Transport Routes

Major Commodity Flow from/to Seaport and Airport

Source: Metro Manila Urban Transport Integration Study, JICA, March 1999

Figure 6.5-1 Major Transport Routes and Commodity Flows in Metro Manila Economic Area

Since the distance from Metro Manila to the northern industrial parks in Subic and Clerk is approximately 100 km, substantial number of firms prefer to establish factories in the southern area where distance to Manila is only one half (Calamba City to Manila Port).

Commodity flow between Metro Manila and the south is far bigger than those between Metro Manila and the north.

6.5.4 Survey Method

The survey was conducted mainly through interview with selected Japanese firms that may use the project interchanges in their business. Among 600 Japanese firms operating in the Metro Manila area and adjacent provinces, 8 to 10 Japanese representative firms, that have long a time been in business operations in the Philippines covering a wide area of Metro Manila and with fairly large business transactions, were selected for interview in order to identify impacts and benefits on their business with the implementation of the project.

The following items were surveyed:

- ✓ Current status of the transportation system of the firm and the potential issues and problems currently they are facing in the field of transportation.
- ✓ Expected improvements on access between port/factory and clients and vice versa brought about by implementation of the Project.
- ✓ Expected reduction of transport related costs owing to implementation of the Project.
- ✓ Expected change in distribution pattern and business perspectives due to the implementation of the project, if any.

The interview format adopted for the survey is presented in **Table 6.5-7**.

6.5.5 Selection of Companies to be Interviewed

Figure 6.5-2 shows location of industrial parks and economic zones located in the Metro Manila economic influential area. The location of offices and factories of major Japanese affiliated firms are shown in **Figure 6.5-2**. The companies for the interview survey were selected from the field in manufacturing, services, wholesale/retail and transportation who may frequently use the road networks in Metro Manila for their business transactions.

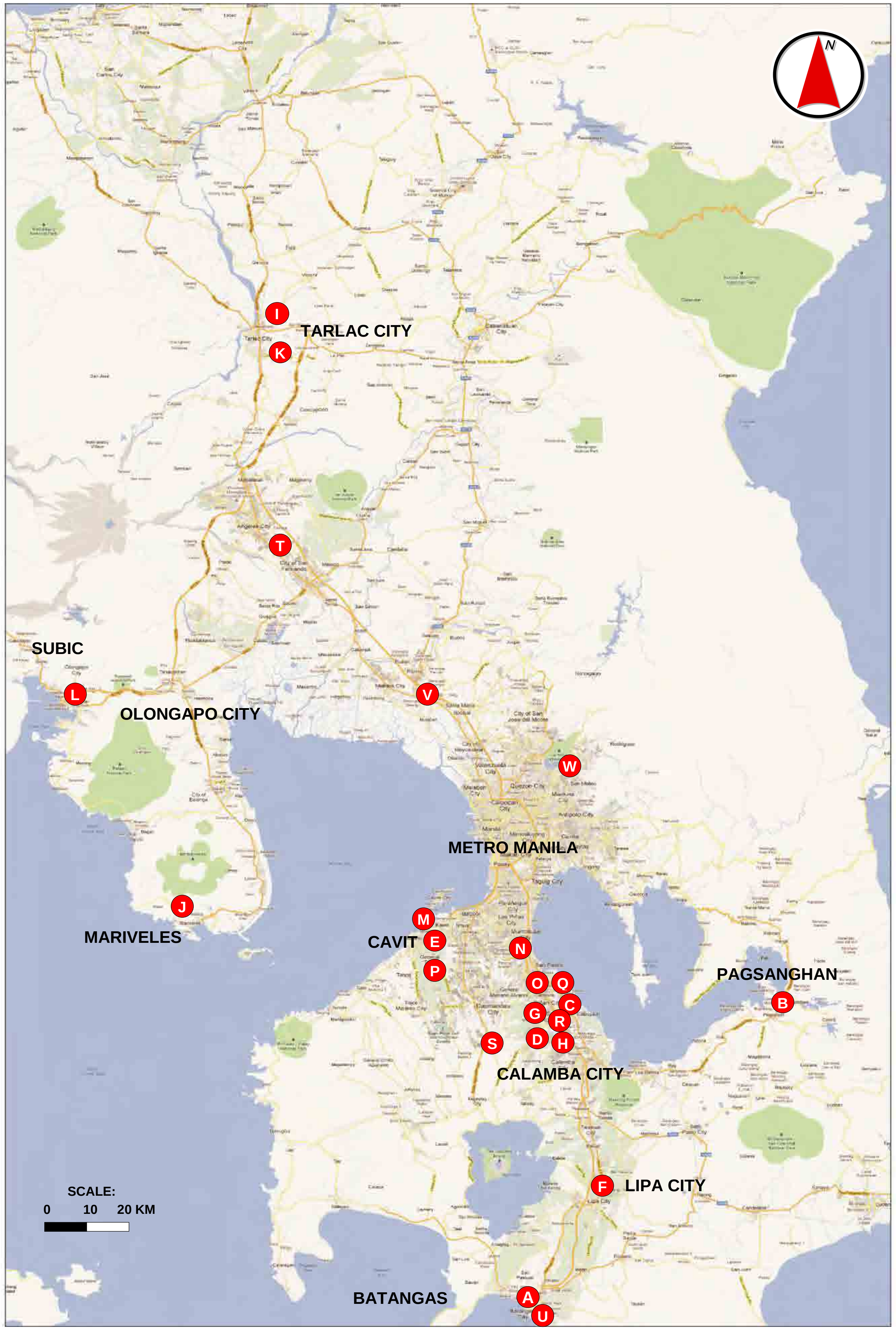
The eight (8) representative firms shown in **Table 6.5-8** were identified for interview. The location of the selected firms and their main offices and business centers are shown in **Figure 6.5-2**.

Table 6.5-7 Interview Survey Format

Questionnaire	
Company Name :	Date and time :
Address	
Tel/E-mail :	
Interviewee :	Interviewer :

1. Current problems and issues of company's logistics system
1.1 Current situation of company's logistics system
a) Locations of offices and factories （Please identify their address and locations on the map）
b) Roles of each office and factory
c) Major origin and destination of physical distribution （Please identify their address and locations on the map）
d) Major distribution routes （Please identify them on the map）
e) Traffic volume and transport mode
f) Status of outside order of logistics
g) Status of containerization
1.2 Current logistics system problems and your request for improvement of transport infrastructure in Manila Metropolitan Area
a) Transport infrastructure and intermodal facilities Seaports, airports, railway stations, roads, truck terminals, inland container depots, etc.
b) Characteristics of the physical distribution business and transport infrastructure problems Supply chain, computerization of physical distribution, outsourcing, containerization, green logistics, etc.
c) Other problems Logistics system institutions such as customs clearance or regulation for cross-border traffic; institutional and human capacity
d) Request for improvements of transport infrastructures
2. Expected improvement effects for access to ports/ industrial estates/ consuming region by the JICA Traffic Infrastructure Improvement Project (5 interchange improvements and road construction at part of C3 missing link)
a) Expected improvement effects for access to ports
b) Expected improvement effects for access to industrial estates
c) Expected improvement effects for access to consuming regions
d) Expected improvement effects for reduction of commuting time
3. Expected transport cost reduction effects by the JICA Project
a) Proportion of logistic cost to business cost
b) Breakdown of logistic cost
c) Transit time
4. Expected changes in logistic system and business activity by the JICA Project
a) Changes in transport demand and logistic system through logistic cost reduction
b) Changes in transport demand and logistic system through transit time reduction
c) Changes in transport demand and logistic system through stability and safety upgrading

Source: JICA Study Team



Source: JICA Study Team

Location Code	Name	Location	Area (ha)	Distance from Manila (km)	Number of Japanese Firms	Name of Major Japansese Firms
A	First Philippine Industrial Park	Batangas	315	52km	21 (39)	- Fujitsu - Honda Motors - Ibiden - Sumitomo Heavy Indusry - Sumitomo Bakelite
B	Laguna Technopark	Laguna	410	44km	60 (110)	- Panasonic (Electronics, Communication) - Honda Motors (Automobile Assembly) - Isuzu (Automobile Assembly) - IMI (Electronic Parts Production) - Hitachi, Toshiba, TDK, NEC (Computerwares)
C	Light Industry & Science Park-I Cabuyao, Laguna	Cabuyao,Laguna	173	35km	18 (62)	- Sumitomo Electronics (printed circuit board) - Epson (Mini printer) - NIDEC Copal Philippines - Uniden Philippines Inc. (Manufacture of cordless telephone) - Organo (Philippines) Inc. (Water treatment-related)
D	Light Industry & Science Park-II Calamba, Laguna	Calamba, Laguna	65	45km	15 (23)	- NEC Toppan Circuit Solutions Philippines, Inc. (Printed wiring board) - NEC Components Phils., Inc. (Electronics components specifically printed wiring board (PWB)) - Mitsui Transnet (Logistics) - KOWA
E	First Cavite Industrial Estate	Dasmarinas, Cavite	155	30km	13 (90)	- Ishida Philippines Grating Co., Inc. - Hitachi Corporation - Philippines Nagano Seiko (Aluminum die-casting) - Mitsuba (motor for vehicles) - Nissin - Universal Robina Corp. (Cup noodle)
F	Lima Land-Lima Technology Center	Lipa City, Batangas	485	65km	12 (22)	- EPSON Precision Philippines, Inc (Inkjet Printer) - Hitachi Cable Philippines, Inc. (Electronic parts / electric wire for automobile) - Koyo Manufacturing (Philippines), Corporation (Bearings for a motorcycle) - JIDECO Manufaturing Philippines, Inc (Motor for vehicles) - YTP-LIMA Manufacturing, Inc.（Wire harness）
G	Carmelray Ⅰ・Ⅱ- Carmelray Industrial Park	Laguna	511	50km	14	- ATC (Transmission) - Philippines Auto Components Corp.(Auto parts) - Fujitsu (HDD) - Fuji Electric Philippines Corp. (Semiconductor) - Automotive Air-conditioning Technology Philippines, Inc (Air-conditioning System)
H	Filinvest Technology Park	Laguna	325	45km	5	- Southeast Precision Inc., - 8M Plastics Technology Inc. - A5 Alliance Industrial Machine - Megatronic Resources Corp., - Mechanical Dynamic Inc.,
I	Luisita Industrial Park	Tarlac	300	120km	4	- Cojungco Group Ind. Park - Sanyo Semiconductor Manufacturing Philippines Corp. (Manufacturing) - International Wiring Systems (Phils.) Corporation (Wire harness) - Sumisetsu Philippines Inc. (Copper processing)
J	Bataan Economic Zone	Mariberez Bataan	Not Available	160km	8	- Accessories Specialists Inc. (Production of bag) - Asahi Kasei Corporation (Glass fiber, reinforced plastic products) - JPN Coiltech Inc. (Solenoid, clutch coil) - Mikuni Engineering Co., Inc. (repair of used car) - Mitsumi Philippines Inc.(Parts manufacturing electrical products)
K	Central Techno Park	Tarlac	Not Available	125km	2	- International Wiring Systems(Phils) Corp. (Sumitomo Electrical) - SANYO Semiconductor Manufacturing Co. , Ltd. (LSI manufacturing assembly)
L	Subic-Technopark	Subic Bay Freeport zone	Not Available	130km	4	- OMRON - Nihon Inter Electronics - Sankyo Seiki Mfg. Co., Ltd. - Sanyo Denki Co., Ltd.
M	CAVITE ECONOMIC ZONE (CEZ)	Rosario Cavite	Not Available	40km	68	-Hayakawa Electronics(Phils.) Corp. (Wire harness, Parts manufacturing electrical products) -IRISO Electronics Phils., Inc.(Parts manufacturing electrical products) -Nanbu Philippines, Inc.(Production, Sales of Plastic Products) -San Technology, Inc.(Parts manufacturing computer)HITACHI -Sun Port Philippines, Inc.(Parts manufacturing printer)
N	MADRIGAL BUSINESS PARK	Ayala Alabang, Muntinlupa City	Not Available	15km	23	-Nipro Hospital Products Inc.（Medical equipment） -Hitachi Chemical Asia-Pacific Pte.Ltd.(Marketing of electronics related products, advanced performance products and other products) -ROHM Semiconductor Philippines Corporation -NISSHO (SINGAPORE) PTE.LTD.(Processed goods continuous press) -TOWA DENKI TRADING (S) PTE.LTD.
O	PEOPLE'S TECHNOLOGY COMPLEX (PTC)	Carmona, Cavite	Not Available	25km	11	-Intex Interiors Corp. (Manufacture of curtains, bedspreads, upholstered products and other interior products) -JD Dynamic Corp. (Manufacture of various automotive parts; manufacture/assembly of lead screw, gear shaft and pinion assembly) -Miumi Technology Corp. (Manufacture of various automotive parts for power seat, power window, etc) -New Polytex International, Inc. (Manufacture of kitchen systems and bathroom products) -Philippine Nagano Seiko, Inc. (Manufacture of reduction gear boxes and parts and shaft for agricultural machinery)
P	GATEWAY BUSINESS PARK	Brgy. Javalera, General Trias, Cavite	Not Available	36km	6	Enomoto Phil. Mfgn. Inc.(Manufacturing and sales of parts for connector) Luzon Electronics Technology, Inc.(Parts of hard disk drive manufacturing) Pentax Luzon(Asahi Optical Cavite Phils. Corp.) (High index opthalmic plastic lenses and progressive lenses) Tokumi Electronics Phils., Inc.(Parts manufacturing electrical products for SONY) Tottori Sanyo Electric (Phils.)(Parts manufacturing electrical products)
Q	LAGUNA INTERNATIONAL INDUSTRIAL PARK (LIIP)	Mamplasan, Binan, Laguna	Not Available	30km	5	Daiwa Seiko Phils. Corp. (Motor vehicle transmission parts ; to include the assembly of automotive parts) DIUP, Inc. (Manufacture of metal-stamped parts for CD-ROM) Electronic Assemblies Inc. (Assembly of PCB for PC parts, printed circuit boards assembly for car parts) Integrated Microelectronics (Manufacture of electronic ballast assembly) Showa Polymer Process Corp. (Industrial rubber product such as hatch sponge padking, sphere-type flexible joints, etc)
R	Toyota Sta. Rosa (Laguna) SEZ	BRGY. Pulong, Sta. Cruz, Sanata Rosa City, Laguna	Not Available	40km	4	Toyota Motors Phils., Inc. Philippine HKR Inc. (Manufacture of precision machine parts for automobiles) oyota Autoparts Phils., Inc ("G" Type light commercial vehicle transmissions,etc) Tokai Rica Phils. (TRP) Inc. (Manufacture of lever combination switches; etc)
S	DAIICHI INDUSTRIAL PARK	Maguyam, Silang, Cavite	Not Available	50km	4	Big Philippines Corp. (Manufacture of moulds and plastic products) Philippine Yushin, Inc.(Manufacture and design of equipment for automation and energy conservation;etc) Toms Manufacturing Corp. (Manufacture of plastic injection parts for audio components and other electronic equipment) Yamashita Mold Philippines Corporation (Fabrication of precision molding dies)
T	CLARK PREMIERE INDUSTRIAL PARK (CPIP)	Clark Freeport Zone, Clark Field, Pampanga	Not Available	70km	4	Aderans Philippines, Inc.(Production and export of wigs for men and women) SMK Electronics (Phils.) Corporation(Touch panel, remote control, keyboard) NANOX PHILIPPINE ,INC.(Manufacture of liquid crystal module and display panel) Yokohama Tire Philippines Inc.
U	-	Batangas	-	-	-	- Pilipinas Shell Petroleum Corporation Refinery(ITOCHU;LPG GAS)
V	-	Tabang, Guiguinto, Bulacan	-	35km	-	- Flavor Food Products International, Inc..(AJINOMOTO;Manufacture and sale of seasonings and food products)
w	Clark Special Economic Zone	Clarkfield, Angeles City	-	20km	-	Yokohama Tire Philippines Inc.(Tire)

Figure 6.5-2 Location of Industrial Parks, Economic Zone and Representative Japanese Firms

Table 6.5-8 Japanese Affiliated Firms Selected for Interview Survey

Name of Firm	Location of Office/Factory	Main Field of Business
1. Toyota Motors Philippines Corporation.	**Head Office:** Ayala Ave., Makati City, MM **Factory:** Sta Rosa City, Laguna	Passenger car assembly and sales
2. EPSON Precision Philippines Inc.	**Head Office, Factory:** Lima Technology Center, Lipa City, Batangas	Assembly of office equipment (printer, scanner and copy machine)
3. Itochu Corporation Manila Branch	**Head Office:** Ayala Ave., Makati City, MM **Factory:** Batangas, Pandacan in Manila City, Pampanga	LP gas retailing, Convenient store operation, Bio-ethanol production.
4. Ajinomoto Philippines Corporation	**Head Office:** Makati City, MM **Factory:** Guiginto in Bulacan	Food ingredients manufacturing
5. Mitsui & Co. (Asia Paficic) PTE. LTD. Manila Branch	**Head Office:** Ayala Ave., Makati City, MM	General trading
6. Nippon Express Philippines Corporation	**Head Office:** Pascor Drive, Parannaque City **Warehouse:** Calamba in Languna	Freight transport
7. Suzuki Philippines, Incorporated	**Head Office, Factory:** Danny Floro St., Bagong Ilog, Pasig City, MM	Motorcycle assembly and sales, Passenger car sales
8. Honda Philippines Inc.	**Head Office, Factory:**First Philippine Industrial Park, Tanauan City, Batangas	Motorcycle assembly and sales, Generator sales

Source: JICA Study Team

6.5.6 Result of Survey

Table 6.5-9 summarizes the result of the interview survey from the said eight firms. The followings are major findings:

(1) Firms that Frequently Use Project Interchanges

Export oriented firms are not frequent users of project intersections. These firms find their business centers free from traffic congestion and are therefore avoiding travel in Metro Manila. On the other hand, firms that handle products for domestic consumption necessarily use the project intersections since Metro Manila is their biggest market in the country and they have to transport their products to consumers in Manila through the project intersections.

(2) Commodity Flow between North and South

As shown in **Figure 6.5-1,** most commodity flows have origin and/or destination from/to Metro Manila, while few commodities are directly transported between the north and south area. However, some of the firms interviewed mentioned that electrical and mechanical parts manufactured in the south are transported to factories in the north for assembly via the C-3, C-4 (EDSA) and C-5. There is a tendency that assembly factories are located in the north and parts manufacturing factories are located in the south. Transporting parts from the south to the north is becoming and growing bigger every year. Mitigation of traffic congestion in Metro Manila will help commodity flows to increase between the north and the south.

Table 6.5-9 Summary of the Interview Survey

Category	Toyota Motor Philippines Corporation	EPSON Precision (Philippines) Inc.	ITOCHU Corporation Manila Branch	Ajinomoto Philippines Corporation	Mitsui & Co. (Asia Pacfic) Pte. Ltd. Manila Branch	Nippon Express Philippines Corporation	Suzuki Philippines, Incorporated	Honda Philippines Inc.
1. Location of Head Office	Alaya Ave., Makati City Metro Manila	Lima Technology Center, Lipa City, Bantangas	Ayala Ave., Makati City, Metro Manila	Gil Puyat Ave., Makati City, Metro Maila	Ayala Ave., Makati City, Metro Manila	Pascor Drive, Paranague City	Danny Floro St., Bagong Ilog, Pasig City, MM	First Philippine Industrial Park, Tanauan City, Batangas
2. Factories, Branches and Other Business Centers	- Car Assemble Fac**tory**: Calamba, Languna	- Lima Technology Center, Lipa City, Bantangas	- LPG Refining Factory: Batangas - Bio-ethanol Plant: Pampanga - Bio-ethanol Mixing Plant: Pnadacan, Manila City	- Packing Plant: Guiginto in Bulacan, Cebu City - Distribution Center: Kamigin in Quezon City, Antipolo in Rizal, Bicutan in Paranaque		- Warehouse: Calamba in Laguna	Danny Floro St., Bagong Ilog, Pasig City, MM(On June, The factory to be transferred to the Carmelray Industrial Park in Laguna)	First Philippine Industrial Park, Tanauan City, Batangas
3. Date of Survey	Dec. 19, 2011	Mar. 7, 2012	Mar. 14, 2012	Mar. 15, 2012	Mar. 22, 2012	Mar. 22, 2012	Apr. 12, 2012	Apr. 13, 2012
4. Mian Business Activities	- Passenger Car Assembly and Sales	- Assemnly of office eqiupment (mainly printers)	- LP gas Refining and retailing - Covenient store operation (under preparation) - Bio-ethanol production	- Ajinomoto Packing and wholesaling - Food ingredients manufacturing	- Steel material import and Steel product export - Chemical material import and Chemical product export - Food product export - Mine development - Investment on automobile and and machine product business	- Air cargo service - Sea cargo service - Moving service - Importation and installation of machineries - Warehouse service in Calamba, Laguna	-Motorcycle assembly and sales -Passenger car sales	-Motorcycle assembly and sales -Generator sales
5. Description of Business in Relation to Road Transport	1. Passenger car is assmebled in Sta Rosa factory 2. 60% of parts are imported, remaining 40% is locally procured 3. Imported parts are transported to the factory by container truck from Manila Port via SLEX 4. Local parts are delivered to the factory by local suppliers 5. Assembled cars are delivered to car dealers by forwarding companies	1. Office eqipment mainly printers are assmebled in the Philippines 2. Share of imported and locally procured parts is 30-70 interms of physical volume but 70-30 in terms of monetary amount 3. Most local parts are procured from factories in southern industrial park not Metro Manila 4. 95% of products are exported. 5. Manila Port is used for both import and export. Products/parts are transported via SLEX	1. ITOCHU owns LP gas refining plant in Batangas 2. LP gas is refilled to tank in the plant and ditributed to gas stations in Metro Manila 3. Delivery of gas tanks is undertken by subsidiary company under direct contrl of ITOCHU 4. Therei is Bio-ethanol plant is in Pampanga and mixing plant is in Pandacan in Manila City 5. ITOCHU is planning to operate convinient store (Family Mart) in the near future	1. There is Ajinomoto packing plant in Guiginto, Bulacan 2. Packed Ajinomoto is sold to local consumers not for export 3. Other ingredients such as soup and crispy are also manufactured Guiginto factory 4. Products are delivered to retailing shops over the country including Metro Manila by Ajinomoto	1. Steel materials row chemical materilas are imported from Japan and sold to local manufacutreres 2. Steel products and chemical products made by local manufacutrers are exported 3. Delivery of row chemical materials are undertaken by Mitsui 4. Around 20% of products manufactured in the south are sold to assembling factories in the north	1. 80% of air cargo service use Manila Airport, 20% uses Cebu Airport 2. 80% of air cargo in Manila Airport is sent to south, remaining 20% is to the north 3. Air cargo goes to the North use EDSA 4. Sea cargo service use Manila Port but not use EDSA for delivery 5. Service area of moving service is limited to Makati	1. Motorcycle is assmebled in Danny Floro factory 2. 50% of parts are imported, remaining 50% is locally procured 3. Imported parts are transported to the factory by container truck from Manila Port and Batangas Port via EDSA 4. Local parts are delivered to the factory by local suppliers 5. Assembled motorcycle and car are delivered to dealers by forwarding companies	1. Motorcycle is assmebled in First Philippine Industrial Park factory 2. 40% of parts are imported, remaining 60% is locally procured 3. Imported parts are transported to the factory by container truck from Batangas Port 4. Local parts are delivered to the factory by local suppliers 5. Assembled motorcycle and generater are delivered to dealers by forwarding companies
6. Expected Impacts by the Projects	1. If mitigation of traffic congestion in Metro Manila will evetually lead to lift of truck ban, Toyota will be greatly benefited.	1. No significant impact is expected since transfer of goods of the firm do not pass project site.	1. Very favorable impact on LP gas delivery to gas stations scattered over Metro Manila 2. Also positive impact is expected to delivery works to convenient stores that also spread over Metro Manila	1. Favorable impacts on develiry of packed ajinomoto to consumers in Metro Manila	1. Favorable impacts on delivery of row chemical materials to local manufactures in Metro Manila 2. Favorable impacts to local manufacturers in the south who sell their products to the north 3. Positive impacts to local manufacturers in Metro Manila who purchase steel materials from Mitsui	1. Air cargo delivery service to the north (mainly Clerk EPZ) uses EDSA and favorable impact is expected	1. Very favorable impact on Motorcycle delivery and passenger car to dealers scattered over Metro Manila 2. Also positive impact is expected to delivery works to convenient dealers that also spread over Metro Manila	1. Very favorable impact on Motorcycle and Generator delivery to dealers scattered over Metro Manila 2. Also positive impact is expected to delivery works to convenient dealers that also spread over Metro Manila
7. Expected Change in Business Opportunities by the Project	1. No drastic change is expected but clients who intend to punches a car may be benefited due to impevement of access to dealers	1. No drastic change is expected.	1. If traffic congetion will be mitigated, francized retailing shops like Family Mart and Shell will be greatly benefited and more bullish business plan can be drawn	1. More profit will expected if delivery cost will be reduced due to mitigation of traffic congestion	1. More profit will expected if delivery cost will be reduced due to mitigation of traffic congestion	1. More delivery service is expected if travel time and cost will be reduced	1. No drastic change is expected but clients who intend to punches a car may be benefited due to impevement of access to dealers	1. No drastic change is expected but clients who intend to punches a car may be benefited due to impevement of access to dealers
8. Issues and Problems in Relation to Road Transport	1. No direct access to SLEX from Manila Port 2. Frequent inundation at container yard in Manila Port that spoils imported parts 3. Truck ban impedes efficient implementation of KANBAN system	1. Small capacity of Manila Port 2. Poor access road to Manila Port 3. Truck ban in Metro Manila seriously restricts transport work of the firm 4. Small number of fleets in Barangays Port hampers transfer of entry port from Manila to Barangays	1. Truck ban seriously impede efficent delivery of materials and products 2. Small capacity of Manila Port creates serious delay in cargo handling	1. Serious negative affects by truck ban 2. Congestion of access road from Manila Port to NLEX	1. Serious negative affects by truck ban 2. Congestion of Manila Port 3. Strict enforcement of overloaded trucks	1. Low traffic manner 2. Bad surface condition of concrete pavement 3. On time delivary is difficult due to traffic jam	1. Low traffic manners snd Rules 2. On time delivary is difficult due to traffic jam	1. On time delivary is difficult due to traffic jam
9. Proposed Improvements on Transport System in the Philippines	1. Mitigation of traffic congestion in Metro Manila for efficient and timely delivery of assembled cars and spare parts to dealers 2. Improvement of access road to Manila Port 3. Improvement of access road to NAIA	1. Improvement of access road to Manila Port and expressways 2. Renovation of NAIA Terminal -1	1. Improvement of access road to Manila Port 2. Improvement od access road to expressway 3. Construction of city expressway that connects SLEX and NLEX	1. Improvement of access road from Manila Port to SLEX and NLEX 2. Construction of outer circumferential road that connects north to south bypassing Metro Manila	1. Improvement of access road to Manila Port	1. Construction of access road exclusively to the airport 2. Capacity expansion of Manila Port 3. Intallation of more pedestrian crossings/decks 4. Formulation of comprehensive traffic management plan	1. Improvement of access road to Manila Port 2. Improvement od access road to expressway	1. Improvement od access road to expressway

Source: JICA Study Team

(3) Poor Access between Expressways and Manila Seaport and Airport

Many Japanese firms have raised concern about the poor access to expressways from Manila Seaport and Airport. Cargoes arrive at the seaport and airport has to be transported to their factories through South Luzon and North Luzon expressways via heavily congested city roads. Travel along congested city roads hampers the timely and efficient transport of imported materials to their respective factories. Furthermore, transport of goods between factories in the north and the south is also hampered by the absence of city expressways that connects south and north expressways

(4) Restricted Truck Operation

In addition to heavily congested city roads to the expressways, the law enforcement widely known as the “Truck Ban” restricts the travel of trucks along designated roads during designated times is another drawback to transport activities of Japanese firms.

Some of the other findings are summarized in **Table 6.5-10.**

Table 6.5-10 Summary of Findings from Interviews to Japanese Firms

1. Expected Impacts of the Project 1) If the project will lead to the lift of truck ban, the firm will be greatly benefited (TOYOTA) 2) Very favorable impacts on delivery of LP gas (ITOCHU) 3) Favorable impacts on delivery of products to consumers (AJINOMOTO, SUZUKI and HONDA) 4) Favorable impacts on delivery of imported good to local manufacturers (MITSUI)
2. Expected Change in Business Opportunities by the Project 1) Deduction of transport cost will increase companies profit and more aggressive business plant can be drawn. (ITOCHU, AJONOMOTO, MITSUI, NITTSU, SUZUKI and HONDA)
3. Proposed Improvements on Transport System 1) Improvement of access road to Manila Port and Expressways (All firms) 2) Renovation of NAIA Terminal -1 (TOYOTA, EPSON) 3) Construction outer Circumferential Road to bypass Metro Manila (AJINOMOTO, SUZUKI and HONDA) 4) Capacity expansion of Manila Seaport (MITSUI, NITTSU) 5) Comprehensive traffic management plan (NITTSU)

Source: JICA Study Team

6.5.7 Conclusion

Most firms that engage in the delivery of goods and services in Metro Manila express favorable opinion on the interchange construction as a quick impact project, but they have also expressed the desire for a fundamental solution to the Metro Manila traffic by introducing modal shift from vehicular transport to rail transport or introducing city expressways including construction of elevated expressways along EDSA as well as city expressways connecting North and South Expressways.

CHAPTER 7

STUDY OF ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

7.1 REVIEW OF LEGAL AND INSTITUTIONAL FRAMEWORK FOR SOCIAL AND ENVIRONMENTAL CONSIDERATIONS IN THE PHILIPPINES

7.1.1 EIA Procedure and EIA Related Laws and Regulations

(1) Laws and Regulations of Environmental Impact Assessment (EIA)

Any private or public projects or activities which are likely to have foreseen adverse effects on the natural and social environment are subject to the Philippine Environmental Impact Statement System (PEISS). Taking into consideration the potential negative impacts of the implementation of any project and other activities in the environment, the Philippine government had instituted measures to encourage the use of EIA as a planning and decision making tool.

PEISS is the set of laws, regulations, administrative orders and guidelines concerning EIA. Among some of the most important laws and guidelines are the following:

1) Presidential Decree No. 1586 (1978)

"An act establishing an Environmental Impact Statement (EIS) System, including other environmental management related measures and for other purposes" to be implemented by Environmental Management Bureau (EMB) created under section 16 of E.O. 192 dated June 10, 1987 replacing the National Environmental Protection Council (NEPC), the National Pollution Control Commission (NPCC), and the Environmental Center of the Philippines (ECP) and integrating their powers and functions in EMB.

2) Presidential Proclamation No. 2146 (1981) and No. 803 (1996)

"Proclaiming certain areas and types of projects as Environmentally Critical and within the scope of Environmental Impact Statement System establish under PD No. 1586".

3) DENR Administrative Order No. 30 Series of 2003 (DAO 03-30), Revised Procedural Manual (2007)

Providing the implementing rules and regulations (IRR) for the Philippine Environmental Impact Statement (EIS) System of PD No. 1586.

(2) Responsible Government Authorities

The review and supervision of PEISS are conducted by the Environmental Management Bureau, Department of Environment and Natural Resources (DENR-EMB). The Department of Environment and Natural Resources (DENR) is the government entity mandated to handle issues related to following five tasks described hereunder.

1) Assure the availability and sustainability of the country's natural resources through judicious use and systematic restoration or replacement, whenever possible;

2) Increase the productivity of natural resources in order to meet the demands for forest, mineral, and land resources of a growing population;

3) Enhance the contribution of natural resources for achieving national economic and social development;

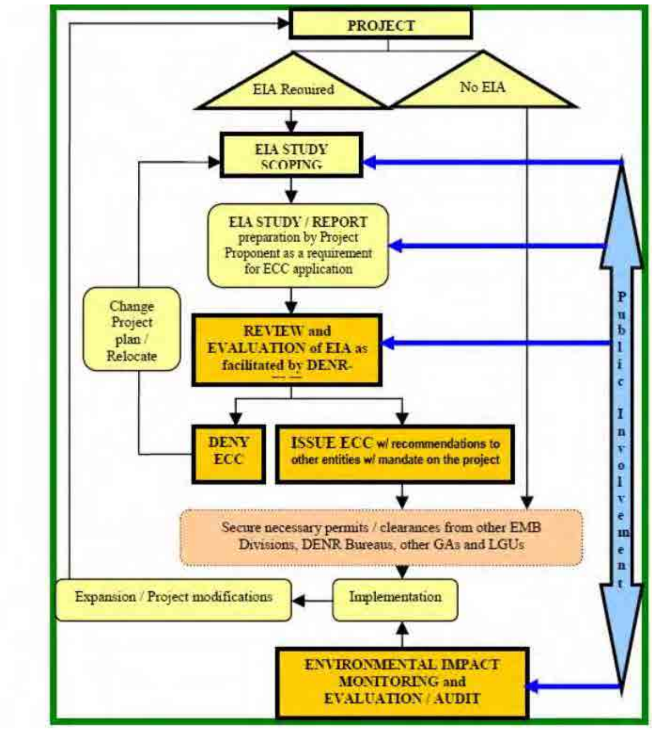
4) Promote equitable access to natural resources by the different sectors of the population;

5) Conserve specific terrestrial and marine areas representative of the Philippine natural and cultural heritage for present and future generations.

On the other hand, DENR-EMB is responsible for the issuance of decision making documents such as Environmental Compliance Certificate (ECC) and Certificate of Non-Coverage (CNC) for PEISS. For the programs and projects in respective regions, EMB Regional Offices are primarily responsible for the consultation and supervision of development projects.

(3) Process of PEISS

Application into the EIS System requires compliance with certain stages of the EIA Process. Requirements per EIA stage vary depending on the project group/type being applied for. A summary flowchart of the complete process is presented in **Figure 7.1-1**.



Legend

🟨	Proponent-driven
🟧	DENR-EMB-driven
▨	Public involvement, which typically begins at scoping but may occur at any stage of the EIA process
🟦	Proponent-driven but outside the EIA Process as requirements are under the mandate of other entities

Source: DENR Administrative Order No. 30 Series of 2003 (DAO 03-30), Revised Procedural Manual (2007)

Figure 7.1-1 Flow Chart of EIA Process in the Philippines

The Philippine EIA Process has six sequential stages Screening, Scoping, EIA Study and Report Preparation, EIA Review and Evaluation, Decision Making, and Post ECC Monitoring, Validation and Evaluation/Audit stage. The first five stages are those involved when a Proponent applies for ECC or CNC. In particular, for the stages of EIA Review and Evaluation driven by DENR-EMB, the maximum workdays are summarized in **Table 7.1-1**.

Table 7.1-1 EIS Review Duration in DENR-EMB

Review and Evaluation Steps	Estimated/Maximum Workdays in DENR-EMB
EMB-Controlled Review Process	120 days
Endorsement of Recommendation	15 days
Sign-off/ Issuance of Decision Document	15 days

Source: DENR Administrative Order No. 30 Series of 2003 (DAO 03-30), Revised Procedural Manual (2007)

(4) Projects Covered by PEISS

Projects which have been originally declared as Environmentally Critical Projects (ECPs) or projects in Environmentally Critical Areas (ECAs) presumed to have significant impacts on the quality of the environment are subject to PEISS. The four (4) ECP project types and twelve (12) ECA categories have been declared through Proclamation No. 2146 (1981) and Proclamation No. 803 (1996), as shown in **Table 7.1-2** and **Table 7.1-3.**

Table 7.1-2 Summary of Environmentally Critical Projects (ECPs)

Main Category	Sub-Category
A. Heavy Industries	• Non-Ferrous Metal Industries • Iron and Steel Mills • Petroleum and Petrochemical Industries • Smelting Plants
B. Resource Extractive Industries	• Major Mining and Quarrying Projects • Forestry Projects • Dikes for/and Fishpond Development Projects
C. Infrastructures	• Major Dams • Major Power Plants • Major Reclamation Projects • Major Roads and Bridges
D. Golf Courses	-

Source: DENR Administrative Order No. 30 Series of 2003 (DAO 03-30), Revised Procedural Manual (2007)

Table 7.1-3 Summary of Environmentally Critical Areas (ECAs)

ECA Categories	Examples
A. Areas declared by law as national parks, watershed reserves, wildlife preserves, and sanctuaries	• Areas of the National Integrated Protected Areas System Act
B. Areas set aside as aesthetic, potential tourist spots	• Areas declared and reserved by the Department of Tourism or other authorities for tourism development
C. Areas which constitute the habitat for any endangered or threatened species of indigenous Philippine wildlife (flora and fauna)	• Areas inhabited by indeterminate species, threatened species, rare species, endangered species
D. Areas of unique historic, archeological, geological, or scientific interests	• National historical landmarks, geological monuments, paleontological and anthropological reservations as designated or determined by the National Historical Institute, National Museum, National Commission for Culture and the Arts, National Commission on Geological Sciences, and other authorities
E. Areas which are traditionally occupied by cultural communities or tribes	• Ancestral lands maintained by the PANAMIN for national minorities • Areas that are occupied or claimed as ancestral lands or ancestral domains by indigenous communities
F. Areas frequently visited and or hard-hit by natural calamities (geologic hazards, floods, typhoons, volcanic activity, etc.	• Areas frequently visited or hard-hit by typhoons • Areas frequently visited or hard-hit by tsunamis • Areas frequently visited or hard hit by earthquakes • Storm surge-prone areas • Flood-prone areas • Areas prone to volcanic activities • Areas located along fault lines or within fault zones • Drought-prone areas
G. Areas with critical slope	• Lands with slope of 50% or more • Alienable and disposable forest lands and unclassified forests
H. Areas classified as prime agricultural lands	• Irrigated and irrigable areas and other areas mapped under the Network of Protected Areas for Agriculture of the Bureau of Soils and Water Management
I. Recharged areas of aquifers	• Areas of sources of water replenishment
J. Water bodies	• Areas that are tapped for domestic purposes • Areas which support wildlife and fishery activities
K. Mangrove Areas	• Tidal areas covered by salt-tolerant, intertidal tree species • Areas declared as mangrove swamp forest reserves
L. Coral Reefs	• Areas characterized by the assemblage of different types of marine plants and organisms • Areas identified by local sources such as the UP-Marine Sciences Institute, DENR-Coastal Environment Program to be rich in corals.

Source: DENR Administrative Order No. 30 Series of 2003 (DAO 03-30), Revised Procedural Manual (2007)

The required documents of projects subject to PEISS for consultation and decision making by EMB - DENR, are classified into five major groups as described in **Table 7.1-4.**

Table 7.1-4 Project Groups for EIA under PEISS

Group I	ECPs in either ECAs or NECAs (Environmentally Critical Projects in either Environmentally Critical Areas or Non-Environmentally Critical Areas)
Group II	NECPs in ECAs (Non-Environmentally Critical Projects in Environmentally Critical Areas)
Group III	NECPs in NECAs (Non-Environmentally Critical Projects in Non-Environmentally Critical Areas)
Group IV	Co-located Projects in either ECA or NECA
Group V	Unclassified Projects

Source: DENR Administrative Order No. 30 Series of 2003 (DAO 03-30), Revised Procedural Manual (2007)

The EIA-covered projects in Groups I, II and IV will require the hereunder listed depending on project type, location, magnitude of potential impacts and project threshold. For non-covered projects in Groups II and III, the PDR is required.

1) Environmental Impact Statement (EIS),
2) Programmatic EIS (PEIS),
3) Initial Environmental Examination Report (IEER), or
4) IEE Checklist (IEEC).
5) Project Description Report (PDR).

All documents should be prepared by the project proponent to be submitted to EMB Central Office or the Environmental Impact Assessment Division of the respective EMB Regional Offices. The outcome of the EIA Process within PEISS administered by the EMB-DENR is the issuance of decision documents. Decision documents may either be an ECC, CNC or a Denial Letter, described as follows:

1) An ECC is issued as a certificate of Environmental Compliance Commitment to which the Proponent conforms with, after DENR-EMB explains the ECC conditions.

2) A Certificate of Non-Coverage (CNC) certifies that, based on the submitted Project Description Report (PDR), the project is not covered by the EIS System and is not required to secure an ECC.

3) A Denial Letter shall contain an explanation for the disapproval of the application and guidance on how the application can be improved to a level of acceptability in the next EIA process.

For Group I projects, ECC application documents need to be submitted to EMB central office to have decisions by EMB Director or DENR Secretary. While, ECC application for Group II need to be submitted to EMB Regional Office to have decision making by the EMB Regional Director. **Table 7.1-5** summarizes Project Groups, EIA Report Types, Decision Documents, Deciding Authorities and Processing Duration.

Table 7.1-5 Summary of Project Groups, EIA Report Types, Decision Documents, Deciding Authorities and Processing Duration

Project Groups	Documents Required For ECC/CNC Application	Decision Document	Deciding Authority	Max Processing Duration
I: Environmentally Critical Projects (ECPs) in either Environmentally Critical Area (ECA) or Non-Environmentally Critical Area (NECA)	Environmental Impact Statement (EIS)	ECC	EMB Director / DENR Secretary	120 days (Working Days)
II: Non- Environmentally Critical Projects (NECPs) in Environmentally Critical Area (ECA)	Environmental Impact Statement (EIS) / Initial Environmental Examination Report (IEER) / Initial Environmental Examination Checklist (IEEC) / Project Description Report (PDR)	ECC	EMB RO Director	15-60 days (Working Days)
III: Non-Environmentally Critical Projects (NECPs) in Non- Environmentally Critical Area (NECA)	Project Description Report (PDR)	CNC	EMB Director / EMB RO Director	15 days (Working Days)
IV: Co-located Projects	Programmatic Environmental Impact Statement (PEIS)	ECC	DENR Secretary	180 days (Working Days)
V: Unclassified Projects	Project Description Report (PDR)	CNC or Recommendation on Final Grouping and EIA Report Type	EMB Director / DENR Secretary / EMB RO Director	15 days (Working Days)

Source: DENR Administrative Order No. 30 Series of 2003 (DAO 03-30), Revised Procedural Manual (2007)

(5) Scope of Items to be Examined and Contents to be Assessed in the EIA/IEER reports

As previously discussed, depending on project type, location, magnitude of potential impacts and project threshold, EIS, IEER or PDR will be required. According to the Memorandum Circular NO.2010-14 “Standardization of Requirements and Enhancement of Public Participation in the Streamlined Implementation of the Philippine EIS System” by DENR (June 29 2010), the outline for EIA Reports for proposed new single projects is shown in **Table 7.1-6**. The contents to be assessed in the IEER are outlined in **Table 7.1-7.**

Table 7.1-6 Outline of EIA Reports for Proposed (New) Single Projects

Project Fact Sheet
Table of Contents
Executive Summary

- I. Project Description
  - 1.1 Project Location and Area
  - 1.2 Project Rationale
  - 1.3 Project Alternatives
  - 1.4 Project Components
  - 1.5 Process/Technology Options
  - 1.6 Project Size
  - 1.7 Development Plan, Description of Project Phase and Corresponding Timeframes
  - 1.8 Manpower
  - 1.9 Indicative Project Investment Cost
- II. Analysis of Key Environmental Impacts
  - 2.1 Land
    - 2.1.1 Land Use and Classification
    - 2.1.2 Geology and Geomorphology
    - 2.1.3 Pedology
    - 2.1.4 Terrestrial Biology
  - 2.2 Water
    - 2.2.1 Hydrology & Hydrogeology
    - 2.2.2 Oceanography
    - 2.2.3 Water Quality
    - 2.2.4 Freshwater or Marine Biology
  - 2.3 Air
    - 2.3.1 Meteorology/Climatology
    - 2.3.2 Air Quality (and Noise)
  - 2.4 People
    - 2.4.1 Identify settlers that will be displaced from among the existing settlers
    - 2.4.2 Discuss the in-migration patterns impact as a result of project implementation
    - 2.4.3 Discuss the impacts on IPs and Culture/Lifestyle (if any)
    - 2.4.4 Discuss the project implementation's threat to public health vis-a-vis the baseline health conditions in the area
    - 2.4.5 Discuss local benefits expected from project implementation
    - 2.4.6 Discuss how the project would affect the delivery of basic services and resource competition in the area
    - 2.4.7 Discuss how the project would affect traffic situation in the area
    - 2.4.8 Identify entity to be accountable for environmental management in the area
    - 2.4.9 Discuss how the project would affect existing properties in the area in terms of relocation and devaluation
    - 2.4.10 Identify affected properties
- III. Environmental/Ecological Risk Assessment
- IV. Impacts Management Plan
- V. Social Development Framework and IEC Framework
- VI. Environmental Compliance Monitoring
- VII. Emergency Response Policy and Generic Guidelines
- VIII. Abandonment/ Decommissioning/Rehabilitation Policies and Generic Guidelines
- IX. Institutional Plan for EMP Implementation

Bibliography/References
Annexes

Source: DENR Memorandum Circular NO. 2010-14, Annex 1-A, June 2010

Table 7.1-7 Initial Environmental Examination Report (IEER) Outline

Project Fact Sheet
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III. Project Description
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    4.1 Land
        - Land use, Pedology, Geology, Geomorphology, Terrestrial biology
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        - Hydrology, Oceanography, Water Quality, Freshwater Biology, Marine Biology
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V. Environmental Management Plan (EMP)
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Source: DENR Administrative Order No. 30 Series of 2003 (DAO 03-30), Revised Procedural Manual (2007)

(6) Public Participation, Public Consultation and Information Disclosure

The PEISS places importance in public participation. According to DENR Administrative Order No. 30 Series of 2003 (DAO 03-30), Revised Procedural Manual (2007), public participation shall be demonstrated through the following activities:

1) The Information, Education and Communication (IEC) with Local Government Units (LGUs) is now explicitly required at the minimum of PEIS/EIS based applications for new or modification proposals as part of the social preparation process of which Public Scoping requirement. The IEC serves as a basis for preliminary identification of stakeholders and related issues in preparation for the Scoping proper.

2) The issues and concerns raised during the Public Scoping for PEIS/EIS-based new projects is a necessary community inputs to the succeeding Technical Scoping of the EIA Review Team with the proponent. The participants of the public scoping consist of key stakeholder representatives, EMB personnel, EIA Review Committee and the Proponent/Preparer representatives. The output will be the Scoping Checklist that comprises the final TOR of the EIA Study.

3) The conduct of the EIA Study shall include local stakeholders, who may serve as local expert sources, aides/guides and resource persons in primary data collection to optimize access to indigenous knowledge of the environment, or as interviewers/ interviewees in the socio-economic/perception surveys which shall be used as the basis for the subsequent formulation of social development plans, IEC, monitoring plans and other components of the environmental management plan.

4) As a form of disclosure of the EIA findings, Public Hearing is required for all new ECPs for which Public Scoping was undertaken and for PEIS-based applications. A waiver of the Public Hearing requested by the Proponent may be granted by the DENR-EMB subject to the absence of mounting opposition or written request for one with valid basis and Public Consultation may be conducted instead of Public Hearing. The Notice of Public Hearing provides explicit instructions on registration, access to the EIA Report (with Project Fact Sheet written in the local dialect or mixed with the popularly known language of the host communities), preparation of position papers, and on the mechanics of how issues may be received before or during the hearing. Prior to Public Hearings or Public Consultations, the Proponent is required to give copies of the full EIA Report to the EMB Regional Offices and host municipalities; copies of Executive Summary to the host barangays; and copies of Project Fact Sheets to other stakeholders for a well-informed participation in the hearing/consultation process.

5) Once an ECC/CNC is issued, the EIA recommendations are transmitted by the DENR-EMB to the concerned LGUs and government agencies to be considered in their decision-making process. This results in a more integrated, coordinated and participative safeguarding of environmental concerns.

(7) Environmental Monitoring and Audit

1) Objectives

Under the Philippine EIS System, the primary purpose of monitoring, validation and evaluation/audit is to ensure the judicious implementation of sound environmental management within a company/corporation and its areas of operation as stipulated in the ECC and other related documents. Specifically, it aims to ensure the following:

- ✓ Compliance with the conditions set in the ECC;
- ✓ Compliance with the Environmental Management Plan commitments;
- ✓ Effectiveness of environmental measures on prevention or mitigation of actual project impacts vis-a-vis the predicted impacts used as basis for the EMP design; and
- ✓ Continuous updating of the EMP for sustained responsiveness in addressing environmental impacts of undertakings.

2) Role and Responsibilities

a) Project Proponent

The Proponents with issued ECCs are primarily responsible for monitoring their projects.
A proponent is required to submit an ECC Compliance Monitoring Report (CMR) to the designated monitoring EMB office on a semiannual frequency. The detailed report on compliance to environmental standards specific to environmental laws shall be submitted through the Self-Monitoring Report (SMR) on a quarterly basis to the concerned EMB office.

b) Multi-partite Monitoring Team (MMT)

The MMT is primarily responsible for validating the proponent's environmental performance and submits findings/recommendations to EMB.
MMTs are organized whenever required in the issued ECC (especially for ECPs) to encourage public participation, to promote greater stakeholder vigilance and to provide appropriate check and balance mechanisms in the monitoring environmental impacts of project implementation. MMTs have the following specific functions:

i) Validate project compliance with the conditions stipulated in the ECC and the EMP;

ii) Validate Proponent's conduct of self-monitoring;

iii) Receive complaints, gather relevant information to facilitate determination of validity of complaints or concerns about the project and timely transmit to the Proponent and EMB recommended measures to address the complaint;

iv) Prepare, integrate and disseminate simplified validation reports to community stakeholders;

v) Make regular and timely submission of MMT Reports based on the EMB-prescribed format.

The Compliance Monitoring and Validation Report (CMVR) shall be submitted semi-annually to the concerned EMB Regional Office, with the Proponent's CMR/SMR as attachment. Moreover, the second CMVR shall preferably present a qualitative desk-validation of the trend analysis report and cumulative environmental performance of the Proponent.

c) EMB

The Environmental Management Bureau shall be primarily responsible for the over-all evaluation/audit of the Proponent's monitoring and the MMT's validation.
Table 7.1-8 summarize monitoring, validation and evaluation/audit schemes undertaken by monitoring entities above.

Table 7.1-8 Monitoring, Validation and Evaluation/Audit Schemes

Monitoring Aspects		Frequency / Timing		
		Proponent Self-Monitoring	MMT Validation of Proponent's Performance	EMB Evaluation/Audit
A. Compliance Reporting	ECC	Semi-annual in CMR	Semi-annual in CMVR[2]	Semi-annual in CER[3]
	EMP[1]	Semi-annual in CMR	Semi-annual in CMVR[2]	Semi-annual in CER[3]
	Environmental Standards (under specific environmental laws)	Detailed report in Quarterly SMR; Summary of compliance in semi-annual CMR	Semi-annual in CMVR[2]	Semi-annual in CER[3]
B. Field Validation		-	Semi-annual	Semi-annual, or whenever there are complaints, exceedance of standards, suspicious data[4]
C. Effectiveness of Environmental Management Measures	Sampling and Measurement	Monthly/ Continuous as committed in the EMOP within the EMP	Only in cases of complaints/ exceedance of standards/ Suspicious data	As the need arises in coordination with the MMT[4]
	Trend Analysis/ Cumulative Performance Report[5]	2nd semi-annual CMR; 4th Quarter SMR	2nd semi-annual CMVR	2nd semi-annual CER

Source: DENR Administrative Order No. 30 Series of 2003 (DAO 03-30), Revised Procedural Manual (2007)

Note: 1) The EMP (Environmental Management Plan) is composed of the Impacts Management Plan (IMP), the Social Development Plan (SDP), Information Education and Communication (IEC) Plan,

2) CMVR has the Proponent's CMR/SMR as an attachment

3) The Compliance Evaluation Report (CER) is prepared by the EMB Case Handler/staff and shall attach the Proponent's CMR/SMR and MMT's CMVR

4) The composite EMB Team (if project has no MMT) conducts validation, or if the Proponent has an existing MMT, the EMB personnel undertake validation as a member of the MMT. Should a composite team be needed to address a mix of issues within the respective mandate of the EMB divisions/units, the EMB composite team shall join the particular MMT validation activity so that there is only one integrated group validating the issues.

5) Trend Analysis is undertaken on key significant environmental parameters in relation to standards while Cumulative Performance Report is done on applicable key significant impacts and measures.

(8) Comparison of PEISS and JICA Guidelines/World Bank (WB) Safeguard Policies

In comparison to the "JICA Guidelines for Environmental and Social Considerations (2002 April)" (hereafter referred to as JICA Guidelines) and World Bank Operational Policy 4.01 - Environmental Assessment (hereafter referred to as WB OP 4.01), there are no variances in terms of the objectives of the JICA Guidelines/WB OP 4.01 and the Philippines' goal as provided in its constitution, environmental policies, EIS system law, and local government code.

7.1.2 Other Environmental Laws and Regulations Concerning the Project

Major environmental laws and regulations, which may be relevant to the interchange projects, must be observed. The PEISS states obligations to strictly comply with the environmental laws, regulations and standards, which have been established by the Philippine government. When project type, location, scale, and magnitude of potential impacts are clarified, all concerning laws and regulations should be identified to examine the requirements.

(1) Environment Code, Presidential Decree No. 1152

Known as the Philippine Environment Code, it launches a comprehensive program on environmental protection and management. It also provides for air, water quality, land use, natural resources and waste management for fisheries and aquatic resources; wildlife; forestry and soil conservation; flood control and natural calamities; energy development; conservation and utilization of surface and ground water and mineral resources.

(2) Water Code, Presidential Decree No. 1067

A decree instituting a water code which revised and consolidated the laws governing the ownership, appropriation, utilization, exploitation, development, conservation and protection of water resources.

(3) Clean Water Act, Republic Act 9275

An Act which aims to protect the country's water bodies from pollution of all possible sources (industrial, commercial, agriculture and household activities). It provides for a comprehensive and integrated strategy to prevent and minimize pollution through a multi-sectoral and participatory approach involving all the stakeholders.

(4) Clean Air Act of 1999, Republic Act No. 8749

An Act which lays down policies to prevent and control air pollution. The act sets standards of exhaust gas from vehicles, manufacturing plants and so on to follow. All potential source of air pollution must comply with the provisions of the Act. As such, all emissions must be with in the air quality standards set under the law. It also imposes the appropriate punishments for violators of the law.

(5) Ecological Solid Waste Management Act, Republic Act No. 9003 (2000)

An Act providing for an ecological solid waste management program, creating the necessary institutional mechanisms and incentives, declaring certain acts prohibited and providing penalties, appropriating funds thereof, and for other purposes.

(6) Pollution Control Law, Presidential Decree No. 984

An Act that serves as the foundation for managing industrial activities which create impacts on air and water quality. It empowers the DENR to impose ex-parte cease and desist orders (CDO) on the grounds of immediate threat to life, public health, safety or welfare, or to animal or plant life when wastes or discharges exceed the normal.

(7) Forestry Reform Code, Presidential Decree No. 705

The Forestry Reform Code of the Philippines recognizes that there is an urgent need for proper classification; management and utilization of the lands of the public domain to maximize their productivity to meet the demands of the increasing population of the Philippines. It surmises that to achieve the above purpose, it is necessary to reassess the multiple uses of forest lands and resources before allowing any utilization to optimize the benefits that can be derived. It emphasizes not only the utilization but also more on the protection, rehabilitation and development of forest lands to ensure the continuity of their productive condition.

7.1.3 Legal and Institutional Framework for Social Consideration

(1) Laws and Regulations on Social Consideration

The policy framework governing Resettlement Action Plans for Structures and Land is derived from the Philippine Constitution, Republic Act (RA) 8974, RA 8371 or the Indigenous Peoples' Rights Act, Environmental and Social Safeguards Policies of the financing institutions and other applicable laws.

The various provisions, laws, policies and guidelines governing the operation and implementation of resettlement action plans and safeguards for indigenous peoples are listed below.

1) 1987 Constitution of the Republic of the Philippines

The national basic policy on land acquisition and involuntary resettlement is based on the following articles.

Article III, Bill of Rights, Section 1: "No person shall be deprived of life, liberty, or property without due process of law, nor shall any person be denied the equal protection of the laws."

Article III, Bill of Rights, Section 9: "Private property shall not be taken for public use without just compensation."

Article XIII, **Urban Land Reform and Hosing, Section 9**: "The State shall, by law, and for the common good, undertake, in cooperation with the private sector, a continuing program of urban land reform and housing which will make available at affordable cost, decent housing and basic services to under-privileged and homeless citizens in urban centers and resettlement areas. It shall also promote adequate employment opportunities to such citizens. In the implementation of such program the State shall respect the rights of small property owners."

Article XIII, **Urban Land Reform and Hosing, Section 10**: "Urban or rural poor dwellers shall not be evicted nor their dwelling demolished, except in accordance with law and in a just and humane manner. No resettlement of urban or rural dwellers shall be undertaken without adequate consultation with them and the communities where they are to be relocated."

2) RA 7167- Local Government Code of 1991

According to Section 19, the power of eminent domain may not be exercised unless a valid and definite offer has been previously made to the owner, and such offer was not accepted. The local government unit may immediately take possession of the property upon the filing of the expropriation proceedings and upon making a deposit with the proper court of at least fifteen percent (15%) of the fair market value of the property based on the current tax declaration of the property to be expropriated, and further the amount to be paid for the expropriated property shall be determined by the proper court, based on the fair market value at the time of the taking of the property.

3) RA 7279- Urban Development and Housing Act of 1992

The mandate of RA 7279 is to 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. Also the act provides 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:

✓ 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 playgrounds.

✓ When government infrastructure project with available funding are about to be implemented.

✓ When there is a court order for eviction and demolition.

Section 21: Basic Services. Socialized housing or resettlement areas shall be provided by the LGUs or the National Housing Authority (NHA) in cooperation with the private developers and concerned agencies with the following basic services and facilities: (a) Potable water; (b) Power and electricity and an adequate power distribution system; (c) Sewerage facilities and an efficient and adequate solid waste disposal system; and (d) Access to primary roads and transportation facilities.

The provision of other basic services and facilities such as health, education, communication, security, recreation, relief and welfare shall be planned and shall be given priority for implementation by the local government unit and concerned agencies in cooperation with the private sector and the beneficiaries themselves.

4) RA 8974- An Act to Facilitate the Acquisition of Right-of-Way, Site, or Location for National Government Infrastructure Projects and for Other Purposes

RA 8974 establishes a uniform basis for determining just compensation for immediate possession of the property involved in eminent domain proceedings.

Section 4: Guidelines for Expropriation Proceedings: Whenever it is necessary to acquire real property for the ROW or location for any national government infrastructure project through expropriation, the appropriate implementing agency shall initiate the expropriation proceedings before the proper court under the following guidelines:

i) agency shall immediately pay the owner of the property the amount equivalent to the sum of one hundred percent (100%) of the value of the property based on the current relevant zonal valuation of the Bureau of Internal Revenue (BIR); and the value of the improvements and/or structures;

ii) where there is no zonal valuation, the BIR is mandated within the period of 60 days from the date of expropriation case to come up with the zonal valuation of the area;

iii) if there is no existing valuation, the implement agency shall immediately pay the owner its proffered value based on standards as follows:

Section 5: Standards for the Assessment of the Value of the Land Subject of Expropriation Proceedings or Negotiated Sale:

a) Classification and use for which property is suited;

b) The development costs for improving the land;

c) The value declared by the owners;

d) The current selling price of similar lands in the vicinity;

e) The reasonable disturbance compensation for the removal or demolition of certain improvements on the land and for the value of improvements;

f) The size, shape or location, tax declaration and zonal valuation of the land.

Section 9: Squatter Relocation: The government through the NHA, in coordination with the LGUs and implementing agencies concerned, shall establish and develop squatter relocation sites, including the provision of adequate utilities and services, in anticipation of squatters that have to be removed from the right-of-way or site of future infrastructure projects. Whenever applicable, the concerned local government units shall provide and administer the relocation sites.

5) Indigenous Peoples' Rights Act (IPRA) of 1997

The IPRA sets conditions, requirements, and safeguards for plans, programs, and projects affecting Indigenous Peoples (IPs). It spells out and protects the rights of IPs. The important provisions of the IPRA are:

a) The right to their ancestral domains (Chapter III, Section 11);

b) The right to an informed and intelligent participation in the formulation and implementation of any project, government or private, that will impact upon their ancestral domains (Chapter III, Section 7b);

c) The right to participate fully, if they so choose, at all levels of decision-making in matters which may affect their rights, lives and destinies through procedures determined by them (Chapter IV, Section 16);

d) The right to receive just and fair compensation for any damages inflicted by or as a result of any project, government or private (Chapter III, Section 7b);

e) The right to stay in their territory and not to be removed from that territory. If relocation is necessary as an exceptional measure, it can only take place with free and prior informed consent of the IPs and Indigenous Cultural Communities (ICCs) concerned (Chapter III, Section 7c);

f) The right to secure the lands to which they have been resettled (Chapter III, Section 7d);

g) The right to determine and decide their own priorities for the lands they own, occupy, or use (Chapter IV, Section 17);

h) The right to maintain, protect, and have access to their religious and cultural sites (Chapter IV, Section 33);

i) The IPRA also created the National Commission on Indigenous Peoples (NCIP) to carry out the policies set forth in the IPRA. The NCIP has issued a number of orders that puts into operation the provisions of the IPRA; the most important for the purposes of this policy is NCIP Administrative Order No. 1 or the Free and Prior Informed Consent Guidelines of 2006.

6) Regulations and Policies of DPWH

DPWH has the largest number of land acquisition cases among the project implementing authorities. Therefore DPWH has independently established the following department orders and manuals on the land acquisition and resettlement procedures.

a) Department Order No.5 (2003), "Creation of the Infrastructure Right of Way and Resettlement Project Management Office (PMO) and the Implementation of the Improved IROW Process"

- ✓ A Land Acquisition Plan and Resettlement Action Plan (LAPRAP) shall be prepared for all projects, whether local or foreign funded, that will require ROW acquisitions, using a standardized compensation package.
- ✓ The determination of Affected Persons (APs) and improvements shall be based on the cut-off date, which is the start of the census of APs and tagging for improvements.

- ✓ The Implementing Office shall prepare the final as-built ROW Plan upon completion of the project, for submission to the IROW and Resettlement PMO.
- ✓ The Implementing Office shall ensure that Infrastructure Right of Way (IROW) costs are always included in project budgets.

b) Infrastructure Right-of-Way (IROW) Procedural Manual (2003)

This Procedure Manual was developed to guide various offices of DPWH in the proper implementation of the IROW Process, in line with Department Order No.5 (2003), which aims to implement streamlined IROW process designed to identify, acquire, and manage ROW efficiently and in a timely manner for the implementation of infrastructure project.

c) Department Order No.327 (2003), Guidelines for Land Acquisition and Resettlement Action Plans (LAPRAP) for Infrastructure Projects"

- ✓ LAPRAP document shall describe 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 shall be prepared using inputs from the IROW Action Plan, the census and socioeconomic survey conducted, detailed engineering study, and parcellary survey results.
- ✓ LAPRAP shall be the basis for qualifying and compensating APs for lands, structures and/or improvements that are partially or fully affected by the Department's infrastructure projects.
- ✓ Provision of resettlement sites shall be the responsibility of the LGUs concerned, with assistance from the concerned government agencies tasked with providing housing.
- ✓ An Indigenous People's Action Plan (IPAP) shall be formulated for IPs if they are affected by the Department's infrastructure projects.

d) Land Acquisition, Resettlement, Rehabilitation and Indigenous Peoples' Policy (LARRIPP), 3rd edition (2007)

The first Land Acquisition, Resettlement and Rehabilitation Policy (LARR) was formulated in 1999 specifically for the World Bank assisted Program. Thereafter, this Policy of 1999 was adopted, with some modifications in pursuance to prevailing laws and policies, by other financing institutions such as the Asian Development Bank (ADB) and the Japanese Bank International for Cooperation (JBIC) in their projects.

The 3rd edition 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.

This policy includes the principles and objectives of the involuntary resettlement policy, the legal framework, eligibility, compensation and entitlements, the indigenous peoples' policy framework, implementation procedures that ensure complaints are processed, public support and participation, and the provision of internal and external monitoring of the implementation of the RAP and safeguard instruments for Indigenous Peoples.

(2) Responsible Government Authorities

There is no government authority in charge to specialize the land acquisition and resettlement in the Philippines. The project proponent (e.g., DPWH) handles the land acquisition and resettlement. Aside from DPWH, the following agencies handling various projects have the opportunity to implement ROW acquisition.

- ✓ National Housing Authority
- ✓ National Power Corporation
- ✓ Transmission Corporation
- ✓ National Irrigation Administration
- ✓ Department of Agrarian Reform

However, only DPWH has developed its own guidelines and manuals. Accordingly other agencies follow DPWH procedures and/or international donors' safeguard policies.

(3) Comparison of Philippines Policies and JICA Guidelines/ WB Safeguard Policies on Involuntary Resettlement

The Philippines policies on resettlement and compensation have been fundamentally harmonized with JICA Guidelines and WB Safeguard Policies. However, there are some discrepancies in the process of land acquisition and replacement cost for compensation. Although no regulations are stipulated in the government laws, for DPWH projects, the RAP shall include public participation and consultation, grievance procedures, institutional arrangements, monitoring and evaluation in accordance with DPWH's policy (LARRIPP, 2007). **Table 7.1-9** summarizes the comparison of relevant regulations in the Philippines and JICA Guideline/WB Policies on involuntary resettlement.

Table 7.1-9 Comparison of Relevant Regulations in the Philippines and JICA Guideline/World Bank Policies on Involuntary Resettlement

JICA Guidelines/World Bank OP4.12	Laws of the Philippines	Comparison/Gaps	Policy and/or Recommendations to bridge the comparison/Gaps
Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. When, after such an examination, avoidance is proved unfeasible, effective measures to minimize impact and to compensate for losses must be agreed upon with the people who will be affected.	No person shall be deprived of life, liberty, or property without due process of law, nor shall any person be denied the equal protection of the laws (Constitution of the Republic of the Philippines, Article III, Section 1). The right to stay in their territory and not to be removed from that territory. If relocation is necessary as an exceptional measure, it can only take place with free and prior informed consent of the IPs and ICCs concerned (IPRA of 1997, Chapter III, Section 7c)	There are no directly corresponding provisions in laws and regulations of the Philippines, but no significant deviations are observed in the Philippines' policies on involuntary resettlement.	-
For projects that will result in large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc.	A Land Acquisition Plan and Resettlement Action Plan (LAPRAP) shall be prepared for all projects, whether local or foreign funded, that will require ROW acquisitions, using a standardized compensation package (Department Order No.5, 2003). LAPRAP document shall describe the project, expected impacts and mitigating measures, socio-economic profile of APs, compensation package, timetable of implementation, institutional arrangements, participation, consultation and grievance procedures (IROW Procedural Manual, 2003).	There are no government laws and regulations to stipulate preparation of RAP in the Philippines. However, in DPWHs policy (LARRIPP, 2007), RAP shall include public participation and consultation, grievance procedures, institutional arrangements, monitoring and evaluation.	The Project Resettlement Policy is in line with DPWH's LARRIP policy and WB OP4.12/JICA guidelines.
Compensation must be based on the full replacement cost as much as possible.	Zonal value as the first offer: In case the mode of acquisition is through a negotiated sale, the first offer shall be the zonal value of the particular land where the property is located, as determined by the BIR. In case the owner rejects the first offer, the DPWH shall renegotiate using the values recommended by the Appraisal Committee or Independent Land Appraiser (ILA) as a guide for negotiation (RA 8974)	The BIR zonal valuation is determined based on the past records of land selling and so differs from ILA valuation.	The Project Policy on compensation is based on the full replacement cost in line with DPWH's LARRIP policy and W B OP4.12/JICA guidelines.

JICA Guidelines/World Bank OP4.12	Laws of the Philippines	Comparison/Gaps	Policy and/or Recommendations to bridge the comparison/Gaps
Appropriate participation by affected people and their communities must be promoted in the planning, implementation, and monitoring of resettlement action plans and measures to prevent the loss of their means of livelihood. In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance.	The information campaign will also convey to the PAPs the available channels for complaints and grievances and related procedures. In this respect the PAPs will be informed that grievances from the PAPs related to LARRIPP implementation or any aspect of the project will be handled through negotiations and are aimed at achieving consensus (LARRIPP, 2007). The women, children, and elderly who are among the PAPs shall likewise be consulted and mobilized to participate in the consultation meeting and discuss with them the socio-cultural implication of the Resettlement Action Plan (LARRIPP, 2007).	There are no government laws and regulations on public participation in the Philippines. However, in DPWHs policy (LARRIPP, 2007), RAP shall include public participation and consultation, grievance procedures, institutional arrangements, monitoring and evaluation.	The Project Resettlement Policy is in line with DPWH's LARRIP policy and WB OP4.12/JICA guidelines.
People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.	Other types of assistance and entitlements other than compensation for land and lost assets include disturbance compensation, income loss, inconvenience allowance, rehabilitation assistance, rental subsidy and transportation allowance or assistance (LARRIPP, 2007).	There are no government laws and regulations on livelihood recovery in the Philippines. However, there are no deviations in DPWH's policy (LARRIPP, 2007).	The Project Resettlement Policy is in line with DPWH's LARRIP policy and WB OP4.12/JICA guidelines.
After projects begin, project proponents etc. monitor whether any unforeseeable situations occur and whether the performance and effectiveness of mitigation measures are consistent with the assessment's prediction. Project proponents etc. should make efforts to make the results of the monitoring process available to local project stakeholders.	The main objective of monitoring the implementation of the RAPs is to see whether or not the RAPs are being carried out in accordance with the LARRIPP. It involves the monitoring of land acquisition, payment of compensation for lost assets, and resettlement of persons severely affected by the project. Internal and external monitoring shall regularly be conducted. The External Monitoring Agent shall include during the monitoring, the results of the disclosure of the LARRIPP, RAP to the PAPs during the public consultation conducted for each project contract packages (LARRIPP, 2007).	There are no government laws and regulations on monitoring and evaluation in the Philippines. However, there are no deviations in DPWH's policy (LARRIPP, 2007).	The Project Resettlement Policy is in line with DPWH's LARRIP policy and WB OP4.12/JICA guidelines.

Source: JICA Study Team based on the information provided by JICA

7.2 BASELINE CONDITIONS

7.2.1 Natural Environment

The project sites of four interchanges are located in a highly built-up and urbanized area in the Quezon City.

(1) Geology and Geomorphology

Quezon City, located within Metro Manila, is situated in a tectonically active region known as the Philippine Mobile Belt. Being a part of this region, Metro Manila has experienced high magnitude earthquakes in recent history. Major structural features, which could generate the earthquake and which can affect Quezon City, include the Valley fault system, which is approximately 6 - 7 km away from Metro Manila, these structural features was the sources of major earthquake events in the past.

Several earthquake generators such as the Philippine Fault Zone, the Casiguran Fault, the Lubang Fault, the Manila Trench, and the nearby Valley Fault System (formerly the Marikina Valley Fault System) among others, may cause immense ground movements, according to the Philippine Institute of Volcanolgy and Seismology (http://www.phivolcs.dost.gov.ph/).

1) Stratigraphy

According to the 1983 geologic map of the Mines and Geosciences Bureau, the project site is underlain mainly by the Guadalupe Formation. This formation consists of thin to medium-bedded, fine grained vitric tuffs and welded volcanic breccias with subordinate amount of tuffaceous, fine to medium-grained sandstone.

The Guadalupe Formation extends to the south towards Parañaque and to the north towards the Caloocan-Novaliches-Bulacan area. It is limited to the western side of Metro Manila by the West Marikina Valley Fault. Unconsolidated rock units belonging to the Quaternary Alluvium overlie the Guadalupe Formation west of Quezon City.

Quaternary alluvial deposits that veneer the rock units belonging to the Guadalupe Formation are composed of silts, sands and unconsolidated or very poorly consolidated pebbles, cobbles and small boulders of the underlying rock types.

2) Topography

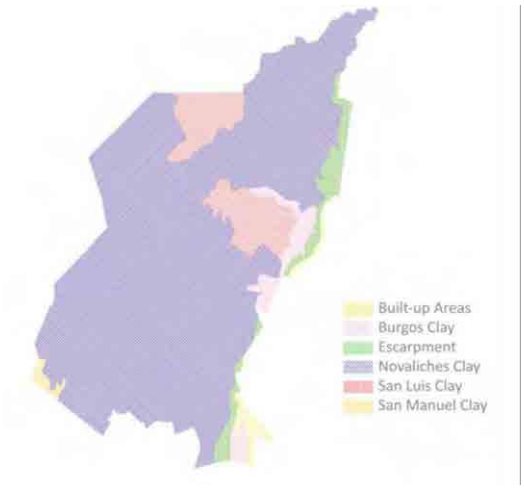
Metro Manila's topography is dominated by the coastal deltaic plain and the Guadalupe Plateau. The deltaic plain is occupied by the Municipality of Navotas, the Cities of Manila and Parañaque and parts of Cavite. The Guadalupe Plateau, where the project site is located, lies on the western side of the coastal plain. It is an elevated feature that extends from Novaliches in the north to Parañaque in the south. The eastern side of the plateau borders the deltaic plains of Manila while the western side ends at the Marikina Valley.

3) Geomorphology

In general, there are two broad geomorphologic units in the Metropolitan Manila Area, namely, the north-south trending plateau and the flat-lying alluvial (Marikina flood plain) and deltaic sediments (Pasig River delta plain), which are situated on either sides of Marikina Rivers are two major river systems that drain off the area with several tributaries feeding it from the north and east of the Metropolitan Manila Area. The plateau or the central elevated portion averages about 10 to 30 meters above mean sea level with highest elevation of 70 meters located in Quezon City. While the Pasig River delta plain has an average elevation of less than 5 meters, which is roughly of concave shape, poor drainage and gently sloping towards Manila Bay. This plain is mainly of beach and estuarine deposits in the north and in the south are lagoonal and beach sediments derived from the clastics formerly and actively dumped by the Pasig River itself. Similarly, the Marikina floodplain is composed of alluvial sediments deposited by the Marikina River (Quezon City Socio-Ecological Profile, 2010).

4) Pedeology

A survey by the Bureau of Soils and Water Management showed that Quezon City has five soil types, namely; the Novaliches Loam Series, San Luis Clay, San Manuel Clay, Burgos Clay and Escapment. The Novaliches Loam series is the predominant soil type commonly called “adobe” and it is mainly characterized as hard and compact. (Quezon City Socio-Ecological Profile, 2010) The project sites are situated belong to the Novaliches Loam Clay Loam (**Figure 7.2-1**).



Source: Quezon City Socio- Ecological Profile, 2010

Figure 7.2-1 Soil Map

(2) Climate

The climate in Quezon City is typical of Metro Manila’s, which has a distinct dry season from December to April and wet season from May to November. The normal annual rainfall total is

2,532.3 mm with the maximum mean monthly total rains being experienced in August with 526.8 mm and the minimum in February with 8.9 mm. The maximum number of 24-rainy days occurs in August while the minimum of two-rainy days occurs in February. The annual total number of rainy days is 153 while the average temperature is lowest at 20.4° C in January and highest at 34.9°C in April. The meteorological data is summarized in **Table 7.2-1**.

Table 7.2-1 Meteorological Data

Month	Rainfall		Temperature			Relative Humid [%]	MSLP	Wind	
	Amount [mm]	No. of RD	Max [^{o}C]	Min [^{o}C]	Mean [^{o}C]			Dir.	Speed [m]
JAN	19.5	4	30.4	20.4	25.4	76	1012.2	NE	1
FEB	8.9	2	31.6	20.6	26.1	71	1012	NE	1
MAR	22.9	3	33.3	21.6	27.4	67	1011.5	SE	2
APR	35.1	4	34.9	23.3	29.1	65	1009.9	SE	2
MAY	160.4	12	34.6	24.4	29.5	71	1008.5	SE	2
JUN	311.6	18	32.9	24.3	28.6	79	1007.9	SW	2
JUL	504.1	22	31.6	23.9	27.8	83	1007.3	SW	2
AUG	526.8	24	31.1	23.9	27.5	84	1007.2	SW	2
SEP	391.7	22	31.5	23.7	27.6	84	1008.2	SW	1
OCT	312	19	31.3	23.2	27.3	83	1008.6	N	1
NOV	155.5	14	31.1	22.4	26.7	81	1010	N	1
DEC	83.9	9	30.3	21.3	25.8	79	1011.6	N	1
ANNUAL	2532.3	153	32.7	22.7	27.4	77	1009.6	SW	2

Source: PAGASA Station 430, Science Garden, Quezon City, Latitude : 14°39' N, Longtitude : 121°03' E.

(3) Parks and Biodiversity (Flora and Fauna)

Quezon City has richer wildlife compared to other cities in Metro Manila due to the size and nature of its parks and open spaces. Studies show that the parks and open spaces in Quezon City are habitat for numerous species of flora and fauna, some of which are classified as endemic or indigenous, exotic, endangered, highly endangered or vulnerable according to the Red List of the International Union for the Conservation of Nature and Natural Resources (IUCN).

However, none of the MMICP project sites is located in the parks and open spaces. Furthermore, none of threatened species of flora and fauna in the IUCN Red List has been identified in the project sites.

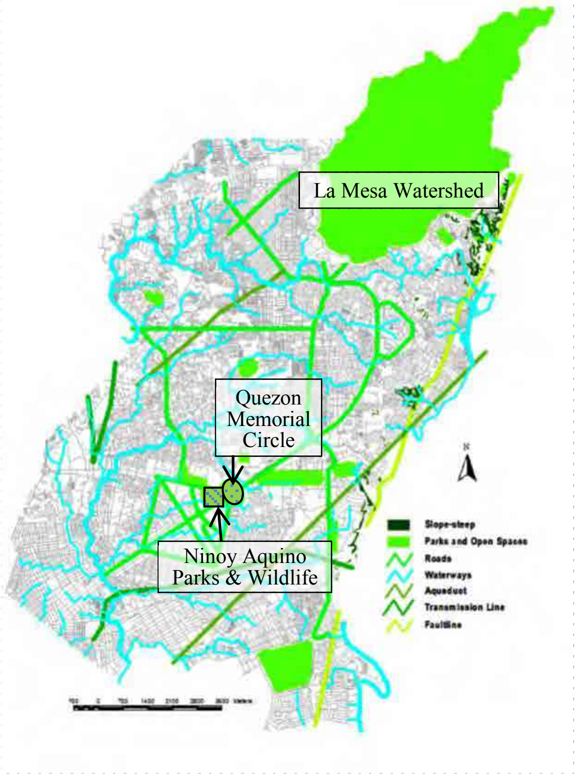
Major parks and reserves are as follows:

1) Quezon Memorial Circle

The Quezon Memorial Circle (QMC) is a 25-hectare public realm located at the heart of the City. It serves as the core and unifying element of the city's Open Space Network System (Garden City) because of its strategic location and high visibility.

The major components of the QMC are the following:

- ✓ Quezon Memorial Monument (Pylon) and shrine, the central element of QMC and shall be the point reference for all development programs, projects and activities
- ✓ Meditative area
- ✓ Parks, playground and other recreational areas
- ✓ Venue for social interaction, socio-cultural exchange, celebrations and other public gatherings
- ✓ Venue for facilities for arts and culture and historical heritage promotion
- ✓ Environment protection showcase area
- ✓ Economic enterprise area



Source: Quezon City Comprehensive Land Use Plan 2011-2030

Figure 7.2-2 Location of Parks and Conservation Areas

2) Ninoy Aquino Parks and Wildlife

The Ninoy Aquino Parks and Wildlife Center is the only zoological and botanical garden with an area of 19.29 hectares located at the southwest of the Quezon Memorial Circle.

It houses some 38 species of trees and shrubs which are represented by 2,443 trees commonly found in Philippine forests. It also keeps various species of endemic and endangered birds, mammals, reptiles and amphibians in the open-air Mini-zoo and Wildlife Rescue Center. It also serves as a venue for public education, as a training and research facility for future veterinarians and biologists, and as a source of wildlife stock for local zoos and

DENR-accredited facilities for their public education, breeding, and other conservation-oriented undertakings. Other amenities include cottages available for conferences, meetings, seminars, etc. and children's playground, visitor's center, a man-made lagoon for fishing, a rock garden and a craft village.

3) La Mesa Watershed

The La Mesa Watershed is the last remaining forest of its size in Metro Manila – the so-called "Green Lung" of the Metropolis. With an area of about 2,700 hectares, it was declared as Watershed Reservation by virtue of Presidential Proclamation No. 1336 on 25 July 2007. It is composed of a variety of ecosystems and is a habitat for Philippine indigenous, endemic, and endangered flora and fauna.

(4) Water Quality

The greater part of Quezon City and its river system drains into the Pasig River System. The QC area comprises 80 km^2 of the San Juan River Basin (which has an area of 87 km^2) and about 8 to 9 km^2 of the Marikina Downstream River Basin (covering an area of 17 km^2). Aside from the high population concentration in these areas, the greater majority of commercial and industrial establishments in the city are likewise located here.

According to the National Water Quality Status Report of 2001-2005 of the DENR- EMB, considered as major sources of water pollution are domestic wastewater discharges. This is attributed to the inadequate treated domestic sewage discharged into the surface waters. Agriculture and livestock waste was the second major pollutant while liquid industrial waste is the third.

The 2006-2007 average BOD of the Pasig River at various stations based on monitoring results conducted by the Pasig River Rehabilitation Commission (PRRC) in **Table 7.2-2** showed that the highest BOD levels are apparent at the Sanchez Station, located near the mouth of the San Juan River, where the greater part of Quezon City drains its wastewater.

The EMB maintains water sampling stations throughout the stretch of San Juan River. These are located at the four minor tributaries in Quezon City namely: San Francisco, Diliman, Ermitaño, and Kamias Creeks. Results of the test done in these water sampling stations during the first quarter of 2008 also showed that samples failed in DO and BOD as shown in **Table 7.2-3**.

Table 7.2-2 BOD (mg/L) of Pasig River: 2006-2007

Station	2006			2007		
	3rd Qr	4th Qr	Average	3rd Qr	4th Qr	Average
Marikina	5.67	6.00	3.33	5.00	3.17	3.17
Bambang	5.50	3.50	39.33	16.67	2.89	6.00
Lambingan	6.17	6.83	5.83	3.30	3.50	39.33
Sanchez	27.00	4.42	4.83	5.33	5.50	3.25
Jones	6.83	33.17	6.83	3.33	28.00	4.11
DENR Standard	< 7 mg/L					

Source: PRRC

Table 7.2-3 BOD and DO of Pasig River

Water Sampling Station	BOD [mg/L]	DO [mg/L]
San Francisco Creek	16	1.76
Diliman Creek	30	1.65
Ermitaño Creek	14	1.67
Kamias Creek	26	1.69
DENR Standard	< 7 mg/L	> 5 mg/L

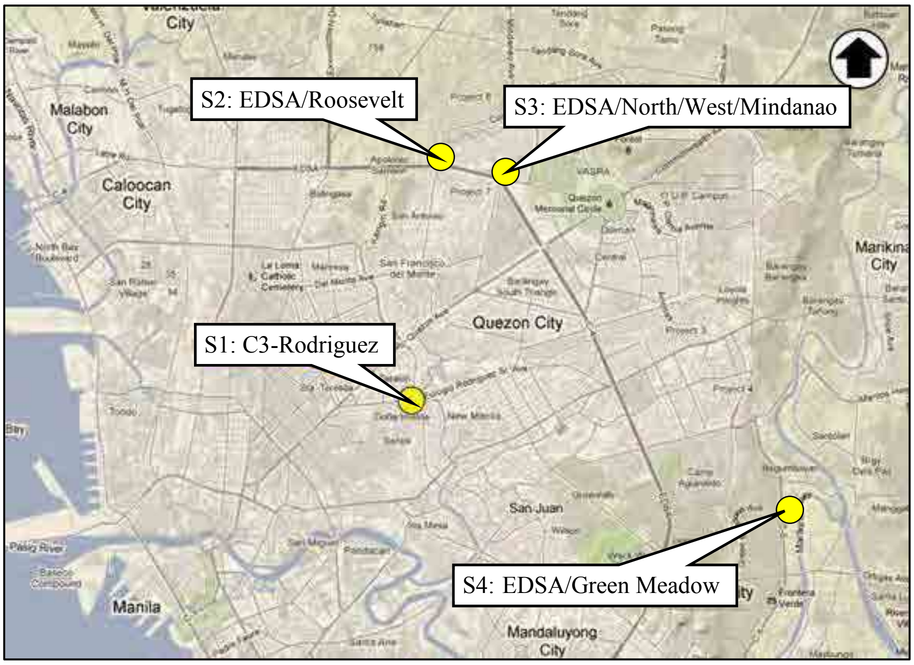
Source: PRRC

(5) Ambient Air Quality

Motor vehicles are the dominant source of air pollution, contributing 70% of the air pollution in Metro Manila. Diesel-fed vehicles are sources of highly visible black smoke, made up largely of soot, unburned fuel residue, gaseous wastes like carbon monoxide, nitrogen oxide and sulfur oxide. Gasoline engines emit soot in less amounts but generate unburned fuel and lead. Comparatively, diesel-fed vehicles are responsible for the emission of most particulate matter, sulfur and nitrogen oxides while gasoline-fueled ones emit higher amounts of carbon monoxide per unit of fuel than the former type of transport vehicle.

Ambient air quality survey was conducted in the middle of February in 2012 to grasp the present ambient air quality along the proposed interchange areas. The location of air pollutants sampling sites is shown in **Figure 7.2-3**.

The air quality parameters measured were Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2) and Total Suspended Particulates (TSP). The methods of sampling and analysis of air samples are in conformity with the National Ambient Air Quality Standards of the DENR which are summarized in **Table 7.2-4**. The results of ambient air quality monitoring are shown in **Table 7.2-5**.



Source: *JICA Study Team*

Figure 7.2-3 Location of Ambient Air Quality and Noise Surveys

Table 7.2-4 Methods of Sampling and Analysis of Air Samples

Parameters	Sampling Method	Analytical method
SO_2	Ambient air pass through an absorbing solution in glass impingers using the Air Check Gas Sampler and Kimoto Gas Bubbler.	Pararosaniline Method
NO_2		Griess-Saltzman Method
TSP	Staplex high-volume sampler is used with a filter paper that is weigh prior to and after sampling	Gravimetric Method

Source: JICA Study Team

Table 7.2-5 Ambient Air Quality Monitoring Results

Pollutant	Unit	Location*1				Philippine *2	WHO *3	Time weighted average
		S1	**S2**	**S3**	**S4**			
TSP	**µg/NCM^{*4}**	176.4	173.2	85.1	189.7	230 90	50 20	24 hours 1year
SO_2	**µg/NCM**	10.5	16.1	12.4	13.1	180 80	20 -	24 hours 1year
NO_2	**µg/NCM**	21.1	30.8	22.2	16.4	150 -	40	24 hours 1year
Monitoring Date & Time		18 Feb 2012 09:45-10:45	17 Feb 2012 12:24-13:24	17 Feb 2012 10:20-11:20	18 Feb 2012 12:46-13:46			

Source: JICA Study Team

*Note: 1) Sampling Sites (**Figure 7.2-3**). S1: C3/Rodriguez, S2: EDSA/Roosevelt, S3: EDSA/North/West/Mindanao, S4: EDSA/Green Meadow*

2) National Ambient Air Quality Guideline Values. “Implementing Rules and Regulations of the Philippine Clean Air Act *of 1999".*

3) WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide, Global Update 2005

4) NCM (Nm^3): Normal Cubic Meter, the metric expression of gas volume at standard conditions.

The observed pollutant concentrations were compared with the National Ambient Air Quality Guideline Values of the Philippine Clean Air Act of 1999 shown in **Table 7.2-5**.

TSP concentrations were below the maximum limit of the short term standard value (24 hours average), however, they exceeded the long term standard value (1 year average). TSP concentrations were also higher than the WHO air quality standards of 24 hours average.

SO_2 levels were well below the maximum limits of the short term and long term standard values. SO_2 concentrations also satisfied the WHO air quality standards of 24 hours average and 1 year average as well.

NO_2 levels were well below the maximum limits of the short term standard values. NO_2 concentrations were also satisfied the WHO air quality standards of 1 year average.

(6) Noise and Vibration

The noise and vibration survey was conducted in February of 2011 to grasp the present noise levels along the proposed interchange areas. The monitoring sites were the same as the ambient air quality monitoring locations shown in **Figure 7.2-3**.

The monitoring results of noise level and vibration are shown in **Tables 7.2-6** and **Table 7.2-7** respectively.

Table 7.2-6 Noise Level Monitoring Results

L_{Aeq} dB(A)		Location*1				Philippine*2	IFC Guidelines*3
		S1	**S2**	**S3**	**S4**		
Day (8.00 a.m. -10.00 p.m.)		79	83	82	80	55 (Residential) 65 (Commercial)	55 (residential) 70 (industrial)
Night (10.00p.m. –5.00 a.m.)		-	-	-	-	45 (Residential) 55 (Commercial)	45 (residential) 70 (industrial)
Monitoring Date & Time	**Day**	18 Feb 2012 09:30-09:40	17 Feb 2012 12:13-12:22	17 Feb 2012 10:10-10:19	18 Feb 2012 12:33-12:42		

Source: JICA Study Team

*Note: 1) Sampling Sites (**Figure 7.2-3**). S1: C3/Rodriguez, S2: EDSA/Roosevelt, S3: EDSA/North/West/Mindanao, S4: EDSA/Green Meadow*

2) The National Pollution Control Commission (NPCC) Memorandum Circular No. 002 Series of 1980, Section 78- Ambient Noise Quality and Emission Standards for Noise.

3) General EHS Guidelines; Environmental Noise Management, International Finance Corporation: IFC 2007.

Time Frame: Day: 7.00 a.m. – 10.00 p.m.; Night: 10.00 p.m. – 7.00 a.m.

Table 7.2-7 Vibration Acceleration Monitoring Results

m/s^2		Location*1				EU Directive (8 hours)*2	ACGIH (8 hours)*3
		S1	**S2**	**S3**	**S4**		
Day		0.2	0.2	0.2	0.2	1.15	0.315 (longitudinal direction) 0.224 (transverse direction)
Monitoring Date & Time	**Day**	18 Feb 2012 10:00-10:05	17 Feb 2012 12:40-12:44	18 Feb 2012 10:33-10:36	18 Feb 2012 13:00-13:05		

Source: JICA Study Team

*Note: 1) Sampling Sites (**Figure 7.2-3**). S1: C3/Rodriguez, S2: EDSA/Roosevelt, S3: EDSA/North/West/Mindanao, S4: EDSA/Green Meadow*

2) 2002/44/EC (EC Vibration Directive): The daily exposure limit value standardised to an eight-hour reference period for whole-body vibration.

3) American Conference of Industrial Hygienists (ACGIH), Threshold Limit Values (TLVs) for the whole body vibration.

According to the Philippine Ambient Noise Standards shown in **Table 7.2-6**, the noise levels during the day at all sites exceeded the maximum allowable noise level of 65 dB(A) for a commercial area. The noise levels during the night also exceeded the maximum allowable noise level of 55 dB(A) at all four sites.

Because monitoring sites were set along the roadsides of the busy traffic, these observed noise levels were almost the same as the emitted noise from vehicles. The sound level is attenuated by distance from the source, for example, the noise level is reduced by approximately 3dB(A) at the point that is apart from the road edge with a distance of 10 meters. However, these noise levels will not satisfy the maximum allowable levels for a residential area.

The observed vibration accelerations were compared with the limit values of EU Directives and ACGIH threshold limit values as shown in **Table7.2-7**. Vibration accelerations were below the limit values in all four interchange areas.

7.2.2 Social Environment

(1) Land Use and Classification

The project sites of four interchanges are located in a highly built-up and urbanized area in Quezon City. The general land classification of Quezon City is residential, commercial, industrial, institutional, etc. with a total area of 16,112.55 hectares. Residential is the dominant sector in the area with 36% of its land resources, followed by institutional sector comprising 7.46% of the area, 6.48% commercial, 4.78% Industrial and 1.40% is open space and others (27.90%). **Table 7.2-8** shows the area and percentage distribution of land resources in Quezon City.

Table 7.2-8 Quezon City Land Use in 2008

Land Use	Area [ha]	Percentage Distribution of Land Resources (%)
Residential	5,804.21	36.02
Institutional	1,201.21	7.46
Commercial	1,044.24	6.48
Industrial	770.32	4.78
Open Space	226.06	1.40
Utility	147.24	0.91
Cemetery	66.81	0.41
Military	222.02	1.38
Vacant	4,060.59	25.20
Total Urban Area	13,542.71	84.39
Total Reservoir	2,569.84	15.61
Total	16,112.55	100%

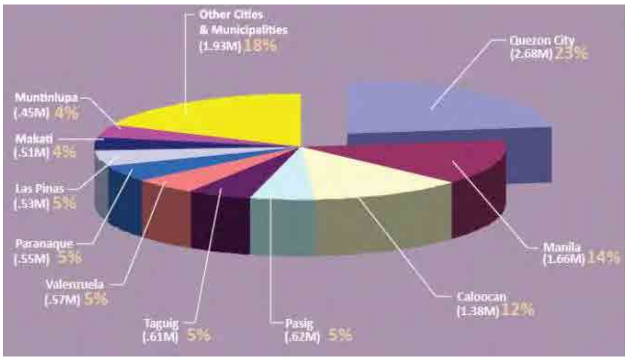
Source: Quezon City Socio- Ecological Profile, 2010

(2) Demography

1) Population and Population Density

Official census results of the National Statistics Office in 2007 show that the city has a population of 2,679,450, an increase of 505,619 persons or 23.26% over the 2000 population of 2,173,831. The city's population is the largest comprising nearly one-fourth (23.19%) of Metro Manila's population of 11,553,427. The city also ranks third among the cities with the largest population in the Philippines (**Figure 7.2-4**). For the period 2000-2007, the city registered an annual population growth rate of 2.92%, higher than the NCR's rate of 2.11% as well as the national growth rate of 2.04%. At the current growth rate, Quezon City's population is expected to double in a span of 24 years.

In 2000, population density was 134.92 persons per hectare and in 2007, it increased to 166.30 persons per hectare. It is projected to be 240.31 persons per hectare in the year 2017. (Quezon City Socio- Ecological Profile, 2010)



Source: Quezon City Planning and Development Office

Figure 7.2-4 Distribution of Population; Metro Manila 2007

2) Informal Settlers

A large section of the city population in need of adequate shelter consists of informal settlers occupying idle, public and private lands. The 2006 actual census conducted by the Urban Poor Affairs Office covered 211,708 families housed in 170,670 structures, an increase of 10,317 families from 2005 census-survey. For 2007, the number of informal settlers increased to 218,802, an increase of 7,094 families from 2006 census shown in **Table 7.2-9**. Their needs are in terms of resettlement or on-site upgrading through any of a combination of tenurial and/or infrastructural upgrading and structural improvement. (Quezon City Socio- Ecological Profile, 2010)

Table 7.2-9 Informal Settles in Quezon City

Year	District I	District II	District III	District IV	Total	Structures
2005	25,935	129,982	14,843	30631	201,391	166,947
2006	27.686	136,726	16,077	31219	211,708	170,670
2007	25.881	142,383	16,139	33972	218,375	175,293

Source: Urban Poor Affairs Office

(3) Industry and Service

Businesses in the city are dominated by small to medium-scale establishments engaged mostly in the distribution of finished products and in the provision of basic personal services.

Registered establishments show that the Service Sector has the highest share with 91.6%, followed by the Industry Sector with only 8.4%. Being a highly urbanized city, agricultural activities have a very small share. The operations in the Agriculture Sector are merely backyard farming and livestock raising activities with no substantial share on the growth of city's economy (**Table 7.2-10**).

Table 7.2-10 Distribution of Business Establishments by Industry Classification in Quezon City

Industry	Agriculture	Industry				Services								Total
		Mining & Quarrying	Electric, Gas & Water	Construction	Manufacturing	Wholesale/ Retail Trade	Transport, Storage& Communication	Real Estate, Renting	Hotel & Restaurant	Financial Intermediation	Health & Social Work	Education	Other Social and Community Services	
Percent	0.01	-	0.019	2.92	5.432	41.94	3.87	23.55	8.19	4.16	2.53	1.84	5.55	100

Source: Quezon City Socio- Ecological Profile, 2010

(4) Employment

The 2003 employment data is the latest available city data. The city's 2003 employed population totaled 871,000 or 85.7% of the total labor force. Majority (51.7%) or 450,000 of these employed were males. Those employed in the Service Sector accounted for the biggest share of total employment with 80.7% share followed by those employed in the Industry Sector with 19% share. (Quezon City Socio- Ecological Profile, 2010)

Unemployed population comprised 145,000 or 14.3% of the total labor force. Most of these unemployed came from the unskilled, poorly-schooled and low-income group. Majority (66.9%) of these unemployed are males. This double-digit unemployment rate is due to limited job opportunities, growing labor force attributed to the city's increasing population to include migrants coming to the city and the mismatch of required skills for available jobs. Although the city's unemployment rate is high, it is lower compared to NCR's 16.9% and other neighboring cities such as Manila (15.2%), Makati (15.1%), Pasay (16.3%) and Pasig (14.6%) but higher compared to the 10.6% national rate (**Table 7.2-11**).

Table 7.2-11 Comparative Unemployment Rates in Philippines, NCR and Quezon City

Year	Philippines	NCR	Quezon City
2000	9.3	16.2	15.3
2001	11.4	18.0	16.1
2002	10.3	16.1	14.9
2003	10.6	16.9	14.3
2004	11.8	18.1	-
2005	8.7	14.9	-
2006	7.9	14.3	-
2007	7.3	12.2	-

Source: National Static Office

7.3 ANALYSIS OF ALTERNATIVES

Project alternatives for four interchange projects were analyzed in Chapter 4. The alternatives including a zero option (without-the-project) case were comparatively evaluated from the viewpoints of environmental and social considerations in this chapter.

7.3.1 C-3/E. Rodriguez Interchange

(1) Without Project Case

This intersection is one of the busiest along the major highways of Metro Manila primarily because it is between two major roads both with high vehicular traffic volume plus the presence of several business establishments in the area such as Puregold, Mercury Drugstore, gasoline stations, among others. The on-going construction of another interchange project at the nearby Quezon Avenue intersection will induce a bottleneck scenario of traffic flow in this particular intersection unless a complimentary interchange project is taken later on.

In the zero option (without-the-project) case, because of the increase of traffic volume in the future as explained in Section 3.3, vehicle hour of through traffic will increase in this intersection. This will make traffic congestion worse and cause the increase of air pollutant emissions from vehicles. Adverse impacts on human health may increase in the zero option case.

(2) Alternative Schemes

Comparative evaluation of the alternative schemes has been summarized in **Table 4.2-2** from the viewpoints of construction cost, construction performance and duration, traffic conditions, as well as environmental and social conditions. This section focuses on environmental and social conditions and review as shown in **Table 7.3-1**.

With regard to social environment aspect, Schemes 2 and 3 have the least adverse impacts among the alternatives. There are no large differences in pollutions (i.e., ambient air quality and noise level) among the alternatives. However, under Scheme 2, flooding of the road is unavoidable.

Table 7.3-1 Comparative Evaluation of Environmental and Social Impacts for Alternative Schemes of C-3/E. Rodriguez Interchange

Alternatives	Scheme-1		Sheme-2		Scheme-3	
	Flyover (Original Design) with 6-Lane Additional Approach		Flyover with No Additional Approach		Flyover with 4-Lane Additional Approach	
Social Environment						
Land Acquisition	Requires ROW acquisition due to improvement of I/C (Demolish 3 building at I/C)	●	No ROW required (No demolition of buildings)	○	No ROW required (No demolition of building)	○
Resettlement	No involuntary resettlement	○	No involuntary resettlement	○	No involuntary resettlement	○
Community Severance	The people on each side of C-3 disconnected from each other due to 630m extent of elevated thru road	●	The people on each side of C-3 is still connected from each other as almost same condition as present.	○	The people on each side of C-3 disconnected from each other can be prevented due to provide RCBC.	○
Natural Environment and Human Health						
Air Quality	Emission of air pollutants will decrease compared with the zero option case.	○	Emission of air pollutants will decrease compared with the zero option case.	○	Emission of air pollutants will decrease compared with the zero option case.	○
Noise	Noise level will be increase due to the increase of traffic volume.	●	Noise level will be increase due to the increase of traffic volume.	●	Noise level will be increase due to the increase of traffic volume.	●
Landscape	Local aesthetic view may deteriorate by the flyover and 6 lanes approach road.	●	Local aesthetic view may deteriorate by the flyover.	●	Local aesthetic view may deteriorate by the flyover and 4 lanes approach road.	●
Flooding	No flood on thru road permanently.	○	No traffic improvement during flood (road overflows during flood)	●	No flood on thru road permanently.	○

Source: JICA Study Team
Note: ○Advantage, ●Disadvantage

7.3.2 EDSA/Roosevelt/Congressional Interchange

(1) Without Project Case

The intersection is one of the busiest along the EDSA highway primarily because of the presence of several business establishments in the area such as the Muñoz Public Market, commercial banks, restaurants, drugstores, malls, among others. The planned construction of another interchange project at the nearby EDSA/ North Ave. intersection will induce a bottleneck scenario of traffic flow at EDSA/Roosevelt intersection unless a complimentary interchange project is taken at later.

In the zero option (without-the-project) case, because of the increase of traffic volume in future as explained in Section 3.3, vehicle hour of through traffic will increase in this intersection. This will make traffic congestion worse and cause the increase of air pollutant emissions from vehicles. Adverse impacts on human health may increase in the zero option case.

(2) Alternative Schemes

Comparative evaluation of the alternative schemes has been summarized in **Table 4.3-2** from the viewpoints of construction cost, construction performance and duration, traffic conditions, as well as environmental and social conditions. This section focuses on the environmental and social conditions and review as shown in **Table 7.3-2**.

With regard to social environment aspect, Schemes 1 and 2 will make the least adverse impacts among the alternatives. From the viewpoint of adverse impact on human health, Scheme-2 has the lowest emissions of air pollutants and noise.

Table 7.3-2 Comparative Evaluation of Environmental and Social Impacts for Alternative Schemes of EDSA/Roosevelt/Congressional Interchange

Alternatives	Scheme-1		Sheme-2		Scheme-3	
	Maintain All Pedestrian Bridges		No Pedestrian Bridge near Muñoz Station		Maintain All Pedestrian Bridges and Improve At-grade intersection	
Social Environment						
Land Acquisition	No additional ROW required	○	No additional ROW required	○	No additional ROW required	○
Resettlement	No involuntary resettlement	○	No involuntary resettlement	○	No involuntary resettlement	○
Local Economy	Less impact than Scheme 3	○	Less impact than Scheme 3	○	Significant impact on local economy and traffic due to long construction duration	●
Pedestrian Convenience	Because the all existing pedestrian bridges are maintained, pedestrian convenience will be preserved.	○	Pedestrian access might become less convenient because of the loss of one bridge near the Muñoz Station.	●	Because the all existing pedestrian bridges are maintained, pedestrian convenience will be preserved.	○
Natural Environment and Human Health						
Air Quality	Lower emission of air pollutants than Scheme 2.	●	Lowest emission of air pollutants due to the lowest vertical grade.	○	Largest emission of air pollutants due to the longer vertical grade.	●
Noise	Lower noise emission than Scheme 2.	●	Lowest noise emission of due to the lower vertical grade.	○	Largest noise emission due to the longer vertical grade.	●
Landscape	Local aesthetic view may deteriorate by the flyover.	●	Local aesthetic view may deteriorate by the flyover.	●	Local aesthetic view may largely deteriorate by the higher and longer flyover.	●

Source: JICA Study Team
Note: ○Advantage, ●Disadvantage

7.3.3 EDSA-North/West/Mindanao Interchange

(1) Without Project Case

The Circumferential Road 4 (C4), popularly known as the Epifanio de los Santos Avenue (EDSA), is the most important component of the Metro Manila major road network system. EDSA functions as a collector-distributor road in the system. It provides access to the fast growing activity centers in the suburban areas. It also serves as a vital link between the northern and southern areas of the metropolis; connecting two major trunk roads, the Manila North and South Luzon Expressways. Due to the incomplete development of C3, C5, and C6, traffic along EDSA is heavily congested. The intersections are among the busiest along the EDSA primarily because of the presence of big business establishments in the area, most notable of which are the SM City Mall and Trinoma.

In the zero option (without-the-project) case, because of the increase of traffic volume in future as explained in Section 3.3, vehicle hour of through traffic will increase in this intersection. This will make traffic congestion worse and cause the increase of air pollutant emissions from vehicles. Adverse impacts on human health may increase in the zero option case.

(2) Alternative Schemes

Comparative evaluation of the alternative schemes has been summarized in **Tables 4.4-2** and **4.4-3** from the viewpoints of construction cost, construction performance and duration, traffic conditions, as well as environmental and social conditions. This section focuses on environmental and social conditions and review as shown in **Tables 7.3-3** and **7.3-4**.

1) EDSA/West/North Interchange

With regard to social environment aspect, Scheme 1 has less adverse impacts than Scheme 2 because of no additional ROW requirement and shorter construction period. From the viewpoint of pollution control, Scheme 2 may have less adverse impacts than Scheme1.

2) North/Mindanao Interchange

With regard to social environment aspect, both schemes require additional ROW. From the viewpoint of pollution control, Scheme 2 has less adverse impact on human health than Scheme1.

Table 7.3-3 Comparative Evaluation of Environmental and Social Impacts for Alternative Schemes of EDSA/West/North Interchange

Alternatives	Scheme-1		Sheme-2	
	Flyover		Cut and Cover Tunnel	
Social Environment				
Land Acquisition	No ROW required.	○	About 400 sq. m of ROW is required for sump pit	●
Resettlement	No involuntary resettlement	○	No involuntary resettlement	○
Local Economy	Less impact than Scheme 2	○	Significant impact on local economy and traffic due to long construction duration.	●
Natural Environment and Human Health				
Air Quality	Emission of air pollutants will decrease compared with the zero option case.	○	Emission of air pollutants will decrease compared with the zero option case. Concentrated air pollutants may be emitted at both side entrances of tunnel.	○
Noise	Noise level will be increase due to the increase of traffic volume.	●	Lower noise emission but noisier at both side entrances of tunnel.	○
Landscape	Local aesthetic view may largely deteriorate by the flyover.	●	Local aesthetic view will be preserved.	○

Source: JICA Study Team
Note: ○Advantage, ●Disadvantage

Table 7.3-4 Comparative Evaluation of Environmental and Social Impacts for Alternative Schemes of North/Mindanao Interchange

Alternatives	Scheme-1		Sheme-2	
	Left Turn Flyover (North -Mindanao) Left Turn Flyover (Mindanao-North)		Left Turn Underpass (North -Mindanao) Left Turn Flyover (Mindanao-North)	
Social Environment				
Land Acquisition	Additional ROW is required at the entrance of 3rd level flyover along North Avenue (about 100 sq. m).	●	About 100 sq. m of ROW is required for sump pit.	●
Resettlement	No involuntary resettlement	○	No involuntary resettlement	○
Natural Environment and Human Health				
Air Quality	Emission of air pollutants might be greater than Scheme 2.	●	Emission of air pollutants might be smaller than Scheme 1.	○
Noise	Noise emission might be greater than Scheme 2 due to long and steep slope.	●	Noise emission might be smaller than Scheme 1.	○
Landscape	Local aesthetic view may deteriorate by the flyover.	●	Local aesthetic view may be better than Scheme 1.	○

Source: JICA Study Team
Note: ○Advantage, ●Disadvantage

7.3.4 C-5/Green Meadows/Acropolis/Calle Industria Interchange

(1) Without Project Case

The C-5/Green Meadows/Acropolis/Calle Industria intersection is one of the busiest mainly because of the presence of several business establishments in the area; one of which is the Eastwood Commercial District. Also, because of the numerous residential areas and subdivisions at the periphery of this intersection, residents comprise a large portion of the human or pedestrian traffic at the intersection.

In the zero option (without-the-project) case, because of the increase of traffic volume in future as explained in **Section 3.3**, vehicle hour of through traffic will increase in this intersection. This will make traffic congestion worse and cause the increase of air pollutant emissions from vehicles. Adverse impacts on human health may increase in the zero option case.

(2) Alternative Schemes

Comparative evaluation of the alternative schemes has been summarized in **Table 4.6-1** from the viewpoints of construction cost, construction performance and duration, traffic conditions, as well as environmental and social conditions. This section focuses on environmental and social conditions and review as shown in **Table 7.3-5**.

With regard to social environment aspect, Scheme 1 has the least adverse impacts among the alternatives because no additional ROW is required. On the aspect of natural environment and human health, Scheme 2 has the least impact because of least noise emission and preservation of local aesthetic view.

Table 7.3-5 Comparative Evaluation of Environmental and Social Impacts for Alternative Schemes of C-5/Green Meadows/Acropolis/Calle Industria Interchange

Alternatives	Scheme-1		Sheme-2		Scheme-3	
	Flyover		Cut and Cover Tunnel		Flyover and Cut & Cover Tunnel	
Social Environment						
Land Acquisition	No ROW required.	○	About 400 sq. m of ROW is required for sump pit	●	About 400 sq. m of ROW is required for sump pit	●
Resettlement	No involuntary resettlement	○	No involuntary resettlement	○	No involuntary resettlement	○
Local Economy	Less impact than Scheme 2	○	Significant impact on local economy and traffic due to long construction duration	●	Less impact than Scheme 2	○
Natural Environment and Human Health						
Air Quality	Lower emission of air pollutants than Scheme 2.	●	Concentrated air pollutants may be emitted at both side entrances of tunnel.	●	Larger emission of air pollutants than Scheme 1 due to long and steep slope section.	●
Noise	Noise emission may larger than Scheme 3.	●	Lowest noise emission but noisier at both side entrances of tunnel.	○	Lower noise emission than Scheme 1, but noisier at both side entrances and long slope section.	●
Landscape	Local aesthetic view may largely deteriorate by the longer flyover.	●	Local aesthetic view will be preserved.	○	Local aesthetic view may deteriorate by the flyover.	●

Source: JICA Study Team
Note: ○Advantage, ●Disadvantage

7.4 RESULTS OF SCOPING

Together with the analysis of the alternatives in Section 7.3, the scoping was conducted for the recommended schemes for four interchanges in order to identify the potential impacts and their magnitude of significance in accordance with the JICA Guidelines.

7.4.1 C-3/E. Rodriguez Interchange

The result of scoping is summarized in **Table 7.4-1**.

Table 7.4-1 Result of Scoping for C-3/E. Rodriguez Interchange

No	Items	Rating		Brief Description
		Construction Phase	Operation Phase	
Social Environment *Regarding the impacts on "Gender" and "Children's Right", might be related to all criteria of Social Environment.				
1	Involuntary Resettlement	D	D	➢ Pre-construction and construction: • Metro Manila Development Authority (MMDA) in cooperated with Quezon City had relocated informal settlers in ROW of C-3 (Araneta Ave). Because land acquisition will not be needed due to the construction of the flyover along C-3, no large involuntary resettlement will be anticipated.
2	Local economy such as employment and livelihood, etc.	B±	B+	➢ Construction: • (+) Employment of skilled and unskilled labor will be expected. • (-) Stalls around the intersection will be temporarily affected. ➢ Operation: • Traffic congestion will be eased.
3	Land use and utilization of local resources	D	D	Since the project will improve the traffic of the existing intersection, there will be no changes on land use and utilization of local resources.
4	Social institutions such as social infrastructure and local decision-making institutions	D	D	Since the project will improve the traffic of the existing intersection, there will be no impacts on social institutions and local decision-making institutions.
5	Existing social infrastructures and services	B-	D	➢ Construction: • Traffic jam is likely to occur during construction. Nuisances such as noise, vibration, exhaust gases and accidents may increase. • Nuisances and traffic of construction vehicles may also influence social infrastructure such as a hospital and church nearby the intersection. • It is necessary to secure the function of commuting roads. • The vicinity of detour routes might be temporary congested. ➢ Operation: • Community severance is not anticipated because several pedestrian accesses will be provided along the additional approach.
6	The poor, indigenous and ethnic people	D	D	There are no indigenous and ethnic people in and around the project site. Although there is a few informal settlers' shanty in the ROW of Rodriguez Ave, they will be not affected by the construction of C-3 flyover.
7	Misdistribution of benefit and damage	B-	D	➢ Construction: • Although some stalls at the intersections might be temporarily affected during construction, RAP has been prepared to avoid any imbalance of damage and also local conflict.
8	Cultural heritage	D	D	There is no cultural heritage in the vicinity of the interchange.
9	Local conflict of interests	D	D	Since the project will improve the traffic of the existing intersection, there will be no social institutions and local decision-making institutions. Local conflict of interests may arise if misdistribution of benefit and damage due to the project is assumed.

10	Water Usage or Water Rights and Rights of Common	B-	D	There is no water right and rights of common in the project area. Majority of residents obtain their domestic water supply from Metropolitan Waterworks and Sewerage System (MWSS). The project will not affect the local water usage. ➢ Construction: • Excavation works within the project site may possibly cause interruption of basic utilities.
11	Sanitation	B-	D	Most of the residents in squatter zones have no toilet facilities. Tatalon Sewage Treatment Plant (combined sewerage system) is now under construction at the intersection (Completion: March 2012). ➢ Construction: • Sanitary conditions will become unfavorable if enough portable toilets are not provided at the construction site.
12	Hazards (Risk) Infectious diseases such as HIV/AIDS	B-	D	➢ Construction: • Most of construction workers will be hired locally. However, countermeasures for prevention of infectious diseases such as HIV/AIDS will be necessary.
Natural Environment				
13	Topography and Geological features	D	D	The flyover will be installed over the existing intersection. There will be no risk of slope failures or landslides.
14	Soil Erosion	D	D	The flyover will be installed over the existing intersection. There will be no risk of soil erosion.
15	Groundwater	D	D	The flyover will be installed over the existing intersection. Groundwater is not locally utilized. Pile driving will not affect groundwater flow.
16	Hydrological Situation	D	B+	➢ Operation: • There is a risk of flooding in the project area due to overflow of San Juan River during a heavy storm. Flood control measures of San Juan River have been planned. • Raising the elevation of the approach road will prevent overflow on the approach road.
17	Coastal Zone (Mangroves, Coral reefs, tidal flats, etc.)	D	D	The intersection is not located in the coastal zone.
18	Flora, Fauna and Biodiversity	B-	D	None of protected area is located in the project area. Any endangered species of flora and fauna are not seen in and around the project site. ➢ Construction: • Trees scattered on the central reserves and sidewalks will be cut off at the construction phase, where necessary. Permit to cut trees will be required by DENR. ➢ Operation: • Replant trees on the central reserves and sidewalks.
19	Meteorology	D	D	No impacts are expected.
20	Landscape	B-	B-	➢ Operation: • The flyover may deteriorate the local aesthetic view. • It will also cause sunlight blocking.

21	Global Warming	D	B+	➢ Construction: • The operation of construction vehicles will emit CO_2 but impact on global warming might be slight. ➢ Operation: • As the traffic flow will increase due to the opening of the C-3 Missing Link in 2018, CO_2 emission will double in the without-project case. On the other hand, the increase of CO_2 emissions will reduce by 24% if the flyover is installed.
Pollution Control				
22	Air Pollution	B-	B+	➢ Construction: • Emission of pollutants due to the operation of construction vehicles may slightly deteriorate the ambient air quality. • Along detour routes, emission of pollutants from vehicles may also slightly affect ambient air quality in the vicinity. ➢ Operation: • As the traffic flow will increase due to the opening of the C-3 Missing Link in 2018, emissions of air pollutants (TSP, SO_2, NO_2) will increase in the without-project case. On the other hand, the emissions of air pollutants will decrease if the flyover is installed.
23	Water Pollution	B-	D	➢ Construction: • Since the flyover will be installed over the existing intersection, turbid water due to soil runoff from cutting and filling may temporary degrade the water quality of San Juan River. ➢ Operation: • Rainfall runoff may flush garbage and degrade river water quality. • However, since Tatalon Sewage Treatment Plant (combined sewerage system) is now under construction at the intersection (Completion: March 2012), discharge water will be treated.
24	Soil Contamination	B-	D	➢ Construction: • Oil and grease emitted from ill-serviced construction machines and heavy vehicles might contaminate soil at the construction site.
25	Waste	B-	D	➢ Construction: • Construction work may generate solid waste such as removed asphalt, soil and sand of the existing roads. Construction workers may also create additional garbage. Waste generation should be properly reduced by reuse and recycle. ➢ Operation: • Road garbage will be properly treated and disposed of in accordance with the regulations of the Philippines.

26	Noise and Vibration	B-	B-	➢ Construction: • Noise and vibration emitted from the operation of construction vehicles may temporary affect sound environment at the project site. • Along detour routes, noise from increased vehicles may also affect sound environment in the vicinity. ➢ Operation: • Reduction of traffic congestion is expected to contribute to noise abatement. • As the traffic flow will increase due to the opening of the C-3 Missing Link in 2018, noise level will increase in the vicinity of the interchange. Noise mitigation measures such as noise barriers should be taken into account.
27	Ground Subsidence	D	D	No impacts are expected.
28	Offensive Odor	D	D	There will be no activities which cause offensive odor.
29	Bottom sediment	D	D	There will be no activities which deteriorate the bottom sediment quality.
30	Accidents	B-	B+	➢ Construction: • Traffic accidents are likely to occur due to the increase of construction vehicles at the construction phase. ➢ Operation: • The pedestrian safety will be secured since pedestrian accesses and sidewalks are installed.

Source: JICA Study Team

Rating: A±: Significant positive/negative impact is expected.
B±: Some positive/negative impact is expected.
C±: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected. IEE/EIA is not necessary.

7.4.2 EDSA/Roosevelt/Congressional Interchange

The result of scoping is summarized in **Table 7.4-2.**

Table 7.4-2 Result of Scoping for EDSA/Roosevelt/Congressional Interchange

No	Items	Rating		Brief Description
		Construction Phase	Operation Phase	
Social Environment *Regarding the impacts on "Gender" and "Children's Right", might be related to all criteria of Social Environment.				
1	Involuntary Resettlement	D	D	There will be no involuntary resettlement.
2	Local economy such as employment and livelihood, etc.	B±	B+	➢ Pre-construction and construction: • (+) Employment of skilled and unskilled labor will be expected. • (-) A few stalls in the Muñoz Public Market at the intersection will be marginally affected and therefore shall be considered in RAP. • (-) Business establishments in the vicinity of construction sites will be temporarily affected. ➢ Operation: • Traffic congestion will be eased.
3	Land use and utilization of local resources	D	D	Since the project will improve the traffic of the existing intersection, there will be no changes on land use and utilization of local resources.

4	Social institutions such as social infrastructure and local decision-making institutions	D	D	Since the project will improve the traffic of the existing intersection, there will be no impacts on social institutions and local decision-making institutions.
5	Existing social infrastructures and services	B-	D	➢ Construction: • Traffic jam is likely to occur during construction. Nuisances such as noise, vibration, exhaust gases and accidents may increase. • Nuisances and traffic of construction vehicles may also influence social infrastructure such as a hospital and church nearby the intersection. • It is necessary to secure the function of commuting roads. • The vicinity of detour routes might be temporary congested. ➢ Operation: • Pedestrian access might become slightly inconvenient because of the demolition of a bridge near the Muñoz Station.
6	The poor, indigenous and ethnic people	D	D	There are no indigenous and ethnic people in and around the project site.
7	Misdistribution of benefit and damage	B-	D	➢ Construction: • Although some stalls at the intersections might be marginally affected during construction, RAP has been prepared to avoid any imbalance of damage and also local conflict.
8	Cultural heritage	D	D	There is no cultural heritage in the vicinity of the interchange.
9	Local conflict of interests	D	D	Since the project will improve the traffic of the existing intersection, there will be no social institutions and local decision-making institutions.
10	Water Usage or Water Rights and Rights of Common	B-	D	There is no water right and rights of common in the project area. Majority of residents obtain their domestic water supply from MWSS. The project will not affect the local water usage. ➢ Construction: • Excavation works within the project site may possibly cause interruption of basic utilities.
11	Sanitation	B-	D	➢ Construction: • Sanitary conditions will become unfavorable if enough portable toilets are not provided at the construction site.
12	Hazards (Risk) Infectious diseases such as HIV/AIDS	B-	D	➢ Construction: • Most of construction workers will be hired locally. However, countermeasures for prevention of infectious diseases such as HIV/AIDS will be necessary.
Natural Environment				
13	Topography and Geological features	D	D	The flyover will be installed over the existing intersection. There will be no risk of slope failures or landslides.
14	Soil Erosion	D	D	The flyover will be installed over the existing intersection. There will be no risk of soil erosion.
15	Groundwater	D	D	The flyover will be installed over the existing intersection. Groundwater is not locally utilized. Pile driving will not affect groundwater flow.
16	Hydrological Situation	D	D	There will be no risk of flooding in the project area.
17	Coastal Zone (Mangroves, Coral reefs, tidal flats, etc.)	D	D	The intersection is not located in the coastal zone.

18	Flora, Fauna and Biodiversity	B-	D	None of protected area is located in the project area. Any endangered species of flora and fauna are not seen in and around the project site. ➢ Construction: • Trees scattered on the central reserves and sidewalks will be cut off at the construction phase, where necessary. Permit to cut trees will be required by DENR. ➢ Operation: • Replant trees on the central reserves and sidewalks.
19	Meteorology	D	D	No impacts are expected.
20	Landscape	B-	B-	➢ Operation: • The flyover may deteriorate the local aesthetic view. • It will also cause sunlight blocking.
21	Global Warming	D	B+	➢ Construction: • The operation of construction vehicles will emit CO_2 but impact on global warming might be slight. ➢ Operation: • As the traffic flow increase and CO_2 emission will increase by 29% in the without-project case n 2018. On the other hand, the increase of CO_2 emissions will reduce by 11% if the flyover is installed.
Pollution Control				
22	Air Pollution	B-	B+	➢ Construction: • Emission of pollutants due to the operation of construction vehicles may slightly deteriorate the ambient air quality. • Along detour routes, emission of pollutants from vehicles may also slightly affect ambient air quality in the vicinity. ➢ Operation: • As the traffic flow will increase, emissions of air pollutants (TSP, SO_2, NO_2) will increase in the without-project case. On the other hand, the emissions of air pollutants will decrease if the flyover is installed.
23	Water Pollution	B-	D	➢ Construction: • Since the flyover will be installed over the existing intersection, turbid water due to soil runoff from cutting and filling may temporary degrade the water quality of San Francisco River. ➢ Operation: • Rainfall runoff on the flyover and road will be properly treated at the wastewater treatment facilities.
24	Soil Contamination	B-	D	➢ Construction: • Oil and grease emitted from ill-serviced construction machines and heavy vehicles might contaminate soil at the construction site.
25	Waste	B-	D	➢ Construction: • Construction work may generate solid waste such as removed asphalt, soil and sand of the existing roads. Construction workers may also create additional garbage. Waste generation should be properly reduced by reuse and recycle. ➢ Operation: • Road garbage will be properly treated and disposed of in accordance with the regulations of the Philippines.

26	Noise and Vibration	B-	B-	➢ Construction: • Noise and vibration emitted from the operation of construction vehicles may temporary affect sound environment at the project site. • Along detour routes, noise from increased vehicles may also affect sound environment in the vicinity. ➢ Operation: • Reduction of traffic congestion is expected to contribute to noise abatement. • As the traffic flow will increase, noise level will increase in the vicinity of the interchange. Noise mitigation measures such as noise barriers should be taken into account.
27	Ground Subsidence	D	D	No impacts are expected.
28	Offensive Odor	D	D	There will be no activities which cause offensive odor.
29	Bottom sediment	D	D	There will be no activities which deteriorate the bottom sediment quality.
30	Accidents	B-	B+	➢ Construction: • Traffic accidents are likely to occur due to the increase of construction vehicles at the construction phase. ➢ Operation: • Since traffic congestion will be eased, the risk of traffic accidents may be lowered.

Source: JICA Study Team

Rating: A±: Significant positive/negative impact is expected.

B±: Some positive/negative impact is expected.

C±: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)

D: No impact is expected. IEE/EIA is not necessary.

7.4.3 EDSA-North/West/Mindanao Interchange

The result of scoping is summarized in **Table 7.4-3.**

Table 7.4-3 Result of Scoping for EDSA-North/West/Mindanao Interchange

No	Items	Rating		Brief Description
		Construction Phase	Operation Phase	
Social Environment *Regarding the impacts on "Gender" and "Children's Right", might be related to all criteria of Social Environment.				
1	Involuntary Resettlement	B-	D	➢ Pre-construction and construction: • About 100 sq. m of ROW is required for sump pit within the Veterans Medical Center Golf Course in order to avoid flooding of the underpass from North to Mindanao Ave.
2	Local economy such as employment and livelihood, etc.	B±	B+	➢ Pre-construction and construction: • (+) Employment of skilled and unskilled labor will be expected. • (-) A few stalls along the Mindanao Avenue will be marginally affected and therefore shall be considered in RAP. • (-) Business establishments in the vicinity of construction sites will be temporarily affected. ➢ Operation: • Traffic congestion will be eased.
3	Land use and utilization of local resources	D	D	Since the project will improve the traffic flow in the existing established commercial area, there will be no changes on land use and utilization of local resources.

4	Social institutions such as social infrastructure and local decision-making institutions	D	D	Since the project will improve the traffic flow in the existing established commercial area, there will be no impacts on social institutions and local decision-making institutions.
5	Existing social infrastructures and services	B-	D	➢ Construction: • Traffic jam is likely to occur during construction. Nuisances such as noise, vibration, exhaust gases and accidents may increase. • Nuisances and traffic of construction vehicles may also influence social infrastructure such as a hospital and church nearby the intersection. • It is necessary to secure the function of commuting roads. • The vicinity of detour routes might be temporary congested. ➢ Operation: • The traffic improvement project may contribute to improving safety and convenience of the communities.
6	The poor, indigenous and ethnic people	D	D	There are no indigenous and ethnic people in and around the project site.
7	Misdistribution of benefit and damage	B-	D	➢ Construction: • Although some stalls at the intersections might be marginally affected during construction, RAP has been prepared to avoid any imbalance of damage and also local conflict.
8	Cultural heritage	D	D	There is no cultural heritage in the vicinity of the interchange.
9	Local conflict of interests	D	D	Since the project will improve the traffic of the existing intersection, there will be no impacts on social institutions and local decision-making institutions.
10	Water Usage or Water Rights and Rights of Common	B-	D	There is no water right and rights of common in the project area. Majority of residents obtain their domestic water supply from MWSS. The project will not affect the local water usage. ➢ Construction: • Excavation works within the project site may possibly cause interruption of basic utilities.
11	Sanitation	B-	D	➢ Construction: • Sanitary conditions will become unfavorable if enough portable toilets are not provided at the construction site.
12	Hazards (Risk) Infectious diseases such as HIV/AIDS	B-	D	➢ Construction: • Most of construction workers will be hired locally. However, countermeasures for prevention of infectious diseases such as HIV/AIDS will be necessary.
Natural Environment				
13	Topography and Geological features	B-	D	➢ Construction: • The underpass will be constructed from North to Mindanao Ave. There will be some risk of slope failures or landslides during excavation works of the underpass.
14	Soil Erosion	D	D	The flyover and underpass will be constructed at the existing intersection in the established commercial area. There will be no risk of soil erosion.
15	Groundwater	D	D	The flyover and underpass will be constructed at the existing intersection in the established commercial area. Groundwater is not locally utilized. Pile driving and excavating the underpass will not affect groundwater flow.

16	Hydrological Situation	D	D	There will be no risk of flooding in the project area.
17	Coastal Zone (Mangroves, Coral reefs, tidal flats, etc.)	D	D	The intersection is not located in the coastal zone.
18	Flora, Fauna and Biodiversity	B-	D	None of protected area is located in the project area. Any endangered species of flora and fauna are not seen in and around the project site. ➢ Construction: • Trees scattered on the central reserves and sidewalks will be cut off at the construction phase, where necessary. Permit to cut trees will be required by DENR. ➢ Operation: • Replant trees on the central reserves and sidewalks.
19	Meteorology	D	D	No impacts are expected.
20	Landscape	B-	B-	➢ Operation: • The flyover may deteriorate the local aesthetic view. • It will also cause sunlight blocking.
21	Global Warming	D	B+	➢ Construction: • The operation of construction vehicles will emit CO_2 but impact on global warming might be slight. ➢ Operation: • As the traffic flow increase and CO_2 emission will increase by 35% in the without-project case n 2018. On the other hand, the increase of CO_2 emissions will reduce by 17% if the flyover is installed.
Pollution Control				
22	Air Pollution	B-	B+	➢ Construction: • Emission of pollutants due to the operation of construction vehicles may slightly deteriorate the ambient air quality. • Along detour routes, emission of pollutants from vehicles may also slightly affect ambient air quality in the vicinity. ➢ Operation: • As the traffic flow will increase, emissions of air pollutants (TSP, SO_2, NO_2) will increase in the without-project case. On the other hand, the emissions of air pollutants will decrease if the flyover is installed.
23	Water Pollution	B-	D	➢ Construction: • Since the flyover and underpass will be constructed at the existing intersection, turbid water due to soil runoff from cutting and filling may temporary degrade the wastewater. ➢ Operation: • Rainfall runoff on the flyover and discharge from the sump pit will be properly treated at the wastewater treatment facilities.
24	Soil Contamination	B-	D	➢ Construction: • Oil and grease emitted from ill-serviced construction machines and heavy vehicles might contaminate soil at the construction site.

25	Waste	B-	D	➢ Construction: • Construction work may generate solid waste such as removed asphalt, soil and sand of the existing roads. Construction workers may also create additional garbage. Waste generation should be properly reduced by reuse and recycle. ➢ Operation: • Road garbage will be properly treated and disposed of in accordance with the regulations of the Philippines.
26	Noise and Vibration	B-	B-	➢ Construction: • Noise and vibration emitted from the operation of construction vehicles may temporary affect sound environment at the project site. • Along detour routes, noise from increased vehicles may also affect sound environment in the vicinity. ➢ Operation: • Reduction of traffic congestion is expected to contribute to noise abatement. • As the traffic flow will increase, noise level will increase in the vicinity of the interchange. Noise mitigation measures such as noise barriers should be taken into account.
27	Ground Subsidence	D	D	No impacts are expected.
28	Offensive Odor	D	D	There will be no activities which cause offensive odor.
29	Bottom sediment	D	D	There will be no activities which deteriorate the bottom sediment quality.
30	Accidents	B-	B+	➢ Construction: • Traffic accidents are likely to occur due to the increase of construction vehicles at the construction phase. ➢ Operation: • Since traffic congestion will be eased, the risk of traffic accidents may be lowered.

Source: JICA Study Team

Rating: A±: Significant positive/negative impact is expected.

B±: Some positive/negative impact is expected.

C±: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)

D: No impact is expected. IEE/EIA is not necessary.

7.4.4 C-5/Green Meadows/Acropolis/Calle Industria Interchange

The result of scoping is summarized in **Table 7.4-4**.

Table 7.4-4 Result of Scoping for C-5/Green Meadows/Acropolis/Calle Industria Interchange

No	Items	Rating		Brief Description
		Construction Phase	Operation Phase	
Social Environment *Regarding the impacts on “Gender” and “Children’s Right”, might be related to all criteria of Social Environment.				
1	Involuntary Resettlement	D	D	There will be no involuntary resettlement.

2	Local economy such as employment and livelihood, etc.	B±	B+	➢ Pre-construction and construction: • (+) Employment of skilled and unskilled labor will be expected. • (-) Business establishments in the vicinity of construction sites will be temporarily affected. ➢ Operation: • Traffic congestion will be eased.
3	Land use and utilization of local resources	D	D	Since the project will improve the traffic of the existing intersection, there will be no changes on land use and utilization of local resources.
4	Social institutions such as social infrastructure and local decision-making institutions	D	D	Since the project will improve the traffic of the existing intersection, there will be no impacts on social institutions and local decision-making institutions.
5	Existing social infrastructures and services	B-	B-	➢ Construction: • Traffic jam is likely to occur during construction. Nuisances such as noise, vibration, exhaust gases and accidents may increase. • Nuisances and traffic of construction vehicles may also influence social infrastructure such as a hospital and church nearby the intersection. • It is necessary to secure the function of commuting roads. • The vicinity of detour routes might be temporary congested. ➢ Operation: • The traffic improvement project may contribute to improving safety and convenience of the communities.
6	The poor, indigenous and ethnic people	D	D	There are no indigenous and ethnic people in and around the project site.
7	Misdistribution of benefit and damage	B-	D	➢ Construction: • Although some stalls at the intersections might be marginally affected during construction, RAP has been prepared to avoid any imbalance of damage and also local conflict.
8	Cultural heritage	D	D	There is no cultural heritage in the vicinity of the interchange.
9	Local conflict of interests	D	D	Since the project will improve the traffic of the existing intersection, there will be no social institutions and local decision-making institutions. Local conflict of interests may arise if misdistribution of benefit and damage due to the project is assumed.
10	Water Usage or Water Rights and Rights of Common	B-	D	There is no water right and rights of common in the project area. Majority of residents obtain their domestic water supply from MWSS. The project will not affect the local water usage. ➢ Construction: • Excavation works within the project site may possibly cause interruption of basic utilities.
11	Sanitation	B-	D	➢ Construction: • Sanitary conditions will become unfavorable if enough portable toilets are not provided at the construction site.
12	Hazards (Risk) Infectious diseases such as HIV/AIDS	B-	D	➢ Construction: • Most of construction workers will be hired locally. However, countermeasures for prevention of infectious diseases such as HIV/AIDS will be necessary.
Natural Environment				
13	Topography and Geological features	D	D	The flyover will be installed over the existing intersection. There will be no risk of slope failures or landslides.

14	Soil Erosion	D	D	The flyover will be installed over the existing intersection. There will be no risk of soil erosion.
15	Groundwater	D	D	The flyover will be installed over the existing intersection. Groundwater is not locally utilized. Pile driving will not affect groundwater flow.
16	Hydrological Situation	D	D	There will be no risk of flooding in the project area.
17	Coastal Zone (Mangroves, Coral reefs, tidal flats, etc.)	D	D	The intersection is not located in the coastal zone.
18	Flora, Fauna and Biodiversity	B-	D	None of protected area is located in the project area. Any endangered species of flora and fauna are not seen in and around the project site. ➢ Construction: • Trees scattered on the central reserves and sidewalks will be cut off at the construction phase, where necessary. Permit to cut trees will be required by DENR. ➢ Operation: • Replant trees on the central reserves and sidewalks.
19	Meteorology	D	D	No impacts are expected.
20	Landscape	B-	B-	➢ Operation: • The flyover may deteriorate the local aesthetic view. • It will also cause sunlight blocking.
21	Global Warming	D	B+	➢ Construction: • The operation of construction vehicles will emit CO_2 but impact on global warming might be slight. ➢ Operation: • As the traffic flow increase, CO_2 emission will increase by 15% in the without-project case in 2018. On the other hand, the increase of CO_2 emissions will reduce by 6% if the flyover is installed.
Pollution Control				
22	Air Pollution	B-	B+	➢ Construction: • Emission of pollutants due to the operation of construction vehicles may slightly deteriorate the ambient air quality. • Along detour routes, emission of pollutants from vehicles may also slightly affect ambient air quality in the vicinity. ➢ Operation: • As the traffic flow will increase, emissions of air pollutants (TSP, SO_2, NO_2) will increase in the without-project case. On the other hand, the emissions of air pollutants will decrease if the flyover is installed.
23	Water Pollution	B-	D	➢ Construction: • Since the flyover will be installed over the existing intersection, turbid water due to soil runoff from cutting and filling may temporary degrade the water quality of White Plains Creek. ➢ Operation: • Rainfall runoff on the flyover and road will be properly treated at the wastewater treatment facilities.
24	Soil Contamination	B-	D	➢ Construction: • Oil and grease emitted from ill-serviced construction machines and heavy vehicles might contaminate soil at the construction site.

25	Waste	B-	D	➢ Construction: • Construction work may generate solid waste such as removed asphalt, soil and sand of the existing roads. Construction workers may also create additional garbage. Waste generation should be properly reduced by reuse and recycle. ➢ Operation: • Road garbage will be properly treated and disposed of in accordance with the regulations of the Philippines.
26	Noise and Vibration	B-	B-	➢ Construction: • Noise and vibration emitted from the operation of construction vehicles may temporary affect sound environment at the project site. • Along detour routes, noise from increased vehicles may also affect sound environment in the vicinity. ➢ Operation: • Reduction of traffic congestion is expected to contribute to noise abatement. • As the traffic flow will increase, noise level will increase in the vicinity of the interchange. Noise mitigation measures such as noise barriers should be taken into account.
27	Ground Subsidence	D	D	No impacts are expected.
28	Offensive Odor	D	D	There will be no activities which cause offensive odor.
29	Bottom sediment	D	D	There will be no activities which deteriorate the bottom sediment quality.
30	Accidents	B-	B+	➢ Construction: • Traffic accidents are likely to occur due to the increase of construction vehicles at the construction phase. ➢ Operation: • Since traffic congestion will be eased, the risk of traffic accidents may be lowered.

Source: JICA Study Team

Rating: A±: Significant positive/negative impact is expected.

B±: Some positive/negative impact is expected.

C±: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)

D: No impact is expected. IEE/EIA is not necessary.

7.5 PREDICTION AND ASSESSMENT OF AMBIENT ENVIRONMENTAL QUALITY

7.5.1 Noise Level

(1) Prediction Method

The mathematical model “ASJ RTN-Model 2008” developed by the Acoustical Society of Japan[1] is used to predict the noise levels based on the projected traffic volume reported in Section 3.3.

The principles and basic formulas used in the prediction model are as follows.

First, obtain the time variation of the A-weighted sound level L_A (unit pattern) observed at a

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[1] K. Yamamoto, “Road traffic noise prediction model “ASJ RTN-Model 2008”: Report of the Research Committee on Road Traffic Noise,” Acoust. Sci. & Tech. 31, 1 (2010)

prediction point for a single vehicle which is passing along the road under consideration. Then, calculate its time integrated value over the duration of its passage, i.e., L_{AE} (the single-event level sound exposure level).

$$L_{AE} = 10\, log_{10} \left(\frac{1}{T_0} \sum_{i=1} 10^{L_{A,i}/10} \cdot \Delta t_i \right) \qquad (eqn.\ 7.5.1)$$

where

$L_{A,\ I}$: the A-weighted sound pressure level at the prediction point emitted from the *i*-th section of the road [dB]

Δt_i : $\Delta D_i / V$

ΔD_i : the length of the *i*-th section of the road [m]

V : the average running speed of the vehicle in the *i*-th section [m/s]

The A-weighted sound pressure level $L_{A,i}$ for noise propagation from the i-th source to the prediction point is calculated by considering the sound propagation in a hemi-free field from an omni-directional point source as:

$$L_{A,i} = L_{WA,i} - 8 - 20\, log_{10}\, r + \Delta L_{cor,i} \qquad (eqn.\ 7.5.2)$$

where

$L_{WA,\ I}$: the A-weighted sound pressure level at a single running vehicle at the *i*-th source [dB]

r_i : the direct distance from the the *i*-th source to the prediction point [m]

The correction term $\Delta L_{cor,i}$ [dB] is related to the various attenuation factors such as the correction for diffraction ($\Delta L_{dif,i}$), correction for ground effect ($\Delta L_{grd,i}$) and correction for atmospheric absorption ($\Delta L_{air,i}$). Therefore,

$$\Delta L_{cor,i} = \Delta L_{dif,i} + \Delta L_{grd,i} + \Delta L_{air,i} \qquad (eqn.\ 7.5.3)$$

The A-weighted sound power level of a road vehicle $L_{WA,\ i}$ [dB] is given by

$$L_{AW,i} = a + b\, log_{10}\, V + C \qquad (eqn.\ 7.5.4)$$

where V is the vehicle speed [km/h], a and b are regression coefficients, and C is the correction term such as correction for pavement condition, road gradient and so on.

Finally, the time averaged value of the noise at a prediction point, L_{Aeq} (the equivalent continuous A-weighted sound pressure level is obtained by taking account of the traffic conditions such as traffic volume (N: number of vehicles per hour) and vehicle types (light and heavy vehicles).

$$L_{Aeq} = 10\, log_{10} \left(10^{L_{AE}/10} \cdot \frac{N}{3600} \right) \qquad (eqn.\ 7.5.5)$$

(2) Input Data and Calculation Conditions

1) Input Data

The future noise levels were calculated based on the projected traffic volume and average travel speed in 2018 reported in **Section 3.3**.

Tables 7.5-1 to **7.5-5** show the projected traffic volume by vehicle types at four interchanges. In this estimate, six vehicle types are categorized into 3 vehicle classes: Light vehicle (car, motorcycle, jeepney and utility vehicle), Heavy vehicle (Track and Bus) and Motorcycle. Average travel velocity during the night time (10.00 p.m. to 6.00 a.m.) was assumed to follow the speed limits[2], i.e., 40 [km/hr] for light vehicles and motorcycle, and 30 [km/hr] for heavy vehicles in this noise estimate.

Table 7.5-1 Projected Average Hourly Traffic Volume in 2018 at C-3/E. Rodriguez Ave I/C

	Day (6.00 a.m. - 10.00 p.m.)		Night (10.00 p.m. - 6.00 a.m.)	
Vehicle class	Traffic volume [unit/hr]	Average velocity [km/hr]	Traffic volume [unit/hr]	Average velocity [km/hr]
Light vehicle	9,675	30	3,602	40
Heavy vehicle	213	32	178	40
Motorcycle	4,050	34	1,162	40

Source: JICA Study Team

Table 7.5-2 Projected Average Hourly Traffic Volume in 2018 at EDSA/Roosevelt I/C

	Day (6.00 a.m. - 10.00 p.m.)		Night (10.00 p.m. - 6.00 a.m.)	
Vehicle class	Traffic volume [unit/hr]	Average velocity [km/hr]	Traffic volume [unit/hr]	Average velocity [km/hr]
Light vehicle	7,065	31	2,957	40
Heavy vehicle	941	32	1,364	30
Motorcycle	1,584	29	359	40

Source: JICA Study Team

Table 7.5-3 Projected Average Hourly Traffic Volume in 2018 at EDSA/North/West I/C

	Day (6.00 a.m. - 10.00 p.m.)		Night (10.00 p.m. - 6.00 a.m.)	
Vehicle class	Traffic volume [unit/hr]	Average velocity [km/hr]	Traffic volume [unit/hr]	Average velocity [km/hr]
Light vehicle	8,100	27	3,962	40
Heavy vehicle	956	33	1,573	30
Motorcycle	1,473	29	375	40

Source: JICA Study Team

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[2] Republic Act No.4136, "Land Transportation and Traffic Code"

Table 7.5-4 Projected Average Hourly Traffic Volume in 2018 at North/Mindanao I/C

	Day (6.00 a.m. - 10.00 p.m.)		Night (10.00 p.m. - 6.00 a.m.)	
Vehicle class	Traffic volume [unit/hr]	Average velocity [km/hr]	Traffic volume [unit/hr]	Average velocity [km/hr]
Light vehicle	4,050	27	1,666	40
Heavy vehicle	137	33	601	30
Motorcycle	1,443	29	307	40

Source: JICA Study Team

Table 7.5-5 Projected Average Hourly Traffic Volume in 2018 at C-5/Green Meadows I/C

	Day (6.00 a.m. - 10.00 p.m.)		Night (10.00 p.m. - 6.00 a.m.)	
Vehicle class	Traffic volume [unit/hr]	Average velocity [km/hr]	Traffic volume [unit/hr]	Average velocity [km/hr]
Light vehicle	10,070	35	2,138	40
Heavy vehicle	454	36	587	30
Motorcycle	2,682	34	512	40

Source: JICA Study Team

2) Calculation Conditions

In this prediction, the correction term C is omitted for simplification in *eqn.* 7.5.4, then the A-weighted sound pressure levels at a single running vehicle $L_{WA,i}$ along the unsteady traffic flow at the interchanges[3] are given as

Light vehicle : $L_{AW,i} = 82.3 + 10\,log_{10} V$ (*eqn.* 7.5.6)

Heavy vehicle : $L_{AW,i} = 88.8 + 10\,log_{10} V$ (*eqn.* 7.5.7)

Motor cycle : $L_{AW,i} = 85.2 + 10\,log_{10} V$ (*eqn.* 7.5.8)

Because of installation of flyover at the interchanges, noise generated by the vibration of the viaduct[3] is also taken into account. The A-weighted sound power level is calculated as

Viaduct : $L_{AW,i} = a + 30\,log_{10} V_h$ (*eqn.* 7.5.9)

where V_h is the running speed of heavy vehicles and a is the value allocated to each type of viaduct. For the concrete viaduct, $a = 35.9$.

Furthermore, the correction terms for attenuation $\Delta L_{cor,i}$ in *eqn.* 7.5.3 were neglected. This simplification provided the conservative estimates, i.e., slightly higher noise levels.

It is assume that all traffic flows would pass through the centre of the interchange and the point of noise source would be at the centre of the intersections. The horizontal distance in **Table 7.5-6** is measured from the centre of the road. The height of the prediction point was set at 1.2 meters above the ground.

(3) Predicted Noise Level

The predicted noise levels based on the projected traffic volume in 2018 are shown in **Table**

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[3] K. Yamamoto, “Road traffic noise prediction model “ASJ RTN-Model 2008”: Report of the Research Committee on Road Traffic Noise,” Acoust. Sci. & Tech. 31, 1 (2010)

7.5.6 for four interchanges. Since the road ROW is 36 to 40 meters wide, the horizontal distance to the edge of the road is 20 meters.

Table 7.5-6 Predicted Noise Levels: L_{Aeq} [dB]

	Time Frame	Day (6.00 a.m. - 10.00 p.m.)				Night (10.00 p.m. - 6.00 a.m.)			
Interchange	Distance^{*1} [m]	10	20	30	40	10	20	30	40
C-3/E. Rodriguez		82	79	77	76	77	75	73	72
EDSA/Roosevelt/Congressional		81	78	76	75	80	77	76	74
EDSA - North/West		81	78	77	75	81	78	76	75
- North-Mindanao		81	78	77	75	77	74	73	71
C-5/Green Meadows/Acropolis		82	79	77	76	78	75	73	72
Philippine^{*1} Standards	Residence	55				45			
	Commercial	65				55			
IFC Guidelines^{*2}	Residence	55				45			
	Industrial	70				70			

Source: JICA Study Team

Note: 1) The National Pollution Control Commission (NPCC) Memorandum Circular No. 002 Series of 1980, Section 78-Ambient Noise Quality and Emission Standards for Noise.Time Frame: Day: 8.00 a.m. – 10.00 p.m.; Night: 10.00 p.m. – 5.00 a.m.

2) General EHS Guidelines; Environmental Noise Management, International Finance Corporation: IFC 2007.Time Frame: Day: 7.00 a.m. – 10.00 p.m.; Night: 10.00 p.m. – 7.00 a.m.

The predicted noise levels at the edge of the road ROW along the interchanges in 2018 might exceed the maximum allowable noise level for a residential area and even for a commercial area, set in the Philippine noise quality standards both during the day and the night. The predicted noise levels at the edge of ROW may also exceed the IFC noise guideline levels.

The estimated noise levels are almost the same as the present noise conditions as reported in **Table 7.2-6**.

(4) Noise Abatement Measures

The recommended proper and feasible abatement measures that should be implemented along the roads and flyovers close to the residential areas, especially schools, hospitals and religious facilities are the following:

- ✓ Install noise barriers and low noise pavement
- ✓ Attach noise absorbing panels under elevated road sections
- ✓ Set environmental facility zones such as green belt
- ✓ Install warning signs on road for horn ban, speed control and lane restriction
- ✓ Regular maintenance on road to keep road surface good condition
- ✓ Develop a mechanism to record and respond to monitoring results and complaints

Table 7.5-7 shows the examples of noise abatement measures, their functions and effectiveness.

Table 7.5-7 Typical Noise Abatement Measures

Mitigation measures	Function	Effectiveness
Low noise pavement	Small porous in the asphalt pavement surface absorb the noise generated by friction between the car tires and road surface.	About 3 dB
Noise barriers	Noise barriers reduce noise by diffraction.	About 10 dB
Environmental buffer zone (e.g., vegetation)	Trees are planted to create green spaces and reduce noise by distance from noise sources.	5~10 dB

Source: Road Development and Environmental Measures, Ministry of Land, Infrastructure, Transportation, and Tourism (http//www.mlit.go.jp/road/ir/data/souon/souon3.html)

7.5.2 Air Pollutants Emission

(1) Estimation method

Emissions of air pollutants such as SPM (Suspended Particulate Matter), SO_2 and NO_x are estimated from the emission factors of developed in the "Technical Handbook for Environmental Impact Assessment of Roads" [4].

The average emission of gaseous pollutants is calculated by the following equation.

$$Q_t = V_W \times \frac{1}{3600} \times \frac{1}{1000} \times \sum_{i=1}^{2}(N_{it} \times E_i) \qquad (eqn.\ 7.5.10)$$

where

Q_t : the average emission of a gaseous pollutant at hour t [mg/m·s]

E_i : the emission factor of the i-th type of vehicle [g/km· vehicle]

N_{it} : the hourly traffic volume of the i-th type of vehicles [vehicle/hr]

V_W : the conversion coefficient [mL/g or mg/g]

The emission factor of the i-th class of vehicle, Ei is calculated by the following equation.

$$E_i = {}^{a}/_{V} + bV + cV^2 + d \qquad (eqn.\ 7.5.11)$$

where V is the average running speed of the i-th type of vehicle and a, b, c, and d are regression coefficients given in **Table 7.5-8** (Technical Handbook for Environmental Impact Assessment of Roads[1] provide the coefficients of SPM, NO_x, SO_2 and CO. **Table7.5-8** shows the calculated emission factors for the light and heavy vehicles at the velocities of 20, 30 and 40 [km/hr].

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[4] Japan Highway Environment Research Institute (HERI), "Technical Handbook for Environmental Impact Assessment of Roads, 2007 edition".

Table 7.5-8 Pollutant Emission Factors [g/km·vehicle] for Vehicle Types

Pollutants	Vehicle Size	*a*	*b*	*c*	*d*	Average speed of vehicle [km/hr]		
						20	30	40
SPM	Light	-0.069	-0.00039	2.87E-06	0.017	0.0070	0.0057	0.0045
	Heavy	0.0318	-0.0031	2.27E-05	0.158	0.1067	0.0865	0.0711
SO_2	Light	0.0783	-0.00016	1.31E-06	0.0112	0.0124	0.0101	0.0088
	Heavy	0.0411	-0.0007	5.51E-05	0.0424	0.0525	0.0724	0.1036
NO_x	Light	-0.902	-0.00578	4.39E-05	0.261	0.1179	0.0970	0.0775
	Heavy	-7.12	-0.0895	0.000735	3.93	2.0780	1.6692	1.3480
CO	Light	-12.5	-0.0559	0.000448	2.2	0.6362	0.5095	0.3683
	Heavy	10.9	-0.0168	0.000115	1.19	1.4450	1.1528	0.9745

Source: JICA Study Team based on Technical Handbook for Environmental Impact Assessment of Roads, 2007

(2) Input Data

The emissions of pollutants were calculated based on the projected traffic flow reported in Chapter 3. Average travel speeds by vehicle types at four interchanges are calculated in **Tables 7.5-9** to **7.5-12**.

Table 7.5-9 Average Travel Speed [km/hr] at C-3/E. Rodriguez Avenue

Vehicle Type		Vehicle Class in *eqn.*1.1	2011	2018		2028	
				With	Without	With	Without
1	Car	Car	27.3	29.9	24.0	30.8	24.4
2	Motorcycle	Car	27.5	30.3	24.0	31.0	25.6
3	Jeepeney	Small truck	27.0	30.4	23.9	31.3	23.6
4	Utility Vehicles	Small truck	27.5	30.8	24.0	31.9	25.7
5	Bus	Bus	27.2	33.8	24.4	34.8	24.7
6	Truck	Truck	27.4	34.0	24.8	34.5	22.1

Source: JICA Study Team

Table 7.5-10 Average Daily Traffic Speed [km/hr] at EDSA/Roosevelt/Congressional

Vehicle Type		Vehicle Class in *eqn.*1.1	2011	2018		2028	
				With	Without	With	Without
1	Car	Car	30.3	30.3	29.3	30.2	28.8
2	Motorcycle	Car	29.3	31.8	28.2	31.7	28.0
3	Jeepeney	Small truck	30.2	29.9	29.2	30.0	28.9
4	Utility Vehicles	Small truck	29.8	33.7	28.7	33.8	29.4
5	Bus	Bus	30.0	30.0	28.9	30.4	28.4
6	Truck	Truck	30.1	27.9	29.0	27.8	28.3

Source: JICA Study Team

Table 7.5-11 Average Daily Traffic Speed [km/hr] at EDSA/North/West/Mindanao

Vehicle Type		Vehicle Class in *eqn.*1.1	2011	2018		2028	
				With	Without	With	Without
1	Car	Car	28.0	28.7	23.7	29.7	24.6
2	Motorcycle	Car	26.8	24.5	24.3	24.7	24.7
3	Jeepeney	Small truck	27.1	27.1	23.6	28.1	23.8
4	Utility Vehicles	Small truck	31.3	35.8	28.7	36.2	29.9
5	Bus	Bus	26.0	28.1	21.5	29.1	22.2
6	Truck	Truck	26.4	29.0	19.6	29.6	20.2

Source: JICA Study Team

Table 7.5-12 Average Daily Traffic Speed [km/hr] at C-5/Green Meadows/Calle Industria

Vehicle Type		Vehicle Class in *eqn.*1.1	2011	2018		2028	
				With	Without	With	Without
1	Car	Car	31.5	33.8	31.3	30.4	27.9
2	Motorcycle	Car	31.4	36.2	31.3	32.4	26.8
3	Jeepeney	Small truck	31.4	34.9	31.2	31.0	26.2
4	Utility Vehicles	Small truck	31.5	36.7	31.2	33.2	27.3
5	Bus	Bus	31.4	35.9	31.2	32.3	27.1
6	Truck	Truck	31.4	34.5	31.3	31.0	27.7

Source: JICA Study Team

(3) Pollutants Emission Estimate

The annual emissions of pollutants calculated by *eqn.*7.5.1 based on average travel speeds in **Tables 7.5-9** to **7.5-12** and vehicle km reported in **Section 3.3** are summarized in **Tables 7.5-13** to **7.5-16**. In this estimate, six vehicle types are categorized into 2 vehicle classes: Light vehicle (car, motorcycle, jeepney and utility vehicle) and Heavy vehicle (Track and Bus).

Table 7.5-13 Annual SPM Emission [tons/year]

Interchanges	2011	2018		2028	
		With	Without	With	Without
C-3/E. Rodriguez	2.26	2.32	2.77	3.36	4.09
EDSA/Roosevelt/Congressional	1.30	1.52	1.68	1.45	1.61
EDSA/North/West/Mindanao	2.01	2.34	2.72	2.21	2.57
C-5/Green Meadows/Acropolis	2.06	2.18	2.38	3.49	3.84

Source: JICA Study Team

Table 7.5-14 Annual SO_2 Emission [tons/year]

Interchanges	2011	2018		2028	
		With	Without	With	Without
C-3/E. Rodriguez	2.72	3.23	3.18	4.81	4.74
EDSA/Roosevelt/Congressional	1.43	1.80	1.79	1.75	1.76
EDSA/North/West/Mindanao	2.27	2.87	2.84	2.78	2.77
C-5/Green Meadows/Acropolis	2.72	3.23	3.14	4.69	4.61

Source: JICA Study Team

Table 7.5-15 Annual NO_x Emission [tons/year]

Interchanges	2011	2018		2028	
		With	Without	With	Without
C-3/E. Rodriguez	41.04	41.88	50.37	60.77	74.44
EDSA/Roosevelt/Congressional	24.19	28.24	31.38	26.78	29.98
EDSA/North/West/Mindanao	36.93	42.99	50.171	40.40	47.18
C-5/Green Meadows/Acropolis	37.43	39.45	43.29	63.13	69.93

Source: JICA Study Team

Table 7.5-16 Annual CO Emission [tons/year]

Interchanges	2011	2018		2028	
		With	Without	With	Without
C-3/E. Rodriguez	112.50	115.78	139.62	167.20	207.15
EDSA/Roosevelt/Congressional	45.47	54.12	59.17	53.71	59.67
EDSA/North/West/Mindanao	85.42	99.67	116.58	95.97	113.38
C-5/Green Meadows/Acropolis	100.37	105.17	116.13	172.22	190.37

Source: JICA Study Team

(4) Reduction of Air Pollutant Emission

Tables 7.5-17 to **7.5-20** show the increase percentages of pollutant emissions in years 2018 and 2028 based on the emission of 2011.

Table 7.5-17 Increase of SPM Emission

Year	2011	2018		2028	
		With	Without	With	Without
C-3/E. Rodriguez Avenue	100%	103%	123%	149%	181%
EDSA/Roosevelt/Congressional	100%	117%	130%	111%	124%
EDSA/North/West/Mindanao	100%	117%	136%	110%	128%
C-5/Green Meadows/Calle Industria	100%	106%	116%	169%	186%

Source: JICA Study Team

Table 7.5-18 Increase of SO_2 Emission

Year	2011	2018		2028	
		With	Without	With	Without
C-3/E. Rodriguez Avenue	100%	119%	117%	177%	174%
EDSA/Roosevelt/Congressional	100%	125%	125%	122%	123%
EDSA/North/West/Mindanao	100%	126%	125%	123%	122%
C-5/Green Meadows/Calle Industria	100%	118%	115%	172%	169%

Source: JICA Study Team

Table 7.5-19 Increase of NO_x Emission

Year	2011	2018		2028	
		With	Without	With	Without
C-3/E. Rodriguez Avenue	100%	102%	123%	148%	181%
EDSA/Roosevelt/Congressional	100%	117%	130%	111%	124%
EDSA/North/West/Mindanao	100%	116%	136%	109%	128%
C-5/Green Meadows/Calle Industria	100%	105%	116%	169%	187%

Source: JICA Study Team

Table 7.5-20 Increase of CO Emission

Year	2011	2018		2028	
		With	Without	With	Without
C-3/E. Rodriguez Avenue	100%	103%	124%	149%	184%
EDSA/Roosevelt/Congressional	100%	119%	130%	118%	131%
EDSA/North/West/Mindanao	100%	117%	136%	112%	133%
C-5/Green Meadows/Calle Industria	100%	105%	116%	172%	190%

Source: JICA Study Team

1) C-3/E. Rodriguez Avenue

The emissions of SPM, NO_x and CO for the without project case will increase by about 23 % due to the increase of the traffic volume in 2018. On the other hand, annual SPM, NO_x and CO emissions will only increase by about 3% in the with-project case. Therefore, the flyover case will reduce SPM, NO_x and CO emissions by about 20%.

On the other hand, in the case of SO_2 in 2018, the emissions will increase by about 18% for both with- and without-project cases. This is because the SO_2 emission factors of heavy vehicles increase as their travel speed increase as shown in **Table 7.5-1.** Although the SO_2 emissions from light vehicles will decrease as the travel speed increase, this effect will be negated by the increase of SO_2 emission due to heavy vehicles.

2) EDSA–Roosevelt Avenue/Congressional Avenue

The emissions of SPM, NO_x and CO for the without project case will increase by 30 % due to the increase of the traffic volume in 2018. On the other hand, annual SPM, NO_x and CO emissions will only increase by about 18% in the with-project case. Therefore, the flyover case will reduce SPM, NO_x and CO emissions by approximately 10%.

On the other hand, in the case of SO_2 in 2018, the increase of emissions will increase by about 17% for both with- and without-project cases. This is because SO_2 emissions from light vehicles will decrease as the travel speed increase, this effect will be negated by the increase of SO_2 emission due to heavy vehicles.

3) EDSA - North/West Ave/Mindanao Avenue

The emissions of SPM, NO_x and CO for the without project case will increase by 16 % due to the increase of the traffic volume in 2018. On the other hand, annual SPM, NOx and CO emissions will only increase by about 6% in the with-project case. Therefore, the flyover case will reduce SPM, NO_x and CO emissions by approximately 10%.

On the other hand, in the case of SO_2 in 2018, the emissions will increase by 16% for both with- and without-project cases. This is because SO_2 emissions from light vehicles will decrease as the travel speed increase, this effect will be negated by the increase of SO_2 emission due to heavy vehicles.

4) C-5/Green Meadows Avenue

The emissions of SPM, NO_x and CO for the without project case will increase by 36 % due to the increase of the traffic volume in 2018. On the other hand, annual SPM, NOx and CO emissions will only increase by about 17% in the with-project case. Therefore, the flyover case will reduce SPM, NO_x and CO emissions by approximately 20%.

On the other hand, in the case of SO_2 in 2018, the emissions will increase by about 18% for both cases. The SO_2 emission of the with-project case might slightly be larger than that of the without-project case. This is because the SO_2 emission factors of heavy vehicles increase as their travel speed increase. Although the SO_2 emissions from light vehicles will decrease as the travel speed increase, this effect will be negated by the increase of SO_2 emission due to heavy vehicles.

(5) Estimate of Ambient Air Quality

When the C-3 Missing Link opens in 2018, the air pollutant emissions of the without MMICP cases will increase due to the increase in traffic volume at the intersections. However, annual emissions of air pollutants in the with-project cases will become about 10 to 20% smaller than the without cases, except for SO_2. The emissions of SO_2 may be the same in both with- and without-project cases.

Therefore the MMICP will contribute in mitigating the air pollutant emissions.

1) Particulate Matter

In the without-project-case, SPM emissions will increase by 16 to 36 % in 2018. On the other hand, SPM emissions will only increase by about 3 to 17 % in the with-project case.

Although the size of particulates measured by TSP is larger than that of SPM, there is a good correlation between TSP and SPM in general. Assuming all other factors being equal to the present conditions, even with 20% increase of SPM emissions in the with-project-case, TSP concentration might not exceed the maximum allowable limits of 24 hours average of the Philippine Clean Air Act of 1999. This is because the present concentrations of TSP are well below the maximum allowable limits of 24 hours average. However, as reported in **Section 7.5.2,** TSP concentrations are higher than the long term limits (1-year-average) and also the WHO air quality standards of 24 hours average.

2) Sulfur Dioxide: SO_2

SO_2 emissions will increase by 15 to 26 % in 2018 for both with- and without-project cases. SO_2 concentration might not exceed the maximum allowable limits of 24 hours average of the Philippine Clean Air Act of 1999. This is because the present concentrations of TSP of 24 hours average are well below the maximum allowable limits of both Philippine Clean Air Act and the WHO air quality standards.

3) Nitrogen Dioxide: NO_2

In the without-project-case, NO_x emissions will increase by 16 to 36 % in 2018. On the other hand, NO_x emissions will only increase by about 2 to 17 % in the with-project case. Nitrogen Oxides (NO_x) consist of nitric oxide (NO) and nitrogen dioxide (NO_2). Increase of NO_x emissions from vehicles will also increase of NO_2 concentration in the atmosphere. Assuming all other factors being equal to the present conditions, even with 20% increase of NO_x emissions in the with-project-case, NO_2 concentration might not exceed the maximum allowable limits of 24 hours average of the Philippine Clean Air Act of 1999. This is because the present concentrations of NO_2 are well below the maximum allowable limits of both Philippine Clean Air Act and the WHO air quality standards as reported in **Section 7.5.2**.

4) Carbon Mono-oxide: CO

In the without-project-case, CO emissions will increase by 16 to 36 % in 2018. On the other hand, CO emissions will only increase by about 3 to 19 % in the with-project case.
The present CO concentrations were not monitored at four interchanges and have not reported in the recent literature. Therefore CO concentrations at the interchanges should be monitored before the project implementation.

5) Remarks

It should be noted that there are some constraints in this estimation, due to the lack of the pollutant emission factors from vehicles in the Philippines. The emission factors used in this study are based on the researches conducted in early 2000 in Japan. For the purpose of relative comparison, these estimates can provide the information for legitimate discussion.

Therefore it should be re-evaluated when emission factors in the Philippines are available. The ambient air quality monitoring was conducted in just one day in the middle of February. In order to grasp background pollutant levels and determine the baseline conditions for the Environmental Monitoring Plan, the monitoring campaign should be carried out before construction.

7.5.3 Estimate of CO_2 Emission

(1) Estimation method

Emissions of CO_2 are estimated from the emission factors of vehicle class developed by the National Institute for Land and Infrastructure Management.[5]

The daily emission of CO_2 is calculated based on the projected future traffic volume by the following equation.

$$Q_t = \sum_{i=1}^{4}(N_i \times E_i) \qquad (eqn.\ 7.5.12)$$

where

Q_t : daily emission of CO_2 [kg-CO_2/km·day]
E_i: CO_2 emission factor of the i-th class of vehicle [g-CO_2/km]
N_i: daily vehicle km of the i-th class of vehicle [km/day]

The emission factor of the i-th class of vehicle, Ei is calculated by the following equation.

$$E_i = {}^{a}/_{V} + bV + cV^2 + d \qquad (eqn.\ 7.5.13)$$

where V is the average travel speed of the i-th class of vehicle and a, b, c, and d are regression coefficients given in **Table 7.5-21** (Technical Note of NILIM[1] provides the coefficients of CO_2, NO_x, PM_{10}, CO and SO_2). **Table 7.5-21** also shows the calculated emission factors for 4 vehicle classes at the velocities of 20, 30 and 40 [km/hr].

Table 7.5-21 CO_2 Emission Factors [g-CO_2/km] for Vehicle Types

Vehicle Size	Regression coefficients				Average speed of vehicle [km/hr]		
	a	***b***	***c***	***d***	20	30	40
Car	1864.3	-2.3201	0.02007	166.85	221.7	177.5	152.8
Small Truck	528.18	-4.9862	0.03926	308.57	251.0	211.9	185.1
Truck	50.285	-27.312	0.20875	1592.7	1132.5	962.9	835.5
Bus	2784.6	-12.752	0.10590	854.18	780.7	659.8	583.2

Source: JICA Study Team based on Technical Note of the NILIM No.141

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[5] Namikawa, Y., Takai Y. and Ohshiro, N. (2003), "Calculation Base of Motor Vehicle Emission Factors", Technical Note of the National Institute for Land and Infrastructure Management No.141.

(2) Input Data

The CO_2 emissions were calculated based on the projected traffic flow reported in Chapter 3. Average travel speeds by vehicle types at four interchanges are summarized in **Tables 7.5-9** to **7.5-12.**

(3) CO_2 Emission Estimate

The annual CO_2 emissions calculated by ***eqn.*7.5.12** based on average travel speeds in **Tables 7.5-9** to **7.5-12** and vehicle km reported in **Section 3.3** are summarized in **Tables 7.5-22** to **7.5-25**. In this estimate, six vehicle types are categorized into 4 vehicle classes: Car (car and motorcycle), small truck (jeepney and utility vehicle), Track and Bus.

Table 7.5-22 Annual CO_2 Emission at C-3/E. Rodriguez Avenue [tons/year]

Year	2011	2018			2028		
		With	Without	Difference	With	Without	Difference
CO_2 Emission	11,381	20,956	23,636	2,680	19,755	22,815	3,061

Source: JICA Study Team

Table 7.5-23 Annual CO_2 Emission at EDSA/Roosevelt/Congressional [tons/year]

Year	2011	2018			2028		
		With	Without	Difference	With	Without	Difference
CO_2 Emission	20,801	24,625	26,812	2,187	24,150	26,546	2,396

Source: JICA Study Team

Table 7.5-24 Annual CO_2 Emission at EDSA/North/West/Mindanao [tons/year]

Year	2011	2018			2028		
		With	Without	Difference	With	Without	Difference
CO_2 Emission	34,978	41,116	47,115	5,999	39,652	45,499	5,847

Source: JICA Study Team

Table 7.5-25 Annual CO_2 Emission at C-5/Green Meadows/Acropolis/Calle Industria [tons/year]

Year	2011	2018			2028		
		With	Without	Difference	With	Without	Difference
CO_2 Emission	39,749	43,275	45,893	2,617	67,552	72,435	4,883

Source: JICA Study Team

(4) Reduction of CO2 Emission

Table 7.5-26 shows the increase percentages of CO_2 emissions in years 2018 and 2028 based on the emission of 2011.

When the C-3 Missing Link opens in 2018, CO_2 emissions of the without MMICP cases will increase from 15% to 108% due to the increase in traffic volume at the intersections. However, annual CO_2 emissions in the with-project cases will become about 6 to 24% smaller than the without cases. Thus the MMICP will contribute in mitigating CO_2 emission.

Table 7.5-26 Increase of CO_2 Emission

Year	2011	2018		2028	
		With	Without	With	Without
C-3/E. Rodriguez Avenue	100%	184%	208%	174%	200%
EDSA/Roosevelt/Congressional	100%	118%	129%	116%	128%
EDSA/North/West/Mindanao	100%	118%	135%	113%	130%
C-5/Green Meadows/Acropolis/Calle Industria	100%	109%	115%	170%	182%

Source: JICA Study Team

1) C-3/E. Rodriguez Avenue

As the traffic flow will increase due to the opening of the C-3 Missing Link in 2018, CO_2 emissions will double in the without-project case. On the other hand, the increase of CO_2 emissions will reduce by 24% if the flyover is installed.

2) EDSA–Roosevelt Avenue/Congressional Avenue

The emissions of CO_2 for the without project case will increase by 29% due to the increase of the traffic volume in 2018. On the other hand, annual CO_2 emissions will increase by 18% in the with-project case. Therefore, the flyover case will reduce CO_2 emissions by 11%.

3) EDSA - North/West Ave. - Mindanao Avenue

The emissions of CO_2 for the without project case will increase by 35% due to the increase of the traffic volume. On the other hand, annual CO_2 emissions will increase by 18% in the with-project case. Therefore, the flyovers and underpass will reduce CO_2 emissions by 17%.

4) C-5/Green Meadows Avenue

The emissions of CO_2 for the without project case will increase by 15% due to the increase of the traffic volume. On the other hand, annual CO_2 emissions will increase by 9% in the with-project case. Therefore, the flyover will reduce CO_2 emissions by 6%.

5) Remarks

The emission factors used in this study are based on the researches conducted in early 2000 in Japan. For the purpose of relative comparison, these estimates can provide the information for legitimate discussion. It should be re-evaluated CO2 emissions when emission factors in the Philippines are available.

7.6 ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan (EMP) for four interchange projects contain a set of mitigation measures to be taken during pre-construction/construction and operation phases, and also the Environmental Monitoring Plan (EMOP) which includes the action needed to implement monitoring.

7.6.1 Mitigation Measures

On the basis of the results of scoping in **Section 7.4**, the mitigation measures for the potential adverse impacts for four interchanges during pre-construction/construction and operation phases are presented in **Tables 7.6-1** to **7.6-8**. The mitigation measures for the Labor Camp Management are common for all four interchange projects and summarized in **Table 7.6-9**.

- ✓ **Tables 7.6-1** and **7.6-2**: C-3/E. Rodriguez Interchange
- ✓ **Tables 7.6-3** and **7.6-4**: EDSA/Roosevelt/Congressional Interchange
- ✓ **Tables 7.6-5** and **7.6-6**: EDSA-North/West/Mindanao Interchange
- ✓ **Tables 7.6-7** and **7.6-8**: C-5/Green Meadows/Acropolis/Calle Industria Interchange
- ✓ **Table 7.6-9**: Mitigation Measures for Labor Camp Management

Table 7.6-1 Mitigation Measures for Pre-construction and Construction Phases in C-3/E. Rodriguez Interchange

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
I. Social Environment					
Local economy such as employment and livelihood, etc.	• Hiring of labor force/manpower	Local labor employment	• Hire unskilled labor (>50%) and skilled labor (>30%) from the vicinity of the project site (RA 6685 and DPWH Department Order 51 series of 1990).	Contractor	DPWH
Existing social infrastructures and services	• Construction of flyover and approach road	• Traffic congestion • Nuisances such as noise, vibration, exhaust gases and accidents • Temporal community severance	• Disseminate information on a construction plan (schedule, traffic restriction section, and etc.) through the media such as radio and paper. • Deploy the traffic enforcers and flagmen at critical construction points to ensure safety of residents. • Perimeter fence shall be installed within the construction area, especially around excavation areas. • Adequate lighting shall be installed within the construction area to provide illumination during nighttime. • Provide temporal pedestrian accesses where necessary though the meeting with LGUs. • Regarding exhaust gases, noise and vibration; refer to mitigation measures for "air pollution" and "noise and vibration" below.	DE/ Contractor/ MMDA/ LGUs	DPWH/ MMDA/ LGUs
Water Usage or Water Rights and Rights of Common	• Construction of flyover and approach road	• Excavation works within the project site may possibly cause interruption of basic utilities.	• Relocation of all affected basic service utilities, especially water, must be undertaken prior to construction to ensure continuous supply of water in the area. • Water and power service interruptions shall be properly scheduled and LGUs shall be notified accordingly to enable them to prepare and undertake the necessary measures. • Water and power service interruptions shall be limited to the least number of days to avoid further disturbance to the affected areas.	DPWH/ Contractor/MWSS/ Manila Electric Company	DPWH/ MMDA/ LGUs
Sanitation	• Influx of Construction workers	• Sanitary conditions will become unfavorable	• Install portable toilets for construction workers. • Install temporal drainage facilities to drain the runoff promptly during a storm.	Contractor	DPWH
Hazards (Risk) Infectious diseases such as HIV/AIDS	• Influx of Construction workers	• Countermeasures for prevention of infectious diseases such as HIV/AIDS	• DPWH and contractor shall provide adequate guidance for construction workers to prevent infectious diseases.	Contractor	DPWH
II. Natural Environment					

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
Flora, Fauna and Biodiversity	• Land clearing	• Cutting of trees	• Permits will be secured from the DENR. • Replanting trees on central reserve and sidewalks.	Contractor	DPWH
Landscape	• Construction of flyover	• Deteriorate the local aesthetic view	• Design consideration to avoid heavy-looking structure of flyover. • Plant trees where possible.	DE/ Contractor	DPWH
III. Pollution Control (Human Health)					
Air Pollution	• Site preparation • Mobilization of equipment and transport of materials • Land clearing • Operation of crushing plant and stockyard • Construction of flyover and approach road	• Increase of particulate matters in the vicinity of construction site due to site preparation and construction activities. • Emission of pollutants from construction machines and vehicles	• Vehicles transporting sands and soils shall be covered with tarpaulin, canvass or sack materials to prevent re-suspension of particulate matters. • Regular sprinkling of water over the construction work area, especially in the dry season. • Stockpiled sands and soils shall be wetted, particularly in windy conditions. • Locate plants and stockyard away from residential and sensitive areas. • Reduce the emission of air pollutants by utilizing low-emission construction machines and vehicles. • Regular tune-up and maintenance of construction equipment and machinery properly. • Stop unnecessary idling.	Contractor	DPWH/ SC
Water Pollution	• All construction works	• Turbid water due to soil runoff from cutting and filling will temporary degrade the water quality of San Juan River. • Possible contamination of water bodies as a result of spillage.	• Avoid the improper land mound to prevent soil erosion from the construction sites, especially during rainy season. • Install a protector and drainage facilities to prevent soil erosion caused by surface runoff during a storm. • For pavement construction, there will be no work during rainy days. • Sediment tanks will be installed for the effluents from the facilities such as crushing plant, quarry, batching plant and other related facilities. • Provide proper construction machines and heavy vehicles and maintain them properly. • Oil and grease traps in drainage system from workshops, vehicles and plant washing facilities and service and fueling areas will be established to prevent contamination of water.	Contractor	DPWH/ SC
Soil Contamination	• Site preparation • Land clearing • Concrete pavement laying • Construction of flyover and approach road	• Oil and grease spilled from ill-serviced construction equipment might contaminate soil at the construction site.	• Provide proper construction machines and heavy vehicles and maintain them properly. • Treat properly wastewater from asphalt wearing and concrete pavement work. • Oil and grease traps in drainage system from workshops, vehicles and	Contractor	DPWH/ SC

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
			plant washing facilities and service and fueling areas shall be established to prevent contamination of water.		
Waste	• All construction works	• Construction work may generate solid waste such as removed asphalt, soil and sand of the existing roads. • Construction workers may also create additional garbage.	• Proper waste management plan to minimize waste generated from construction works shall be included in the construction plan. • Waste disposal sites shall be identified during detailed design stage. • Implement proper management and disposal of construction waste. • Contractor shall be adequately educated on applicable methods for a) restraint of generation; b) classified collection; c) storage; d) transportation; e) proper maintenance of disposal areas. • Re-use and disposal of excess excavated materials on selected areas.	Contractor	DPWH/ SC
Noise and Vibration	• All construction works	• Noise and vibration emitted from the operation of construction machinery and vehicles will temporary affect sound environment at the project site.	• Inform construction schedule to residents in advance. • High noise generating construction activities shall be scheduled during daytime and to minimize disturbance to surrounding residential areas. • Control construction works at night. • Use low-noise construction machines and heavy vehicles. • Noise suppressors, such as mufflers will be installed whenever deemed necessary to maintain the noise generated by various construction machinery and heavy equipment to permissible limits.	Contractor	DPWH/ SC
Accidents	• Traffic Management Plan	• Traffic accidents are likely to occur due to the increase of construction vehicles at the construction phase.	• The routes for construction vehicles shall be determined through the meeting with stakeholders, MMDA and LGUs. • Disseminate information on a construction plan (schedule, traffic restriction section, and etc.) through the media such as radio and paper. • Provide adequate education and training to construction workers regarding traffic safety. • Deploy the traffic enforcers and flagmen at critical construction points to ensure safety of motorists. • Illuminated warning signs and barricades shall be installed along the construction area to prevent untoward accidents. • Adequate lighting shall be installed within the construction area to provide illumination during nighttime. • Perimeter fence shall be installed within the construction area, especially around excavation areas to prevent untoward accidents. • Personnel will be assigned at every detour road's points of entry and exit to regulate traffic flow.	DE/ Contractor/ MMDA/ LGUs	DPWH/ MMDA/ LGUs

Source: JICA Study Team

Note: DE: Design Engineer, SC: Supervising Consultant

Table 7.6-2 Mitigation Measures for Operation Phase in C-3/E. Rodriguez Interchange

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
I. Natural Environment					
Landscape	• Existence of flyover	• Deteriorate the local aesthetic view	• Maintain replanted trees.	LGUs	LGUs/ DPWH
II. Pollution Control (Human Health)					
Air Pollution	• Increase of traffic volume	• As the traffic flow will increase due to the opening of the C-3 Missing Link, emissions of air pollutants will increase.	• The emissions of air pollutants (TSP, SO2, NO2) will decrease if the flyover is installed, compared with the zero option (without-the-project) case(+). • Strictly enforce the emission standards for motor vehicles set pursuant to Philippine Clean Air Act of 1999. • Trees should be planted in the central reserves and sidewalks where possible. • Regular monitoring of ambient air quality along the interchange should be conducted. • Develop a mechanism to record and respond to monitoring results and complaints.	DPWH/ DOTC/DTI/ LGUs	DPWH/ DENR-EMB/ MMDA/ LGUs
Noise and Vibration	• Increase of traffic volume	• As the traffic flow will increase due to the opening of the C-3 Missing Link in 2018, noise level will increase in the vicinity of the interchange.	• Trees should be planted in the central reserves and sidewalks where possible. • Based on the monitoring results of noise levels after opening the flyover, installation of noise barriers should be considered where necessary. • Regular monitoring of noise levels along the interchange should be conducted. • Install warning signs on road for horn ban, speed control and lane restriction. • Regular maintenance on road to keep road surface good condition. • Develop a mechanism to record and respond to monitoring results and complaints.	Contractor/ DPWH	DENR-EMB DPWH/ MMDA/ LGUs

Source: JICA Study Team

Note: DE: Design Engineer, SC: Supervising Consultant

Table 7.6-3 Mitigation Measures for Pre-construction and Construction Phases in EDSA/Roosevelt/Congressional Interchange

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
I. Social Environment					
Local economy such as employment and livelihood, etc.	• Hiring of labor force/manpower	• Local labor employment	• Hire unskilled labor (>50%) and skilled labor (>30%) from the vicinity of the project site (RA 6685 and DPWH Department Order 51 series of 1990).	Contractor	DPWH
	• Improvement of the intersection	• Structures of a few stalls in the Muñoz Public Market will be marginally affected.	• Compensation shall be considered for the affected structure in RAP.	DPWH/ LGUs	DPWH/ MMDA/LGUs
Misdistribution of benefit and damage	• Improvement of the intersection	• Structures of a few stalls in the Muñoz Public Market will be marginally affected.	• RAP has been prepared to avoid any imbalance of damage and also local conflict.	DPWH/ LGUs	DPWH/ MMDA/LGUs
Existing social infrastructures and services	• Construction of flyover and approach road	• Traffic congestion • Nuisances such as noise, vibration, exhaust gases and accidents • Temporal community severance	• Disseminate information on a construction plan (schedule, traffic restriction section, and etc.) through the media such as radio and paper. • Deploy the traffic enforcers and flagmen at critical construction points to ensure safety of residents. • Perimeter fence shall be installed within the construction area, especially around excavation areas. • Adequate lighting shall be installed within the construction area to provide illumination during nighttime. • Provide temporal pedestrian accesses where necessary though the meeting with LGUs. • Regarding exhaust gases, noise and vibration; refer to mitigation measures for “air pollution” and “noise and vibration” below.	DE/ Contractor/ MMDA/ LGUs	DPWH/ MMDA/ LGUs
Water Usage or Water Rights and Rights of Common	• Construction of flyover and approach road	• Excavation works within the project site may possibly cause interruption of basic utilities.	• Relocation of all affected basic service utilities, especially water, must be undertaken prior to construction to ensure continuous supply of water in the area. • Water and power service interruptions shall be properly scheduled and LGUs shall be notified accordingly to enable them to prepare and undertake the necessary measures. • Water and power service interruptions shall be limited to the least number of days to avoid further disturbance to the affected areas.	DPWH/ Contractor/MWSS/ Manila Electric Company	DPWH/ MMDA/ LGUs

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
Sanitation	• Influx of Construction workers	• Sanitary conditions will become unfavorable	• Install portable toilets for construction workers. • Install temporal drainage facilities to drain the runoff promptly during a storm.	Contractor	DPWH
Hazards (Risk) Infectious diseases such as HIV/AIDS	• Influx of Construction workers	• Countermeasures for prevention of infectious diseases such as HIV/AIDS	• DPWH and contractor shall provide adequate guidance for construction workers to prevent infectious diseases.	Contractor	DPWH
II. Natural Environment					
Flora, Fauna and Biodiversity	• Land clearing	• Cutting of trees	• Permits will be secured from the DENR. • Replanting trees on central reserve and sidewalks.	Contractor	DPWH
Landscape	• Construction of flyover	• Deteriorate the local aesthetic view	• Design consideration to avoid heavy-looking structure of flyover. • Plant trees where possible.	DE/ Contractor	DPWH
III. Pollution Control (Human Health)					
Air Pollution	• Site preparation • Mobilization of equipment and transport of materials • Land clearing • Operation of crushing plant and stockyard • Construction of flyover and approach road	• Increase of particulate matters in the vicinity of construction site due to site preparation and construction activities. • Emission of pollutants from construction machines and vehicles	• Vehicles transporting sands and soils shall be covered with tarpaulin, canvass or sack materials to prevent re-suspension of particulate matters. • Regular sprinkling of water over the construction work area, especially in the dry season. • Stockpiled sands and soils shall be wetted, particularly in windy conditions. • Locate plants and stockyard away from residential and sensitive areas. • Reduce the emission of air pollutants by utilizing low-emission construction machines and vehicles. • Regular tune-up and maintenance of construction equipment and machinery properly. • Stop unnecessary idling.	Contractor	DPWH/ SC
Water Pollution	• All construction works	• Turbid water due to soil runoff from cutting and filling will temporary degrade the water quality of San Francisco River. • Possible contamination of water bodies as a	• Avoid the improper land mound to prevent soil erosion from the construction sites, especially during rainy season. • Install a protector and drainage facilities to prevent soil erosion caused by surface runoff during a storm. • For pavement construction, there will be no work during rainy days. • Sediment tanks will be installed for the effluents from the facilities such as crushing plant, quarry, batching plant and other related facilities. • Provide proper construction machines and heavy vehicles and maintain	Contractor	DPWH/ SC

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
		result of spillage.	them properly. • Oil and grease traps in drainage system from workshops, vehicles and plant washing facilities and service and fueling areas will be established to prevent contamination of water.		
Soil Contamination	• Site preparation • Land clearing • Concrete pavement laying • Construction of flyover and approach road	• Oil and grease spilled from ill-serviced construction equipment might contaminate soil at the construction site.	• Provide proper construction machines and heavy vehicles and maintain them properly. • Treat properly wastewater from asphalt wearing and concrete pavement work. • Oil and grease traps in drainage system from workshops, vehicles and plant washing facilities and service and fueling areas shall be established to prevent contamination of water.	Contractor	DPWH/ SC
Waste	• All construction works	• Construction work may generate solid waste such as removed asphalt, soil and sand of the existing roads. • Construction workers may also create additional garbage.	• Proper waste management plan to minimize waste generated from construction works shall be included in the construction plan. • Waste disposal sites shall be identified during detailed design stage. • Implement proper management and disposal of construction waste. • Contractor shall be adequately educated on applicable methods for a) restraint of generation; b) classified collection; c) storage; d) transportation; e) proper maintenance of disposal areas. • Re-use and disposal of excess excavated materials on selected areas.	Contractor	DPWH/ SC
Noise and Vibration	• All construction works	• Noise and vibration emitted from the operation of construction machinery and vehicles will temporary affect sound environment at the project site.	• Inform construction schedule to residents in advance. • High noise generating construction activities shall be scheduled during daytime and to minimize disturbance to surrounding residential areas. • Control construction works at night. • Use low-noise construction machines and heavy vehicles. • Noise suppressors, such as mufflers will be installed whenever deemed necessary to maintain the noise generated by various construction machinery and heavy equipment to permissible limits.	Contractor	DPWH/ SC
Accidents	• Traffic Management Plan	• Traffic accidents are likely to occur due to the increase of construction vehicles at the construction phase.	• The routes for construction vehicles shall be determined through the meeting with stakeholders, MMDA and LGUs. • Disseminate information on a construction plan (schedule, traffic restriction section, and etc.) through the media such as radio and paper. • Provide adequate education and training to construction workers regarding traffic safety. • Deploy the traffic enforcers and flagmen at critical construction points to	DE/ Contractor/ MMDA/ LGUs	DPWH/ MMDA/ LGUs

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
			ensure safety of motorists. • Illuminated warning signs and barricades shall be installed along the construction area to prevent untoward accidents. • Adequate lighting shall be installed within the construction area to provide illumination during nighttime. • Perimeter fence shall be installed within the construction area, especially around excavation areas to prevent untoward accidents. • Personnel will be assigned at every detour road's points of entry and exit to regulate traffic flow.		

Source: JICA Study Team

Note: DE: Design Engineer, SC: Supervising Consultant

Table 7.6-4 Mitigation Measures for Operation Phase in EDSA/Roosevelt/Congressional Interchange

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
I. Natural Environment					
Landscape	• Existence of flyover	• Deteriorate the local aesthetic view	• Maintain replanted trees. •	Contractor/ DPWH/LGUs	DPWH/ LGUs
II. Pollution Control (Human Health)					
Air Pollution	• Increase of traffic volume	• As the traffic flow will increase emissions of air pollutants will increase.	• The emissions of air pollutants (TSP, SO2, NO2) will decrease if the flyover is installed, compared with the zero option (without-the-project) case(+). • Strictly enforce the emission standards for motor vehicles set pursuant to Philippine Clean Air Act of 1999. • Trees should be planted in the central reserves and sidewalks where possible. • Regular monitoring of ambient air quality along the interchange should be conducted. • Develop a mechanism to record and respond to monitoring results and complaints.	DPWH/ DOTC/ DTI/ LGUs	DPWH/ DENR-EMB/ MMDA/ LGUs
Noise and Vibration	• Increase of traffic volume	• As the traffic flow will increase, noise level will increase in the vicinity of the interchange.	• Trees should be planted in the central reserves and sidewalks where possible. • Based on the monitoring results of noise levels after opening the flyover, installation of noise barriers should be considered where necessary. • Regular monitoring of noise levels along the interchange should be conducted. • Install warning signs on road for horn ban, speed control and lane restriction. • Regular maintenance on road to keep road surface good condition. • Develop a mechanism to record and respond to monitoring results and complaints.	Contractor/ DPWH	DENR-EMB DPWH/ MMDA/ LGUs

Source: JICA Study Team

Note: DE: Design Engineer, SC: Supervising Consultant

Table 7.6-5 Mitigation Measures for Pre-construction and Construction Phases in EDSA-North/West/Mindanao Interchange

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
I. Social Environment					
Land Acquisition	• Construction of the tunnel and sump pit	• No resettlement and demolish of structures	• Compensation for loss of land at full replacement cost shall be considered in RAP.	DPWH/ LGUs	DPWH/ MMDA/LGUs
Local economy such as employment and livelihood, etc.	• Hiring of labor force/manpower	• Local labor employment	• Hire unskilled labor (>50%) and skilled labor (>30%) from the vicinity of the project site (RA 6685 and DPWH Department Order 51 series of 1990).	Contractor	DPWH
	• Construction of the depressed and improvement of the intersection	• Structures of a few stalls along Mindanao Ave will be marginally affected.	• Compensation shall be considered for the affected structure in RAP.	DPWH/ LGUs	DPWH/ MMDA/LGUs
Misdistribution of benefit and damage	• Construction of the depressed and improvement of the intersection	• Structures of a few stalls along Mindanao Ave will be marginally affected.	• RAP has been prepared to avoid any imbalance of damage and also local conflict.	DPWH/ LGUs	DPWH/ MMDA/LGUs
Existing social infrastructures and services	• Construction of the depressed and flyover. • Improvement of the intersection	• Traffic congestion • Nuisances such as noise, vibration, exhaust gases and accidents • Temporal community severance	• Disseminate information on a construction plan (schedule, traffic restriction section, and etc.) through the media such as radio and paper. • Deploy the traffic enforcers and flagmen at critical construction points to ensure safety of residents. • Perimeter fence shall be installed within the construction area, especially around excavation areas. • Adequate lighting shall be installed within the construction area to provide illumination during nighttime. • Provide temporal pedestrian accesses where necessary though the meeting with LGUs. • Regarding exhaust gases, noise and vibration; refer to mitigation measures for "air pollution" and "noise and vibration" below.	DE/ Contractor/ MMDA/ LGUs	DPWH/ MMDA/ LGUs
Water Usage or Water Rights and Rights of Common	• Construction of the depressed, flyover and approach road. • Improvement of the intersection	• Excavation works within the project site may possibly cause interruption of basic utilities.	• Relocation of all affected basic service utilities, especially water, must be undertaken prior to construction to ensure continuous supply of water in the area. • Water and power service interruptions shall be properly scheduled and LGUs shall be notified accordingly to enable them to prepare and undertake the necessary measures.	DPWH/ Contractor/MWSS/ Manila Electric Company	DPWH/ MMDA/ LGUs

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
			• Water and power service interruptions shall be limited to the least number of days to avoid further disturbance to the affected areas.		
Sanitation	• Influx of Construction workers	• Sanitary conditions will become unfavorable	• Install portable toilets for construction workers. • Install temporal drainage facilities to drain the runoff promptly during a storm.	Contractor	DPWH
Hazards (Risk) Infectious diseases such as HIV/AIDS	• Influx of Construction workers	• Countermeasures for prevention of infectious diseases such as HIV/AIDS	• DPWH and contractor shall provide adequate guidance for construction workers to prevent infectious diseases.	Contractor	DPWH
II. Natural Environment					
Flora, Fauna and Biodiversity	• Land clearing	• Cutting of trees	• Permits will be secured from the DENR. • Replanting trees on central reserve and sidewalks.	Contractor	DPWH
Landscape	• Construction of flyover	• Deteriorate the local aesthetic view	• Design consideration to avoid heavy-looking structure of flyover. • Plant trees where possible.	DE/ Contractor	DPWH
III. Pollution Control (Human Health)					
Air Pollution	• Site preparation • Mobilization of equipment and transport of materials • Land clearing • Operation of crushing plant and stockyard • Excavation • Construction of the depressed, flyover and approach road. • Improvement of the intersection	• Increase of particulate matters in the vicinity of construction site due to site preparation and construction activities. • Emission of pollutants from construction machines and vehicles	• Vehicles transporting sands and soils shall be covered with tarpaulin, canvass or sack materials to prevent re-suspension of particulate matters. • Regular sprinkling of water over the construction work area, especially in the dry season. • Stockpiled sands and soils shall be wetted, particularly in windy conditions. • Locate plants and stockyard away from residential and sensitive areas. • Reduce the emission of air pollutants by utilizing low-emission construction machines and vehicles. • Regular tune-up and maintenance of construction equipment and machinery properly. • Stop unnecessary idling.	Contractor	DPWH/ SC
Water Pollution	• All construction works	• Turbid water due to soil runoff from cutting and filling will temporary degrade the wastewater quality.	• Avoid the improper land mound to prevent soil erosion from the construction sites, especially during rainy season. • Install a protector and drainage facilities to prevent soil erosion caused by surface runoff during a storm. • For pavement construction, there will be no work during rainy days.	Contractor	DPWH/ SC

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
		• Possible contamination of water bodies as a result of spillage.	• Sediment tanks will be installed for the effluents from the facilities such as crushing plant, quarry, batching plant and other related facilities. • Provide proper construction machines and heavy vehicles and maintain them properly. • Oil and grease traps in drainage system from workshops, vehicles and plant washing facilities and service and fueling areas will be established to prevent contamination of water.		
Soil Contamination	• Site preparation • Land clearing • Excavation • Concrete pavement laying • Construction of flyover and approach road	• Oil and grease spilled from ill-serviced construction equipment might contaminate soil at the construction site.	• Provide proper construction machines and heavy vehicles and maintain them properly. • Treat properly wastewater from asphalt wearing and concrete pavement work. • Oil and grease traps in drainage system from workshops, vehicles and plant washing facilities and service and fueling areas shall be established to prevent contamination of water.	Contractor	DPWH/ SC
Waste	• All construction works	• Construction work may generate solid waste such as removed asphalt, soil and sand of the existing roads. • Excavated waste soil from the depressed section • Construction workers may also create additional garbage.	• Proper waste management plan to minimize waste generated from construction works shall be included in the construction plan. • Waste disposal sites shall be identified during detailed design stage, especially for excavated waste soil. • Implement proper management and disposal of construction waste. • Contractor shall be adequately educated on applicable methods for a) restraint of generation; b) classified collection; c) storage; d) transportation; e) proper maintenance of disposal areas. • Re-use and disposal of excess excavated materials on selected areas.	Contractor	DPWH/ SC
Noise and Vibration	• All construction works	• Noise and vibration emitted from the operation of construction machinery and vehicles will temporary affect sound environment at the project site.	• Inform construction schedule to residents in advance. • High noise generating construction activities shall be scheduled during daytime and to minimize disturbance to surrounding residential areas. • Control construction works at night. • Use low-noise construction machines and heavy vehicles. • Noise suppressors, such as mufflers will be installed whenever deemed necessary to maintain the noise generated by various construction machinery and heavy equipment to permissible limits.	Contractor	DPWH/ SC

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
Accidents	• Traffic Management Plan	• Traffic accidents are likely to occur due to the increase of construction vehicles at the construction phase.	• The routes for construction vehicles shall be determined through the meeting with stakeholders, MMDA and LGUs. • Disseminate information on a construction plan (schedule, traffic restriction section, and etc.) through the media such as radio and paper. • Provide adequate education and training to construction workers regarding traffic safety. • Deploy the traffic enforcers and flagmen at critical construction points to ensure safety of motorists. • Illuminated warning signs and barricades shall be installed along the construction area to prevent untoward accidents. • Adequate lighting shall be installed within the construction area to provide illumination during nighttime. • Perimeter fence shall be installed within the construction area, especially around excavation areas to prevent untoward accidents. • Personnel will be assigned at every detour road's points of entry and exit to regulate traffic flow.	DE/ Contractor/ MMDA/ LGUs	DPWH/ MMDA/ LGUs

Source: JICA Study Team

Note: DE: Design Engineer, SC: Supervising Consultant

Table 7.6-6 Mitigation Measures for Operation Phase in EDSA-North/West/Mindanao Interchange

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
I. Natural Environment					
Landscape	• Existence of flyover	• Deteriorate the local aesthetic view	• Maintain replanted trees.	LGUs	DPWH/ LGUs
II. Pollution Control (Human Health)					
Air Pollution	• Increase of traffic volume	• As the traffic flow will increase emissions of air pollutants will increase.	• The emissions of air pollutants (TSP, SO2, NO2) will decrease if the flyover is installed, compared with the zero option (without-the-project) case(+). • Strictly enforce the emission standards for motor vehicles set pursuant to Philippine Clean Air Act of 1999. • Trees should be planted in the central reserves and sidewalks where possible. • Regular monitoring of ambient air quality along the interchange should be conducted. • Develop a mechanism to record and respond to monitoring results and complaints.	DPWH/ DOTC/ DTI/ LGUs	DPWH/ DENR-EMB/ MMDA/ LGUs
Noise and Vibration	• Increase of traffic volume	• As the traffic flow will increase, noise level will increase in the vicinity of the interchange.	• Trees should be planted in the central reserves and sidewalks where possible. • Based on the monitoring results of noise levels after opening the flyover, installation of noise barriers should be considered where necessary. • Regular monitoring of noise levels along the interchange should be conducted. • Install warning signs on road for horn ban, speed control and lane restriction. • Regular maintenance on road to keep road surface good condition. • Develop a mechanism to record and respond to monitoring results and complaints.	Contractor/ DPWH	DENR-EMB DPWH/ MMDA/ LGUs

Source: JICA Study Team

Note: DE: Design Engineer, SC: Supervising Consultant

Table 7.6-7 Mitigation Measures for Pre-construction and Construction Phases in C-5/Green Meadows/Acropolis/Calle Industria Interchange

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
I. Social Environment					
Local economy such as employment and livelihood, etc.	• Hiring of labor force/manpower	• Local labor employment	• Hire unskilled labor (>50%) and skilled labor (>30%) from the vicinity of the project site (RA 6685 and DPWH Department Order 51 series of 1990).	Contractor	DPWH
Existing social infrastructures and services	• Construction of flyover and approach road	• Traffic congestion • Nuisances such as noise, vibration, exhaust gases and accidents • Temporal community severance	• Disseminate information on a construction plan (schedule, traffic restriction section, and etc.) through the media such as radio and paper. • Deploy the traffic enforcers and flagmen at critical construction points to ensure safety of residents. • Perimeter fence shall be installed within the construction area, especially around excavation areas. • Adequate lighting shall be installed within the construction area to provide illumination during nighttime. • Provide temporal pedestrian accesses where necessary though the meeting with LGUs. • Regarding exhaust gases, noise and vibration; refer to mitigation measures for "air pollution" and "noise and vibration" below.	DE/ Contractor/ MMDA/ LGUs	DPWH/ MMDA/ LGUs
Water Usage or Water Rights and Rights of Common	• Construction of flyover and approach road	• Excavation works within the project site may possibly cause interruption of basic utilities.	• Relocation of all affected basic service utilities, especially water, must be undertaken prior to construction to ensure continuous supply of water in the area. • Water and power service interruptions shall be properly scheduled and LGUs shall be notified accordingly to enable them to prepare and undertake the necessary measures. • Water and power service interruptions shall be limited to the least number of days to avoid further disturbance to the affected areas.	DPWH/ Contractor/ MWSS/ Manila Electric Company	DPWH/ MMDA/ LGUs
Sanitation	• Influx of Construction workers	• Sanitary conditions will become unfavorable	• Install portable toilets for construction workers. • Install temporal drainage facilities to drain the runoff promptly during a storm.	Contractor	DPWH
Hazards (Risk) Infectious diseases such as HIV/AIDS	• Influx of Construction workers	• Countermeasures for prevention of infectious diseases such as HIV/AIDS	• DPWH and contractor shall provide adequate guidance for construction workers to prevent infectious diseases.	Contractor	DPWH

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
II. Natural Environment					
Flora, Fauna and Biodiversity	• Land clearing	• Cutting of trees	• Permits will be secured from the DENR. • Replanting trees on central reserve and sidewalks.	Contractor	DPWH
Landscape	• Construction of flyover	• Deteriorate the local aesthetic view	• Design consideration to avoid heavy-looking structure of flyover. • Plant trees where possible. • Installation of a fence (noise barriers) to protect privacy along the residential zone.	DE/ Contractor	DPWH
III. Pollution Control (Human Health)					
Air Pollution	• Site preparation • Mobilization of equipment and transport of materials • Land clearing • Operation of crushing plant and stockyard • Construction of flyover and approach road	• Increase of particulate matters in the vicinity of construction site due to site preparation and construction activities. • Emission of pollutants from construction machines and vehicles	• Vehicles transporting sands and soils shall be covered with tarpaulin, canvass or sack materials to prevent re-suspension of particulate matters. • Regular sprinkling of water over the construction work area, especially in the dry season. • Stockpiled sands and soils shall be wetted, particularly in windy conditions. • Locate plants and stockyard away from residential and sensitive areas. • Reduce the emission of air pollutants by utilizing low-emission construction machines and vehicles. • Regular tune-up and maintenance of construction equipment and machinery properly. • Stop unnecessary idling.	Contractor	DPWH/ SC
Water Pollution	• All construction works	• Turbid water due to soil runoff from cutting and filling will temporary degrade the water quality of White Plains Creek. • Possible contamination of water bodies as a result of spillage.	• Avoid the improper land mound to prevent soil erosion from the construction sites, especially during rainy season. • Install a protector and drainage facilities to prevent soil erosion caused by surface runoff during a storm. • For pavement construction, there will be no work during rainy days. • Sediment tanks will be installed for the effluents from the facilities such as crushing plant, quarry, batching plant and other related facilities. • Provide proper construction machines and heavy vehicles and maintain them properly. • Oil and grease traps in drainage system from workshops, vehicles and plant washing facilities and service and fueling areas will be established to prevent contamination of water.	Contractor	DPWH/ SC
Soil Contamination	• Site preparation	• Oil and grease spilled	• Provide proper construction machines and heavy vehicles and maintain	Contractor	DPWH/

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
	• Land clearing • Concrete pavement laying • Construction of flyover and approach road	from ill-serviced construction equipment might contaminate soil at the construction site.	them properly. • Treat properly wastewater from asphalt wearing and concrete pavement work. • Oil and grease traps in drainage system from workshops, vehicles and plant washing facilities and service and fueling areas shall be established to prevent contamination of water.		SC
Waste	• All construction works	• Construction work may generate solid waste such as removed asphalt, soil and sand of the existing roads. • Construction workers may also create additional garbage.	• Proper waste management plan to minimize waste generated from construction works shall be included in the construction plan. • Waste disposal sites shall be identified during detailed design stage. • Implement proper management and disposal of construction waste. • Contractor shall be adequately educated on applicable methods for a) restraint of generation; b) classified collection; c) storage; d) transportation; e) proper maintenance of disposal areas. • Re-use and disposal of excess excavated materials on selected areas.	Contractor	DPWH/ SC
Noise and Vibration	• All construction works	• Noise and vibration emitted from the operation of construction machinery and vehicles will temporary affect sound environment at the project site.	• Inform construction schedule to residents in advance. • High noise generating construction activities shall be scheduled during daytime and to minimize disturbance to surrounding residential areas. • Control construction works at night. • Use low-noise construction machines and heavy vehicles. • Noise suppressors, such as mufflers will be installed whenever deemed necessary to maintain the noise generated by various construction machinery and heavy equipment to permissible limits.	Contractor	DPWH/ SC
Accidents	• Traffic Management Plan	• Traffic accidents are likely to occur due to the increase of construction vehicles at the construction phase.	• The routes for construction vehicles shall be determined through the meeting with stakeholders, MMDA and LGUs. • Disseminate information on a construction plan (schedule, traffic restriction section, and etc.) through the media such as radio and paper. • Provide adequate education and training to construction workers regarding traffic safety. • Deploy the traffic enforcers and flagmen at critical construction points to ensure safety of motorists. • Illuminated warning signs and barricades shall be installed along the construction area to prevent untoward accidents. • Adequate lighting shall be installed within the construction area to provide illumination during nighttime.	DE/ Contractor/ MMDA/ LGUs	DPWH/ MMDA/ LGUs

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
			• Perimeter fence shall be installed within the construction area, especially around excavation areas to prevent untoward accidents. • Personnel will be assigned at every detour road's points of entry and exit to regulate traffic flow.		

Source: JICA Study Team

Note: DE: Design Engineer, SC: Supervising Consultant

Table 7.6-8 Mitigation Measures for Operation Phase in C-5/Green Meadows/Acropolis/Calle Industria Interchange

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
I. Natural Environment					
Landscape	• Existence of flyover	• Deteriorate the local aesthetic view	• Maintain replanted trees. • Installation of a fence (noise barriers) to protect privacy along the residential zone.	Contractor/ DPWH/LGUs	DPWH/ LGUs
II. Pollution Control (Human Health)					
Air Pollution	• Increase of traffic volume	• As the traffic flow will increase emissions of air pollutants will increase.	• The emissions of air pollutants (TSP, SO2, NO2) will decrease if the flyover is installed, compared with the zero option (without-the-project) case(+). • Strictly enforce the emission standards for motor vehicles set pursuant to Philippine Clean Air Act of 1999. • Trees should be planted in the central reserves and sidewalks where possible. • Regular monitoring of ambient air quality along the interchange should be conducted. • Develop a mechanism to record and respond to monitoring results and complaints.	DPWH/ DOTC/ DTI/ LGUs	DPWH/ DENR-EMB/ MMDA/ LGUs
Noise and Vibration	• Increase of traffic volume	• As the traffic flow will increase, noise level will increase in the vicinity of the interchange.	• Trees should be planted in the central reserves and sidewalks where possible. • Based on the monitoring results of noise levels after opening the flyover, installation of noise barriers should be considered where necessary.	Contractor/ DPWH	DENR-EMB DPWH/ MMDA/ LGUs

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
			• Regular monitoring of noise levels along the interchange should be conducted. • Install warning signs on road for horn ban, speed control and lane restriction. • Regular maintenance on road to keep road surface good condition. • Develop a mechanism to record and respond to monitoring results and complaints.		

Source: JICA Study Team

Note: DE: Design Engineer, SC: Supervising Consultant

Table 7.6-9 Mitigation Measures for Labor Camp Management during Pre-construction and Construction Phases

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
Fundamental Infrastructure and healthcare services	• Construction and management of the labor camp	• Potable water	• The Contractor will construct and maintain all labor accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing. • The Contractor will also provide potable water facilities within the precincts of every workplace in an accessible place, as per standards set by the Philippines Occupational Safety and Health Standards (As Amended), 1992. • The contractor will also guarantee the following: • i) Supply of sufficient quantity of potable water in every workplace/labor camp site at suitable and easily accessible places and regular maintenance of such facilities. • ii) If any water storage tank is provided that will be kept such that the bottom of the tank at least 1m from the surrounding ground level. • iii) If water is drawn from any existing well, the contractor shall ensure that sharing water will not cause any shortage in the local community. • iv) Testing of water will be done every month as per parameters prescribed in the Philippine National Standards for Drinking Water 2007.	Contractor	DPWH/ SC
		• Sanitation and sewage	• The sewage system for the camp are designed, built and operated in	Contractor	DPWH/

Environmental Component Likely to be Affected	Activities Which Will Likely Impact the Environmental Component	Environmental and Social Impacts	Mitigation/Enhancement Measures	Responsibility	
				Implementation	Supervision/ Monitoring
		system	such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place. • Separate toilets/bathrooms, wherever required, screened from those from men (marked in vernacular) are to be provided for women. • Adequate water supply is to be provided in all toilets and urinals. • Provide hand washing facilities at all cooking and eating areas. • Provide good mobile toilets for each construction site. Alternatively, install two chamber septic tanks toilets for each construction team of 50 - 100 workers		SC
		• Waste management	• The contractor shall provide segregated rubbish bins in the camps and ensure that these are regularly emptied and disposed off as per the Waste Management Plan. • Provide many rubbish bins around camp. Discourage throwing of garbage, waste food, cigarettes, drinks cans on ground. Empty bins to skips regularly and transfer to landfill when full or at least weekly. • Arrangements for disposal of night soils (human excreta) approved by the MMDA/LGUs or as directed by the SC will have to be provided by the contractor.	Contractor	DPWH/ SC
		• Transmission of infectious diseases from local people to workers and vice versa	• Improve awareness of infectious diseases prevention, particularly HIV/AIDS and flu for workers. • Set up a medical facility for large-size construction camps for first aid and health care for workers. • Install sign boards, lighting system at the construction sites, borrow pits, or places which may cause accidents for people and workers. • Fill up holes, ponds created by filling, cutting and earthworks to prevent health risk and remove vector growth places. • Fill up ponds at worker sites and kill rats, bugs, flies and mosquitoes.	Contractor	DPWH/ SC
		• Development of temporary camp to permanent resettlement	• Ensure abandonment of construction camp after the completion of the project • Donate work camp buildings as public facilities such as a barangay center.	Contractor	DPWH

Source: JICA Study Team

Note: DE: Design Engineer, SC: Supervising Consultant

7.6.2 Environmental Monitoring Plan

Items requiring monitoring are summarized in the following tables based on the mitigation measures elaborated in **Tables 7.6-1** to **7.6-9**. The Environmental Monitoring Plan (EMOP) shall be included in the EIA documents for each package of MMICP with mitigation measures as Environmental Management Plan (EMP) when DPWH applies the ECC to DENR-EMB.

(1) Environmental Monitoring Plan for Construction Phase

The EMOP during the construction phase is presented in **Table 7.6-10**, which is common for all interchange projects.

Table 7.6-10 Environmental Monitoring Plan for Construction Phase

Monitoring Programme/Items	Location	Parameters	Frequency/Schedule	Responsibility
Resettlement Action Plan (RAP)	All interchange construction sites	• Additional ROW Affected Structures Other Affected Structures	Refer to RAP	Refer to RAP
Local economy (Employment)	Project sites	• Ratio of local employment versus total employment	Monthly for a construction period of each package^{*1}	DPWH/LGUs Contractor/SC
Traffic Management Plan	Intersections and detour roads	• Continuous flow of traffic	Daily monitoring for a construction period of each package^{*1}	MMDA/ DPWH/LGUs Contractor/SC
Public Meeting (Safety Measures)	All interchange construction sites	• Community health and safety issues, grievance	Quarterly for a construction period of each package^{*1}	DPWH/SC Contractor/ LGUs
Trees	All interchange construction sites	• Condition of Trees	Quarterly for a construction period of each package^{*1}	DPWH/LGUs/ DENR/SC/ Contractor
Ambient Air Quality	All interchange construction sites (Figure 7.3-2)	• Air pollutants: PM10, NO2, SO2	Quarterly for a construction period of each package^{*1}	DPWH/SC/ Contractor/ LGUs/DENR
		• Air pollutants: Dust dispersion	For a construction period of each package^{*1}	DPWH/SC Contractor/ LGUs/DENR
Noise and vibrations	All interchange construction sites (Figure 7.3-2)	• Noise level: LAeq (day and night) • Vibration acceleration	Quarterly for a construction period of each package^{*1}	DPWH/SC/ Contractor/ LGUs/DENR
Waste	All interchange construction sites and labour camp	• Site conditions and cleanliness	Daily monitoring for a construction period of each package^{*1}	DPWH/SC/ DENR/LGUs Contractor

Source: JICA Study Team

Note 1) Monitoring shall be conducted even when construction period is extended.

2) SC: Supervising Consultant, DPWH: Environmental and Social Services Office (ESSO),
MMT: Multi-partite Monitoring Team

(2) Environmental Monitoring Plan for Operation Phase

The EMOP during the operation phase is presented in **Table 7.6-11**, which is common for all interchange projects.

Table 7.6-11 Environmental Monitoring Plan for Operation Phase

Monitoring Programme	Location	Parameters	Frequency/Schedule	Responsibility
Replanted Trees	All interchange project sites(Figure 7.3-2)	•Trees' height and diameter	1 survey for first three operational years	DPWH/LGUs
Ambient Air Quality	All interchange project sites(Figure 7.3-2)	•Air pollutants: PM10, NO2, SO2, CO	Twice a year after opening the roads	DPWH/DENR
Noise and vibrations	All interchange project sites	•Noise level: LAeq (day and night) •Vibration acceleration	Twice a year after opening the roads	DPWH/DENR

Source: JICA Study Team

Note 1) Monitoring shall be conducted even when construction period is extended.

2) SC: Supervising Consultant, DPWH: Environmental and Social Services Office (ESSO),
MMT: Multi-partite Monitoring Team

7.6.3 DPWH Policy for EMP Implementation and Multi-partite Monitoring Team

The policy of the DPWH requires that, in the design and implementation of the project, all efforts must be exercised to ensure that:

- ✓ Adverse social and environmental impacts are avoided, minimized and/or mitigated;
- ✓ Everybody will benefit from the project; and
- ✓ Project stakeholders are consulted regarding the project design, implementation and operation

In view of the above premises, a Multi-partite Monitoring Team (MMT) shall be formulated and undertaken to assist the DPWH in implementing its policy. The composition of the MMT shall include the following:

- Representative from the Proponent (DPWH–URPO-PMO and ESSO)
- Representative from the DENR-EMB Regional Office;
- Representative from the Local Government Unit/s (LGUs);
- Representative from NGO;
- Representative/s from other interested stakeholders such as the business sector

7.6.4 Self-monitoring

DPWH shall also conduct regular self-monitoring of specific parameters indicated in the EMOP through its environmental unit (ESSO). The ESSO shall submit a semi-annual monitoring report within January and July of each year.

7.6.5 Monitoring Report Submission to JICA

DPWH has also the responsibility to prepare the reports of environmental monitoring results in accordance with the EMOP including the EMP and submit it to JICA in the form as shown in **Appendix 7.1**. The monitoring reports shall be submitted to JICA quarterly during the construction phase. During the operation phase after opening the interchanges, the report shall be submitted to JICA biannually for three years.

7.7 SUPPORT DPWH IN PREPARATION OF EIA DOCUMENTS TO OBTAIN ECC

7.7.1 Required EIA Documents for MMICP to Obtain ECC

(1) Review of Environmental Category

The results of scoping presented in **Section 7.4** suggest that the all four interchange projects could be categorized B.

1) Impacts on Socio-economic Conditions

- ✓ No large scale involuntary resettlement is anticipated.
- ✓ Only a few stalls will be marginally affected.
- ✓ As a consequence, the abbreviated RAP will be prepared as required in accordance with JICA Guidelines and WB Safeguard policy, as well as the legal systems of the Philippines (Refer to Section 7.8).

2) Impacts on Natural Environment and Human Health

- ✓ The project sites of all four interchange projects are not located in any vicinity of the protected areas. Any significant negative impacts are not expected because there will be no land reclamation, land cutting and land clearing.
- ✓ Adverse impacts on human health such as deterioration of ambient air quality will be eased due to the projected traffic.
- ✓ The appropriate Environmental Impact Study will be conducted in accordance with Philippines EIA regulations and also JICA Guidelines.

(2) Preliminary Scoping Conducted with DENR-EMB

In accordance with the Project Grouping Matrix of the Revised Procedural Manual for DENR Administrative Order 2003-30 (the implementing rules and regulations of the Philippine EIS System of Presidential Decree No. 1586), the interchange projects, flyovers or tunnels fall under "Group II – Non-Environmentally Critical Projects located in Environmentally Critical Areas" wherein the project proponents are required to submit an Initial Environmental Examination Report (IEE) for ECC application.

In this regard, a Preliminary Scoping was held at the Office of the Regional Director, DENR-EMB National Capital Region (NCR) on 29 November 2011. Presiding Officer during the Technical Meeting was Regional Director Roberto Sheen. The other attendees were the following:

- ✓ Emiliano R. Kempis – Chief, EIA & Monitoring Division (DENR–EMB-NCR)
- ✓ Joyce J. Marciano – Chief, Review and Assessment Section (DENR–EMB-NCR)

- ✓ Dolores M. Viloria – Economist (DPWH–ESSO)
- ✓ Koyo Ogasawara – JICA Study Team (Environmental & Social Considerations)
- ✓ Francisco A. Kalalo, Jr – JICA Study Team (Environmental & Social Considerations)

Upon evaluation of the individual interchange project, the EIA & Monitoring Division Chief (assisted by the Review and Assessment Section Chief) decided that the Proponent must prepare and submit an IEE Report for each ECC application based on the applicable DENR Guidelines (DAO 2003-30).

The DENR–EMB-NCR furnished the Proponent's Representatives copies of the DENR Memorandum Circular No. 14, Series of 2010 (Standardization of Requirements and Enhancement of Public Participation in the Streamlined Implementation of the Philippine EIS System) and the new Annotated Outline for EIA Reports for Proposed (New) Single Projects.

Therefore, the required documents to submit to DENR-EMB are the IEE Report in order to obtain the ECCs for four interchange projects.

7.7.2 IEE Report Preparation

The JICA Study Team supports DPWH in the preparation of the IEE reports, entrusting adequate and well experienced local consultants to carry out the surveys necessary for IEE.

In accordance with the PEIS explained in **Section 7.1**, the contents to be assessed in the IEER are outlined in **Table 7.1-7**. Because the following items should be covered in the IEE/EIA reports in accordance with JICA Guidelines, the necessary information are supplemented in this Chapter.

1) Baseline Survey on environmental and social conditions: **Section 7.2**
2) Institutions and organizations relevant to environmental and social considerations in the Philippines): **Section 7.1**
    a) Laws and regulations on environmental and social considerations
    b) Gaps between JICA Guidelines and policy, laws and regulations in the Philippines
    c) Roles and responsibilities of relevant organizations
3) Analysis of alternatives (including “without project” option): **Section 7.3**
4) Implementation of scoping: **Section 7.4**
5) Prediction and assessment of environmental impacts: **Sections 7.4** and **7.5**
6) Environmental Management Plan including mitigation measures and monitoring plans: **Section 7.6**
7) Cost and budget and funding sources of Environmental Management Plan: **Section 7.8**
8) Stakeholders meetings: **Section 7.9**

7.7.3 Cost and Budget

(1) Cost Estimates for Mitigation Measures

Cost estimate for the environmental mitigation measures during the construction and operation phases are summarized in **Table 7.7-1**.

Table 7.7-1 Cost Estimate for Environmental Mitigation Measures

Item	Stage	Mitigation Measures	Unit	Unit Cost (Php)	Quantity	Total Cost (Php)
Trees	Construction	Trees replanting	-.	-	-	Covered in Engineering Cost
	Operation	Tree monitoring	-	-	-	LGUs
Air Quality	Construction	Dust control measures: sprinkling of water; covers of the trucked material during transportation	-	-	-	Covered in Engineering Cost
	Construction	Pollutant emission control measures: low emission construction vehicles, maintenance and inspection.	-	-	-	Covered in Engineering Cost
Water and soil	Construction	Wastewater control measures and spill protection of oil and grease	-	-	-	Covered in Engineering Cost
	Construction	Establish an oil spill monitoring system and a rapid response unit in the contractor's team.	-	-	-	Covered in Engineering Cost
Noise and Vibrations	Construction	Noise and vibration control measures: Proper service of equipment; installation of sound barriers for pile driving activity; construction activities to be restricted during day time hours only.	-	-	-	Covered in Engineering Cost
	Construction/ Operation	Noise barriers (Transparent noise barrier sheets such as acrylic plates)	-	-	-	Covered in Engineering Cost
		Planting tress	-	-	-	Covered in Engineering Cost
	Operation	Install warning signs on road for horn ban, speed control and lane restriction	-	-	-	DPWH/ MMDA
	Operation	Regular maintenance on road to keep road surface good condition	-	-	-	DPWH
	Operation	Develop a mechanism to record and respond to monitoring results and complaints	-	-	-	DPWH/ LGUS
Waste	Construction	Project Waste Management Plan (PWMP): To promote segregation and recycling (3R: Reduce, Re-use and Recycle)	-	-	-	Covered in Engineering Cost
Traffic congestion	Construction	Traffic Management Plan	-	-	-	Covered in Engineering Cost
Community severance	Construction	Provision of pedestrian and livestock underpasses, service road, foot bridges and street lighting.	-	-	-	Covered in Engineering Cost
	Construction	Temporary traffic diversions to include walkways and cycle tracks.	-	-	-	Covered in Engineering Cost

Item	**Stage**	**Mitigation Measures**	**Unit**	**Unit Cost (Php)**	**Quantity**	**Total Cost (Php)**
Community Health and Safety	Construction	Public meetings regarding health and safety issues during construction, grievance redress (quarterly for a construction period of each package)	-	-	-	Covered in Engineering Cost
Labor Camp	Construction	Occupational health and safety for labor camp	-	-	-	Covered in Engineering Cost
Total Cost for Environmental Mitigation Measures						-

Source: JICA Study Team

(2) Cost Estimates for Environmental Monitoring Plan (EMOP)

Cost estimate for the EMOP during construction and during the operation phase are summarized in **Tables 7.7-2** and **7.7-3** respectively.

Table 7.7-2 Cost Estimate for EMOP Plan during Construction

No.	Monitoring Works	Unit	Unit Cost (Php)	Quantity	Total Cost (Php)
1	Local economy (Employment)	-	-	-	Covered by enginnering cost
2	Traffic Management Plan Monitoring	-	-	-	Covered by enginnering cost
3	Trees	No.	50,000	4 times/year	200,000
4	Ambient Air Quality	No.	40,000	4 times/year	160,000
5	Noise and Vibrations	No.	30,000	4 times/year	120,000
6	Waste Management Plan Monitoring	-	-	-	Covered by enginnering cost
7	Public Meetings	-	-	-	Covered in Engineering Cost
Total Annual Cost for Environmental Monitoring (No.1 to 7)					**480,000**

Source: JICA Study Team

Table 7.7-3 Annual Cost for EMOP during Operation

No.	Monitoring Works	Unit	Unit Cost (Php)	Quantity	Total Cost (Php)
1	Replanted Trees	L.S.	50,000	2 times/year	100.000
2	Ambient Air Quality	No.	40,000	2 times/year	80,000
3	Noise and Vibration	No.	30,000	2 times/year	60,000
Annual EMOP Cost during Operation					**240,000**

Source: JICA Study Team

Since there are three packages, the monitoring costs for each package are summarized in **Tables 7.7-4** and **7.7-5**.

Table 7.7-4 Total Cost for EMOP during Construction

Package	Annual Unit Cost (Php)	Construction period (year)	Total Cost (Php)
Package 1	480,000	2 (24months)	960,000
Package 2	480,000	1.83 (22months)	880,000
Package 3 (2 I/C)	480,000 x2	1.83 (22months)	880,000 x2
		Total EMOP Cost during Construction	**3,600,000**

Source: JICA Study Team

Table 7.7-5 Total Cost for EMOP during Operation

Package	Annual Unit Cost for operation (Php)	Total Cost for operation (Php)
Package 1	240,000	240,000
Package 2	240,000	240,000
Package 3 (2 I/C)	240,000 x2	480,000
	Total Annual EMOP Cost during Operation	960,000
	Total Cost for the first 3 operational years	**2,880,000**

Source: JICA Study Team

(3) Budget

Note that implementation of the C3-E. Rodriguez Interchange was cancelled by the DPWH to give priority to the construction of Skyway Stage 3, second level, along C3 under BOT scheme.

1) Budget for Mitigation Measures

All the costs for mitigation measures for each interchange project are covered by the engineering cost shown in **Chapter 5**. The budget for implementing the mitigation measure is under JICA loan.

The contractors are responsible for studying, preparing options and implementing the environmental mitigation measures. These costs shall be included incorporated in the bidding documents for the contractors.

2) Budget for Environmental Monitoring Plan

Total EMOP cost during the construction phase is estimated in **Table 7.7-4**. The budget for implementing the EMOP during the construction phase is under the construction supervision item and covered by JICA loan.

Total annual EMOP during the operation phase is estimated in **Table 7.7-5** for first three operational years. The budget for implementing the EMOP during the operation phase shall be covered by DPWH.

7.8 SUPPORT DPWH IN PREPARATION OF RESETTLEMENT ACTION PLAN (RAP)

7.8.1 Required RAP Documents for MMICP

In accordance with the JICA Guidelines/World Bank O.P 4.12, in order to minimize the number of PAPs and affected structures, alternative schemes were examined as discussed in **Section 7.3** and **Chapter 4**. As a consequence, PAPs are avoided and affected structures are minimized as shown in **Table 7.8-1**.

Project Affected Persons (PAPs) due to four interchange projects are summarized in **Table 7.8-1**. There are no PAPs including informal settlers to be relocated in any project sites of MMICP. Therefore, an Abbreviated Resettlement Action Plan (ARPA) is acceptable for each interchange project.

Table 7.8-1 Land Acquisition, PAPs and Affected Structure for MMICP

Interchange	Land Acquisition	PAPs	Affected Structure
C-3/E. Rodriguez	None	None	None
EDSA/Roosevelt/Congressional	None	None	5 stalls (marginal[*1])
EDSA/North/West/Mindanao	Additional ROW for sump pit (50 sq.m)	None	25 stalls (marginal[*1])
C-5/Green Meadows/Acropolis/ Calle Industria	None	None	None

Source: JICA Study Team

Note 1) the impact is only partial and the remaining portion of the property or asset is still viable for continued use.

7.8.2 The results of Census Survey and Inventory (Assets & Land) Survey

(1) C-3/E. Rodriguez Avenue Interchange

According to LAPRAP (2005), 94 informal settlers (PAPs) had been encroaching along the ROW. However, According to the information from DPWH-UPRO, informal settlers had been removed by MMDA and Quezon City as part of the METRO GWAPO Program.

1) METRO GWAPO Program

The JICA Study Team conducted a site visit on 09 February 2012. Purpose of the visit was primarily to get information relevant to the removing of residential structures (owned by informal settlers) inside the ROW along G. Araneta Avenue near the corner of E. Rodriguez Avenue under the MMDA's METRO GWAPO Program in cooperation with the Quezon City conducted April 2007.

MMDA's METRO GWAPO was a five-year program with an estimated cost of roughly Php 23.3 billion which includes projects that would address traffic management, roadways clearing, resettlement, flood control, and disaster management. It aims to transpose Metro Manila into a good-looking metropolis.

There were two groups of Informal Settlers who were affected by the sidewalk clearing/

road widening project at G. Araneta Ave.

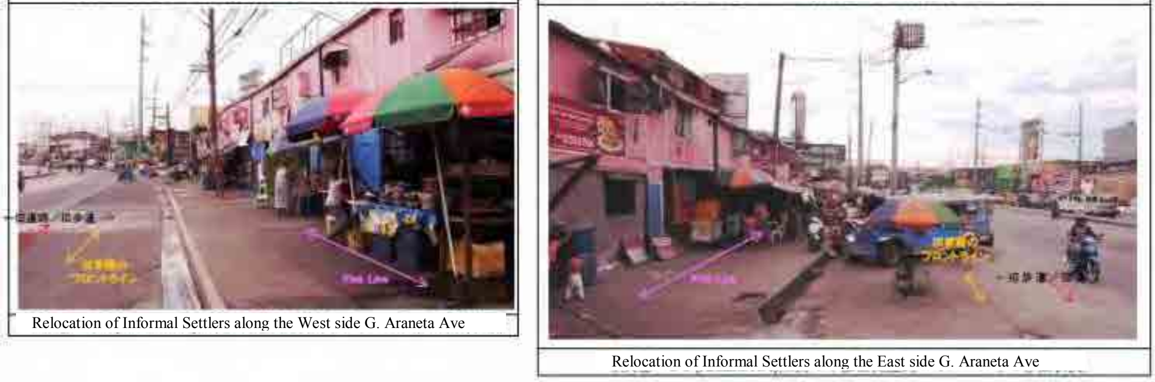
Through an interview with the President of 630 G. Araneta Neighborhood Association (eastern side of G. Araneta Ave.) – Mrs. Amparo Moya, the Team got information that all affected owners of residential structures were given each a total of Php15,000 (Php10,000 from Quezon City LGU and Php5,000 from MMDA). Families or owners of structures along the first and second rows had no choice but to relocate by themselves upon receipt of the financial assistance.

The MMDA drew the Pink Lines establishing demarcation lines where no private structures (temporary or permanent). The Pink Lines also serves as demarcation lines or limits for pedestrian walkways. The Informal Settler Families are now all located in a privately-owned property (**Figure 7.8-1**).

On the other side of G. Araneta Ave. (western side of G. Araneta Avenue) – Mrs. Ellen Guillermo, President of D' Original KANAI Neighborhood Association and several members of the Gregorio 625 Blk. 3 Araneta Neighborhood Association, Inc. informed the JICA Study Team that they received the same financial assistance (PhP15,000). Affected families were all able to rebuilt residential structures because they had areas left outside the Pink Lines after removing structures inside the demarcation lines or Pink Lines. The Informal Settler Families are also now all located in a privately-owned property (**Figure 7.8-1**).

Community of Informal Settlers along the West side of G.Araneta Ave

Community of Informal Settlers along the East side of G.Araneta Ave



Relocation of Informal Settlers along the West side G. Araneta Ave

Relocation of Informal Settlers along the East side G. Araneta Ave

Source: JICA Study Team

Figure 7.8-1 Community of Informal Settlers at along G. Araneta Avenue

2) Affected Structures

Because no land acquisition is required for this project, there are no identified Project Affected Families (PAFs) whose structures will be marginally and severely affected.

3) Other Improvements and Trees

The number of affected other improvements are listed in **Table 7.8-2**. The affected trees are listed in **Table 7.8-3**.

Table 7.8-2 Affected Other Structures of C-3/E. Rodriguez Interchange

No.	Kinds of Posts	Brgy. Dona Imelda	Brgy. Tatalon	Total
1	Utility Post (inside the pink line)	24	7	31
2	Utility Post (outside the pink line)	9	19	28
3	Lamp Post (outside the pink line)	2	21	23
4	Street Marker/Signages (inside)	3	-	3
5	Signboard	-	1	1
6	Traffic Light	3	1	4
7	Waiting Shed	4	1	5
8	Extension (Hotel SOGO)	24	1	25

Source: JICA Study Team

Table 7.8-3 Affected Trees of C-3/E. Rodriguez Interchange

Brgy. Dona Imelda

Species	No. of Trees	Unit Cost (Php)	Amount (Php)
Balite	3	-	-
Mahogany (small)	24	5,471.25	131,310.00
Mahogany (large)	1	5,471.25	5,471.25
Pine Tree	1	-	-
Papaya (s)	1	-	
Total	30	-	136,781.25

Brgy. Tatalon

Species	No. of Trees	Unit Cost (Php)	Amount (Php)
Sampaloc (large)	2	-	-
Mango (medium)	1	-	-
Acacia (large)	1	-	-
Duhat (medium)	1	-	-
Balite (small)	1	-	-
Papaya (small)	1	-	-
Coconut	1	-	-
Total	8	-	0.00

Source: JICA Study Team

Note that the cost for the trees with an assessed value as per DENR will be given to the LGUs. The trees with no assessed value will be replaced by 10 seedlings/trees to be cut as per DENR's policy. The LGUs will determine an open space based on the National Greening Program for reforestations in coordination with DENR and DPWH.

(2) EDSA/Roosevelt/Congressional Interchange

1) Affected Structures

Although no land acquisition is required for this project, based on the preliminary survey, the following list in shown **Tables 7.8-4** are the affected structures classified as movable stalls within Munoz Market. These stalls can be moved backward to accommodate the proposed construction activities during the actual construction. Hence, disturbance of their daily business operation will be minimal. The disturbance may only take at least one day during the transferring of their stalls backward to be assisted by DPWH. The stall owners extended their support to the proposed project so they are willing to move backward.

Table 7.8-4 Affected Structures of EDSA/Roosevelt/Congressional Interchange (Munoz Market)

No.	Brgy.	Name	Type of Stalls	
			Fruit Stand	Merchandise
1	Katipunan	Pol Marcillan		✓
2	Katipunan	Louie Cayabyab		✓
3	Katipunan	Bobby Millar	✓	
4	Katipunan	Rey Madabo	✓	✓
5	Katipunan	Gemalyn Rogel	✓	✓

Source: JICA Study Team

2) Other Improvements and Trees

The number of affected other improvements are listed in **Table 7.8-5**. The affected trees are listed in **Table 7.8-6**.

Table 7.8-5 Affected Other Structures of EDSA/Roosevelt/Congressional Interchange

No.	Kinds of Posts	Brgy. Katipunan	Brgy. Ramon Magsaysay	Total
1	Utility Post (inside the pink line)	62	-	62
2	Utility Post (outside the pink line)	28	-	28
3	Lamp Post (outside the pink line)	3	3	6
4	Control Board	3	3	6
5	Signboard	1	-	1
6	Foot Bridge	2	2	4
7	Informative Sign	2	-	2
8	Extension (Stalls)	15	-	15
9	Brgy. Outpost	1	1	2
10	Bridge	-	1	1
11	Bus/Jeepney Bay	1	-	1
12	Marker Arch	2	2	4
13	Billboard (STI)	-	1	1

Source: JICA Study Team

Table 7.8-6 Affected Trees of EDSA/Roosevelt/Congressional Interchange

Brgy. Katipunan

Species	No. of Trees	Unit Cost (Php)	Amount (Php)
Balite inside pink line (s)	39	-	-
Bonggangvilla (s) - Center Island	10	-	-
Total	30	-	0.00

Brgy. Ramon Magsaysay

Species	No. of Trees	Unit Cost (Php)	Amount (Php)
Bonganvilla (s)	25	-	-
Mahogany (m)	4	5,471.25	21,884.80
Mahogany (FG)	1	5,471.25	5,471.25
Balete (s)	14	-	-
Total	44	-	27,356.05

Source: JICA Study Team

(3) EDSA/North/West/Mindanao Interchange

1) Land Acquisition

It was initially assessed that a 100 m^2 lot of Veterans Memorial Hospital utilized as Golf Course will be acquired in order to install a sump pit. The Golf Course is operated by the Government Owned and Controlled Corporation.

2) Affected Structures

Based on the preliminary assessment, an estimated 30 m^2 (0.6m width x 50m length) of sidewalks classified as commercial utilized by the following business establishments along Mindanao Avenue will be affected shown in **Table 7.8-7**. These business establishments will be minimally disturbed during construction due to the removal and re-pavement of 30m^2 extension pavements. However, their businesses may be still in operation during construction, considering that none of their commercial structures will be demolished.

Table 7.8-7 Marginally Affected Extension of EDSA/North/West/Mindanao Interchange (Pavement)

No.	Barangay	Name	Owner
1	Pag-Asa	Three Kings Auto Electrical Services	-
2	Pag-Asa	Auto Center	-
3	Pag-Asa	Vulcanizing Shop	-
4	Pag-Asa	JA-Euro	-
5	Pag-Asa	Pag-Asa Motor Trading	-
6	Pag-Asa	J Carlos Food Hous	Milagros Cornelia
7	Pag-Asa	Victoria Couture & Design	-
8	Pag-Asa	Velco Gasoline Station	-
9	Pag-Asa	Wegel Underchasis Shop	-
10	Pag-Asa	839 Machine Works	-
11	Pag-Asa	Manrose Enterprises	-
12	Pag-Asa	MCTG Trading	-
13	Pag-Asa	MJD Health & Fitness Gym	-
14	Pag-Asa	Midea Air Conditioner	-
15	Pag-Asa	VarAdus Food House	-
16	Pag-Asa	Elaps Litson & Liempo	-
17	Pag-Asa	Orbitzenana Resto	-
18	Pag-Asa	Lotto Station & Restaurant	Cris Abaluna
19	Pag-Asa	Stall # 19	Arnold Orsal
20	Pag-Asa	Toknene Canteen	Violeta Orsal
21	Pag-Asa	Stall # 21	Rolie Colinco
22	Pag-Asa	GNR Bldg.,	-
23	Pag-Asa	Princess Videoke	-
24	Pag-Asa	Sari-Sari Store	Alex Villareal
25	Pag-Asa	Rovick Gaming Center	-

Source: JICA Study Team

3) Other Improvements and Trees

The number of affected other improvements are listed in **Table 7.8-8**. The affected trees are listed in **Table 7.8-9**.

Table 7.8-8 Affected Other Structures of EDSA/North/West/Mindanao Interchange

No.	Kinds of Posts	Bgry. Bungad	Bgry. Phil-Am	Bgry. Pag-Asa	Total
1	Utility Post (inside the pink line)	-	-	22	22
2	Utility Post (outside the pink line)	12	6	-	18
3	Lamp Post (outside the pink line)	10	10	14	37
4	Street Marker/Signages (inside)	-	-	-	2
5	Control Board	-	-	-	3
6	Traffic Light	-	-	1	1
7	Waiting Shed	-	-	1	1
8	Foot Bridge	-	-	-	2
9	Informative Sign	-	-	4	4
10	Brgy. Outpost	-	-	-	1
11	Bridge	-	-	-	1

Source: JICA Study Team

Table 7.8-9 Affected Trees of EDSA/North/West/Mindanao Interchange

Brgy. Pag-Asa

Species	No. of Trees	Unit Cost (Php)	Amount (Php)
Acacia (Full Grown)	1	5,316.00	10,632.00
Ipil-Ipil (Medium)	7	-	-
Coconut (Full Grown)	4	-	-
Papaya (Small)	2	-	-
Duhat (Medium)	1	-	-
Jackfruit	3	-	-
Santol (Full Grown)	2	-	-
Cotton/Kapok	1	-	-
Big-Leafed Mahogany (Med)	36	5,471.25	372,045.00
Big-Leafed Mahogany (Full Grown)	25	5,471.25	273,562.50
Mango	1	-	-
Big-Leafed Mahogany (Small)	2	-	-
Coconut (Full Grown)	5	-	-
TOTAL	148	-	**656,239.50**

Source: JICA Study Team

(4) C-5/Green Meadows/ Acropolis/Calle Industria Interchange

1) Affected Structures

Because no land acquisition is required for this project, there are no identified PAFs whose structures will be marginally and severely affected.

2) Other Improvements and Trees

The number of affected other improvements are listed in **Table 7.8-10**. The affected trees are listed in **Table 7.8-11**.

Table 7.8-10 Affected Other Structures of C-5/Green Meadows Interchange

No.	Kinds of Posts	Bgry. Ugong Norte	Brgy. Bagumbayan	Total
1	Utility Post (inside the pink line)	5	100	105
2	Utility Post (outside the pink line)	3	85	88
3	Lamp Post (outside the pink line)	3	2	5
4	Street Marker/Signages (inside)	-	4	4
5	Street Marker/Signages (outside)	-	1	1
6	Control Board	2	-	2
7	Signboard	1	1	1
8	Traffic Light	-	5	5
9	Waiting Shed	2	2 (inside)	4
10	Foot Bridge	-	2	2
11	Fire Hydrant	-	1	1
12	Fence	-	1 (inside)	1
13	Bridge	-	2	2

Source: JICA Study Team

Table 7.8-11 Affected Trees of C-5/Green Meadows Interchange

Brgy. Ugong Norte

Species	No. of Trees	Unit Cost (Php)	Amount (Php)
Mahogany	1	5,471.25	5,47125
Bonganvilla	1	-	
Total	2	-	5,471.25

Brgy. Bagumbayan

Species	No. of Trees	Unit Cost (Php)	Amount (Php)
Indian Tree (FG)	26	-	-
Bonganvilla	234		-
Mahogany (s)	3	5,471.25	16,413.75
Mahogany (m)	15	5,471.25	82,068.75
Mahogany (FG)	21	5,471.25	114,896.25
Banaba	60	-	-
Aratilis	1	-	-
Alibangbang	6	-	-
Narra (s)	2	-	-
Rose	6	-	-
Fire Tree (s)	2	-	-
Camachile (FG)	3	-	-
Ipil-Ipil (FG)	1	-	-
Banaba (newly planted)	6	-	-
Balite	2	-	-
Total	388	-	213,378.75

Source: JICA Study Team

7.8.3 Eligibility for Compensation and Entitlements

(1) Cut-off Date

The Cut-off Date eligible for compensation was set on 1st February 2012 when the socio-economic survey commenced. No structure and field established in the project-affected area after the Cut-off Date shall be eligible for compensation. The Cut-off Date has been explained and declared during the first level Public Consultation Meetings.

(2) Compensation Entitlements

The compensation entitlements for each category of PAPs are summarized in **Table 7.1-12**, based on the JICA Guidelines/World Bank O.P4.12 and DPWHs policy (LARRIPP, 2007) discussed in **Table 7.1-9**.

Table 7.8-12 Entitlement Matrix

	Type of Loss	Application	Entitled Person	Compensation
1	Main Structures (e.g. house cum store)	Structure, with or without a building permit, partially affected and the remaining structure is still viable for continued use.	Owners of structure with full title or tax declaration to the land or those who are covered by customary law (e.g., possessory rights, usufruct) or other acceptable proof of ownership	+ Compensation in cash for the affected portion of the structure, including the cost of restoring the remaining structure, as determined by the Municipal/City Resettlement Implementation Committee (MRIC) with no deduction for salvaged building materials. + PAPs who have business affected due to the partial impact on the structure are entitled to a subsistence allowance for income loss during the reconstruction period. (Such will be verified and computed by the MRIC).
			Owners of structures, including shanty dwellers in urban areas, have no title or tax declaration to the land or other acceptable proof of ownership	+ Compensation in cash for the affected portion of the structure, including the cost of restoring the remaining structure and reconnection of damaged utilities, as determined by the MRIC with no deduction for salvaged building materials. + Shanty dwellers in urban areas who opt to go back to their place of origin in the province or be shifted to government relocation sites will be provided free transportation. + PAPs who have business affected due to the partial impact on the structure are entitled to a subsistence allowance for income loss during the reconstruction period. (Such will be verified and computed by the MRIC). + Professional squatters will not receive compensation but they can collect their salvageable materials.
			Renters (tenants) of leased affected structures, including renters of shanty dwellings in urban areas Nil	+ Given 3 month notice on the schedule of demolition + If shifting is required, PAP is given transitional allowance equivalent to one month rent of a similar structure within the same area. + For house tenants renting structures outside of, or within the ROW, but who have to transfer elsewhere, will be provided free transportation. + Renting shanty dwellers in urban areas who opt to go back to their place of origin in the province or be shifted to government relocation sites will be provided free transportation.

	Type of Loss	Application	Entitled Person	Compensation
		Entire structure affected OR when the remaining structure becomes not viable for continued use, with or without a building permit	Owners of structures with full title or tax declaration to the land or those who are covered by customary law (e.g., possessory rights, usufruct) or other acceptable proof of ownership Nil	+ Compensation in cash for the entire structure at replacement cost as determined by the MRIC without deduction for salvaged building materials. + Disturbance fee of PhP 10,000 will be added to the amount to be paid for the structure. + PAPs who have business affected due to the severe impact on the structure are entitled to a subsistence allowance for the loss of income during the reconstruction period. (Such will be verified and computed by the MRIC). + If relocation is necessary, free transportation will be provided. + Rehabilitation assistance in the form of skills training and other development activities and equivalent to PhP 15,000 will be provided in coordination with other government agencies if the present means of livelihood is no longer viable and the PAP will have to engage in a new income activity.
			Owners of structures, including shanty dwellers in urban areas, have no title or tax declaration to the land or other acceptable proof of ownership ---- HH (house) ---- HH (house cum shop)	+ Compensation in cash for the entire structure at replacement cost as determined by the MRIC without deduction for salvaged building materials. + Substitute lot of equal or bigger area and, preferably, near the PAP household's original place + Shanty dwellers in urban areas who opt to go back to their place of origin in the province or be shifted to government relocation sites will be provided fee transportation. + PAPs who have business affected due to the severe impact on the structure are entitled to a subsistence allowance for the loss of income during the reconstruction period.
				(Such will be verified and computed by the MRIC). + If relocation is necessary, free transportation will be provided. + Rehabilitation assistance in the form of skills training and other development activities and equivalent to PhP 15,000 will be provided in coordination with other government agencies if the present means of livelihood is no longer viable and the PAP will have to engage in a new income activity. + Professional squatters will not receive compensation but they can collect their salvageable materials.

	Type of Loss	Application	Entitled Person	Compensation
			Renters (tenants) of leased affected structures, Including renters of shanty dwellings in urban areas	+ Given 3 month notice on the schedule of demolition + PAP is given transitional allowance equivalent to on month rent of a similar structure within the same area + For house tenants renting structures outside of, or within the ROW, but who have to transfer elsewhere will be provided free transportation. + Rehabilitation assistance in the form of skills training and other development activities and equivalent to PhP 15,000 will be provided in coordination with other government agencies if the present means of livelihood is no longer viable and the PAP will have to engage in a new income activity. + Renting shanty dwellers in urban areas who opt to go back to their place of origin in the province or be shifted to government relocation sites will be provided free transportation.
		Shops, with or without building permit, partially affected and the remaining structures are still viable for continued use.	Owners of structure with or without full title or tax declaration to the land or those who are covered by customary law (e.g., possessory rights, usufruct) or other acceptable proof of ownership -----HH	+ Compensation in cash for affected portion of the structure, including the cost of restoring the remaining structure and reconnection of any damaged utilities, as determined by the MRIC with no deduction for salvaged building materials. + As determined by the MRIC, PAPs will be entitled to a transitional allowance to cover for their computed income loss during the demolition and reconstruction of their ships, but not to exceed a 1 month period..
			Renters (tenants) of affected shops Nil	+ As determined by the MRIC, shop renters will be entitled to a transitional allowance to cover for their computed income loss during the period that their business is interrupted.
		Entire shop affected OR when the remaining structure becomes not viable for continued use, with or without a building permit	Owner of structure with or without full title or tax declaration to the land or those who are covered by customary law (e.g., possessory rights, usufruct) or other acceptable proof of ownership	+ Compensation in cash for the entire structure at replacement cost as determined by the MRIC without deduction for salvaged building materials. + Subsistence allowance of PhP 15,000 to each PAP + Rehabilitation assistance in the form of skills training and other development activities and equivalent to PhP 15,000 will be provided in coordination with other government agencies if the present means of livelihood is no longer viable and the PAP will have to engage in a new income activity + Professional squatters will not receive compensation but they can collect their salvageable materials. + If household is relocating, PAP will be entitled to: - Free transportation - Substitute lot of equal or bigger area and, preferably, near the PAP household's original place

	Type of Loss	Application	Entitled Person	Compensation
			Renters (tenants) of affected shops Nil	+ Given 3 month notice on the schedule of demolition + Subsistence allowance of PhP 15,000 + If shifting, either permanently or temporarily is required, shop renters are entitled to free transportation + Rehabilitation assistance in the form of skills training and other development activities and equivalent to PhP 15,000 will be provided in coordination with other government agencies if the present means of livelihood is no longer viable and the PAP will have to engage in a new income activity
2.	Other fixed assets or structures	Loss of, or damage to, affected assets, partially or entirely		+ Compensation in cash for affected portion of the structure, including the cost of restoring the remaining structure, as determined by the concerned appraisal committee, with no depreciation nor deduction for salvaged building materials.
3.	Electric and/or water services	Loss of, or damage to, affected assets, partially or entirely		+ Compensation to cover cost of restoring the facilities
4.	Public structures	Loss of, or damage to, public infrastructure (e.g., Barangay waiting shed, military outpost).		Compensation in cash at replacement cost to respective barangay governments.

Source: Land Acquisition, Resettlement, Rehabilitation and Indigenous Peoples' Policy (LARRIPP), 3rd edition (2007)

7.8.4 Stakeholder Meeting and Public Consultation

The JICA Study Team assisted DPWH-URPO and ESSO in conducting a series of Public Consultation Meetings in January through April 2012 for relevant barangays in the vicinity of the project sites as reported in **Section 7.9**. The objectives of the public consultations/meetings were to create awareness on the part of the stakeholders particularly on project concepts, requirements of NEDA, DENR, JICA and other concerned agencies as far as environmental and social safeguards considerations are concerned and the likely impacts, schedule of activities, and the setting up of a cut-off date. The EIA and RAP preparations were discussed in the meetings (Refer to **Section 7.9**).

7.8.5 Grievance Process

Grievance related to any aspect of the project or sub-project will be handled through negotiations and are aimed at achieving consensus following the procedures outlined below:

1) Grievance will be filed by the Project Affected Family (PAF) with the Resettlement Implementation Committee (RIC) who will act within 15 days upon receipt thereof, except complaints and grievances that specifically pertain to the valuation of affected assets, since such will be decided upon by the proper courts;

2) If no understanding or amicable solution can be reached, or if the PAF does not receive a response from the RIC within 15 days of registry of the complaint, he/she can Appeal to the

concerned Regional Office, which should act on the complaint/grievance within 15 days from the day of its filing;

3) If the PAF is not satisfied with the decision of the District Engineering Office, he/she, as a last resort, can submit the complaint to any court of law.

   PAFs will be exempted from all administrative and legal fees incurred pursuant to the grievance redress procedures.

   All complaints received in writing (or written when received verbally) from the PAFs will be documented and shall be acted upon immediately according to the procedures.

In the event that the PAF rejects the compensation at replacement cost offered by the DPWH, the DPWH or the PAF may take the matter to court. When court cases are resorted to by either the DPWH through expropriation or by the PAFs through legal complaints, the DPWH will deposit with the court in escrow the whole amount of the replacement cost (100%). It is offering to the owner for his/her assets as compensation to allow the DPWH to proceed with the works. The PAF will receive the replacement cost of the assets within one (1) month following the receipt of the decision of the court.

7.8.6 Institutional Arrangement

All concerned public and private organizations and institutions must strive to work closely together for implementation of the projects to ensure the success of the government project.

DPWH LARRIP requires that, in the design and implementation of the project, all efforts must be exercised to ensure that:

1) adverse social and physical impacts are avoided, minimized and/or mitigated;
2) everybody, including PAFs, will benefit from the project;
3) PAFs 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; and
4) Project stakeholders (which include PAFs) are consulted regarding the project design, implementation and operation;

In view of the above premises, the creation of Municipal Resettlement Implementation Committee shall be formed to assist the DPWH implement its policy.

(1) The Municipal/City Resettlement Implementation Committee (MRIC)

An MRIC for each affected municipality will be formed and composed of the following:

- ✓ The Municipal/City Mayor
- ✓ The DPWH-URPO, Regional Director

- ✓ The Chairperson of the Barangay
- ✓ A representative of the PAFs in the barangay and
- ✓ A representative of municipal-wide Non-government Organization (NGO), if there is any, endorsed by the other members of the RIC.

(2) The functions of the MRIC

1) Assist the DPWH staff engaged in LARRIP activities in (i) validating the list of PAFs; (ii) validating the assets of the PAFs that will be affected by the project (using a prepared compensation form; and (iii) monitoring and implementing the LARRIP;
2) Assist the DPWH staff engaged in the LARRIP activities in the public information campaign, public participation and consultation;
3) Assist the DPWH in the payment of compensation to PAFs;
4) Receive complaints and grievances from PAFs and other stakeholders and act accordingly;
5) Maintain a record of all public meetings, complaints, and actions taken to address complaints and grievances; and
6) In coordination with concerned government authorities, assist in the enforcement of laws/ordinances regarding encroachment into the project site or the ROW.

(3) The functions of the DPWH Offices

1) The URPO shall be the over-all responsible for the supervision of the construction of project. It shall ensure that funds for the timely implementation of RAP are available. It will assist the ESSO and IROW-PMO who provides technical guidance in the implementation of the RAP.
2) The PMO-IROW will provide assistance to ESSO in the resettlement activities
3) The Environmental and Social Services Office (ESSO) shall provide technical guidance and support in the implementation of the RAP and will be responsible for the following resettlement activities:
   a) overall preparation and planning of the RAP;
   b) submit RAP budget plans (to include compensation, relocation costs, operation) for Approval and allocation of needed resources by the DPWH central office;
   c) amend or complement the RAP in case problems are identified during the internal and/or external monitoring of its implementation;
   d) in collaboration with URPO, monitor the actual payment of compensation to PAFs; and,
   e) in collaboration with its regional counterpart, prepare periodic supervision and monitor

reports on RAP implementation for submission to URPO and to the JICA.

7.8.7 Monitoring Mechanism

The main objective of monitoring the implementation of the RAP is to determine whether or not the RAP is carried out in accordance with the Resettlement Policy. It involves the monitoring of land acquisition, payment of compensation for lost assets and resettlement of PAPs.

(1) Supervision and Internal Monitoring

The DPWH ESSO shall conduct the supervision and in-house monitoring of implementation of the RAP. The tasks of the Internal Monitoring Agent (IMA) are to:

1) Regularly supervise and monitor the implementation of the RAPs in coordination with URPO and the Resettlement Implementation Committee.
2) Verify that the re-inventory baseline information of all PAFs has been carried out and that the valuation of assets lost or damaged, the provision of compensation and other entitlements, and relocation if there is any has been carried out in accordance with the RAP Policy and the RAP Report.
3) Supervise that the RAP is implemented as designed and approved.
4) Verify that funds for implementing the RAP is provided by URPO in timely manner and in amounts sufficient for the purpose.
5) Record all grievances and their resolution and ensure that complaints are dealt with, in timely manner.

(2) External Monitoring and Evaluation

An External Monitoring Agent (EMA) will be commissioned by the DPWH-PMO to undertake independent external monitoring and evaluation. The EMA for the Project will be either a qualified individual or a consultancy firm with qualified and experienced staff. The Terms of Reference of the engagement of the EMA shall be prepared by the DPWH.

The tasks of the EMA are the following:

1) Verify results of internal monitoring;
2) Verify and assess the results of the information campaign for PAFs rights and entitlements;
3) Verify that the compensation process has been carried out with the procedures communicated with the PAFs during the consultations;
4) Assess whether resettlement objectives have been met; specifically, whether livelihoods and living standards have been restored or enhanced;
5) Assess efficiency, effectiveness, impact and sustainability of resettlement, drawing lessons

as a guide to future resettlement policy making and planning;

6) Ascertain whether the resettlement entitlements were appropriate to meet the objectives, and whether the objectives were suited to PAF conditions;

7) Suggest modification in the implementation procedures of the RAPs, if necessary, to achieve the principles and objectives of the Resettlement Policy Framework.

8) Review on how compensation rates were evaluated; and

9) Review of the handling of compliance and grievances cases.

(3) Stages and Frequency of Monitoring

The stages and monitoring frequency of the contract packages by the IMA and EMA as follows:

1) Compliance Monitoring

This is the first activity that both IMA and EMA shall undertake to determine whether or not the RAPs were carried out as planned and according to this policy.

The EMA will submit an Inception Report and Compliance Monitoring Report one month after receipt of Notice to Proceed for the engagement. The engagement of the EMA shall be scheduled to meet the Policy's requirement of concluding RAP implementation activities at least one (1) month prior to the start of civil works.

2) Semi-Annual Monitoring - The EMA will be required to conduct a monthly monitoring of RAP implementation activities.

3) Final Evaluation

Final evaluation of the implementation of the LARRIPP will be conducted three months after the completion of payments of compensation to PAPs.

(4) Post- Evaluation

This activity will be undertaken a year after the completion of the project, to determine whether the social and economic conditions of the PAFs and the affected IPs after the implementation of the project have improved.

(5) Reporting

The EMA is accountable to the PMO and reports to the ESSO. The PMO submits copy of EMA's Reports to JIAC.

7.8.8 Implementation Schedule

DPWH, PMO-URPO through the Project Consultant in coordination with the ESSO shall establish a schedule for the implementation of RAP and the required monitoring taking into account the project's implementing schedule shown in **Table 5.4-1**. It is expected that one month prior to the start of the civil works, all RAP activities have been determined by the IMA and EMA as having been conducted.

For all four RAPs, no relocation is needed considering that only trees and other improvements have been identified to be affected. Therefore, payment of compensation to PAFs or LGUs for the trees to be cut will be undertaken in 2015 including the transferring of utility posts and other facilities prior to commencement of work.

For the Package-1, i.e., EDSA/North/West/Mindanao Ave. Interchange Project, an activity of ROW acquisition will commence once the detailed design is finalized by the end of 2014 as explained in **Section 5.4**.

Table 7.8-13 RAP Implementation Schedule

Activity	Year	2012		2013				2014				2015				2016			
	Term	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Finalize Abbreviated RAP		■	■																
Detailed Design								■	■	■	■								
Set-up RAP Implementation Team & Prepare the Work Plan							■												
Confirm PAPs and Assets								■	■										
Handling of Grievance								■	■	■	■	■	■	■	■	■	■	■	■
Payment of Compensation to PAPs													■	■					
ROW Acquisition (Package-1)												■	■	■	■				
Removal of Assets															■				
Construction																■	■	■	■

Source: JICA Study Team

7.8.9 Cost and Budget

The costs necessary for implementing the RAP are estimated for four interchange projects in **Tables 7.8-14** to **7.8-17**.

Table 7.8-14 Summary of Impacts and Estimated Resettlement Cost of C-3/E. Rodriguez I/C

Description	Amount (Php)	Remarks
Re-connection of utilities and other facilities	1,185,000.00	• Affected utilities and other facilities will be coordinated with National Power Corporation, MERALCO and other concerned agencies for the transferring and re-installation/ reconnection. • The estimated cost includes materials & labor cost computed at Php15,000/lamp post. This cost including the number of affected cost will be subject for validation after the detailed design (DD).
Trees and other perennials	131,786.25	• A Permit to Cut Trees will be secured to DENR prior to cutting. • Numbers of trees to be cut including cost are subject for validation after DD.
Other facilities/utilities	500,000.00	• Lump sum estimated cost to re store other facilities such as sign boards etc. but still subject for validation after DD.
Sub-Total	1,816,786.25	-
5% Management Cost	90,839.31	-
10% Contingencies	181,678.62	-
TOTAL	**2,089,304.18**	• Estimated RAP cost is subject for validation after DD.

Source: JICA Study Team

Table 7.8-15 Summary of Impacts and Estimated Resettlement Cost of EDSA/Roosevelt/Congressional I/C

Description	Amount (Php)	Remarks
Re-connection of utilities and other facilities	1,440,000.00	• Affected utilities and other facilities will be coordinated with National Power Corporation, MERALCO and other concerned agencies for the transferring and re-installation/ reconnection. • The estimated cost includes materials & labor cost computed at Php15,000/lamp post. This cost including the number of affected cost will be subject for validation after the detailed design (DD).
Trees and other perennials	27,356.05	• A Permit to Cut Trees will be secured to DENR prior to cutting. • Numbers of trees to be cut including cost are subject for validation after DD.
Other improvements 5 stalls	75,000.00	• It was estimated that stall owners will be given at least Php15,000 for their income loss including materials while transferring their stalls.
Other facilities/utilities	500,000.00	• Lump sum estimated cost to re store other facilities such as sign boards etc. but still subject for validation after DD.
Sub-Total	2,042,356.05	-
5% Management Cost	102,117.80	-
10% Contingencies	204,235.60	-
Total	**2,348,709.45**	• Estimated RAP cost is subject for validation after DD.

Source: JICA Study Team

Table 7.8-16 Summary of Impacts and Estimated Resettlement Cost of EDSA/North/West/Mindanao I/C

Description	Amount (Php)	Remarks
Land Acquisition	4,000,000.00[*1]	• A 100 m^2 lot will be acquired but subject for validation after the Detailed Design (DD). *1) Refer to **Table 5.3-3** in Section 5.3.
Re-connection of utilities and other facilities	1,110,000.00	• Affected utilities and other facilities will be coordinated with National Power Corporation, MERALCO and other concerned agencies for the transferring and re-installation/ reconnection. • The estimated cost includes materials & labor cost computed at Php15,000/lamp post. This cost including the number of affected cost will be subject for validation after DD.
Trees and other perennials	656,239.50	• A Permit to Cut Trees will be secured to DENR prior to cutting. • Numbers of trees to be cut including cost are subject for validation after DD.
Other improvements 30 m^2 extension pavement	300,000.00	• It was estimated that Php10,000/m2 is the cost replacement.
Other facilities/utilities	500,000.00	• Lump sum estimated cost to re store other facilities such as sign boards etc but still subject for validation after DD.
Sub-Total	6,566,239.5	-
5% Management Cost	328,311.97	-
10% Contingencies	656,623.95	-
Total	**7,551,175.42**	• Estimated RAP cost is subject for validation after DD.

Source: JICA Study Team

Table 7.8-17 Summary of Impacts and Estimated Resettlement Cost of C-5/Green Meadows/Acropolis/Calle Industria

Description	Amount (Php)	Remarks
Re-connection of utilities and other facilities	2,970,000.00	• Affected utilities and other facilities will be coordinated with National Power Corporation, MERALCO and other concerned agencies for the transferring and re-installation/ reconnection. • The estimated cost includes materials & labor cost computed at Php15,000/ lamp post. This cost including the number of affected cost will be subject for validation after the detailed design (DD).
Trees and other perennials	213,378.75	• A Permit to Cut Trees will be secured to DENR prior to cutting. • Numbers of trees to be cut including cost are subject for validation after DD.
Other facilities/utilities	500,000.00	• Lump sum estimated cost to re store other facilities such as sign boards, etc., but still subject for validation after DD.
Sub-Total	3,683,378.75	-
5% Management Cost	184,168.93	-
10% Contingencies	368,337.87	-
Total	**4,235,885.55**	• Estimated RAP cost is subject for validation after DD.

Source: JICA Study Team

The estimated resettlement costs for each package are summarized in **Table 7.8-18**, and will be covered by the government of the Philippines equity.

Note that implementation of the C3-E. Rodriguez Interchange was cancelled by the DPWH to give priority to the construction of Skyway Stage 3, second level, along C3 under BOT scheme

Table 7.8-18 Total Cost for Environmental Monitoring Plan during Operation

Package	Estimated RAP Cost (Php)
Package 1	7,551,175.42
Package 2	4,235,885.55
Package 3 (2 I/C)	4,438,013.63
Total Estimated RAP Cost	16,225,074.60

Source: JICA Study Team

7.9 SUPPORT DPWH TO HOLD PUBLIC CONSULTATION MEETINGS

7.9.1 First Public Consultation Meetings

(1) Objectives

The objectives of the first public consultation meetings are as follows. The details of the stakeholder consultation meeting are referred to **Appendix 7.2**.

- ✓ To briefly discuss the Proposed Project, its concepts and objectives;
- ✓ To explain the requirements of JICA, DENR, NEDA and other concerned agencies such as the preparation of Environmental Impact Assessment and Resettlement Action Plan (RAP) prior to project implementation;
- ✓ To set the Cut-off Date;
- ✓ To inform the conduct of inventory of affected assets, trees and other facilities; and
- ✓ To schedule a Public Consultation to all Stakeholders who will be directly and indirectly affected by the proposed projects.

(2) C-3/Rodriguez Interchange

Separate meetings for the two concerned barangays were held for this proposed project.

The first Public Consultation Meeting for Barangay Tatalon was held at the Barangay Hall of Tatalon on January 20, 2012. Participants were the Punong Barangay, three Kagawad, Barangay Administrator, Barangay Secretary and two other officials of the Barangay.

The first Public Consultation Meeting for Barangay Doña Imelda was held at the Barangay Hall of Doña Imelda on January 20, 2012. Participants were the Barangays Punong four Kagawad and one lawyer.

The issues and concerns raised at the meetings are presented in **Tables 7.9-1** and **7.9-2**. The reactions to opinions and countermeasures for the issues considered by DPWH are also summarized in these tables below.

Table 7.9-1 Summary of Discussion

The 1st Public Consultation Meeting for Barangay Tatalon (C-3/Rodriguez Interchange)

Issues and Comments	Reactions/Countermeasures by DPWH
Bgry.Tatalon is a flooded area	Drainage facilities are incorporated in the design
Affected properties and facilities	Inventory of affected properties/facilities will be undertaken in the 1st week of February. Compensation for damaged properties/assets will be based on the LARRIP Policy of DPWH.
Alternative route	Traffic Management Plan will be prepared
Recommended for another fly-over along E. Rodriguez	Noted. For further study.
Final Design of the flyover/ Entry and exit point	Design Plans/ Schemes will be presented on the next consultation
Implementation schedule	Construction maybe on the last quarter of 2015.
Sub-contracting in civil works	This would be discussed with the main Contractor.
LGU will join in the conduct of socio-economic survey and inventory of affected properties, facilities, trees, etc.	Noted.
Is the replacement of Bridge along E. Rodriguez corner Araneta Ave. included in the project?	For clarification.

Source: JICA Study Team

Table 7.9-2 Summary of Discussion

The 1st Public Consultation Meeting for Barangay Doña Imelda (C-3/Rodriguez Interchange)

Issues and Comments	Reactions/Countermeasures by DPWH
Entry and exit point	Final design will be presented on the next public consultation.
How to address affected properties	Compensation for damaged properties/assets will be based on the LARRIP Policy of DPWH.
Where are the Alternative Routes?	Traffic Management Plan will be prepared.
After completion of the project, Can the LGU construct a Police Outpost beneath the flyover?	This will be discussed to proper concerned agencies.
Implementation schedule	Construction maybe on the last quarter of 2015.
Project Cost	Still in the preparation of Design Plans and during the next public consultation, the cost will be presented.

Source: JICA Study Team

(3) EDSA/Roosevelt/Congressional Interchange

The first Public Consultation Meeting was held at the Barangay Hall of Bahay Toro on January 19, 2012. Participants were the Punong Barangay and four Kagawad of Brgy. Katipunan and one Kagawad Secretary and fourteen officials of Baragay Bahay Toro.

The issues and concerns raised at the meetings are presented in **Table 7.9-3**. The reactions to opinions and countermeasures for the issues considered by DPWH are also summarized in the table below.

Table 7.9-3 Summary of Discussion
The 1st Public Consultation Meeting for EDSA/Roosevelt/Congressional Interchange

Issues and Comments	Reactions/Countermeasures by DPWH
Number of affected structures, utilities, trees.	A socio-economic survey and inventory of affected properties will be undertaken in February 2012 and this will be the cut-off date.
How much will you pay for affected properties?	Compensation for damaged properties/assets will be based on the LARRIP Policy of DPWH
Where is the alternative route during the project implementation?	Traffic Management Plan will be prepared
Where is the landing and takeoff of the flyover?	Detailed design will be presented on the next public consultation.
Implementation schedule	Construction will start maybe at the last quarter of 2015

Source: JICA Study Team

(4) EDSA/North/West /Mindanao Interchange

The first Public Consultation Meeting was held at the Barangay Hall of Bagong Pag-asa on January 19, 2012. Participants were the Punong Barangay of Bargaya Phil-am and Baragay Bungad, six Kagawad of Baragay Phil-am, one Kagawad and the Barangay Secretary of Barangay Ramon Magsaysay, and three Kagawad of Baragay Sto. Cristo.

The issues and concerns raised at the meetings are presented in **Table 7.9-4**. The reactions to opinions and countermeasures for the issues considered by DPWH are also summarized in the table below.

Table 7.9-4 Summary of Discussion
The 1st Public Consultation Meeting for EDSA/North/West/Mindanao Interchange

Issues and Comments	Reactions/Countermeasures by DPWH
Is drainage system considered in the Design since Trinoma and SM are flood prone area?	Drainage facilities are incorporated in the design.
How to compensate affected properties if there is any?	Replacement Cost for affected structures including restoring the remaining structure. For other improvements - cost for reconnecting the facility such as water, power and telephone including public structures. For trees and other perennials -compensation will be based on commercial value as determined by DENR or Appraisal Committee. MERALCO post, water system will be properly coordinated to concerned agencies for the transferring of such facilities. (Compensation based on the LARRIP Policy of DPWH).
Alternative Routes during project implementation	Traffic Management Plan will be prepared.
Local Employment	There is a DPWH policy that at least 70% of laborers will be hired at the project area.
Air and Noise Pollution	Baseline data on air and noise will be measured.
Implementation schedule	Construction will start maybe by last quarter of 2015.
Project Cost	Still in the preparation of Design Plans/ Schemes and during the next public consultation, the cost will be presented.
Installation of informative signs/advisories prior to project implementation and additional warning signs/devices will be installed during implementation.	Noted.
Requested for a public consultation and the presence of Representatives from SM & Trinoma was suggested	Noted.
What is the height, how long and where is the entry and exit points of the proposed interchange?	The JICA Study Team is still preparing design plans/schemes for the proposed project and it will be discussed during the next consultation.
During the project implementation, entering the Phil-Am subdivision as an alternative route will be restricted considering that this is a private property.	Noted.

Source: JICA Study Team

(5) C-5/Green Meadows/Acropolis/Calle Industria Interchange

The 1st Public Consultation Meeting for this proposed project was held at the Barangay Hall of Bagumbayan on January 20, 2012. Participants were the Punong Barangay, six Kagawad, the Brgy. Secretary and one other Baragay Official of Baragay Bagumbayan and the Barangay Secretary of Baragay Ugong Norte.

The issues and concerns raised at the meetings are presented in **Table 7.9-5**. The reactions to opinions and countermeasures for the issues considered by DPWH are also summarized in the table below.

Table 7.9-5 Summary of Discussion
The 1st Public Consultation Meeting for C-5/Green Meadows/Acropolis/Calle Industria I/C

Issues and Comments	Reactions/Countermeasures by DPWH
Entry and Exit point of the proposed tunnel	Design Plans will be presented on the next public consultation to be announced later.
How to address affected properties?	Compensation for damaged properties/assets will be based on the LARRIP Policy of DPWH.
Alternative Routes	Traffic Management Plan will be prepared.
Where to transfer the newly planted trees in the center island?	The LGU will determine an open space based on the "National Greening Program" so the DPWH could assist the LGU in re-planting the balled trees.
Negative impacts during construction	Mitigation measures for the adverse effects will be incorporated in the EIA study, thus, An Environmental Management Plan will be prepared.
All the participants endorsed the proposed project and hoping that it will be implemented the soonest	Noted.
Implementation schedule	Construction may start on the last quarter of 2015.
Request for another public consultation so that all the owners/representatives from the commercial establishments along the vicinity of Eastwood will attend.	Noted.

Source: JICA Study Team

7.9.2 Second Public Consultation Meetings

(1) Objectives

The objectives of the second public consultation meetings are as follows. The details of the stakeholder consultation meeting are referred to **Appendix 7.2**.

- ✓ To explain the alternative schemes of interchange;
- ✓ To explain the JICA Guidelines for Environmental and Social Considerations and the potential impacts due to the project (scoping of EIA, RAP preparation)
- ✓ To obtain comments/suggestion of stakeholders on the Project and Environmental and Social considerations.

(2) C-3/Rodriguez Interchange

The second Public Consultation Meeting for this project was held at the Barangay Conference Hall of Tatalon on March 03, 2012. There were 32 participants from local residents, Barangay officials and private sector representatives.

The issues and concerns raised at the meetings are presented in **Table 7.9-6**. The reactions to opinions and countermeasures for the issues considered by DPWH are also summarized in the table below.

Table 7.9-6 Summary of Discussion
The 2nd Public Consultation Meeting for Barangay Tatalon (C-3/Rodriguez Interchange)

Issues and Comments	Reactions/Countermeasures by DPWH
• Traffic Issue • Income loss for tricycle drivers	Identification of accessible jeepney/tricycle loading and unloading stations will be taken into account before the implementation of the project.
• The best scheme for the interchange	As soon as the study has been finalized, the 3rd public consultation meeting will be scheduled.
• Owners of the establishments along C-3, should also be invited on the next consultation so that they will also be aware of the proposed project of the government to avoid conflicts or delays in the implementation.	All owners of business within the vicinity of the proposed projects will be invited to respond to their queries.
• Is soil testing undertaken along Kaliraya and E. Rodriguez?	An in depth Geo-Technical Investigation was conducted and incorporated in the detailed design of the proposed project.
• Construct a Barangay Outpost underneath the new flyover.	This concern will be coordinated to concerned agencies as soon as the project will be turn-over to LGUs.
• Local laborers	DPWH policy (Republic Act 6685 / DPWH M.C. # 93 (Series of 1988) that at least 50% of unskilled workers and 30% of skilled workers for the project must be hired locally or within the project area.
• Another flyover or the proposed project should be constructed along E. Rodriguez considering the traffic congestion at present.	The existing 4-lane road along E. Rodriguez could not accommodate another 4-lane flyover and it would be a major problem in clearing the ROW if this will be proposed.
• Since the implementation of the proposed project will be realized by Year 2016, the newly constructed stalls or commercial establishments should still be considered eligible for compensation even after the cut-off date which is February 2012.	Constructing within the Road-Right of Way will no longer be tolerated to avoid conflicts between different road users for reason that a cut-off date has been imposed.
• Business owners whose establishments were not considered as PAFs will be given income loss due to the decrease of market during construction.	Based on the DPWH policy, only the identified PAFs will be eligible for compensation. The negative impact is short term in nature.
• A follow-up reaction on the income loss was mentioned that if that will be the case, taxes withheld on the part of the LGUs will be affected	After all the sacrifices, progress will come in.
• Recommended Scheme considering of flooding in this area.	All necessary measures have been taken into consideration, but still subject for further study.

Source: JICA Study Team

(3) EDSA/ Roosevelt/Congressional Interchange

The second Public Consultation Meeting was held at the Barangay Covered Court of Bahay Toro on March 03, 2012. There were 78 participants from local residents, Barangay officials and private sector representatives.

The issues and concerns raised at the meetings are presented in **Table 7.9-7**. The reactions to opinions and countermeasures for the issues considered by DPWH are also summarized in the table below.

Table 7.9-7 Summary of Discussion
The 2nd Public Consultation Meeting for EDSA/Roosevelt/Congressional Interchange

Issues and Comments	Reactions/Countermeasures by DPWH
Traffic/Re-Routing	Traffic Management Plan will be prepared
Compensation	Computation of compensation will be based on the LARRIP policy of DPWH
Manila Water	Coordinated to concerned agencies before project implementation.
Exact beginning and End of flyover	As soon as the study has been finalized, the 3rd public consultation meeting will be scheduled.
Employment	Local labor force will be given priority. DPWH policy (Republic Act 6685 / DPWH M.C. # 93 (Series of 1988) that at least 50% of unskilled workers and 30% of skilled workers for the project must be hired locally or within the project area.
Sub-Contract	Has to be discussed with the main Contractor.
Toll fee	It was informed that the Project would be implemented by the DPWH thru a loan and not by Build-Operate-Transfer scheme, so no Toll Fee/s will be collected.

Source: JICA Study Team

(4) EDSA/North/West/Mindanao Interchange

The second Public Consultation Meeting for this proposed project was held at the Barangay Covered Court of Bagong Pag-Asa on March 24, 2012. There were 36 participants from local residents, MMDA/LGU officials and private sector representatives.

The issues and concerns raised at the meetings are presented in **Table 7.9-8**. The reactions to opinions and countermeasures for the issues considered by DPWH are also summarized in the table below.

Table 7.9-8 Summary of Discussion
The 2nd Public Consultation Meeting for EDSA/North/West/Mindanao Interchange

Issues and Comments	Reactions/Countermeasures by DPWH
Scheme 2 was proposed and the Design should be a 2nd level flyover on West Ave.	It was informed that all aspects of the project including engineering, environmental and social aspects are carefully studied including the project economic benefits.
Is there already a selected scheme?	The JICA study team is still finalizing the design and the selected scheme will be presented on the next consultation.
During construction, is there any access going to SM	A Traffic Management Plan will be prepared including a re-routing scheme.
Affected Assets.	Affected assets will be compensated at replacement cost as per LARRIP policy of DPWH.
Proposed design North/West?	Final design will be presented on the next meeting
Is flooding in the area considered on the design?	Flooding is already considered in the design
Suggest to consider the flood	Noted.
Suggest for perspective on presentation	Noted. On 3rd Consultation
The presence of traffic enforcer from MMDA was requested.	Noted.

Source: JICA Study Team

(5) C-5/Green Meadows/Acropolis/Calle Industria Interchange

Separate meetings for the two concerned barangays were held for the second level Public Consultation Meetings.

The second Public Consultation Meeting was held at the Barangay Covered Court of Bagumbayan on February 22, 2012. There were 80 participants from local residents, Barangay officials and private sector representatives.

The second Public Consultation Meeting was held at the Green Meadows Clubhouse of Barangay Ugong on March 13, 2012. There were 42 participants from local residents and Barangay officials.

Table 7.9-9 Summary of Discussion

The 2nd Public Consultation Meeting at Barangay Bagumbayan

Issues and Comments	Reactions/Countermeasures by DPWH
• Trees that would eventually be affected during the project implementation • Air and noise pollution during construction • Reduced income of the business establishments around Eastwood • Additional income for local populace during implementation • In case that flyover will be pushed through, could they convert areas beneath the flyover to multi-purpose utilization/s because he fears that these areas might just be comfort zones/areas for beggars. • Alternative Route during construction • Re-routing along Eastwood and Mercury Ave. was proposed • The construction/rehabilitation of Mercury Ave. should be first implemented before the project starts so it could be utilized as an alternate route. • Schedule of project Implementation	It was informed that all studies being undertaken by the JICA and DPWH Study Team would address any negative impacts resulting from the project. Likewise, it was mentioned that there was already an initial inventory of trees to be affected. The preparation of RAP and EIA is on progress. A Traffic Management Plan will be part of the requirements to be prepared under the Detailed Engineering Design.
• Calle Industria can be used as an exit point so the people are accessible in going to Eastwood. • Recommended is a Tunnel scheme	Comparative analysis of the 3 proposed schemes and likewise, discussed that during the preparation of the detailed engineering design, the vicinity of the proposed project were taken into consideration in the identification of entry and exit points.
Is the Project going to be pushed-through whether we like it or not?	The purpose of this public consultation is to ensure that the issues and concerns of the stakeholders will be incorporated in the study/finalization of the design and make arrangement.
• Installation of pedestrian lane was recommended • An exit from flyover towards Calle Industria was suggested.	The recommendation was noted.
Opposition to the construction of flyover because if a flyover would be constructed, the tendency will lead to a decrease of persons who are patronizing the business establishments around Eastwood.	Economic growth and the importance of development in the project area are taken into account in designing the Alternatives.

How many percent of the present traffic will be decongested if the proposed project will be realized?	Based on assumptions, traffic decongestion due to project will be 30%; however, the traffic analysis is still on-going and once it is finalized, the exact figure/s will be presented on the next public consultation.
Any affected land	No additional land along C-5 would be acquired except for a 400 m^2 purposely for a sump pit in the tunnel scheme.
• Project Cost • Charge or Toll Fee/s	Approximate project cost of the different alternative schemes are the following: 1. Flyover – MP 1,350 2. Tunnel – MP 2,576 3. Flyover & Tunnel – MP 1,312 The Project would be implemented by the DPWH thru a loan and not by Build-Operate-Transfer scheme, so no Toll Fee/s will be collected.
Asked if what scheme will be done, and decision between the government and the community.	Safety, mobility and access considerations are taken into account in road design and the final or best Alternative will be presented on the next public consultation.
C5 is the main access of the PUVs going to Eastwood. Bonni Serrano is traffic congested.	Economic viability, traffic analysis, and environmental & social safeguards were undertaken on the vicinity of the proposed project.
The participation of MMDA was requested for the next public consultation meeting.	Noted.

Source: JICA Study Team

The issues and concerns raised at the meetings are presented in Tables 7.9-9 and 7.9-10. The reactions to opinions and countermeasures for the issues considered by DPWH are also summarized in the table below.Table 7.9-10 Summary of Discussion

The 2nd Public Consultation Meeting at Barangay Ugong Norte

Issues and Comments	Reactions/Countermeasures by DPWH
Project Cost	Preliminary cost estimates of the alternatives are: Flyover – MP1,350; Tunnel – MP2,576; and Flyover and Tunnel – MP1,312.
Ongoing construction will cause traffic congestion	A traffic analysis was conducted and will be presented on the next consultation. Likewise, Traffic Management Plan will be prepared.
Any affected structures	No affected structures were identified.
Mitigation of noise and air pollution	An Environmental Management Plan will be prepared.
Consideration of the fault lines	A geotechnical investigation has been taken into consideration.
Property impacts resulting from the design and construction	Noted.
Safe ingress/egress as well as access to commercial establishments and schools will be provided.	Noted.
Present traffic volume and percentage diversion in the project implemented case.	A traffic analysis was conducted and will be presented on the next consultation. Likewise, Traffic Management Plan will be prepared.

Source: JICA Study Team

7.9.3 Third Public Consultation Meetings

(1) Objectives

The objectives of the third public consultation meetings are as follows. The details of the public consultation meeting are referred to **Appendix 7.2.**

- ✓ To explain the selected scheme of interchange;
- ✓ To comply with PEISS and JICA Guidelines;
- ✓ To explain the main results of EIA and RAP studies; and
- ✓ To obtain comments/suggestion of stakeholders on the Project and Environmental and Social considerations.

(2) C-3 (G. Araneta Ave.)/ E. Rodriguez Ave. Interchange

Separate meetings for the two concerned barangays were held for this proposed project.

The third Public Consultation Meeting for Barangay Tatalon was held at the Barangay Hall of Tatalon on March 28, 2012. There were about 40 participants from local residents, Barangay officials and private sector representatives.

The third Public Consultation Meeting for Barangay Doña Imelda was held at the Barangay Hall of Doña Imelda on March 29, 2012. There were 17 participants from local residents, Barangay officials and private sector representatives.

The issues and concerns raised at the meetings are presented in **Tables 7.9-11** and **7.9-12**. The reactions to opinions and countermeasures for the issues considered by DPWH are also summarized in these tables below.

Table 7.9-11 Summary of Discussion
The 3rd Public Consultation Meeting at Barangay Tatalon

Issues and Comments	Reactions/Countermeasures by DPWH
What is the effect of the project to tricycles, jeepney drivers association?	The effect of the project to the TODA & TAJODAI is only minimal since prior to implementation there are re-routing and traffic management plan to be adopted. The JICA Team studied the movement of traffic/ vehicles in the project area to incorporate in the design.
What is the proposed final Scheme? What is the basis in selecting Scheme # 3?	The proposed selected scheme is Lower elevation flyover and elevated thru road. Scheme 3 was recommended even it is more expensive than Scheme 2 due to the extent of elevated road to prevent from flood during heavy rain, and this scheme can provide 2-lanes per direction of service road at-grade section which sufficient for any activity of the people along this road.
When project started, is it the drainage 1st to be constructed or the flyover?	The project will be simultaneously undertaken because drainage system is a component of the proposed project
Is there proposed MRT or LRT	No proposed MRT or LRT on the project alignment.
The drainage facilities should be coordinated with Maynilad.	All infrastructure projects being implemented by DPWH are closely coordinated with concerned agencies such as Maynilad, PLDT and NPC.
Ask for a E-copy of agenda and design	Noted.

Issues and Comments	Reactions/Countermeasures by DPWH
What is the effect of the project to the environment?	Air quality, surface water hydrology and quality, noise, land use, population, employment, livelihood, health, safety of workers and traffic management during construction will be considered and addressed in IEER.
Noise level before putting noise barrier	Noise barrier will be installed if noise will reached the maximum standard noise level.
Safety of design	Safety of goods and services is incorporated in the design.
Improvement under flyover	After the implementation, the area under the flyover could be re-stored aesthetically (plant trees).
Engineering solution on Flood	Hydrological study was conducted in the project area and engineering solutions are considered in the design.
Friendship Lane	During construction, the friendship lane will be open to traffic.
U-Turn Slot and Traffic Light	Traffic Management Plan and Re-routing scheme will be prepared prior to project implementation.
Project cost	The project cost: approximately 4-Lane (2-Lanes for each direction) Flyover = PhP 330.0 Million, and Approach Roads = PhP 113.4 Million
Why we requested loan from JICA not from other institutions?	It is where the DPWH requested for a financial assistance and JICA responded positively.
Employment opportunity	DPWH Policy regarding the hiring of skilled and unskilled labor force.
How long is the construction period?	The construction period would take 2 years.

Source: JICA Study Team

Table 7.9-12 Summary of Discussion
The 3rd Public Consultation Meeting at Barangay Doña Imelda

Issues and Comments	Reactions/Countermeasures by DPWH
Who will claim payment of Trees that have been planted by the LGU? How about the Electric Post?	The cost of affected trees is estimated based on DENR's price and payment will be claimed by the LGU. The transferring of electric post/lamp post will be coordinated to MERALCO or NPC.
Waste during construction	Disposal site will be determined prior to project implementation in coordination with the LGUs.
What is the basis of payment to affected trees, facilities etc.	Replacement cost will be based on the LARRIP policy of DPWH
Affected tricycle drivers, jeepney drivers	The effect of the project to the TODA & TAJODAI is only minimal since prior to implementation there are re-routing and traffic management plan to be adopted and JICA Study Team studied the movement of the traffic/vehicles in the project area, thus incorporated in the design.
Entry and exit point (fly-over)	Explained.
Effect on Noise, Traffic and Business Establishment	An Environmental Management Plan for this project was prepared taking into consideration the negative impacts and its mitigation measures.
All laborers/workers who are not residents in Dona Imelda that will be hired will apply for a permit to work, for peace and order purposes.	Noted.
Project implementation	Tentative schedule of implementation will be in Year 2012

Source: JICA Study Team

(3) EDSA/Roosevelt /Congressional Interchange

The third Public Consultation Meeting was held at the Barangay Covered Court of Bahay Toro on March 29, 2012. There were 35 participants from local residents, Barangay officials and private sector representatives.

The issues and concerns raised at the meetings are presented in **Table 7.9-13**. The reactions to opinions and countermeasures for the issues considered by DPWH are also summarized in the table below.

Table 7.9-13 Summary of Discussion

The 3rd Public Consultation Meeting for EDSA/Roosevelt/Congressional Interchange

Issues and Comments	Reactions/Countermeasures by DPWH
Is Munoz Market will be affected?	Based on the design and during the conduct of socio-economic survey last February 1-15, 2012, no structures would be affected particularly the Munoz Market except for the stalls that can be moved backward during the implementation.
Will the Contractor coordinate with the Brgy Officials in hiring of laborers?	Prior to start of civil works, the contractor will coordinate with the LGUs regarding the activities including the hiring of skilled and unskilled laborers.
Follow-up question, To whom they will apply?	They will apply to the contractor and to the DPWH for job site workers.
Is there a parking lot along EDSA?	There are existing parking lots in EDSA that will not be disturbed.
Is there widening?	No widening involves in the implementation of the project.
How to handle traffic during implementation?	A traffic management plan has been prepared for this project including re-routing scheme to be adopted during the implementation to avoid traffic congestion.
Is the Footbridge below MRT along R. Magsaysay being affected?	There is a footbridge to be affected and this will be replaced after the completion of the project.
Entry and Exit fly-over.	The selected scheme was discussed.
How to compensate affected trees, other improvements and facilities?	A RAP was prepared for this project which includes and addresses the computation of replacement cost to all affected properties.

Source: JICA Study Team

(4) EDSA/North/West/Mindanao Ave. Interchange

The third Public Consultation Meeting for this proposed project was held at the Barangay Covered Court of Bagong Pag-Asa on April 17, 2012. There were about 12 participants from Barangay officials and private sector representatives.

The issues and concerns raised at the meetings are presented in **Table 7.9-14**. The reactions to opinions and countermeasures for the issues considered by DPWH are also summarized in the table below.

Table 7.9-14 Summary of Discussion

The 3rd Public Consultation Meeting for EDSA/North/West/Mindanao Interchange

Issues and Comments	Reactions/Countermeasures by DPWH
How to mitigate Air and Noise pollution?	There is an environmental management plan prepared for this project that includes on how to mitigate noise and air pollution that will be adopted during the actual construction.
Where to file complains if they will encounter problems during construction phase?	There will be a grievance committee for this project or they can file complaints to DPWH concerned personnel.
Assurance by residents that contractor will comply with rules and regulations as far as construction activities are concerned.	There will be a monitoring team to be formulated to monitor ongoing activities of Contractor as far as environmental and social safeguards are concerned.
Are residents being part of the monitoring team during construction?	Representative from the LGUs is a member of the team.
SM staff is requesting a copy of Plans and profiles of the proposed interchange so they could harmonize their future projects.	Noted.
Is the design final already?	Since the implementation schedule will be on 2016, there are still rooms for improvement of the detailed design.
Compensation of the identified affected improvements & trees	Compensation for all affected improvements including trees and lots to be acquired will be based on the LARRIP Policy of DPWH.

Source: JICA Study Team

(5) C-5/ Green Meadows/Acropolis/Calle Industria Interchange

The third Public Consultation Meeting was held at the Barangay Covered Court of Bagumbayan on March 31, 2012. There were about 330 participants from local residents, Barangay officials and private sector representatives.

The issues and concerns raised at the meetings are presented in **Table 7.9-15**. The reactions to opinions and countermeasures for the issues considered by DPWH are also summarized in the table below.

Table 7.9-15 Summary of Discussion

The 3rd Public Consultation Meeting at Barangay Bagumbayan

Issues and Comments	Reactions/Countermeasures by DPWH
Air and Noise Quality	An Environmental Management Plan has been prepared for this project. The EMP is sets of mitigation measures to be adopted by the Contractors to minimize negative impacts including the air and noise pollution.
Trees (Brgy. Project) along C5.	Affected trees will be replaced and it was informed that the LGUs will determine an open space for reforestation in consonance with the National Greening Program.
Fault Line.	An in-depth geotechnical investigation and other technical and engineering studies have been conducted and such studies were considered in designing the proposed project.
It was suggested that trees should be balled if possible.	Noted.
Alternate route	The prepared Traffic Management Plan including re-routing scheme should be adopted.
Can they used Calle Industria and Eastwood as alternate routes?	Calle industria is not a private road so it could be utilized as an alternate route during construction but Eastwood cannot be used as alternate route considering that this is a private route.

Source: JICA Study Team

7.10 JICA ENVIRONMENTAL CHECKLIST

The JICA Study Team assisted DPWH with elaborating the JICA Environmental Checklist to comply with the JICA Guidelines.

The draft JICA Environmental Checklist which is common for all four Interchange projects is prepared in **Appendix 7-3**.

CHAPTER 8

C-3 MISSING LINK

8.1 BACKGROUND TO THE STUDY ON THE C-3 MISSING LINK

The existing Circumferential Road No. 3 (C-3) in Metro Manila is incomplete, in that only the northern segment is in place. The southern segment (hereafter referred to as the C-3 Missing Link) has not yet been implemented. The circumferential road network serving south-central Metro Manila is therefore not functioning effectively resulting in heavily congested traffic conditions on C-4 (EDSA) since there are no other viable alternatives for traffic bound to the north within the city. Construction of the C-3 missing link, together with the construction of the flyovers proposed under this preparatory survey, is expected to significantly contribute to the decongestion of heavy traffic along the circumferential roads.

The existing C-3 road extends north from the junction of N. Domingo and G. Araneta Avenue in San Juan City, crossing San Juan River and continuing north along G. Araneta Avenue in Quezon City, turning west along Sgt. Emilio Rivera Avenue, and then continuing along C-3 road in Caloocan City before terminating at the junction with Radial Road 10, in Navotas. C-3 Northern Segment is classified as an arterial road with uncontrolled access, serving collector/distributor roads along its length at major intersections. The approximate length of the existing C-3 Northern Segment is 10.8km. The C-3 Northern Segment is a 6 lane divided road for most of its length, except for a 600m long section in Caloocan City, where it reduces to a narrow undivided road.

The proposed C-3 Missing Link will extend south from the junction of N. Domingo in San Juan City, passing through Mandaluyong City, Manila City for some alignments, crossing or running along the San Juan River and Pasig River, before connecting with Buendia Avenue in north Makati City to complete the circumferential road link to Roxas Boulevard. Depending on the route and the termination point, the proposed C-3 Missing Link will be between approximately 5.0km to more than 7.0km in length and will be a 6 lanes divided road.

Six (6) alternative alignments for the C-3 Missing Link have been established by DPWH. The Original Alignment of the C-3 Missing Link was established in 1981, following a 1977 feasibility study prepared by JICA. The 1st Revised Alignment was established in 1996 under a Memorandum of Agreement signed by the Secretary of DPWH, Chairman of MMDA and the mayors of the three Local Government Units (LGUs) to mention Makati City, Mandaluyong City and San Juan City. All other alignments have been established since that time.

The study involved review of the C-3 missing link construction on report and also study of influence to the proposed flyovers by captioned project.

8.2 PROJECT SETTING

8.2.1 Administration, Population and Land Use

The proposed alternative alignments run through four (4) cities in the Metropolitan Manila, namely San Juan City, Mandaluyong City, Manila City and Makati City. The population, land area and population density of the respective cities are tabulated below.

Table 8.2-1 Population, Land Area and Density

City/Municipality	Population (2007)	Land Area (sq. km)	Density (persons/km)
San Juan	125,338	6.0	21,065
Mandaluyong	305,576	9.3	32,893
Manila	1,660,714	25.0	66,482
Makati	567,349	21.6	26,303

Source: 2010 Philippine Statistical Yearbook

All affected cities are primarily highly urbanized with scattered factory/industrial developments concentrated along the rivers and commercial strips located along the major streets and avenues. Makati City is the financial center of the Philippines and one of the major financial, commercial and economic hubs in Asia.

Major commercial strips in the area are located along Ayala Avenue, Gil Puyat Avenue (Buendia), and J.P. Rizal in Makati City, and Boni Avenue, Shaw Boulevard, San Francisco, and M. Martinez Avenue in Mandaluyong City.

Informal settlements are located between SM City Sta. Mesa and C-3 Road.

8.2.2 Topography and Geology of Project Area

Metropolitan Manila is located in the Central Valley in Luzon Island which is sandwiched between the Zambales range in the east and the Sierra Madre range in the west. The topography of Metro Manila can be classified into three zones namely; (1) the Coastal Lowland along Manila Bay, (2) the Central Plateau and (3) Marikina Plain. The surface geology of the Central Plateau consists of deposits of the Guadeloupe Tuff formation. On the other hand, the Coastal Lowland and the Marikina Plain mainly consist of alluvium deposits. The Marikina Plain is a pull-apart basin, and is delineated by the East Valley fault and the West Valley fault.

Manila City and the western margins of Mandaluyong City and Makati City are located on the Coastal Lowlands. The central and eastern areas of Mandaluyong and Makati cities are located on the Central Plateau together with San Juan City.

The alluvial deposits along Pasig and San Juan Rivers extend to depth requiring correspondingly deep foundations for viaduct structures along the rivers.

8.2.3 River Systems

(1) Pasig River

The Pasig River connects Laguna de Bay to Manila Bay. Stretching for 27 km its major tributaries are the Marikina River and San Juan River. The total catchment area of Pasig River is 570 sq. km, including the 90 sq. km of San Juan River that empties into it. The Pasig River is technically a tidal estuary, as the flow direction depends upon the water-level difference between Manila Bay and Laguna de Bay. During the dry season, the water level in Laguna de Bay is low and the flow direction of the Pasig River depends on the tides. During the wet season, when the water level of Laguna de Bay is high, flow is normally from Laguna de Bay towards Manila Bay. According to the Pasig River Rehabilitation Commission (PRRC), the average width of Pasig River is 91m and average depth is 4m with the deepest sections being 6m. Flow volume can be as low as 12cum/sec in the dry season months from March to May whereas during the rainy season flow can increase to 275 cum/sec during the months of October to November. The 100-year return period design discharge of the Pasig River is 1300cum/s downstream of the tributary with the San Juan River and 650cum/s upstream of the San Juan River tributary according to the 2004 JICA Study on improvement of existing bridges along Pasig River.

The Pasig River has long served as a major transport route for cargoes and travelers encompassing the cities of Manila, Makati, Mandaluyong, Pasig, San Juan, Pasig, Taguig and Marikina. The river serves as a major conduit of manufacturing firms abutting its North and South Banks for the transport of raw materials. The increasing volume of cargoes to meet economic demands has paved the way for the growth of barging or lighterage industry. The river has always played a vital role in the flow of waterborne commerce in the Port of Manila and supports both the domestic and international shipping trade. Today the river remains the secondary artery for seaborne trade and commerce in Metro Manila. Barges and lighters are used as the main carriage usually towed by tugboats, although a few are self-propelled vessels. Other vessels mostly wooden-hulled also use the river. Barges are mostly of the hatch type. Some are tanker barges used for the carriage of liquid bulk like fuel, oil, chemicals, molasses and the like. According to the Philippine Ports Authority, barge sizes range from 450 DWT to 1,400 DWT with a few exceptional bigger ones. The average length of barges/lighters is about forty (40) meters.

A ferry service used to run along Pasig River but has not been in operation since January 2011. There are about 9 ferry stations along the river including one near Lambingan Bridge (down river) and one at Sta. Ana. According to the Pasig Coast Guard Station, the previous franchise to run the ferry operations has been cancelled after the operator stopped operations following the withdrawal of government subsidy. Ferry operations may recommence under a new franchise if a suitable operator comes forward.

Restrictions on vertical clearance are imposed by the existing bridges crossing the Pasig River. The lowest bridge, with a vertical clearance of only 3.5m above high water level, is Ayala Bridge that can only be navigated by the larger vessels during periods of low tide.

The Philippine Coast Guard (PCG) Memorandum-Circular No. 05-07 “Pasig River Safety, Security, and the Governance of its Ecosystem” provides the PCG with authority in the Pasig River over, among others:

- ✓ Vessel Safety Requirements
- ✓ Traffic Management (including speed limits)
- ✓ Ships/Vessels Security Requirements
- ✓ Security in the Restricted Area (Malacañang Complex)
- ✓ Marine Environmental Protection

The Pasig Coast Guard Station has a mandate to promote safety and security of vessels, passengers and cargoes along the river and to promote the protection of the river’s ecosystem from pollution by vessels on the river.

Along the banks of the Pasig River there are planned and on-going development of linear and pocket parks along the river easement which, although legally proclaimed as parks and preservation areas in existing laws and regulations, is mostly occupied by industrial establishments.

(2) San Juan River

The San Juan River originates in the south of La Mesa Dam as the San Francisco River. The San Francisco River changes name to the San Juan River after joining the Dario River and the Mariablo River. The San Juan River empties into the Pasig River 7.15km upstream from the mouth at Manila Bay. The channel length of San Juan River, including the San Francisco River, is 11.0km, with the main river proper having a length of 7.3km. The width of the river in the project area is typically 40m-50m.

The San Juan River collects water from several tributaries, including Maytunas Creek in San Juan City. The river is flood prone over most of its length with wide areas of floodwater breakout, including within the project area and including the length of Maytunas Creek.

The San Juan River is not navigable and is outside the mandate of the Philippine Coast Guard.

(3) Pasig River Rehabilitation Programs

In 1993, a flagship project named the Pasig River Rehabilitation Programs (PRRP) was implemented, under a Presidential Task Force, as a multi-agency undertaking to restore the

Pasig River to its historically pristine condition. DPWH was appointed for the civil works for flood mitigation, especially the channel improvement.

In 1999 the Pasig River Rehabilitation Commission (PRRC) was formed (under DENR as of 2006) with the following powers and functions, among others:

- ✓ Formulate a master plan
- ✓ Regulate Easement
- ✓ Integrate and coordinate development programs
- ✓ Relocation of formal and informal settlers
- ✓ Undertake improvement projects, such as dredging
- ✓ Formulate implementing rules and regulations

Projects undertaken by the PRRC include:

- ✓ The Pasig River Dredging Project, dredging 19km length of Pasig River extending from Manila Bay to the C-5 Bridge (completed with Belgian financial assistance)
- ✓ Construction of linear parks (several completed, others planned or ongoing)
- ✓ Construction of ferry stations (completed)
- ✓ Under DPWH, the following projects have been undertaken:
- ✓ Pasig River Rehabilitation Project (locally funded), including San Juan River (completed 2004)
- ✓ Pasig-Marikina River Channel Improvement Project (JBIC assisted), Phase 1 Detailed Engineering Design (completed 2002)
- ✓ Pasig-Marikina River Channel Improvement Project (JICA assisted), Phase 2 Construction (ongoing)

One component of Phase 1 of the Pasig-Marikina River Channel Improvement Project was a Study on Comprehensive River Management Plan, undertaken in 2002. This 2002 Plan covered the whole basin area of Pasig-Marikina, including stretches of the Upper Marikina River and the main channel of the San Juan River.

The design and construction of improvement works for a 2.4km stretch of the San Juan River, from about 260m from its confluence with Pasig River up to the Old. Sta. Mesa Bridge, have been completed under the Pasig River Rehabilitation Project and this section was therefore not included in the scope of the Comprehensive River Management Plan. The improvement works comprised of a composite bored pile and steel sheet pile revetment with a reinforced concrete pile cap.

8.3 ALTERNATIVE ALIGNMENTS AND DPWH COMPARATIVE STUDY

8.3.1 Alternative Alignments

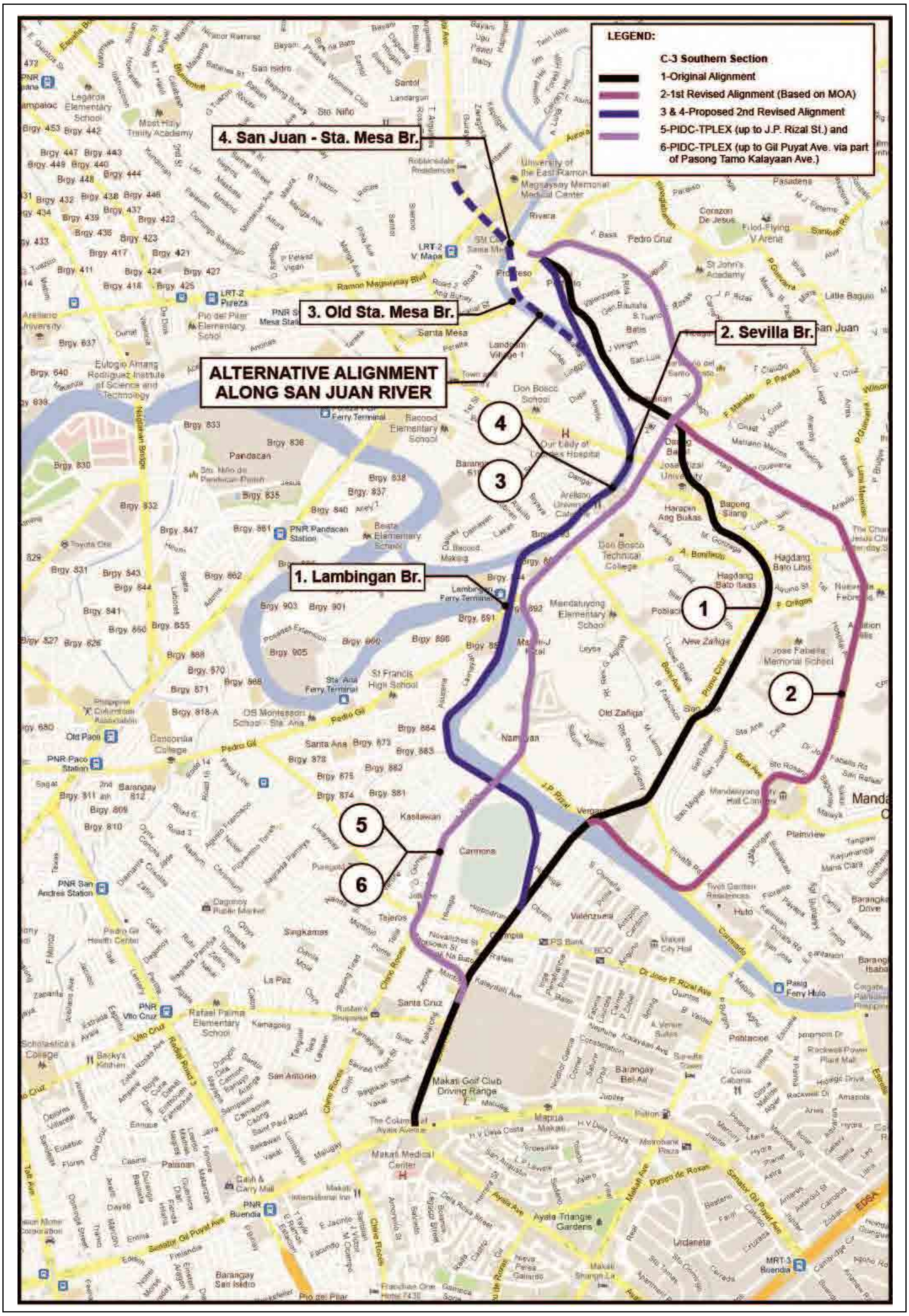
The six (6) alternative alignments for the C-3 Missing Link were presented to the Secretary of DPWH in July 2011, together with a comparative study prepared by URPO. These alignments are presented in **Figure 8.3-1** and are listed as shown in **Table 8.3-1**:

Table 8.3-1 C-3 Missing Link Alternative Alignments

Ref	Alignment	Length (km)	Route
1	Original Alignment (6 Lane)	5.5	**Starts** at junction Buendia Ave. /Ayala Ave. **Follows**: South Ave. – Trabajo St. – (crossing Pasig River and J.P. Rizal) – Primo Cruz St. - Daang Bakal – (crossing Shaw Blvd.) – F. Manalo **Ends** at junction N. Domingo/ G. Araneta
2	1st Revised Alignment (4 Lane)	7.3	**Starts** at junction Buendia Ave. /Ayala Ave. **Follows**: South Ave. – Trabajo St. – (crossing Pasig River) – turn right onto Coronado St – turn left onto San Francisco St – Maysilo Loop - 9 de Febrero St. – new alignment along Maytunas Creek **Ends** at junction N. Domingo/ G. Araneta
3	2ND Revised Alignment a1 (4 Lane)	5.4	**Starts** at junction Buendia Ave. /Ayala Ave. **Follows:** South Ave. – Trabajo St. (east of Sta Ana Racetrack) – turn left to occupy the waterway of Pasig River– (crossing Pasig River near Lambingan Bridge) – occupies waterway of San juan River – (crosses F. Manalo) **Ends** at junction N. Domingo/ G. Araneta
4	2ND Revised Alignment a2 (4 Lane)	5.4	**Starts** at junction Buendia Ave. /Ayala Ave. **Follows:** South Ave. – Trabajo St. (east of Sta Ana Racetrack) – turn left to occupy the river bank on south side of Pasig River – (crossing Pasig River near Lambingan Bridge) – occupies river bank on east side of San Juan River – (crosses F. Manalo) **Ends** at junction N. Domingo/ G. Araneta
5	PIDC-TPLEX Alignment b1 (4 Lane)	4.8	**Starts** at junction J.P. Rizal St. /Chino Roces Ave. **Follows**: A. Reyes Ave. (west of Sta Ana Racetrack) - (crossing Pasig River) – J.P. Rizal – New Panaderos St – General Kalentong – F. Blumentritt **Ends** at junction N. Domingo/ G. Araneta
6	PIDC-TPLEX Alignment b2 (4 Lane)	5.4	**Starts** at junction Buendia Ave. /Ayala Ave. **Follows**: South Ave. – turn left on Kalayaan Ave – turn right on A. Reyes Ave. (west of Sta Ana Racetrack) – J.P. Rizal – New Panaderos St – General Kalentong – F. Blumentritt **Ends** at junction N. Domingo/ G. Araneta

Source: JICA Study Team

The comparative study prepared by DPWH URPO is presented under **Appendix 8.1**.



Source: DPWH-URPO

Figure 8.3-1 Alternative Alignments – DPWH Study

8.3.2 DPWH Comparative Study

The Comparative Study and supporting documents provided to the Study Team for review comprise of the following:

Ref	Documents	Content
CS1	DPWH Position Paper (undated)	• Position paper giving background and description of alternative alignments made in 1995 and 1996 in response to adverse public response in 1991 to the Original Alignment proposed in 1981 (Original Alignment in Table 8.3-1). • Comparison table (length, ROW cost and construction cost) between Original Alignment and preferred alternative alignment at that time (undated - presumed 1996) • Memorandum from the President, dated Dec 1995, directing DPWH Secretary to expedite resolution of issues affecting the construction of the C-3 Missing Link • Memorandum of Agreement (MoA) between DPWH, MMDA, and the respective mayors at that date of Makati City, Mandaluyong City and San Juan City, agreeing to a revised alignment for the C-3 Missing Link (1st Revised Alignment in Table 8.3-1). • Plans of a proposed revised alignment indicating a mostly elevated concept with on/off ramps indicated at Maysilo Loop and Shaw Boulevard and running along Matunas Creek and F. Manalo (1st Revised Alignment) • Cross-section of the double deck structure proposed along Maytunas Creek for the proposed 1st Revised Alignment • Cross section drawings of box girder viaduct along Maysilo Loop, box girder bridges along 2-lane and 4-lane roads, and double deck structure along F. Manalo. • Memorandum to the President from Secretary of DPWH dated February 1996 offering resolution of issues affecting the construction of the C-3 Missing Link with the agreed alignment under the MoA above (1st Revised Alignment).
CS2	DPWH Assorted Papers (undated)	• Detailed comparison table of all alternative alignments, presenting ROW acquisition areas, detailed description, costs, advantages and disadvantages of each scheme. Civil cost estimates assuming the case of all viaduct construction for both 4 lane and 6 lane options also included. • Summary sheets of Original Alignment, 1st Revised Alignment and 2nd Revised Alignment giving description, length, ROW acquisition and estimated cost. One sheet per alignment alternative and combined summary sheet. • Location plan of Original Alignment, 1st Revised Alignment and 2nd Revised Alignment
CS3	DPWH Presentation materials "Circumferential Road 3" (undated)	• Location plan of C-3 and descriptions of Northern Section and Southern Section (Missing Link) • C-3 Parcellary Plan for the ROW acquisition required for narrow section of C-3 road in Caloocan City (Northern Section) • Location plan of the six (6) alignments with photos for the C-3 Missing Link • Location plans of the six (6) alignments including descriptions of each route • Comparison table of the six alignments presenting ROW costs, land improvement cost, civil works costs and cost scenarios if all alignments are fully elevated with both 4 and 6 lane alternatives. • Comparison tables presenting advantages and disadvantages of all six alternative alignments • Simple cross sections showing pier locations for the alignments proposed along the Pasig River

Ref	Documents	Content
CS4	DPWH Presentation materials "Circumferential Road 3 (C-3) Southern Segment" (undated – presumed July 2011)	• Location plan of C-3 showing the Missing Link (Southern Segment) • Location plan of the six (6) alignments • Plan of Proposed Final Alignment (2nd Revised Alignment in Table 8.3-1) giving description of both alternatives (in the river and on the river bank of Pasig River and San Juan River) • Plan of C-3 Southern Section Proposed Final Alignment (showing 2nd Revised Alignment) • Comparison table of cost of C-3 Southern Section Proposed Final Alignment (Option 1: route in the river, Option 2 : route along the river bank) • Comparison table of advantages and disadvantages of alignment of C-3 Southern Section Proposed Final Alignment • Comparative typical cross-sections of viaduct structure in the river and on the river bank • Proposed Implementation Schedule • Perspective photo-montages of San Juan River showing with/without Project

Upon presentation of the six alignments at the Office of the Secretary, DPWH, in July 2011, the 2nd Revised Alignment a1, making use of the Pasig River and San Juan River waterways, was selected by DPWH as the preferred alignment.

The option of extending the alignment along San Juan River to connect with C-3, rather than crossing F. Manalo, was also identified for further study.

8.3.3 Review of DPWH Comparative Study

The Study Team established the following evaluation criteria for the review of the DPWH alignment study and for the updated comparative study to be undertaken by the Study Team:

1) Proposed Scope of Work

2) Construction Issues

3) ROW Acquisition

4) Resettlement Issues

5) Environmental Issues

6) Navigation Issues in Pasig River

7) Construction Cost

The results of the review of the DPWH comparative study, taking account of the evaluation criteria established above, are presented below:

	Review Item	C-3 Missing Link Alignment	Comment
1	Proposed Scope of Work		
	a) Route Alignments and Lengths	Route alignments described in the DPWH documents are partly contradicted by the location plans also included, namely: • 1st Revised Alignment at Maysilo Circle, original plans show direct crossing and other plans show a circumferential alignment. • PIDC-TPLEX Alignments, text description not coinciding with plans, two alternative alignments also shown on plans.	Route alignments to be clearly established by this study.
		Route lengths described in the DPWH documents are in part not consistent with the initial findings of the Study Team.	Updated lengths of each proposed alignment to be confirmed by this study.
	b) Number of Lanes	Original alignment presented as 6 lanes and all other alignments presented as 4 lanes.	Study to be based on 6 lanes to match the existing C-3 Northern segment. Number of required lanes should be established in a future detailed study based on estimated traffic volume.
	c) Typical cross-sections	A limited number of typical cross-sections established only for the 1ST revised alignment. Outline sections presented for the 2nd revised alignment. No typical cross-sections presented for the other alignments.	Typical cross-sections to be established by this study for all alignments, particularly at critical or sensitive locations.
	d) Location and length of at-grade and elevated sections	The Original Alignment is identified as being at grade and all other alignments described as combination of at grade/elevated. The lengths of sections at grade and elevated are not provided. It is understood from the civil construction costs that there are substantial lengths of elevated section for the Original Alignment and that the 2nd Revised Alignments and the PIDC-TPLEX Alignments are all mostly elevated.	Location and length of at-grade and elevated sections for each alignment to be established by this study.

	Review Item	C-3 Missing Link Alignment	Comment
	e) Structure configuration	Structure configurations for elevated sections (single deck or double deck) are identified for the 1st Revised Alignment (both types) and for the 2nd Revised Alignment (single deck). No structure configurations are identified for the Original Alignment or for the PIDC-TPLEX alignments.	Outline structure configurations for each alignment to be established by this study.
	f) Design Speed and other Design Criteria.	No design criteria are listed. Design speeds are not established.	Outline design criteria will be established in the study, including the design speeds and associated lane widths. Reference will be made to available data from the Coast Guard with regard to requirements for navigation clearance, restrictions and vessel characteristics.
2	Construction Issues	Certain construction related issues are raised in the DPWH documents, including river and land access considerations for the 2nd Revised Alignments (river alignments). The issue for dredging in the river for 2nd Revised Alignments is also raised.	Construction related issues will be updated by this study.
3	ROW Acquisition a) ROW Acquisition	Estimated areas of ROW acquisition are identified in the DPWH documents for 5 of the 6 alignments. However no detailed breakdown of the ROW estimates are provided.	Estimates of required area of ROW acquisition will be updated by this study.
	b) Sensitive Sites	No reference is made to sensitive sites (cemeteries and historic buildings) crossed by or otherwise affected by the alignments.	Sensitive sites will be identified to the extent possible in the study.
4	Resettlement Issues	No reference is made to the number project affected buildings or people in the DPWH documents.	Rough estimates of number of project affected buildings and people will be made by the study.
5	Environmental Issues	Some reference is made to environmental issues, such as scouring and obstruction in the river.	The environmental aspects of the alignments will be updated.

	Review Item	C-3 Missing Link Alignment	Comment
6	Navigation Issues	No reference made to navigation issues in Pasig River.	Navigation issues in Pasig River should be addressed by the study.
7	Construction Cost	Construction costs, both civil construction and ROW acquisition related costs, are presented for all alignments. However no detailed breakdowns are presented.	Construction costs and ROW acquisition costs will be updated by this study supported by breakdowns of basic cost items.

8.4 UPDATED STUDY

8.4.1 Geometric Design Standards

The proposed geometric design standards for the C-3 Missing Link are as follows:

Design Condition	Arterial Thru	Service	Ramp
Design Speed	60kph	40kph	40kph
Minimum Horizontal Curvature: R	125m	60m	60m
Maximum Vertical Grade	6%	6%	6%
Minimum Length of Vertical Curve			
K value at crest	K = 11	K = 5	K = 5
K value at sag	K = 18	K = 8	K = 8
Vertical Clearance	5m	5m	5m
Lane width/ Service Road Width / Ramp Width	3.35m (11ft)	6.00m (>19ft)	6.00m (>19ft)
Minimum Sidewalk Width	-	2.5m (preferred) 1.5m (minimum)	-

The DPWH Design Guidelines Criteria and Standards specifies lane widths on highways ranging from 3.00m (<10ft) to 3.65m (12 ft) with a desirable width of 3.35m (11ft). Research indicates there is only a slight decrease in safety when providing 3.35m (11ft) lanes compared to 3.65m (12ft) lanes. For urban arterial roads with relatively low design speeds (less than 70kph), such as C-3, 3.35m (11ft) traffic lanes are therefore recommended.

8.4.2 Typical Sections

In the absence of a detailed traffic study, the number of lanes assumed for the alternative alignments is taken to be the same as the existing C-3 Northern Segment, a 6 lane divided road. Typical sections, based on a 6 lane divided road, are presented in **Figure 8.4-1** to **8.4-9**.

All viaducts are assumed to have spans of 35m and to feature AASHTO Type V girders. With regard to a desirable minimum offset of 5m is assumed from the roadway edge of elevated structures to adjacent residential buildings taking into consideration traffic noise abatement, and an absolute minimum offset of 3m is assumed to commercial buildings for fire-fighting access.

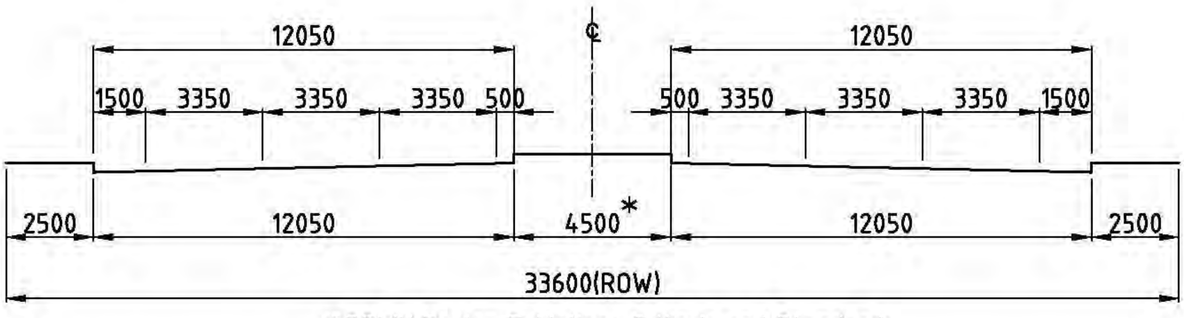
With regard to easements, the Water Code of the Philippines specifies a 3m wide easement in urban areas for the banks of rivers. However, MMDA resolution No. 3 Series of 1996 prescribes a 10m easement for Pasig River and Mandaluyong City Zoning Ordinance prescribes a 10m easement for San Juan River within Mandaluyong.

Typical sections in Pasig River take account of the requirement to provide navigational clearance. The Philippine Coast Guard Memorandum No. 05-97 "Navigational Clearance for Road Bridges" mandates the following:

- ✓ A road bridge over inland waterways must have a minimum vertical clearance of 3.75m from the highest water level that allows the safe passage of vessels or watercraft.
- ✓ The navigational span of a bridge should be provided in a way that it does not obstruct the safe navigation of vessels.

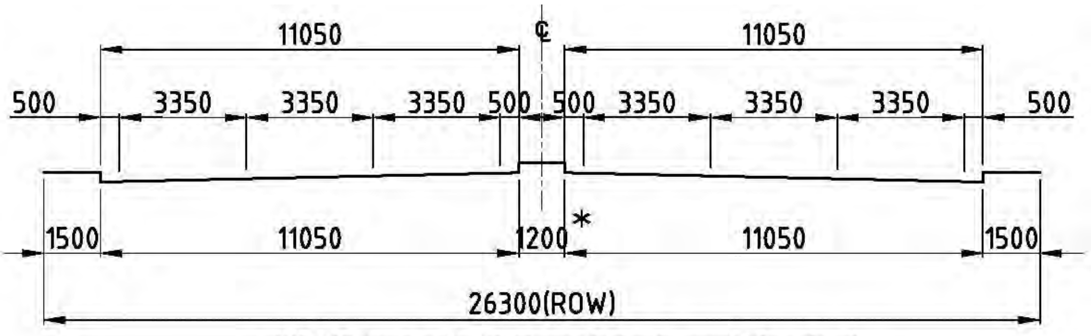
The navigation span lengths of the existing bridges crossing the Pasig River range from 40.3m at MacArthur Bridge to 61.5m at Ayala Bridge. The central navigation span of Lambingan Bridge, within the project area, is 61.1m. The recently implemented Pasig River dredging project dredged a 60m wide section along the river and therefore this width could be considered a de-facto desirable minimum horizontal clearance along the river that also corresponds to the minimum width of the river in the project area.

Given that San Juan River is not navigable, typical sections show only a central 30m wide waterway clearance per the requirements imposed on other bridges recently constructed in the river (Bacood-Mandaluyong Bridge).



*DPWH Design Guidelines Criteria and Standards

a) Desirable

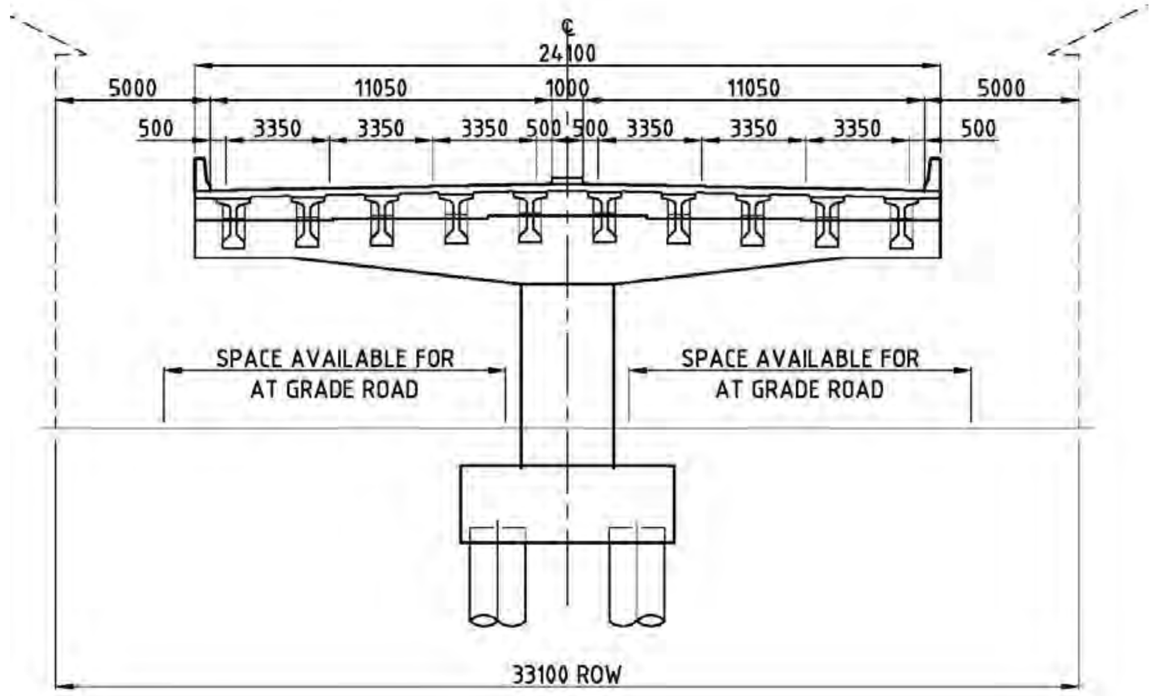


*DPWH Design Guidelines Criteria and Standards

b) Absolute Minimum

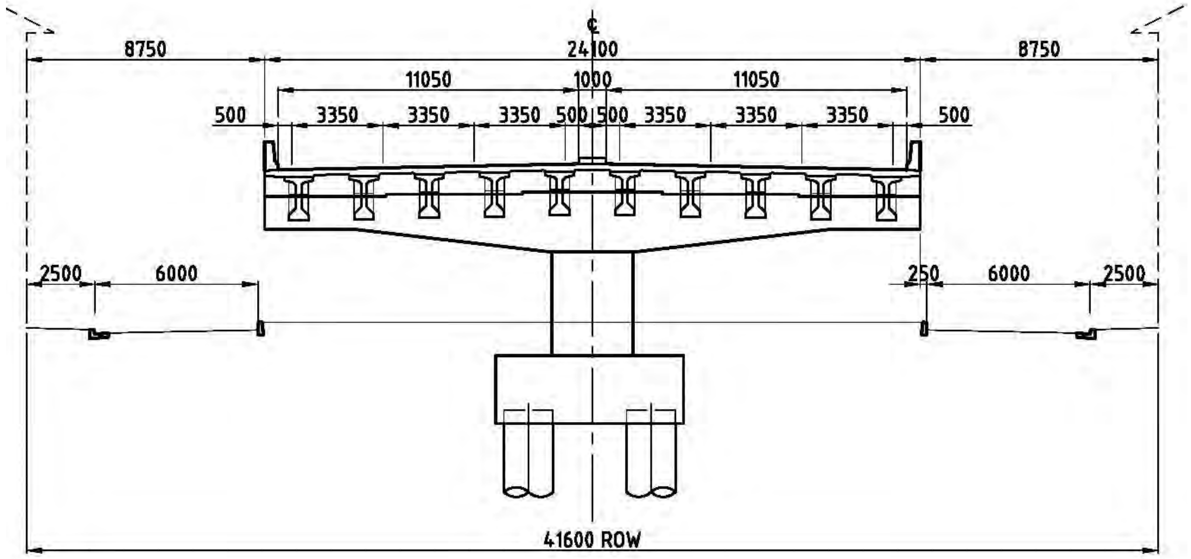
Source: JICA Study Team

Figure 8.4-1 Typical Cross Section – 6 Lane Road At-Grade



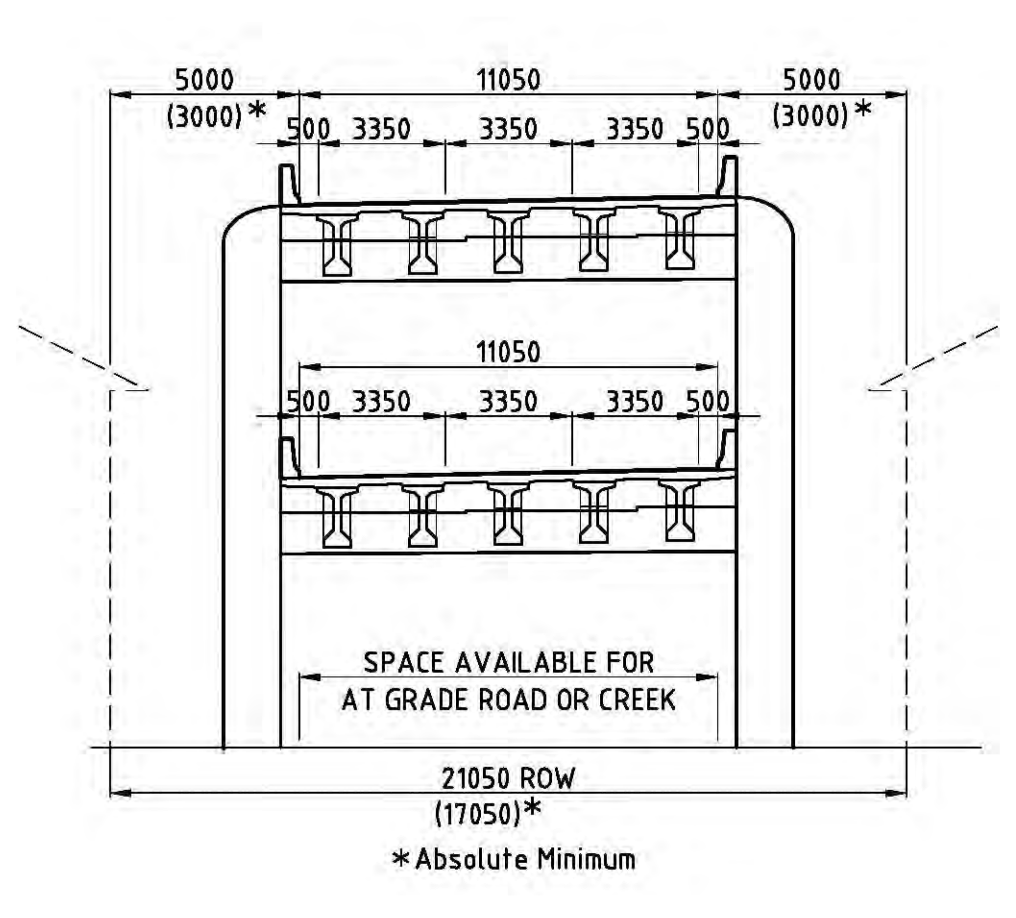
Source: JICA Study Team

Figure 8.4-2 Typical Cross Section – 6 Lane Road Elevated



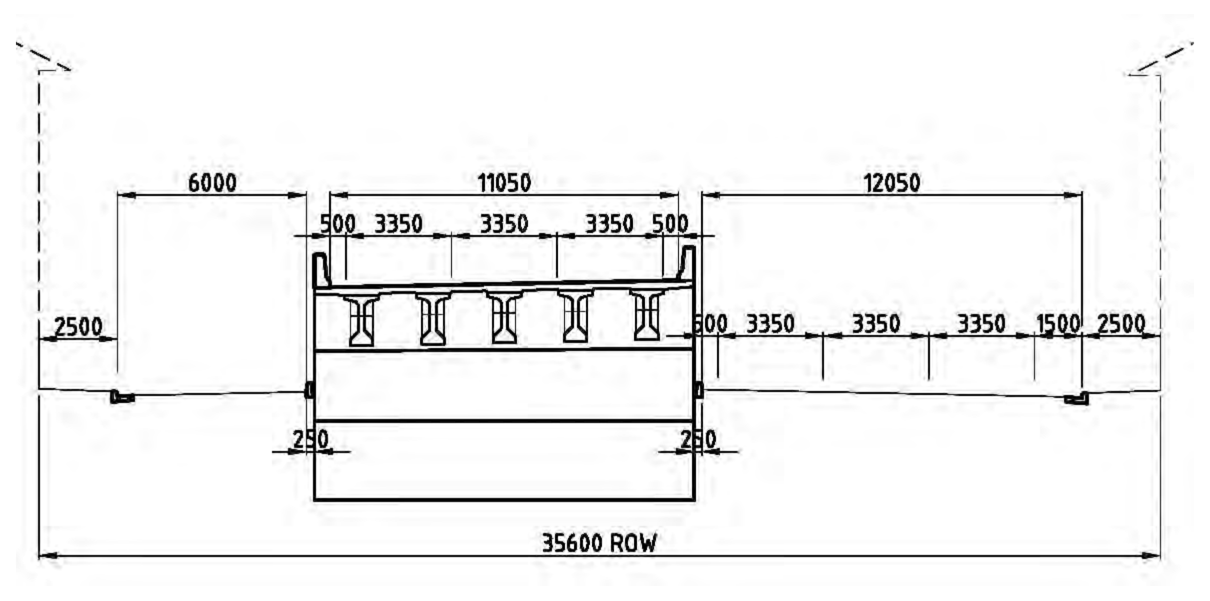
Source: JICA Study Team

Figure 8.4-3 Typical Cross Section – 6 Lane Road Elevated plus Service Roads



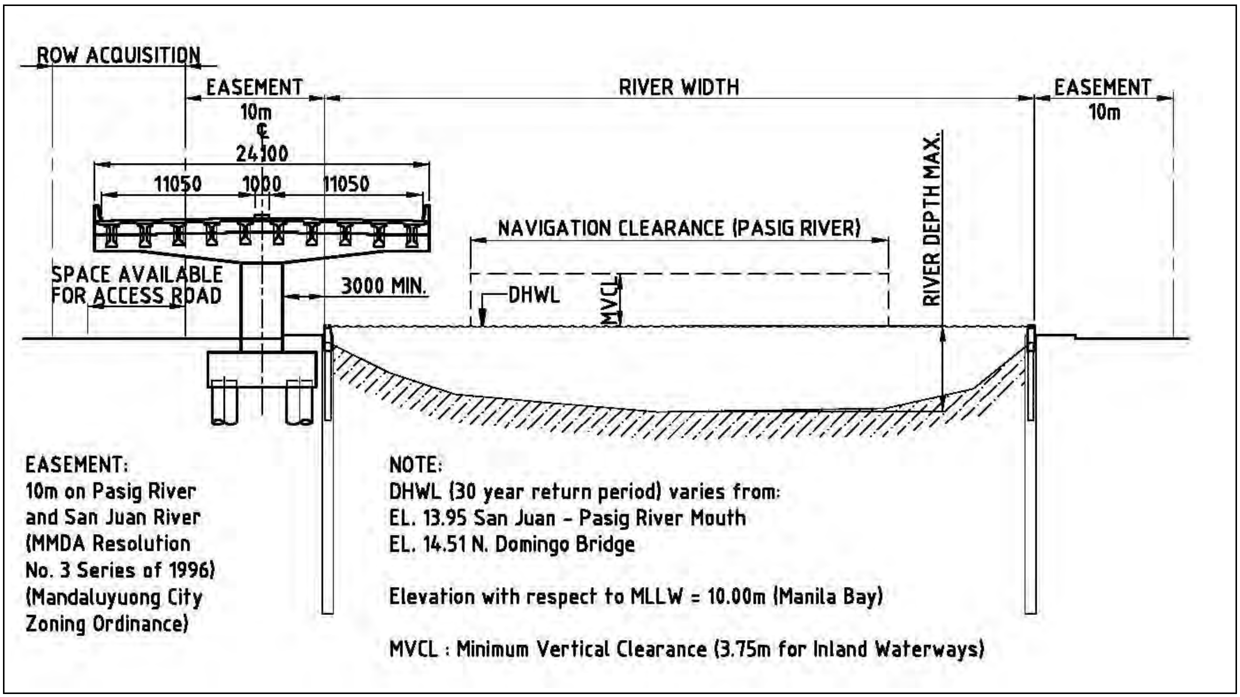
Source: JICA Study Team

Figure 8.4-4 Typical Cross Section – 6 Lane Road Double Deck



Source: JICA Study Team

Figure 8.4-5 Typical Cross Section –Road Approach to 6 Lane Double Deck



EASEMENT:
10m on Pasig River
and San Juan River
(MMDA Resolution
No. 3 Series of 1996)
(Mandaluyuong City
Zoning Ordinance)

NOTE:
DHWL (30 year return period) varies from:
EL. 13.95 San Juan - Pasig River Mouth
EL. 14.51 N. Domingo Bridge

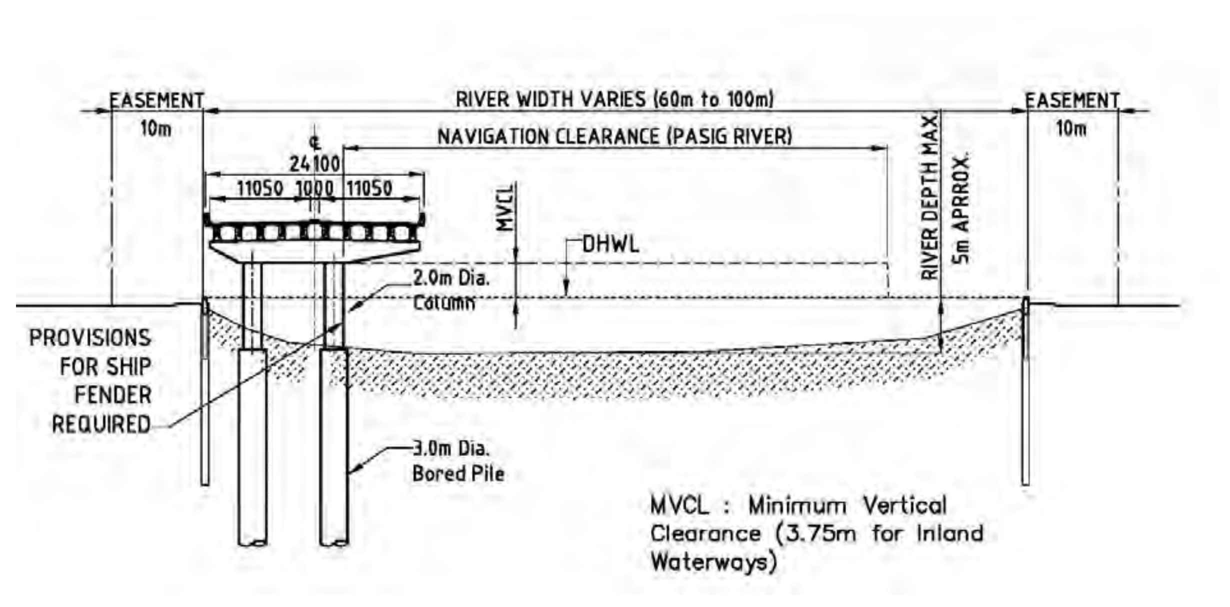
Elevation with respect to MLLW = 10.00m (Manila Bay)

MVCL : Minimum Vertical Clearance (3.75m for Inland Waterways)

Source: JICA Study Team

Figure 8.4-6 Typical Cross Section – 6 Lanes Elevated– Pier on Riverbank

Pasig River and San Jan River

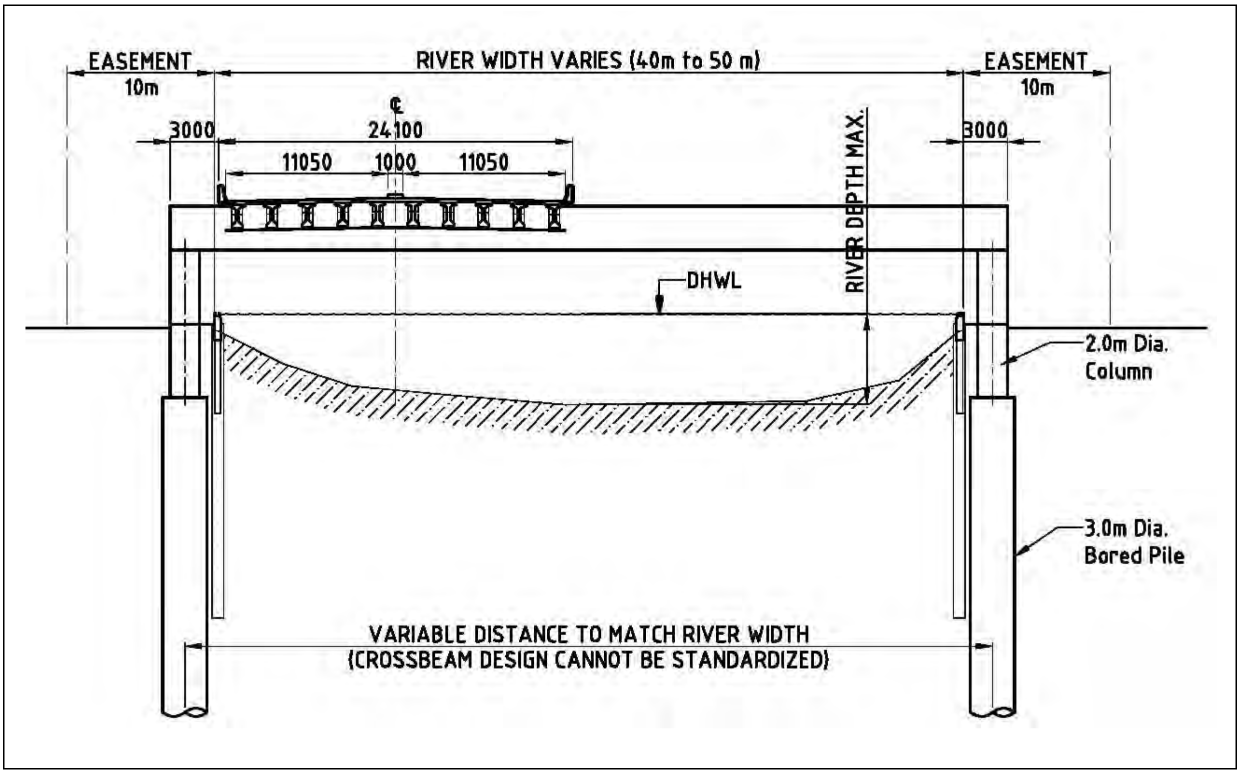


MVCL : Minimum Vertical Clearance (3.75m for Inland Waterways)

Source: JICA Study Team

Figure 8.4-7 Typical Cross Section –6 Lanes Elevated

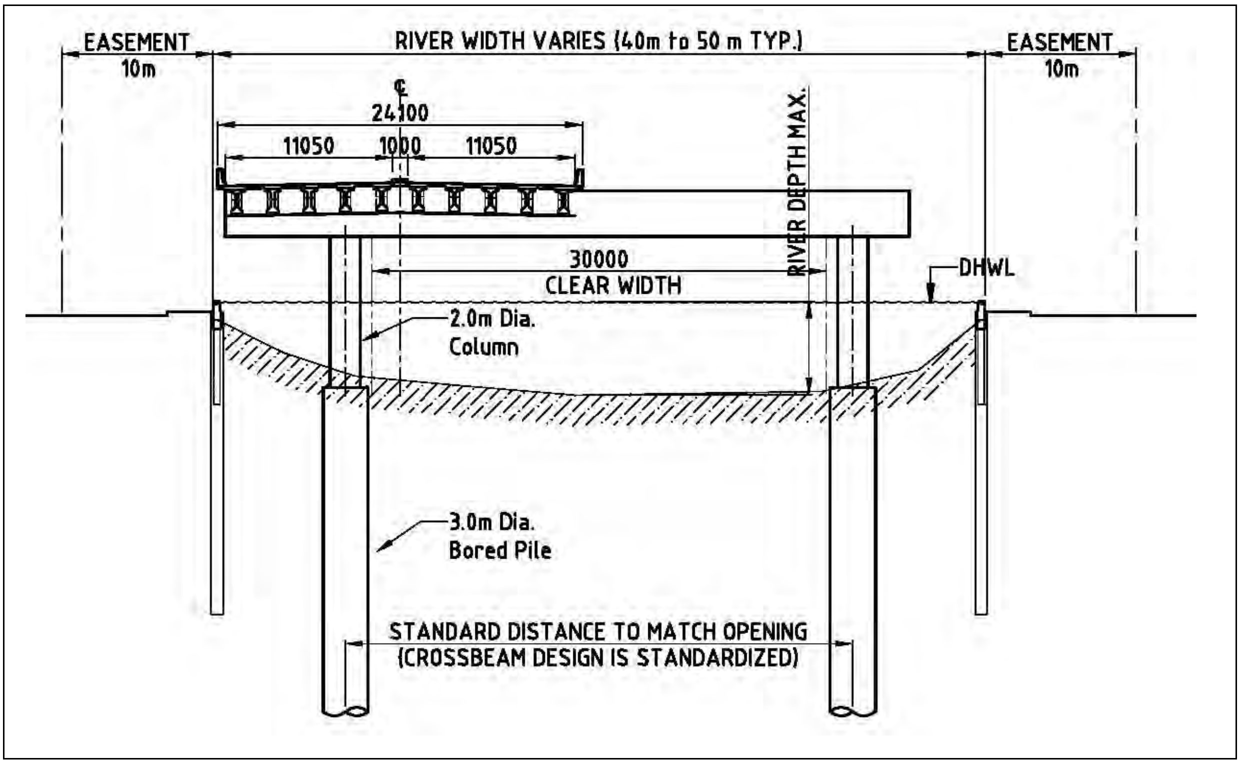
Deck above Waterway - Pier in Pasig River



Source: JICA Study Team

Figure 8.4-8 Typical Cross Section –6 Lanes Elevated

Deck above Waterway - Pier on Bank of San Juan River



Source: JICA Study Team

Figure 8.4-9 Typical Cross Section –6 Lanes Elevated

Deck above Waterway - Pier in San Juan River

8.4.3 Scope of Work of Each Alignment

The scope of work of each alignment has been established in outline, based on the available data from the DPWH alignment study, desk study of available NAMRIA maps and the typical sections presented in Section 8.4.2.

All alignments provide a divided 6 lane road, given that the existing C-3 northern section is also a 6 lane divided road. The lengths of each alignment have been updated in outline based upon the above desk study. Detailed lengths based on an engineering study of alignments have not been established. The alignments, including photographs of typical streets, are presented in **Appendix 8.2**. The scope of work of each alignment is presented in **Table.8.4-1**. In establishing the scope of work for the alignments along Pasig River and San Juan River, the option to extend the alignment along San Juan River to connect directly with G. Araneta Ave. has been adopted.

All alignments, except Alignment 5, propose double-deck viaduct sections along South Avenue, given that the alignments run adjacent to Manila South Cemetery. Available ROW along South Avenue is in the order of 18m according to satellite images. A double deck configuration with absolute minimum offset to building/property lines will require a 17.05m wide corridor. The use of double deck viaduct will therefore avoid ROW acquisition of South Cemetery.

The estimated required ROW acquisition is based on the required widths established from the typical cross-sections given in **Figure 8.4-1** to **8.4-9** and on estimates of available ROW made from inspection of open source internet based satellite images. It is noted that the estimated areas of ROW acquisition does not correspond with the estimates made during the DPWH studies. Further co-ordination will be required with DPWH on this matter prior to finalization of the report.

The routes of the alignments, together with photographs at selected locations, are presented in **Appendix 8.2**.

(1) Viaduct Configuration

Single level viaduct structures are proposed as a preferred configuration, given the additional costs associated with double deck viaducts and the complications associated with connecting double decks with on-ramp and off-ramp structures. However, where available ROW is limited, double deck viaducts have been proposed, consistent also with some alignments from the original DPWH studies. Refer to **Table 8.4-1** for a brief description of the locations of the double deck viaducts for each affected alignment.

Long span bridges, in the order of 50m to 100m or so, will be necessary to cross the Pasig River, and the San Juan River. A study on span length and structure type at these crossings has not been undertaken for this preliminary study.

(2) Interconnectivity with Local Roads

The interconnectivity of the proposed alternative alignments with local roads is a key aspect in promoting the functionality of each route in collecting and distributing traffic. The proposed location of on/off ramps and/or service roads for each alignment are presented in **Figure 8.4-10** and summarized in **Table 8.4-2**.

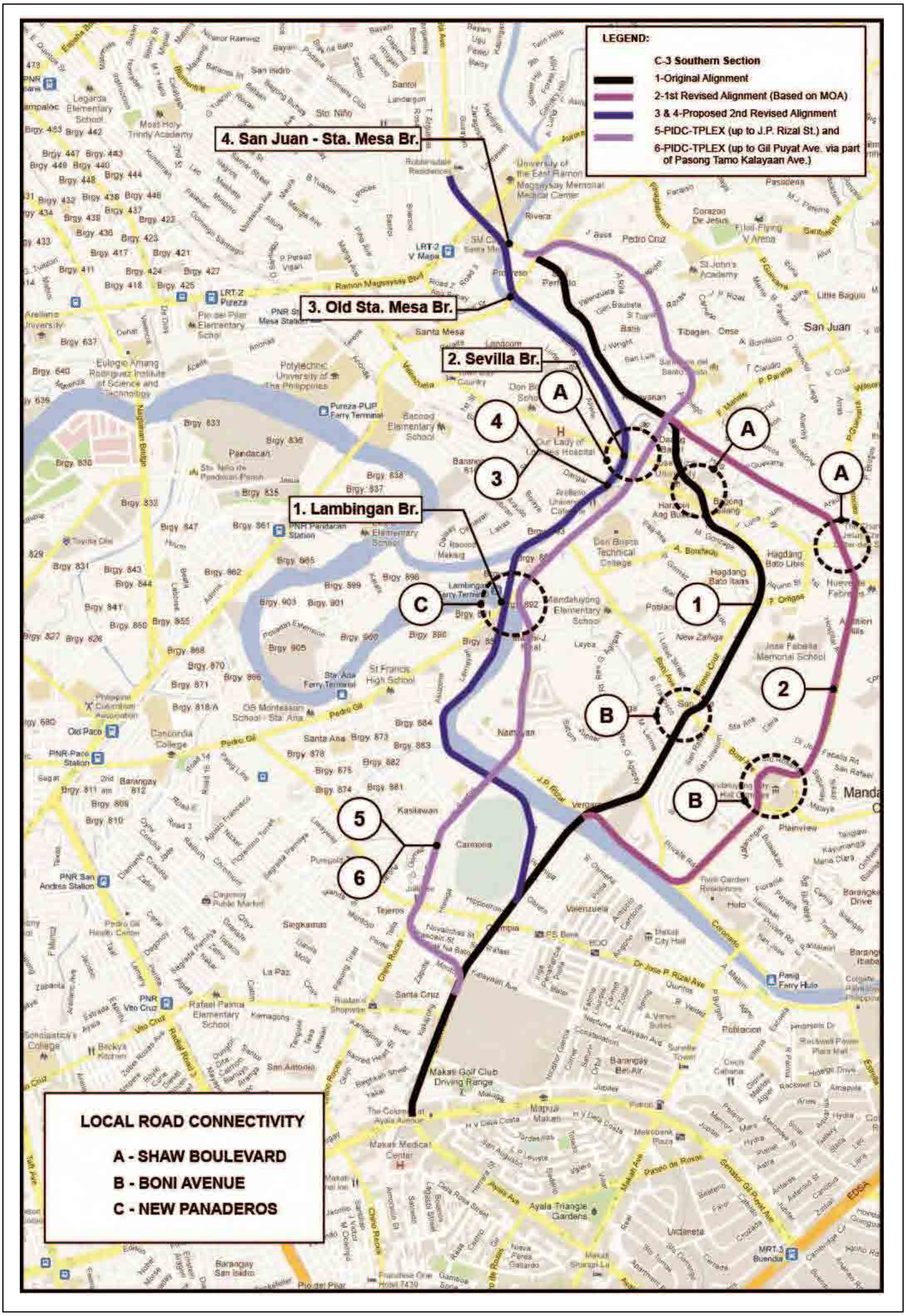
The configuration of on/off ramps required to access and exit viaduct structures at all start/end locations and at proposed interchange locations have not been established for this preliminary study. Rough cost estimates however have been included under **Section 8.4.6**.

The extent and layout of proposed on/off ramps have not been established in this preliminary study.

Table 8.4-1 Scope of Work of the Alternative Alignments, C-3 Missing Link

Ref	Description	Length				ROW Acquisition (sqm)	Comment
		At Grade (km)	Elevated Single Deck (km)	Elevated Double Deck (km)	Total (km)		
1	Original Alignment (6 Lane)	1.05	0.80	3.95	5.8	102,000	• Single decks crossing Pasig River and Boni Avenue. • Double deck required along South Avenue, to cross Shaw Blvd. and extending north along F. Manalo to N. Domingo.
2	1st Revised Alignment (6 Lane)	1.05	1.6	4.65	7.3	105,000	• Single decks crossing Pasig River and Boni Avenue. • Double deck required along South Avenue, to cross Shaw Blvd. and to extend north along Maytunas Creek to N. Domingo.
3	2nd Revised Alignment a1 (6 Lane)	0.0	4.55	1.75	6.3	35,000	• Double deck section along South Ave up to the river • All other sections are single deck including 3rd level over Lambingan Bridge
4	2nd Revised Alignment a2 (6 Lane)	0.0	4.55	1.75	6.3	92,000	• Double deck section along South Ave up to the river • All other sections are single deck including 3rd level over Lambingan Bridge
5	PIDC-TPLEX Alignment b1 (6 Lane)	1.55	0.15	3.4	5.1	74,000	• At grade section along Chino Roces and AP Reyes up to the Pasig River and along JP Rizal after the Pasig River • Single deck crossing of Pasig River • Double deck proposed for all other sections given the limited roadway widths of New Panaderos and F. Blumentrit
6	PIDC-TPLEX Alignment b2 (6 Lane)	1.15	0.15	5.1	6.4	77,000	• Double deck along South Ave. and Kalayaan Ave, given narrow road width of Kalayaan and need to be elevated above it. • At grade section along AP Reyes up to the Pasig River and along JP Rizal after the Pasig River • Single deck crossing of Pasig River • Double deck proposed for all other sections given the limited roadway widths of New Panaderos and F. Blumentrit

Source: JICA Study Team



Source : JICA Study Team

Figure 8.4-10 Interconnectivity of Alternative Alignments with the Local Road Network

Table 8.4-2 Connections of Alternative Alignments to the Local Road Network

Ref	Name	Length km	Start	Connections		End
1	Original	5.8	Junction Gil Puyat Ave. (Buendia) /Ayala Ave	Boni Avenue (Sta. 2.8 km)	Shaw Boulevard (Sta. 4.3 km)	Junction N. Domingo / C-3 Araneta Ave (Sta. 5.8km)
2	1st Revised	7.3	Junction Gil Puyat Ave. (Buendia) /Ayala Ave	Boni Avenue (Sta. 3.3 km)	Shaw Boulevard (Sta. 4.8 km)	Junction N. Domingo / C-3 Araneta Ave (Sta. 7.3km)
3	2nd Revised a1 (River)	6.3	Junction Gil Puyat Ave. (Buendia) /Ayala Ave	New Panaderos (Lambingan) (Sta. 3.3 km)	Shaw Boulevard (Sta. 4.4 km)	C-3 Araneta Ave after crossing LRT Line 2 (Sta. 6.3km)
4	2nd Revised a2 (Riverbank)	6.3	Junction Gil Puyat Ave. (Buendia) /Ayala Ave	New Panaderos (Lambingan) (Sta. 3.3 km)	Shaw Boulevard (Sta. 4.4 km)	C-3 Araneta Ave after crossing LRT Line 2 (Sta. 6.3km)
5	PIDC-TPLEX b1	5.1	Junction J.P. Rizal Ave. /Chino Roces Ave	New Panaderos (Lambingan) (Sta. 2.1 km)	Shaw Boulevard (Sta. 3.2 km)	Junction N. Domingo / C-3 Araneta Ave (Sta. 5.1km)
6	PIDC-TPLEX b2	6.4	Junction Gil Puyat Ave. (Buendia) /Ayala Ave	New Panaderos (Lambingan) (Sta. 3.4 km)	Shaw Boulevard (Sta. 4.5 km)	Junction N. Domingo / C-3 Araneta Ave (Sta. 6.4km)

Source: JICA Study Team

(3) Navigation Issues in Pasig River

The Pasig River is a busy navigable water way. According to the Commander of the Pasig Coast Guard Station, there are typically between 150 to 200 vessel movements along the river every day. Types of vessels range from large steel hulled tankers and barges to small wooden “Petuya” boats.

The Commander of the Pasig Coast Guard Station has advised the Study team that the section of Pasig River just upstream of Lambingan Bridge is already posing navigational problems for the larger vessels plying the river. At this location, approximately 900m upstream of the Lambingan Bridge, the river bends 90 degrees to the right and narrows down from 100m to less than 60m. Any obstructions in the river reducing the navigable width will further exacerbate the already difficult situation and the Commander strongly advised against constructing any structure supports in the river at this location.

Any structures in the river will have to be designed to withstand vessel collision forces. The design vessel to be used in such design calculations will have to be established. The design vessel is selected using probability based analysis. Typical forces for various DWT are presented below, based on AASHTO LRFD Bridge Design Specifications.

Vessel Deadweight tonnage DWT	Head-on Ship Collision Impact Force kN
500	8,050
1000	11,384
1500	13,943

Note: vessel impact velocity assumed to be 3m/s in line with the current speed restrictions imposed by the Pasig Coast Guard

The forces presented above are substantially greater than design forces imposed on bridge substructures from earthquake loads and are therefore highly likely to be the critical design condition in limiting the probability of bridge collapse.

(4) San Juan Pasig River Issues

San Juan River is not navigable and therefore not subject to considerations of vessel navigation and ship collision forces.

The principal consideration in placing pier supports in the river is the reduction in the hydraulic capacity of the waterway, since San Juan River is already flood prone. The width of the river varies within the section under consideration for the C-3 Missing Link alignment. Maintaining a minimum waterway width at least no less than the minimum width of the river along this section will in broad terms therefore not have a substantial effect on the discharge capacity. Nevertheless any proposal to occupy the waterway of San Juan River will have to address hydraulic capacity issues and be coordinated with the relevant authorities and any proposed projects for river channel improvement. Measures such as dredging the channel or widening the river may have to be considered to compensate for the loss of waterway area.

The existing Bacood-Mandaluyong Bridge, connecting Lubiran (Manila City) with Aglipay (Mandaluyong City), features an S-curve alignment that occupies the San Juan River for a length of approximately 150m, with piers located within the waterway. The waterway clearance requirement given on the plans is for a clear centrally located opening of 30m across the width of the river.

Two alternative pier layouts along San Juan River have been identified in this study and these are presented in **Figures 8.4-8** and **8.4-9**. Both pier layouts straddle the waterway and allow for transverse placement of the deck on crossbeams to suit the elevated road alignment. Locating piers within the easement as shown in **Figure 8.4-8** has the advantage that the waterway is not occupied. However this arrangement will require the river banks to be cleared of both formal and informal residents, and industrial/commercial buildings will be affected. Any proposals to occupy the easement will also have to be cleared with the DENR. In addition the cross beam supporting the viaduct will have to have a variable design to match the varying river width. The arrangement given in **Figure 8.4-9** with the pier columns occupying the waterway has the advantage that the easement is not affected, the design can be standardized to a constant width and the proposed 30m clear opening has already been established by the existing Bacood-Mandaluyong Bridge.

For the purposes of determining area of ROW acquisition the arrangement given in **Figure 8.4-9** has been assumed in this study.

8.4.4 Project Affected Buildings and Project Affected People

Numbers of affected buildings and building landmarks have also been made from open source satellite images. Base map of satellite images are presentation Appendix 8.3 insert on original.

Numbers of Project Affected People (PAPs) have been estimated by assuming that the average number of persons per household is approximately five (5) based on the data of 2007 Census of Population (National Statistic Office) in National Capital Region.

Actual numbers of buildings, building type, and project affected people will have to be determined based on future detailed survey and investigation.

The estimated ROW acquisition, number of affected buildings, PAPs and landmarks are presented in **Table 8.4-3** to **Table 8.4-5**. For the Final Report a walk through survey will be undertaken to verify assumptions made and landmarks affected.

Table 8.4-3 Estimated ROW Acquisition, Number of Affected Buildings, PAPs and Landmarks (1/3)

Ref	Alignment Description	Items				
		City	Estimated ROW Acquisition (sqm)	Number of Buildings Affected	Number of Project Affected People	Notable Landmarks
1	Original Alignment (6 Lane)	Makati	14,000	176	880	Manila South Cemetery, South Ave. F. Benitez Elementary School, South Ave. Olympia Ville (partial demolition)
		Manila	0	0	0	none
		Mandaluyong	65,000	589	2,945	Mandaluyong Municipal Cemetery (demolish), Rustans Expresslane, Primo Cruz-Boni Core Oil Gas Station (demolish), Primo Cruz-Boni Barangay Hall Bagong Silang (demolish), J. Luna Andoks restaurant (demolish), Shaw Boulevard SM Hypermarket, Shaw Boulevard Jose Rizal University, Shaw Boulevard Ice Plant, F. Bernardo
		San Juan	23,000	121	605	New San Juan City Coliseum, F. Manalo San Juan Slaughterhouse, F. Manalo
		Totals	**102,000**	**886**	**4,430**	
2	1st Revised Alignment (6 Lane)	Makati	14,000	176	880	Manila South Cemetery, South Ave. F. Benitez Elementary School, South Ave.
		Manila	0	0	0	none
		Mandaluyong	55,000	488	2,440	Holy Cross Chapel, San Francisco Integral Piping Corporation, San Francisco Tiger City Gym, San Francisco Shell Gas Station, San Francisco FSA Corporate Plaza, San Francisco Ebreo Architecture compound, San Francisco MDIT Office, San Francisco Mandaluyong City Hall Complex, Maysilo Loop Archdiocesan Shrine of Divine Mercy, Maysilo Loop Botanical Gardens, M. Martinez Honda Motors, 9 Febrero-Shaw Grand Alphatech International Corp., Gomezville Horizon City Flats, Maytunas Creek
		San Juan	36,000	121	605	New San Juan City Coliseum, F. Manalo San Juan Slaughterhouse, F. Manalo
		Totals	**105,000**	**785**	**3,925**	

Source: JICA Study Team

Table 8.4-4 Estimated ROW Acquisition, Number of Affected Buildings, PAPs and Landmarks (2/3)

Ref	Alignment Description	Items				
		City	Estimated ROW Acquisition (sqm)	Number of Buildings Affected	Number of Project Affected People	Notable Landmarks
3	2nd Revised Alignment a1 (6 Lane in River)	Makati	19,000	55	275	Manila South Cemetery, South Ave. F. Benitez Elementary School, South Ave La Campana Fabrica de Tabacos, Olympia Barangay Quisumbing-Baltbat Stables, Olympia Barangay GE Lighting Company, Carmona Barangay BJS Compound, Kasilawan Barangay
		Manila	8,000	25	125	Manila Boat Club, Barangay 881 Former Interwood Factory Facility, Barangay 884 TWP Flying V Petrol Depot, Barangay 888 Powdered goods warehouse, Barangay 888 Eurovila Townhouse, Barangay 888 (near Lambingan Bridge) Lambingan Bridge Puregold Kalentong supermarket, Barangay 893 Bacood-Mandaluyong Bridge, Barangay 608
		Mandaluyong	0	0	0	Sevilla Bridge, Daang Bakal Barangay
		San Juan	8,000	30	150	SCT Furnishing Incorporated, Kabayan Barangay San Juan Slaughterhouse, Batis Barangay AMA Computer College, Batis Barangay Brangay Batis Health Center, Batis Barangay Baguio Oil Factory and Warehouse, Batis Barangay Old Sta. Mesa Bridge, Progreso Barangay Health Center, Progreso Barangay San Juan - Sta. Mesa Boundary Bridge
		Totals	**35,000**	**110**	**550**	
4	2nd Revised Alignment a2 (6 Lane on River Bank)	Makati	28,000	55	275	Same as above
		Manila	36,000	83	415	Same as above
		Mandaluyong	2,000	0	0	Same as above
		San Juan	23,000	52	260	Same as above
		Totals	**92,000**	**190**	**950**	

Source: JICA Study Team

Table 8.4-5 Estimated ROW Acquisition, Number of Affected Buildings, PAPs and Landmarks (3/3)

Ref	Alignment Description	Items				
		City	Estimated ROW Acquisition (sqm)	Number of Buildings Affected	Number of Project Affected People	Notable Landmarks
5	PIDC-TPLEX Alignment b1 (6 Lane)	Makati	14,000	60	300	Carmona Sports Complex, A.P. Reyes
		Manila	5,000	71	355	Puregold Kalentong supermarket, New Panaderos Unex Machineries Inc., New Panaderos CNT Complex, New Panaderos
		Mandaluyong	29,000	86	430	Merryland Village, Wonderland Townhouses, Acropolis Subdivision, Pag-Asa Ext., Arellano University, Mandaluyong Wet Market, The MarketPlace Mall, Liberation Marker, BPI Family Bank, Harapin ang Bukas Barangay Hall, GIST-Kalentong, all New Panaderos Commercial Building, Phil-Trust Bank and BDO, corner New Panaderos- Shaw Boulevard
		San Juan	26,000	136	680	Kabayanan Child and Youth Learning Center, Kabayanan Barangay Hall, Globe Telecom San Juan, Dominican College, Caltex Gas Station, My San Biscuit, Shell Gas Station, Leonardo's Apartment, Glialcoms Bldg, Meralco Office, Metrobank, Equitable Bank, all F. Blumentritt Security Bank, Caley Building - St. Nazarene Child Integrated Development Center, Banco San Juan, RCBC, all N. Domingo
		Totals	**74,000**	**353**	**1,765**	
6	PIDC-TPLEX Alignment b2 (6 Lane)	Makati	7,000	124	620	Manila South Cemetery, South Ave. F. Benitez Elementary School, South Ave Carmona Sports Complex, A.P. Reyes
		Manila	8,000	71	355	Same as above
		Mandaluyong	36,000	86	430	Same as above
		San Juan	26,000	136	680	Same as above
		Totals	**77,000**	**417**	**2,085**	

Source: JICA Study Team

8.4.5 Environmental Issues

(1) Roadside air pollution

Since the baseline conditions of ambient air quality in the project area can be considered to be almost the same for all alternatives, roadside air pollution levels will depend on emission of gaseous pollutants from vehicles. Furthermore, future traffic volume and average running speed may not be different among the alternatives, therefore, it can be assumed that emission of pollutants will be the same in six alternatives.

However, the adverse impacts on human health due to air pollutants will be significant along the roadside in populated residential area. Among the alternatives, since the length of the routes passing through the residential area of Alignments 1 and 2 are longer than other alternatives, the impacts of emission gases will be more significant than other alignments.

(2) Roadside noise impact

Increase of roadside noise levels will depend on the projected future traffic volume and running speed of vehicles. It is assumed that future traffic volume and average running speed may not be different among the alternatives, therefore, there will be not so much difference in noise emission from projected traffic. However, maximum allowable noise levels are set in more stringent in residential and sensitive areas (school and hospital), so that the alignments go through such areas will need noise abatement measures.

Since Alignments 1 and 2 are established in the populated residential area, noise impact will be the most significant among the alternatives.

Since Alignments 3 and 4 are established along the rivers or on the river banks, noise impact on roadside residence will be less significant than other alternative alignments.

(3) Sunlight easement (shadow control)

Elevated road structure blocks sunlight and casts a shadow on houses along the roadsides. Potential impacts on residences will depend on the length of elevated sections.

Since Alignments 1 and 2 are established in the populated residential area, shadow impact will be the most significant among the alternatives. Although the length of elevated sections is the longest in Alternative 3 and 4, those routes are established along the rivers or on the river banks, residence areas affected by shadow will be smaller than other alternative alignments.

(4) Water quality deterioration

In Alignment 3, piers will be constructed on the riverbeds in Pasig River and San Juan River. Installation of piers may deteriorate river water quality as follows.

During the construction phase:

- ✓ Elution of pollutants into water column from disturbed sediment, if sediment over the riverbeds is contaminated with pollutants such as heavy metals and hazardous chemicals;

- ✓ Spillage of the pollutants (e.g., oil and grease) from construction machines such as pile drivers.

During the operation phase:

- ✓ Storm water runoff flushing the road surface directly discharge pollutants into the rivers.

(5) Summary

Relative comparison of the environmental issues is summarized in **Table 8.4-6**. For the Final Report the comparative study should take into account the projected traffic volume of six alternative alignments and also land use plans of the cities in order to improve the prediction/assessment of environment impacts.

Table 8.4-6 Relative Comparison of Environmental Impacts of 6 Alternative Alignments

Alignment / Environmental impacts	**Original Alignment**	**1st Revised Alignment**	**2nd Revised Alignment a1 (in River)**	**2nd Revised Alignment a2 (on River Bank)**	**PIDC-TPLEX Alignment b1**	**PIDC-TPLEX Alignment b2**
	(1)	(2)	(3)	(4)	(5)	(6)
1) Roadside air pollution	xx	xx	x	x	xx	xx
2) Roadside noise level	xxx	xxx	x	xx	xxx	xxx
3) Sunlight shading	xxx	xxx	-	x	x	x
4) Water quality deterioration (rivers)	-	-	x	-	-	-
Total number of 'x' impacts	8	8	3	4	6	6

Source: JICA Study Team

Note: Magnitude of impact: xxx: significant impact; xx: moderate impact; x: slight impact; (-): No impact or very small impact is expected.

8.4.6 Preliminary Cost Estimate

The summary of preliminary cost estimate of the six (6) alternative alignments is presented in **Table 8.4-7**. Note that the estimate includes approximate costs for the on/off ramps.

The construction cost estimates were based on the following unit rates, derived in part from the approved budgets of recent DPWH projects in Metro Manila, as follows:

Item		Unit Cost (Peso/m/Lane)* (Peso/Ramp)**	Note
Lane At-Grade	:	25,000*	With reference to NRIMP2 Marcos Highway Rehabilitation Project and CLEX Feasibility Study
Viaduct : 2ND Level (over land)	:	300,000*	With reference to C-5 / Lanuza / Vargas Flyover; C-2 / R-7 Flyover Projects; proposed Skyway Stage 3 and NLEX-SLEX Connector projects
Viaduct : 3RD Level (over land)	:	375,000*	With reference to recent unit rates assumed by URPO for 3RD Level structures constructed along EDSA
Viaduct : 2ND Level (over water)	:	390,000*	Additional cost to account for craneway in river / construction from barges and soft ground conditions
Viaduct : 3RD Level (over water)	:	460,000*	Additional cost to account for craneway in river / construction from barges and soft ground conditions
On/off ramp : 2ND Level	:	150,000,000**	Assuming 6m lane width, 250m long ramp
On/off ramp : 3RD Level	:	300,000,000**	Assuming 6m lane width, 500m long ramp

Source: JICA Study Team

The ROW acquisition and land improvement cost estimates were based on the:

Item		Unit Cost (Peso/sq.m)	Note
ROW Acquisition (Makati City)	:	50,000	Assumption only, BIR zonal rates out of date
ROW Acquisition (all other locations)	:	30,000	Assumption only, BIR zonal rates out of date
Land Improvement Cost	:	22,000	With reference to average values assumed in DPWH comparative study

Source: JICA Study Team

Table 8.4-7 Cost Estimate

Alignment	**Original Alignment**	**1st Revised Alignment**	**2nd Revised Alignment a1 (in River)**	**2nd Revised Alignment a2 (on River Bank)**	**PIDC-TPLEX Alignment b1**	**PIDC-TPLEX Alignment b2**
	(1)	(2)	(3)	(4)	(5)	(6)
Construction Cost	12,000	14,700	16,400	14,600	9,600	13,900
ROW Acquisition and Land Improvement Cost	5,600	5,700	2,100	4,700	4,100	4,400
Total Cost	17,600	20,400	18,500	19,300	13,700	18,300

Unit = Millions of Pesos
Source: JICA Study Team

8.4.7 Comparative Study

The comparative study of the six alignments of the C-3 Missing Link is presented in **Table 8.4-8.**

Table 8.4-8 Comparative Study of the Alternative Alignment, C-3 Missing Link

Ref	Description	Scope and Cost	Construction Aspects	Road Network Aspects	Environmental Impact & Pasig River Navigation	ROW Acquisition (excluding ramps)	Project Affected People	Comment
1	Original Alignment (6 Lane, 5.8 km.)	Relatively narrow available width along South Ave. (Makati), and Shaw Boulevard (Mandaluyong) to N. Domingo (San Juan), with substantial commercial and institutional developments each side require the use of a double deck viaduct at these locations . COST: 17,600MP	Adequate traffic management during construction will be crucial.	Connects to both Boni Avenue and Shaw Boulevard. Double deck configuration at Shaw and N. Domingo will require longer access ramps and greater ROW acquisition. The double deck structure along South Ave. will require ramps onto Gil Puyat and Ayala Avenue.	Since the route is established in the populated residential area, the impacts of emission gases, noise and sunlight shading will be the most significant among the alternatives and must be mitigated. Number of impacts: 8	Very substantial ROW acquisition (102,000 sqm). Requires wholescale demolition at: Olympia Ville, Mandaluyong Cemetery, Core Oil Gas Station, Barangay Hall Bagong Silang, and residential blocks from Valenzuela to N. Domingo. Encroachment into Manila South Cemetery is avoided with double deck viaduct along South Ave.	Maximum estimated number of PAPs at 4,430.	Large area of ROW acquisition and largest number of PAPs makes this one of the least favored routes.
2	1st Revised Alignment (6 Lane, 7.3 km.)	Relatively narrow available width along South Ave. (Makati), and the Maytunas Creek alignment in San Juan requires the use of a double deck viaduct to limit ROW acquisition. COST: 20,400MP	Adequate traffic management during construction will be crucial.	Connects to both Boni Avenue and Shaw Boulevard. Double deck configuration at Shaw and N. Domingo will require longer access ramps and greater ROW acquisition. The double deck structure along South Ave. will require ramps onto Gil Puyat and Ayala Avenue.	Since the route is established in the populated residential area, the impacts of emission gases, noise and sunlight shading will be the most significant among the alternatives and must be abated. Number of impacts: 8	Greatest ROW acquisition (105,000 sqm). Requires wholescale demolition at: Olympia Ville, residential blocks at corner of Coronado-San Francisco, along Maytunas Creek (partial), and residential blocks from Valenzuela to N. Domingo. Encroaching into Manila South Cemetery is avoided with double deck viaduct along South Ave.	Second largest estimated number of PAPs at 3,925.	Largest area of ROW acquisition and very large number of PAPs makes this one of the least favored routes.
3	2nd Revised Alignment a1 (6 Lane, 6.3 km.)	Relatively narrow available width along South Ave. (Makati) requires the use of a double deck viaduct at this location. Single deck viaduct can be used elsewhere for elevated sections. Third level >100m long span required over Lambingan Bridge. COST: 18,500MP	Access along both waterways will be required for construction. Barges could be used both to deliver materials and as a platform for construction equipment along Pasig River. Craneways may be necessary along San Juan River given that the river is not navigable. Water craft management, using a one-direction at a time ship control system, will be required in Pasig River.	Connects to both New Panaderos and Shaw Boulevard. Single level deck will facilitate simpler access ramp layouts. The double deck structure along South Ave. will require ramps onto Gil Puyat and Ayala Avenue.	Piers will be constructed on the riverbeds in Pasig River and San Juan River. Installation of piers and untreated storm runoff may deteriorate river water quality. Ease of navigation along Pasig River will be severely impacted especially where the river narrows and at the point where the rivers bends 90 degrees on the approach to Lambingan. Number of impacts: 3	Least ROW acquisition (35,000 sqm) given that most of alignment is in Pasig and San Juan River. There is a requirement to partially demolish Olympia Ville, between Kalayaan Avenue and J.P. Rizal. Encroachment into Manila South Cemetery is avoided with double deck viaduct along South Ave.	Smallest estimated number of PAPs at 550.	Most favored in terms of limiting area of ROW acquisition and number of PAPs. However construction along sections of Pasig River may not be possible given the existing critical navigation problems.
4	2nd Revised Alignment a2 (6 Lane, 6.3 km.)	Relatively narrow available width along South Ave. (Makati) requires the use of a double deck viaduct at this location. Single deck viaduct can be used elsewhere for elevated sections. Third level >100m long span required over Lambingan Bridge. Local road access along the river bank at grade can be provided within the width of ROW acquisition. COST: 19,300MP	Construction access along the river banks can be made after the easement has been cleared. No construction activities are required in the river waterways.	Connects to both New Panaderos and Shaw Boulevard. Single level deck will facilitate simpler access ramp layouts. The double deck structure along South Ave. will require ramps onto Gil Puyat and Ayala Avenue.	Since the route is established in the populated residential area, noise abatement measures will be needed. Number of impacts: 4	Still substantial ROW acquisition (92,000 sqm) given the need to acquire ROW along the river banks of Pasig and San Juan River. Substantial demolition of industrial and residential properties. There is a requirement to partially demolish Olympia Ville, between Kalayaan Avenue and J.P. Rizal. Encroachment into Manila South Cemetery is avoided with double deck viaduct along South Ave.	Second smallest estimated number of PAPs at 950.	Reasonably favored in terms of limiting number of PAPs. No adverse impacts on river waterway or navigation. However construction along the banks will still require substantial ROW acquisition.
5	PIDC-TPLEX Alignment b1 (6 Lane, 5.1 km.)	The narrow available width along New Panaderos (Mandaluyong) and Blumentritt (San Juan) has dictated the use of a double deck viaduct to limit ROW acquisition. COST: 13,700MP	Adequate traffic management during construction will be crucial.	Connects to both New Panaderos and Shaw Boulevard. Double deck configuration at both locations will require longer access ramps and greater ROW acquisition.	Since the route is established in the commercial and residential area, the impacts of emission gases, noise and sunlight shading should be mitigated. Number of impacts: 6	Double deck configuration limits ROW acquisition (74,000 sqm). However many properties affected including commercial buildings especially along New Panaderos and F. Bulmentritt. Curved alignment cuts the corner at F. Blumentritt requiring wholescale demolition in one section.	Estimated number of PAPs still substantial at 1,765.	Route not favored since it does not extend to Gil Puyat.
6	PIDC-TPLEX Alignment b2 (6 Lane, 6.4 km.)	The narrow available width along South Ave. and Kalayaan (Makati), New Panaderos (Mandaluyong) and Blumentritt (San Juan) has dictated the use of double deck viaducts to limit ROW acquisition. COST: 18,300MP	Adequate traffic management during construction will be crucial.	Connects to both New Panaderos and Shaw Boulevard. Double deck configuration at both locations will require longer access ramps and greater ROW acquisition. The double deck structure along South Ave. will require ramps onto Gil Puyat and Ayala Avenue.	Since the route is established in the commercial and residential area, the impacts of emission gases, noise and sunlight shading should be mitigated. Number of impacts: 6	Double deck configuration limits ROW acquisition (77,000 sqm). Affected properties same as above. In addition ROW acquisition along Kalayaan Avenue will be required.Encroachment into Manila South Cemetery is avoided with double deck viaduct along South Ave.	Estimated number of PAPs still substantial at 2,085.	Route not favored given the need for ROW acquisition along commercial strips, despite double deck construction, and wholescale demolition in Blumentritt to accommodate the curved alignment.

Source: JICA Study Team

8.4.8 Effect on the Project Interchanges due to Construction of the Missing Link

The effect on the Project interchanges due to construction of the Missing Link is analyzed using MMUTIS's data.

MMUTIS is the "Metro Manila Urban Transportation Integration Study" done by JICA in 1998. MMUTIS is the latest traffic study regarding the whole Metro Manila area arterial traffic. The MMUTIS Traffic Demand Forecast Model is an available model of the transport network that covers the entire Manila Metropolitan Area.

The MMUTIS model was developed as a four-step transport model and includes public transportation. The software for the model is STRADA, which is the transport modeling software package developed by JICA. Essentially, all the models were used for the HN-LS expressway evaluation in this study transport model.

MMUTIS covers the transport network in the metropolitan area and the network includes the projects of 5 interchanges (C-3/E. Rodriguez, EDSA/ Roosevelt/ Congressional, EDSA/ North/ West/ Mindanao, C-5/ Kalayaan, C-5/ Green Meadows/ Acropolis/ Calle Industria) and C-3 Missing Link; therefore, the model is suitable for the effect analysis.

The MMUTIS transport network includes the following:

- ✓ Expressways
- ✓ Primary Roads
- ✓ Secondary Roads
- ✓ Railways

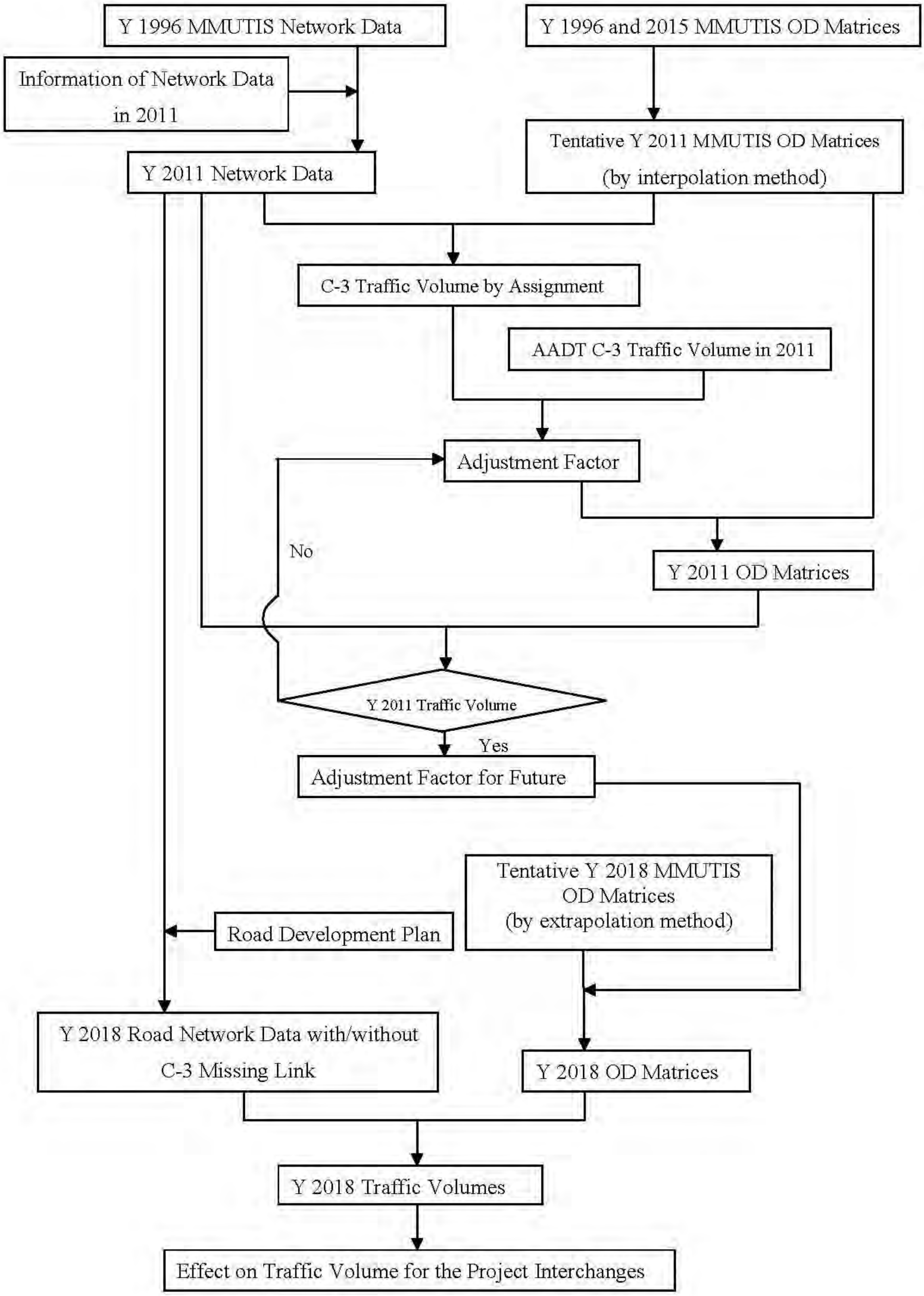
MMUTIS forecasted the traffic demand in 1996 and 2015. But, OD matrices for the year 2005 also exist.

This study model is based on MMUTIS model data. Effect analysis was done for the C-3 Missing Link opening year 2018.

(1) Demand Forecast Model

The base data is the MMUTIS models of 1996 and 2015 (master plan case). These data were updated for the current model (year 2011) and future model (year 2018). Main update tasks were for Network data and OD data. Parameters for the assignment were the same as those in MMUTIS.

The flow of the update of the model and Effect Analysis is shown in **Figure 8.4-11**.



Source: JICA Study Team

Figure 8.4-11 Flow of Effect Analysis on Traffic Volume for the Project Intersections due to Construction of the C-3 Missing Link

1) Forecast Model for Year 2011

a) OD Matrices and Assignment

MMUTIS established OD matrices for 1996, 2005 and 2015. In the first step, tentative 2011 OD matrices were established temporally with an interpolation method using MMUTIS 2005 OD matrices and 2015 OD matrices. The assignment was run using the tentative OD matrices and the 2011 network. The assignment method is the incremental method that was also used in MMUTIS.

In the second step, the adjustment ratio was calculated by comparing the results of the assignment and an estimate considering the difference in traffic volume by MMDA (Metropolitan Manila Development Authority). The traffic volumes on C-3 road near the ending point of the C-3 Missing Link were provided by the Traffic Engineer Center of MMDA. The traffic volume of 2011 was estimated using the average growth rate for the last three years.

The adjustment ratio was calculated using the traffic volume in PCU since the unit of MMUTIS OD matrices is PCU (Passenger Car Unit).

The 2011 OD matrices are calculated by adjusting the tentative 2011 OD matrices with the adjustment ratio.

The PCU Evaluation Factor and traffic volume on C-3 near the Missing Link starting point are presented below:

Table 8.4-9 PCU Equivalent Factor

	Car	Jeepney	Bus	Truck	Motorcycle	Motor-Tricycle
Factor	1.0	1.5	2.0	2.5	1.0	2.5

Source: DPWH Highway Planning Manual 2003

Table 8.4-10 Daily Traffic Volume on C-3 near Missing Link

	2008	2009	2010	2011 Estimation*
Car	44,680	50,712	53,110	57,951
Jeepney	2,282	2,363	2,539	2,679
Bus	28	73	41	65
Truck	3,840	3,146	3,704	3,698
Total	50,830	56,294	59,394	64,392

Source: MMDA Traffic Engineering Center
Note: JICA Study Team Estimation

	2008	2009	2010	2011 Estimation
Car	44,680	50,712	53,110	57,951
Jeepney	3,423	3,545	3,809	4,018
Bus	56	146	82	130
Truck	9,600	7,865	9,260	9,244
Total	57,759	62,268	66,261	71,343

Source: JICA Study Team calculations

b) Adjustment Ratio for 2011 OD matrices

The ratio (estimated traffic volume/traffic volume by assignment) of estimated traffic volume and traffic volume of assignment results in the first step was 1.14. The difference was less than 1% between the traffic volume and the results of the assignment in the second step; therefore, 1.14 was accepted as the adjustment ratio for the 2018 OD matrices.

2) Forecast Model for Year 2018

a) Network data

The 2011 network data is modified for the 2018 network considering the current on-going Project.

The alignment of the Missing Link for the network is the second revised alignment. The table below shows the condition of the Missing Link.

Table 8.4-11 Conditions of the Missing Link for Checking the Effect on the Project Interchanges

Total Length	Number of lanes	Start	Connections		End
6.3 km	6	Junction Gil Puyat Ave. (Buendia) /Ayala Ave	New Panaderos (Lambingan) (Sta. 3.3 km)	Shaw Boulevard (Sta. 4.4 km)	C-3 Araneta Ave after crossing LRT Line 2 (Sta. 6.3 km)

Source: JICA Study Team

b) OD Matrices and Assignment

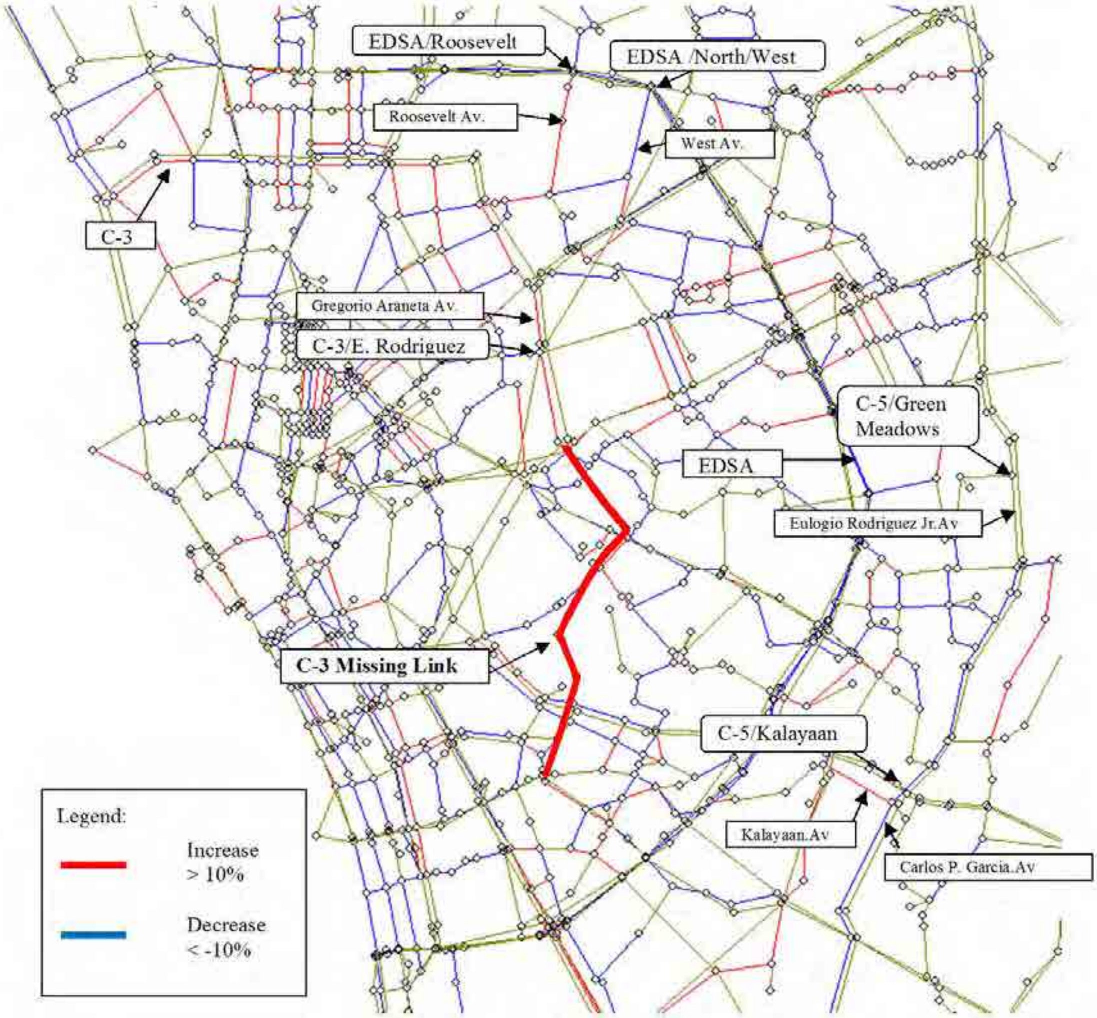
Tentative 2018 OD matrices were established temporally with an extrapolation method using MMUTIS 2005 OD and 2015 OD matrices. The tentative OD matrices were adjusted by the adjustment ratio.

The assignment method is the incremental method, which was also used in MMUTIS.

(2) Effect on Traffic Volume for the Project Interchanges due to Construction of the C-3 Missing Link

The figure below shows the traffic volume increase/decrease percentage (with Project/without Project) for the case of C-3 Missing Link construction with 2018 as the opening year.

Due to C-3 connecting to roads with the Missing Link, much traffic running on other ring roads will divert to C-3. Therefore, traffic volumes of other ring roads will tend to decrease.



Source: JICA Study Team

Figure 8.4-12 Effect on Traffic Volume for the Project Interchanges due to Construction of the C-3 Missing Link

The effects on each intersection are given below:

1) C-3/E. Rodriguez

The south road connects to the Missing Link; therefore, the effect is substantial. Traffic between the north and south (Gregorio Araneta Avenue) will increase by 26-56%.

2) EDSA/Roosevelt/Congressional

It is located in the north area far from the Missing Link. The traffic on Roosevelt Avenue connecting to the Missing Link increases by 46%, but the effects on traffic volume for other roads connecting to the interchange are minimal.

3) EDSA/North/West/Mindanao

It is located in the north area far from the Missing Link. Traffic on West Avenue will divert to Roosevelt Avenue at EDSA/Roosevelt/Congressional interchange. The traffic volume will be reduced by about 30%. Roosevelt Avenue is closer to C-3 than West Avenue. Effects on traffic volume for other roads connecting to the interchange are minimal.

4) C-5/Kalayaan

It is on a ring road (Carlos P. Garcia Avenue) parallel to the Missing Link. Traffic on Kalayaan Ave. will increase by about 10%. Traffic on Carlos P. Garcia Ave. will decrease by about 10%.

5) C-5/Green Meadows/Acropolis/Calle Industria

It is on a ring road (Eulogio Rodriguez Jr. Avenue) parallel to the Missing Link but it is far from the Missing Link. The effect on traffic volume is minimal.

8.4.9 Recommendations

Several alternative alignments for the C-3 missing link have been proposed and studied since the early 1970s, but the project has not been pursued due to the huge RROW requirement, the large number of PAPs, the high cost of the project, and the long duration it will take from the study stage until completion of implementation. Further delay in the construction of said missing link will not acceptable considering its expected impacts on the present traffic situation in Metro Manila.

The advantageous alignments are those that follow the Pasig and San Juan Rivers, namely the 2nd Revised Alignment “a1” (in the river) and the 2nd Revised Alignment “a2” (on the river bank). The favorable features of these alignments are minimal number of affected buildings, minimal number of project affected person’s (PAP’s) and least environmental impacts. On the other hand, the disadvantages of both alternatives are the navigation problems in Pasig River, obstruction of waterway area in San Juan River for the scheme occupying the waterways and the need for substantial ROW acquisition for the scheme occupying the river banks.

This preliminary study are based on secondary data gathered from DPWH Head Office, regional offices and other concerned agencies. Detailed investigations, particularly with regard to establishing preliminary designs, assessing traffic impacts and confirming economic viability should be conducted prior to project implementation. Given the very substantial impact that the C-3 Missing Link Project will have in improving the circumferential road network in Metro Manila and in decongesting C-4, it is recommended that the Study on the C-3 Missing Link should be the subject of a feasibility study. The scope of the feasibility study should be:

I. Review and confirm the necessity of the Project
  - Confirm consistency with existing master plans and development plans such as MMUTIS and other related projects, including plans of DPWH, DENR, MMDA and any private sector projects which might possibly affect the project, particularly with regard to river channel improvement projects.
  - Review existing survey results on traffic volume and data.
  - Review existing studies on flood conditions along San Juan River and high water levels along Pasig River.

II. Establish future traffic demand and existing site conditions based on:
  - Update the traffic demand forecast with a traffic study (traffic volume, travel speed among others) taking account of the effect of the C-3 Missing Link on the road network.
  - Topographic survey.
  - Geotechnical investigation.
  - Available data on flood conditions and existing drainage facilities.
  - Obtaining as–built drawings, as available, of existing facilities along the rivers.
  - Establish the controls that will influence any design proposals in Pasig River, including hindrance structures, high water levels, navigation and vessel collision issues, and in San Juan River, including hindrance structures and flood conditions.

III. Outline design of alternatives schemes, including schemes on the banks and within the waterways of Pasig River and San Juan River, comparative study of alternatives and recommendations on preferred scheme. Alternative structure schemes for spanning both the Pasig River at Lambingan and San Juan River should also be included.

IV. Preliminary design of preferred scheme including cost estimate.

V. Prepare proper construction period and implementation schedule.

VI. Prepare financial scheme based on estimate cost, construction period and implementation schedule.

VII. Formulate a Feasibility Study Report, including calculation of EIRR in accordance with NEDA protocols, identification of operation & effect indicators and examination of environmental and social considerations.

VIII Prepare a Resettlement Action Plan (RAP) including a resettlement implementation schedule

IX Identify expected financing scenarios and possibility of using Japanese ODA

8.4.10 Related Proposed Projects in Metro Manila

In addition to the DPWH proposal for a C-3 Missing Link Project, there are several other proposals, from the private sector and other government agencies, to provide elevated roadways serving a similar function or occupying corridors that may intersect with the C-3 Missing Link Project. The other proposed projects are listed below:

	Proposed Project	**Proponent**
1	C-3 Expressway	Ayala Corporation
2	NLEX-SLEX Connector	Metro North Tollway Corp. (MNTC)
3	Metro Manila Skyway Stage 3	CITRA/PNCC
4	SKYBRIDGE	MMDA

Refer to **Figure 8.4-13** for a location plan of the related proposed projects.

(1) C-3 Expressway (Ayala Corporation)

The C-3 Expressway involves a 16.2 km., 6 lane divided roadway. It will keep the existing segments of C-3 road as public access roads with grade separation improvements at the major intersections along the line (E. Rodriguez, Quezon Avenue, Del Monte, A Bonifacio and 5th Avenue W/Rizal Avenue). The following are the segments for private sector:

- ✓ Segment 1: 9.4 km tolled expressway from Gil Puyat Avenue, at the boundary of Pasay and Makati to G. Araneta Ave in Quezon City. It shall pass through - Buendia (crossing Skyway and Ayala) - South Avenue (along the South Cemetery) - head north adjacent to the Sta Ana Race track - pass through a viaduct above the Pasig River/San Juan Bridge -cross Aurora Blvd/ LRT 2 and terminating at grade in G. Araneta Avenue.
- ✓ Segment 2: E Rodriguez Avenue crossing (construction of a 0.58 km flyover)
- ✓ Segment 3: Del Monte Crossing (construction of a 0.47 km flyover)
- ✓ Segment 4: A Bonifacio Crossing (construction of a 0.54 km flyover).
- ✓ Segment 5: River Avenue (in 5th Avenue W) viaduct (construction of a 1.35 km flyover above 5th Avenue with an interchange to the end of NLEX
- ✓ Segment 6: Construction and reconfiguration of the existing at-grade sections to establish a grade-separated 4 lane-divided expressway throughout the C-3 alignment.

In total, the project will require more than 12 km of elevated structures above both existing roads and above Pasig and San Juan Rivers. More than 3 km of the total length will not be tolled.

Segment 1 of this proposed project effectively overlaps with the preferred DPWH alignment for the C-3 Missing Link.

Project	Proponent	Length (km)	Legend	Remarks
C-3 Missing Link	DPWH	6.3	⬛	6 lanes - ODA
Skybridge	MMDA	8.3	◻	6 lanes - MYDA
Skyway Stage 3	CITRA	14.5	🟥	6 lanes - PPP
NLEx-SLEx Connector	MNTC	13.3	🟪	4 lanes - BOT
C-3 Expressway	AYALA	16.2	🟦	6 lanes – BOT / PPP

Source: JICA Study Team and proponents of the projects

Figure 8.4-13 Related Projects in Metro Manila

(2) NLEX-SLEX Connector (MNTC)

The 13.3 km NLEX-SLEX Connector is a 4 lane divided elevated tolled roadway that starts at Skyway Buendia, will follow Osmena Highway, turn right to Quirino Avenue then veers to the right towards the PNR tracks at Plaza Dilao. The alignment then follows PNR tracks up to Caloocan and terminates at the connection to the NLEx via Segment 10 of the NLEx Phase 2 project at 5th Avenue. A further 11km of elevated roadway is proposed along Segment 9 and Segment 10 of the NLEx Phase 2 to connect with NLEx Phase 1

The proposed elevated road will not share any section of the C-3 Missing Link Project corridor.

(3) Metro Manila Skyway Stage 3 (CITRA/PNCC)

The 14.5km Metro Manila Skyway Stage 3 is a 6 lane divided elevated tolled roadway that starts at Skyway Buendia, follows Osmena Highway, turns right on Quirino Avenue, turns to follow PNR tracks, turns onto Old Sta. Mesa and N Domingo, turns left at San Juan Bridge (SM Centerpoint), follows G Araneta, then turns left at Sgt Rivera and then right at A Bonifacio. The proposed roadway terminates at Balintawak on EDSA, linking to NLEX.

This proposed elevated road will occupy the same corridor as the C-3 Missing Link at the junction of N. Domingo with G. Araneta.

(4) SKYBRIDGE (MMDA)

The Skybridge will be an 8.3km 6 lane divided elevated roadway following the route of the preferred DPWH alignment, from JP Rizal Avenue, following the route of the Pasig River and San Juan River and terminating at the junction of C-3 with E. Rodriguez. The roadway will interconnect with local roads at JP Rizal, New Panaderos, Shaw Boulevard, N. Domingo, Aurora Boulevard and E. Rodriguez. There is no information available regarding whether the roadway will be tolled.

This proposed project effectively overlaps with the preferred DPWH alignment for the C-3 Missing Link extending the scope of the project to E. Rodriguez.

8.5 MAJOR SUBJECTS TO BE SOLVED IN THE FUTURE

Following subjects are requires to discussion/coordination and to be solved among the concerned agencies.

Subjects	Involved offices	Matter of discussion
1. Alignment of entire section of C-3 missing link	DPWH, MMDA and Ayala	(a) Where alignment is passing?
2. Beginning point of north side C-3 missing link	DPWH, CITRA, MMDA and Ayala	(a) Where is beginning point of C-3 alignment? (b)Where passing North-South connector expressway by CITRA and AYALA (c)Where passing skybridge by MMDA
3. Narrow river width and curve section at about 700m up stream of Pasig river from Lambingan bridge.	DPWH, Coast Guard	(a) What is the requirement for ship navigation. (b) What is the best alignment?
4. Availability of old Sta. Ana horse race track	DPWH, Ayala Land INC.	(a) Accept C-3 alignment passing through in the old Sta. Ana horse race track or not. (b) If accept, which section of old station will be passing?

CHAPTER 9

CONCEPTUAL STUDY FOR TRAFFIC CAPACITY EXPANSION ALONG EDSA

9.1 BACKGROUND OF THE PROJECT

Epifanio de los Santos Avenue (EDSA) is the main circumferential road of Metro Manila. It functions as a collector-distributor road providing access to the suburban areas, and provides an important link between the northern and southern parts of the metropolitan area. EDSA is a partially controlled access, mostly 10-lane divided highway, with three general lanes and the two outer lanes reserved for buses in each direction. The highway is 24 kilometers in length and has many interchanges along its stretch.

EDSA forms majority portion of Circumferential Road 4 (C-4) in Metro Manila. Although it never runs within (nor adjacent to) the city limits of Manila proper, it runs in a rough semicircle around the City of Manila and, from the south, passes through the cities of Pasay, Makati, Mandaluyong, Quezon, and Caloocan. The southern endpoint of EDSA is at a roundabout near the SM Mall of Asia in Pasay and its northern terminus is at Monumento in Caloocan. When the avenue was constructed during the presidency of Manuel L. Quezon, it was named 19 de Junio (June 19), after the birthday of national hero Jose Rizal. It was later renamed Highway 54, and under Republic Act. No. 2140 in 1959 was further renamed in honor of Epifanio de los Santos, a noted Filipino historian.

Since the dramatic increase in traffic volume at the end of the 1980s, the Government has implemented several grade separation projects at major intersections along EDSA, including Ortigas Interchange (1991), Timog–Kamias, P. Tauzon and Santolan Interchanges (1992), Shaw and Boni Interchanges (1998), Pasay Road–Ayala Avenue Interchange (2000), and Quezon Avenue Interchange (2003). Grade separation schemes identified for North Avenue–West Avenue and Roosevelt Avenue Interchanges along EDSA are to be included under an upcoming phase of implementation.

The Metro Rail Transit (MRT) Line 3 runs along most of EDSA, occupying the central reserve both at grade and on viaduct, from Taft Avenue in the south to North Avenue near the SM City North EDSA Mall in northern EDSA. The Light Rail Transit (LRT) Line 1 Extension runs as an elevated viaduct along the central reserve of EDSA from the EDSA–North Avenue intersection in Quezon City to the Monumento roundabout in Caloocan City while LRT Line 2 crosses above EDSA at the intersection of EDSA and Aurora Boulevard.

EDSA handles more than 200,000 vehicles per section on average every day. Notwithstanding the improvements to EDSA brought by the construction of several interchanges, in addition to the

MRT Line 3 and LRT Line 1 North Extension, the limited capacity of EDSA to handle the large daily volumes of traffic from early morning to late evening has resulted in severe congestion and low traffic speeds. Such a situation is severely hampering the socio-economic development of Metro Manila and is an impairment to the environment.

In view of the above critical condition, a Conceptual Study on Traffic Capacity Expansion along EDSA has been proposed.

9.2 OBJECTIVES AND CONCEPT OF CONCEPTUAL STUDY

The main objective of the study of the capacity expansion of C-4 is to determine the availability of space and identify possible problem(s) in the construction of a viaduct/tunnel along EDSA considering the existing structures and also the proposed flyovers. Given the nature of EDSA, with substantial existing and proposed infrastructure occupying the ROW, this study will as a basic focus aim to identify problems for future structure planning and attendant construction difficulties. The study on available space along EDSA will therefore be a key consideration in developing outline structure plans. Major hindrance structures will be listed including type of structures and ranked based on construction difficulty considering ROW issues, scale of construction, technical difficulty, anticipated construction cost, etc. Further outline study will be conducted for the sections along EDSA where the five highest ranked hindrance structures are located for viaduct planning including establishment of outline structure plan, elevations and critical sections. Construction methodology and construction phasing will be a key consideration in the study on structure plan.

The conceptual study consists of the following items:

1) Confirmation of consistency between the proposed project and present traffic plans in Metro Manila
2) Confirmation of hindrance structures
3) Confirmation of open spaces for the viaduct plan and tunnel plan
4) Study on outline plan of structures and rough cost estimate of civil works

9.3 CONFIRMATION OF CONSISTENCY BETWEEN THE PROPOSED PROJECT AND PRESENT TRAFFIC PLANS IN METRO MANILA

The confirmation study will consider the following three items:

9.3.1 Trunk Roads

The basic arterial road network in Metro Manila is comprised of 6 circumferential roads and 10 radial roads. Circumferential roads C-3 and C-5 have not yet been completed and C-6 is still under study.

9.3.2 Expressways

Metro Manila is served by several expressways, some of which intersect with EDSA. The South Luzon Expressway (SLEX) is a network of toll expressways that connects Metro Manila to the provinces in the south. The North Luzon Expressway (NLEX) is a toll expressway that connects Metro Manila to the provinces of the Central Luzon region in the north. The Manila–Cavite Expressway or Coastal Road, considered part of Radial Road 1 (R-1) of Metro Manila, connects Roxas Boulevard to the city of Parañaque in Metro Manila, to Kawit, Cavite. The Daang Hari–SLEX Link is currently under bid. There are plans to connect SLEX with NLEX with the south–north connector road section and also plans to construct the Cavite–Laguna Expressway (CALA).

9.3.3 Railways

LRT Lines 1 and 2, MRT 3 and the PNR Manila–Bicol line are in operation. MRT 7 is under study. The proposed PNR North Rail Project is currently under negotiation and there are also plans to develop a high speed rail connection to Clark International Airport. The proposed PNR South Rail Project will link the province of Laguna to provinces in the Bicol Region through a high-speed train service.

Some plans above are related to the proposed study with regards to the share of traffic volume but passenger interface plan between rail and vehicle transport shall be carefully formulated to attain synthesized positive impacts.

9.4 CONFIRMATION OF OPEN SPACES FOR TUNNEL PLAN AND VIADUCT PLAN

The study will confirm in outline available open space to accommodate the support structures of high level viaduct solutions and tunnel solutions at critical locations along EDSA. The basic concept in assessing available space is developing outline solutions that will minimize occupation of width along EDSA and also minimize ROW acquisition, if necessary, in addition to establishing minimum requirements for at-grade traffic, both during construction and in service. In planning structure configurations, a basic minimum requirement of three lanes in each direction along EDSA at-grade will be assumed based on present conditions, with additional lanes accommodated where possible and as necessary.

The study on hindrance structures will be a key consideration in confirming available space. For high level viaduct solutions, critical considerations in confirming available space will include optimum span lengths of viaduct and type and location of foundations and pier configurations, including single column and portal frame arrangements. Tunnel solutions will require sufficient subterranean space to accommodate the tunnel section, most critical at interchange locations and MRT/LRT station locations, and space along EDSA for ventilation shafts and emergency exit facilities. Space available for on-ramp and off-ramp locations for both tunnel and viaduct solutions will also be a critical issue. Future development plans along EDSA will be included in the study of available space.

9.5 CONFIRMATION OF HINDRANCE STRUCTURES

All existing and proposed major structures, located or planned to be located along both directions along EDSA, that may form a hindrance to any proposed expansion project will be identified and the impact analyzed in broad terms. The following hindrance structures for both directions on EDSA have been identified based on a preliminary inspection:

1) MRT/LRT Stations	:	15 stations
2) Flyovers along EDSA	:	Southbound = 7 locations, Northbound = 6 locations
3) Underpasses along EDSA	:	3 locations
4) Flyovers across EDSA	:	Southbound = 6 locations, Northbound = 8 locations
5) Underpass across EDSA	:	1 location
6) Pedestrian Bridges	:	30 locations

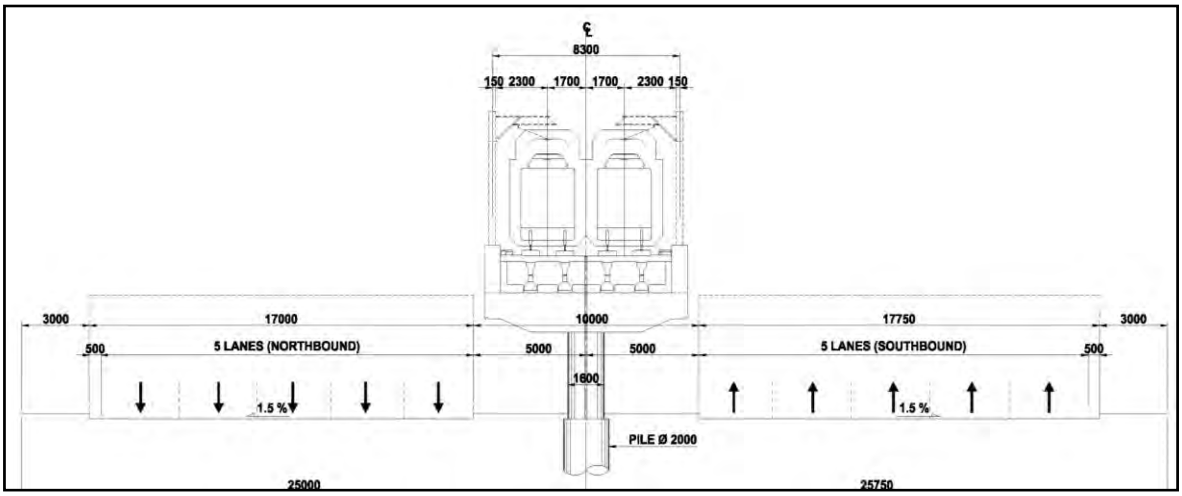
The layout of these structures will be confirmed from as-built plans, as available. In case as-built plans are not available, layouts will be estimated by site inspections.

9.6 EDSA GENERAL CONDITION

9.6.1 Topology

EDSA generally has a 50 m road right-of-way (RROW). It commonly has 10 lanes with five equal lanes per direction divided by a median separator (refer to **Figure 9.6-1**). The three inner lanes are reserved for fast moving through traffic, while the remaining two outer lanes are for right turning and for public transport vehicles. The original width per lane on EDSA was commonly 3.50 m prior to the construction of intersection grade separation structures and the light rail transport system. Because of these incursions on the thoroughfare, the lane width was reduced to 3.25 m and lesser on the service lanes. The width per lane, however, is still sufficient for a maximum 60 km/h regulated vehicle speed. Also, along EDSA bus bays are intermittently located and at times these occupy the outer service lanes hampering through traffic.

Pedestrian sidewalks with 3 m maximum width exist on the road’s adjacent ends. Within the sidewalks, streetlights and various utility posts are found supporting electrical, telecommunications, and other overhead cables. Several other utility lines for water, sewerage, etc., together with drainage, are encased in pipes below ground beneath both sidewalk and the road itself. A median separator exists throughout EDSA. Both the MRT 3 and LRT 1 North Extension fully occupy this corridor. Further, on certain sections this has been expanded laterally to accommodate light rail operational requirements. Median widening was made for the rail at-grade tracks and platform stations.



Source: JICA Study Team

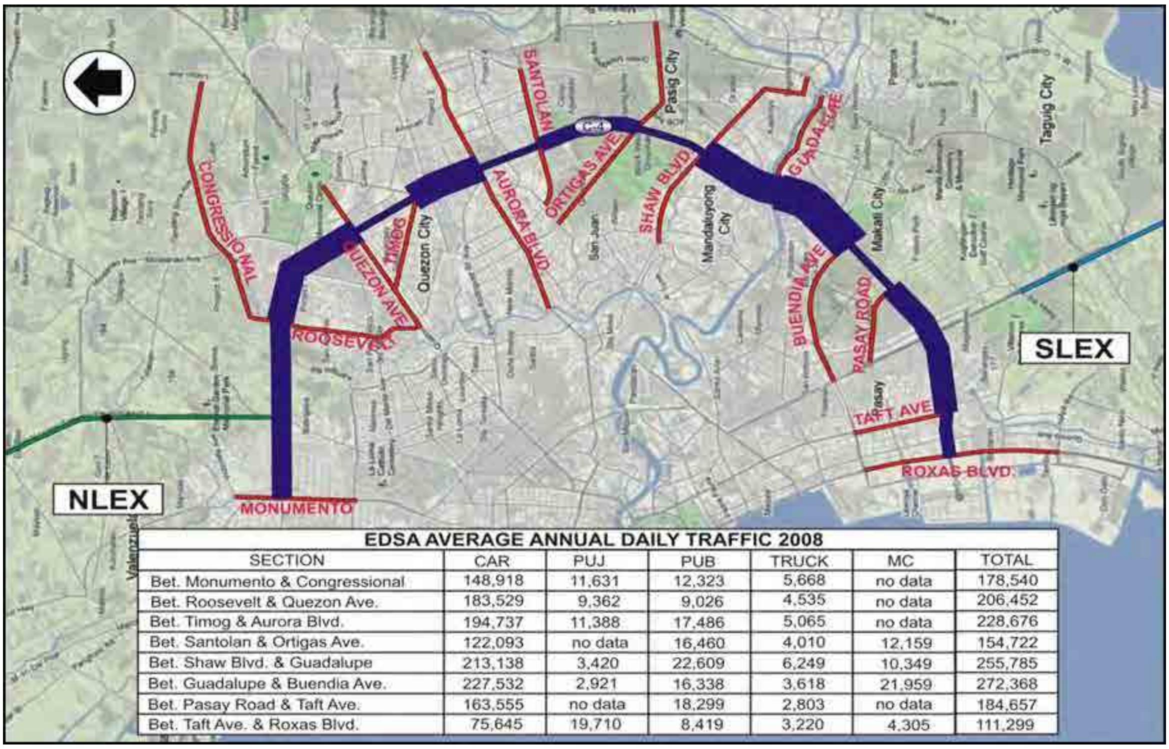
Figure 9.6-1 Typical EDSA Cross-section

The space fronting EDSA are considered prime lots. Various commercial buildings (malls, markets, shops, etc.), residential structures (hotels, condominiums, apartments, houses), government and private office buildings are lined up along EDSA. Of interest, there are two military camps (i.e., Camp Aguinaldo and Camp Crame) also located along EDSA. Thus, acquisition of additional RROW beyond the available 50.0 m would be immensely expensive. Therefore, an elevated expressway contained within the existing roadway corridor is proposed, to enhance traffic capacity of EDSA and improve its level of service.

9.6.2 Traffic Condition

Together with Metro Manila's progressive development, the traffic volume along EDSA has been steadily increasing each year. To ease traffic flow on EDSA slow moving cargo trucks has been prohibited on its major section, between Pasong Tamo in Makati and Balintawak in Quezon City/Caloocan City. This is imposed except on a specific time window which is from 9:00 PM to 6:00 AM daily except Sundays, and Holidays. To further decongest EDSA, a volume reduction scheme has been implemented to reduce daily traffic theoretically by twenty percent (20%) by prohibiting all vehicle types on the basis of its last digit plate number from 7:00 AM to 7:00 PM. Despite these measures taken the average annual daily traffic (AADT) on EDSA remains significantly high.

On year 2008 the AADT on several segments of EDSA has already reached more than 200,000 vehicles (Refer to **Figure 9.6-2**). For a roadway with ten-lane capacity this corresponds to a level of service (LOS) F. LOS is a measure used by traffic engineers to determine the effectiveness of a transportation facility and basically categorizes the roadway operations capacity. (Refer to **Figure 9.6-3**)



EDSA AVERAGE ANNUAL DAILY TRAFFIC 2008

SECTION	CAR	PUJ	PUB	TRUCK	MC	TOTAL
Bet. Monumento & Congressional	148,918	11,631	12,323	5,668	no data	178,540
Bet. Roosevelt & Quezon Ave.	183,529	9,362	9,026	4,535	no data	206,452
Bet. Timog & Aurora Blvd.	194,737	11,388	17,486	5,065	no data	228,676
Bet. Santolan & Ortigas Ave.	122,093	no data	16,460	4,010	12,159	154,722
Bet. Shaw Blvd. & Guadalupe	213,138	3,420	22,609	6,249	10,349	255,785
Bet. Guadalupe & Buendia Ave.	227,532	2,921	16,338	3,618	21,959	272,368
Bet. Pasay Road & Taft Ave.	163,555	no data	18,299	2,803	no data	184,657
Bet. Taft Ave. & Roxas Blvd.	75,645	19,710	8,419	3,220	4,305	111,299

Source: MMDA

Figure 9.6-2 EDSA Average Annual Daily Traffic (2008) – MMDA

The LOS F is described as breakdown in vehicular flow. Flow is forced; every vehicle moves in lockstep with the vehicle in front of it with frequent slowing required. Technically it is a roadway in a constant traffic jam, or a roadway for which the travel time cannot be predicted. Roads operating at LOS F generally have more demand than capacity.

The LOS computation is presented in **Appendix 9.1**.

LOS A – free-flow operations

LOS B – reasonably free flow

LOS C – flow with speeds at or near the FFS

LOS D – speeds begin to decline slightly with increasing flow

LOS E – operation at capacity

LOS F – breakdowns in vehicular flow

Source: JICA Study Team

Figure 9.6-3 Description of Level of Service

For reference the nearest circumferential road C5 on the same basis year 2008 already has an AADT of 184,000 vehicles.

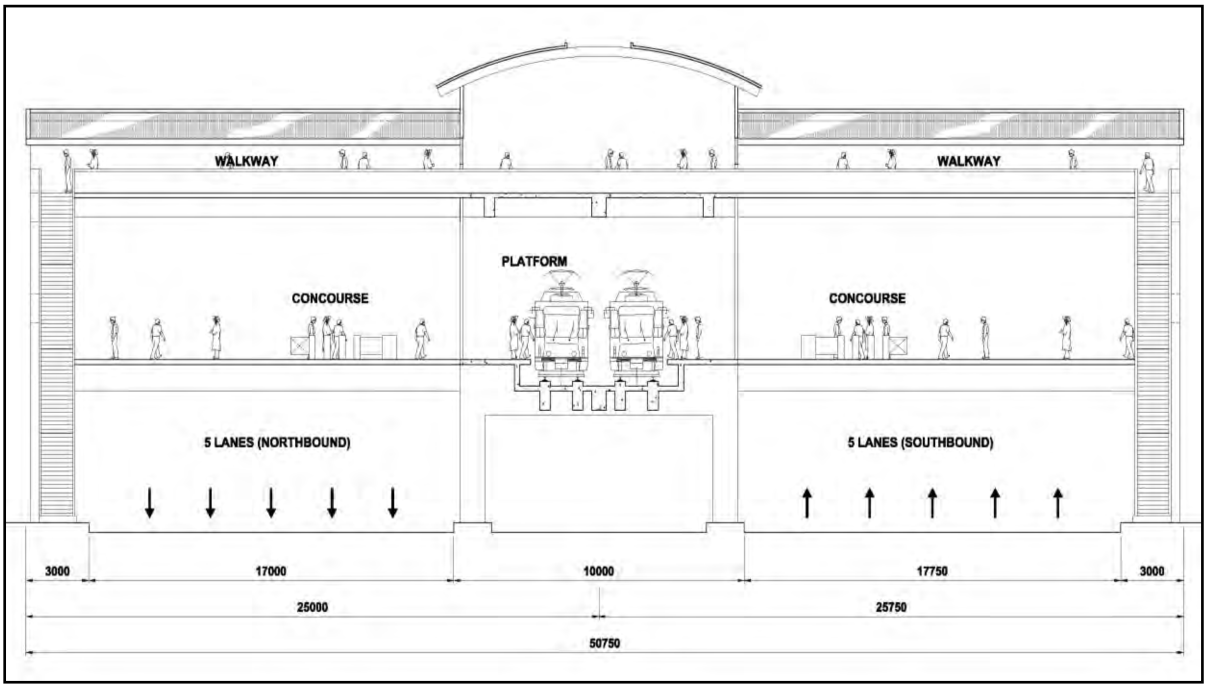
With the above conditions prevailing: EDSA at over capacity, prohibitive cost in acquiring additional RROW, and alternative routes also congested, a capacity expansion scheme via elevated or underground expressway is seriously considered.

9.6.3 Hindrance Structures/Sections

The concept of an elevated expressway would have been an easy undertaking if EDSA was free of obstructions. As described above, improvement of traffic flow along EDSA especially at major intersections necessitated construction of several grade level separation structures. These are identified in **Figure 9.6-5** and listed below:

Roxas Boulevard Crossing Flyover
Tramo Left-turn Flyover
Magallanes Interchange
Ayala–Pasay Road Underpass
Ayala Left-turn Flyover
Buedia–Kalayaan Viaduct
Rockwell Left-turn Flyover
Pioneer–Crossing Underpass
Shaw Underpass and Crossing Flyover
Ortigas Interchange
Santolan Flyover
P. Tuazon–Aurora Boulevard Underpass
Kamuning–East and Timog Avenue Flyover
Quezon Avenue Flyover and Underpass Crossing
Balintawak Interchange

Moreover, there are still three flyovers (Taft Avenue, North–West Avenue and Roosevelt–Congressional Avenue) along EDSA which are programmed for construction to complete the free-flow through traffic on EDSA's major intersections as envisioned by the national government.



Source: JICA Study Team

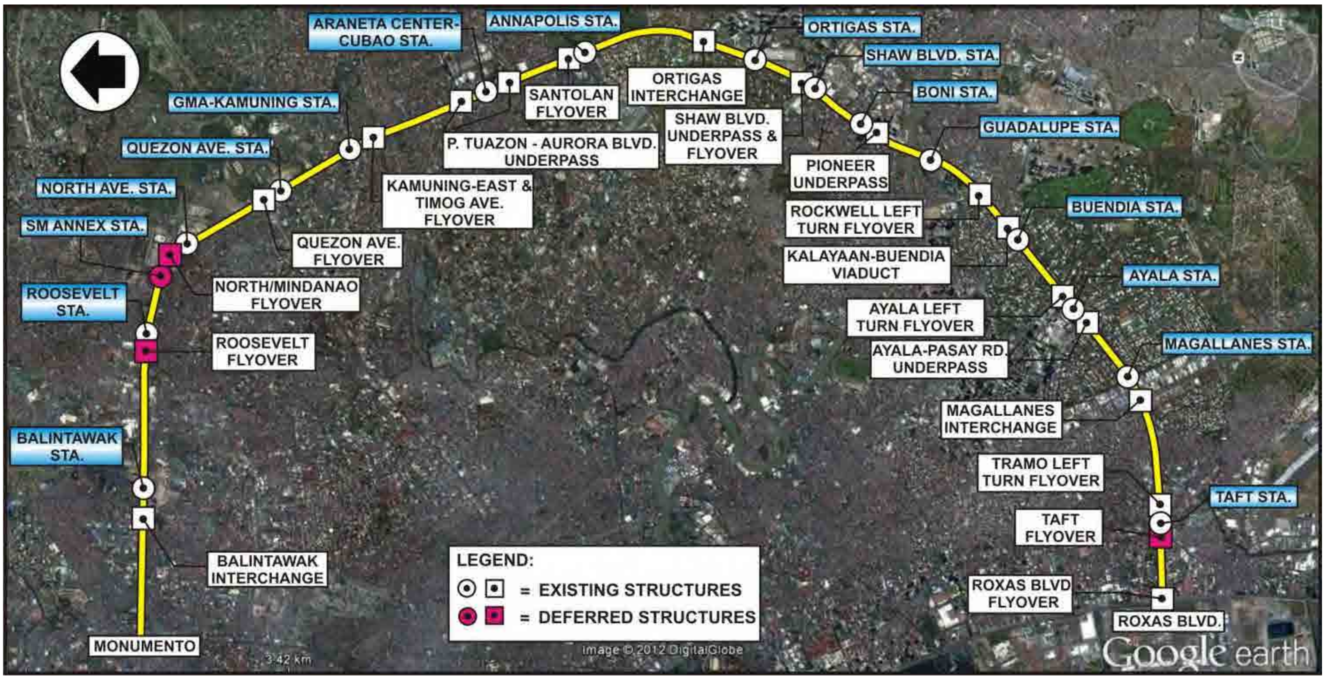
Figure 9.6-4 Typical Station Elevation on EDSA

As earlier discussed, there are numerous MRT 3 and LRT 1 stations on EDSA which straddle over its northbound and southbound lanes. A typical station elevation over EDSA is presented in **Figure 9.6-4**. The locations of these stations are also reflected in **Figure 9.6-5**. The lists of stations are enumerated below:

MRT 3	LRT 1 North Extension
Taft Station	SM Annex Station (deferred)
Magallanes Station	Roosevelt Station
Ayala Station	Balintawak Station
Buendia Station	
Guadalupe Station	
Boni Station	
Shaw Boulevard Station	
Ortigas Station	
Annapolis Station	
Araneta Center–Cubao Station	
GMA–Kamuning Station	
Quezon Avenue Station	
North Avenue Station	

There are other various structures on EDSA that may have impact on this study. These are the foot bridges or pedestrian overhead crossings, overhead and underground utilities (i.e., power, water, telecommunication, etc.) and drainage structures. All visible structures on EDSA that may hinder viaduct scheme as an option for capacity expansion are identified, with their locations indicated, and with remarks to their possible removal or structural alteration.

The natural terrain, subsoil condition and the Pasig River may also impact on the selection of a recommended scheme.



Source: JICA Study Team

Figure 9.6-5 Locations of Flyover/Underpass and MRT/LRT Stations

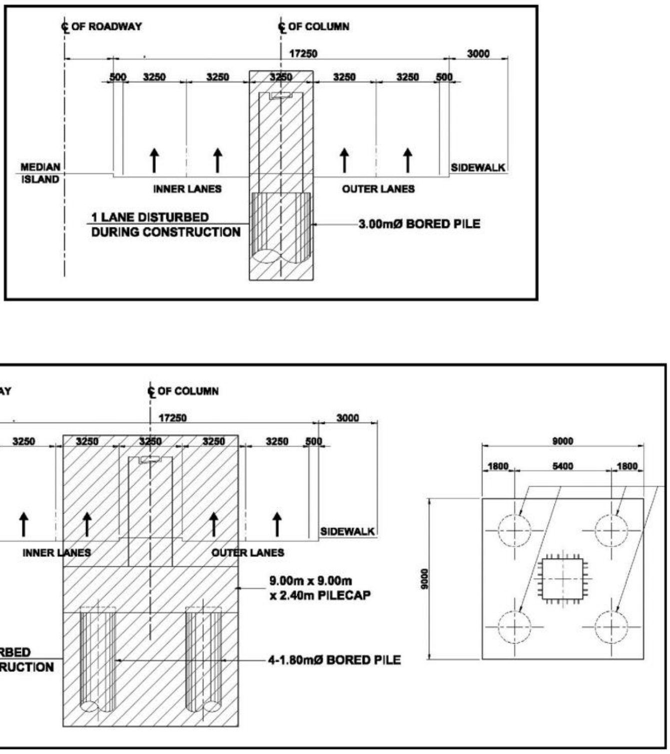
9.7 VIADUCT SCHEME

9.7.1 Proposed Viaduct Plan and Profile

It is proposed that a 23.36 km 6-lane expressway (three lanes per direction) be erected over EDSA to increase its traffic capacity. This concept will require supporting structures, columns and foundations, over the current roadway. This will diminish the number of at-grade lanes per direction from five to four. However, after the construction of the elevated viaduct, EDSA will have a total of seven lanes per direction. This is inclusive of the additional three new lanes above the at-grade roadway. This effectively adds two more traffic lanes on EDSA per direction.

The proposed configurations of the viaduct substructure are presented in **Table 9.7-1**. This table also presents the advantages and disadvantages of each substructure configuration. The viaduct layout over the middle lane is preferred as it requires the least impact on existing overhead and underground utilities and the least reconstruction of existing drainage structures. It also naturally forms a division between the inner fast lanes and the outer service lanes. The inner at-grade lanes are intended for motorist on short trip destinations, while the elevated lanes are for motorist on long trip destinations. The distance of the long trips are established by the location of the on and off ramps. This is elaborated further on the succeeding section. Also, the proposed viaduct can be configured as a balanced/regular structure which is structurally better in resisting seismic events. Consequently, its construction methodology is less complicated. The elevation or height of the viaduct is maintained at second level where possible. It is proposed that the viaduct generally traverse above all pedestrian footbridges with sufficient vertical headroom. This ensures the thirty-two footbridges along EDSA to be maintained as they are to avoid acrimonious disputes for its removal and/or relocation. The proposed complete plan layout and elevation profile is presented in **Appendix 9.2**.

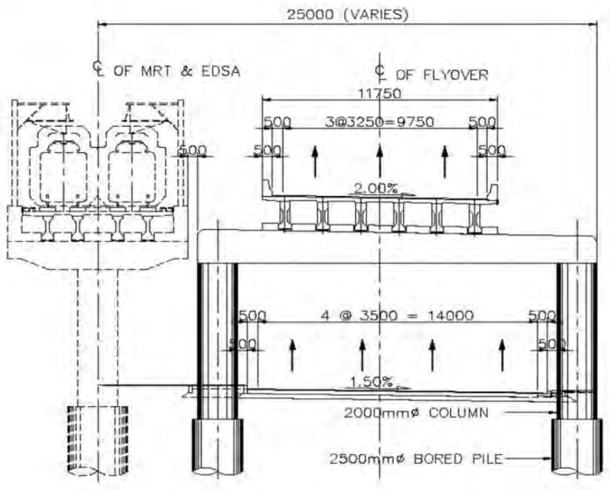
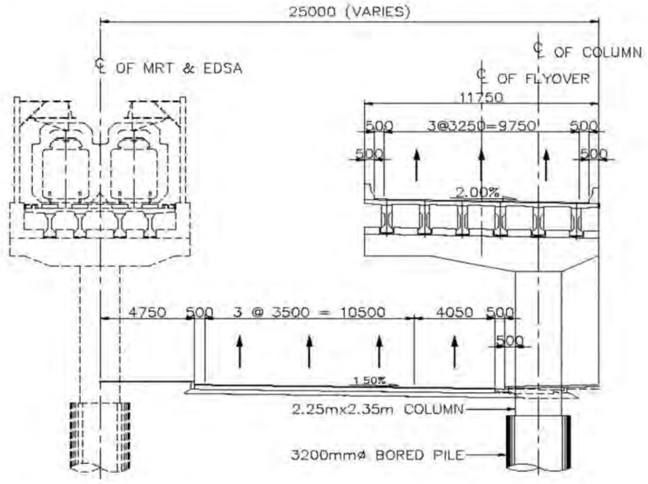
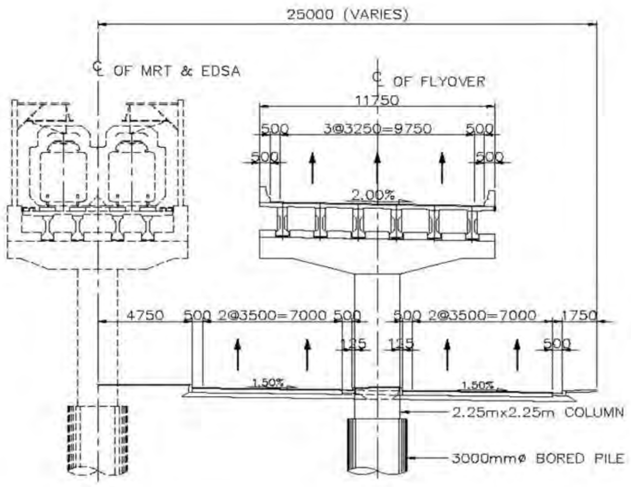
To lessen concerns on traffic management during construction, single large diameter concrete pile is recommended over pile group with pile cap as foundation type for the viaduct. This foundation type requires the least area for construction, and subsequently brings about the least traffic disturbance during construction of the viaduct substructure. **Figure 9.7-1** clearly illustrates the advantage of a single large diameter pile foundation in terms of affected number of lanes.



Source: JICA Study Team

Figure 9.7-1 **Minimal Construction Space for Single Large Diameter Pile**

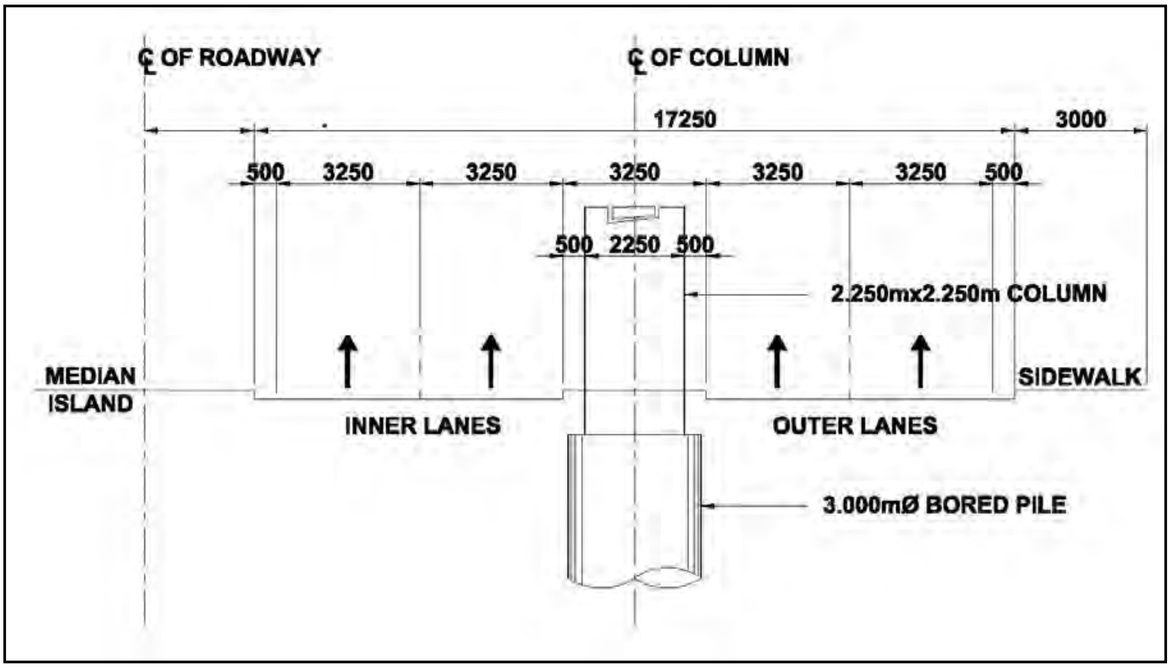
Table 9.7-1 Comparison of Applicable Types of Viaduct Substructures

	SECTION		SECTION		SECTION	
SUBSTRUCTURE CONFIGURATION						
DESCRIPTION	**PORTAL TYPE PIER (TWO COLUMN BENT)**		**SINGLE COLUMN WITH UNBALANCED HAMMER HEAD TYPE PIER**		**SINGLE COLUMN TYPE PIER**	
STRUCTURAL RESPONSE	• TWO COLUMN BENTS HAVE BETTER SEISMIC RESISTANCE. • TWO COLUMN BENTS ARE MORE RIGID AND STABLE EVEN FOR LONGER COLUMNS. • COLUMN SIZES CAN BE MORE SLENDER FOR FRAME STRUCTURES.	O	• UNBALANCED HAMMER HEAD PIERS ARE LESS RESILIENT TO STRONG SEISMIC FORCES. • INCREASED SUSCEPTIBILITY TO SEISMIC EVENTS ESPECIALLY FOR TALL PIERS. • SINGLE COLUMNS WITH UNBALANCED SUPERSTRUCTURE LOAD REQUIRES MORE REINFORCEMENT.	X	• SINGLE COLUMN PIERS ARE RESILIENT TO SEISMIC EVENTS IF PROPERLY DESIGNED. • SINGLE COLUMN PIERS ARE DUCTILE BUT LESS STURDY FOR TALL PIERS. • COMPARED TO SEMI CALTILEVER DECK SINGLE COLUMNS WITH BALANCED DECK WILL HAVE SMALLER DIMENSION.	△
CONSTRUCTION DIFFICULTY & DURATION	• LONGER CONSTRUCTION PERIOD. • MORE CONSTRUCTION MATERIAL (ie 2 COLUMNS AND BORED PILES, LONGER COPING BEAMS). • CONSTRUCTION LESS DIFFICULT SINCE SUBSTRUCTURES ARE LOCATED AT OUTER SIDE OF ROADS.	X	• SHORT CONSTRUCTION PERIOD. • CONSTRUCTION LEAST DIFFICULT SINCE SUBSTRUCTURE IS LOCATED NEAR THE SIDEWALK.	△	• SHORTER CONSTRUCTION PERIOD WITH UNCOMPLICATED FALSEWORK. • CONSTRUCTION REQUIRES THOUGHTFUL CONSIDERATION OF TRAFFIC MANAGEMENT (MOBILITY OF EQUIPMENT AND LABOR AT THE MIDDLE OF THE ROAD).	O
TRAFFIC FUNCTIONALITY	• LESSENS ONE TRAFFIC LANE. • COLUMNS ON EITHER SIDE WILL REDUCE TRAFFIC SPEEDS DUE TO PERCEIVED LATERAL FRICTION.	△	• LESSENS TRAFFIC CAPACITY BUT MAINTAINS WIDE BUS LANES. • MAINTAINS EDSA TRAFFIC FLOW ALBEIT LESSER AT-GRADE CAPACITY.	O	• LESSENS ONE TRAFFIC LANE. • PHYSICALLY SEPARATES BUS LANES WITH COMMUTER CARS. • MAKES ENTERING/EXITING TO/FROM INNER (CAR) LANES MORE DIFFICULT.	△
AFFECTED UTILITIES	• MOST AFFECTED EXISTING OVERHEAD AND UNDERGROUND UTILITIES. • MOST AFFECTED LATERAL ROAD DRAINAGES.	X	• AFFECTS OVERHEAD AND UNDERGROUND UTILITIES LOCATED ON AND NEAR EXISTING SIDEWALK. • AFFECTS EXISTING DRAINAGE SYSTEM.	△	• LEAST POSSIBILITY OF AFFECTED OVERHEAD AND UNDERGROUND UTILITIES (SUCH AS POWER AND COMMUNICATION LINES). • LEAST POSSIBILITY OF AFFECTED DRAINAGE SYSTEM.	O
COST	• MOST EXPENSIVE	X	• MORE EXPENSIVE	△	• LEAST EXPENSIVE	O
RANKING/ TOTAL POINTS	OX△XX		X△O△△		△O△OO — RECOMMENDED	
GENERAL APPLICABILITY FOR SITE CONDITION	• WHERE EXISTING ROADWAY IS AT ITS WIDEST. • WHERE AVAILABILITY OF VERTICAL CLEARANCE FROM ELEVATED MRT IS PRESENT. • WHERE TALL PIERS ARE REQUIRED. • WHERE LONGER SPANS ARE REQUIRED. • WHERE THERE IS A NEED FOR TRANSITION IN ALIGNMENT.		• WHERE AN EXISTING FLYOVER RESTRICTS AVAILABILITY OF SPACE. • WHERE ELEVATED TURNING STRUCTURES EXIST. • WHERE EXISTING ROADWAY IS AT ITS NARROWEST. • WHERE SHORTEST SPANS AND PIERS ARE REQUIRED.		• WHERE EXISTING ROADWAY CAN ACCOMMODATE PHYSICALLY SEPARATING BUS AND CAR LANES. • WHERE VERTICAL CLEARANCES ARE RESTRICTED BY OVERHEAD UTILITIES	

Source: JICA study team

NOTE : O - **BEST** △ - **BETTER** X - **NOT GOOD**

The general maximum span length of the superstructure is optimized for column and pile with dimensions to only occupy a single lane. Thus, as shown in **Figure 9.7-2**, a square concrete column with maximum size of 2.25 m x 2.25 m can be constructed, with sufficient lateral clearance to its immediate flanking lanes. The column can be supported soundly by a 3.0 m diameter concrete bored pile assuming favorable sub-soil conditions. These substructure dimensions may support adequately superstructure spans of 30.0 m length.



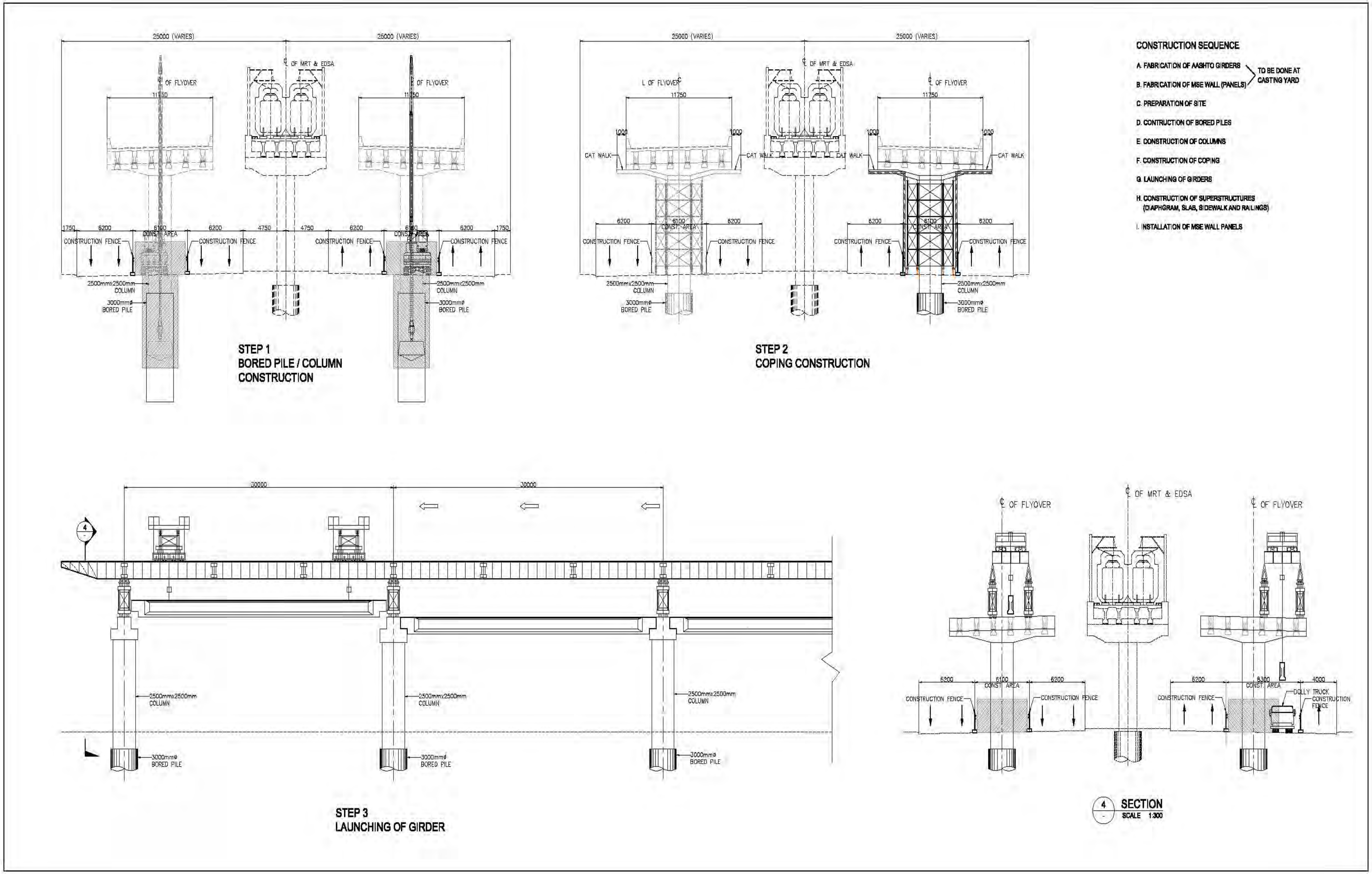
Source: JICA Study Team

Figure 9.7-2 Maximum Substructure Dimensions

For the superstructure, precast concrete girders or beams are also recommended over cast-in-place beams to minimize erection of temporary supports for effective traffic management during construction. Also, erection gantry can be utilized in lieu of crawler cranes to further reduce roadway traffic friction during construction. **Figure 9.7-3** presents a possible construction methodology.

The construction, especially for substructure works, can be done on a twenty four hour cycle to hasten construction schedule. The superstructure beams can be fabricated off-site. Delivery and installation can be done at late evenings to avoid peak hour traffic and lessen traffic disturbance. This construction methodology does not apply to special structures essential on sites with significant obstruction and limited construction space.

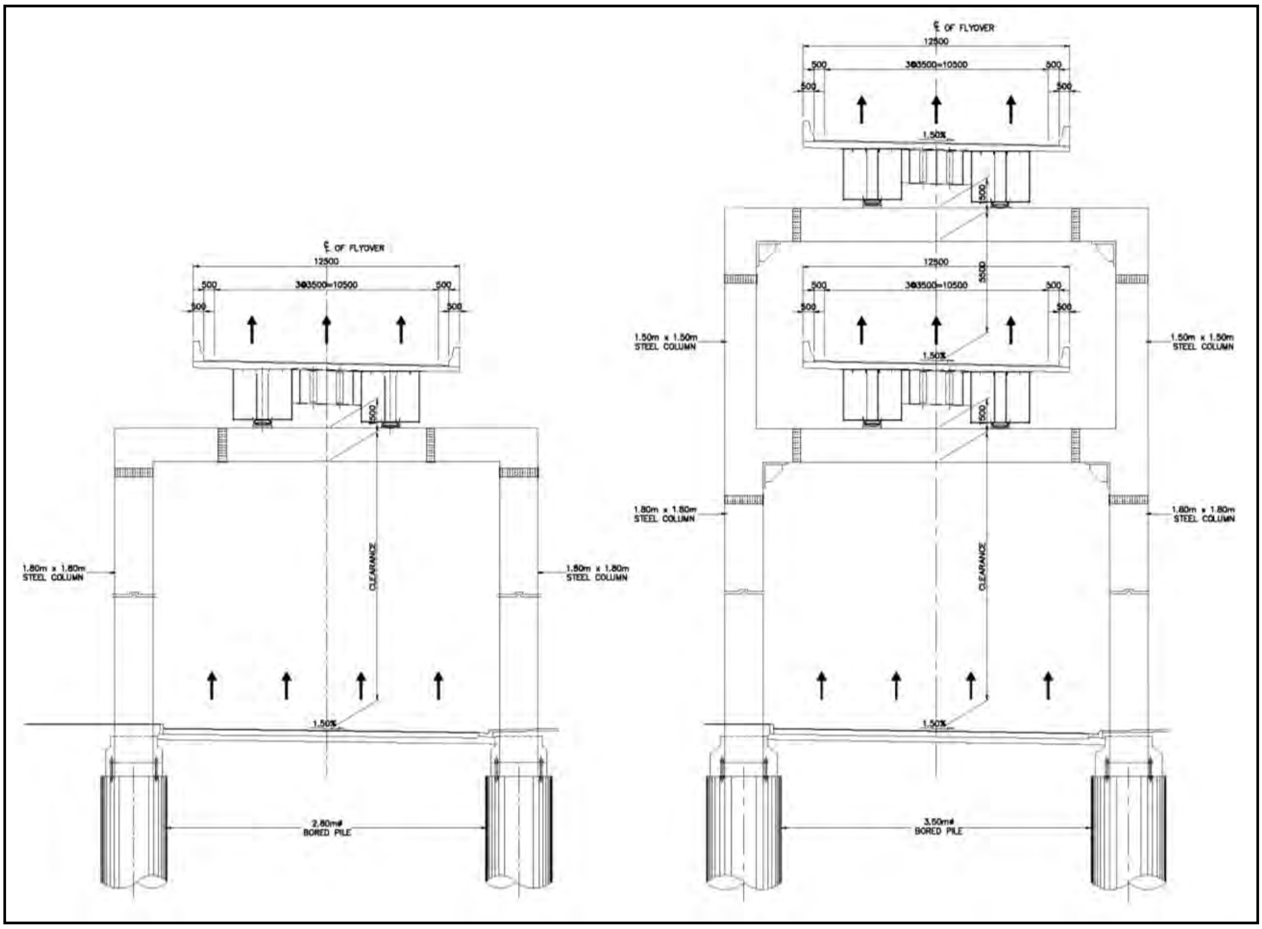
For site conditions requiring long spans and high piers, steel box girders supported by rectangular steel columns are recommended. Although costly these are more effective structurally and faster and easier to construct. Moreover, on locations with very limited RROW a double deck structure is considered.



Source: JICA Study Team

Figure 9.7-3 Construction Methodology for Second Level Viaduct

This viaduct pier supports a three lane upper thoroughfare on top of another three lane thoroughfare for the opposing traffic direction at its lower deck. These are proposed on sites complicated by the cohabitation of grade separation structures and light rail platform stations. These steel viaduct piers are shown in **Figure 9.7-4**



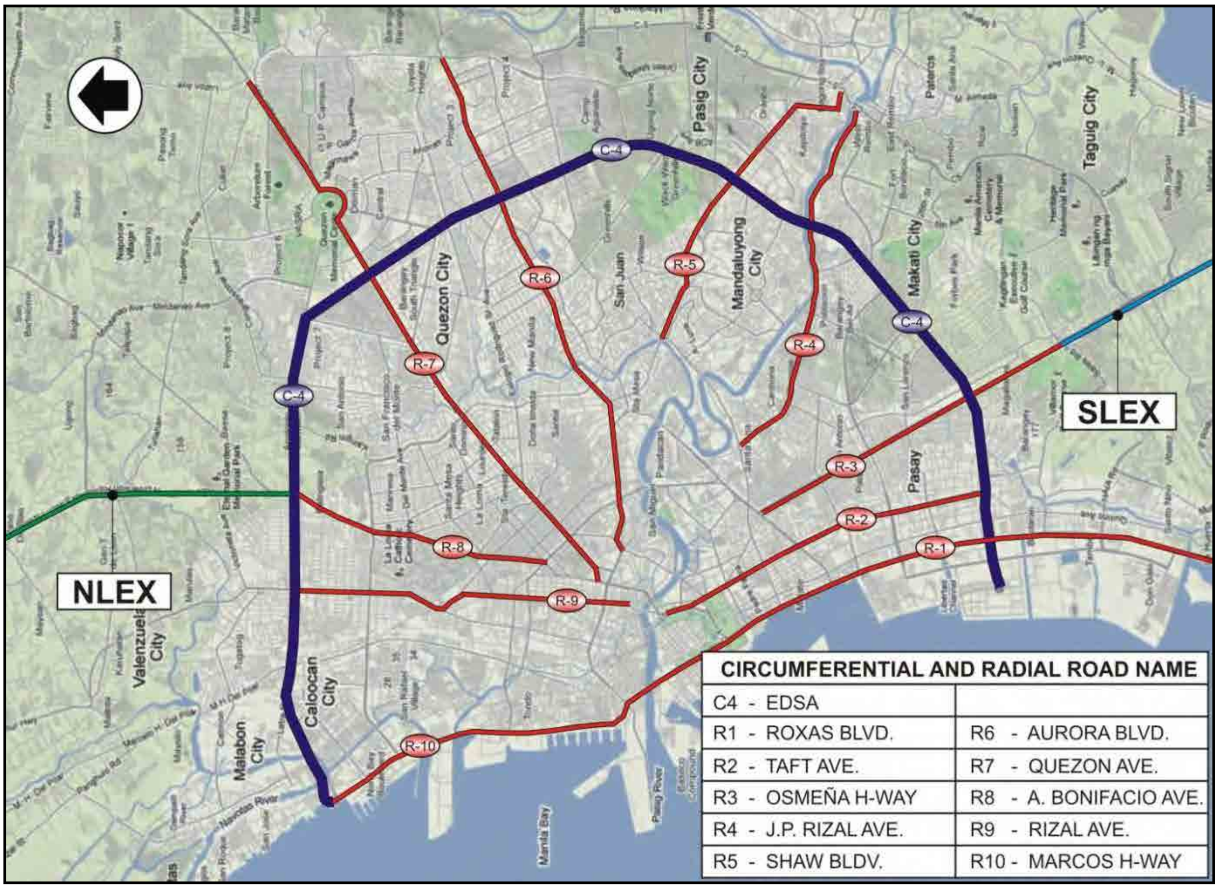
Source: JICA Study Team

Figure 9.7-4 Steel Viaduct Piers

9.7.2 Proposed Location of Ramps

Due to very limited locations of undeveloped areas along EDSA, the number and location of on and off-ramps are carefully selected. The criteria set are the following:

1) Location shall be on or near major radial roads and/or cater to highest traffic demand;
2) Location shall not reduce further the number of functional lanes on EDSA;
3) Location shall utilize suitable space with the least possible cost of additional RROW (e.g., undeveloped areas, government owned properties, etc.); and
4) Location shall consider under-utilized secondary roads.



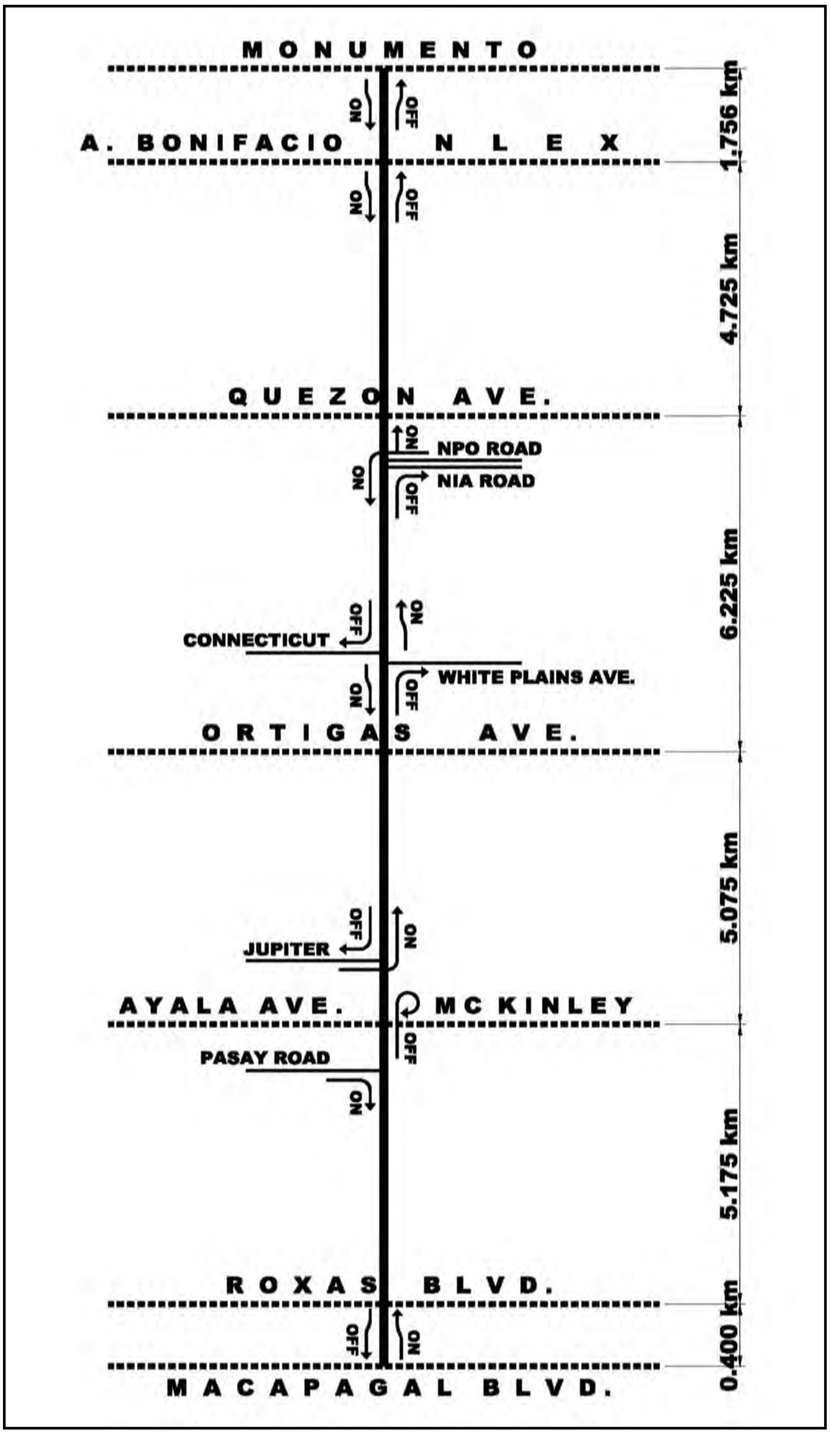
Source: JICA Study Team

Figure 9.7-5 Location of Intersecting Radial Roads

On this initial study, item “a” makes reference to **Figure 9.7-5** and to the traffic data from MMDA **Figure 9.6-2**. It recognizes the segment of EDSA with the highest vehicle daily volume and the variance of vehicle volumes between segments. This data variance conveys ingress and egress of vehicles moving to and away from EDSA. A comprehensive traffic study is recommended for the final arrangement or position of the viaduct interchange ramps.

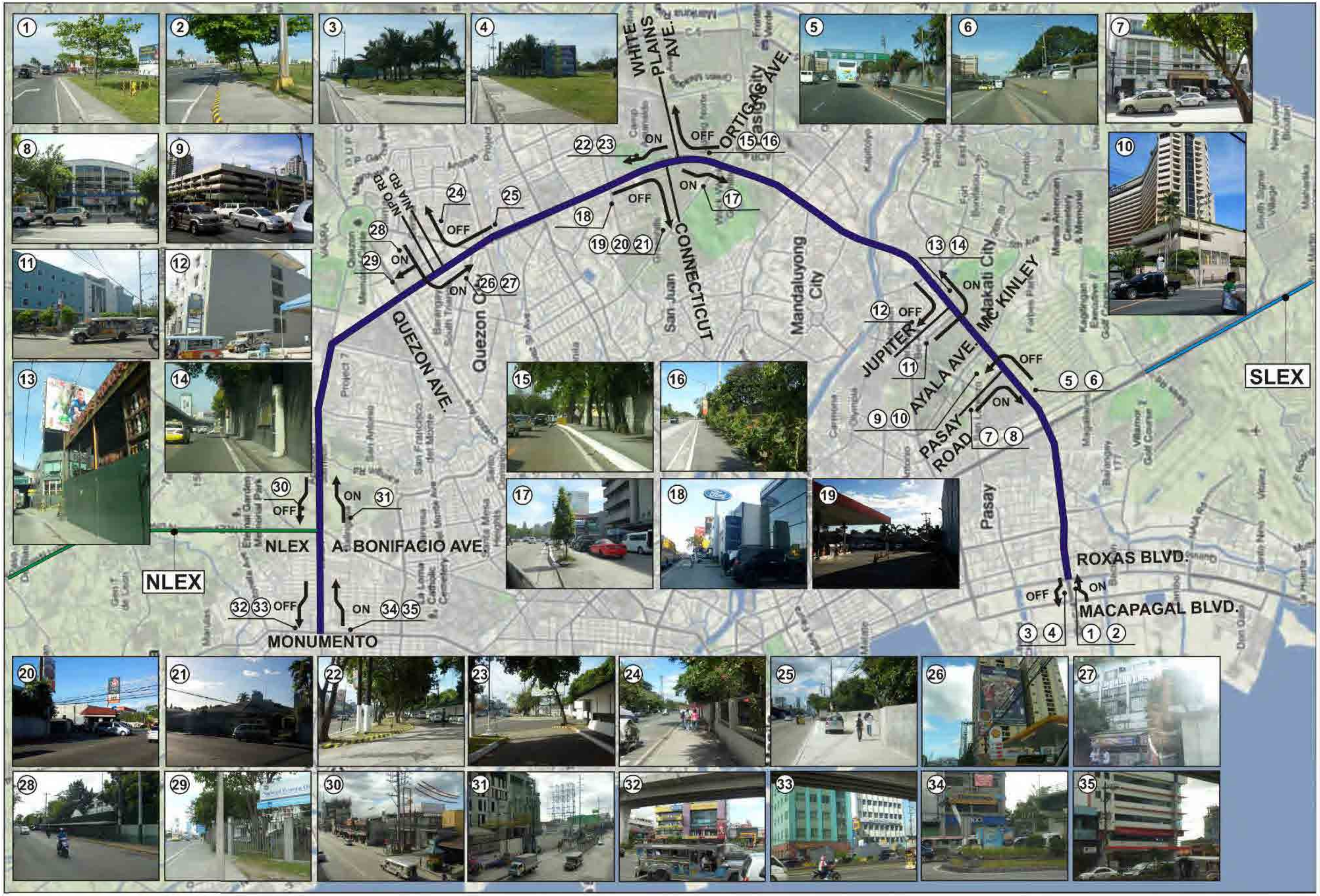
A line diagram showing locations of proposed on and off-ramps, relative position to intersecting major radial roads, and distance between ramps is presented in **Figure 9.7-6**. Coincidentally, the interchange ramps give access to the major central business districts (CBDs) of Makati and Ortigas, and the hub of government offices in Quezon City. The ramps are adequately spaced to allow vehicles to maintain regular speed or promote free flow of traffic with minimal occasions of slow down due to friction from merging and diverging traffic from the on and off ramps. The interchange ramps are accessible roughly every 5.3 km. This distance corresponds to the minimum long trip which is approximately a quarter of the entire length of the elevated viaduct.

For the second criteria imposed, it is absolutely necessary to secure additional RROW either along EDSA or along the selected secondary roads deemed suitable as proposed ramp location. Photos of actual ramp sites requiring additional RROW are shown in **Figure 9.7-7**. Along EDSA, a portion of Camp Aguinaldo and an undeveloped property beside the National Printing Office are possible ramp sites that may offer minimal cost of RROW. The proposed ramp beside the military camp may present security issues which need to be resolved (i.e., provision for higher fences, CCTV cameras, etc.). Despite the last two criteria, the ramp structures require extensive additional RROW. The estimated additional RROW requirement for an elevated viaduct scheme on EDSA is roughly140,000 m^2.



Source: JICA Study Team

Figure 9.7-6 Interchange Ramp Locations



Source: JICA Study Team

Figure 9.7-7 Actual Site Condition along Proposed Ramp Locations

9.7.3 The Five Highly Critical Hindrance Structures/Sections

The erection of a 6-lane viaduct over EDSA is already difficult because of the inevitable construction beside, below and possibly above vehicular traffic. It also entails relocation of numerous overhead and underground utilities. However, it is complicated even more by the convergence of several transport facilities (i.e., MRT 3, LRT 1, PNR and grade separation structures) on several intersections. This is aggravated by constrained alignment options due to impractical acquisition of additional RROW.

The stretch of EDSA was examined to identify the five most difficult locations for a viaduct construction. These are then ranked and evaluated according to construction complexity. A list ranking first the site assessed with the major hindrance and the most difficult construction is presented below.

1) Osmeña Highway (Magallanes) Intersection (R-3 Road crossing EDSA)

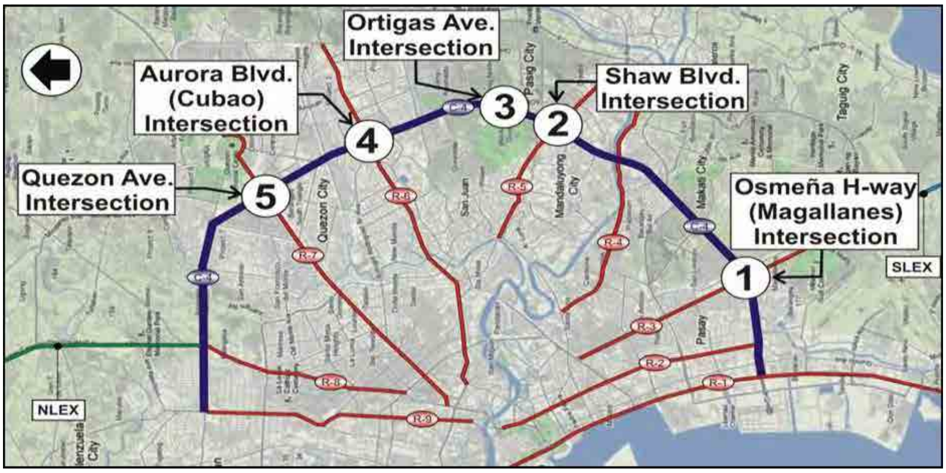
2) Shaw Boulevard Intersection (R5 Road crossing EDSA)

3) Ortigas Avenue Intersection

4) Aurora Boulevard (Cubao) Intersection (R6 Road crossing EDSA)

5) Quezon Avenue Intersection (R7 Road crossing EDSA)

This ranking excludes locations of intersection with flyovers still programmed for construction. (i.e., Taft Avenue, West–North Avenue, and Roosevelt–Congressional Avenue). The exact locations of these sites are shown in **Figure 9.7-8**. The challenge in each of this location is the erection of tall pier substructures and long span superstructures requiring massive substructure and foundation on a limited construction area. All five locations have potential RROW issues. For this five locations traffic management is vital in formulating the most suitable construction methodology, so too is the safety of motorists and pedestrians in construction planning.



Source: JICA Study Team

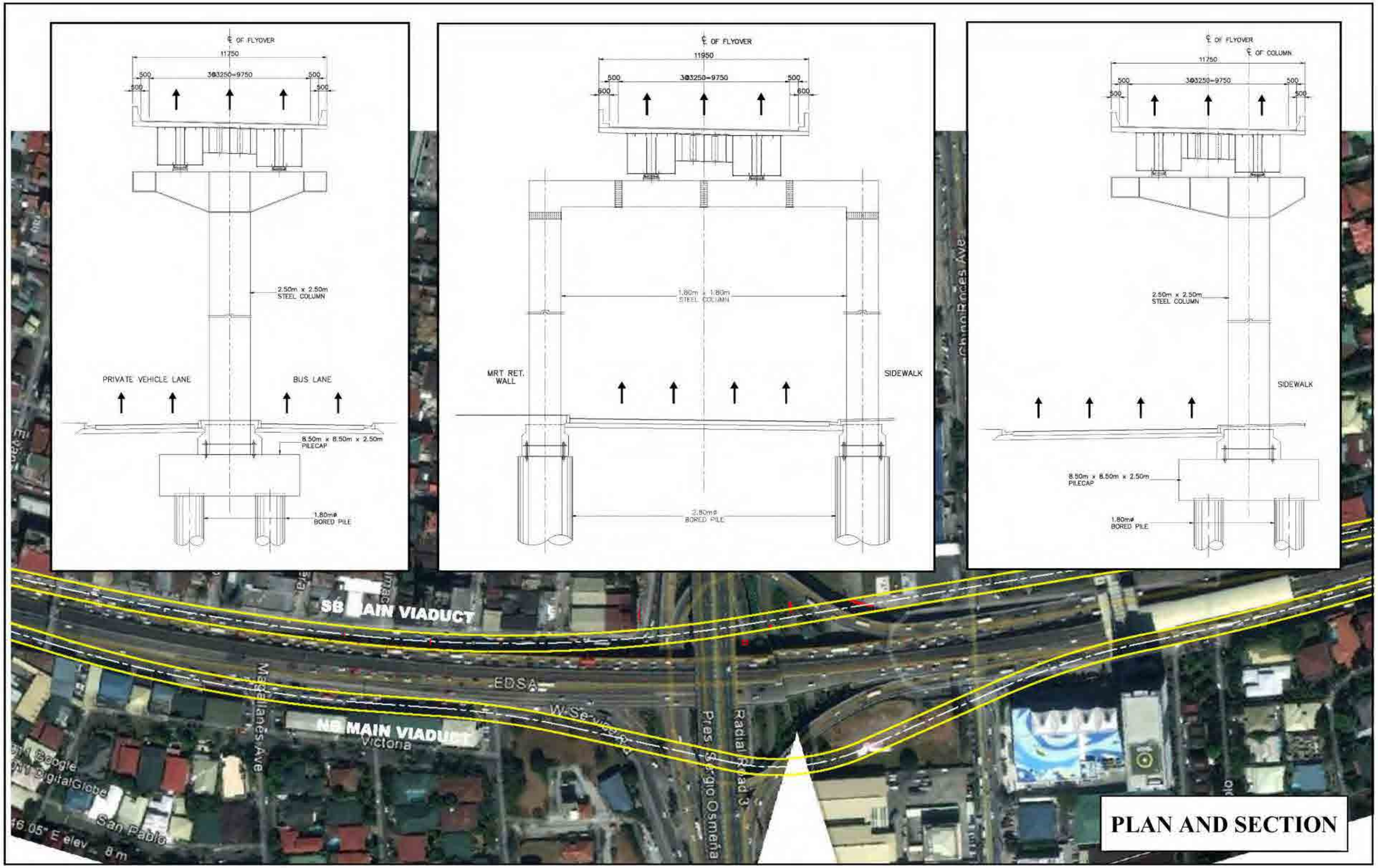
Figure 9.7-8 Location of the Five Most Difficult Construction Site

(1) Osmeña Highway (Magallanes) Intersection

The proposed viaduct at Magallanes is split in two, one for the northbound traffic and the other for the southbound traffic. The viaduct is proposed to be at third level traversing underneath the fourth level Skyway Viaduct. If the minimum vertical clearance of 5.10 m relative to the Magallanes Flyover and the Skyway Viaduct is not achievable, then it shall cross over the Skyway Viaduct at fifth level. The viaduct will then be approximately 32 m above ground or almost equivalent to a height of an eleven storey building. North of the Magallanes Flyover is the Magallanes MRT 3 Station. At this segment the viaduct must be above the roof line of the MRT station or roughly still at fourth level or 24 m above ground.

The difficulty at this site is the co-existence of several transport facility (i.e., Skyway's Toll Expressway, DPWH's Magallanes Interchange, and DOTC's Philippine National Railway [PNR] train tracks, and MRT 3 light rails). Each entity requires vertical and horizontal clearances to their transport corridor. Thus, at this setting it is more than likely that the viaduct shall have long spans (45 m to 60 m) and tall piers (24 m to 32 m) because of this restriction. For this viaduct configuration steel structures are recommended.

Source: JICA Study Team

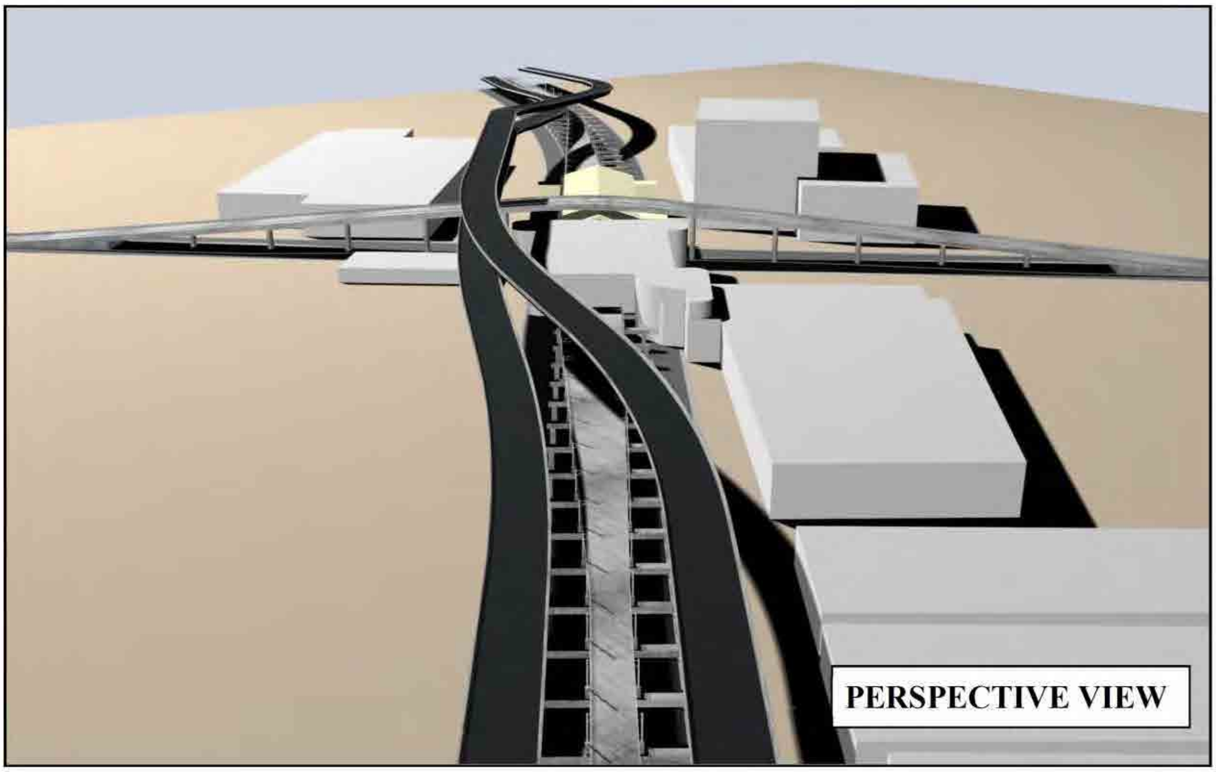


Source: JICA Study Team

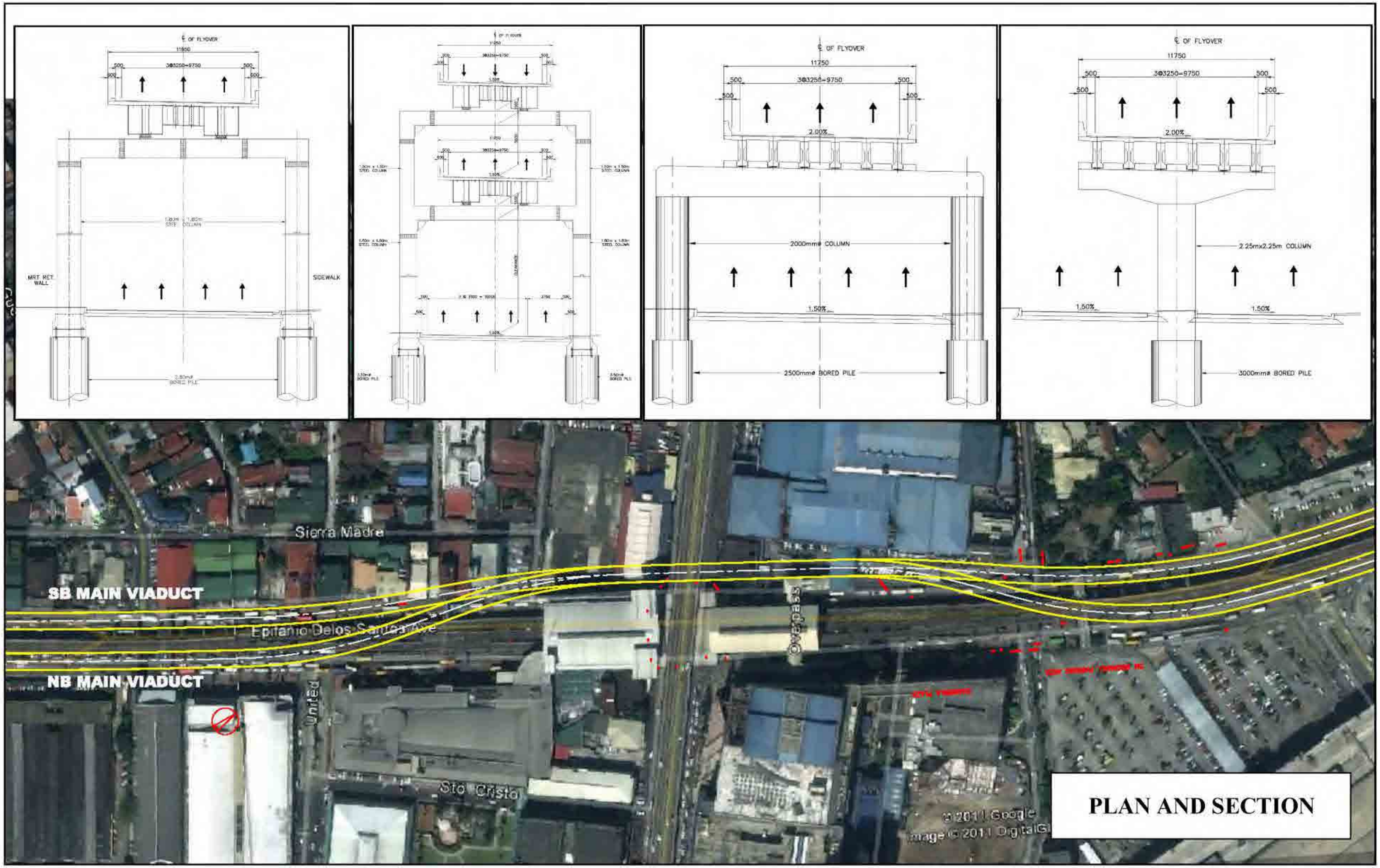
(2) Shaw Boulevard Intersection

At this intersection there are multi-level grade separation structures: an underpass road along EDSA and a third level flyover across EDSA along Shaw Boulevard above the second level viaduct of the MRT 3 over EDSA. A platform station is also located very near the intersection South of EDSA. This station is connected via a concourse to several commercial malls. The following malls, Rustan's Shangri-la, Starmall, and EDSA Central occupy the three corner lots of the intersection. The fourth corner is still relatively undeveloped.

If the viaduct alignment is confined within EDSA RROW, the necessary viaduct length spanning the covered segment of EDSA is 130 m long with pier height at 24 m above level ground. To reduce the required span length, the alignment is shifted West of EDSA or adjacent to the southbound lanes occupying the less developed space. A double deck steel viaduct is proposed over the parking space in front of Starmall which then traverses over Shaw Boulevard at fifth level above the roof line of the MRT station and bisects the corner property with the least improvement. For this proposed alignment, although the pier height remains at the same level its substructure is considerably sturdier since it is set farther away from the underpass retaining walls. This alignment also reduces the superstructure span to 60 m. At this intersection acquisition of additional RROW is recommended. The possession of additional RROW simplifies construction as well as reduces risk of damage of the retaining walls of the existing underpass road and more importantly lessens vulnerability of the proposed viaduct structure.



Source: JICA Study Team



PLAN AND SECTION

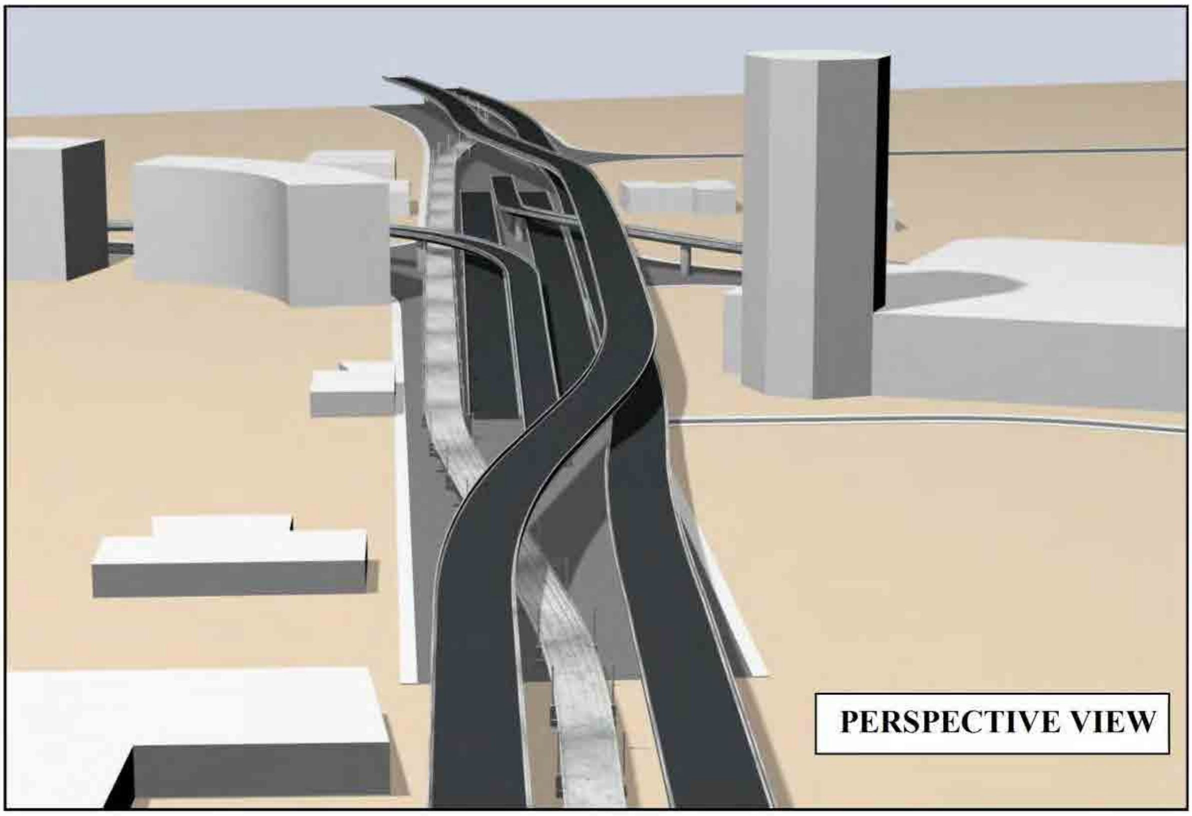
Source: JICA Study Team

(3) Ortigas Avenue Intersection

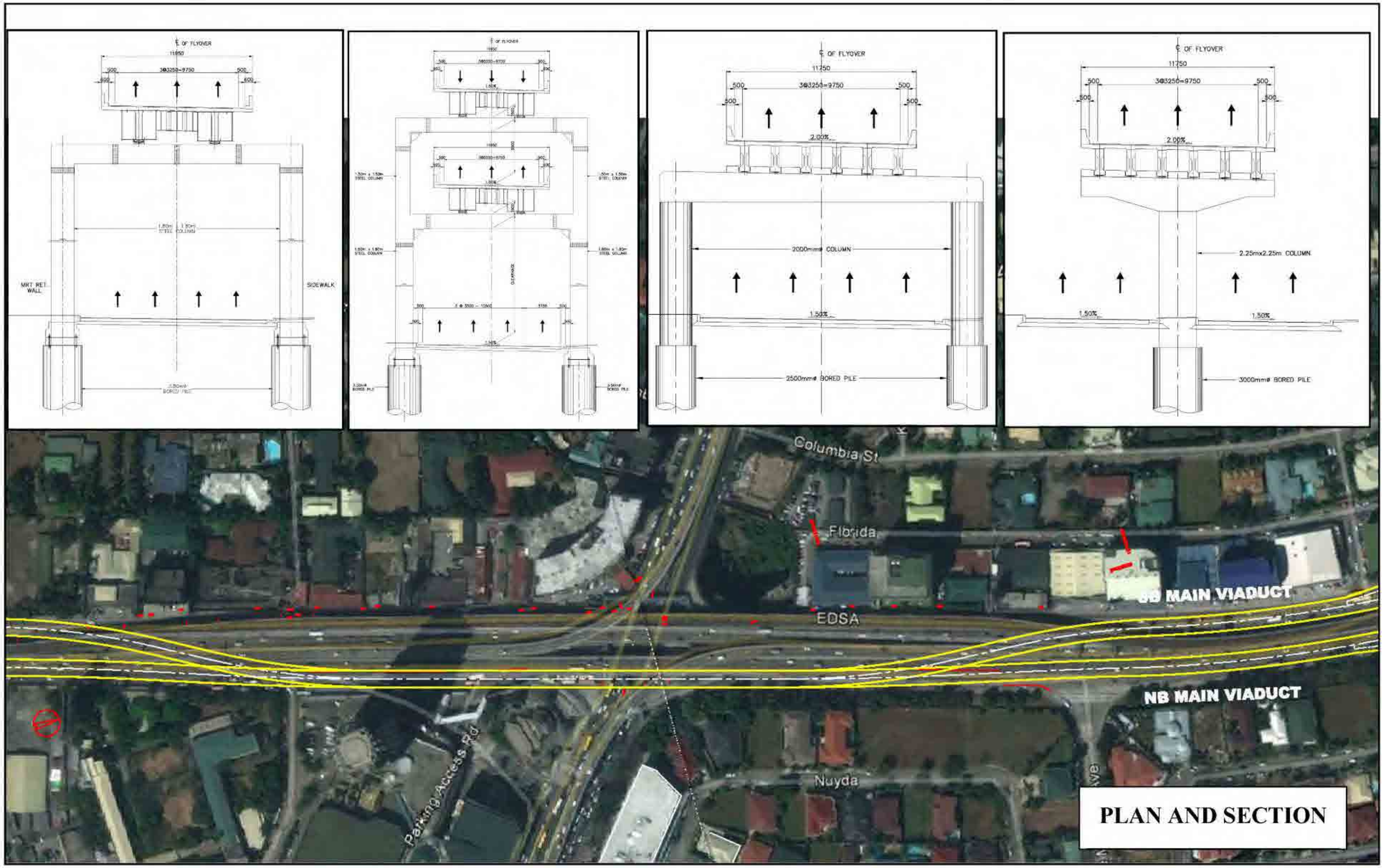
The interchange at Ortigas intersection has the main flyover on the second level of EDSA. The left turn flyovers to Pasig and Mandaluyong cross over at the third level. The MRT 3 viaduct also runs along EDSA at second level above the southbound service lanes. These structures fully obstruct the passage southbound except at the strip above the sidewalk. This however becomes unusable since an open deep cut excavation is found alongside the sidewalk at a corner on the intersection which precludes positioning of any structure foundation. The only usable corridor is above the northbound 2-lane service road adjacent to the EDSA National Shrine.

To fit six lanes over two available at-grade lanes and acquire the least RROW a double deck viaduct is proposed. The lower deck may run parallel and level with the EDSA main flyover at an elevation 8 m above ground. While the upper deck rises above the left-turn flyover at fourth level or about 32 m above ground. The three southbound lanes cross over opposing traffic and occupy the top most deck and gradually shift back above its regular course. Due to limited at-grade space long span superstructures are certain which may range from 50 m to 60 m. Steel structures are recommended for the viaduct on this location. For high piers and long spans, steel members are suitable viaduct components because lighter materials are more manageable to handle and easily erected.

This proposed alignment may affect a portion of the EDSA Shrine. The extent of intrusion can only be assessed once topographic survey data is available.



Source: JICA Study Team

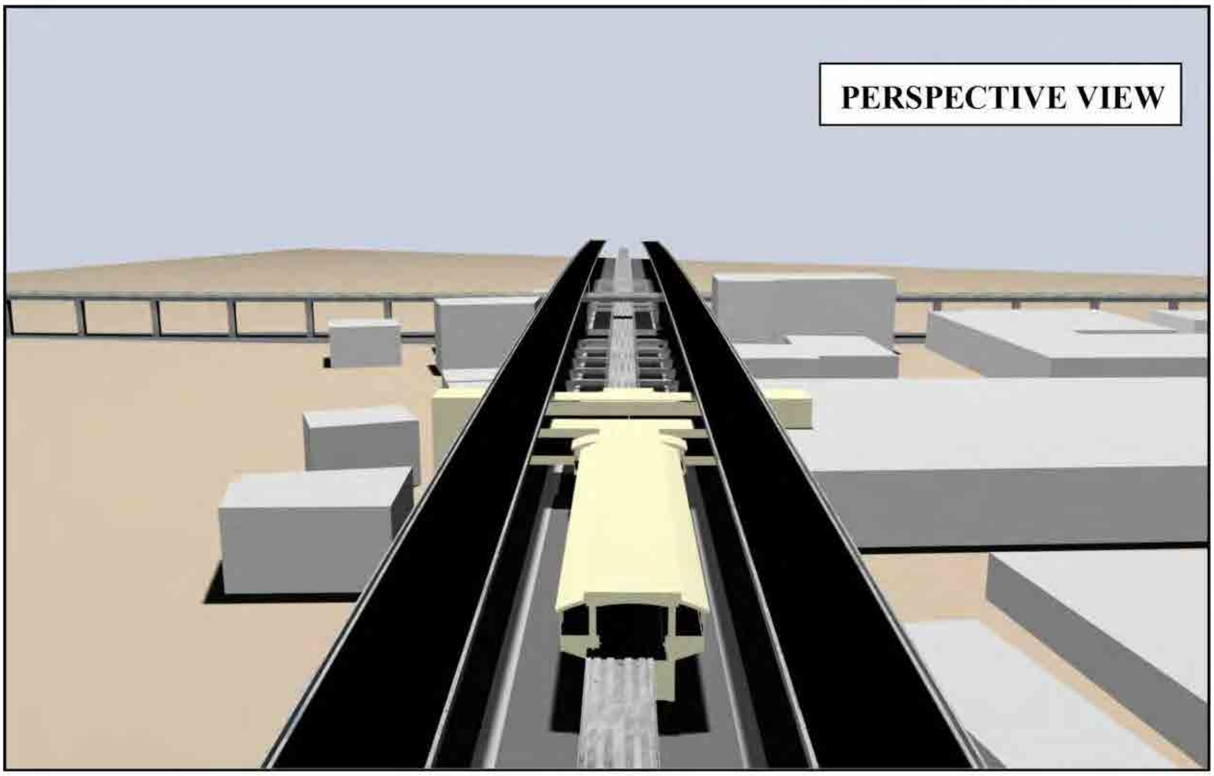


Source: JICA Study Team

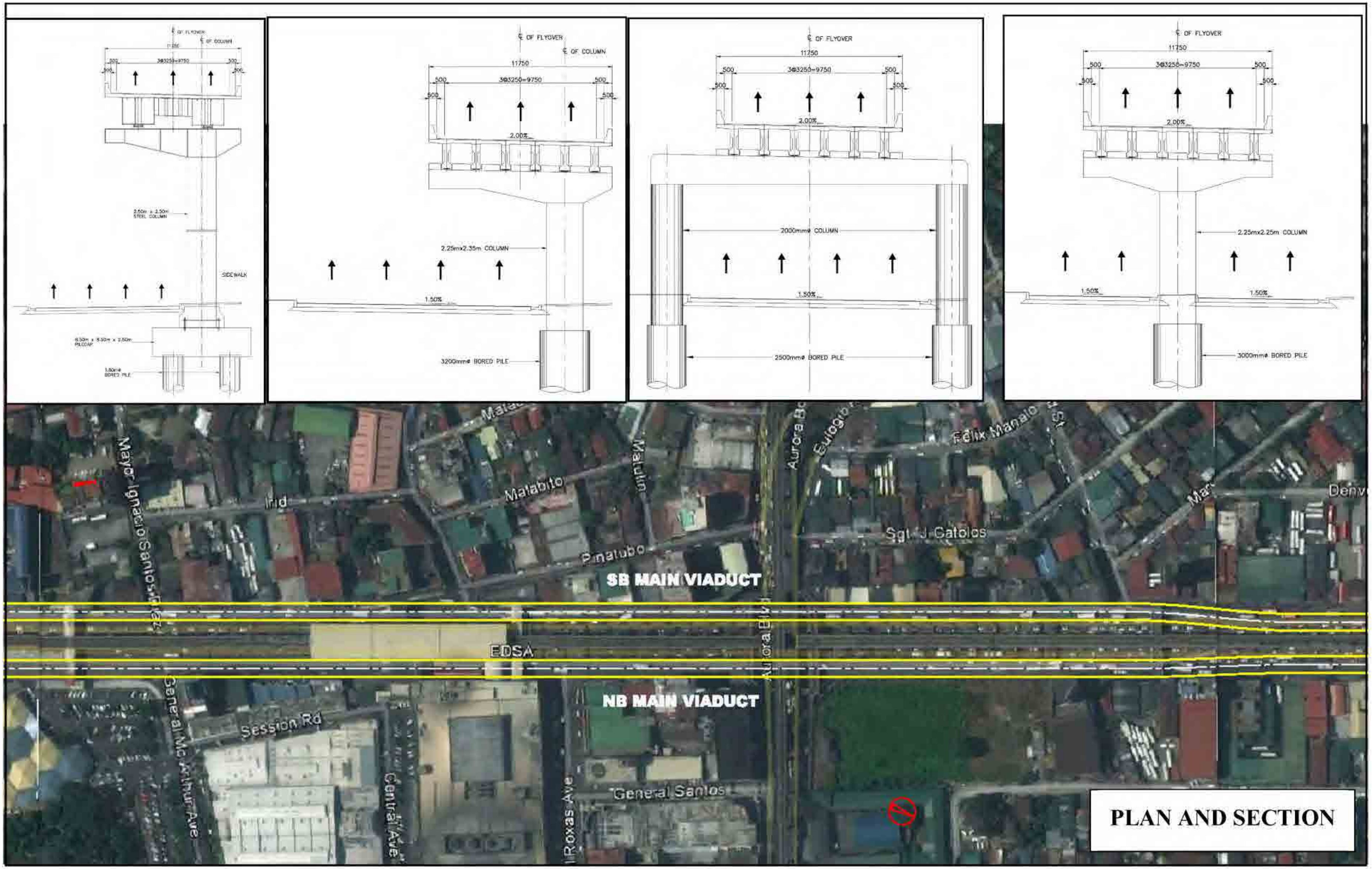
(4) Aurora Boulevard (Cubao) Intersection

There are two light rails, MRT 3 and LRT 2, on the EDSA–Aurora Boulevard intersection. MRT 3 is along EDSA at second level, whereas LRT 2 is along Aurora Boulevard at third level crossing EDSA. Both are above the 6-lane depressed road (three lanes per traffic direction) along the centerline of EDSA. At the at-grade, a 3-lane service road for both opposing traffic remains. Twelve lanes are available at this junction since the median separator was narrowed for the road underpass. Located in close proximity to the south of the intersection is a MRT 3 station.

The proposed viaduct at this intersection is split in two and occupies the space above the 3-lane service roads. Both the northbound and southbound viaducts will have three lanes and are raised almost at fifth level as they cross Aurora Boulevard. This is necessary to comply with the vertical clearance requirement of the third level LRT 2 and its catenary lines, and to safely pass above the roof line of the nearby station. Again the recommended steel viaduct will have tall piers with heights near 30 m and long spans approximately 50 m to 60 m. The footing of the viaduct columns will be set safely away from the underpass retaining walls to assure its structural integrity. The viaduct footings near the intersection may be located next to the sidewalk for a cantilever deck or positioned on the depressed road to form a regular deck. The latter will require taller piers but guarantees better stability having been set on more stable ground conditions. This structural arrangement maintains the three existing outer service lanes commonly used by public transport vehicles.



Source: JICA Study Team

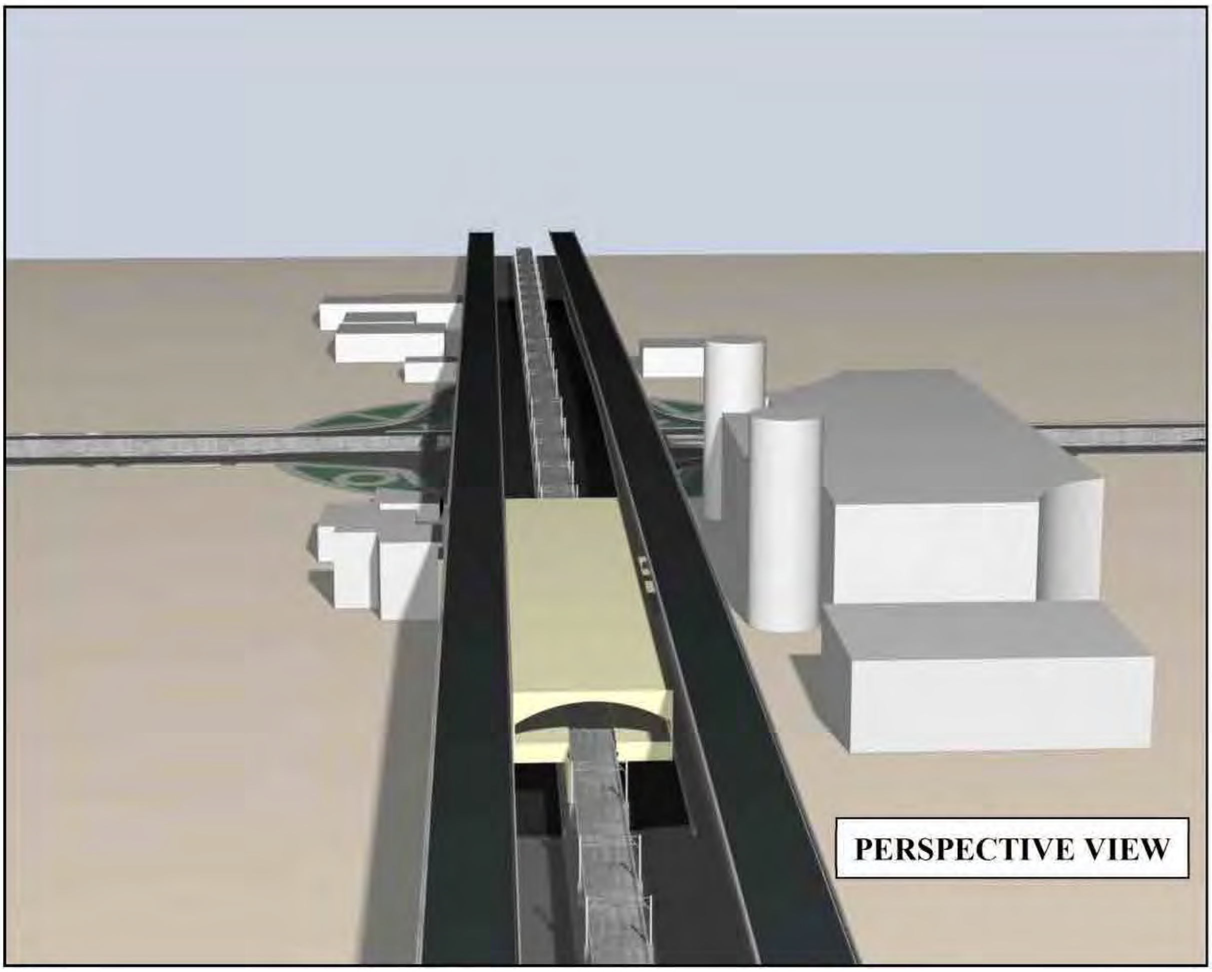


Source: JICA Study Team

(5) Quezon Avenue Intersection

The concerns for a proposed elevated viaduct passing over the Quezon Avenue intersection are the multi-level grade separation highway structures, the MRT 3 viaduct and a nearby station already in place. On EDSA a 3-lane flyover on both northbound and southbound directions concurrently with a 4-lane divided underpass, crossing below EDSA along Quezon Avenue, mitigates the intersection traffic. The MRT 3 trains runs on a viaduct between these flyovers and stops at a station a few hundred meters near this intersection. The construction of these transport facilities left only two traffic lanes on either direction at the outer service lanes.

The proposed viaduct will utilize the available space above the service lanes. Given that each traffic direction is planned for three lanes, the viaduct superstructure will be a level above the existing flyovers. Thus, the viaduct will be predominantly at third level or 16 m above ground except where it rises above the MRT station. The crest elevation is estimated to be nearly fourth level or 22 m above ground. Steel columns and steel box girders will be recommended. The maximum pier to pier distance will be slightly shorter at approximately 45 m to 55 m enough to span over Quezon Avenue. The viaduct columns will be on the sidewalk unless additional RROW is secured.



Source: JICA Study Team

Source: JICA Study Team

9.7.4 Find Space for Proposed Viaduct

Result of study for five (5) intersections which identified most difficult locations shows that found spaces for proposed viaduct structures which means that also can be found space for the proposed flyovers due to difficulty of the proposed flyover are equal or lower than five(5) study conducted intersections.

9.7.5 Cost Estimate

This section presents the results of preliminary project cost estimate for this study. The project cost consists of Construction Cost (concrete viaduct, steel viaduct, approach ramp, at-grade road improvements, miscellaneous structures, facilities for the engineers and contractor preliminaries), Traffic Management, Utility Relocation, Engineering Cost, Right-of-Way and Resettlement, and Contingencies and Price Escalation. The summary of estimated project cost is shown in **Table 9.7-2**.

Table 9.7-2 Summary of Estimated Project Cost

ITEM NO.	DESCRIPTION	UNIT	QTY.	COST (MP)	Remarks
A.	**Direct Construction Cost**			92,592	
A.1	Facilities for the Engineer (1% of A.3 – A-7)	l.s.	1.0	890	
A.2	Other General Requirements (3% of A.3 – A.7)	l.s.	1.0	2,671	
A.3	At-Grade Road Improvement	l.s.	1.0	1,272	
A.4	Bridge and Other Structures			84,791	
A.5	Miscellaneous Structures	l.s.	1.0	848	
A.6	Street Lighting	l.s.	1.0	1,272	
A.7	Traffic Signal Light	l.s.	1.0	848	
B.	**Traffic Management (1% of A.3 – A.7)**	p.s.	1.0	890	
C.	**Utility Relocation (3% of A.3 – A.7)**	p.s.	1.0	2,671	
D.	**Indirect Construction Cost**			26,615	
	OCM + Profit (14% of A+B+C)			13,461	
	Vat 12% of A+B+C+ OCM+Profit			13,154	
E.	**Estimated Construction Cost**				
	SUBTOTAL: A + B + C + D			122,769	
F.	**Administrative & Consultancy Cost (10% of E)**			12,277	
G	**Contingencies (5% of E+F)**	p.s.	1.0	6,752	
H	**ROW and Resettlement (Using Zonal Value)**	l.s.	1.0	28,522	
	TOTAL COST (E+F+G+H)			**170,320**	

Source: JICA Study Team

The Direct Construction Cost is roughly estimated for structures at per square meter basis. The structure elevations and typical cross-sections are found on **Appendix 9.3**. Price Analysis was classified mainly as direct and indirect cost. Direct cost considers cost of materials, cost of labor and equipment cost, while indirect cost considers overhead, contingencies and miscellaneous cost, engineering and administrative supervision, office expenses, insurance, etc.

Traffic management works include provision and securing of the approval of traffic management during construction. The cost is estimated at 1% of Direct Construction Cost. Utility Relocation works include the removal and realignment of private and public utilities such as telecommunication lines, power lines, drainage line and waterlines affected by the proposed construction. The cost is estimated at 3% of the Direct Construction Cost. Engineering Costs include detailed engineering, construction supervision, government quality assurance and administrative cost. The cost is estimated at 10% of the Civil Works Cost. Contingency Cost is assumed at 5% of Civil Works Cost.

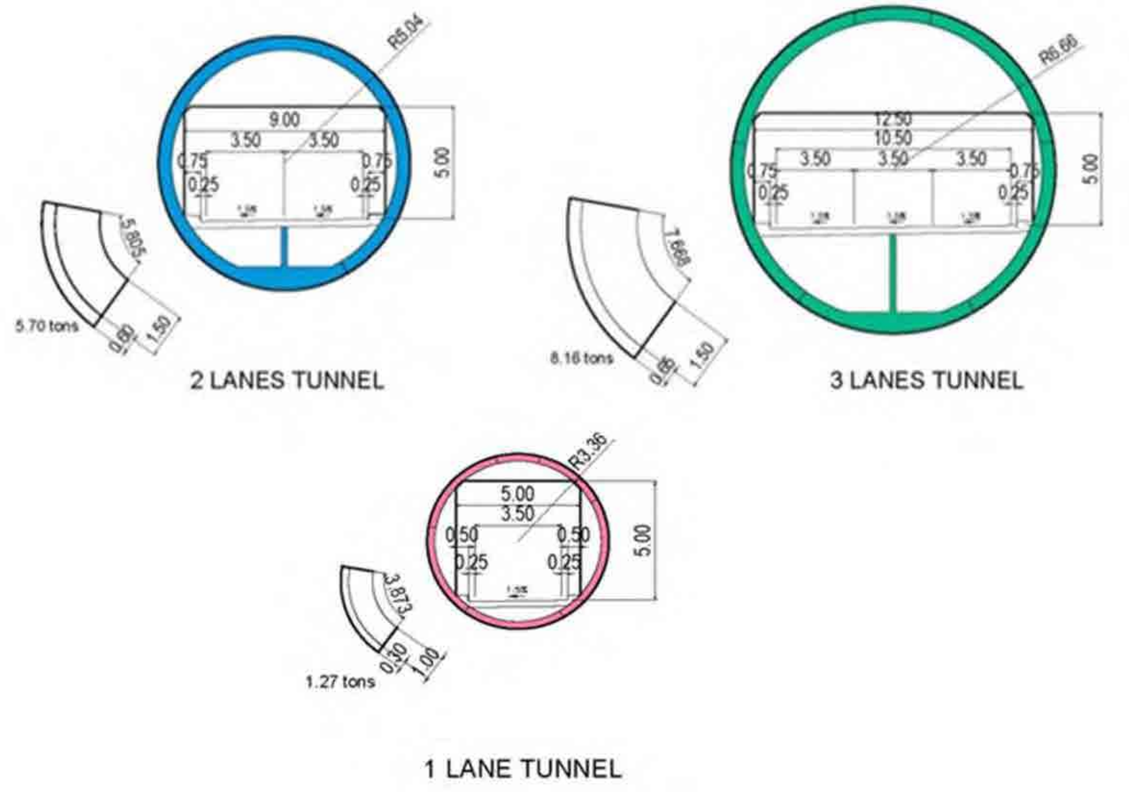
The Right-of-Way and Resettlement cost is established based on the following assumptions; (a) the elevated viaduct will utilize mostly DPWH RROW and will run along existing roads without any cost, (b) the cost is established based on a combined government zonal value and market price value, and (c) compensation cost is roughly estimated by classifying affected structures into residential houses, commercial buildings, factories, warehouses, schools, and permanent facilities.

These are presented in cost estimate tabulation form in **Appendix 9.4**.

9.8 TUNNEL SCHEME

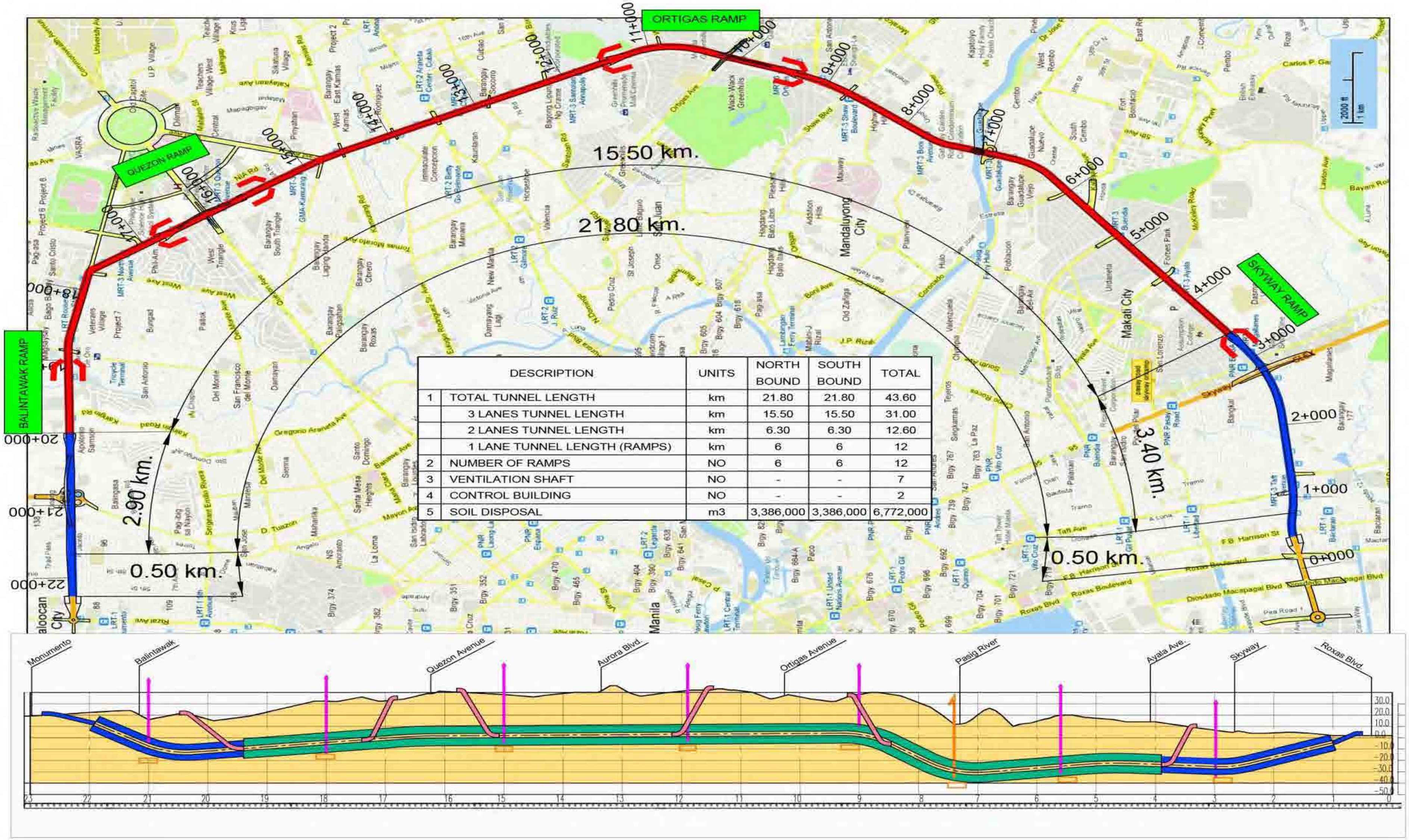
9.8.1 Proposed Plan and Typical Cross Sections of Tunnel

The project is to construct a 22.8 km double highway tunnel (northbound and southbound) under the EDSA. The beginning and endpoint of the tunnel are located between Roxas Boulevard and Taft Avenue, and Monumento Circle and Balintawak, respectively. The main tunnel consists of 2-lane tunnels (inside diameter D = 10.1 m) at both sides of the entrance and exit while 3-lane tunnels (inside diameter D = 13.3 m) shall be used for the entire middle section. 1-lane ramps (inside diameter D = 6.7 m) shall be provided at four locations. These are near Skyway, Ortigas Avenue, Quezon Avenue, and Balintawak. There are no problems regarding horizontal alignment of the tunnel since EDSA do not have steep or extreme variations in alignment. The tunnel should have enough earth covering due to many structures located along EDSA; MRT stations and flyovers, which are supported by foundation piles. **Figure 9.8-1** shows the typical cross-sections of three types of tunnels, and **Figure 9.8-2** shows Tunnel Layout (Plan and Profile)



Source: JICA Study Team

Figure 9.8-1 Typical Tunnel Section of 3 Types of Tunnels



	DESCRIPTION	UNITS	NORTH BOUND	SOUTH BOUND	TOTAL
1	TOTAL TUNNEL LENGTH	km	21.80	21.80	43.60
	3 LANES TUNNEL LENGTH	km	15.50	15.50	31.00
	2 LANES TUNNEL LENGTH	km	6.30	6.30	12.60
	1 LANE TUNNEL LENGTH (RAMPS)	km	6	6	12
2	NUMBER OF RAMPS	NO	6	6	12
3	VENTILATION SHAFT	NO	-	-	7
4	CONTROL BUILDING	NO	-	-	2
5	SOIL DISPOSAL	m3	3,386,000	3,386,000	6,772,000

Source: JICA Study Team

Figure 9.8-2 Tunnel Layout (Plan and Profile)

9.8.2 Standard Earth Covering of Tunnel

To have proper distance of earth covering of tunnel from the hindrance of existing structures.

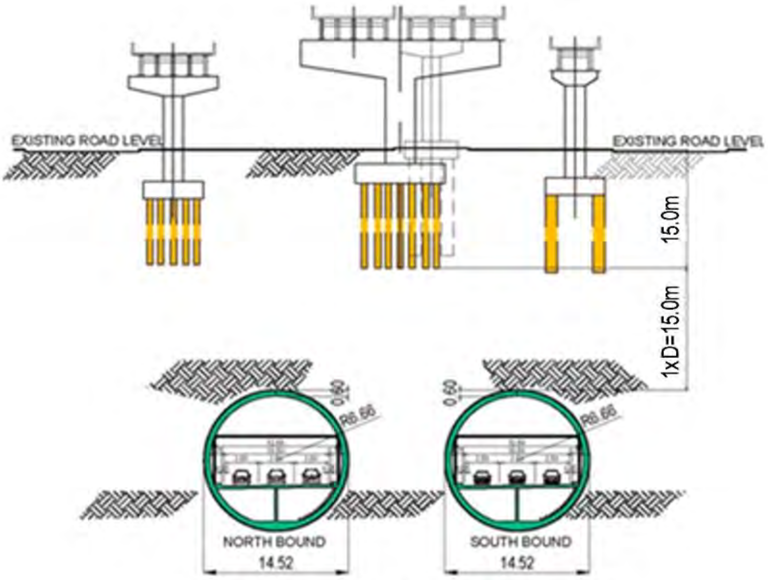
Computation of earth covering underground and under river shown below:

Underground : Same diameter of tunnel (1.0 x diameter of tunnel)

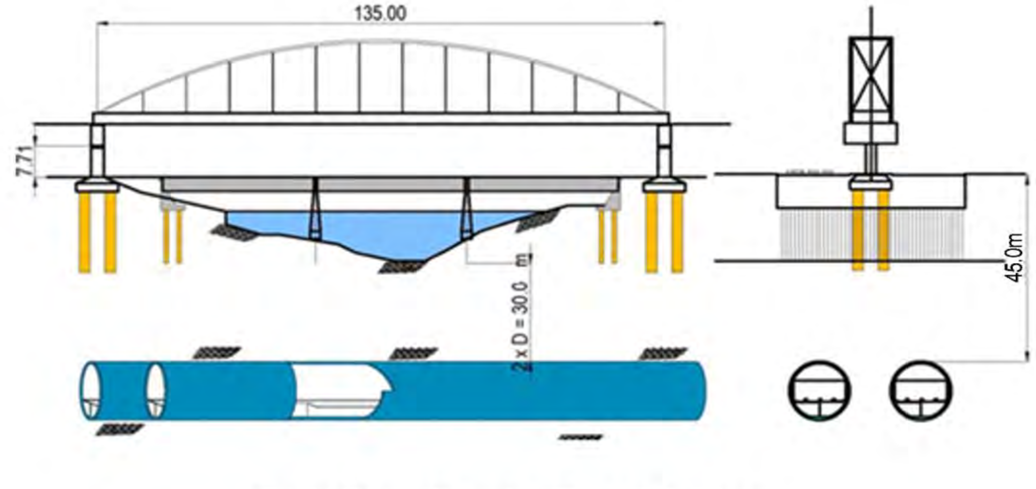
(15m (estimated pile length) + 1.0 x 14.62= 29.6m → 30.0m)

Under river : Two times of diameter of tunnel (2.0 x diameter of tunnel)

(2 x 14.62= 29.2m →30.0m)



Standard Tunnel Section



Pasig River Crossing Tunnel Section

Source: JICA Study Team

Figure 9.8-3 Typical Profile of Tunnel

9.8.3 Ramp (Entrance and Exit)

One-lane ramp tunnel provided at four locations as follows;

1) Between Skyway and Makati

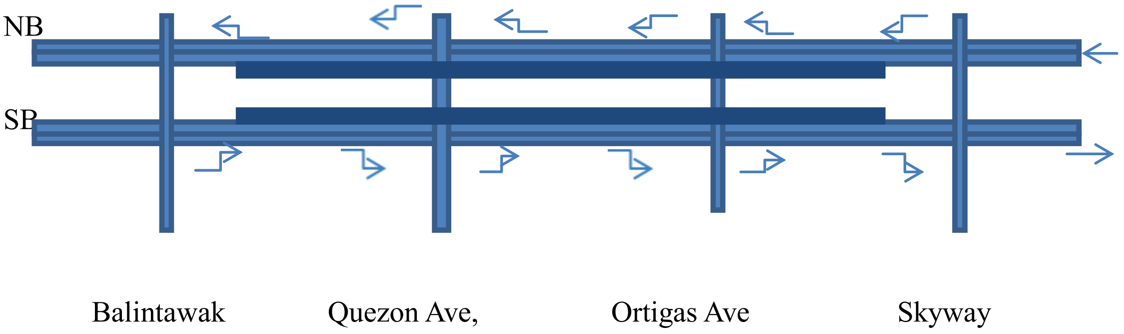
2) Before and after Ortigas Avenue

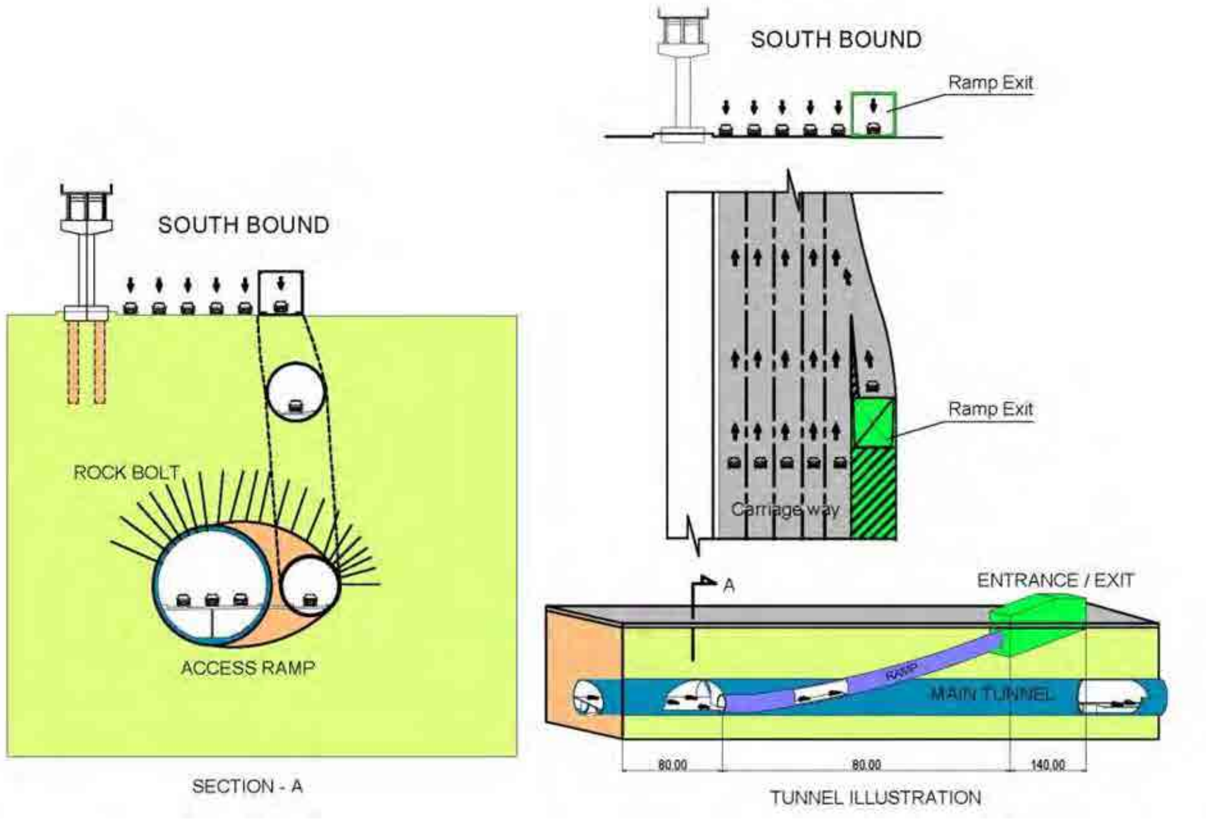
3) Before and after Quezon Avenue and

4) Between Balintawak and Roosevelt Avenue (south side of Balintawak)

Length of each ramp requires about 1000m as follows;

(difference in elevation about 36m ÷ 0.04 (4.0% vertical grade) = 900m



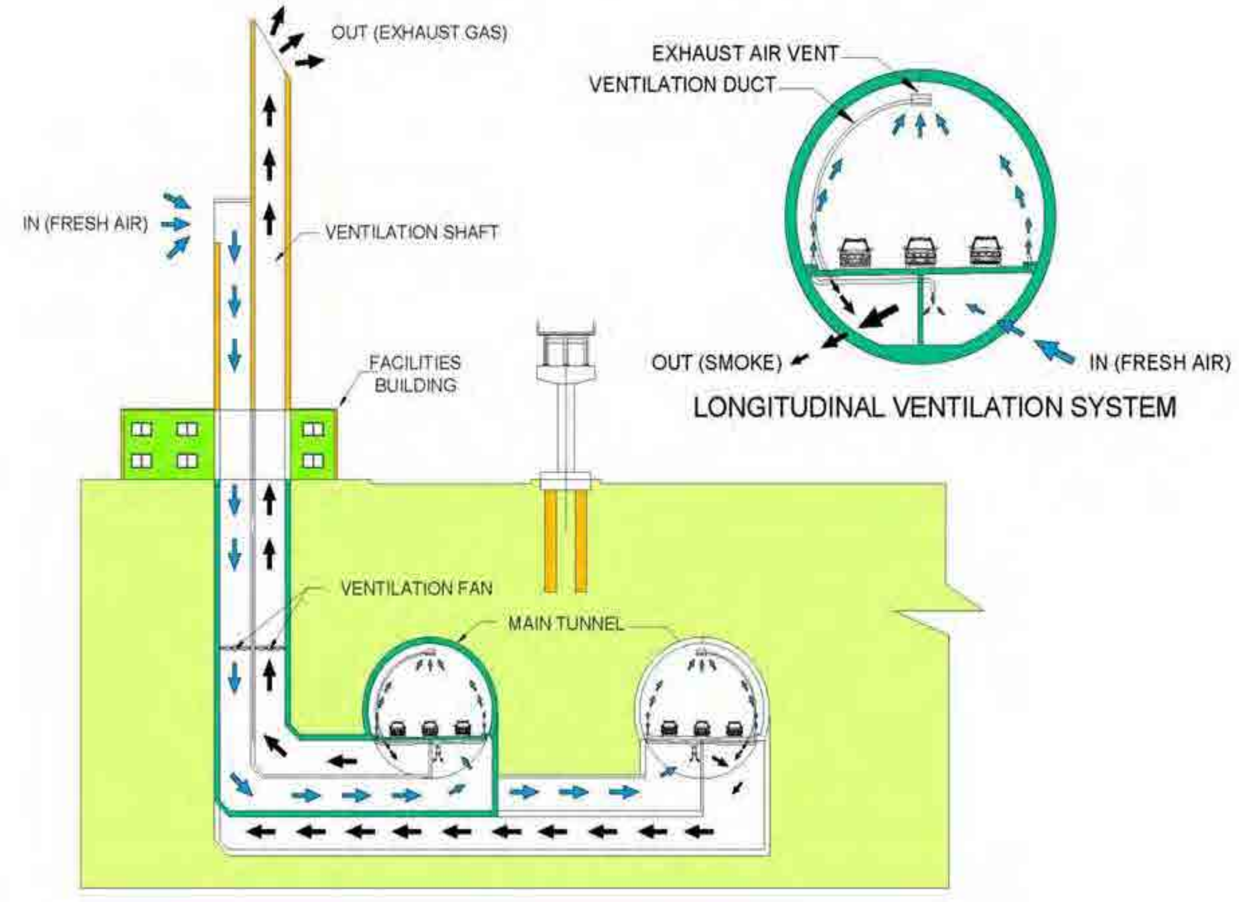


Source: JICA Study Team

Figure 9.8-4 General Concept of Ramp

9.8.4 Ventilation System

The main function of the tunnel ventilation system is to discharge the vehicle exhausted fumes and smoke from fire. Generally, discharged smoke in short-length tunnels uses compulsory electric fan and the direction of the fan is the same with that of the vehicle. But such ventilation system will be overwhelmed with exhausted fumes or fire smoke in longer tunnels. To improvement the above situation in longer tunnels, airflow shall be diverted into two sections underneath the deck slab of carriageway: one to discharge smoke and the other to take in fresh air. Discharge smoke section will contain the smoke and prevent it from spreading out in the tunnel while the intake fresh air section will be utilized for access of people a evacuation. Ventilation towers shall be constructed at about 3km interval because each ventilation tower will not only be used for smoke ventilation but also for electric supply, water deposit, and access for people. General concepts of this system are shown in **Figure 9.8-5** General Concept of Ventilation System.

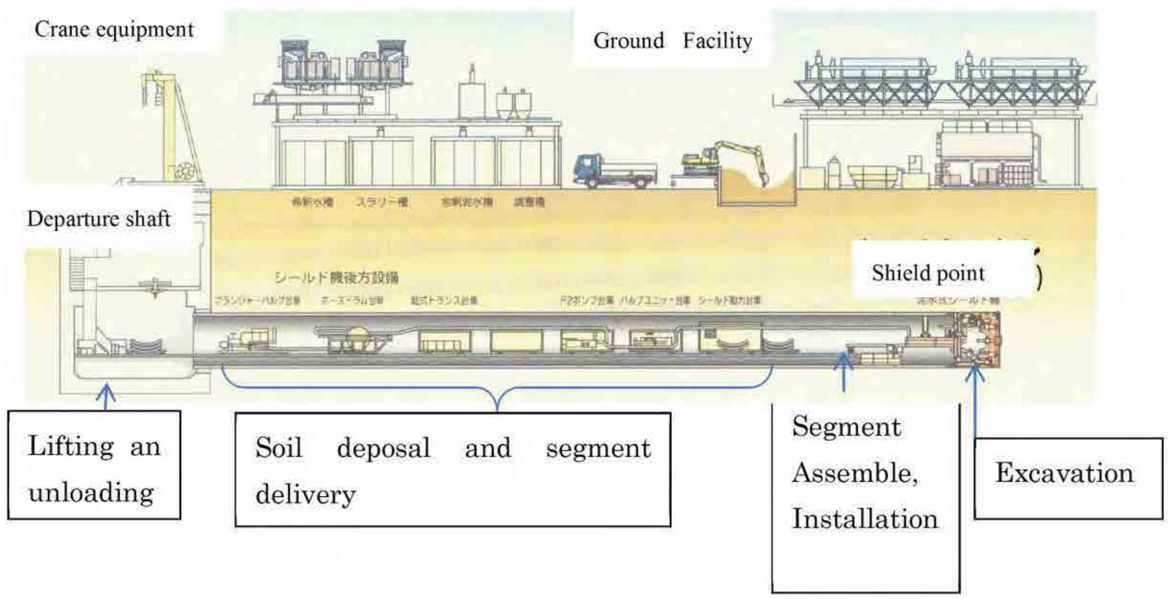


Source: JICA Study Team

Figure 9.8-5 General Concept of Ventilation System

9.8.5 Shield Shaft

Tunnel excavation will be done by one shield machine per direction between departure vertical shaft and arrival vertical shaft. Shield tunnel construction works are routine works of excavation, assembly of precast concrete segments and grouting between concrete segment and soil. Those routine works are important for construction speed and smooth progress of construction.



Shield method procedure:

1) Shield Excavation: Excavated by a rotation cutter in front of the shield machine.
2) Maintaining of the tunnel section: Keeping earth pressure balance between cutter head and excavation surface to prevent over excavation to cause ground settlement.
3) Tunnel segment: Pre-cast Concrete segments assembled and installed at the shield machine rear space.
4) Shield driving: Shield machine moves forward using shield jack which is supported by installed pre-cast concrete segments.
5) Grout behind the segments: Fill the grout between the soil and Pre-Cast Concrete segment with a cement grout to prevent ground settlement.

These above routine works continually implemented shall make for a smooth and safe construction.

Shield Machine

After Excavation Tunnel

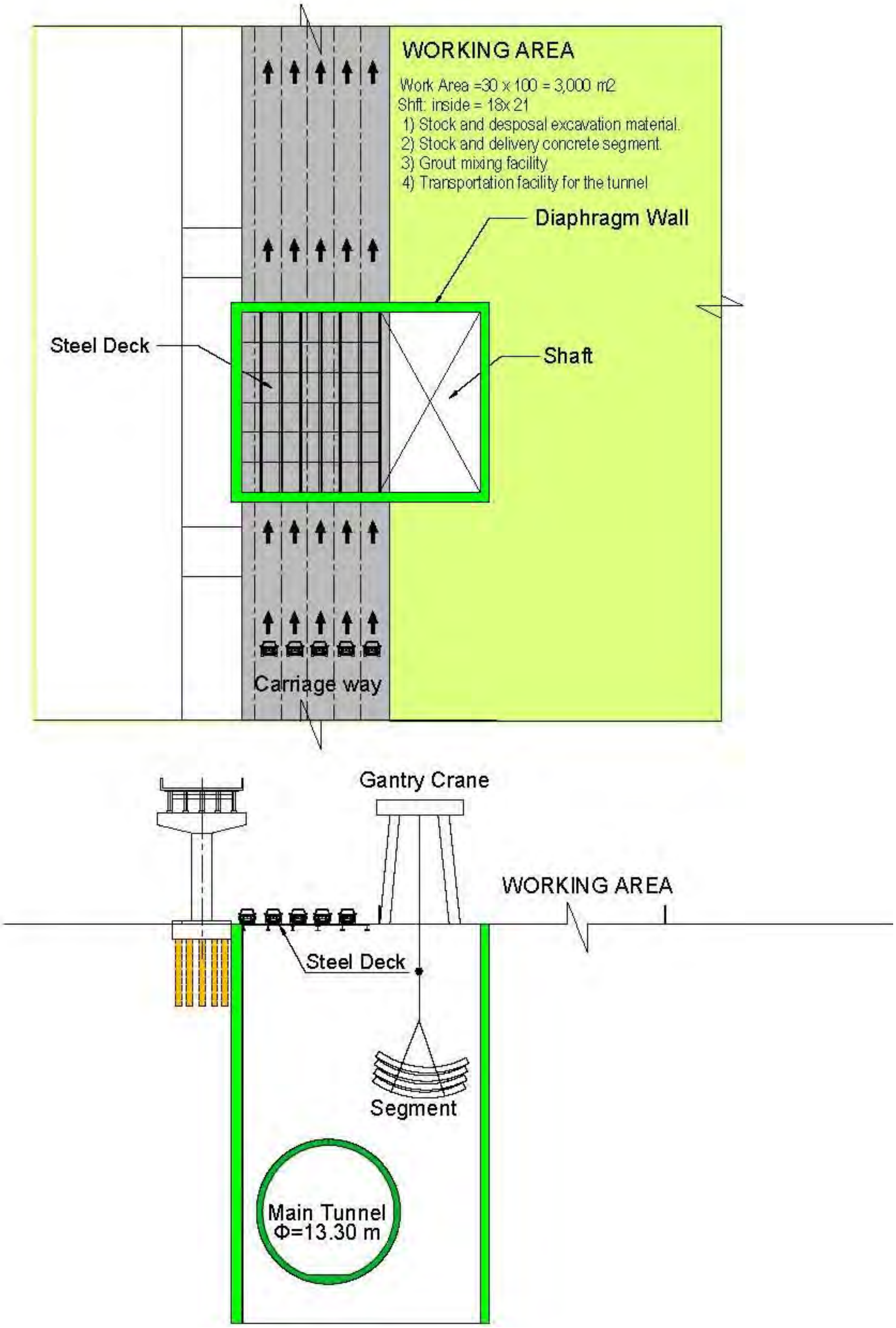
Bringing in and carrying out of all of the materials and equipments required for construction works inside the tunnel will only use the departure vertical shaft. About 3,000 m^2 is required for the temporary construction yard around the vertical shaft at grade, which shall be utilized for lifting machine of vertical shaft, stockyard of excavated soil and delivered precast concrete segments, crane for loading and unloading, product facilities of grouting, parking yard for tracks and vehicles and control house. The following volume is expected if shield excavation implemented at 18 m/day:

Volume of excavation/day : 3.14 x R^2 x 18 m = 2.432 m^3

Required no. of dump trucks : 100 dump trucks x 6 m^3 x 4 roundtrips = 2.400 m^3

Precast segment (9 ton/piece) : 72 pieces (requires 18 trailers per day)

In view of the above, proper and efficient planning for carrying out and delivery shall be done while also considering minimizing the influence on existing traffic flow due to utilizing heavy equipments, such as trucks and cranes (refer to **Figure 9.8-6**, General Concept of Vertical Shaft).

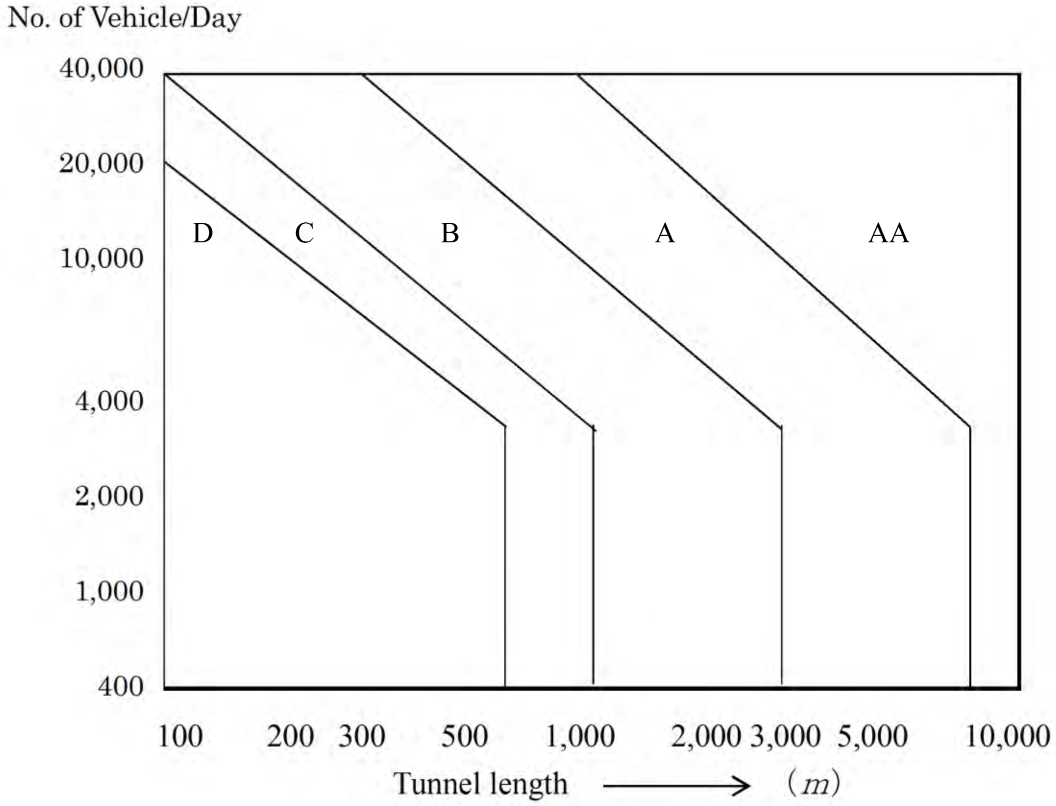


Source: JICA Study Team

Figure 9.8-6 General Concept of Vertical Shaft

9.8.6 Required Tunnel Facilities

The classifications of the emergency facilities are based on tunnel length and volume of traffic (see **Figure 9.8-7**, Classification of Tunnel Facilities and **Table 9.8-1**, Requirement of Tunnel facilities).



Source: Installation Standard of Emergency Facilities for Road Tunnel, Social Foundation Japan Road Association

Figure 9.8-7 Classification of Tunnel Facilities

Grade of this tunnel is AA based on the following figures:

Traffic volume = 81,000 vehicles/day/3-lane and tunnel length = 22,800 m)

Table 9.8-1 Requirement of the Tunnel Facilities

Tunnel Grade **Emergency Facilities**		**AA**	**A**	**B**	**C**	**D**
(1) Emergency call and warning device	1) Emergency phone system	○	○	○	○	
	2) Push button emergency call unit	○	○	○	○	
	3) Fire detector	○	△			
	4) Emergency alarm	○	○	○	○	
(2) Fire extinguisher equipment	1) Fire extinguisher	○	○	○		
	2) Fire hydrant	○	○			
(3) Evacuation facility	3) Signboard	○	○	○		
	4) Ventilation or evacuation exit	○	△			
(4) Other facility	1) Water tap system	○	△			
	2) Radio communication system	○	△			
	3) Radio repeat or loudspeaker communication facility	○	△			
	4) Water spray system	○	△			
	5) CCTV facility	○	△			

Source: Installation Standard of Emergency Facilities for Road Tunnel, Social Foundation Japan Road Association.

○ **:** As a General Rule △ : As needed

(1) Emergency Call and Warning Devices

The facilities for emergency call and warning devices shall have the following activities:

Notice fire and any accident in the tunnel

↓

Report fire and accident to control room

↓

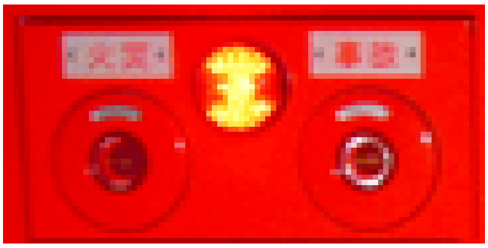
Activate emergency warning system

↓

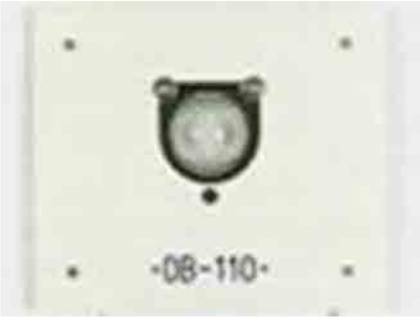
Activate extinguishing the fire, evacuation system, etc.

1) Emergency Phone and Signboard (setting interval is 200 m)

2) Push Button Emergency Call Unit (setting interval is 50 m)



3) Fire Detector (setting interval is 50 m)



4) Emergency Alarm and Sign

Emergency information such as fire and any accident and trouble in the tunnel shall be given to vehicle drivers to minimize gravity of the accident or avoid occurrence of succeeding accidents.

Table 9.8-2 Rough Estimated Quantities of Emergency Call and Warning Device (Entire Section)

Description	Quantity (pieces)	Setting interval
(a) Emergency phone	215	200 m
(b) Push button emergency call	860	50 m
(c) Fire detector	860	50 m
(d) Emergency alarm and sign	108	400 m

(2) Fire Control Equipment

Fire extinguishing facilities are used for the initial fire control

1) Fire Extinguisher (setting interval is 50 m)

2) Fire Hydrant (setting interval is 50 m)

Standard requirements

Diameter is 40mm.

Discharge water 130 l/min

Pressure is 0.29 MPa

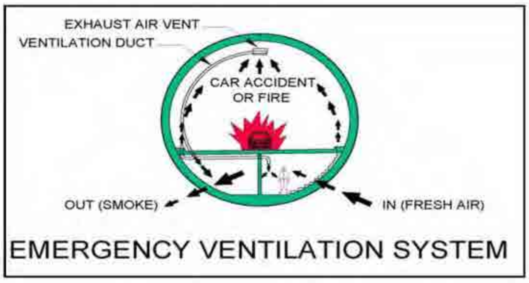
Table 9.8-3 Rough Estimated Quantities of Fire Control Equipment (Entire Section)

Description	Quantity (pieces)	Setting interval
(a) Fire Extinguisher	860	50 m
(b) Fire Hydrant	860	50 m

(3) Evacuation Facilities

Evacuation facilities shall be provided for vehicle passengers who need to evacuate from the tunnel due to fire and any accidents or troubles. Evacuation passages shall go down first to intake ventilation duct under the deck slab and run to the ventilation vertical shaft or exit or entrance ramps. Electrical system in the intake duct will provide automatic switch-on systems once refugees open the door of emergency entrance. Control room shall be responsible for safe evacuation of refugees to the ground from intake ventilation duct utilizing monitoring cameras and loudspeakers. **Table 9.8-4** Show rough estimated quantities of evacuation facilities

1) Sign Board



2) General Concept of Emergency Exit

Table 9.8-4 Rough Estimated Quantities of Evacuation Facility (Entire Section)

Description	Quantity (pieces)	Setting interval
(a) Signboard	430	100 m
(b) Smoke ventilation	4,200	10 m
(c) Exit facilities	430	100 m

(4) Other facilities

Other facilities are information system, warning facilities, fire extinguishing facilities and refugee instruction facilities.

1) Hydrant Cock and Siamese Connection

Hydrant cock is used for full-scale extinguishing of a fire by the firefighter. In addition, a Siamese connection for water supply from firefighting pump to the hydrant cock in the tunnel shall be provided as needed.

Requirement of hydrant cock is 65 mm diameter and 400 t/min of water discharge with 0.29 MPa discharge pressure considering two hydrant cocks used simultaneously.

Size of water tank to be considered shall be for 40 minutes of continuous discharge of water by two hydrant cocks.

2) Radio Communication Facility

This facility shall be used for communication between tunnel and ground during the activity of fire extinguishing, evacuation, etc.

3) Radio Repeat and Loudspeaker Communication Facility

This facility is used to give any information to the road user from the control room.

Radio repeat facilities

Loudspeaker

4) Water Spray System (Fire Sprinkler)

These facilities spread out particle-shaped water from tunnel ceiling to protect against the spread of fire and support fire extinguishing activities. One discharge section should be a minimum of 50 m and the discharge water volume is 6 l/min m^2 as standard

Fire Sprinkler

5) CCTV Camera

The purpose of CCTV camera is to monitor conditions in the tunnel. CCTV camera should be provided with automatic detection system. Which shall deliver warning/information to control room using warning lights and sound once any abnormal situation in the tunnel is identified. Proposed distance between CCTV cameras is 100m as standard.

6) Control Room

Control rooms with monitoring and control facilities shall be installed at ventilation towers which are located nearest both entrances and exits. Control room operation should provide efficient monitoring and information systems with monitoring screens, control panel and other necessary equipment and facilities.

Table 9.8-5 Rough Estimated Quantities of Other Emergency Facilities (Entire Section)

Description	Quantity(pieces)	Setting interval
(a) Hydrant Cock and Siamese Connection	215	200 m
(b) Radio Communication	66	500 m
(c) Radio Repeat or Loudspeaker	66	500 m
(d) Water Spray System	14,300	3 m
(e) CCTV Camera	430	100 m
(f) Control Room	2	Big, End

Source: JICA Study Team

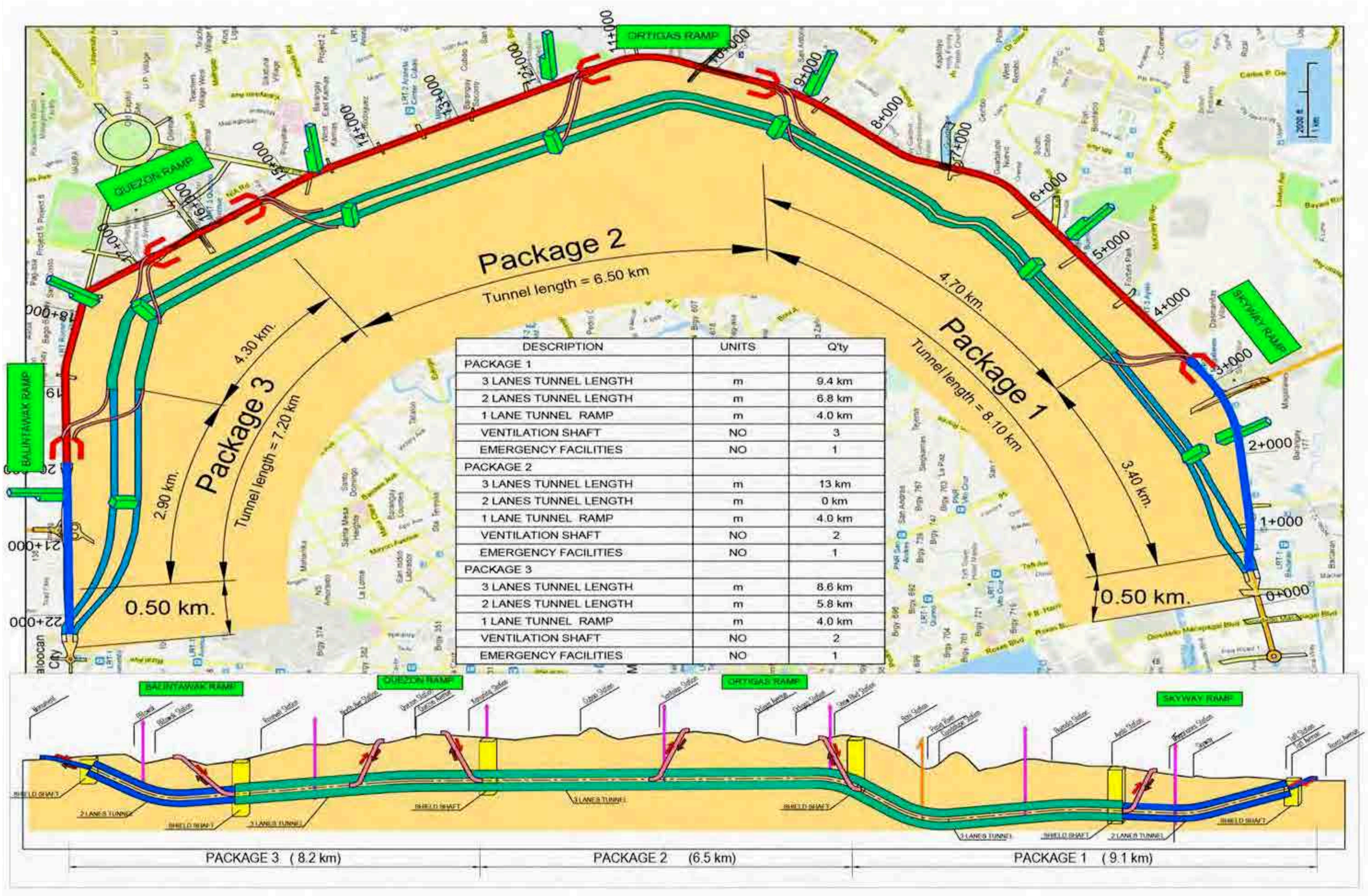
9.8.7 Construction Schedule

(1) Construction Packages

In consideration of budget and traffic management, the 22.8 km total length of tunnel shall be divided into three packages as follows:

Package 1 : Beginning point to Ortigas Avenue, 8.6 km
Package 2 : From Ortigas Avenue to Quezon Avenue, 6.5 km
Package 3 : From Quezon Avenue to end point, 7.7 km

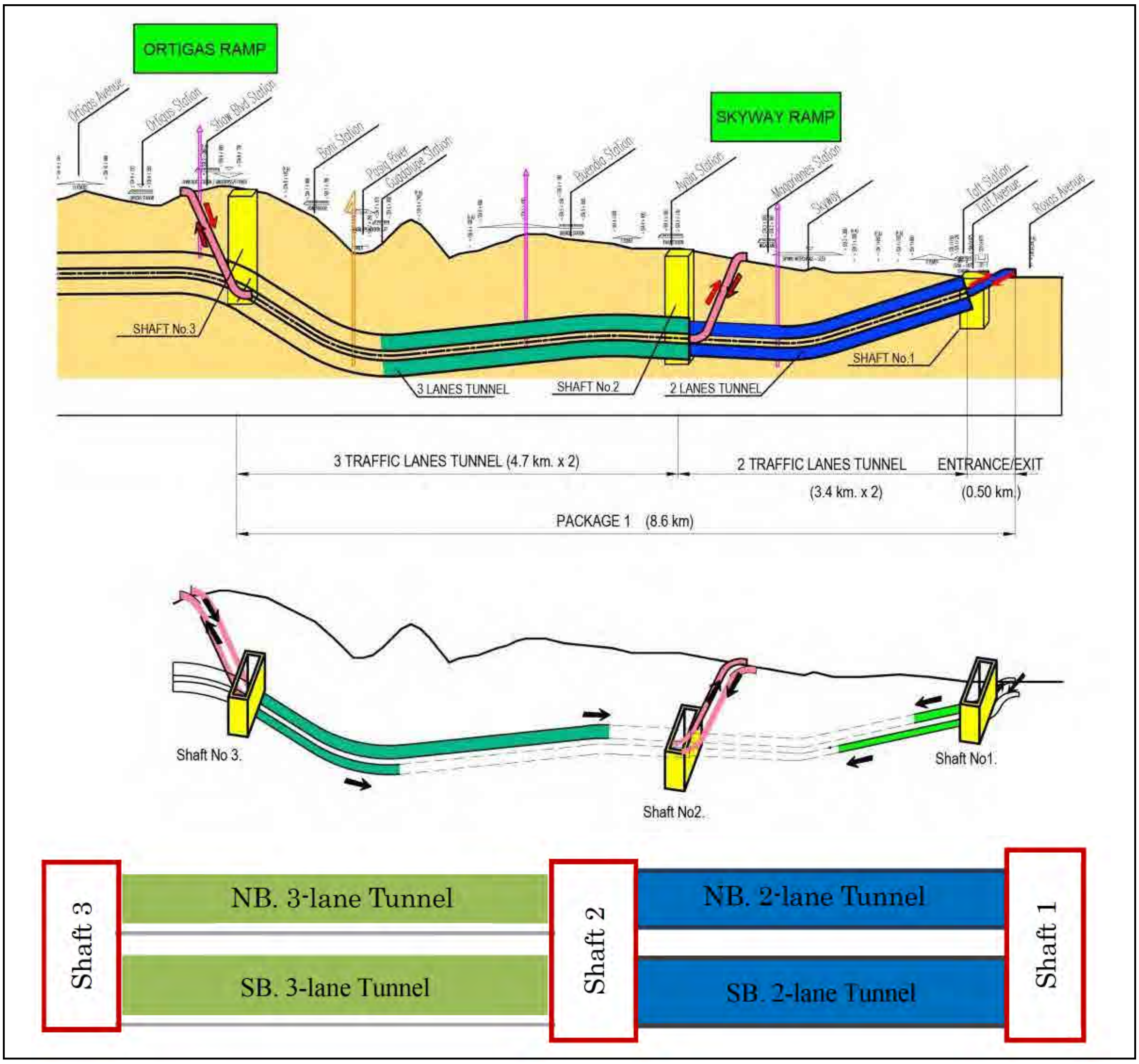
Figure 9.8-8 shows the plan and profile of the three packages and **Figure 9.8-9** presents the construction concept of Package I).



DESCRIPTION	UNITS	Q'ty
PACKAGE 1		
3 LANES TUNNEL LENGTH	m	9.4 km
2 LANES TUNNEL LENGTH	m	6.8 km
1 LANE TUNNEL RAMP	m	4.0 km
VENTILATION SHAFT	NO	3
EMERGENCY FACILITIES	NO	1
PACKAGE 2		
3 LANES TUNNEL LENGTH	m	13 km
2 LANES TUNNEL LENGTH	m	0 km
1 LANE TUNNEL RAMP	m	4.0 km
VENTILATION SHAFT	NO	2
EMERGENCY FACILITIES	NO	1
PACKAGE 3		
3 LANES TUNNEL LENGTH	m	8.6 km
2 LANES TUNNEL LENGTH	m	5.8 km
1 LANE TUNNEL RAMP	m	4.0 km
VENTILATION SHAFT	NO	2
EMERGENCY FACILITIES	NO	1

Source: JICA Study Team

Figure 9.8-8 Plan and Profile of the 3 Packages



Source: JICA Study Team

Figure 9.8-9 Construction Concept of Package I

(2) Construction Schedule

1) Relocation of utilities underground and aboveground.

2) Construction and setting of shield departure shaft and facilities at construction yard

3) Assembly of main tunnel shield machine inside departure shaft and start excavation.

4) (2 units of D = 13.3 m 3-lane shield machines are deployed at Shaft 3 towards shaft 2 and 2 units of D = 10.1 m 2-lane shield machines are deployed at Shaft 1 towards Shaft 2).

5) Ramp tunnel shield is deployed from shaft after main tunnel shield is completed. (Shield machine D = 6.6 m requires 4 units. 2 units are deployed at shaft 2 and other 2 units are deployed at shaft 3.)

6) Connect Main tunnel and ramp tunnel at underground after ramp shield tunnel completed.

7) Construct carriage way concrete slab and other items for highway in the tunnel.

8) Construct ventilation shaft and other civil works.

9) Setting and fixing of equipment and facilities for monitoring and operation of tunnel.

10) Open to public traffic.

(3) Overall Construction Schedule

Based on previous experience of the past project in Japan, Consultant's proposed schedule is shown in **Table 9.8-6** Rough Estimated Construction Schedule.

Table 9.8-6 Rough Estimated Construction Schedule

Year Description		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Package 1																					
Construction	Design & Bidding	■	■																		
	Land Acquisition		■																		
	Preparations			■																	
	Shaft				■																
	Tunnel work					■	■														
	Tunnel connection						■	■													
	Civil Works						■	■													
	Facilities								■												
Package 2																					
Construction	Design & Bidding							■	■												
	Land Acquisition								■												
	Preparations									■											
	Shaft										■										
	Tunnel work											■	■								
	Tunnel connection												■	■							
	Civil Works												■	■							
	Facilities														■						
Package 3																					
Construction	Design & Bidding													■	■						
	Land Acquisition														■						
	Preparations															■					
	Shaft																■				
	Tunnel work																	■	■		
	Tunnel connection																		■	■	
	Civil Works																		■	■	
	Facilities																				■

Source: JICA Study Team

Note:

1) Conditions for preparation of above rough estimated schedule

a) Excavation by one shield machine is estimated 18m/day which does not include period of assembly and dismantling of shield machine and maintenance and replacement of parts of shield machine.

b) Maintain five lanes per direction at-grade traffic along EDSA.

c) ROW acquisition to be completed before implementation starts.

2) Issues

a) To find out disposal area of 7 million m^3 of excavated soil.

b) Requires traffic management due to mobilization of big number of trucks, trailer and, concrete mixer trucks, etc.

c) Rough estimated quantities for 3 type tunnel are shown in the table below.

Description	3 Traffic Lanes	2 Traffic Lanes	1 Traffic Lane
Tunnel length	15.5 km x 2 = 31.0 km	6.3 km x 2 = 12.6 km	6.0 kmx 2 = 12.0 km
Segment	T = 650 mm	T = 650 mm	T = 350 mm
Segment Concrete	884,000 m^3	254,000 m^3	56,000 m^3
Slab Concrete	167,000 m^3	48,000 m^3	12,000 m^3
Excavation	5,201,000 m^3	1,259,000 m^3	519,000 m^3

i) Major quantities per day per one shield machine (3-lane)

Volume of excavation per day : $3.14 \times 6.56^2 \times 18m = 2.432m^3/day$

Pre-cast Segment 9^{ton}/pieces : $(1.5^m \times 3.8^m \times 0.65^m) = 72$ pieces/day

Concrete : $227.000m^3/730$ day x 0.86 = $360m^3$/day

ii) Required transportation of major three (3) heavy equipments per day

Dump trucks : $2.432m^3 \div 6m \div 4$ round trip = 101 trucks → 404 travel times

Trailer : 72 pieces÷1 piece÷4 round trip=18 trailers → 72 travel times

Concrete mixer truck : 360 $m^3 \div 6m3 \div 4$ roundtrip = 15 mixer trucks → 60 travel times

iii) Required ROW acquisition and Lease of Land

✓ ROW acquisition

Ramp : $10,000m^2$ x 12 ramps = 120,000 m^2

Ventilation : $2,100m^2$ x 7 ventilation = 14,700 m^2

Vertical Shaft : $250m^2$ x 12 shaft = 3,000 m^2

Total 177,700 m^2

✓ Lease of land

Vertical Shaft : $3,000m^2$ x 12 = 36,000 m^2

9.8.8 Cost Estimate

(1) Condition for Cost Estimation

1) Rough cost will be estimated based on completed projects and the past experiences in Japan considering site condition of EDSA

2) Exchange rate between peso and yen is 1 peso = 1.90 yen

3) 10 m x 1,000 m = 10,000 m of ROW acquisition of ramp will be considered to acquire entire section instead of lease.

4) Vertical shaft will be constructed phase by phase to minimize traffic congestion along EDSA and present five lanes traffic and side walk are maintained during the construction providing steel temporary deck plate on the top of vertical shaft. Part of vertical shaft will be purchased instead of leased since part of them is to be used for concrete structure underground after the completion of the project. 3,000 m^2 of temporary construction yard beside the vertical shaft will be leased for stock yard of excavated soil and delivered pre-cast concrete, and for delivering and carrying out construction materials and equipment.

5) Land acquisition will be considered for ventilation shaft.

6) 26% is commonly used as indirect cost for general construction projects in the Philippines but 30% will be used as indirect cost this time since tunnel is constructed for the first time at the Urban City in the Philippines.

7) Cost will roughly be estimated in the following five schemes:

Scheme 1	Entire Section of both directions		
	Main tunnel (3-lane)	:	15.5 km x 2-direction
	Entrance/exit at both end (2-lane)	:	7.3 km x 2-direction
Scheme 2	Package-1 of Scheme-1		
	Main tunnel (3-lane)	:	4.7 km x 2 direction
	Entrance/exit (2-lane)	:	3.9 km x 2 direction
Scheme 3	Only one (1) direction of scheme-1		
	Main tunnel (3-lane)	:	15.5 km x 1-direction
	Entrance/exit at both end (2-lane)	:	7.3 km x 1-direction
Scheme 4	Construct 2-lane for both directions		
	Maintain tunnel (2-lane)	:	22.8 km x 2-direction
Scheme 5	Only one (1) direction of scheme-4		
	Main tunnel (2-lane)	:	22.8 km x 1-direction

8) Summary of roughly estimated cost of each scheme is as shown in **Table 9.8-7**, roughly estimated operational cost in **Table 9.8-8** and proposed organization for operation and maintenance in **Figure 9.8-10**.

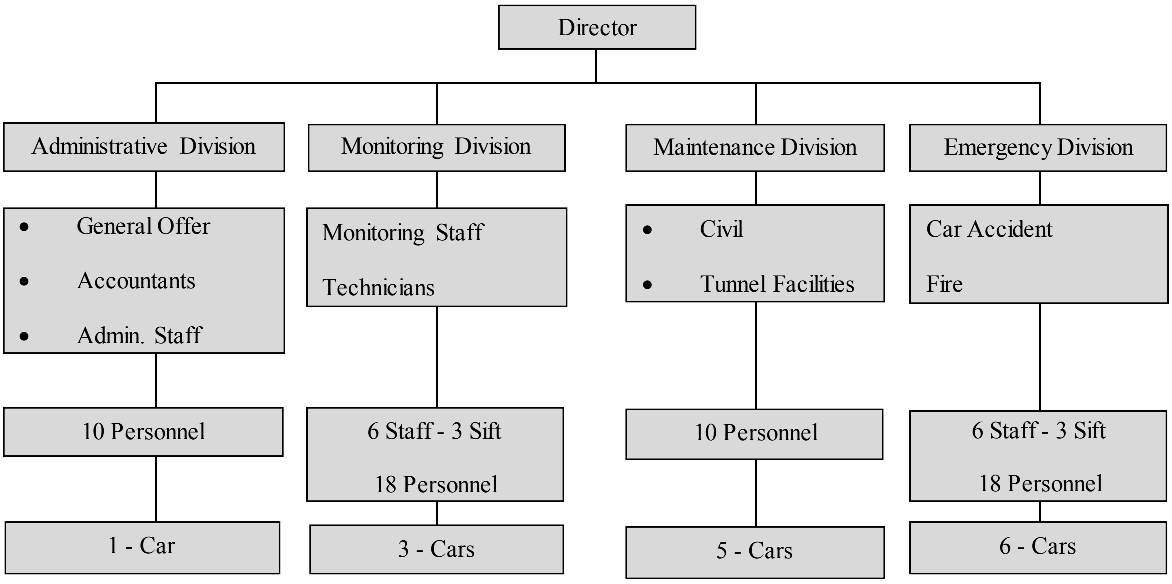
Breakdown of cost estimation of each schemes are presented in **Appendix 9.5**.

Table 9.8-7 Summary of Rough Estimate Cost of Each Schemes

(Unit: 100 M Yen/Peso)

Description	Sceheme-1		Scheme-2		Scheme-3		Scheme-4		Sceheme-5	
	Entire Section of both directions Main Tunnel (3-Lanes) = 15.5km x 2 directions Entrance/Exit at both end 2-Lanes = 7.3km x 2 directions		**Package 1 of Scheme-1** Main Tunnel (3-Lanes) = 4.7km x 2 directions Entrance/Exit at both end 2-Lanes = 3.9km x 2 directions		**Only (1) Direction of Scheme-1** Main Tunnel (3-Lanes) = 15.5km 1-direction Entrance/Exit at both end 2-Lanes = 7.3km 1-directions		**Construct 2-lane Tunnel both Direction** Main Tunnel (2-lanes) = 22.8 km x 2 directions		**Only (1) Direction of Scheme-4** Main Tunnel (2-lanes) = 22.8 km 1-directions	
	Yen	Peso	Yen	Peso	Yen	Peso	Yen	Peso	Yen	Peso
1. Construction Cost										
A. Direct cost	4,549	2,431	1,688	902	2,377	1,271	3,360	1,797	1,743	933
Main tunnel	2,779	1,486	971	519	1,389	743	1,873	1,002	937	501
Ramp Tunnel	960	513	384	205	480	257	960	513	480	257
Shield shaft	73	39	37	20	37	20	37	20	18	10
Ventilation shaft	480	256	206	110	343	183	312	167	218	117
Facilities	257	137	90	48	128	68	178	95	90	48
B. Genral Cost	90	48	34	18	48	26	68	36	34	18
Traffic Management (1% of A)	45	24	17	9	24	13	34	18	17	9
Utility Relocation (1% of A)	45	24	17	9	24	13	34	18	17	9
C. Indirect cost (30% of A+B)	1,392	744	517	276	728	389	1,028	550	533	285
D. Sub total (A + B +C)	6,031	3,223	2,239	1,196	3,153	1,686	4,456	2,383	2,310	1,236
E. VAT (12% of D)	724	387	269	144	378	202	535	286	277	148
F. Construction cost (D+E)	6,755	3,610	2,508	1,340	3,531	1,888	4,991	2,669	2,587	1,384
G. Consultancy Cost (10% of F)	676	361	251	134	353	189	499	267	259	138
H. Land acquisition including compensation	586	313	214	114	304	162	523	278	277	147
for structures										
I. Contingency Cost (5% of F+G)	372	199	138	74	194	104	275	147	142	76
Total Cost (F+G+H+I)	**8,389**	**4,483**	**3,111**	**1,662**	**4,382**	**2,343**	**6,288**	**3,361**	**3,265**	**1,745**

Source: JICA Study Team



Source: JICA Study Team

Figure 9.8-10 Proposed Organization for Operation and Maintenance

Table 9.8-8 Rough Estimated Operational Cost

Description	Unit Cost (MP/mon.)	Cost/Year	
a. Office Operation and Maintenance	P 200,000	MP 2.4	2.52%
b. Personnel Salary	61 Personnel x P 50,000 = P 3,050,000	MP 36.6	38.36%
c. Operation and Maintenance of cars use for monitoring and emergency	15 - Cars x P100,000 = P 1,500,000	MP 18.0	18.87%
d. Maintenance of tunnel equipment and monitoring facilities	P 2,000,000/mon.	MP 24.0	25.16%
e. Electricity fee for office and tunnel	Office - P200,000 Tunnel - P 1,000,000 Halogen High Pressure Sodium Ramp and others	MP 2.4 MP 12.0	2.52% 12.58%
Total		MP 95.4	100.00%

Source: JICA Study Team

CHAPTER 10

SEMINAR ON LATEST JAPANESE ROAD AND BRIDGE CONSTRUCTION TECHNOLOGY

10.1 OBJECTIVES

The objective of the seminar is to introduce the latest Japanese technologies on road and bridge construction for understanding technical supervision of STEP scheme for the proposed flyover project and also Filipino engineers for them to apply the same in on-going and future projects they are implementing and will implement. There technologies are related to tunnel construction, asphalt pavement, rapid construction methods, bridge rehabilitation and improvement and quality control systems.

10.2 SEMINAR PROGRAM

Venue : H_2O Hotel, Manila City Date : March 6 and 7, 2012

- Day 1 (6th March)

TIME	PROGRAM/TOPICS		SUB-TOPICS	SPEAKER
8:30 - 9:00	Registration		-	DPWH Secretariat / KEI
9:00 - 9:05	Philippine National Anthem		-	
9:05 - 9:15	Message		-	DPWH Secretary Rogelio L. Singson
9:15 - 9:20	Welcome Address		-	Mr.Takahiro SASAKI Chief Representative JICA PHILIPPINES OFFICE
9:20 - 9:50	Statement / Briefing		Road Infrastructure Plans for Metro Manila	DPWH Assistant Secretary Maria Catalina E. Cabral
9:50 - 10:10	*Break Time & Photo Session*			
10:10 - 10:40	Seminar-1	Introduction of Japanese Road Technologies	-	Mr.Tomohiro HASEGAWA Director for International Affairs, Road Bureau Ministry of Land, Infrastructure, Transport and Tourism(MLIT)
10:40 - 10:50	*Break Time*			
10:50 - 11:10	Seminar-2	Tunnelling Construction Techniques	1. Urban Tunnels (Harmonica Construction, Jacking and Shield Methods)	Mr.Yutaka HIBIYA The Overseas Construction Association of Japan, Inc. (TAISEI CORPORATION)
11:10 - 11:30			2. Mountain Tunnels (NATM)	Dr.Satoru AMANO The Overseas Construction Association of Japan, Inc. (OBAYASHI CORPORATION)
11:30 - 11:50			Question / Answer	
11:50 - 13:20	*Lunch Time*			
13:20 - 13:40	Seminar-3	Pavement Technology	1. Pavement Quality Control During Construction	Dr.Tsutomu ISHIGAKI The Japan Road Contractors Association (NIPPO CORPORATION)
13:40 - 14:00			2. Porous Asphalt Pavement and Advanced Pavement Technology	Dr.Katsura ENDO The Japan Road Contractors Association (NIPPON ROAD CO.,LTD.)
14:00 - 14:20			3. Pavement Management in NEXCO	Dr.Keizo KAMIYA NIPPON EXPRESSWAY RESEARCH INSTITUTE CO.,LTD.
14:20 - 14:50			Question / Answer	
14:50 - 15:00	Information		-	Mr.Yuuki ARATSU Deputy Director General, and Group Director for Transportation and ICT JICA Economic Infrastructure Department

- DAY2 (7th March)

TIME	PROGRAM/TOPICS		SUB-TOPICS	SPEAKER
8:30 - 9:00	Registration		-	DPWH Secretariat / KEI
9:00 - 9:20	Seminar-4	Rapid Construction Methods (Concrete Bridge)	1. Rapid Bridge Construction Method Applying Precast Segments	Mr.Hideyuki TAKEDA The Overseas Construction Association of Japan, Inc. (KAJIMA CORPORATION)
9:20 - 9:30			Question / Answer	
9:30 - 9:40	*Break Time*			
9:40 - 9:50	Seminar-5	Rapid Construction Methods (Steel bridge)	1. Introduction of the Japan Bridge Association	Mr.Ichiro KITAGAKI THE JAPAN BRIDGE ASSOCIATION Director Chairman of International Business Special Committee (KOMAIHALTEC INC.)
9:50 - 10:10			2. Viaduct in Urban Area and Steel Structures	Mr.Taku HIRAI THE JAPAN BRIDGE ASSOCIATION International Business Special Committee (YOKOGAWA BRIDGE CORPORATION)
10:10 - 10:30			3. Rapid Construction of Steel Bridges	Mr.Hideyuki KAMAI THE JAPAN BRIDGE ASSOCIATION International Business Special Committee (MITSUI ENGINEERING & SHIPBUILDING CO.,LTD.)
10:30 - 10:50			4. Chronology of Seismic Design Criteria and Survey Report of the Great East Japan Earthquake	Mr.Tatsuhiko KASAI THE JAPAN BRIDGE ASSOCIATION Executive Head of Maintenance Committee (MIYAJI ENGINEERING , INC.)
10:50 - 11:20			Question / Answer	
11:20 - 12:50	*Lunch Time*			
12:50 - 13:10	Seminar-6	Bridge Rehabilitation and Improvement Technology	1. Repair and Reinforcement of Concrete Bridge Technology & Seismic Resistance and Isolation Technology	Mr.Yoshihiko TAIRA The Overseas Construction Association of Japan, Inc. (Sumitomo Mitsui Construction Co., Ltd)
13:10 - 13:30			2. Maintenance of Steel Bridges and Urban Expressway Management	Mr.Hiroyuki WADA METROPOLITAN EXPRESSWAY CO.,LTD.
13:30 - 13:50			Question / Answer	
13:50 - 14:00	*Break Time*			
14:00 - 14:20	Seminar-7	Quality Control System Technology	1. Quality Control of Highway and Bridge Construction	Mr.Nobuhiro HONDA The Overseas Construction Association of Japan, Inc. (SHIMIZU CORPORATION)
14:20 - 14:30			Question / Answer	
14:30 - 14:40	Fill up Questionnaire		-	DPWH Secretariat / KEI
14:40 - 14:50	Wrap-up		Conclusion and Recommendations	DPWH Under Secretary Raul C. Asis
14:50 - 15:00	Closing Statement		-	Mr.Yuuki ARATSU Deputy Director General, and Group Director for Transportation and ICT JICA Economic Infrastructure Department

Attendance

(1) PHILIPPINES

The participants of the seminar from DPWH and other Offices are shown in Table below:

Attendance	Day 1 (March 6, 2012)	Day 2 (March 7, 2012)
DPWH		
1. Secretary Rogelio L. Singson	-	1
2. Under Secretary Rafael C. Yabut	1	1
3. Under Secretary Jaime A. Pacanan	1	1
4. Under Secretary Raul C. Asis	1	1
5. Under Secretary Romeo S. Momo	1	1
6. Assistant Secretary Roy L. Manao	-	-
7. Assistant Secretary Dimas S. Soquilon	1	-
8. Assistant Secretary Alfredo G. Tolentino	1	1
9. Assistant Secretary Eugenio R. Pipo Jr.	1	1
10. Assistant Secretary Maria Catalina E. Cabral	1	1
Regional Directors		
1. Cordillera Administrative Region	1	1
2. Region 1	1	1
3. Region 2	1	1
4. Region 3	1	1
5. Region 4A	1	1
6. Region 4B	1	1
7. Region 5	1	-
8. Region 6	1	1
9. Region 7	1	1
10. Region 8	1	1
11. Region 9	1	1
12. Region 10	1	1
13. Region 11	1	1
14. Region 12	1	1
15. Caraga Region	1	1
16. National Capital Region	1	1
Bureau/Service Directors		
1. Bureau of Design	3	3
2. Bureau of Construction	3	3
3. Bureau of Research and Standards	1	1
4. Bureau of Maintenance	2	2
5. Planning Service	4	4
Project Management Office		
1. Feasibility Studies	5	5
2. Urban Roads Project Office	4	4
3. Philippine Japan Highway Loan Project	2	2
4. Built Operate Transfer Office	2	2
5. National Road Improvement and Management Project	-	1
6. Urgent Bridge	2	2

Attendance	Day 1 (March 6, 2012)	Day 2 (March 7, 2012)
7. Asian Development Bank	2	2
8. Flood Control and Sabo Engineering Center	1	1
9. Special Bridge	2	2
10. National Capital Region	3	3
Government Agencies		
1. UP-National Center for Transportation Studies	1	1
2. National Economic and Development Authority	1	1
3. Department of Transportation and Communication	1	1
4. Metro Manila Development Authority	1	1
Local Government Units		
1. Las Piñas City	1	-
2. Makati City	1	1
3. Marikina City	1	1
4. Taguig City	1	-
5. Valenzuela City	1	1
6. San Juan City	1	1
7. Caloocan City	1	1
8. Muntinlupa City	1	1
9. Pasig City	1	1
10. Mandaluyong City	1	1
11. Manila	1	1
12. Cebu	2	2
Private Institutions and Academe		
1. University of the Philippines	1	1
2. La Salle University	1	1
3. Mapua Institute of College	1	1
4. Transportation Science Society of the Philippines	2	-
5. Philippine Constructors Association	2	2
Total	**84**	**80**

(2) JAPAN

The list of the resource Speakers are shown in the table of Seminar Program. The participants from the Japanese embassy, JICA Office and the Ministry of Land Infrastructure and Transport are listed hereunder:

Ministry of Land Infrastructure, and Transport and Tourism Director Overseas Project Division Policy Bureau Mr. Yuichi Ishikawa
Embassy of Japan in the Philippines Second Secretary Economic Affairs (Infrastructure Department) Mr. Akio Yonezawa
JICA Head Office Deputy Director General for Transportation and ICT Economic Infrastructure Department Mr. Yuki Aratsu

JICA Head Office Deputy Director for Transportation and ICT Group Economic Infrastructure Department Mr. Takanori Fukui
JICA Head Office Southeast Asia Division 5, Southeast Asia and Pacific Department Mr. Eiichi Murashima
JICA Manila Office, Chief Representative Mr. Takahiro Sasaki
JICA Manila Office, Deputy Assistant Director Operation Planning Division 2 Operation Strategy Department Mr. Kota Yasumura
JICA Expert Mr. Kazumasa Atarashi

10.3 QUESTION AND ANSWER RESULTS

10.3.1 Q &A Seminar 1 and 2- Tunneling Construction Techniques

1. Q: How would you compare the cost of tunnel construction versus the elevated structure?

   A: It depends on the condition of the situation. Basically the mobilization of equipment to be utilized for tunneling is more expensive than bridge construction.

2. Q: How do you maintain tunnels in urban areas? For example, in leakage of water or something like this?

   A: With regard to maintenance work pertaining to leakage of water, we allocate one lane for the maintenance work while the other lane is utilized for the existing vehicle traffic.

3. Q: With regard to the earthquake, is mountain tunnels earthquake proof design being considered?

   A: In Japan, the design method against earthquake proof design is very rare. Since Japan and the Philippines have similar situation as both countries are located in the Pacific Ring of Fire, Japanese earthquake design method and technology can be also applied to the Philippine design and construction technology.

4. Q: Was there any Japanese Technology applied to the construction of Smart Tunnel in Kuala Lumpur?

   A: I don't have any idea about this but the result of this construction method can also be observed in Japan in the future.

5. Q: How much would it cost to design a tunnel in terms of percentage to the total construction cost?

   A: Tunnels design is about less than 10% of the total cost of construction though it depends on the condition and length of tunnel to be designed.

6. Q: Can tunneling works be applied to all types of soil?

   A: With regard to shield tunnel method, it depends on the soil and ground condition, we have different types of used of extracting machine. Of course tunneling method can be applied to all type of soil on each particular condition with varying types of machine and methodology.

7. Q: How much would it cost per linear meter of a tunnel? (Just a rough estimate)

   A: For a 2 lanes tunnel, the estimated cost is about 3 to 4 billion yen. When converted to Philippine peso, the cost may be 1.5-2 billion pesos per linear meter.

8. Q: Do the road tunnels presented belong to the category of expressways?

   A: No, they are not expressways, they are only local roads.

9. Q: What is the maximum slope for the approach on tunnel?

   A: Maybe 4 to 5% but it depends on the purpose. Slope is determined based on the geometric requirement of highways.

10.3.2 Q &A Seminar 3- Pavement Technology

1. Q: How much is the average toll rate per km Expressways in Japan?

   A: About 85% of the toll road users in Japan are equipped with ETC on their vehicles and it cost per kilometer is about 10,000-15,000 yen. However, I have no idea if the government gives subsidy for the operation of ETC.

2. Q: If the IRI reached 3.5, will you do the repair accordingly?

   A: 3.5 IRI already require necessary rehabilitation. We have to observe some points in order to arrive at the right IRI.

3. Q: Do you think that porous asphalt will still be effective in the Philippines under the wet and very wet weather?

   A: Japan has rainy season like the Philippines. So I think porous asphalt will be able to achieve good condition even during the heavy rainy season.

4. Q: Is there any acceptable standard on Roughness Index on porous asphalt?

   A: In Japan, our level of limitation is as same as the conventional one. I would like to say that the IRI at 2-2.5 is better but if it is a very large one for the consultant side, we use 11.0 or less for the initial value of IRI.

5. Q: Considering the temperature that we have, the weather and the materials, which do you think is the most appropriate or would improve our pavement technology?

   A: I would like to say everything. I mean it depends on what do you want for the warm mix asphalt. For water retaining pavement, temperature is 10-15°C but we have to give particular attention to the quality control.

6. Q: How hot is the warm mix asphalt and how hot is the hot mix asphalt? Is there a stage wherein the hot mix asphalt becomes cooler and what are the advantages?

   A: For hot mix asphalt, the temperature is 160°C or something like that. For warm mix asphalt, the temperature is 130°C. On the other hand, the temperature used for asphalt in ultra-modified asphalt is 170 or 180°C. Therefore, the temperature for warm mix asphalt using the ultra-modified one is 140 or 150°C. It is 30°C below the normal hot mix asphalt.

10.3.3 Q &A Seminar 4- Rapid Construction Methods (Concrete Bridge)

1. Q: In Japan, you say you are going to construct a segmental box girder. Do you specify the construction methodology in the plan or you require your contractor decide the construction methodology?

   A: The Engineers will basically decide as to which design or what kind of construction method should be adopted or whether they would fit for a particular location. It includes the cost, estimates, and the environment. In most of the cases, other contractors are required to provide some options or alternatives. Usually, the method is already determined before we accept the job.

2. Q: In the bridge that was constructed in SCTEX, how usual routine maintenance is done?

   A: We remove the painting from the steel surface of the bridge, and thereafter make some observations. Usually the girder fabricated in Japan doesn't destroy any paintings as it made from special materials.

10.3.4 Q &A Seminar 5- Rapid Construction Methods (Steel Bridge)

1. Q: In the Rapid Steel Bridge Construction, are the erection tools, facilities and girder included in the total construction cost or not?

   A: Actually, cost for bridge erection itself is relatively high. It may be at 10% or 20% of the total construction cost. Rapid Construction Method uses special equipment with a huge transportation vehicle cost will result in a very high cost.

2. Q: Regarding the erection by conventional method, in this case, how much is it in Philippine Peso, the construction cost per bridge using steel or concrete per linear meter?

   A: Unfortunately we are not familiar with the situation in the Philippines right now. Such kind of question may be answered by Katahira people. In Japan, in cases of Urban Highway Bridge Construction, maybe 60-70% of them are steel structure while 40% are concrete. Steel bridges are more expensive than concrete bridges. The government will decide as to what particular structure will be constructed.

3. Q: In your presentation, you don't use any piles for bridge foundation. I saw in your presentation that you are applying movement method for bridge foundation. I am just wondering if these techniques are applicable to all types of soil and how do you consider the liquefaction in the ground to your design?

   A: Unfortunately, I'm not a specialist in geotechnical work but in my little knowledge on the presented project soft soil underneath of the spread foundation will be strengthened by injecting batch in order to sustain the weight of the superstructure of the steel. So such kind technique seems to be effective in this kind of project. In addition, span arrangement depends on the underground condition. Therefore, the consultant will have to study in detail at the site.

4. Q: I noticed that the utilities were directly located under the bridge. They are normally placed outside of the carriageway. Could you explain why they were placed there?

   A: In Japan, special utility facilities such as sewage pipe and gas pipeline are placed underneath the road and not on the housing area. The gas pipeline is already paved with steel or concrete bridges and they are usually in good condition. Therefore, there is no need to excavate these in order to observe such facility.

5. Q: With regard to the pre-cast segment concrete base construction, it was noted in your presentation that segment was further splitted into pieces. Is this considered in the design? Because splitting of segment may add more construction joints and I'm wondering if it will make the structure bigger?

   A: Further splitting will not affect structural integrity at all. We can study the effects of splitting of those structures. Usually, the biggest concern is on the transportation of the segments because if the segment is 15m in width or 4 or 5m in height, we need to consider the weight during the transportation.

6. Q: Based on the presentation, can the steel cantilever bridge be handled at a 4 to 6 lane or just 2 lanes?

   A: Steel cantilever can be handled only at 2-lane because the handling at 6-lane is not so easy for this kind of design. This design has been also used for railway project.

10.3.5 Q &A Seminar 6- Bridge Rehabilitation and Improvement Technology

1. Q: Referring to Slide 9, how do you classify serious damage? For example, what are those serious damages that are Ranked A and will they need immediate repair?

   A: Structures with serious damage are subject to a more detailed evaluation of various defects. We can evaluate each damages even other separate standard evaluation criteria.

2. Q: Based on Slide 34, with respect to the maintenance activities linking with data systems, can

you tell this system briefly and how much is this system?

A: We exert a lot of time for this system and if we found any error in this system, we change it. For now, we do not experience any maintenance work so I cannot state how much this kind of maintenance system is.

3. Q: Referring to Slide 34, particularly on the chart of the data system, are the data inputted into this data system taken from the observed data gathered during visual inspection or taken from non-destructive construction?

A: In our case, we don't have enough staff so we contracted an Inspection Company. Basically, the inspections conducted are mostly visual inspection. However if inspection is not sufficient or adequate to detect the damage, we use ultrasonic equipment resolution and other available modern devices.

4. Q: With respect to the presentation of widening of bridge, is it possible only for a box girder base?

A: It depends on the situation and we can use box girder on this structure.

5. Q: With respect to the repair work on liquefaction, is this practiced for an elevated highway or an up-graded highway?

A: No, it is only for fly-over but we have 5% ground-level highway.

10.3.6 Q &A Seminar 7- Quality Control System Technology

1. Q: One of the innovative techniques that you have presented is the use of urea granules for reducing cracks on concrete, can you explain further this technique?

A: Urea granules are additives now used as admixtures. It reduces two types of cracks: (1) Temperature cracks caused when temperature decreases and (2) Shrinkage cracks- caused when moisture evaporation reduces. These granules are already available in the market.

10.4 SUMMARY AND ANALYSIS OF QUESTIONNAIRE

The answers given on the questionnaire sheets showed the participants' high interest on the high level of technology that was imparted by each topic, as well as their satisfaction on the management of the Seminar as a whole.

In view of the above, the Seminar was successfully held.

The Survey Questionnaire containing 39 questions, which were distributed to the attendees are summarized below.

Q1- In this seminar, which subject that interests most?

Answers are Summarized answers hereunder:

	Subject	No.1	No.2	No.3	Total	Share (%)
Seminar – 1	Introduction of Japanese Technologies	0	1	3	4	3.9
Seminar – 2	Tunneling Construction Techniques	17	6	5	28	27.2
Seminar – 3	Pavement Technology	9	12	7	28	27.2
Seminar – 4	Rapid Construction Method (Concrete Bridge)	4	5	3	12	11.6
Seminar – 5	Rapid Construction Method (Steel Bridge)	7	7	7	21	20.4
Seminar – 6	Bridge Rehabilitation and Improvement Technology	0	3	3	6	5.8
Seminar – 7	Quality Control System	0	0	4	4	3.9
Total		**37**	**34**	**32**	**103**	**100.0**

The above summary shows that, the most interesting topic discussed during the seminar was on Tunneling Construction Technology which was ranked first with 17 points. The second most interesting topic is Pavement Technology while Rapid construction Method is ranked third.

Q2- What type of seminar would you consider in the future and why?

Answers are summarized here in under:

	Subject	No.1	No.2	Total	Share (%)
Seminar – 1	Introduction of Japanese Road Technologies	2	0	2	3.4
Seminar – 2	Tunneling Construction Techniques	10	4	14	24.2
Seminar – 3	Pavement Technology	10	6	16	27.6
Seminar – 4	Rapid Construction Method (Concrete Bridge)	4	4	8	13.8
Seminar – 5	Rapid Construction Method (Steel Bridge)	8	5	13	22.4
Seminar – 6	Bridge Rehabilitation and Improvement Technology	2	1	3	5.2
Seminar – 7	Quality Control System	1	1	2	3.4
Total		**37**	**31**	**58**	**100.0**

Based on the above summary, Tunneling Construction Techniques (1st), Pavement Technology (2nd), and Rapid Construction Method (steel bridge), are the first three priority subject to be considered in the future activities.

Q3- Please give your comments about the seminar:

All the comments gathered from the participants are as follows:

1) Very satisfactory and hand outs are ok
2) Selections of topics are proper and timely
3) The seminar gave us new knowledge on how to address present problems
4) Topics and seminar materials are very informative
5) The program is well delivered by the expert speakers

6) It clearly provides new technologies to address requirement of today.
7) Need more similar seminars in the future
8) The program is very good and is applicable to Philippine condition
9) The program is well organized and the speakers are expert on their respective field of study
10) The program, venue and the food served are very good

Suggested comments:

1) Discussions on all the topics are very short and more details should be presented.
2) Speakers and topics chosen are good but lacks of applications and knowledge under Philippine setting.
3) Larger venue should have been given so that more participants can attend the seminar.
4) The venue is excellent but there should have been given more food choices. The comfort rooms are narrow/small.
5) Venue is a little tight for 100 persons.
6) Invite DPWH personnel to attend trainings/seminars in Japan.
7) The seminar gave an overview but it was better if detailed handouts were given.

10.5 CONCLUSION

The Seminar was satisfactorily conducted because the Speakers lectured on interesting topics and a lively exchange of questions and answers were ensued between the resource Speakers and the participants during the lecture.

The following are the reasons why the Seminar was considered satisfactory:

1) All of the topics were interesting
2) The presentation of the lecture by the speaker were given with interesting and excellent materials
3) There was proper coordination with participating related offices regarding road and bridge construction.
4) Almost all top officials from DPWH attended
5) Good arrangement of issuance of Certificate of Attendance
6) Invitation letter was issued under the name of DPWH Secretary

The following opinions were suggested to be considered when the next seminar is conducted (based on comments from questionnaire):

1) Give more time for each topic (20 minutes presentation is a bit short).

2) Present more applications and knowledge under Philippine setting.

3) Provide more comfortable venue to attendance such as food, number of toilets, etc.

Picture below shows the attendance of Top Officials of DPWH, Resource Speaker and Japanese Consultants and Officials in the Seminar.

Welcome Address – Mr. SASAKI(JICA Philippines)

Message – Mr. R. L.SINGSON (DPWH Secretary)

Question

Answer

Photo Session