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

PREPARATORY SURVEY
FOR EXPRESSWAY PROJECTS
IN
MEGA MANILA REGION

NAIA EXPRESSWAY PROJECT (Phase II)

FINAL REPORT
MAIN TEXT

NOVEMBER 2012

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

CTI ENGINEERING INTERNATIONAL CO., LTD
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ORIENTAL CONSULTANTS CO., LTD
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EI
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NAIAX

EXCHANGE RATE

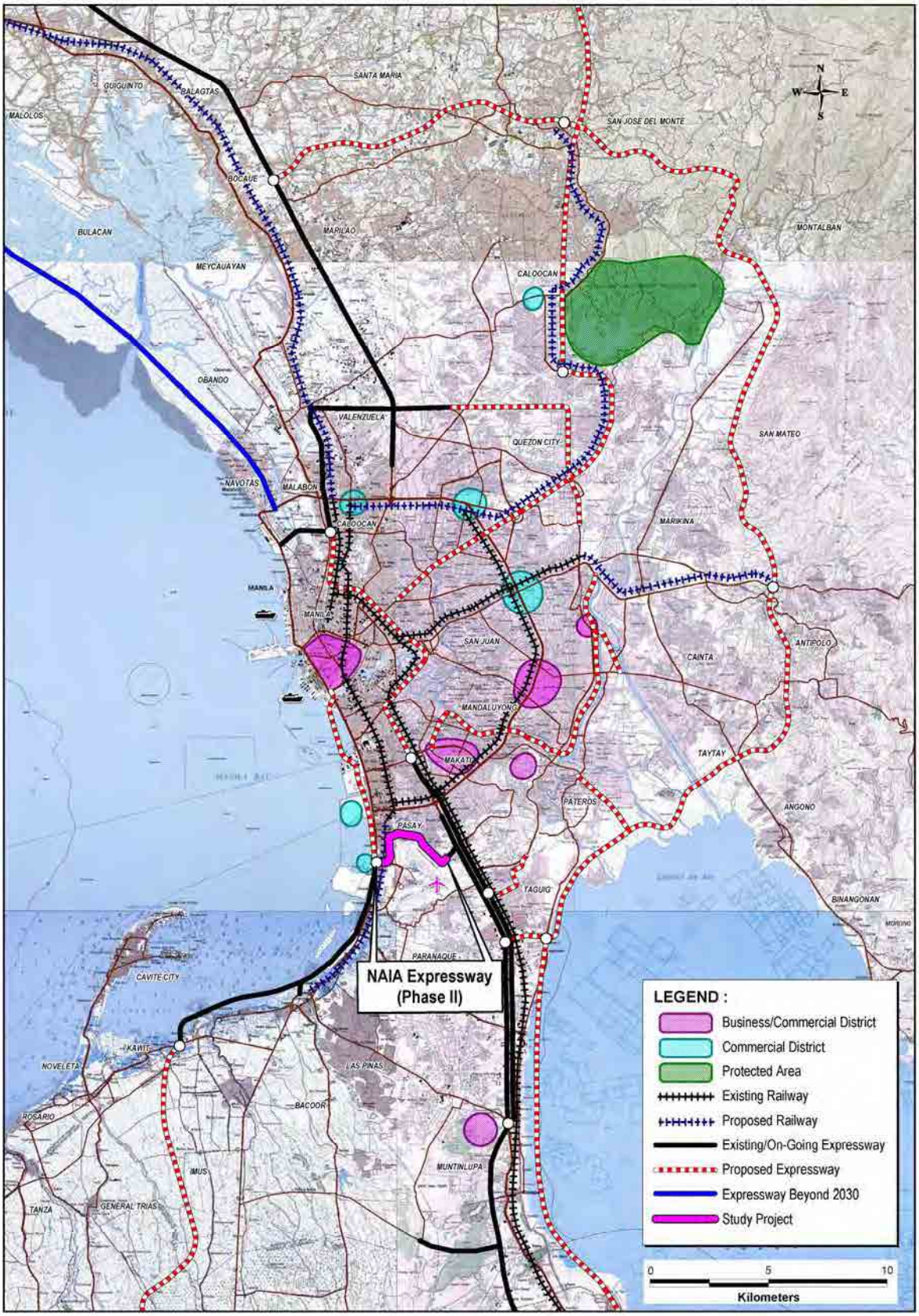
May 2011

1PhP= 1.90 Japan Yen

1US$=43.2Philippine Peso

1US$= 82.0 Japan Yen

Central Bank of the Philippines



LOCATION MAP OF THE STUDY AREA

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ACRONYMS AND ABBREVIATIONS

ADB	:	Asian Development Bank
B/C	:	Benefit/Cost Ratio
BCDA	:	Bases Conversion Development Authority
BLT	:	Build-Lease-Transfer
BOT	:	Build-Operate and Transfer
CAAP	:	Civil Aviation Authority of the Philippines
CDCP	:	Construction Development Corporation of the Philippines
CLEx	:	Central Luzon Expressway
DBFO		Design, Build, Finance and Operate
DBP	:	Development Bank of the Philippines
DENR	:	Department of Environment and Natural Resources
DBM	:	Department of Budget and Management
DOF	:	Department of Finance
DOTC	:	Department of Transportation and Communications
DPWH	:	Department of Public Works and Highways
DTI	:	Department of Trade and Industry
EIA	:	Environmental Impact Assessment
EIRR	:	Economic Internal Rate of Return
EIS	:	Environmental Impact Statement
EO	:	Executive Order
FIRR	:	Financial Internal Rate of Return
GDP	:	Gross Domestic Product
GFS	:	Government Financing Support
GOCCs	:	Government-Owned and Controlled Corporations
GOJ	:	Government of Japan
GRP	:	Government of the Republic of the Philippines
HSH	:	High Standard Highway
ICC	:	Investment Coordinating Committee
IEE	:	Initial Environmental Examination
IFC	:	International Finance Corporation of World Bank Group
IRR	:	Internal Rate of Return
JICA	:	Japan International Cooperation Agency
KOICA	:	Korean International Cooperation Agency
LAPRAP	:	Land Acquisition Plan and Resettlement Action Plan
LGUs	:	Local Government Units
LRTA	:	Light Rail Transit Authority
MARINA	:	Maritime Industry Authority
MRG	:	Minimum Revenue Guarantee
MIAA	:	Manila International Airport Authority
MMDA	:	Metro Manila Development Agency
MRT	:	Mass Rail Transit
MRTC	:	Metro Rail Transit Corporation
NCR	:	National Capital Region
NDC	:	National Development Corporation
NEDA	:	National Economic Development Authority
NGO	:	Non-Governmental Organization
NLEx	:	North Luzon Expressway
NPER	:	Net Public Expenditure Reduction
NPV	:	Net Present Value
O&M	:	Operation and Maintenance
ODA	:	Official Development Assistance
OSG	:	Office of the Solicitor General
PD	:	Presidential Decree
PEA	:	Philippine Estate Authority
PEGR	:	Philippines-Australia Partnership for Economic Governance Reform
PIP	:	Public Investment Plan
PMO-BOT	:	Project Management Office for Build-Operate-Transfer
PNCC	:	Philippine National Construction Company
PNR	:	Philippine National Railways
PPA	:	Philippine Port Authority
PPP	:	Public-Private Partnership
R.A.	:	Republic Act
RAP	:	Resettlement Action Plan
ROW	:	Right of Way
SC	:	Steering Committee
SCTEx	:	Subic-Clark-Tarlac Expressway
SLEx	:	South Luzon Expressway
SPC	:	Special Purpose Company
STAR	:	Southern Tagalog Arterial Road
STOA	:	Supplemental Toll Operation Agreement
TCA	:	Toll Concession Agreement
TOA	:	Toll Operation Agreement
TOC	:	Toll Operation Certificate
TOR	:	Terms of Reference
TPLEx	:	Tarlac-Pangasinan-La Union Expressway
TRB	:	Toll Regulatory Board
TWG	:	Technical Working Group
USAID	:	United States Agency for International Development
WACC	:	Weighted Average of Capital Cost
WB	:	World Bank

EXECUTIVE SUMMARY

1 BACKGROUND OF THE PROJECT

The NAIAX project is located mostly in Pasay City with a small section falling within Paranaque City, all within Metro-Manila.

The NAIAX improves access of NAIA airport to Metro Manila and Southern Luzon Expressway/Skyway. Both expressways contribute to the investment climate improvements of Metro Manila and Southern Industrial Area by increasing capacity and efficiency of transportation and solving the congestion in the area.

The NAIAX meets the policy "Medium Term Plan 2011-2016" of DPWH which aims to ease the congestion of Metro Manila. The project also exploits PPP schemes which new Aquino Administration seeks to strengthen the country's financial state.

In 2010, JICA-assisted High Standard Highway Network Development Master Plan (hereinafter referred to "HSH Master Plan Study") formulated the expressway network in the 200 km radium sphere from Metro Manila. The Study recommended NAIAX as one of eight first priority projects.

In 2010, JICA-assisted Preparatory Survey for Public-Private Partnership (PPP) Infrastructure Development Projects (hereinafter referred to as "PPP Infra Projects"). This Study prioritized PPP expressway projects in accordance with the criteria established which are based on the necessity and urgency of project, profitability of the project and implementability of the project. Phase-2 of NAIAX was ranked no. 3 out of 10 priority projects.

2 NECESSITY OF THE PROJECT

The necessity of NAIAX is summarized as flows:

- NAIAX is a long-term solution for drastic increase of traffic carrying capacity along NAIAX Corridor.
- NAIAX mainly serves for NAIA Terminals related traffic.
- NAIA is the gateway of international/domestic investors, businessmen, and tourists.
- With NAIAX, image of the country will be improved and more investors will be attracted for investment, which will contribute to improvement of international competitiveness.
- NAIAX will reduce traffic congestion of at-grade roads.

3 OBJECTIVE OF THE PROJECT

NAIA has three (3) passenger terminals. NAIAX Phase I was implemented as the conventional public project to provide easier access to NAIA Terminal III. The NAIAX Phase-2 is an extension of Phase-1 and the objectives of the project are as follows:

- To provide easier access to NAIA Terminals which are the international gateway to the Philippines
- To reduce traffic congestion of roads related to NAIA terminals.
- NAIAX will connect the existing Skyway, Manila-Cavite Coastal Expressway as well as proposed NLEx-SLEx Connector Expressway and CALAX, and provide easier access between international cargo terminals (NAIA, Manila International Ports, Batangas

International Port) and southern industrial areas in Cavite. NAIAX will contribute to improvement of international/domestic investment environment and economic development.

4 TECHNICAL ISSUES OF NAIAX

The feasibility study of NAIAX Phase-2 was completed in 2010. However, there are still technical issues to be solved prior to the bidding as follows:

- Navigation clearance of NAIA
- Possible conflict with LRT Line-1 South Extension
- Availability of land at the west end ramps
- Vertical clearance at the bridge connecting two buildings over Pres. Diosdado Macapagal Boulevard
- Monument constructed at the roundabout near the entrance to Terminal III. The expressway will go over the round-about.
- Connecting method with NAIAX Phase – 1. Some structure of Phase 1 may have to be removed, or ROW acquisition of Air Base maybe needed.
- New pedestrian bridge is under construction. The expressway profile needs to be amended.
- Needs to review arrangement of on and off ramps and Toll collection system

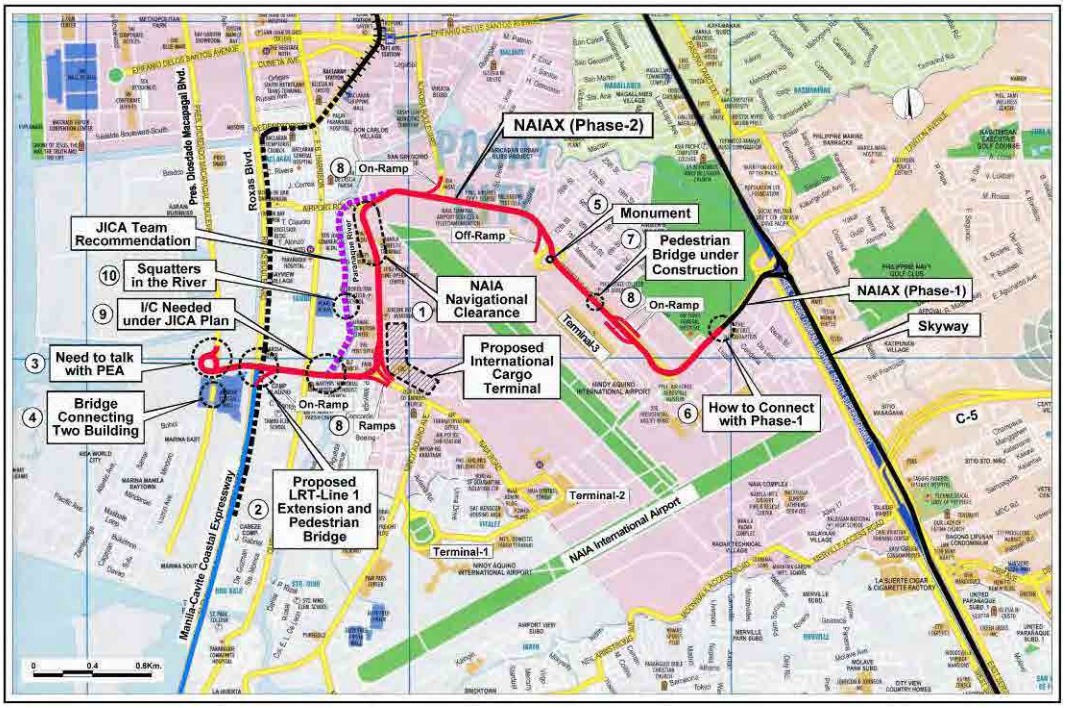


FIGURE 4-1 TECHNICAL ISSUES OF NAIAX PHASE-2

4.1. NAIA Navigational Clearance

To ensure that the proposed vertical alignment of NAIAX satisfies the requirement of NAIA navigational clearance, the vertical and horizontal alignment of NAIAX was reviewed. In order to ensure the above vertical clearance, two route alignments were studied. **TABLE 4.1-1** shows the comparison table of Alternatives and Alternative-2 was recommended in result.

TABLE 4.1-1 ALTERNATIVES FOR NAVIGATIONALCLEARANCE

Plan				
	Alternative 1		Alternative 2	
Concept	Expressway alignment along Paranaque River		Highway express alignment along Domestic Road	
Road length (Main)	1702m		1780m	
Ramp length	2514m		1984m	
Construction Cost (including ROW)	1.2 Billion Php		1.0 Billion Php	
Geometric Design Condition	Fair	Rmin =150m (main)	Fair	Rmin= 190 (main)
Traffic flow	Poor	Accessibility to Terminal 1 and 2 is low due to long ramp	Good	Accessibility to terminal 1 and 2 is better
Social Impact	Poor	Relocation and compensation of squatters along Paranaque River(more than 100 household) necessary.	Fair	Needs land acquisition along Domestic Road but large building remains without demolition Access to facilities along road remains the same
Environmental Impact	Poor	Due to construction of bridge piers (50nos) in the Paranaque river, risk of inundation increases (impediment ratio 11%). River widening and protection is necessary with road construction. Influence to upper and down stream needs to investigate.	Good	No negative impact to the Paranaque river.
Constructability	Poor	Due to construction in the river, construction is more difficult than Alternative-2 and it takes longer time	Good	The expressway can be constructed by familiar construction method.
Maintenance	Poor	Difficult due to piers in river	Good	Easy
Evaluation	Poor		Good	**This scheme is recommended**

Since the alignment along the domestic road is recommended, three alternatives were furthermore studied in due consideration of height limit requirement of NAIA. Among engineering evaluation, the Alternative-3 was recommended.

TABLE 4.1-2 ALTERNATIVES FOR HEIGHT LIMIT REQUIREMENT

	Alternative-1	Alternative-2	Alternative-3
Expressway Alignment	West side of Domestic Road	East side (airport side) of Domestic Road	Center of domestic Road
ROW Acquisition	West side: 11.5 m. East side: 1.1 m.	West side: 11.5 m. East side: 3.5 m.	West side: 10.5 m. East side: 1.0 m.
Impact to Large Buildings	No large buildings are affected.	No large buildings are affected.	No large buildings are affected.
Accessibility to Abutting Area	West side area: by 1-lane road East side area by 2x2=4 lane road.	West side area: by 2x2=4 lane road East side area by 1-lane road	West side area: by 2-lane road East side area by 2 lane road.
Accessibility to NAIA Terminal-4	By 2x2=4 lane road	By 1-lane road. U-turn area needs to be provided between Section (A) and Section (B)	By 2-lane road. U-turn area needs to be provided between Section A and (B) and Section (B) and (C).
Recommendation	Access to West area is not good. Not recommended.	Access to East area and NAIA Terminal-4 is not good. Not recommended.	Best option to provide access to both West and East areas and NAIA Terminal-4. **Recommended.**

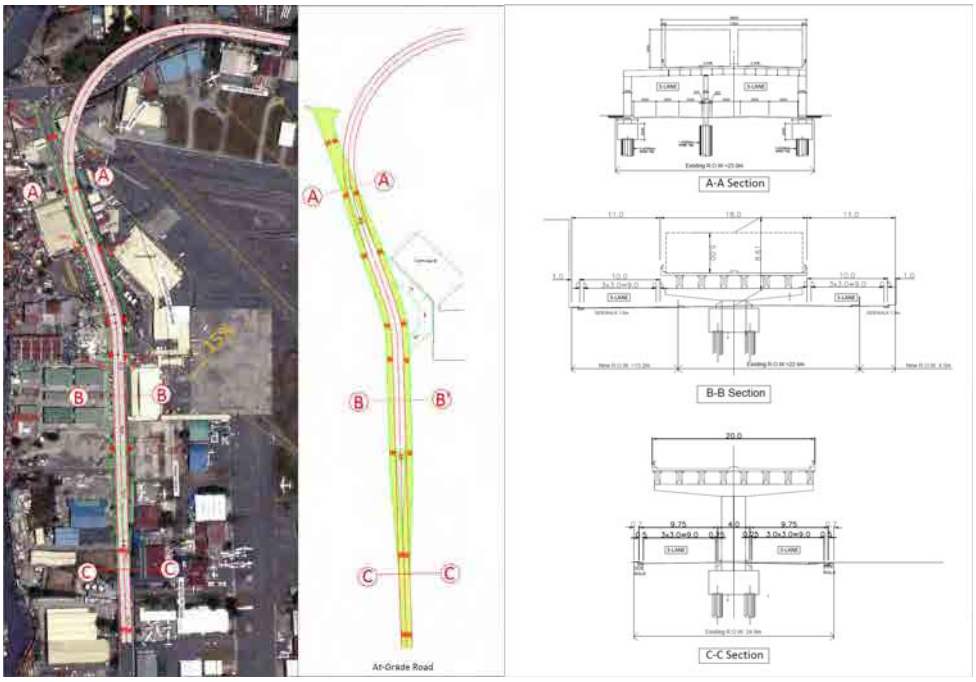


FIGURE 4.1-1 RECOMMENDED PLAN FOR NAIA NAVIGATIONAL CLEARANCE

4.2. West End Alternatives

On the alignment of the west end of NAIAX phase-2, The LRT Line-1 Cavite extension and MIA station has been planned. Thus, the alignment alternatives of the west end point of NAIAX phase-2 were studied in order to avoid the conflict with the LRT extension plan. The Alternative 3, NAIAX ends at Roaxas Blvd. was recommended as shown in **TABLE 4.2-1**.

TABLE 4.2-1 COMPARISON FOR NAIAX PHASE-2 END POINT OF INTERCHANGE

Description	Alternative-1A Expressway Ends at Macapagal Blvd.	Alternative-1B Expressway Ends at Macapagal Blvd.	Alternative-2 Expressway Ends at Roxas Blvd.
Section			
Traffic Functionality	• Traffic from Reclamation Area to Makati direction or vis-á-vis Macapagal Blvd. • Accessibility to the Reclamation Area is much better than Alternative-2. • Traffic on Roxas Blvd. will be reduced.	• Same as Alternative-1 A.	• All expressway-related traffic uses Roxas Blvd., and access to Reclamation Area is made via Roxas Blvd. • Measures to divert to Macapagal Blvd. will be needed, such as a flyover from Manila-Cavite Coastal Expressway to Mapacagal Blvd.
Traffic Control Center & Maintenance Equipment Depot	• Space between A ramp and Macapagal Blvd. can be used as Maintenance Equipment Depot, etc.	• Same as Alternative-1 A.	• Such space needs to be found in other area along the expressway.
Construction Cost up to Parañaque River	**Php 2,112.3 Million** (2.11 times, or + Php 1,113.2 M) 3rd Level Structure = 1.610 lane-km 2nd-3rd Level Structure = 2.169 lane-km Ground to 2nd Level Structure = 1.026 lane-km 4.805 lane-km	**Php 2,123,8 Million** (2.13 times, or + Php 1,124.7 M 3rd Level Structure = 1.620 lane-km 2nd-3rd Level Structure = 2.230 lane-km Ground to 2nd Level Structure = 1.008 lane-km 4.858 lane-km	**Php 999.1 Million** (1.00) 3rd Level Structure = 0.170 lane-km 2nd-3rd Level Structure = 1.710 lane-km Ground to 2nd Level Structure = 1.090 lane-km 2.970 lane-km
ROW Acquisition Cost	26,179 sq.m. x Php 35,000/sq.m. = **Php 916 Million** *Note: ROW acquisition negotiation may take long time*	25,140 sq.m. and demolition of 19,128 sq.m. 25,140 sq.m. x Php 35,000/sq.m. + 19,128 x Php 5,900/sq.m. = **Php 993 Million** *Note: ROW acquisition negotiation may take long time.*	872 sq.m. x Php 35,000/sq.m. = **Php 30.5 Million**
Recommendation	Δ Traffic functionality is better than Alternative-2, however, construction cost is quite high, thus financial viability will be affected and higher Government Financial Support will be required.	Δ Same as Alternative-1 A.	o Although traffic functionality will be sacrificed to some extent, financial viability will be much improved than the other alternatives. This alternative **was recommended**.

4.3. Alternatives at Park ‘n Fly Building Area

The NAIAX has a possibility to inference with the Park’n Fly Building where land lease by MIAA. Two alternatives are studied as the **TABLE 4.3-1**, the alternative two was recommended.

TABLE 4.3-1 ALTERNATIVES STUDYAT PARK ‘N FLY BUILDING

	Alternative-1	Alternative-2
Park ‘n Fly Building	Affected	Not Affected
Ramp B Length	708 m	886 m (+14.9 Million Php)
Ramp C Length	372 m	467 m (+ 8.0 Million Php)
ROW Acquisition and Compensation of Building	• Land Acquisition from MIAA • Negotiation with Park ‘n Fly Building owner needed. • Replacement cost • Business compensation cost • Demolition cost	• Land acquisition from MIAA • Negotiation only with MIAA is needed. • Relocation of informal settlers (about 50 households) is required.
Recommendation	• It is expected that negotiation with Park ‘n Fly Building owner will take a long time and ROW delivery will be delayed. ・Park ‘n Fly Building is quite useful for Terminal-s and 2 passengers. • **Alternative-2 was recommended**, provided that resettlement sites for informal settlers be provided. (MIAA has designated resettlement site.)	

4.4. Alternatives at Interface between NAIAX Phase-1 and Phase-2

NAIA Phase-1 was completed in 2010.. The NAIAX Phase-2 must be extended from this condition. Available space is 19.0 m at Section A and 18.78 m at Section B. The connection alternatives are schematically shown in **FIGURE 4.4-1** and the comparison of alternative were studied as shown in **TABLE 4.4-1**.

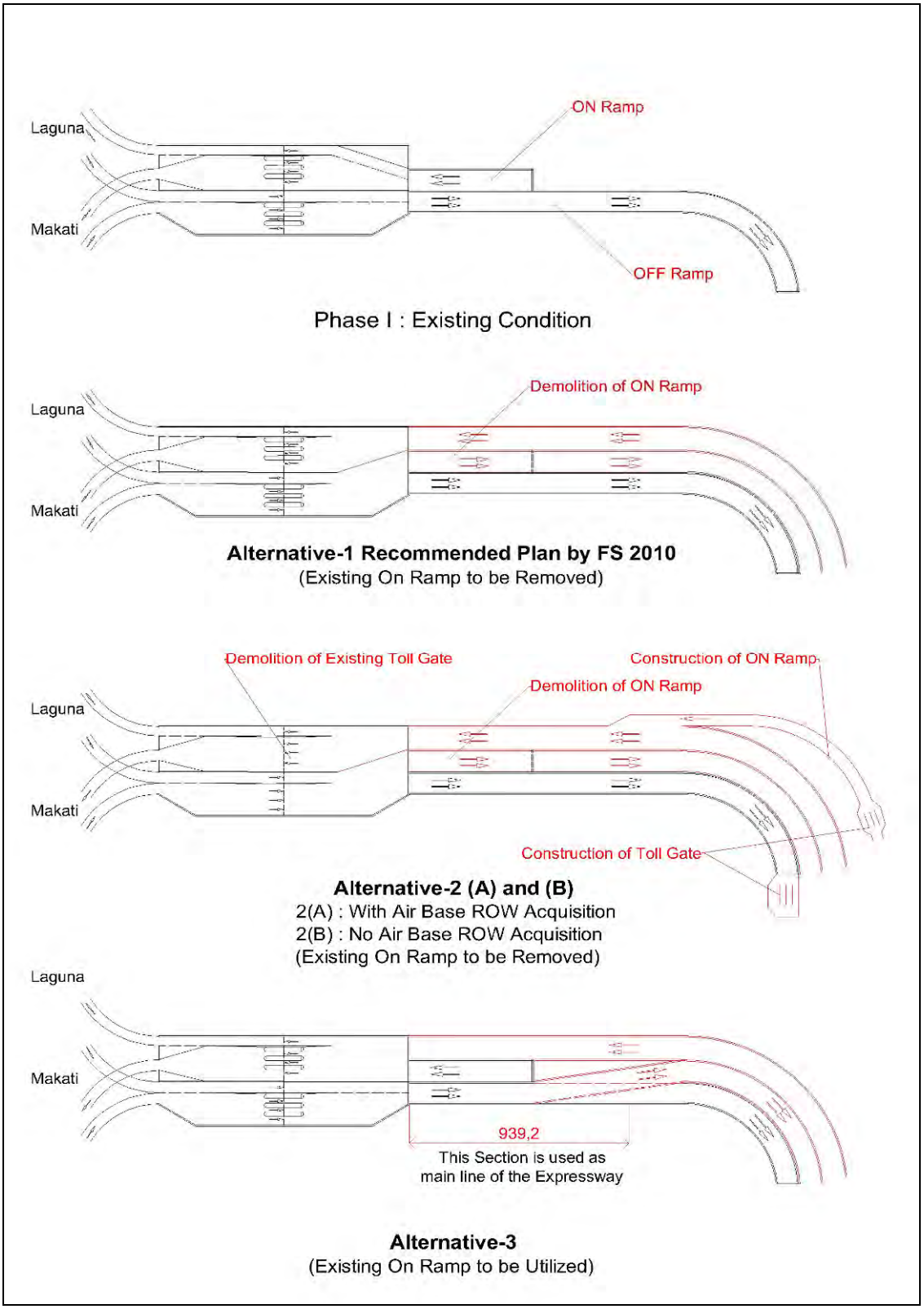


FIGURE 4.4-1 NAIAX PHASE-1 AND PHASE-2 CONNECTION ALTERNATIVES

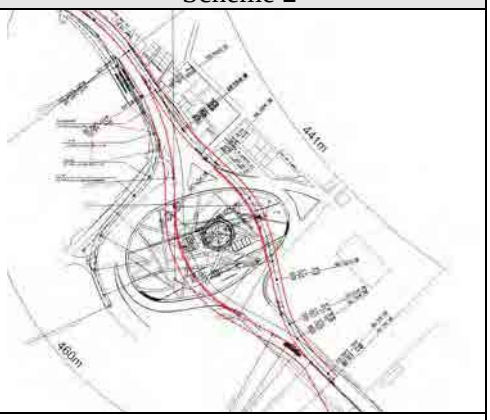
TABLE 4.4-1 COMPARISON OF ALTERNATIVES OF NAIAX PHASE-1 AND PHASE-2 CONNECTION

	Alternative-1 Recommended plan by FS in 2010	Alternative-2(A) Improved Plan of Alternative-1	Alternative-2(B) Modification of Alternative-2(B)	Alternative-3 To utilize Existing On-ramp
Feature	• Existing on-ramp to be removed. • Available space is used for the expressway (2-lane x 2 direction = 4-lane)	• Existing on-ramp to be removed. • Available space is used for the expressway (2-lane x 2 direction = 4-lane) • Removed on-ramp is constructed at the NAIA Terminal III exit.	• In order to avoid acquisition of Villamor Air Base Headquarter, the expressway alignment partly utilizes the space over the existing off-ramp. Thus, the expressway has to go up and shifted toward the existing off-ramp, then go down again.	• A part of the existing off-ramp (2-lane, 6 m) is used as the main carriageway of the expressway. • Number of existing toll booths will not be enough to accommodate the expressway traffic. • Distance from toll booths to on-ramp is too short to maneuver main traffic and on-ramp traffic
On-ramp location and Accessibility	**Poor** • Removed on-ramp is constructed along Andrews Ave. Exit traffic from Terminal III needs to go around the at-grade road and make a U-turn at the round-about with the monument to enter the expressway.	**Good** • Traffic from NAIA Terminal III can enter directly to the on-ramp.	**Fair** • Traffic from NAIA Terminal III can enter directly to the on-ramp. • Removed on-ramp is constructed at the NAIA Terminal III. Since the expressway is located at high elevation, this ramp needs to be long which makes it difficult to get traffic from NAIA Terminal III.	**Good** • Traffic from NAIA Terminal III can enter directly to the on-ramp.
Main Route Alignment	**Good** • Vertical alignment is the same as the Phase-1 section.	**Good** • Vertical alignment is the same as the Phase-1 section.	**Poor** • The expressway has to go up and shifted toward the existing off-ramp, then go down again.	**Fair** • Horizontal alignment for main traffic is not so well.
Land Acquisition	**Good** • No land acquisition	**Fair** • Villamor Air Base Headquarter land is affected (width = 4 m, Length = 250 m). No building affected.	**Good** • No land acquisition	**Good** • No land acquisition
Environment	**Poor** • Exit traffic from Terminal III needs to go around the at-grade road and make a U-turn at the round-about with the monument to enter the expressway. Traffic must take long trip compared with other alternatives.	**Good** • Traffic from NAIA Terminal III can directly enter the on-ramp	**Good** • Traffic from NAIA Terminal III can directly enter the on-ramp	**Good** • Traffic from NAIA Terminal III can go directly enter the on-ramp
Cost	• Cheapest	• Almost Same as Alternative-1	**Expensive** • Complicated substructure is required resulting in high cost.	**Expensive** • Though off-ramp will not be removed, the complicated structure will be required, resulting in high cost.
Recommendation	Not recommended.	**Recommended**	Not recommended	Not recommended

4.5. Alignment at MMDA Monument

A monument was built by MMDA at Circulo del Mundo along Andrews Ave. The two (2) alternative alignments were studied and evaluated as shown in **TABLE 4.5-1**.

TABLE 4.5-1 ALTERNATIVE STUDY AT MMDA LANDMARK

Scheme	Scheme 1		Scheme 2	
Plan				
Concept	Scheme1: Both direction combined structure		Scheme2: Expressway splited by direction.	
Bridge length	460m		900m(460m+440m)	
Construction Cost	812.3MP(1.00)		829.4MP(1.02)	
ROW acquisition	683m2(MIAA)		1,157m2(Commercial)	
Number of relocation houses	0		3 houses They have already been relocated two times, so there is strong objection against third relocation.	
Geometric Condition	Fair	Rmin =123m	Fair	Rmin=123m, *The inner shoulder require widening of 1.35m for stopping distance at R123m
Social Impact	Good	No private land acquisition	Poor	Some private commercial land acquisition required. Relocation of 3 houses required.
Constructability	Good	Constriction will be concentrate in one alignment at the round-about.	Poor	Construction will be separated at the round-about which may cause traffic congestion
Aesthetic view	Fair	There will be no obstacle of view from Pasay City side	Poor	The highway will be obstacle to the monument from both sides
Evaluation	**Recommended**		Not recommended	

4.6. Ramp Layout Study

The 2010 FS Ramp Layout as shown in **FIGURE 4.6-1** had some technical issues. The engineering study related to the location, traffic volume accessibility has been carried out. In the result, based on the original ramp plan with Seven (7) on (entrance)-ramps and seven (7) off (exit)-ramps, it was proposed that two ramps, No. 5 and 8, were removed.

TABLE 4.6-1 ISSUES OF RAMP LAYOUT ON NAIAX 2010 FS

<table>
<tr><th>Ramp Number</th><th>Issues</th></tr>
<tr><td>(1) Ramp No. 10 (off-ramp from 3rd level to the ground level)</td><td>• End of ramp is located too close to the intersection (only 65 m).
• Intersection traffic queue will be extended to up to the end of the ramp, thus free exit of traffic on this ramp will be affected.
• There will be definitely conflict of traffic (through traffic and left-turn traffic, which will cause traffic congestion and traffic accidents.
• Recommended to extend this ramp towards NAIA Terminal 1 and 2.</td></tr>
<tr><td>(2) Ramp No. 11 (off-ramp from 2nd level to the ground level) Is this ramp needed?</td><td>• This ramp ends within the intersection.
• Since traffic which utilize this ramp has very short travel distance, resulting in low traffic demand, recommended to be removed. Travel distance which utilizes this ramp;
Ramp (3) to Ramp (11) = 1.4 km.
Ramp (4) to Ramp (11) = 1.2 km.</td></tr>
<tr><td>(3) Ramp No. 2 (on-ramp from Aurora Blvd.) Is this ramp needed?</td><td>• Travel distance and traffic demand which utilizes this ramp is;
<table><tr><th></th><th>Travel Distance</th><th>Traffic Demand (2015)</th></tr><tr><td>Ramp (2) ~ Ramp (10)</td><td>1.9 km.</td><td>1,761</td></tr><tr><td>Ramp (2) ~ Ramp (12) & (13)</td><td>2.6 km.</td><td>53</td></tr></table>• Traffic demand is not so high, and ROW acquisition is required, thus recommended to be removed.</td></tr>
<tr><td>(4) Ramp No. 6 (on-ramp from Terminal 3)</td><td>• To utilize this ramp from Terminal 3 to Skyway, traffic must go around the at-grade road, since the existing on-ramp is proposed to be removed.
• Under the above condition, exit traffic from Terminal 3 will be discouraged to utilize this ramp.
• It is recommended that this ramp should be located at the exit of Terminal 3. (This is studied in section 3.4. Alternatives at Connection Point of Phase-1 and Phase-2.)</td></tr>
</table>

The Estimated ramp traffic volume based on the revised ramp lay out (ramp (5) and ramp (8) are removed) is shown in **FIGURE 4.6-2**.

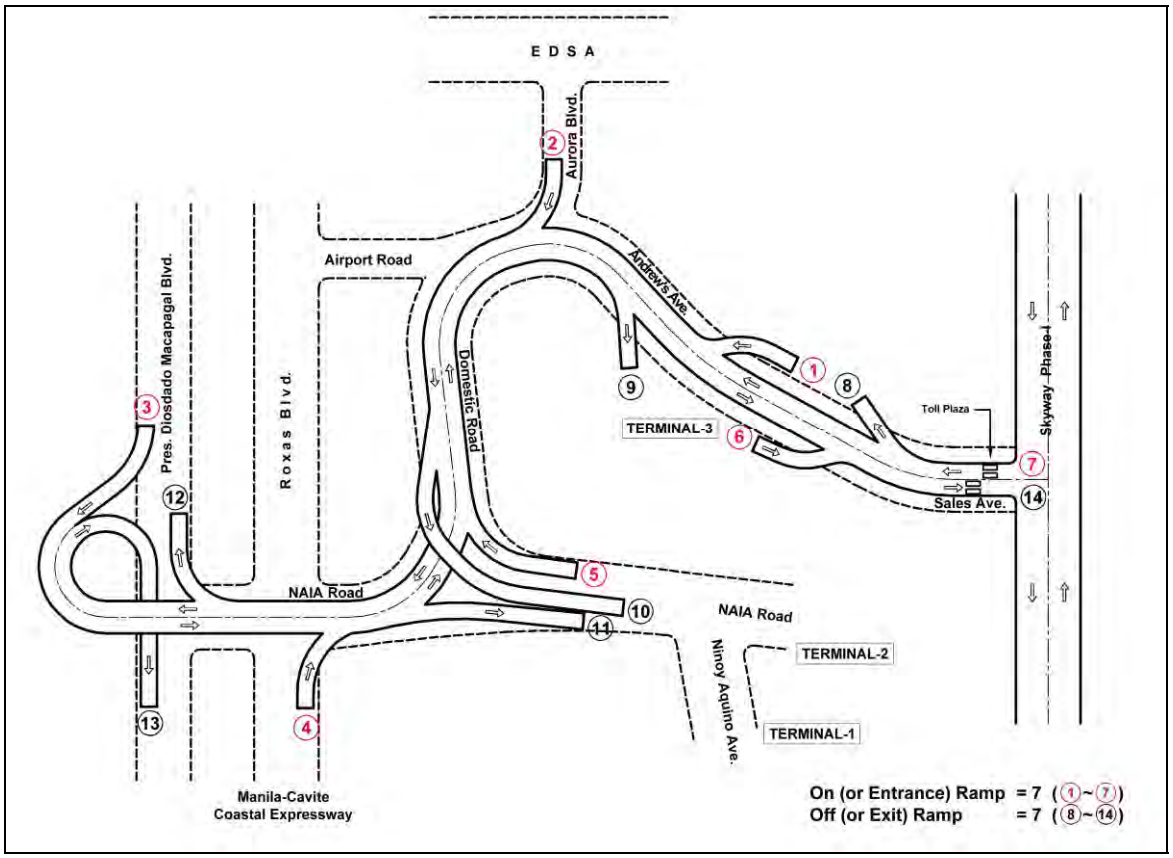


FIGURE 4.6-1 SCHEMATIC NAIAX RAMP LAYOUT (2010 FS)

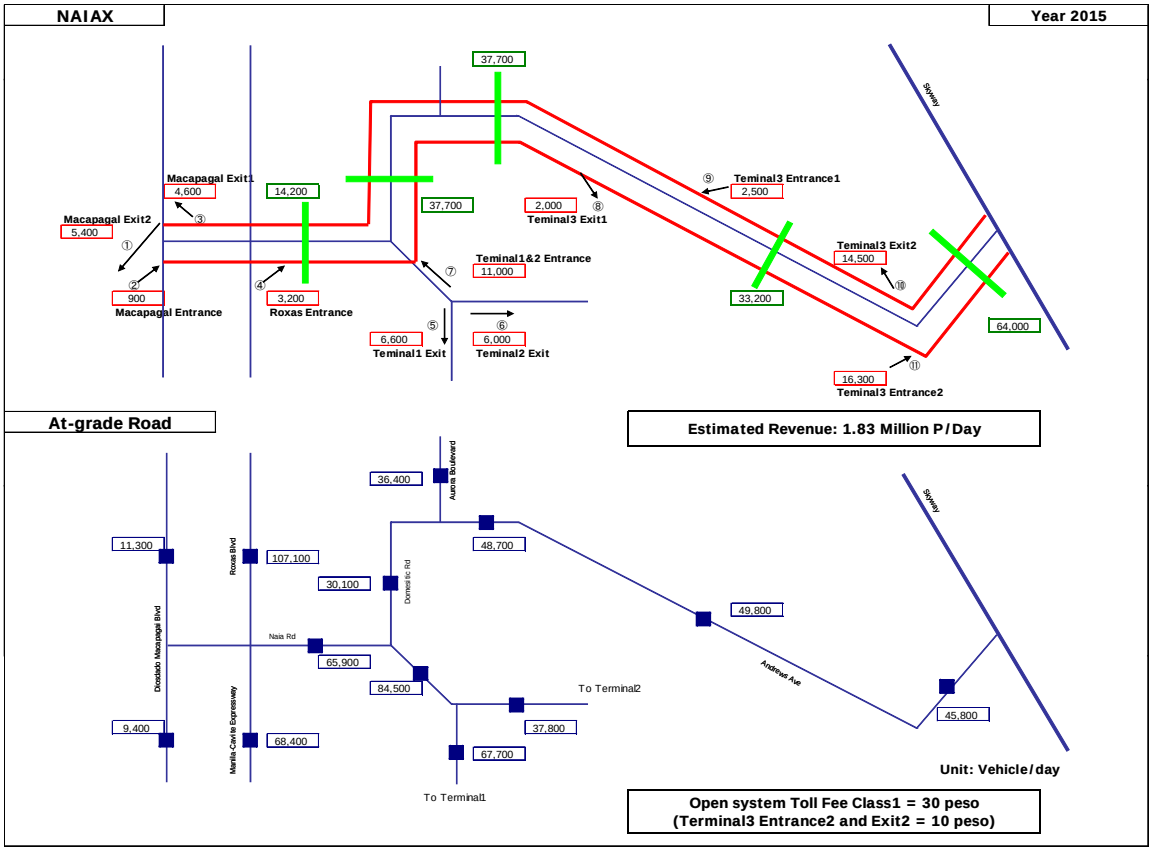


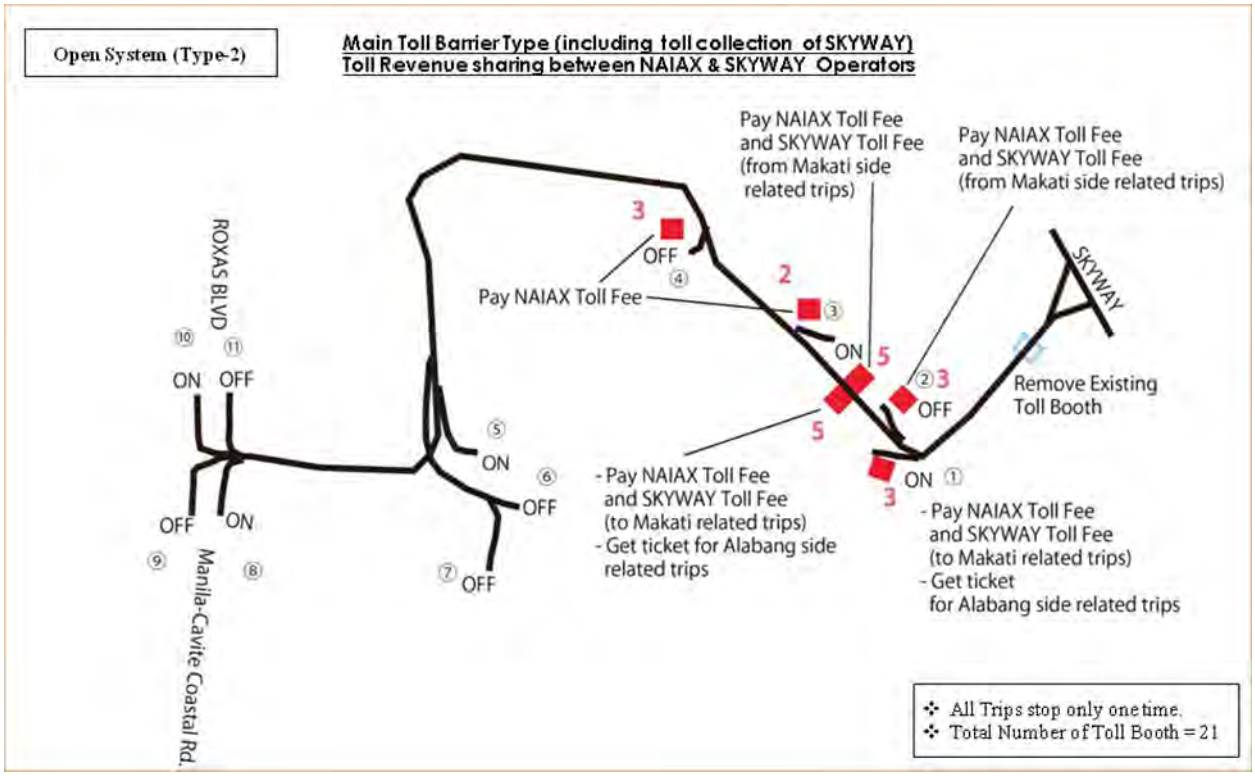
FIGURE 4.6-2 TRAFFIC PROJECTION ON REVISED RAMP LAYOUT

4.7. Toll Collection System

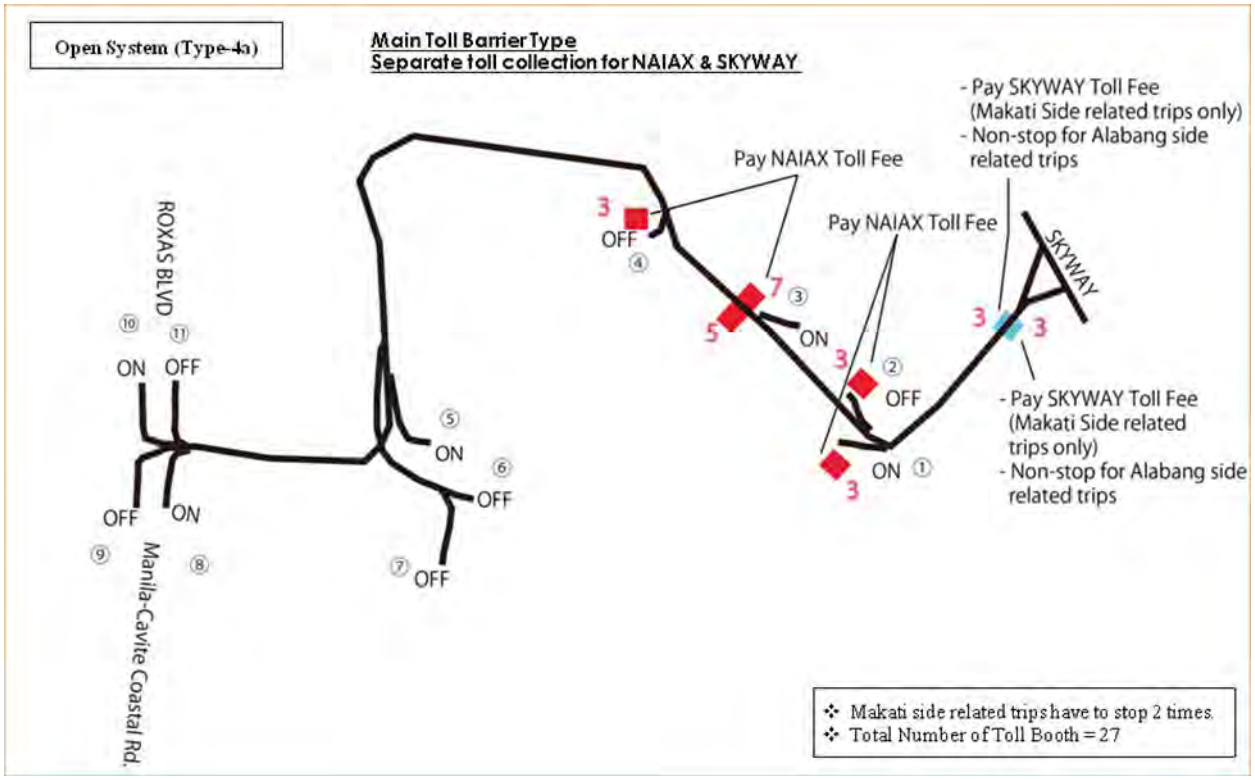
Based on the original toll collection system in the 2010 FS, additionally Four Alternative plans were studied. The Type-2 and Type 4, Open systems were recommended.

TABLE 4.7-1 COMPARISON OF TOLL COLLECTION SYSTEM

Toll collection System	No. of Toll Booth	Characteristics of the System	Recommendation
Type-1: Closed System (2010 FS Plan)	39	• Toll fee in proportion to travel distance can be applied. • All trips must stop 2 times, which discourages usage of expressway. • Control of overloaded trucks is practically difficult. • Toll collection transaction time is longer. • Higher operation cost.	Not Recommended
Type-2: Open System	21	• Flat toll rate • Toll collection of both NAIAX and Skyway, thus toll revenue sharing between NAIAX and Skyway Operators need to be agreed. • All trips stop only 1 time, thus convenient for expressway users. • Facility of toll booths of NAIAX Phase-1 can be transferred to other toll booths. • Toll collection transaction time at main toll barrier and NAIA Terminal 3 related toll booths is longer. • Control of overloaded trucks is difficult. • Least ROW acquisition. • Least operation cost.	**Recommended**, if both operators of NAIAX and Skyway agree on revenue sharing system.
Type-3: Open System	25	• Flat toll rate. • Separate toll collection for NAIAX and Skyway. • All trips stop 1 time except Makati-side related traffic. • Toll booth location for No. 8 & 10 and for No. 5 requires additional ROW acquisition. • Control of overloaded trucks is practically difficult. • Second least operation cost.	Not recommended, because of toll booth location for No. 8 and 10 and for No. 5 which requires additional ROW acquisition.
Type-4a: Open System	27	• Similar to Type-2 • Separate toll collection for NAIAX and Skyway. • All trips stop 1 time except Makati-side related traffic.	**Recommended**, when toll revenue sharing between operators of NAIAX and Skyway can not be reached.
Type-4b: Open System	21	• Similar to Type-4a • No toll collection at No.1 and No. 2 (or NAIA Terminal 3 related traffic)	Not recommended, since this reduces toll revenue.



(TYPE 2 OPEN SYSTEM, RCOMMENDED)



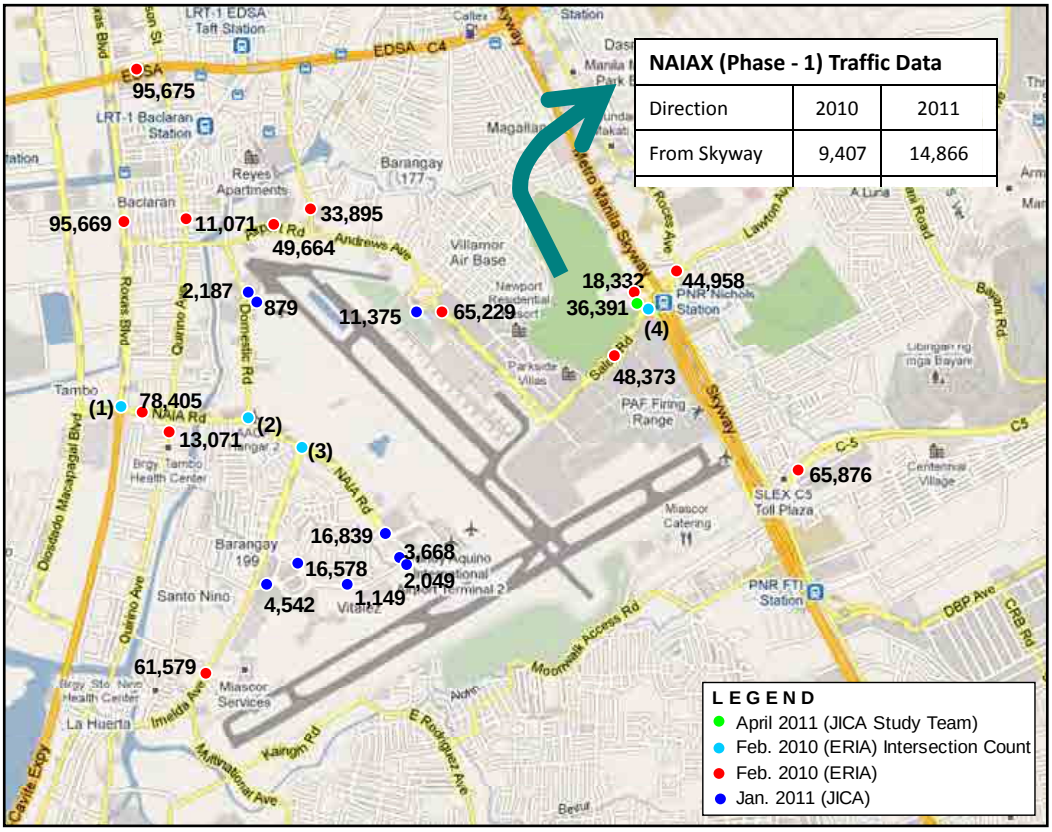
(TYPE 4-A OPEN SYSTEM, RCOMMENDED)

FIGURE 4.7-1 ALTERNATIVE OF TOLL COLLECTION SYSTEM

5 TRAFFIC DEMAND FORECAST

5.1. Existing Traffic Volume

Traffic volume of roads surrounding the NAIA airport is shown in **FIGURE 5.1-1**. As seen in the figure, there is high number of vehicles to the corridor where the future expressway runs over – 48,373 at Sales Road, 65,229 at Andrew's Avenue, 78,405 at NAIA Road (Seaside Drive). Data denotes the number of vehicles. Recorded traffic at NAIA Phase-1 in 2010 is 18,332 vehicles in both directions. This number increases to 36,391 this year with 60% of traffic moving in the direction of Skyway.



Note: Feb 2010 data (NAIA - FS by ERIA), Jan. 2011(Study on Airport Strategy for Greater Capital Region by JICA). Both data are in ADT (Average Daily Traffic).

FIGURE 5.1-1 TRAFFIC VOLUME OF ROADS SURROUNDING NAIA AIRPORT

5.2. Willingness to Pay to NAIAX

Those willing to pay to use the expressway have the following preference: 27.2% are willing to pay 20 pesos; 40.4% are willing to pay 30 pesos; 26.2% are willing to pay 50 pesos; 6.2% are willing to pay 80 pesos.

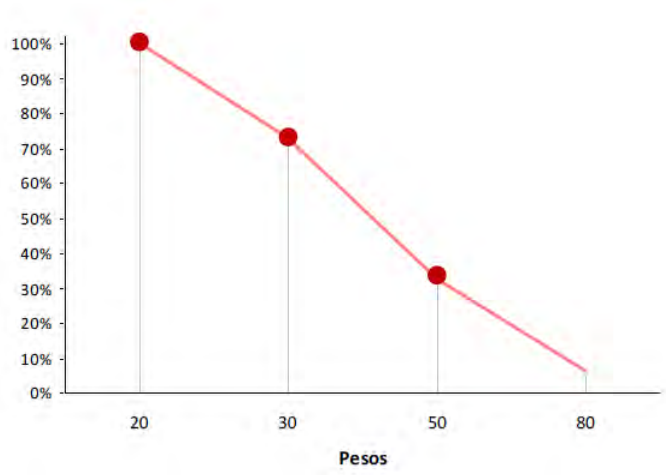


FIGURE 5.2-1 AMOUNTS OF TOLL MOTORISTS WILLING TO PAY TO USE ENTIRE EXPRESSWAY FOR THEIR OTHER TRIPS

TABLE 5.2-1 AMOUNT OF TOLL MOTORISTS WILLING TO PAY/ TO USE ENTIRE NAIA

(₱)	Sample	Share (%)	Amount (%
20	180	27.1%	100.0%
30	268	40.4%	72.9%
50	174	26.2%	32.4%
80	41	6.2%	
Total	663	100.0%	6.2%

5.3. Toll Rate vs. Revenue

The estimated traffic volume and expected amount of revenue generated from the expressway is shown in **FIGURE 5.3-1**. Amount of revenue per day will be 1.75 million for 30 pesos toll fee, 1.79 million for 40 pesos toll fee, and 1.54 million for 50 pesos toll fee.

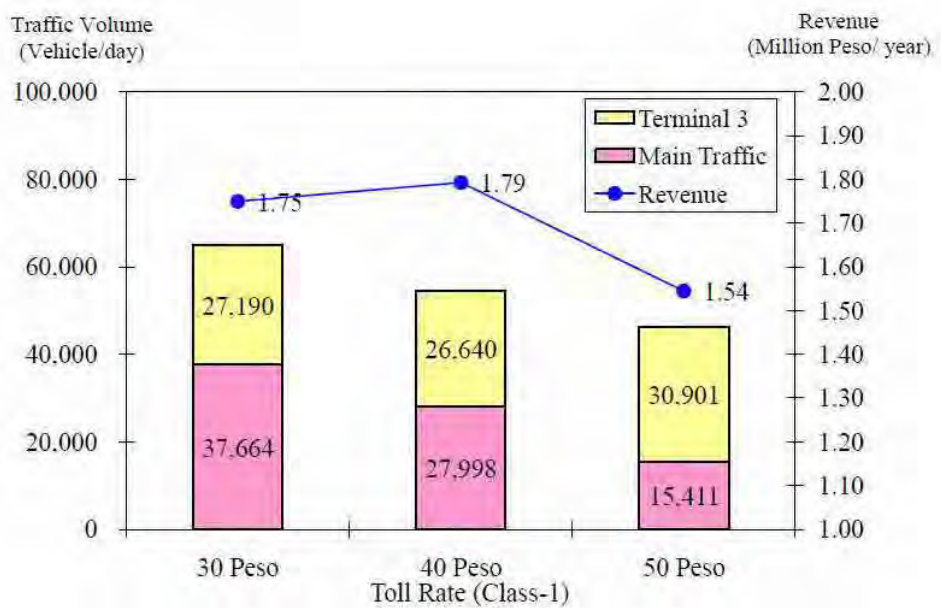


FIGURE 5.3-1 TOLL RATE VS. REVENUE (2015)

Traffic assignment is conducted on 30 pesos toll rate and 40 pesos toll rate for Class – 1.

- Average willingness to pay for NAIAX is 31.6 peso and 70% of respondent are willing to pay for more than 30 peso.
- Although maximum amount of revenue is 40 peso case, the difference with 30 peso case is not that substantial.

- Toll rate of NAIAX (P6/km = 30peso/5km, 40 Peso case is P8/km,) is almost the same with the present Skyway's toll rate and it will be acceptable rate.
- In order to maximize the revenue, 40 peso case is desirable. In order to be more attractive to motorists, 30 peso case is desirable.

5.4. Traffic Assignment Result and Toll Revenue

Traffic Volume of two alternative cases, 30 peso and 40 peso were projected.

TABLE 5.4-1 TRAFFIC VOLUME AND REVENUE (NAIAX PHASE-2)

Case	Vehicle Class	Year 2015	Year 2020	Year 2030
30 Peso Case	Class 1	51,878	54,343	64,725
	Class 2	10,730	17,216	23,832
	Class 3	2,246	5,121	7,026
	Total	64,854	76,680	95,583
	Revenue			
40 Peso Case	Class 1	43,450	43,066	49,697
	Class 2	9,156	17,902	22,699
	Class 3	2,032	5,200	6,701
	Total	54,638	66,168	79,097
	Revenue			

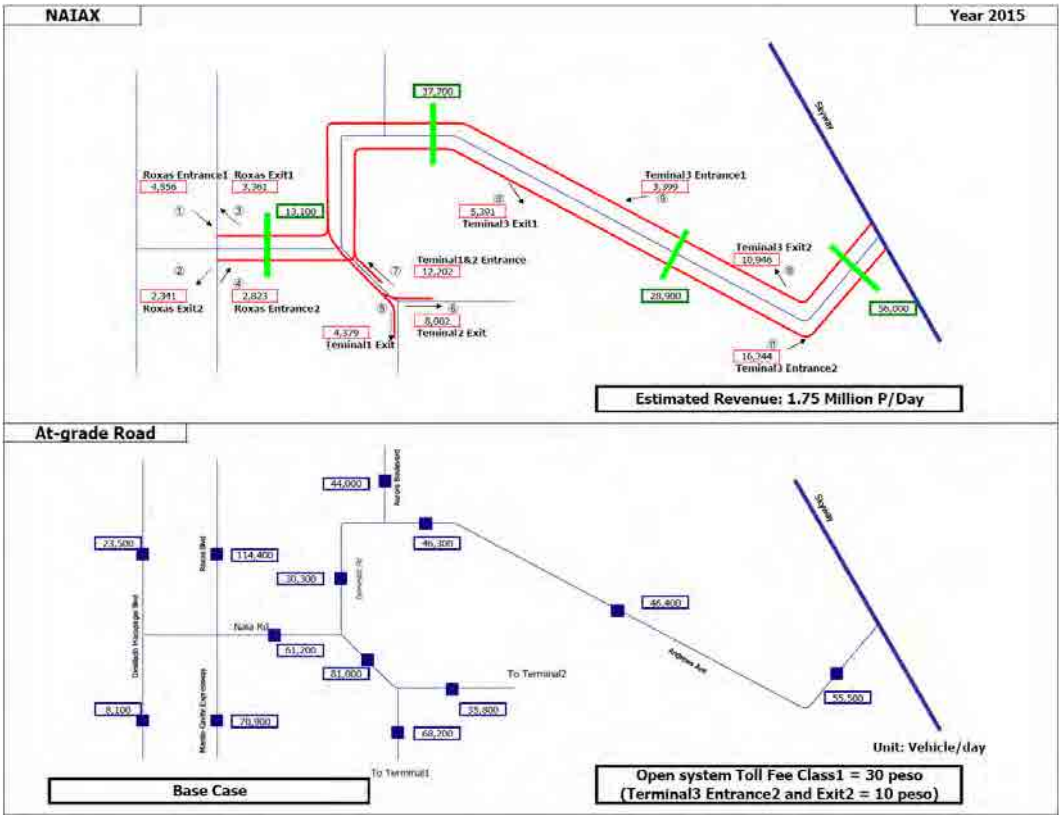


FIGURE 5.4-1 NAIAX TRAFFIC PROJECTION (YEAR 2015, 30 PESO CASE)

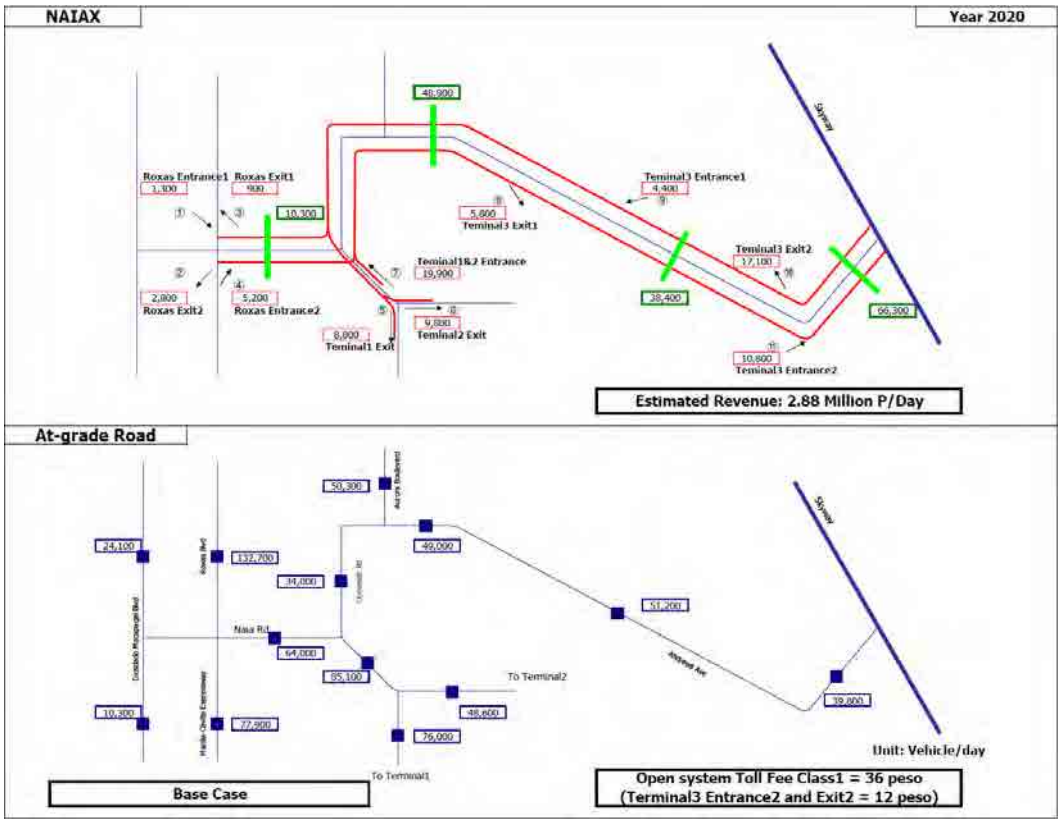


FIGURE 5.4-2 NAIAX TRAFFIC PROJECTION (YEAR 2020, 30 PESO CASE)

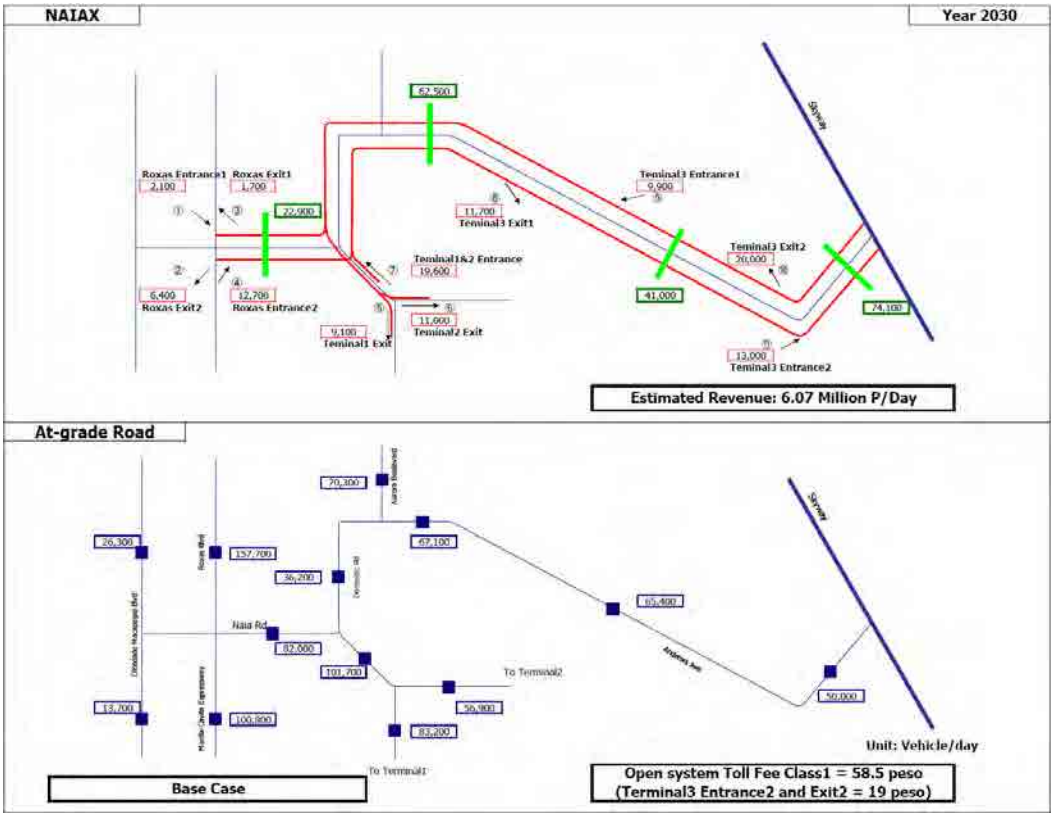


FIGURE 5.4-3 NAIAX TRAFFIC PROJECTION (YEAR 2030, 30 PESO CASE)

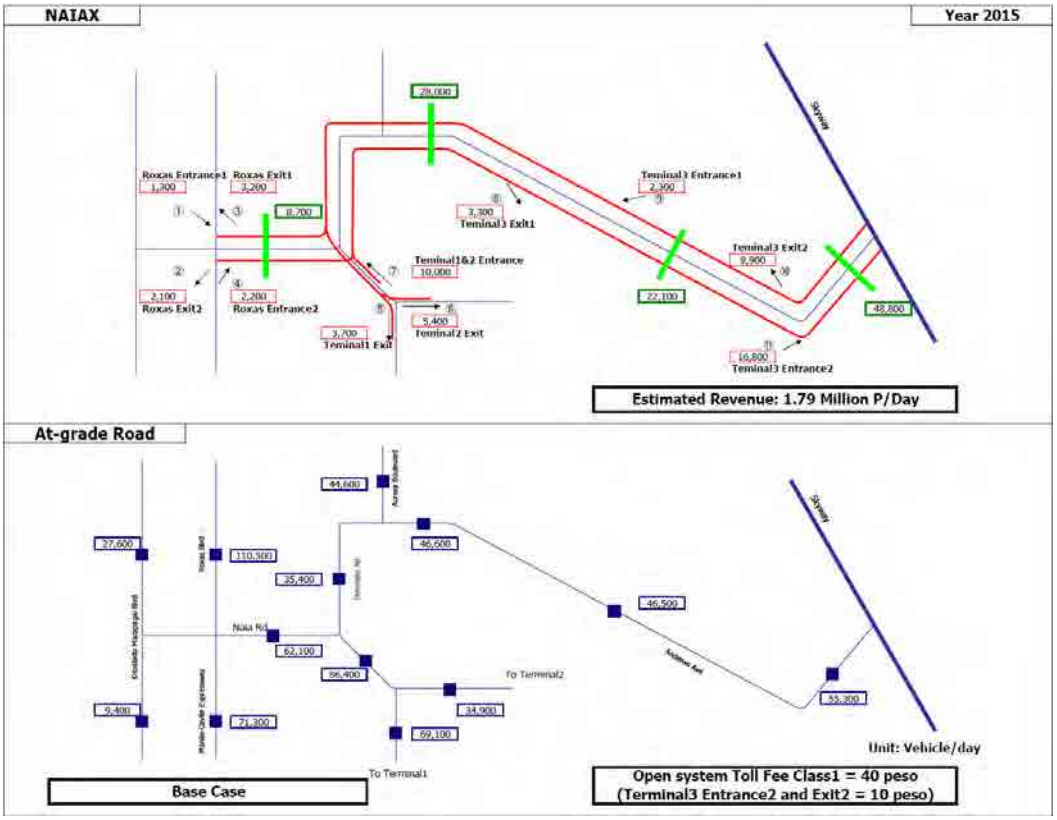


FIGURE 5.4-4 NAIAX TRAFFIC PROJECTION (YEAR 2015, 40 PESO CASE)

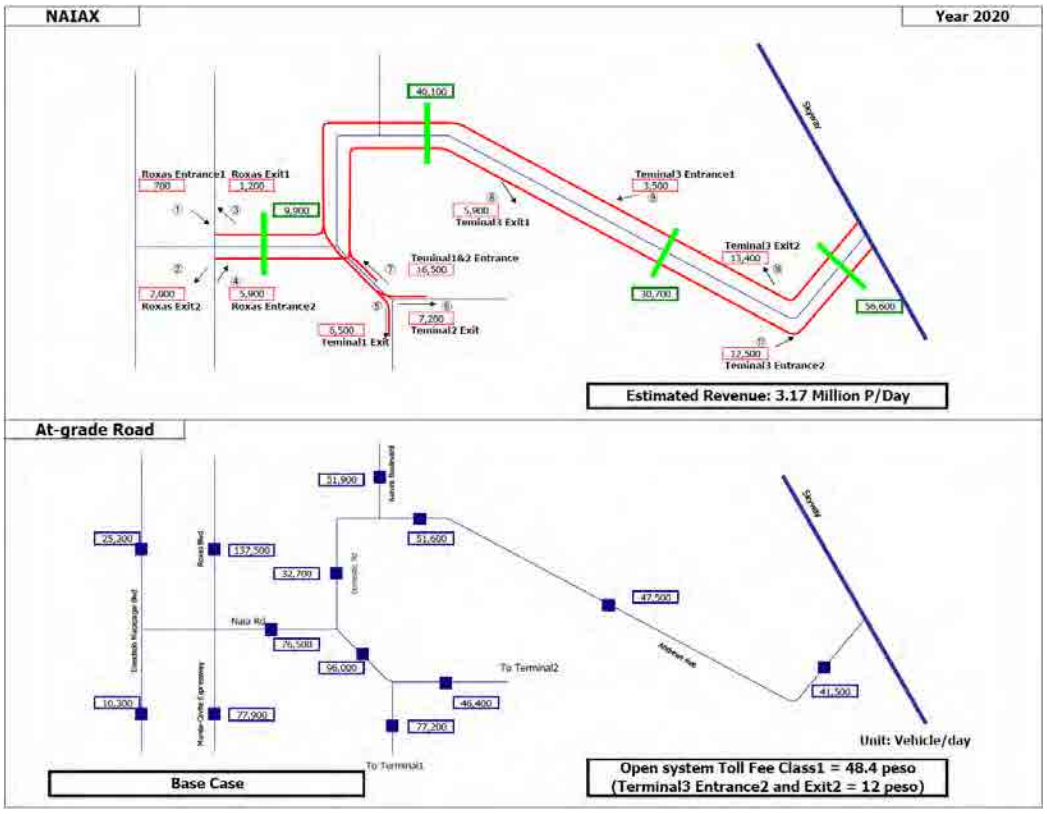


FIGURE 5.4-5 NAIAX TRAFFIC PROJECTION (YEAR 2020, 40 PESO CASE)

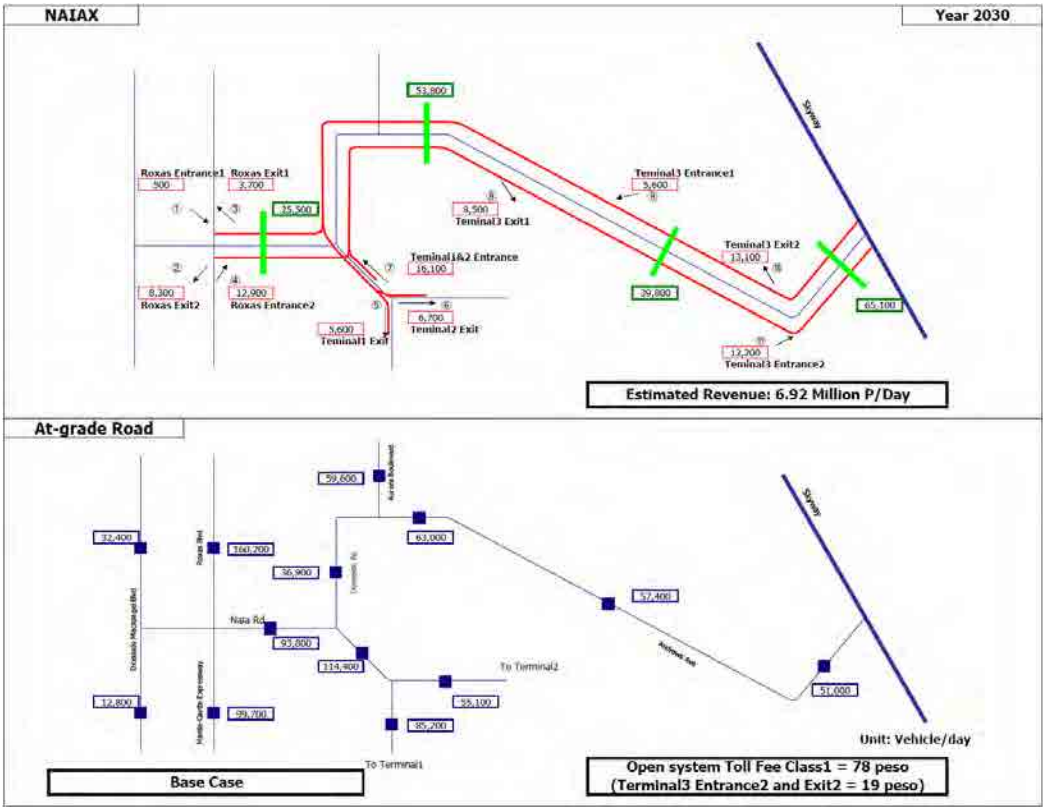


FIGURE 5.4-6 NAIAX TRAFFIC PROJECTION (YEAR 2030, 40 PESO CASE)

6 SCOPE OF THE PROJECT

6.1. Outline of the Project

(1) Expressway Alignment

NAIAX Phase-2 starts at the end point of Phase-1 running over Sales Avenue, Andrews Avenue, Domestic Road, NAIA (MIA) Road and ends at Roxas Boulevard/Manila-Cavite Coastal Expressway.

(2) Ramp Layout

Five (5) new on-ramps and five 5) new off-ramps and one (1) existing off-ramp are provided as shown in **Figure 6.1-1**. One (1) on-ramp constructed under Phase-1 is removed. One (1) overloaded truck/Emergency Exit is provided.

- One (1) on-ramp for NAIA Terminal III exit traffic and one existing off-ramp from Skyway for access to NAIA Terminal III.
- One (1) on-ramp along Andrews Ave. to collect traffic jam from NAIA Terminal III traffic and traffic on Andrews Ave.
- One (1) off-ramp to access to NAIA Terminal I and Terminal II.
- One (1) on-ramp to collect traffic from NAIA Terminal I and Terminal II.
- One (1) on-ramp and one (1) off-ramp from/to Roxas Boulevard.
- One (1) on-ramp and one (1) off-ramp from/to Manila-Cavite Coastal Expressway.
- One (1) existing on-ramp of Phase-1 is recommended to be removed.

(3) Number of traffic lanes of the main expressway and ramps

- Number of traffic lanes of the expressway is four (4) lanes (2-lane x 2-direction).
- Number of traffic lanes of all ramps is one (1) lane.

(4) Number of traffic lanes of at-grade roads during and after expressway construction

Number of traffic lanes of at-grade roads is as shown in **TABLE 6.1-1**.

TABLE 6.1-1 NUMBER OF TRAFFIC LANES OF AT-GRADE ROADS

At-grade Road		Existing No. of Traffic Lanes	No. of Traffic Lanes During Construction	No. of Traffic Lanes After Construction
Sales Avenue	East Bound	3 (Before on-ramp) 2 (After on-ramp)	2	3
	West Bound	3 (Under off-ramp) 2 (Under off-ramp)	2	3
Andrews Avenue (Sales Ave. – Roundabout)	East Bound	3-4	3	3-4
	West Bound	3	3	3
Andrews Avenue (Roundabout – Domestic Road)	East Bound	3	2	3
	West Bound	3	2	3
Domestic Road	North Bound	3	2	3
	South Bound	3	2	3
NAIA (MIA) Road (Domestic Road – Quirino Avenue)	East Bound	4	2	4
	West Bound	4	2	4
NAIA (MIA) Road (Quirino Avenue – Roxas Boulevard)	East Bound	4	2	4
	West Bound	3	2	3

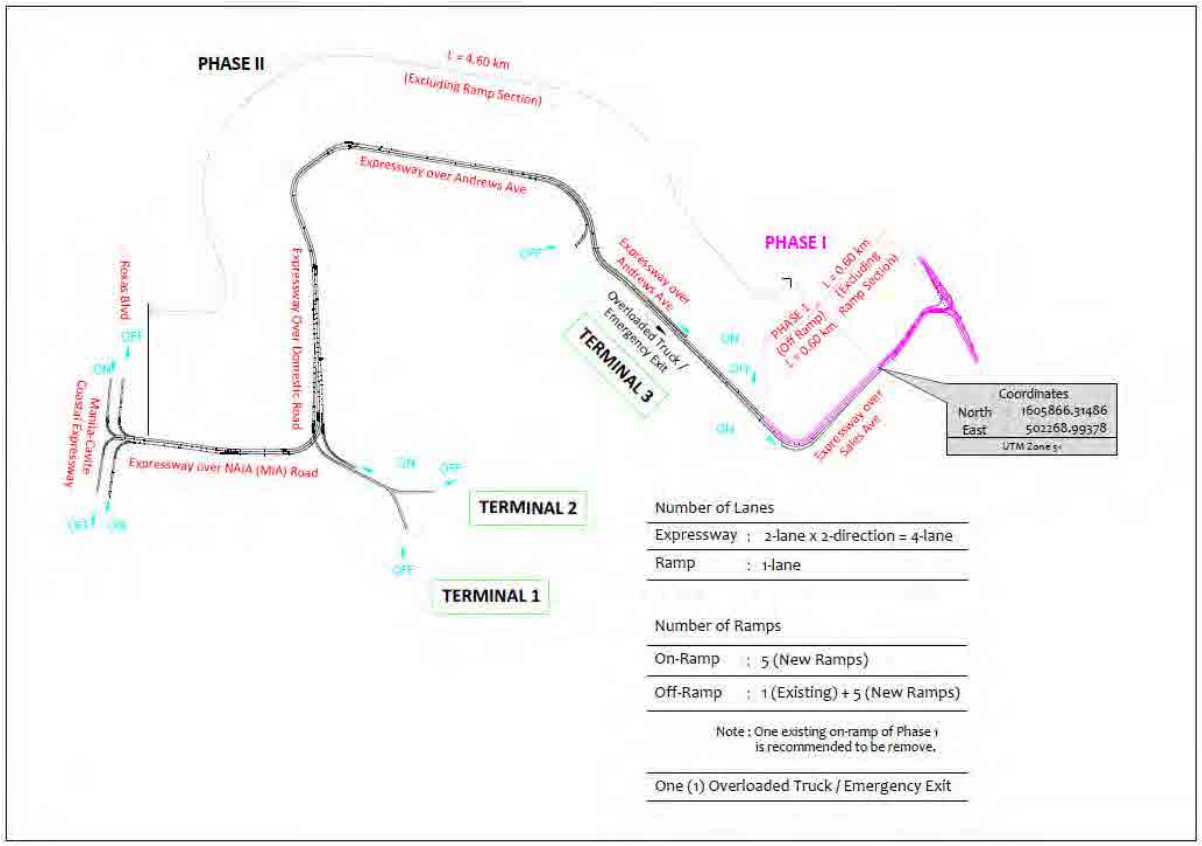


FIGURE 6.1-1 MINIMUM EXPRESSWAY CONFIGURATION

(5) Vertical Clearance for Expressway and At-grade Roads

Vertical clearance for expressway and at-grade roads is as follows;

- Desirable Vertical Clearance: 5.00 m
- Absolute Minimum Vertical Clearance (Note-1): 4.88 m
- Note that applicable only to the section controlled by NAIA Navigational Height Limit.

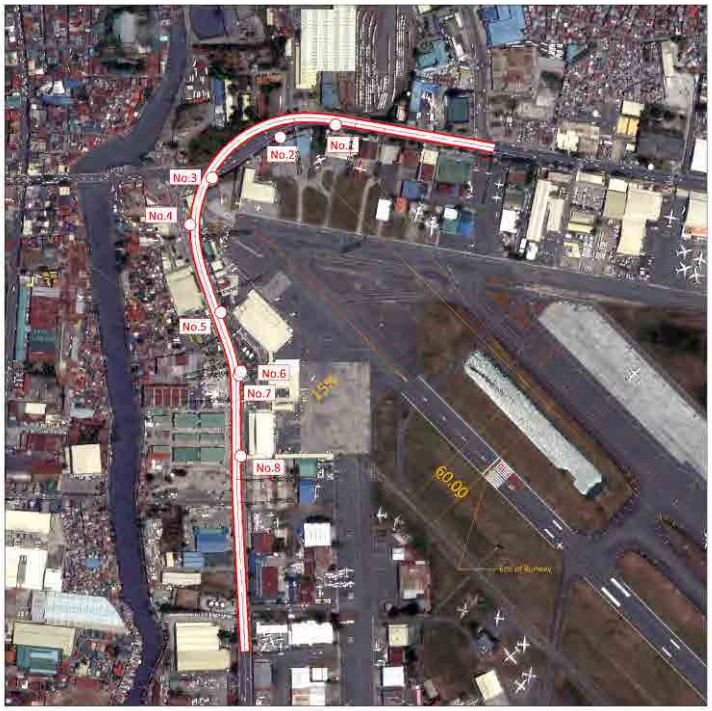
(6) Pedestrian Overpass Bridge

Existing pedestrian overpass bridges are treated as follows. Minimum vertical clearance on the pedestrian overpass bridge is 2.00 m.

Pedestrian Overpass Bridge along Andrews Avenue:	To remain as is.
Pedestrian Overpass Bridge along Domestic Road:	To be removed and converted to the pedestrian crossing with traffic light.
Pedestrian Overpass Bridge near the Intersection between Domestic Road and NAIA Road:	To be removed and replaced with new one near the intersection.
Pedestrian Overpass Bridge at the Intersection between NAIA Road and Roxas Boulevard:	To remain as is.

(7) NAIA Navigational Height Limit

NAIA navigational height limit is shown in **FIGURE 6.1-2** which shall be confirmed by Civil Aviation Authority of the Philippines (CAAP).



Available net height

No	Navigation clearance from Mean Sea level	Road Elevation	Available net height
1	14.463	2.92	11.54
2	15.256	2.90	12.36
3	16.274	2.34	13.93
4	15.627	2.33	13.30
5	12.613	2.24	10.37
6	10.595	2.69	7.91
7	10.513	2.75	7.76
8	20.65	2.99	17.66

FIGURE 6.1-2 HEIGHT LIMIT ALONG ANDREWS AVE. AND DOMESTIC ROAD AND AVAILABLE NET HEIGHT

6.2. Design Standard

The following standard is mainly used as reference in NAIAX Phase-2 design.

- A Policy on Geometric Design of Highways and Streets, AASHTO 2004
- Highway Safety Design Standards Part 1 Road Safety Design Manual, May 2004, DPWH
- Japan Road Association, Road Structure Ordinance,2004
- Highway design manual, Metropolitan Expressway Co., Ltd., Japan
- Highway design manual, NEXCO, Japan

TABLE 6.2-1 GEOMETRICAL DESIGN STANDARD OF NAIAX PHASE-2

Category	Item	Unit	Roadway Standard	Ramp way Standard
Basic Element	Design Speed	km/h	60	40
	Design Vehicle	-	SU	SU
	Stopping Sight Distance	m	85 (absolute 75)	50
	Passing Sight Distance	m	410	270
Cross Section Element	Pavement Type	-	Asphalt Concrete	Asphalt Concrete
	Number of lane	nos	4	2
	Lane Wide	m	3.50	3.50
	Median Width	m	1.00	-

Category	Item	Unit	Roadway Standard	Ramp way Standard
	Inner Shoulder Width	m	0.50	0.50
	Outer Shoulder Width	m	1.50 (absolute 0.50)	2.00 (absolute 0.50)
	Normal Cross fall	%	2.00	2.00
	Maximum Super Elevation		6.00	6.00
	Super Elevation	%	Exhibit 3-26	Exhibit 3-26
	Maximum relative Gradients	%	0.60	0.66
Horizontal Alignment	Minimum Radius	m	123	43
	Minimum Transition Curve length	m	30	22
	Minimum Radius not requiring Transition Curve	m	1030 (absolute 500)	525
	Super elevation Run off	%	1/125	1/125
Vertical Alignment	Maximum Vertical Gradient	%	5 (absolute 7)	6 (absolute 7)
	Minimum K Value Crest	%	18.0	6.0
	Minimum K Value Sag	%	18.0	9.0
	Minimum Vertical Curve Length	%	60	60
	Maximum Composition Grade	%	11.5	11.5

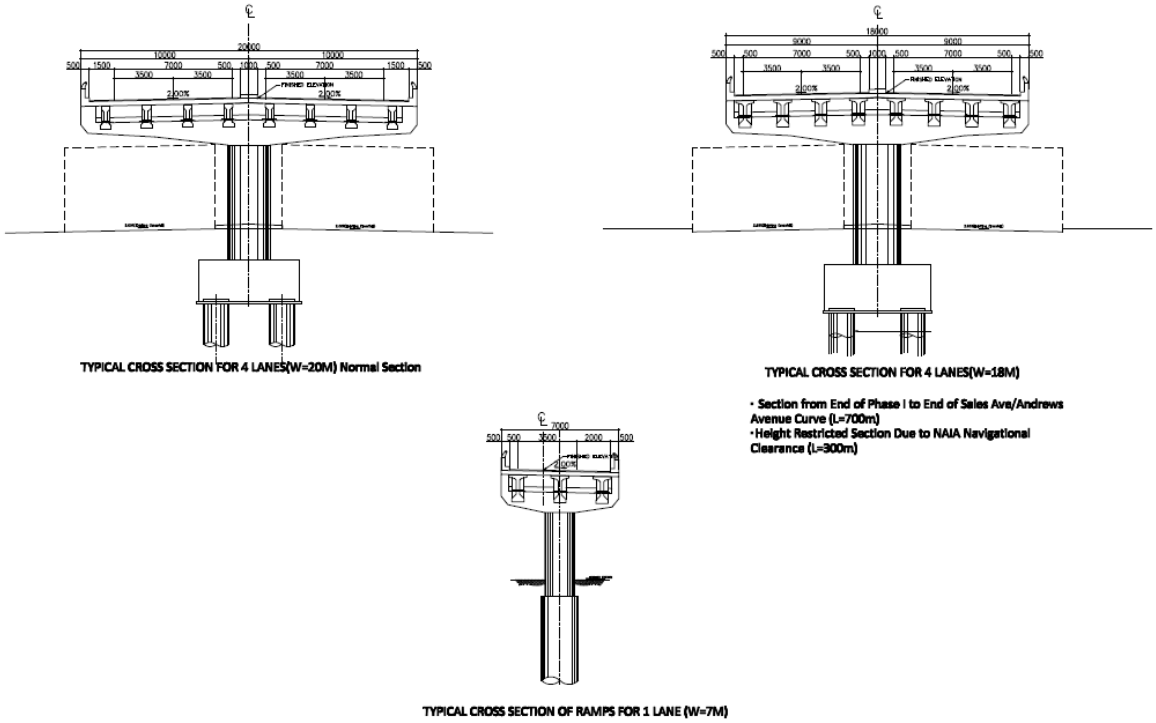


FIGURE 6.2-1 TYPICAL CROSS SECTION of NAIAX PHASE-2

7 PROJECT COST

The estimated project costs were summarized by currency component (foreign, local and tax) and by cost sharing (GOP, ODA, and Private Components). The construction cost composed of civil works, consultancy service, ROW acquisition and administrative Cost. The operation and maintenance cost also estimated by annual base and periodical base.

TABLE 7-1 ESTIMATED CONSTRUCTION COST OF NAIAX PHASE-2

Unit: Million Pesos in 2011 price

Items	Total	Currency Component			Cost Sharing		
		Foreign	Local	Tax	GOP	Private	Utility Company
Civil Work	9,655.85	3,449.99	5,014.58	1,191.28	4,300.00	5,355.85	
Repair / Improvement Cost for Phase-1	13.80	4.93	7.16	1.71		13.80	
Utility Relocation Cost	169.42	60.54	87.98	20.90			169.42
ROW Acquisition Cost	947.76	-	846.21	101.55	947.76		
Detailed Engineering Design Cost	124.95	36.64	74.92	13.39		124.95	
Construction Supervision Cost	226.45	65.71	136.48	24.26		226.45	
Independent Consultant Cost: D/D Stage	58.38	20.83	31.29	6.26	29.19	29.19	
Independent Consultant Cost: Construction Stage	137.71	44.23	78.73	14.75	68.86	68.85	
Project Management Cost	57.93		51.72	6.21	57.93		
Insurance Cost	111.10		89.10	22.00		111.10	
Total	11,503.35	3,682.87	6,418.17	1,402.31	5,403.74	5,930.19	169.42

TABLE 7-2 ESTIMATED OPERATION AND MAINTENANCE COST OF NAIAX PHASE-2

Unit: Million Pesos in 2011 price

Category	Items	Total
Annual Operation and Maintenance Cost	Routine Maintenance Cost	6.26
	Operation Cost	116.80
	Sub-Total	123.06
Periodic Maintenance Cost (every 10 years)		265.85
Independent Consultant Fee		18.52
Insurance Cost and Tax		10.22

8 ECONOMIC EVALUATION

8.1. Assumption and Indicators of Economic Analysis

Economic costs and benefits throughout the project life periods are compared by a discount cash flow analysis. The discount rate is at 15%, which is widely used in Philippines as a social discount rate. For economic evaluation, three indicators are calculated: EIRR, B/C and NPV. In addition, the economic life is assumed to be 30 years, taking into account future rapid growth and changes of socioeconomic conditions. The Unit VOC and travel time cost applied are explained in the **TABLE 8.1-1** and **8.1-2**.

TABLE 8.1-1 UNIT VOC BY FOUR (4) VEHICLE TYPES IN 2011

Peso/km/veh

Speed (km/hr)	Passenger Car	Jeepney	Bus	Truck
20	14.46	10.32	26.16	37.93
30	13.05	9.14	23.23	34.01
40	11.64	7.97	20.30	30.09
50	10.23	6.79	17.37	26.16
60	10.04	6.73	17.40	25.94
70	9.86	6.66	17.43	25.71
80	9.67	6.59	17.45	25.48
90	9.76	6.81	17.50	25.69
100	9.86	7.02	17.54	25.90

TABLE 8.1-2 UNIT TRAVEL TIME COST BY PCU IN 2011

Peso/hour/veh.

Vehicle Type	2011
Public	478.0
Private	227.0
All Passenger Car	320.2

8.2. Results of Economic Analysis

The results of economic analysis are shown in **TABLE 8.2-1**. The economic costs and benefits of the project generated a positive NPV and an EIRR that is higher than the government-prescribed hurdle rate (15%). These values indicate that the project is economically viable.

TABLE 8.2-1 RESULTS OF ECONOMIC ANALYSIS

	Case1: Toll Rate 30 Peso	Case2: Toll Rate 40 Peso
EIRR	18.6%	16.6%
B/C	1.35	1.16
NPV (Million peso @ i=15%)	2,753.3	1,248.7

8.2.1. Economical Project Sensitivity

The project sensitivity to identified risks is shown in **TABLE 8.3-1** and **8.3-2**. The Case-1 results show that the project is able to hurdle the minimum acceptance criteria of EIRR = 15% and NPV = 0 except Cost Plus 10%, Benefit Less 20% Case and Cost Plus 20%, Benefit Less 20% Case. TheCas-2 results show that the project is able to hurdle the minimum acceptance criteria of EIRR = 15% and NPV = 0 in case of only Cost plus 10% and Benefit less 10%.

TABLE 8.3-1 PROJECT SENSITIVITY (Case 1: Toll rate 30 Peso)

	NPV (Million Pesos)	B/C	EIRR
Base Case	2,753.3	1.35	18.6 %
Cost plus 10%	1,957.1	1.22	17.0 %
Cost plus 20%	1,160.9	1.12	16.0 %
Benefit less 10%	1,681.8	1.21	16.9 %
Benefit less 20%	610.3	1.08	15.5 %
Cost plus 10%, Benefit less 10%	885.0	1.10	15.8 %
Cost plus 10%, Benefit less 20%	-185.9	0.98	14.5 %
Cost plus 20%, Benefit less 10%	89.4	1.01	14.8 %
Cost plus 20%, Benefit less 20%	-982.1	0.90	13.5 %

TABLE 8.3-2 PROJECT SENSITIVITY (Case 2: Toll rate 40 Peso)

	NPV (Million Pesos)	B/C	EIRR
Base Case	1,248.7	1.16	16.6 %
Cost plus 10%	452.5	1.05	15.5 %
Cost plus 20%	-343.6	0.96	14.6 %
Benefit less 10%	327.7	1.04	15.4 %
Benefit less 20%	-593.4	0.93	14.2 %
Cost plus 10%, Benefit less 10%	-468.5	0.95	14.4 %
Cost plus 10%, Benefit less 20%	-1,389.6	0.84	13.2 %
Cost plus 20%, Benefit less 10%	-1,264,7	0.87	13.5 %
Cost plus 20%, Benefit less 20%	-2,185.8	0.77	12.4 %

9 PPP SCHEME

For NAIAX Phase-2, the adoption of BTO scheme with Government Financial Support is planned by the Philippines government. Therefore, the same PPP modality is assumed in this study as well. The diagram on the assumed PPP modality is shown as **FIGURE 9-1**.

After the completion of the construction of NAIAX Phase-2 implemented by the Concessionaire, the ownership of the NAIAX Phase-2 facility is transferred to the DPWH. However, the Concessionaire is responsible for the operation and maintenance of NAIAX during the Concession period, and it also can gain revenue with the collection of toll fee from the NAIAX users. In accordance with the stipulation of the Philippines BOT Law, the government subsidy up to 50% of the project cost is granted to the Concessionaire as financial support by the government.

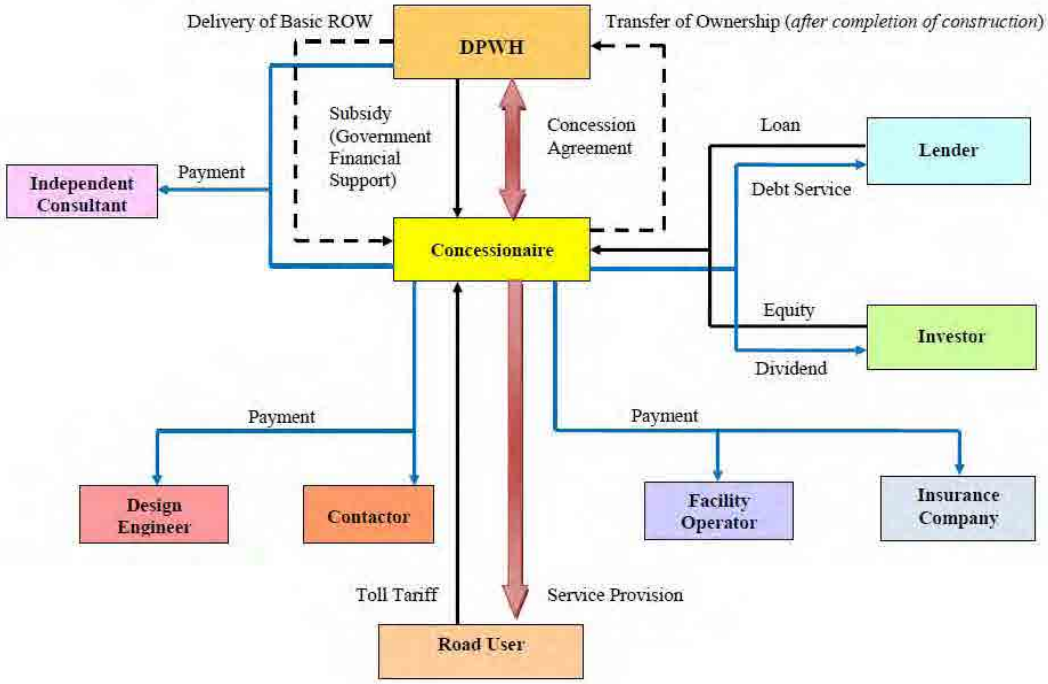


FIGURE 9-1 PPP MODALITY (BTO WITH GOVERNMENT FINANCIAL SUPPORT)

10 FINANCIAL EVALUATION

10.1. Parameters for Financial Analysis

The requisite parameters fro financial analysis of NAIAX PHASE-2 are described in **TABLE 10.1-1**.

TABLE 10.1-1 REQUISITE PARAMETERS FOR FINANCIAL ANALYSIS OF NAIAX PHASE-2

Item			Assumption
Base year for financial analysis			・2011
Implementation/Operation Period			
	Beginning year of the implementation		・2011 (the date of signing of the Concession Agreement is the end of 2011)
	Concession Period		・35 years from the signing of the Concession Agreement
	Land Acquisition Period		・12 months (from Jul 2011 to Jun 2012)
	Detailed Engineering Design (DED) Period		・10 months (from Jan 2012 to Oct 2012)
	Construction Period		・24 months (from Dec 2012 to Nov 2014)
	Beginning year of the operation		・January 2015
	Operation Period		・32 years (up to the end of Dec 2046)
Toll Tariff Revenue			
	Initial Toll Rate in the beginning year of the operation (Class 1)		Case 1: 30 Pesos / Vehicle for the main section Case 2: 40 Pesos / Vehicle for the main section ・10 Pesos / Vehicle for the Terminal 3 section in the both cases
	Toll Rate Adjustment		Case 1: + 5% / Every 2 years Case 2: + 10% / Every 2 years
Cost Estimate			
	Project Cost (in 2011 prices)		・Physical Contingency is included.
		(i) Land Acquisition Cost	947.76 Million Pesos ・The government is fully responsible
		(ii) Main Civil Work Cost	9,655.85 Million Pesos

Item			Assumption
		(iii) Government Financial Support (GFS) for Main Civil Work	Case 1 (Base Case): 4,300.00 Million Pesos (excluding price contingency) ・The government shoulders 45% of the Main Civil Work Cost (Initial Assumption) Case 2: 4,500.00 Million Pesos (excluding price contingency) ・The government shoulders 47% of the Main Civil Work Cost (Initial Assumption) Case 3: 5,000.00 Million Pesos (excluding price contingency) ・The government shoulders 52% of the Main Civil Work Cost (Initial Assumption)
		(iv) GFS provision schedule	Scenario 1 (Base): 1st (July 2013), 2nd (April 2014), 3rd (December 2014) Scenario 2 (3 months advanced): 1st (April 2013), 2nd (January 2014), 3rd (December 2014) ・1st provision is 30% of GFS, 2nd provision is 40% of GFS, 3rd provision is 30% of GFS.
		(iv) Repair/Improvement Cost of Phase I	13.80 Million Pesos
		(v) Utility Relocation Cost	169.42 Million Pesos ・Utility Company is fully responsible
		(vi) DED Cost	124.95 Million Pesos
		(vii) Construction Supervision Cost	226.45 Million Pesos
		(iix) Independent Consultant Cost for DED Stage	58.38 Million Pesos ・one-half of the cost provided by the government
		(ix)Independent Consultant Cost for Construction Stage	137.71 Million Pesos ・one-half of the cost provided by the government
		(x)Project Management Cost	57.93 Million Pesos ・The government is fully responsible
		(x)Insurance Cost Total	111.11 Million Pesos
		Ground Total	Base Case: 11,503.35 Million Pesos ・The government shoulders around 41.9% of the Project Cost, excluding the ROW acquisition and project management
	O & M Cost (Unit: Million Pesos at March 2011 Prices)		
		(i) Operating Cost	136.00 Million Pesos / Year
		(ii) Routine Maintenance Cost	6.26 Million Pesos / Year
		(iii) Periodic Maintenance Cost	265.85 Million Pesos/ every very 10 years ・Periodic maintenance can be done in 2 years (10th and 11th year, and so on.)
		(vi) Government Agent Cost	18.52 Million Pesos / Year ・The government is fully responsible
	Other Cost items		
		Price Escalation	・Annual 5.0% Price Escalation is applied to Project cost as Price Contingency. ・It also is applied to O&M Cost and Annual Insurance Cost.
		Annual Insurance Fee	・10.21 Million Pesos / Year
		Loan Management Fee	・0.3% of Loan
Financing Structure of the Concessionaire in Capital Investment			
	Equity		・Share of Project Cost excluded the government fund (e.g. ROW acquisition cost) shown as below. Case 1: 30%　Case 2: 20%　Case 3: 40%
	Debt		・Share of Project Cost excluded GOP's fund shown as below. Case 1: 70%　Case 2: 80%　Case 3: 60%
	Loan Interest Rate		・10% ・It is assumed that commercial bank loan is utilized.
	Loan Tenure		
		Grace Period	・2 years (during Construction Period)
		Loan Repayment Period	・12 years from financial closure
	Repayment Structure		・Even annuity basis (Annual loan amortization is done at constant amount)
Financing of the Concessionaire during the Operation Period			
	Securing Working Capital (in net negative cash flow during the operation period)		Scenario 1 (without short-term loan): Utilization of the Concessionaire's own funds (e.g. additional equity) Scenario 2 (with short-term loan): Utilization of short-term loan (Repayment period is 1 year)
	Short-term loan		
		Interest Rate	・5%

Item			Assumption
		Loan Repayment Period	・1 year
Depreciation			
	Depreciation Methodology		・Based on the following formula. Annual depreciation value = PPC / T PPC: Private sector share of the Project Cost including Loan Management Fee and Interest during the Construction Period T : Operation Period (32 years) (・The Concessionaire doesn't own the facility due to BTO scheme. Therefore, such formula above is assumed.)
Taxation			
	Corporate Tax		・[Revenue - O&M cost - Insurance cost - Annual deprecation cost - Interest payment – Local Government Tax] x tax rate (30%)
	VAT		・None
	Local Government Tax		・2% of Gross Revenue
	Property Tax		・None due to BTO scheme
	Tax Exemption		Scenario 1: With Corporate Income Tax Holiday ・7 years from the commencement of the operation (in accordance with Executive Order No. 226, The Omnibus Investments Code of 1987) Scenario 2: Without Corporate Income Tax Holiday ・However, Net Operating Loss Carry Over will be applicable. The Net Operating Loss of the Concessionaire shall be carried over as a deduction from gross income for the next 3 taxable years.

10.2. Project Implementation Schedule

FIGURE 10.2-1 explained the implementation schedule of NAIAX PHASE-2. The projects assumes to be started in the may 2011 by Government approval of the project, the construction work will be finished by the end of 2014, then the operation shall be starts from the beginning of 2015.

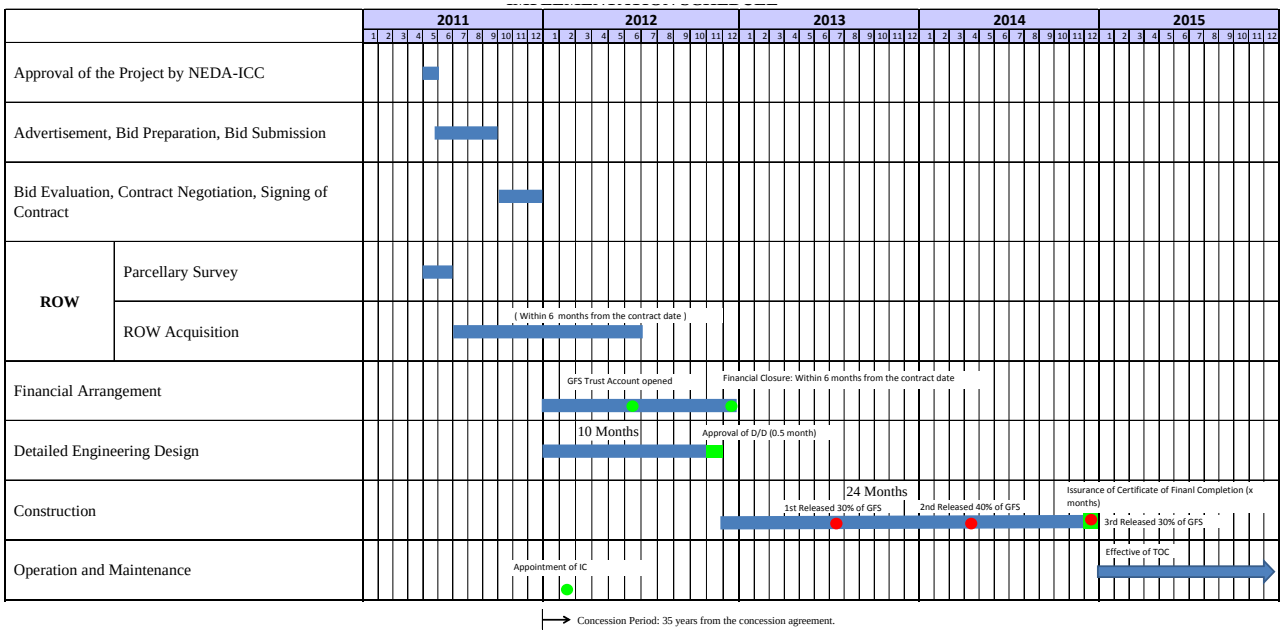


FIGURE 10.2-1 IMPLEMENTATION SCHEDULE

10.3. Results of Financial Analysis

(1) Variation of GFS, initial toll rate and toll rate adjustment

The Results of financial viability for cases of variation of GFS, Initial Toll Rate and Toll Rate Adjustment are shown in **TABLE 10.3-1**. IRRs for SPC are viable except for the Case 1 with Initial Toll Rate 30 Pesos / vehicle, 50% Toll Rate adjustment (5% increase every 2 year). Equity IRRs are viable only in case of 40 Pesos / vehicle, 100% Toll Rate adjustment (10% increase every 2 year).

TABLE 10.3-1 RESULTS OF FINANCIAL ANALYSIS
(GFS, INITIAL TOLL RATE AND TOLL RATE ADJUSTMENT)

Yellow; IRR for SPC over 11.5%, Equity IRR over 15%

GFS	Initial Toll Rate	Toll Rate Adjustment	Project IRR	IRR for SPC	Equity IRR
Case 1: 4,300 Million Pesos (42% of Project Cost)	30 Pesos / Vehicle	50% (5% increase every 2 years)	6.07%	10.31%	10.53%
		100% (10% increase every 2 years)	8.42%	12.78%	13.99%
	40 Pesos / Vehicle	50%	7.19%	11.72%	12.36%
		100%	9.27%	13.87%	15.30%
Case 2: 4,500 Million Pesos (44% of Project Cost)	30 Pesos / Vehicle	50%	6.07%	10.56%	10.81%
		100%	8.42%	13.04%	14.25%
	40 Pesos / Vehicle	50%	7.19%	11.99%	12.64%
		100%	9.27%	14.14%	15.57%
Case 3: 5,000 Million Pesos (49% of Project Cost)	30 Pesos / Vehicle	50%	6.07%	11.25%	11.56%
		100%	8.42%	13.74%	14.94%
	40 Pesos / Vehicle	50%	7.19%	12.72%	13.41%
		100%	9.27%	14.86%	16.37%

(2) With/Without Short-term loan

The Results for selected cases with / without short term loan are shown in **TABLE 10.3-2**. The IRR for SPC and the Equity IRR are decreased without short-term loan, under the assumption on short-term loan for this study (Interest Rate is 5%, Repayment Period is 1 year).

TABLE 10.3-2 RESULTS OF FINANCIAL ANALYSIS (WITH/WITHOUT SHORT-TERM LOAN)

Yellow; IRR for SPC over 11.5%, Equity IRR over 15%

GFS	Initial Toll Rate	Toll Rate Adjustment	Short-term Loan	IRR for SPC	Equity IRR
Case 1: 4,300 Million Pesos	40 Pesos / Vehicle	100%	With	13.87%	15.30%
			Without	13.84%	14.73%
Case 2: 4,500 Million Pesos	40 Pesos / Vehicle	100%	With	14.14%	15.57%
			Without	14.12%	15.10%
Case 3: 5,000 Million Pesos	30 Pesos / Vehicle	100%	With	13.74%	14.94%
			Without	13.71%	14.47%
	40 Pesos / Vehicle	100%	With	14.86%	16.37%
			Without	14.84%	16.09%

(3) Variation of the Ratio of Equity and Loan

The Results for the cases for Variation of the Ration of Equity and Loan are shown in **TABLE 10.3-3**. In case of Equity ratio decrease, the IRR for SPC and the Equity IRR are improved.

TABLE 10.3-3 RESULTS OF FINANCIAL ANALYSIS (RATIO OF EQUITY AND LOAN)

Yellow; IRR for SPC over WACC, Equity IRR over 15%

GFS	Initial Toll Rate	Toll Rate Adjustment	Ratio (Equity/Loan)	IRR for SPC	Equity IRR
Case 1: GFS 4,300 Million Pesos	40 Pesos / Vehicle	100%	3:7	13.87%	15.30%
			2:8	13.98%	16.76%
			4:6	13.76%	14.51%
Case 2: GFS 4,500 Million Pesos	40 Pesos / Vehicle	100%	3:7	14.14%	15.57%
			2:8	14.25%	17.05%
			4:6	14.02%	14.81%
Case 3: GFS 5,000 Million Pesos	30 Pesos / Vehicle	100%	3:7	13.74%	14.94%
			2:8	13.84%	16.33%
			4:6	13.62%	14.21%
	40 Pesos / Vehicle	100%	3:7	14.86%	16.37%
			2:8	14.99%	17.82%
			4:6	14.73%	15.64%

WACC is; 11.5% in case of 3:7, 11.0% in case of 2:8, 12.0% in case of 4:6

(4) Consideration of GFS Provision Schedule

The Results of the cases for consideration of GFS Provision Schedule are shown in **TABLE 10.3-4**. Advanced provision of GFS will make possible late financing of the Concessionaire during construction period. Therefore, the Concessionaire is able to reduce interest during construction. In case of 3 Months Advanced provision, the Equity IRR is improved a little.

TABLE 10.3-4 RESULTS OF FINANCIAL ANALYSIS (GFS PROVISION SCHEDULE)

Yellow; IRR for SPC over WACC, Equity IRR over 15%

Case	Initial Toll Rate	Toll Rate Adjustment	Ratio (Equity/Loan)	Base Schedule		3 Months Advanced	
				IRR for SPC	Equity IRR	IRR for SPC	Equity IRR
Case 1: 4,300 Million Pesos	40 Pesos / Vehicle	100%	3:7	13.87%	15.30%	13.86%	15.35%
			2:8	13.98%	16.76%	13.97%	16.82%
			4:6	13.76%	14.51%	13.74%	14.56%
Case 2: 4,500 Million Pesos	40 Pesos / Vehicle	100%	3:7	14.14%	15.57%	14.13%	15.63%
			2:8	14.25%	17.05%	14.24%	17.11%
			4:6	14.02%	14.81%	14.01%	14.87%
Case 3: 5,000 Million Pesos	30 Pesos / Vehicle	100%	3:7	13.74%	14.94%	13.72%	15.00%
			2:8	13.84%	16.33%	13.82%	16.41%
			4:6	13.62%	14.21%	13.61%	14.28%
	40 Pesos / Vehicle	100%	3:7	14.86%	16.37%	14.84%	16.45%
			2:8	14.99%	17.82%	14.97%	17.90%
			4:6	14.73%	15.64%	14.72%	15.72%

(5) Consideration of corporate income tax holiday

The Results of the selected cases are shown in **TABLE 10.3-5**. IRR for SPC and Equity IRR are improved with 7 years Corporate Income Tax Holiday, but they raise only a little. Estimated taxable income of the Concessionaire in this study is negative for a few years less than 7 years during the initial operation period in spite of the Income Tax Holiday. Therefore, the Concessionaire need not pay corporate income tax during such period even if Income Tax Holiday is not granted.

TABLE 10.3-5 RESULTS OF FINANCIAL ANALYSIS
(WITH/WITHOUT CORPORATE INCOME TAX HOLIDAY)

Yellow; IRR for SPC over WACC, Equity IRR over 15%

GFS	GFS Provision Schedule	Initial Toll Rate	Toll Rate Adjustment	Equity /Loan	Without Tax Holiday		With Tax Holiday	
					IRR for SPC	Equity IRR	IRR for SPC	Equity IRR
Case 1: 4,300 Million Pesos	Base schedule:	40 Pesos / Vehicle	100%	3:7	13.87%	15.30%	14.03%	15.47%
				2:8	13.98%	16.76%	14.07%	16.86%
				4:6	13.76%	14.51%	14.02%	14.88%
Case 2: 4,500 Million Pesos	Base schedule	40 Pesos / Vehicle	100%	3:7	14.14%	15.57%	14.33%	15.80%
				2:8	14.25%	17.05%	14.36%	17.18%
				4:6	14.02%	14.81%	14.32%	15.23%
Case 3: 5,000 Million Pesos	3 months advanced	30 Pesos / Vehicle	100%	3:7	13.72%	15.00%	13.87%	15.17%
				2:8	13.82%	16.41%	13.91%	16.52%
				4:6	13.61%	14.28%	13.86%	14.62%
	Base schedule	40 Pesos / Vehicle	100%	3:7	14.86%	16.37%	15.15%	16.82%
				2:8	14.99%	17.82%	15.17%	18.03%
				4:6	14.73%	15.64%	15.14%	16.23%

11 ENVIRONMENTAL AND SOCIAL CONSIDERATION

11.1. Scoping Results of Environmental Impacts by NAIAX PHASE-2

TABLE 11.1-1 and **11.1-2** show the environmental impacts on NAIAX project on each environmental concerns and project activities through the project stage of pre-construction, construction and operation, management after the construction.

TABLE 11.1-1 MATRIX TABLE FOR ENVIRONMENTAL IMPACT EVALUATION ON NAIAX PROJECT

Stage			Pre-Construction	Construction									O&M after construction			
Environment Concerns \ Activities			Field Survey	Recruitment of Job Opportunity	Mobilization of Equipment and Materials	Site Clearance	Setting up Base Camp	Earth works	Piling and Construction of Substructure	Construction of Viaduct & Bridge	Construction of Road	Construction of Comple-mentary Structures	Recruitment of Job Opportunity	Increase of traffic volume	Maintenance of Toll Road	Operation of Toll Road and Gate
Social Environment	1	Resettlement/Land Acquisition	XXX													
	2	Economic Activities		+			X						+			
	3	Social and Public facilities			X				X	X	X		X		+	
	4	Split of Communities														
	5	Cultural Property														
	6	Water rights and Rights of Common														
	7	Public health Condition												X		
	8	Waste				X	X	X		X	X					
	9	Hazards (Risk)			X	X	X		X		X	X				+
Natural Environment	1	Topography and Geology														
	2	Soil Erosion				X		X			X					
	3	Ground water														
	4	Hydrological situation				XX	X	X		X	XX					
	5	Coastal Zone														
	6	Fauna and Flora				X										
	7	Meteorology												X		
	8	Landscape						X	X	X						
Pollution	1	Air Pollution			XX			X		X	X	X		X		++
	2	Water Pollution					X		X							
	3	Soil Contamination														
	4	Noise and Vibration			XX		X	X	X	X	X	X		X		X
	5	Land Subsidence														
	6	Offensive Odor														

Note: +: Positive Impact X: Negative Impact, but its magnitude will not be significant. XX, XXX: Negative Impact, of which special attention has to be paid

TABLE 11.1-2 MATRIX OF SCOPING RESULTS

Name of Proponent		*Department of Public Works and Highway (DPWH)*		
No	***Impacts***	***Rating*** *Impacts Construction*		***Reasons of Evaluation***
		During	***After***	
*Social Environment: *Regarding the impacts on "Gender" and "Children's Right", might be related to all criteria*				
1	*Involuntary Resettlement*	*A*	*D*	*Approximately 50 households (There are individual houses sited on the ground and not condominium type housing. Number of Affected persons is counted approximately 280) are allocated on the expressway alignment route. Within above figures 40 households in Barangay 191 are identified as informal settlers, they have been inhabited for long years with solid concrete and mortar structure units. Other 9 households are settled in Barangay Tambo and detail of their family and life style are under the social survey process. Other than above said households there are small retail shops, nursery school, basket court, Land transportation office and security guard station of Barangay affected and counted approximately 17 cases. Total of 9 cases of Business establishments and ex-post office remained after burned within the property of MIA are partially affected and they have to move back to their original location. Basically the most of expressway ROW is located within the property belonged to MIA and Philippine Air Force etc., The area for construction of interchanges and ramp ways are to be required for new land acquisition.*
2	*Local economy such as employment and livelihood, etc.*	*B-/ B+*	*+*	*During the construction period, small retail shops and vendor shops which managed especially by women are affected due to reduced numbers of daily customer and as a results their sales accounts may temporally be reduced.* *Meanwhile employment opportunity for construction labor will be increased. Viaduct structure of the expressway provides shade along the route, but the right to sunlight is not a subject to the problem for local peoples in the tropical region. In operation period of the expressway the traffic volume of the project area will divert to the expressway and smooth traffic along the existing road will encourage vicinity business activities therefore vicinity sales accounts will not be decreased so much but increased.* *The users of the expressway will have their trip destination with time saving and no traffic jam, and expressway has this service function to them as to be bypass for the project area. Current status of the existing congested traffic environment of the area will be improved and it will be encouraged to stable and active business activities for the vicinity peoples. Transferring and transporting both peoples and goods are to be harmonized as to be contributed local economy.*
6-1	*The poor*	*B-*	*B+*	*Some poor class peoples are inhabited; little direct impact is expected by the project. Many opportunities on participation of project related business activities and employment are generated during the construction period. After construction vicinity business activities will be increased due to enhancement of the existing road condition and improved roadside environment, employment opportunities also increased consequently.*
Natural Environment				
14	*Soil Erosion*	*B*	*D*	*Almost no earthwork by cutting and embankment is applied; it may not be caused soil erosion impact. The construction work is viaduct and bridge type, abutments of the bridge is situated outside of the river and no pier installed in the water, side protection of abutment is constructed with concrete wall and no earth embankment, so that soil erosion will be not occurred. In some case of excavation activities for pier foundations, piles of excavated earth will cause temporally*
20	*Landscape*	*B*	*B*	*Contrast between location of the viaduct and landmark feature will give quality of perceptional impact to the pedestrian. Probably the location of viaduct sited back side of the feature will be sense of stable due to the design figure and motional direction of the feature.* *Construction activities will cause busy looks during the construction period especially at roundabout of landmark sited near the front of terminal 3.*

21	*Global Warming*	*B*	*C*	*The project will contribute to solve increase of traffic volume and traffic congestion in future, increase of CO_2 will affect global warming impact due to traffic volume increased. Currently Metro Manila has a policy to promote tree planting program to contribute global worming phenomena. Through the study of CO_2 emission comparing the case of with project and without project is preparing.*
				Pollution
22	*Air Pollution*	*B*	*C*	*Air pollution will be expected due to generate vehicle emission and dust by construction activities during the construction period. After construction traffic congestion will be mitigated and less air pollution will be expected than before. However the traffic volume will be increased consequently air pollution become to be worsening unless proper regulations on traffic control vehicle emission gas etc., by the Philippine Government concerned.*
23	*Water Pollution*	*B*	*D*	*Excavation activities of foundation work of piers may cause temporally impact when local drainage and sewerage system will be affected by construction activities. The existing drainage and sewerage system shall be checked together with LGUs engineer and safety management of construction work shall be prepared for avoiding water pollution problems.* *After construction the storm drainage system will be improved and no water pollution will be expected.* *Currently water quality of Paranaque river is polluted and functioned as urban drainage channel.*
25	*Waste*	*B*	*D*	*Wastes and refuse materials from construction site and workers camp yard are usually generated, these wastes must be checked either dangerous, toxic, spoiled or not, if these risky wastes are identified disposed to the specific place directed by LGU. Basically these wastes can be managed by the contractor during construction period.*
26	*Noise and Vibration*	*B*	*B*	*Operation activities of construction equipment and vehicles generate certain level of noise and vibration and affect nearby living local peoples. These impacts will be temporally during construction period. After construction numbers of vehicles on the expressway and existing road will cause noise and vibration impacts to the vicinity peoples. Because of high elevation of the viaduct generated noise from the expressway will diffuse in the air, so that noise is not so much level.*
30	*Accidents*	*B*	*C*	*According to increase numbers of construction vehicle during the construction period, ration of traffic accident will increase. Management of transportation operation in the construction site is one of the important responses for the contractor. After the construction traffic flow will be improved because of improvement of road facilities, so that accident may be reduced.* *The expressway will be furnished with all standard safety measures. Very little impact is expected.*
31	*Traffic congestion*	*B*	+	*Traffic control management will be required during construction period; an effective road width will be reduced narrow for construction activities, so that traffic congestion will be accelerated. After the construction, traffic volume will be diverted in to the expressway and traffic congestion will be much reduced on the existing road.*

Source: The study team

11.2. Environmental Monitoring Plan

The Environmental Monitoring Plan shows the framework on which the NAIAX Project Proponent and the various stakeholders are willing to implement to continuously supervise the environmental protection measures during the Pre-construction/Construction, Operation/Maintenance, and Abandonment periods of the proposed NAIX Project.

This Environmental Monitoring Plan provides the NAIX Project Proponent a guideline on monitoring, verification, and making of the necessary corrective actions on the Project's various environmental impacts. In addition, this will also provide the NAIX Project Proponent some baseline information in recording and examining the long-term effects of the Project's different environmental aspects and corresponding impacts, on which future strategies (i.e. remediation, clean-up activities, etc.) can be formulated and applied. **TABLE 11.2-1** shows the Environmental Monitoring Plan of the proposed Project.

TABLE 11.2-1 MATRIX OF THE NAIAX 'S ENVIRONMENTAL MONITORING PLAN

Concern	Parameter to be Monitored	Sampling Measurement Plan			Responsibility	Estimated Cost
		Method	Frequency	Location		
A. Pre-construction stage						
Affected houses, establishments, and trees	No. of houses and Establishments to be directly affected	Survey	Once	Affected location along the proposed highway alignment	DPWH DPWH Contractor	Part of Feasibility Study Costs
	No. of trees	Terrestrial Survey/ Inventory	Once			
Air Quality	Dust	Visual observation	Once	Immediate vicinity of construction sites	DPWH Contractor	Minimal
	NO2, SO2	Air sampler	Once	Identified sampling station	DPWH Contractor	PhP 10,000 per sampling station
	TSP	High volume sampler	Once			
	Noise	Digital sound level meter	Quick sampling			
Water Quality	TSS, Oil& Grease, color	Quick sampling	Quick sampling	The bridge location of identified/affecte d water bodies	DPWH Contractor	PhP 5,000 per sampling activity
B. Construction stage						
Affected houses, establishments, and trees	No. of houses and Establishments to be directly affected	Survey	Twice (Initial and Confirmatory)	Along the proposed highway alignment	DPWH DPWH Contractor	Part of Feasibility Study Costs
	No. of trees	Terrestrial Survey/ Inventory				
Air Quality	Dust	Visual observation	Daily	Immediate vicinity of construction sites	DPWH Contractor	Minimal
	NO2, SO2	Air sampler	Quarterly	Identified sampling station	DPWH Contractor	PhP 10,000 per sampling station
	TSP	High volume sampler	Quarterly			
	Noise	Digital sound level meter	Quick sampling			
Water Quality	TSS, Oil& Grease, color	Quick sampling	Quick sampling	The bridge location of identified/affecte d water bodies	DPWH Contractor	PhP 5,000 per sampling activity
Solid Wastes	Tons/day, no. of items/day	Visual observation,	Daily	Construction site, office/base camp	DPWH Contractor	Marginal cost
Hazardous	Liters/No. of	Visual inspection/	Monthly	Construction site,		

Concern	Parameter to be Monitored	Sampling Measurement Plan			Responsibility	Estimated Cost
		Method	Frequency	Location		
Wastes	drums (liquids) Kilograms (solids)	weighing		office/base camp		
Occupational Safety	No. of work-related injuries No. of safety man-hours	Log-book registration	Daily	Immediate vicinity of the construction sites, command center		
Public Perception/ Acceptability	No. of valid complaints	Consultations with local officials and residents	Variable	Affected barangay/s	To be determined	
C. Operation and Maintenance stage						
Storm water Run-off	BOD, COD, pH, heavy metals, TPH	Quick sampling	Quarterly	Drainage outlets	NAIAX Operator through subcontractor	PhP 20,000 per sampling activity
Air Quality	NO2, SO2, TSP	Air sampler High volume sampler	Quarterly	To be determined		
	Noise	Digital sound level meter	Quarterly	To be determined		
Solid Wastes	kgs./day	Visual inspection/ weighing	Daily	Field Operations Center	NAIAX Operator	Part of Operations costs
Hazardous Wastes	Liters/No. of drums (liquids) Kilograms (solids)	Visual inspection/ weighing	Quarterly	Field Operations Center	NAIAX Operator	Minimal, Part of Operations costs
Occupational Safety	No. of work-related injuries No. of safety man-hours	Log-book/database registration	Daily	Field Operations Center	NAIAX Operator	Part of Operations costs
Expressway Safety	No. of vehicular accidents	Log-book/database registration	Daily	Field Operations Center	NAIAX Operator	Part of Operations costs
Public Perception/ Acceptability	No. of valid complaints	Consultations with local officials, residents	Variable	Affected barangay/s or concerned citizens	NAIAX Operator	To be determined

11.3. Resettlement Action Plan

The implementation of the NAIAX is expected to yield a number of involuntary resettlement impacts as a result of land acquisition for ROW. Among these social impacts is the displacement from their abode are an estimated 40 informal settler families that are residing beside the Paranaque River at Barangay 191. Refinements to the road alignment had avoided displacing other landed families and barangay offices in Barangay 185. Other affected areas are commercial establishments with expired leases (with MIAA) that have partially affected offices and facilities along the road alignment.

The public consultation meeting involving the affected persons from Barangay 191 had indicated that all of them desire to shift to government relocation site preferably within the city in order to minimize the impact of their dislocation from their present livelihood and support services. **FIGURE 11.3-1** shows the map of the project site indicating the location of the proclaimed relocation site and pictures of the present condition.

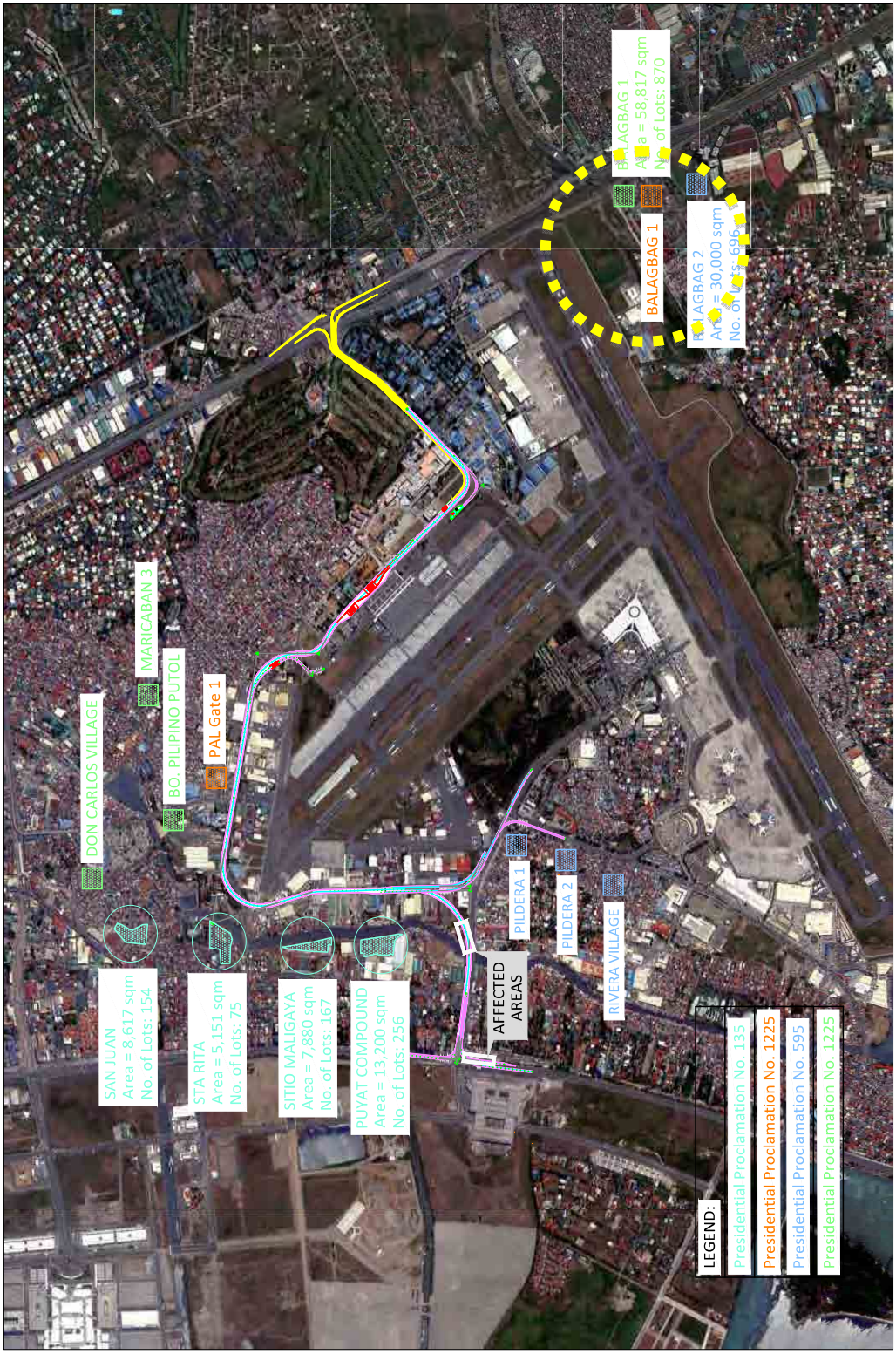


FIGURE 11.3-1 LOCATION OF LOTS WITH PROCLAIMED FOR USE AS RELOCATION SITE

11.4. Implementation Schedule

The preparation and implementation of the RAP would take about one year and nine months to complete. Activities include: a) the preparation of the draft RAP, b) RAP review and approval process; c) Creation of a Resettlement Implementation Committee (RIC) to implement the RAP in the field; d) Signing of the Memorandum of Understanding among DPWH, MIAA, NHA and LGU Pasay City purposely to plan and develop the relocation site; e) Delivery or actual payment of Compensation and other benefits to PAFs; f) Preparation and implementation of Income Restoration Programs (IRP); and g) monitoring and evaluation.

ACTIVITIES	2011				2012				2013				2014			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1 Resettlement Action Plan (RAP) Preparation																
2 RAP Review & Approval																
3 Creation of RIC and RAP Implementation																
4 Signiing of MOU, Planning and Relocation Site Establishment																
5 Delivery of Compensation and Other Benefits to PAFs																
6 Shifting of PAFs to Relocation Site																
7 Preparation and Implementation of Income Restoratin Projects																
8 Monitoring & Evaluation																
9 Detailed Design																
10 Construction Phase																

FIGURE 11.4-1 RESETTLEMENT SCHEDULE

12 PROJECT EFFECT

(1) Comparison of Average Travel Time and Travel Speed of At-grade Road and Expressway

FIGURE 12.1-1 with blue chart above shows the comparison of average travel time between ordinary road and NAIAX. in using the expressway, it requires only 7.5 minutes to travel the whole route, as compared to 22.4 minutes using the at-grade route 1 (Roxas boulevard to SLEX), and 18.6 minutes using the at-grade route 2 (Slex to Roxas boulevard), with a savings of 14.9 minutes and 11.1 minutes, respectively.

The chart with the red color below shows the comparison of average travel speed between ordinary road and expressway. in using the expressway, the travel speed can be maximized at 45 km/hr as compared to 17.6 km/hr for route 1 (Roxas boulevard to SLEX), and 21.4 km/hr for route 2 (SLEX to Roxas boulevard).

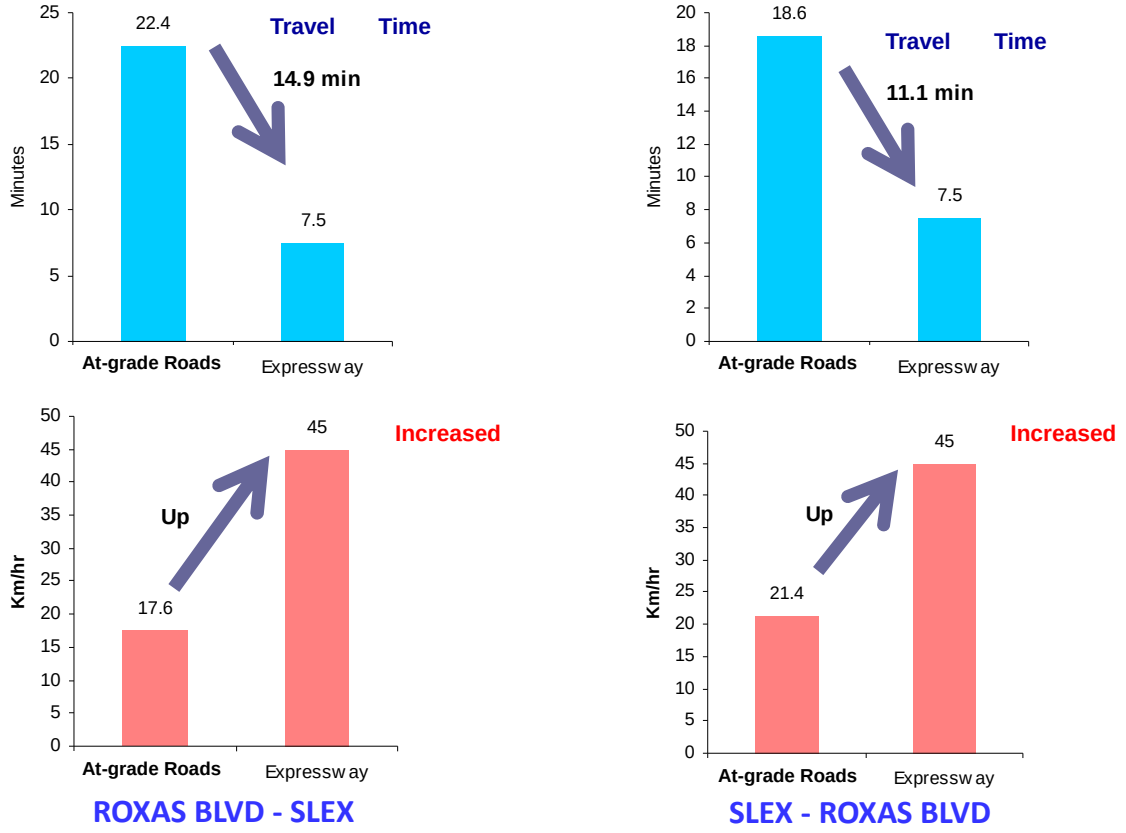


FIGURE 12.1-1 COMPARISON OF TRAVEL TIME AND AVERAGE TRAVEL SPEED BETWEEN ORDINARY ROAD AND EXPRESSWAY

(2) Vehicle Travel Hour

The savings in vehicle travel hour which is estimated by traffic assignment is presented in **FIGURE 12.1-2**. If NAIAX is constructed, around 7,245 vehicle-hours will be saved in 2015. This number increases to about 24,319 in 2020 and about 28,708 in 2030. Saving in vehicle-hour will help in improvement of environment.

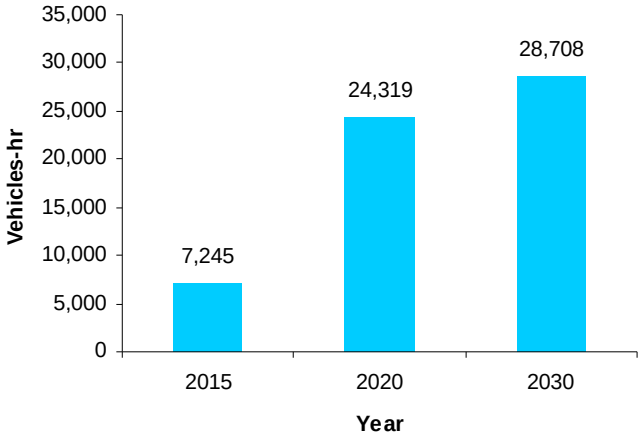


FIGURE 12.1-2 SAVINGS IN VEHICLE TRAVEL HOUR/DAY (WITH – WITHOUT PROJECT)

(3) Unquantifiable Effects

In addition to improvement of transport efficiency and direct economic impacts, the following positive impacts are expected to be generated from the NAIAX.

1) Contributes to Formation of Expressway Network

One of the serious constrains of the existing expressways in the country is the lack of network formation which would provide seamless linkages among the expressways. NAIAX can contribute in the formation of expressway network by linking Skyway to Cavite Coastal Road Expressway.

2) Contributes to Economic Development

Interview results to manufacturing industries located inside the economic zones in Cavite mentioned that one of the problems affecting their business operation is the heavy traffic congestion particularly roads connecting to ports and airports. Construction of NAIAX will remove one of the problems mentioned by industry players.

3) Contributes to Promotion of Tourism Industry

Upon exiting from airport's terminal, tourists of the country are exposed to the chaotic transportation situation of the country. Travel time survey indicated that during peak hours, it took more than 21-minutes to reach SLEX from Terminal 1 and 2 and it took almost 40-minutes for motorists moving in opposite direction. Travel speed is between 8 to 15 km/hr.

This level of congestion leaves many tourists of the country frustrated and creates a negative impression that will discourage them to promote the country to their friends and associates or to return back in the future. Construction of NAIAX although will not totally erase this problem is expected to lessen this negative impression.

4) Contributes to Social Development

Large scale construction work will need large number of labour forces. Jobs created from this project will help reduce the number of unemployed workers. And during operation and maintenance stage, long term or stable jobs will be generated which would help uplift people's lives.

5) Contributes to Affect Disaster Response

During national emergency causes by disasters, transportation hubs like ports and airports are very critical facility to realize swift movement of people and goods. The proposed NAIAX will be constructed taking into account ability to withstand disaster. When disaster struck in distant places, the NAIAX will form part of Skyway/SLEX and Coastal Road Expressway that will feed the airport to affect emergency response.

6) Contributes to Growth of Construction Industry

Project of this scale will contribute to the growth of construction industry in the country. Constant availability of jobs will improve their financial conditions which would allow them to invest more for technology innovation, employment of regular engineers, and capacity development of employees.

7) Improvement of Environment along Existing Roads

A large volume of traffic will be diverted to the new expressway from the existing roads, thus traffic load on existing roads will be reduced, resulting in improvement of environment along existing roads.

13 SUPPLEMENTAL WORK

13.1. Grade Separation Alternative Study

(1) Location of Intersection

The grade separation plans in critical intersections along NAIAX were studied. The location of the targeting intersections is indicated in **FIGURE 13.1-1**.

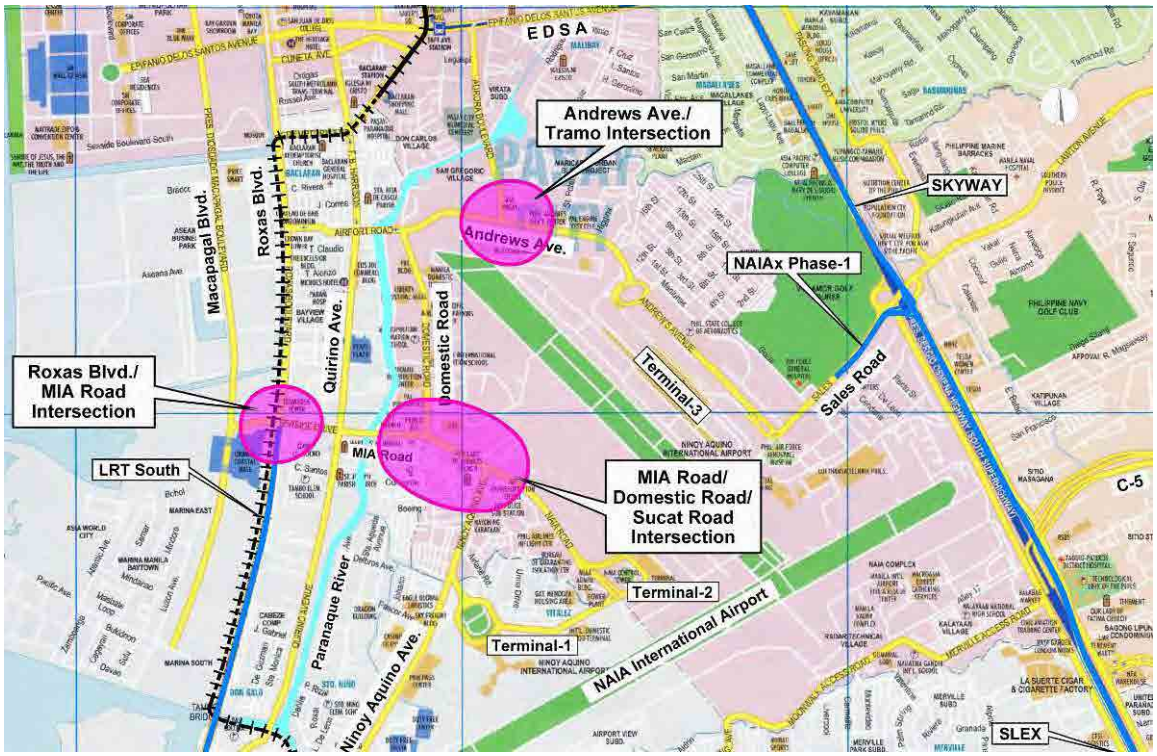


FIGURE 13.1-1 LOCATION OF CRUCIAL INTERSECTION ALONG NAIAX PHASE-2

(2) Recommended Schematic Design of Grade Separation

The three (3) grade separations on the crucial intersection were planned and designed. The schematic designs on each grade separation are illustrated as **FIGURE 13.1-2**.

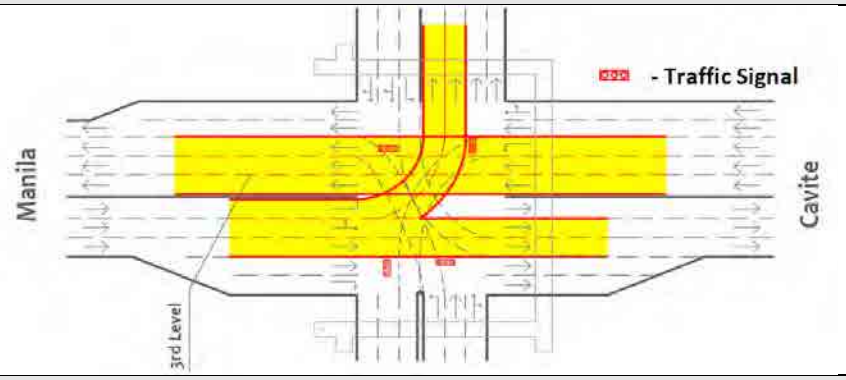
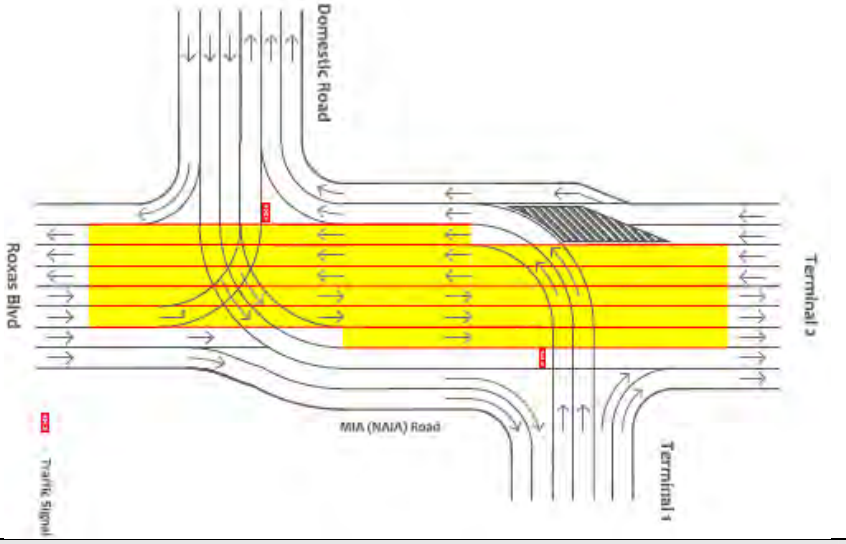
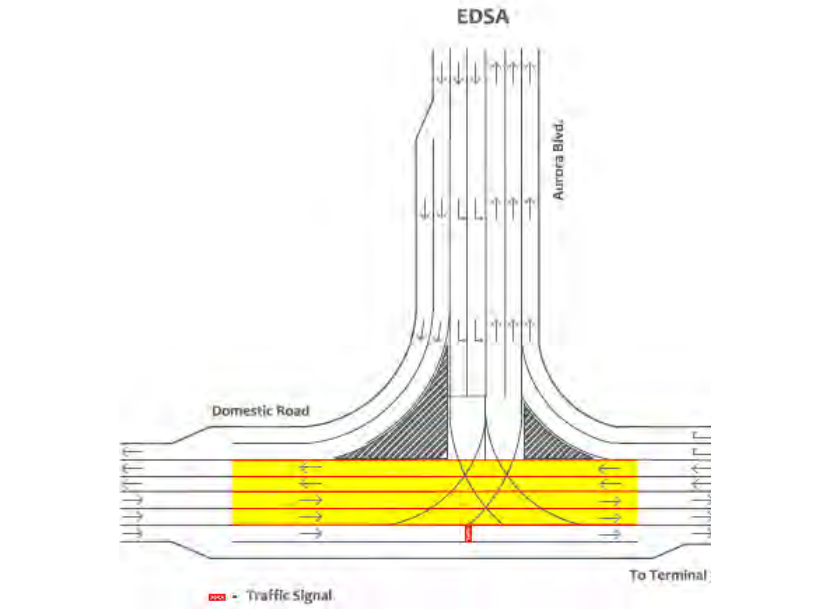
Roxas Blvd. / MIA Road Intersection	
	Cost Civil Work; 1,032Million Pesos ROW Cost; 24 Million Pesos Total: 1,056 Million Pesos
MIA Road / Domestic Road / Sucat Road Intersection	
	Cost Civil Work; 955Million Pesos ROW Cost; 5 Million Pesos Total: 970 Million Pesos
Andrews Ave. / Tramo Road Intersection	
	Cost Civil Work; 297Million Pesos ROW Cost; 103Million Pesos Total: 400 Million Pesos

FIGURE 13.1-2 SCHEMATIC DESIGN OF GRADE SEPARATION

13.2. Further NAIAX Alignment Alternative Study

Concerned to the NAIAX alignment, further alternative study has been done. The three (3) alternatives are prepared, Parañaque River alignment, Airport Road alignment and MIAA Compound alignment. **TABLE 13.2-1** explained the comparative analysis among alternatives. In the result, compared with the original alignment, all three alternatives are not recommended.

TABLE 13.2-1 COMPARATIVE ANALYSIS FOR NAIAX FURTHER ANALYSIS

	Route Map	Evaluation
Parañaque River Alignment		• Civil work cost is higher by about 0.9 Billion Pesos due to construction in the river, longer ramps to Terminal I and Terminal II and Widening of river and reconstruction of revetment. • Parañaque River is a flood-prone river, thus widening of the river is required. • Need relocation of informal settlers (about 200 houses) living within river ROW
Airport Road Alignment		• Not recommended due to NAIA Navigational Height Limit, access ramps to Terminal I and Terminal II can not be constructed.
MIAA Compound Alignment		• Airport Security Problem • Existing toll booth needs to be relocated • From Roxas Blvd. side, no access to Terminal III. • Vertical grade of 5% is required (standard is 4%). ・Additional ROW acquisition of 19.5 m. in width along Villamor Air Base is required.

13.3. C-5 Extension Alignment Alternatives

(1) Alignment Study of C-5 extension

Three (3) alignment alternatives of C-5 extension have been prepared. The comparative analysis is indicated as **TABLE 13.3-1**. The Alternative 3 was recommended for both Expressway and National Road Standard. The alternative 3 was recommended among Expressway Standard, and the alternative 3C among National Road Standard.

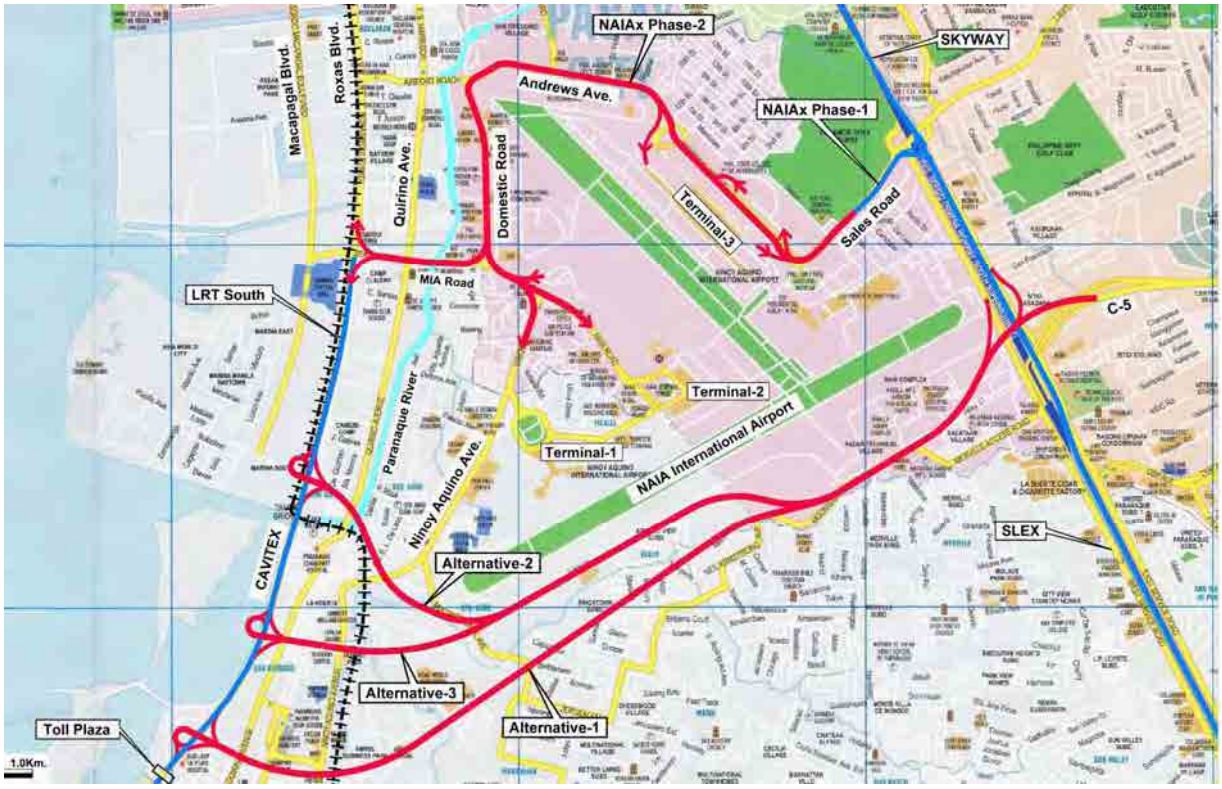


FIGURE 13.3-1 C-5 EXTENSION ALIGNMENT ALTERNATIVES

TABLE 13.3-1 COMPARATIVE ANALYSIS RESULT OF C-5 EXTENSION ALIGNMENT ALTERNATIVES

		Expressway			National Road		
		Alt-1	Alt-2	Alt-3	Alt 1A	Alt – 2B	Alt – 3C
Expressway/Road Length (km)		7.02	6.52	6.29	7.02	6.52	6.29
ROW Acquisition	Land Area Affected (Ha)	32.32	21.31	20.45	19.92 (20.44)	16.01 (16.53)	15.20 (15.72)
	No. of Structure Affected (No.)	900	890	850	550 (560)	520 (530)	500 (510)
Cost	Civil Work Cost (Billion Pesos)	5.27	4.63	4.34	2.57 (2.90)	2.94 (3.27)	2.42 (2.75)
	Land Acquisition Cost (Billion Pesos)	4.50	2.99	2.87	2.74 (2.81)	2.20 (2.27)	2.09 (2.16)
	Resettlement Cost (Billion Pesos)	1.97	1.95	1.86	1.19 (1.21)	1.14 (1.16)	1.10 (1.12)
	Total (Billion Pesos)	11.74	9.57	9.07	6.50 (6.92)	6.28 (6.70)	5.61 (6.03)

(###) include Skyway connection

(2) Franchise Issue of C-5 Extension

There are some issues on the franchise of C-5 Extension as follows.

- UEM-MARA has a franchise for R-1 to R-3.
- Citra Metro Manila Tollways Corp. has a franchise of Skyway with which C-5 Extension is connected.
- If C-5 Extension is implemented by PPP, will an open bidding be done, or negotiated with UEM-MARA?
- If C-5 Extension is implemented by DPWH as National Road Standard, UEM-MARA will complain.
- It may take a long time to conclude a franchise issue.

13.4. Alternative Analysis between NAIAX, Grade Separation and C-5 Extension

The comparative analysis among the alternatives, Original NAIAX plan, Grade Separation, C-5 Extension with expressway standard and C-5 Extension with National road standard have been carried out. **TABLE 13.4-1** explains the route of the alternatives.

TABLE 13.4-1 COMPARATIVE ANALYSIS BETWEEN NAIAX, GRADE SEPARATION AND C-5 EXTENSION ALTERNATIVE

		NAIAX	Grade Separation	C-5 Extension	
				Expressway Standard	National Road Standard
Distance / Location		4.6 km(6.5 km) Note-1	4 Intersections	6.52 km	6.52 km
Cost (Billion Pesos)	Civil Work	9.66	2.29	4.34	2.75
	ROW / Relocation	0.95	0.13	4.73	3.28
	Total	10.61	2.42	9.07	6.03
Government Funding (Billion Pesos)		GFS (Max) 5.00 ROW 0.95 Total (Max) 5.95	2.42 （All）	4.73 (ROW)	6.03 （All）
Benefit	Vehicle Operating Cost Saving	343	133	396	354
	Travel Time Cost Saving	1,269	493	1,466	1,309
	Total Saving	1,612	626	1,862	1,663
Implementation Schedule (assume to start from July 2011)		Completed in Dec. 2016	Completed in June 2015	Completed in June 2017	Completed in June 2017

13.5. Recommendation

Based on the comparative analysis, the following are concluded and recommended.

(1) NAIAX Phase-2

- Being recommended to implement this project.
- It is a long term solution for traffic capacity expansion.
- Accessibility to NAIA Terminals will be greatly improved.
- Image of the country will be highly improved by foreign/domestic investors due to easy access to NAIA: International/Domestic Gateway.
- NAIAX will reduce traffic congestion of at-grade roads.
- The Project is ready for tendering.

(2) Grade Separation Alternative

- It improves traffic condition at the intersection, but not for adjacent sections, thus it is not a long term solution.
- If grade separation structures are built, construction of an expressway in the future will be practically impossible.

(3) C-5 Extension

- Timing of the implementation is uncertain due to franchise issue.
- Franchise issues should be firstly concluded.
- All kinds of efforts should be made to reduce negative social impacts. (over 500 houses or 3,000 people will be affected)

CHAPTER 1
INTRODUCTION

1.1 BACKGROUND OF THE PROJECT

The Philippines has been experiencing relatively slower economic development partly due to limited flow of direct investments into manufacturing sector compared to other rapidly growing ASEAN countries after the recovery from Asian Economic Crisis. In order to foster both domestic and foreign investments, improving overall investment climate including road network has been an urgent matter. In particular, the economic activities are extremely concentrated in Metro Manila where 37% of GDP and 13% of total population are accumulated in merely 0.2% of the country's land. This extreme concentration causes serious congestion and delays of distribution of goods and movement of people, resulting to huge damage to economy and lowering the country's international competitiveness as an investment destination. Likewise, living condition in Metro Manila has been eroded due to air pollution and traffic noise caused by chronic congestion. In summary, solving traffic congestion in Metro Manila by networking surrounding cities and upgrading/expanding highways around Mega Manila – the area covering Metro Manila, Central Luzon and CALABARZON – contributes to improvement of both investment climate and living climate.

In early 2000s, the plan to construct NAIA Expressway (NAIAX) was envisioned in line with construction of NAIA Terminal III. Phase I construction of NAIA Expressway and its related roads project started in 2003 and completed in 2010 with the National Government funding. NAIAX Phase II is the continuation of Phase I and is planned to be implemented under the Public-Private Partnership (PPP) Scheme.

1.2 OBJECTIVES OF THE PROJECT

Objectives of the project are as follows;

- To provide easier and improved access to three (3) NAIA Terminals which are the international gateway to the Philippines.
- To reduce traffic congestion of roads related to NAIA Terminals.
- To improve international/domestic investment environment for faster economic development.

1.3 NECESSITY OF THE PROJECT

(1) Sectoral Linkages

The NAIA Expressway is intended to alleviate the existing and future traffic problems going to and from the country's premier airport, the Manila International Airport/Ninoy Aquino International Airport Complex, a major gateway and economic hub. It will provide the needed high-speed access route to NAIA Terminal 3, and have the direct links to Passenger Terminals 1 and 2 and the International Cargo Terminal. Furthermore, the NAIA Expressway will provide a seamless link between the Southern Luzon Expressway ("SLEX")/Skyway and the Manila-Cavite Toll Expressway/Roxas Blvd.

(2) Project Linkages with the National and Regional Development Thrusts, Goals, Genderand Development

The NAIA Expressway will support national development objectives of sustaining the viability of Metro Manila as a primary engine of growth in the Philippines for industry, commerce, and services, as well as for social and cultural development, by making the mobility of people and goods in the area faster and less costly particularly due to savings in vehicular operation and travel time costs. The project will also boost tourism by making the NAIA Complex more accessible to foreign and local travelers. The project will stimulate development particularly in Metro Manila and its surrounding provinces, especially in Cavite which has been experiencing rapid urban development. It will also support the development in the nearby reclamation area facing Manila Bay and the former military bases of Villamor and Bonifacio which are emerging as new commercial hubs. The NAIA Expressway will support gender and development, especially as it facilitates the movement of women engaged in the pursuit of trade, tertiary services, and education while the project will also significantly decongest the area around NAIA and, thus, reduce noise and pollution in support of the Government's climate change agenda.

1.4 PROJECT RATIONAL

(1) PhilippineDevelopmentPlan (2011 – 2016)

Philippine Development Plan (PDP), 2011-2016 was announced in 2011. Development policies of infrastructure are as follows;

DEVELOPMENTPOLICIESOFINFRASTRUCTURE

"**Accelerating Infrastructure Development"**

(1) To optimize resources and investment
- Improve project preparation, development and implementation
- Synchronize planning and budgeting
- Coordinate and integrate infrastructure initiative

(2) To attract investments in infrastructure
- Improve the institutional and regulatory environment of the infrastructure sector
- Encourage PPPs

(3) To foster transparency and accountability in infrastructure development
- Encourage stakeholder participation

(4) To adopt to climate change and mitigate the impacts of natural disasters
- Institutionalize Climate Change Act (CCA) and Disaster Risk Reduction Management (DRRM)

(5) To provide productive employment opportunities
- Adopt a labor-intensive scheme where applicable.

With regards to the transport sector, issues and challenges are established as follows;

TRANSPORTSECTORISSUESANDCHALLENGES

(a) Assessment and Issues
- Lack of integrated and coordinated transport network
- Overlapping and conflicting functions of transport and other concerned agencies
- Transport safety and security concerns

(b) Strategic Plan and Focus
- Adopt a comprehensive long-term National Transport Policy (NTP)
- Develop strategic transport infrastructure assets
  - Prioritize asset preservation
  - Provide access to major and strategic tourism destinations and production areas
  - Promote environmentally sustainable and people-oriented transport

(c) Develop an Integrated Multi-modal Logistics and Transport System
- Identify and develop strategic logistics corridors based on a National Logistics Master Plan
- Improve Roll-on/roll-off ship (RORO) terminal system
- Explore ASEAN connectivity through sea linkages

(d) Separate the Regulatory and Operation Functions of Transport and Other Concerned Agencies. To address the overlapping and conflicting functions of transport and other concerned agencies.

(e) Comply with Safety and Security Standards. To ensure transport safety and standards.

(f) Provide Linkages to Bring Communities into the Mainstream of Progress and Development. To promote conflict-affected and highly impoverished areas.

(2) RoadDevelopmentGoals

Public Investment Program (PIP) (2011 - 2016) was formulated by DPWH in 2011. Goals were set as follows;

DEVELOPMENTGOALSUNDERPIP

1. Provide safe environment through quality infrastructure facilities;
2. Increase mobility and total connectivity of people through quality infrastructure resulting to improved quality of life;
3. Strengthen national unity, family bonds and tourism by making the movement of people faster, cheaper and safer;
4. Facilitate the decongestion of Metro Manila via a transport logistics system that would ensure efficient linkages between its business centers and nearby provinces;

5. Implement more Public-Private Partnership (PPP) projects for much needed infrastructure and level playing field for investment;
6. Study the mechanism for longer maintenance period for roads and bridges; and
7. Generate more transport infrastructure with minimal budget cover or contingent liabilities.

Strategic focuses were set as follows;

STRATEGICFOCUS

- Implement activities in the following order of priorities:
  a. Maintenance or asset preservation – to preserve existing roads in good condition
  b. Rehabilitation – to restore damaged roads to their original designed condition
  c. Improvement – to upgrade road features so that they efficiently meet traffic demands; and
  d. New Construction
- Prioritize upgrading of the national road network, as to quality and safety standards
- Prioritize national roads to address traffic congestion and safety in urban centers and designated strategic tourism destinations
- Completion of on-going bridges along national roads
- Develop more Public-Private Partnership (PPP) projects for much needed infrastructure and level playing field for investments
- Study the mechanism for a longer maintenance period (5 – 10 years) in road and bridges construction contract provision
- Prioritize flood control projects in major and principal river basins to address climate change based on master plan and adopting new technologies in flood control and slope management
- Prioritize adequate flood control and upgraded drainage design standards and facilities in flood-disaster prone areas to mitigate loss of river and damage to properties
- Promote innovative technology such as geo-textiles and coco-netting in slope protection and soil erosion control
- Promote retarding basin and rain water harvesting for non-domestic use
- Prioritize water supply in designated strategic tourist destinations/centers

(3) Master Plan on High Standard Highway Network

The study of master plan on High Standard Highway (HSH) Network Development was conducted in Year 2010. **Figure 1.4-1** shows the proposed HSH network in Metro Manila and 200 km sphere. Based on this master plan, Public Investment Program (2011-2016) for expressway projects was formulated.

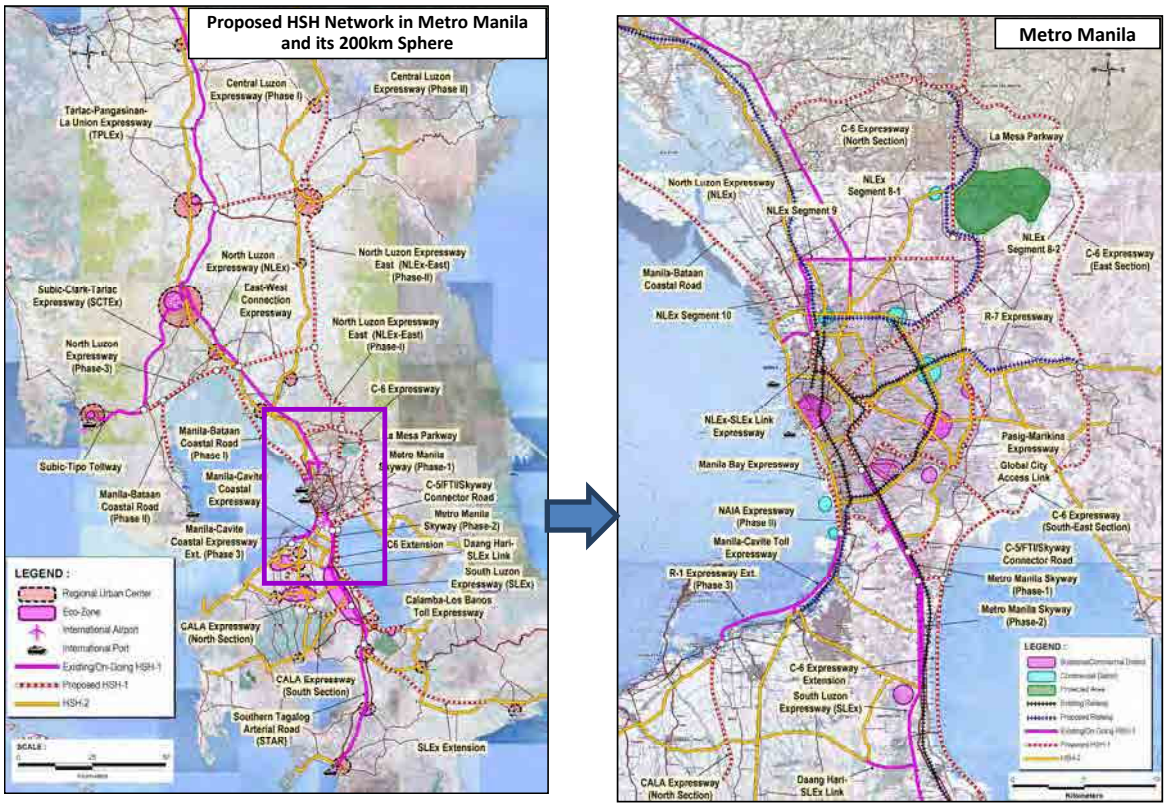


FIGURE 1.4-1 PROPOSED HSH NETWORK

Source: The Study of Master plan on High Standard Highway Network Development, 2010, JICA

NAIAX is one of the 1st priority projects in this Master plan shown in **Table 1.4-1**.

TABLE 1.4-1 PROPOSED HSH PROJECTS PRIORITY

	Name of HSH	Length (km)	Cost (billion pesos)
1st Priority Group	NLEx–SLEx Link Expressway	13.4	31.14
	CALA Expressway	41.8	19.67
	C-5/FTI/SKYWAY Connector Rd.	3.0	4.76
	NAIA Expressway (Phase 2)	4.9	12.18
	C-6 Expressway/Global City Link	66.5	54.29
	Central Luzon Expressway(CLLEX)	63.9	29.23
	SLEx Extension (to Lucena)	47.8	16.45
	Calamba-Los Banos Expressway	15.5	5.23
	Sub-total	256.8	172.95
2nd Priority Group	R-7 Expressway	16.1	25.81
	NLEX East / La Mesa Parkway	103.0	38.94
	Manila – Bataan Coastal Road	70.3	72.94
	NLEX (Phase 3)	36.2	28.42
	East-West Con. Expressway	26.6	16.48
	C-6 Extension	43.6	18.61
	Manila Bay Expressway	8.0	46.54
	Pasig Marikina Expressway	15.7	49.58
	Sub-total	319.5	297.32
TOTAL		576.3	470.27

Source: The Study of Master plan on High Standard Highway Network Development, 2010, JICA

1.5 CURRENT ROAD INFRASTRUCTURE SECTOR AND ITS DEVELOPMENT PLAN RELATED TO THE PROJECT

DPWH Public Investment Program (PIP) for 2011 -2016 contains the following target and priority programs.

TABLE 1.5-1 TARGET OUTCOMES OVER THE MEDIUM TERM

	Year			Requirement
	2011	2014	2016	
a. National Arterial Roads(15,987km)	94% Paved	100% Paved in good condition		・ Paving of 1,443km ・ Rehab./ widening/ upgrading/ construction of 2,828km
b. National Secondary Roads(15,372km)	72% Paved	81% Paved	100% Paved in good condition	・ Paving of 3,329km ・ Rehabilitation of 1,798km
c. National Bridge (330,089m) (7,792 bridges)	95%	98%	100% Permanent	・ Replacement of 8,544 lm of temporary bridges ・ Improvement of 6,047 lmof existing bridges ・ Construction of 2,154 lm new bridges ・ Repair/rehabilitation of 104,293 lm of bridges

Source: Public Investment Program (2011-2016) As of April 2012, DPWH

Under the PIP for 2011-2016, DPWH is envisaging a total investment of 698,084 million pesos. Of this total investment requirement in the PIP, 585,938 million pesos or 84% is earmarked for the highway sector, 83, 948 million pesos (12%) for flood control works and 28,198 million pesos (4%) for other locally-funded projects over the six (6) year program.

The total investment requirement for 2013 up to 2016 is based on the annual 10% increase from the approved budget of 99,490 million pesos for Y2012.

TABLE 1.5-2(2011-2016) PUBLIC INVESTMENT PROGRAM SUMMARY

List of Project	Prior Year	Proposed Allocation (in Million Pesos)						
		2011	2012	2013	2014	2015	2016	Total (2011-2016)
1.Roads	**75,703**	**75,047**	**81,246**	**91,697**	**101,347**	**113,722**	**122,878**	**585,938**
-Foreign assisted project	41,490	19,566	14,257	30,313	28,889	35,186	39,162	167,645
-PPP	-	-	1,474	11,164	7,450	4805	-	24,894
-Locally funded project	34,213	55,481	65,243	50,219	65,008	73730	83,715	393,398
2.Flood Control Project	**19,692**	**11,166**	**10,816**	**12,523**	**13,854**	**14,960**	**20,628**	**83,948**
-Foreign assisted project	13,283	2,978	2,300	2,670	3,728	6656	12,406	30,738
-Locally funded project	6,419	8,188	8,517	9,853	10,127	8304	8,221	53,211
3. Other Locally Funded DPWH Project	**36,288**	**4,474**	**7,428**	**5,219**	**5,181**	**3,738**	**2,157**	**28,198**
GRAND TOTAL	**131,683**	**90,687**	**99,490**	**109,439**	**120,383**	**132,421**	**145,663**	**698,084**

Source: Public Investment Program (2011-2016) As of April 2012, DPWH

1.6 PAST AND FUTURE PLAN OF OTHER DONOR'S PROJECT RELATED TO PPP POLICIES

(1) Technical Assistance by ADB, AusAID, and CIDA

In terms of capacity building, "Technical Assistance for Strengthening Public-Private Partnerships in the Philippines" are being carried out as of November 2011. This is a capacity development program financed by ADB AusAID (the Australian Agency for International Development), and CIDA (The Canadian International Development Agency). The purpose of the program is to help the Philippines to clear obstacles and to pave the way for PPP. Under this program, ADB provides a US$1.5 million grant, AusAID provides a US$7 million grant and CIDA provides a US$1.2 million grants. The program is to run from April 2011 to July 2013.

The expected outputs of the program are 1) Strengthening of PPP Enabling Framework, 2) Strengthening Capacity of the PPP Center, 3) Institutionalization of PPP Best Practice and 4) Establishment of Long-term Financing and Risk Guarantee Mechanisms.

(2) Other Programs and Activities

Besides ADB TA, there are several assistance programs planned by GoP and foreign agencies.

Singapore Cooperation Enterprise (SCE) has agreed with GoP to provide TA to promote PPP. The objectives of SCE TA are to:

- Achieve an in-depth understanding of the benefits and challenges for greater private sector participation in the financing of public sector projects; and the policy actions required to strengthen the enabling environment, legislative and regulatory frameworks for PPP;
- Build capabilities for key public sector officials involved in the procurement and implementation of infrastructure projects, through the implementation of a pilot PPP transaction; and
- Provide examples of Singapore's infrastructure procurement process by sharing Singapore's lessons and experience in developing successful and commercially viable PPP projects.

It was agreed that SCE will provide a grant worth approximately S$1.423 million (P48.373 Million) to DOTC for PPP capacity development of DOTC. GoP will provide counterpart fund of S$ 270,100. The grant will cover one-year period. Based on the Joint Press Release issued

by SCE and Temasek Foundation on March 31, 2011, SCE will work with the DOTC to develop institutional capabilities for key agencies within the Philippine Government responsible for the procurement of infrastructure projects under the PPP framework.

Furthermore, according to the Joint Press Release, SCE will send a team of Singapore PPP experts to work with DOTC to prepare and structure a pilot project for procurement under the PPP framework. The pilot project will provide a real-life and hands-on case study where Philippine Government officials can adapt relevant lessons from Singapore to bring projects to a biddable and bankable stage.

SCE will also help DOTC organize a series of capacity building workshops to build capacity for some 100 Philippine Government officials in the development and implementation of PPP transactions. During these workshops, Singapore public sector agencies, such as Public Utilities Board, Singapore Sports Council and Institute of Technical Education, will share with the workshop participants the key challenges Singapore had faced, including the policy considerations, regulatory framework and practical experiences in implementing Singapore's PPP projects. The Singapore private sector players involved in Singapore's PPP projects will also share the perspective of the private sector investors and project developers in investing in a PPP project.

There is also information about assistance coming from the World Bank. According to the World Bank's website, they are interested in helping specific projects, such as expansion of the LRT System and the sewerage system in Manila. There can be further assistance that is directed towards individual projects.

1.7 RELATION BETWEEN OTHER JICA ODA LOAN PROJECTS AND OTHER DONOR PROJECTS

Projects related of NAIAX are below.

- LRT-1 Extension Project
- NLEx-SLEx Connector Road Project

1.LRT-1 Extension Project

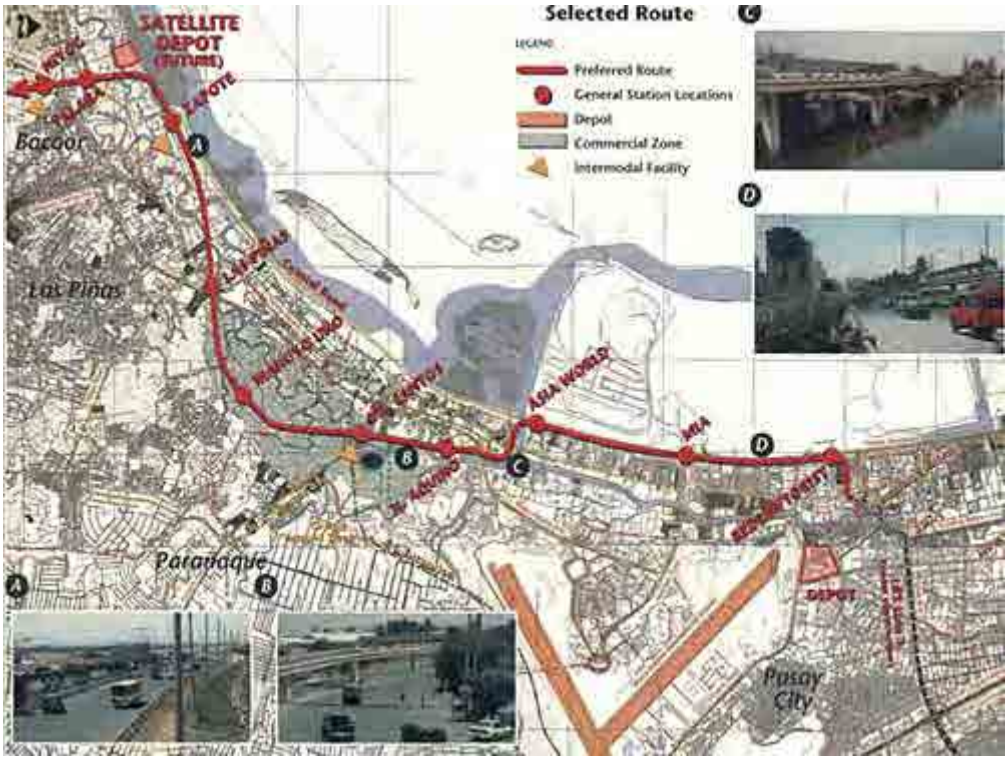
The LRT Line 1 South Extension Project starts from the existing Baclaran station through southern Metro Manila (Parañaque, Las Piñas) to Bacoor, the Province of Cavite.

- Extension of the existing 20.7 km. LRT Line 1 by approximately 11.7 km. from Baclaran to Bacoor including the initial Rolling Stock (55 train sets).
- Eight (8) passengers stations with a provision for two (2) additional stations; one (1) satellite depot and three (3) Intermodal facilities.
- Operations and Maintenance Concession of the integrated line with systems enhancement works throughout the concession period.
- Estimated Project Cost:P 61.53 Billion(GOP:₱30,593.63 Million, Private Sector:₱30,934.18 Million)
- Target Implementation Schedule

ACTIVITY	DATE
NEDA Approval	March 2012
Bidding Process	March - November 2012
Expected Date of Award/ Effectivity	December 2012
Start of Construction (Phase 1)	April 2013
Start of Construction (Phase 2)	April 2015
Commissioning Phase 1(Baclaran to Dr. Santos Ave. Station)	May 2015
Commissioning Phase 2(Dr. Santos Ave. Station to Niyog Station)	May 2017

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

Figure 1.7-1 shows the location of LRT-1. NAIAX may affect MIAA Station and DEPOT of LRT.



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

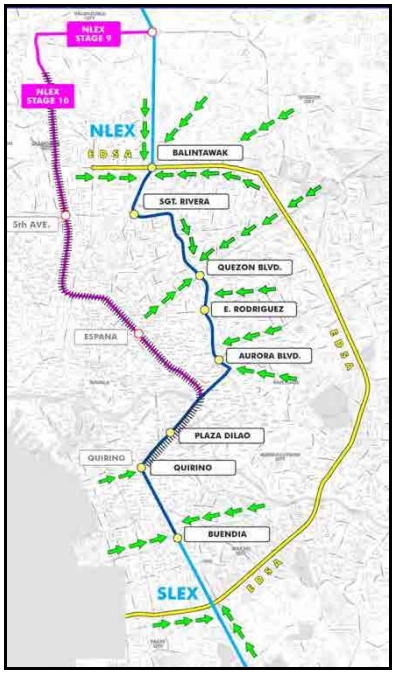
FIGURE 1.7-1 LOCATION MAP OF LRT-1 EXTENSION

2.NLEx-SLEx Connector Road Project

Currently, Metro Pacific Tollways Development Corp (MPTDC) and San Miguel Corp-backed Citra Metro Manila Tollways Corp (CMMTC), headed by San Miguel have presented their proposalon their respective NLEx-SLEx connector road projects.

The road projects will link Makati City to Caloocan and Balintawak.

Linking NLEx and SLEx has been in the pipeline since 2010, when MPTDC submitted an unsolicited proposal for it. It was supposed to be just one project until CMMTC submitted its own proposal, claiming it has the right to develop the project as an extension of its Skyway. The two proposals covered different routes for the proposed link.



Source: SMC-Citra Group

TWOROADS. Metro Pacific and San Miguel-Citra propose to build separate roads connecting NLEx and SLEx. MPIC's proposal is the pink line, while San Miguel-Citra's is the shorter, dark blue line. Illustration from the SMC-Citra group

1.8 LESSON AND COUNTERMEASURE FROM THE SIMILAR PAST PROJECT

Interview surveys were conducted to government officials and the private O& M companies in order to identify the bottleneck and recommendation in the Preparatory Survey for PPP infrastructure Development Project (JICA 2011).

Table 1.8-1 shows the summary of major issues and bottlenecks of PPP project and corresponding recommendations.

TABLE 1.8-1 MAJOR ISSUES AND BOTTLENECKS OF PPP PROJECTS

	Issues and Bottlenecks of PPP Projects	Recommendations
1. Legal Framework	1.1 There are two laws/E.O. to allow the private sector toinvest infrastructure projects: a) RA 7718 (BOT Law) and its IRR b) EO 423 and its Guidelines and Procedure for entering into joint venture agreement between the Government and the private entities. ▪ No NEDA ICC nor NEDA Board's project approval is required. ▪ Head of Agency has authority to approve the JV Agreement regardless of project cost.	1.1 Options: **Option 1** : EO 423 be abolished and integrated into RA 7718 **Option 2** : Modification of Guidelines and Procedure - Project should be approved by NEDA ICC or NEDA Board - Ceiling of project cost should be specified. - Enough time should be given to challengers.
	1.2 Modification of IRR of RA 7718 Amendments of IRR is being studied on i) Approval of Individual Projects and Draft Contract, ii) List of Priority Projects, iii) Publication of Invitation, iv) Approving Authority for the Contract, v) Contract Variation, vi) Protest Fee, vii) Timelines, viii) Substitution/Withdrawal of a Member of a Consortium/Joint Venture, ix) Government Shoulder the Differential, x) Period of Comparative Bids Preparation, xi) Information Disclosure of Unsolicited Proposal, xii) New ROW Acquisition Under Unsolicited Proposal	1.2 Amendments should be finalized as early as possible.
	1.3 Creation of PPP Laws Present BOT Law is for the one type of PPP schemes, which should be improved by adding other PPP schemes so as to add more flexibility to other types of PPP schemes and to specify the Government's responsibilities.	1.3 Study on creation of PPP Law should start.

Source: Preparatory Survey for Public-Private Partnership (PPP) Infrastructure Development Project (JICA2010)

TABLE 1.8-1 MAJOR ISSUES AND BOTTLENECKS OF PPP PROJECTS

	Issues and Bottlenecks of PPP Projects	Recommendations
2. Institutional Framework	2.1 Lack of Experiences/Capacity of Government Officials for Planning and Implementation of PPP Projects - Historically, planning and implementation of BOT projects was led by the private sector's initiative. - The Government is discouraging the unsolicited proposals. - The Agencies are required to be more pro-active and take a leadership for PPP projects.	2.1 Agencies should take a leadership for promotion of PPP projects. - Develop priority projects with implementation priority and firm implementation schedule. - The roles of the private sector, government agencies and other authorities as well as LGUs in transport infrastructure development in operation and management needs to be defined.
	2.2 No PPP Project Specialized Office except DPWH.	2.2 Organize PPP Specialized Office.
	2.3 BOTCenter has been not so active.	2.3 In close coordination with Agencies, BOT center should be more active in project development of PPP projects.
	2.4 Strengthening of DPWH Planning Service and PMO-BOT - In line with the DPWH Rationalization Plan, DPWH is planning to upgrade existing PMO-BOT to PPP Service.	2.4 PMO-BOT should be upgraded to PPP Service as early as possible.
	2.5 Materials for PPP Capacity Development and manuals/standards are incomplete. - Training materials for PPP - Standard PQ/Tender and Draft Toll Concession Agreement - O & M manual	2.5 Necessary materials, standards and manuals should be prepared. DPWH should establish regular PPP training course.
3. PPP Project Financing	3.1 Long period (sometimes years) is required for financial closure due to unfavorable offer of banks to the investor (short repayment period with no grace period and high interest rate). Some commercial banks are not familiar with the PPP project financing.	3.1 PPP fund to finance the private entities needs to be created.
	3.2 Delay in ROW acquisition delays financial closure.	3.2 Refer to 4.4

Source: Preparatory Survey for Public-Private Partnership (PPP) Infrastructure Development Project (JICA2010)

TABLE 1.8-1 MAJOR ISSUES AND BOTTLENECKS OF PPP PROJECTS

	Issues and Bottlenecks of PPP Projects	Recommendations
3. PPP Project Financing	3.3 Project Development Fund (PDF) of BOTCenter is not fully utilized.	3.3 PDF needs to be revitalized by increasing fund as well as establishment of rules and guidelines for usage.
	3.4 On the part of financing the Government expenditure, it is still relying on the project loans from the international lending institutions and/or bilateral sources.	3.4 PPP fund to finance the Government expenditure needs to be studied and established.
4. Bottlenecks in PPP Project Cycle	4.1 <u>Master Plan/Basic Plan/Project Identification Stage</u> • Master Plan and/or basic plans were not updated. • Listing of projects and their implementation schedule was not updated. • Project promotion has been largely relied on the private sector.	4.1 Master Plan, project list and project implementation priority should be always updated and firm implementation schedule and corresponding budgeting should be done.
	4.2 <u>Business Case/Feasibility Study Stage</u> • Level of feasibility studies has been incomplete/inadequate. • Soon after a feasibility study is completed, it has been difficult to go into a tendering stage due to unfixed ROW, lack of ECC, lack of LGUs' endorsement, etc. • Agencies' capacity and local consultants' capacity to undertake a feasibility study of PPP project is not sufficient.	4.2 • More fund and time should be spent for this study • Complete information and documents for NEDA's project approval and succeeding tendering should be prepared.
	4.3 <u>Project Approval Stage</u> • Lengthy time is required until the project is approved by NEDA ICC or NEDA Board.	4.3 • Complete information and documents should be prepared during the feasibility study stage. • NEDA should undertake seminars on "ICC Project Evaluation Procedure and Guidelines".

Source: Preparatory Survey for Public-Private Partnership (PPP) Infrastructure Development Project (JICA2010)

TABLE 1.8-1 MAJOR ISSUES AND BOTTLENECKS OF PPP PROJECTS

	Issues and Bottlenecks of PPP Projects	Recommendations
4. Bottlenecks in PPP Project Cycle	4.4 <u>ROW Acquisition/Resettlement Stage</u> • Preparation of IROW plan and parcellary plan takes long time due to inaccurate land registration, difficulty to locate land owners, inaccurate record of lot boundary, etc. • A lot of documentations are needed and lot owners have difficulty to prepare required documents. • Land valuation is made based on BIR land valuation for the first offer, and based on Provincial/ City Appraisal Committee or Land Bank valuation for the second offer, these are close to, but still lower than market value. • In case that land owners fail to prepare complete documents, expropriation is the only solution. • ROW acquisition Teams are not provided sufficient logistics (like service vehicles, computers, etc.). • More staff who are familiar with ROW acquisition are needed. • Some Toll Concession Agreements include the private sector's funding for ROW acquisition.	4.4 • Preparation of IROW plan and parcellary plan and succeeding ROW acquisition should start soon after the project is approved by NEDA Board or NEDA ICC. • Once major critical documents are prepared, cash advance by the private sector should be made to PAPs through the Government, which shall be refunded to the private sector. This arrangement should be specified in TCA. • Land value should be based on the prevailing market price. • Enough logistics support such as service vehicles, computers, etc. should be provided for ROW acquisition team, cost of which should be included in the project cost. • IROW Procedural Manual should be updated and more staff should be trained.
	4.5 <u>Tender Stage</u> *1) Government Projects* • Selection of Consultants and Contractors takes lengthy time. - Consultant selection - over 8 months - Contractor selection - over 10 months *2) Selection of Project Proponent of PPP Project* • Selection of project proponent takes lengthy time - over 12 months *3) Unsolicited Proposal* • Takes much longer time to finalize due to many disputes and counteroffers and negotiation of contract terms such as toll rates, risk allocation, etc.	4.5 *1) Government Projects* • Selection of Consultants should target 6 months or less. • Selection of Contractor should target 8 months or less. *2) Selection of Project Proponent of PPP Project* • Selection of Project Proponent should target 10 months or less. • Agency should undertake project campaign and enough information should be disclosed before the project is advertized. • All tender conditions and draft Toll Concession Agreement should be agreed between DPWH and TRB before advertisement.

Source: Preparatory Survey for Public-Private Partnership (PPP) Infrastructure Development Project (JICA2010)

TABLE 1.8-1 MAJOR ISSUES AND BOTTLENECKS OF PPP PROJECTS

	Issues and Bottlenecks of PPP Projects	Recommendations
4. Bottlenecks in PPP Project Cycle	4.6 Contracting Stage • Review of Toll Concession Agreement (TCA) by TRB usually takes lengthy time. • Approval of NEDA Board also takes lengthy time.	4.6 • Close coordination between NEDA and Agencies should be made.
	4.7 Toll Operation Agreement Stage • Review by TRB of toll adjustment formula and other O & M aspects take considerable time.	4.7 • From the feasibility study stage, TRB should be involved.
	4.8 Fund Procurement/Preparation Stage • Government - Budget constraints and delay in budget release - Difficult to cope with cost overrun. • Private - Delay in attaining financial closure due to difficulty in meeting lender's requirement such as complete ROW acquisition, government financial support, approval of toll rates and toll rate adjustment formula. - Difficult to find appropriate financer (short repayment period with no grace period, and high interest rates). - Unexpected changes requiring additional costs due mainly to additional facilities required by LGUs and LGU fees.	4.8 • Government - Needs provision of adequate annual budget. - Needs to tap ODA. • Private - Creation of fund to finance the private sector for infrastructure project implementation should be studied.
	4.9 Detailed Design Stage • Lacks proper coordination with LGUs, thus modification of design, requirement of additional facilities, etc. is required by LGUs. • Lacks proper coordination with utility companies for relocation/protection of public utilities affected.	4.9 • Proper coordination with LGUs and utility companies should be done during the feasibility study. • Value engineering should be exercised.

Source: Preparatory Survey for Public-Private Partnership (PPP) Infrastructure Development Project (JICA2010)

TABLE 1.8-1 MAJOR ISSUES AND BOTTLENECKS OF PPP PROJECTS

	Issues and Bottlenecks of PPP Projects	Recommendations
4. Bottlenecks in PPP Project Cycle	4.10 Construction Stage • Delayed construction due to delayed delivery of ROW and financial closure. • Needs more strict quality control and schedule control.	4.10 • An Independent Certificate Engineer should be employed at the cost of the Government.
	4.11 Operation and Maintenance Stage • Approval of toll fee and adjustment of toll fee by TRB is delayed. • Increase of toll fee is usually objected by the people and politicians and adoption of new toll rate is delayed.	4.11 • TRB should approve toll fee and its adjustment in accordance with provisions of TCA. • The Government should compensate the loss of revenue due to delayed increase of toll rates. • TRB and operators should jointly make information disclosure to the people why toll rates and toll adjustment are needed and determined and what are benefits of users.
	4.12 End of Contract and Facility Transfer Stage No experience on this stage, yet.	-

Source: Preparatory Survey for Public-Private Partnership (PPP) Infrastructure Development Project (JICA2010)

1.9 DPWH ORGANIZATION AND CURRENT O& M COMPANY

(a) DPWH Organization (Central Office)

Organization chart of DPWH is shown in **Figure1.9-1**. Offices within the DPWH which are related to the development of PPP projects are highlighted and discussed below.

Planning Service (PS)

Tasked to formulate policies, plans and programs for the development of the national road network, which includes expressways; prepare PPP proposals for ODA financing; maintain a national road database; and prepare multi-year and annual budgets for the construction (including right-of-way and engineering) and maintenance of national roads.

PMO-Feasibility Studies (PMO-FS)

Assigned to conduct/supervise FS of major foreign-assisted and locally-funded road and expressway projects; and assist the PS and PMO-BOT in preparing project proposals for ODA financing.

PMO-Built-Operate-Transfer (PMO-BOT)

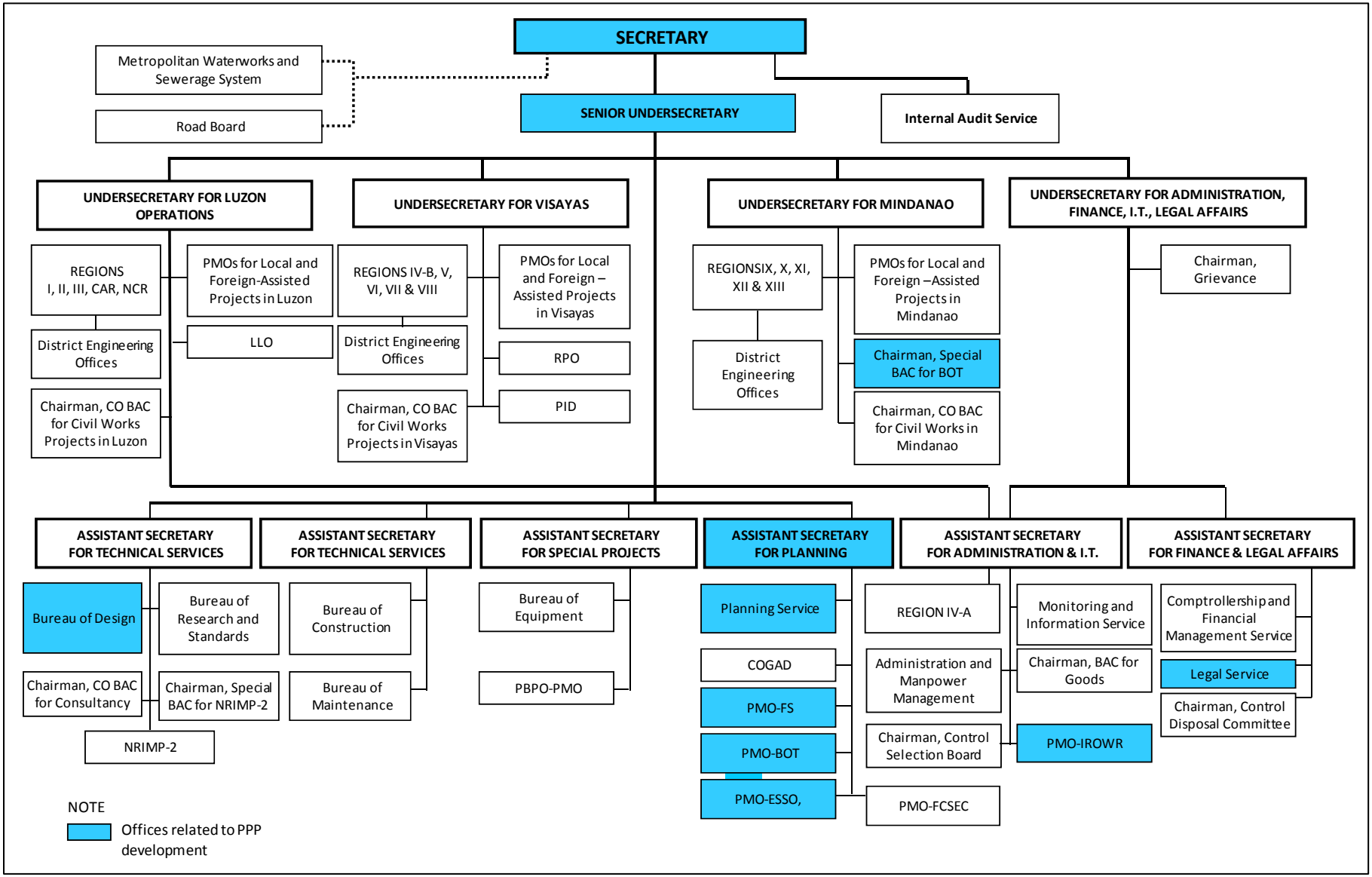
Tasked to identify and initiate projects for BOT/PPP implementation; prepare/review feasibility studies (FS) and proposals for BOT/PPP projects for approval of the NEDA-Investment Coordinating Committee (ICC); prepare bidding documents; participate in negotiations and finalization of BOT/PPP contracts; and monitor/supervise the implementation of BOT/PPP projects.

Environmental and Social Services Office (ESSO)

Involved in preliminary planning activities related to Environmental Impact Assessment (EIA), Social Impact Assessment (SIA), Rapid Social Assessment, Resettlement Action Plan (RAP); conduct public consultations on PPP projects; conduct Information, Education and Communication (IEC) on environment-related concerns; and compliance and effects monitoring of ECC conditions and Environmental Management Plan (EMP).

PMO-Infrastructure Right-of-Way and Resettlement (PMO-IROWR)

Tasked to consult with LGUs, local communities, project affected persons, and the designer/contractor for PPP projects; coordinate with the Presidential Commission for the Urban Poor (PCUP) and the National Housing Authority (NHA) on the relocation of squatter families; conduct census and tagging of affected lots and improvements; coordinate with the Bureau of Internal Revenue or BIR (for zonal valuation), Registry of Deeds (for titles), Assessor's Office, and DAR (for land conversion); coordinate and negotiate with affected property owners on the sale of their properties; coordinate with the Office of the Solicitor General (OSG) for filing of expropriation proceedings; and effect payment of affected properties.



- *As of July 2012*

Source: DPWH website

FIGURE 1.9-1 ORGANIZATION CHART OF DPWH

(b) Overview of Current Toll Expressway Companies for Construction and O&M

Table 1.9-1 shows the summary of toll expressway investors and O&M companies and **Table 1.9-2** shows the summary of current toll collection system and traffic control system.

TABLE 1.9-1 TOLL EXPRESSWAY COMPANY

Investors	Operating Expressway(length)	O&MCompanies	Remarks
Manila North Tollways Corp.(MNTC)	・ North Luzon Expressway (82.6km) ・ Subic-TipoTollway (8.5km)	Tollways Management Corp.	Metro Pacific Investment Corp.(Hong Kong Fund)
(BCDA)	・ Subic-Clark-Tarlac Expressway (93.8km)	Tollways Management Corp.	Construction by ODA fund
Private Infrastructure Development Corp. (PIDC)	・ Tarlac-Pangasinan-La Union Expressway (88.0km under construction)	―	PIDC was established by ten (10) local contractor companies
UEM-MARA Philippine Corp.	・ Manila-Cavite Coastal Expressway (8.8km) and Extension (11.2km)	Direct operation	Malaysian Fund
Citra Metro Manila Tollways Corp./ San Miguel Corp.	・ Skyway : PhaseI (9.4km) ・ South Luzon Expressway (13.4km) ・ Skyway：PhaseII (6.8km)	Skyway O&M Company	Indonesia Fund
San Miguel Corp.	・ South Luzon Expressway (37.2km)	South Luzon Tollways Corp.	Philippine Fund
Ayala Corp/	・ DaangHariSLEx Link Road		Philippine Fund
San Miguel Corp.	・ Southern Tagalog Arterial Road (STAR) (41.9km)	Star Infrastructure Development Corp.	Philippine Fund

TABLE 1.9-2TOLL EXPRESSWAY'S TOLL COLLECTION SYSTEM AND TRAFFIC CONTROL SYSTEM

Operating Expressway(length)	Toll Collection System	Traffic Control System
・ North Luzon Expressway (82.6km)	・ Cash, EC-tag, Easy Trip	Yes, CCTVs, Vehicle detectors and VMSs (Variable Message e Sign) are installed.
・ Subic-Clark-Tarlac Expressway (93.8km) ・ Subic-TipoTollway (8.5km)	・ Cash only	Not yet installed
・ Manila-Cavite Coastal Expressway (8.8km) and Extension (11.2km)	・ Cash only	Not yet installed
・ Skyway：PhaseI (9.4km) ・ South Luzon Expressway (13.4km) ・ Skyway：PhaseII (6.8km)	・ Cash, E-pass	Yes, CCTVs are installed.
・ South Luzon Expressway (37.2km)	・ Cash, E-pass	Yes, CCTVs and VMSs are installed.
・ Southern Tagalog Arterial Road (STAR) (41.9km)	・ Cash only	Not yet installed

1.10 SOCIO-ECONOMIC CONDITION OF THE STUDY AREA

(1) Land-Use

The National Capital Region has a total area of about 63,300 hectares which is 0.2% of the total land area of the Philippines (30 million hectares). Of the 17 cities and municipality that compose the NCR, Quezon City has the biggest land area at 17.171 hectares (27.1%), followed by Caloocan City, and Pasig City at 5,580 (8.8%) and 4,846 (7.7%) hectares respectively. Paranaque and Pasay City ,which are traversed by Phase II of the NAIAX, has a total land area of 4,657 (7.4%) and 1,397 (2.2%) hectares, respectively. **Table 1.10-1** contains the breakdown of NCR component cities and municipality's land area.

TABLE 1.10-1 LAND AREA OF METRO MANILACOMPONENT CITY / MUNICIPALITY

City/Municipality	Area (hectares)	%
1 Manila City	2,498	3.9%
2 Caloocan City	5,580	8.8%
3 Pasay City	1,397	2.2%
4 Makati City	1,831	2.9%
5 Mandaluyong City	929	1.5%
6 San Juan	595	0.9%
7 Quezon City	17,171	27.1%
8 Muntinlupa City	3,975	6.3%
9 Paranaque	4,657	7.4%
10 Pasig City	4,846	7.7%
11 Marikina City	2,152	3.4%
12 Taguig	4,521	7.1%
13 Pateros	1,040	1.6%
14 Las Pinas	3,269	5.2%
15 Malabon	3,264	5.2%
16 Navotas	894	1.4%
17 Valenzuela	4,702	7.4%
Total	63,321	100.0%

Source: MMDA

A paper prepared by the Philippine Center for Development Studies in 2000 had indicated that NCR has a predominantly urban environment. About one third (65%) of the land is devoted to residential areas, more than 10% is for institutional and slightly less than 10% is used for commercial purposes. The large tracks of land within and at the suburbs had been developed for

residential area that caters to the big population of the metropolis estimated at 11 million (2009). Similarly, it is in Metro Manila where the business/commercial districts are located in cities such as in Manila, Makati, Mandaluyong, Pasig, and Taguig.**Table1.10-2** contains the land use of Metro Manila.

TABLE 1.10-2 LAND USE OF METRO MANILA*

Landuse	Area	%
Residential	41,158.7	65
Commercial	5,065.7	8
Industrial	1,899.6	3
Institutional	6,712.0	11
Utilities	2,532.8	4
Agricultural	2,786.1	4
Open Space	2,532.8	4
Forest Land/Parks	633.2	1
Total	63,321.0	100

Source: Land Use Planning in Metro Manila and the Urban Fringes: Implications of the Land and Real Estate Market, Philippine Institute for development Studies, June 200

(2) Demography

1) National Demographic Profile

The National Statistics Office (NSO) that had conducted the national census on 01 August 2007, reported that the total Philippine population is about 88.57 million with an average annual growth rate of 2.04 percent. This figure had exceeded the projected average annual population growth rate for the period 2005 to 2010 placed at 1.95 percent by the 2000 Census of Population and Housing. **Table 1.10-3** shows the country's population based on census conducted in year 1995, 2000 and 2007. This data show that from year 2000 to 2007, there was an increase of 12.07 million Filipinos within the span of seven (7) years, while from 1995 to 2000, the increase was at 9.88 million. **Table 1.10-4** presents the average annual population growth rate in the Philippines.

TABLE 1.10-3 COMPARATIVE PRESENTATION OF THE PHILIPPINE POPULATION FROM 1995 TO 2007

Census Year	Census Date	Philippine Population
2007	August 1, 2007	88.57 million
2000	May 1, 2000	76.50 million
1995	September 1, 1995	66.62 million

**Source: National Statistics Office*

TABLE 1.10-4 COMPARATIVE PRESENTATION OF THE COUNTRY'S AVERAGE ANNUAL POPULATION GROWTH RATE FROM 1960 TO 2007

Reference Period	Average Annual Population Growth Rate in the Philippines
2000-2007	2.04 %
1990-2000	2.34 %
1980-1990	2.35 %
1970-1980	2.75 %
1960-1970	3.01 %

**Source: National Statistics Office*

The top three (3) regions with the highest population based on the 2007 Population Census are the Calabarzon (Region IV-A) with 11.74 million, NCR (Metro Manila) with 11.5 million and Central Luzon (Region III) with 9.72 million. The combined population in the said regions comprised more than one-third (37.3 percent) of the total population in the Philippines. Aside from the ARMM, the three regions likewise have the biggest growth rate between the years 2000 – 2007. **Table 1.10-5** contains the population details.

TABLE1.10-5 TOTAL POPULATION AND ANNUAL POPULATION GROWTH RATES BY REGION BASED ON POPULATION CENSUSES 1995, 2000, AND 2007

Region/Province	Total Population			Annual Population Growth Rate (%)		
	1-Aug-07	1-May- 00	1-Sep-1995	2000-2007	1995-2000	1995-2007
PHILIPPINES	88,574,614	76,506,928	68,616,536	2.04	2.36	2.16
National Capital Region	11,553,427	9,932,560	9,454,040	2.11	1.06	1.70
Cordillera Administrative Region	1,520,743	1,365,220	1,254,838	1.50	1.82	1.62
Region I - Ilocos	4,545,906	4,200,478	3,803,890	1.10	2.15	1.51
Region II - Cagayan Valley	3,051,487	2,813,159	2,536,035	1.13	2.25	1.56
Region III - Central Luzon	9,720,982	8,204,742	7,092,191	2.36	3.17	2.68
Region IV-A - Calabarzon	11,743,110	9,320,629	7,750,204	3.24	4.03	3.55
Region IV-B - Mimaropa	2,559,791	2,299,229	2,033,271	1.49	2.67	1.95
Region V - Bicol	5,109,798	4,674,855	4,325,307	1.23	1.68	1.41
Region VI - Western Visayas	6,843,643	6,211,038	5,776,938	1.35	1.56	1.43
Region VII - Central Visayas	6,398,628	5,706,953	5,014,588	1.59	2.81	2.07
Region VIII - Eastern Visayas	3,912,936	3,610,355	3,366,917	1.12	1.51	1.27
Region IX - Zamboanga Peninsula	3,230,094	2,831,412	2,567,651	1.83	2.12	1.94

Region/Province	Total Population			Annual Population Growth Rate (%)		
	1-Aug-07	1-May- 00	1-Sep-1995	2000-2007	1995-2000	1995-2007
Region X - Northern Mindanao	3,952,437	3,505,708	3,197,059	1.67	1.99	1.79
Region XI - Davao	4,156,653	3,676,163	3,288,824	1.71	2.41	1.98
Region XII - Socsargen	3,829,081	3,222,169	2,846,966	2.41	2.69	2.52
Caraga Region	2,293,480	2,095,367	1,942,687	1.25	1.63	1.40
Autonomous Region in Muslim Mindanao	4,120,795	2,803,045	2,362,300	5.46	3.73	4.78

**Source: NSO, 2007*

2) Demographic Profile of NCR (Metro Manila)

Metro Manila has a total population of 11,553,427 million as of August 1, 2007. Of the 32 highly urbanized cities in the country having more than 1 million populations, among them are in NCR which includes the following cities: Quezon City (2.68 million), City of Manila (1.66 million), and Caloocan City (1.36 million). Of the two cities traversed by NAIAX phase II, Parañaque City has a bigger population of 552,660 while Pasay City has 403,064. The other cities within NCR with the highest population includesTaguig City (613,343), Makati City (510,383), Las Piñas City (532,330), Pasig City (617,301), and Marikina (424,610). All of these areas are located with proximity to NAIAX. With respect to population growth rate, Taguig City had registered to have the highest at 3.82% over the period between 2000-2007, which is followed by Caloocan (3.06%), Paranaque (2.88%) and Pasig (2.80%). It is worth noting that the start of NAIAX Phase I is in Taguig City with the highest population growth rate, while the end of NAIAX Phase II is in Paranaque City also having the 3rd highest growth rate. **Table 1.10-6** contains the population data for all the component cities and municipality of NCR.

TABLE 1.10-6 TOTAL POPULATION, TOTAL NO. OF BARANGAYS, POPULATION DENSITY AND ANNUAL POPULATION GROWTH RATES IN METRO MANILA

Local Government Unit	Total No. of Bgys.	Total Population	Population Density (persons per km^2)	Annual Population Growth Rate (2000-2007)
PHILIPPINES	41,975	88,574,614	-	2.04
NCR (Metro Manila)	1,695	11,553,427	18,246	2.11
City of Manila	896	1,660,714	43,079	0.68
Mandaluyong City	27	305,576	27,138	1.29
City of Marikina	16	424,610	12,500	1.14
City of Pasig	31	617,301	19,913	2.80
Quezon City	142	2,679,450	16,630	2.92

Local Government Unit	Total No. of Bgys.	Total Population	Population Density (persons per km^2)	Annual Population Growth Rate (2000-2007)
City of San Juan	21	125,338	20,907	0.87
Caloocan City	188	1,378,856	25,855	3.06
City of Malabon	21	363,681	23,076	0.98
City of Navotas	-	245,344	22,780	0.87
City of Valenzuela	32	568,928	12,762	2.21
City of Las Piñas	20	532,330	12,815	1.65
City of Makati	33	510,383	18,654	1.91
City of Muntinlupa	9	452,943	9,699	2.48
City of Parañaque	16	552,660	11,589	2.88
Pasay City	201	403,064	21,214	1.77
Taguig City	18	613,343	12,810	3.82
Pateros	10	61,940	29,495	1.05

Source: NSO, 2007

(3) Economic Trend

The economic performance of NCR as well as neighboring provinces is depicted in **Figure 1.10-1**. These three regions, NCR, Region III and Region IV-A, are considered the economic engine of the country contributing 56.8% of the country's economic output. NCR consistently surpassed the national average.

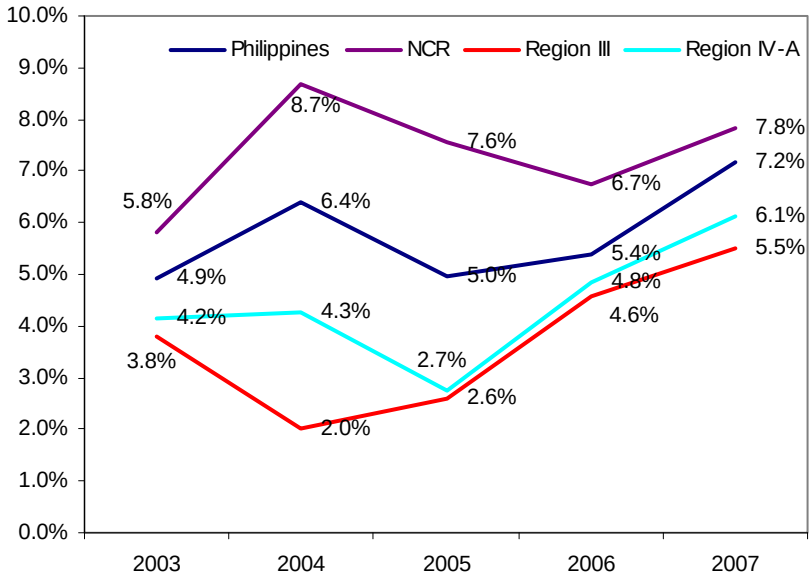


FIGURE 1.10-1 GDP AND GRDP GROWTH RATE

The industrial structure of the economy of NCR is as follows: Primary Sector (0%), Secondary Sector (34%), and Tertiary Sector (66%) as shown in **Table 1.10-7**.

TABLE 1.10-7 INDUSTRIAL STRUCTURE OF THE ECONOMY, 2007

	Primary	Secondary	Tertiary	Total
Philippines	251,272	445,486	671,883	1,368,641
NCR	**1**	**151,135**	**295,656**	**446,793**
Region III	27,963	40,500	45,539	114,001
Region IV-A	30,253	67,971	67,853	166,077
IN PERCENTAGE				
Philippines	18%	33%	49%	100%
NCR	**0%**	**34%**	**66%**	**100%**
Region III	25%	36%	40%	100%
Region IV-A	18%	41%	41%	100%

Source: NSO, 2007

In terms of economic growth rate, the country in general posted high economic growth from 2002 to 2007. High growth is particularly observed from 2006 to 2007 where 7.18% growth rate was recorded. At regional level, NCR registered 7.84% from 2006 to 2007; Region III had 6.11% and Region IV-A with 5.49% in the same period as depicted in **Table 1.10-8**.

TABLE 1.10-8 ECONOMIC GROWTH RATE (2002-2007)

	2002-03	2003-04	2004-05	2005-06	2006-07
Philippines	4.93 %	6.38 %	4.95 %	5.40 %	7.18 %
NCR	**5.82 %**	**8.67 %**	**7.56 %**	**6.74 %**	**7.84 %**
Region III	3.79 %	2.00 %	2.74 %	4.83 %	6.11 %
Region IV-A	4.15 %	4.27 %	2.59 %	4.57 %	5.49 %

Source: NSBC, 2008

1) Per Capita GDP and GRDP

The per capita GRDP in current price and constant price are shown in **Table 1.10-9** and **Table 1.10-10** respectively. As expected, NCR being the capital of the country has the highest per capita GRDP which almost 3 fold higher than the national average. Per capita GRDP of Region IV-A is a bit lower that the national average at 0.90. The country's per capita GRDP grew by 3.8% per annum from 2003 to 2007. Highest growth is realized in NCR and followed by Region IV-A and

then by Region III as presented in **Table 1.10-10**.

TABLE 1.10-9 PER CAPITA GRDP IN CURRENT PRICE

Unit: Peso

	2003	2004	2005	2006	2007	
Philippines	52,718	58,149	63,556	69,365	74,947	1.00
NCR	**148,743**	**165,814**	**184,758**	**205,117**	**223,332**	**2.98**
Region III	39,407	42,256	45,789	49,469	52,351	0.70
Region IV-A	50,997	55,213	59,320	63,640	67,466	0.90

Source: NSBC, 2008

TABLE 1.10-10 PER CAPITA GRDP IN CONSTANT PRICE

Unit: Peso

	Per Capita GRDP					Growth Rate
	2003	2004	2005	2006	2007	2003-2007
Philippines	13,252	13,789	14,186	14,681	15,429	3.87 %
NCR	**31,730**	**33,867**	**35,742**	**37,856**	**40,252**	**6.13 %**
Region III	11,092	11,054	11,142	11,448	11,904	1.78 %
Region IV-A	13,853	14,068	14,159	14,439	14,891	1.82 %

Source: NSBC, 2008

2) Employment

The number of establishment in NCR reaches 196,426 in 2007. The said number of establishments generated 2,025,751 employments in the region.

TABLE 1.10-11NUMBER OF ESTABLISHMENTS AND EMPLOYMENTS BYREGION/PROVINCE: LUZON

Region/Province	No. of Establishments			No. of Employments		
	2005	2006	2007	2005	2006	2007
Philippines	782,980	783,065	783,869	5,479,297	4,984,883	5,187,793
NCR	**195,412**	**195,632**	**196,426**	**1,976,359**	**1,869,507**	**2,025,751**
Region III	84,368	84,344	84,361	480,020	419,320	421,962
Region IV-A	114,182	114,114	114,208	924,867	857,361	856,193
Luzon Total	**362,654**	**362,819**	**363,539**	**2,790,975**	**2,564,084**	**2,723,991**

Source: NSO, Statistical Sampling and Operations Division, 2000 List of Establishments

CHAPTER 2
OUTLINE OF 2010 FEASIBILITY STUDY

2.1 EXPRESSWAY CONFIGURATION

The expressway configuration proposed by the 2010 FS is shown in **Figure 2.1-1**. Schematic ramp layout is shown in **Figure 2.1-2**.

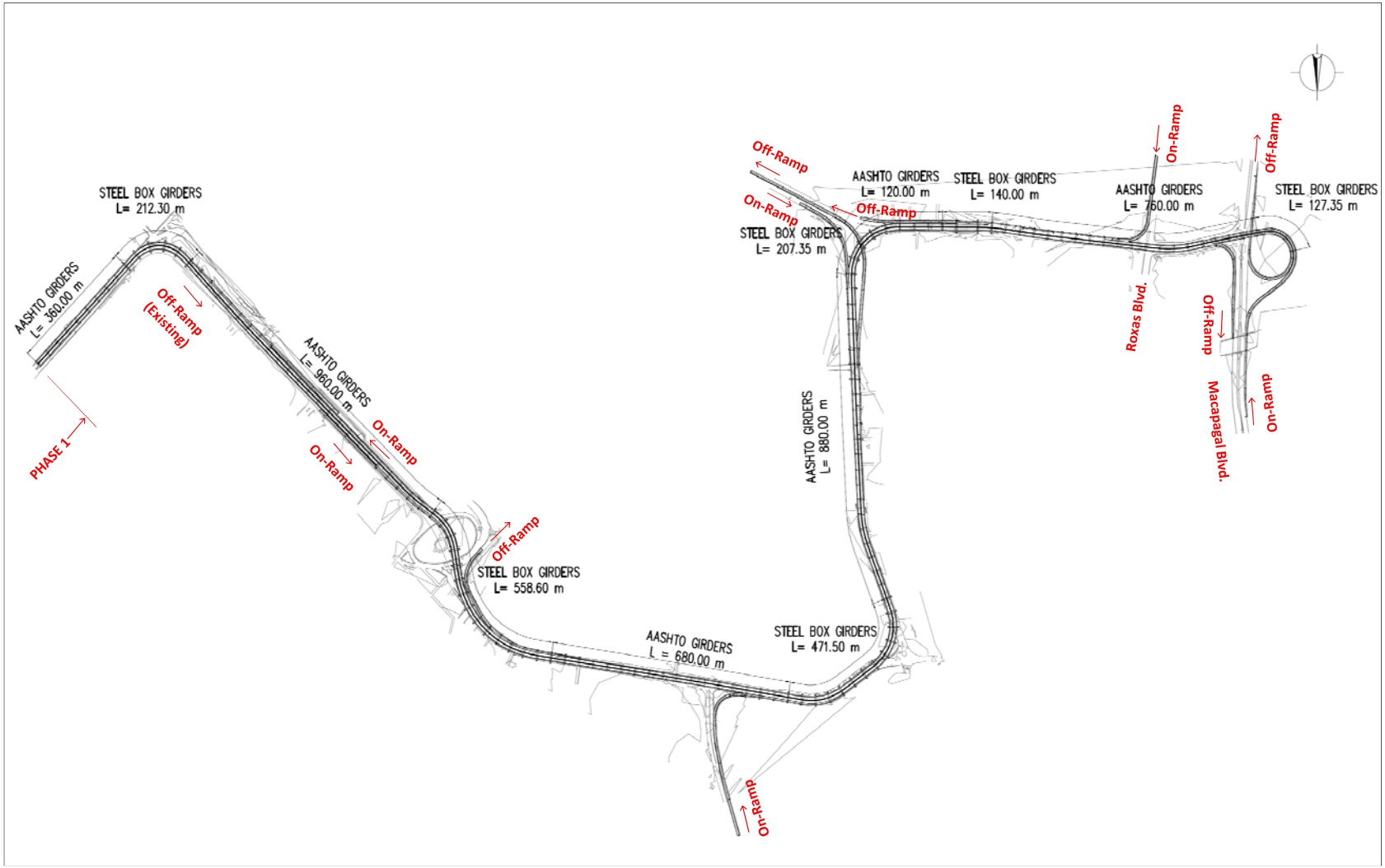


FIGURE 2.1-1 EXPRESSWAY CONFIGURATION PROPOSED BY THE 2010 FS

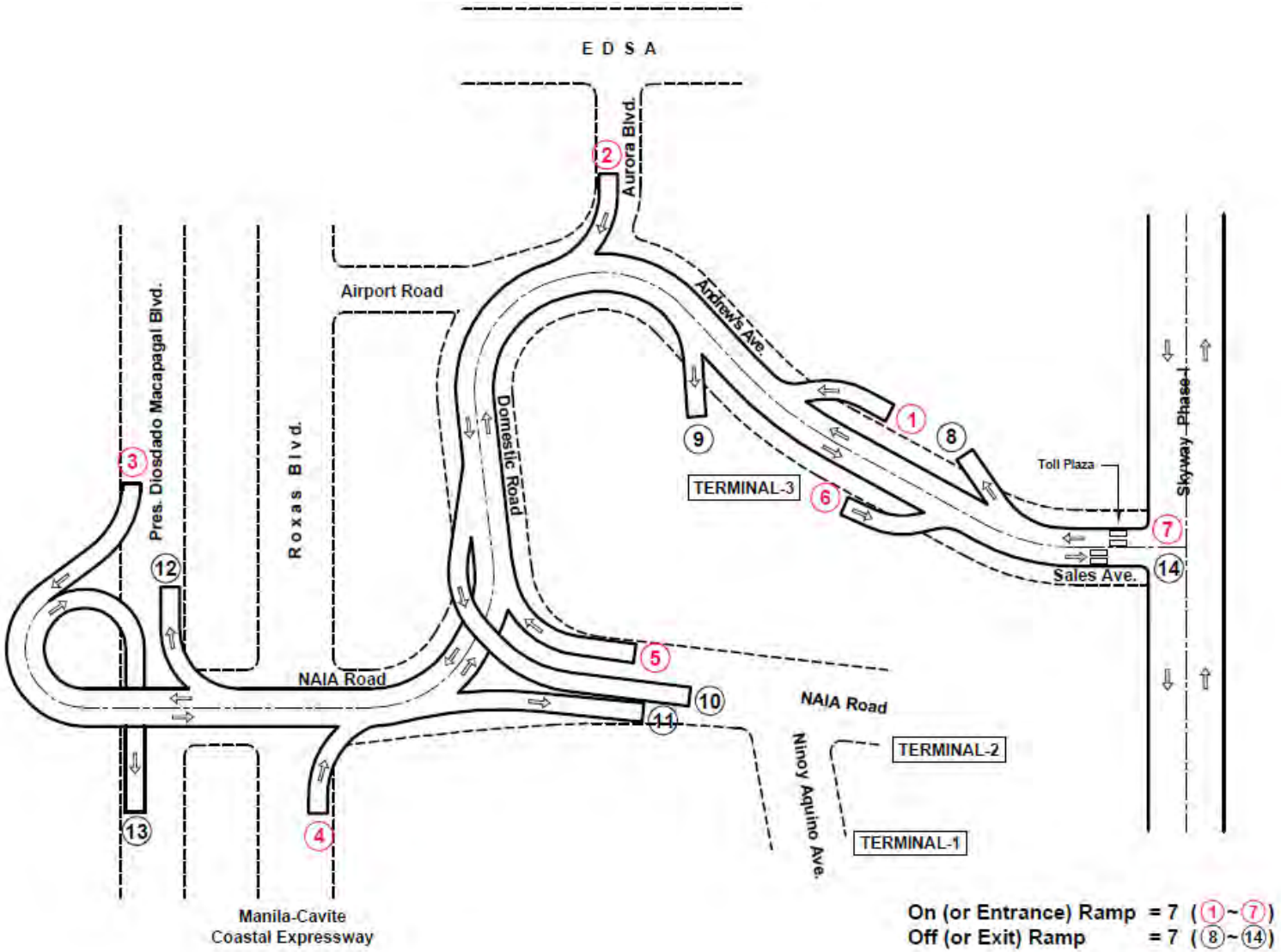


FIGURE 2.1-2 SCHEMATIC RAMP LAYOUT

2.2 TECHNICAL ISSUES

Our review results show that the 2010 FS contains various technical issues as summarized in **Table 2.2-1** and shown in **Figure 2.2-1**.

TABLE 2.2-1 SUMMARY OF TECHNICAL ISSUES

1.	***NAIA Navigational Clearance***
2.	***West End Alternatives***
3.	***Alternatives at Park 'n Fly Building Area***
4.	***Alternatives at Interface between Phase-1 and Phase-2***
5.	***Alignment at MMDA Landmark***
6.	***Ramp Lay-out***
7.	***Design Standards***
8.	***Vertical Clearance for At-grade Roads and Expressway***
9.	***Number of Traffic Lanes to be provided***
10.	***Toll Collection System (Open System or Closed System)***
11.	***Pedestrian Overpass Bridges***
12.	***Economical Span Length for the Standard Section***

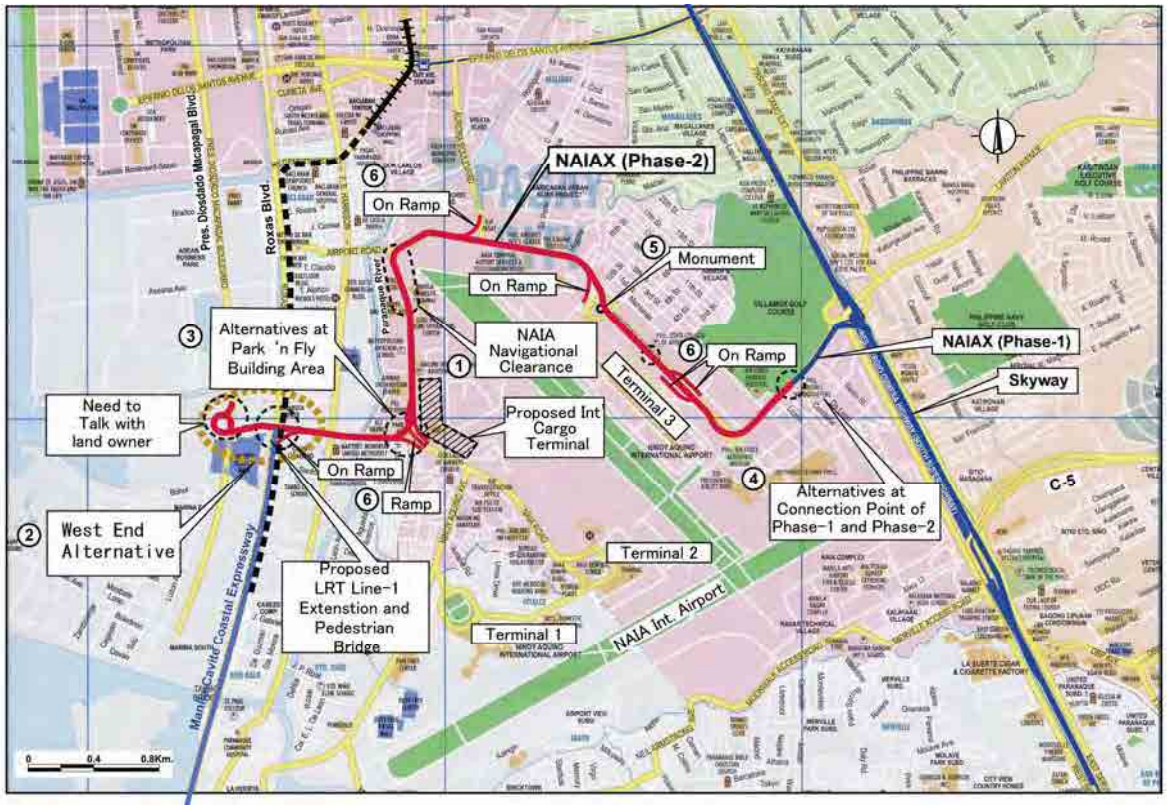


FIGURE 2.2-1 LOCATION AREA OF TECHNICAL ISSUES

CHAPTER 3
RECOMMENDED SOLUTIONS FOR TECHNICAL ISSUES

There are many technical issues in 2010 Feasibility Study which were mentioned in Chapter 2. The recommended solution for each technical issue is described below.

3.1 NAIA NAVIGATIONAL CLEARANCE

To ensure that the proposed vertical alignment of NAIAX satisfies the requirement of NAIA navigational clearance, the vertical and horizontal alignment of NAIAX was reviewed.

3.1.1 NAIA Navigational Clearance Requirements

- NAIA Navigational Clearance
  Figure 3.1.1-1(1) and **(2)** shows Navigation Clearance (Civil Aviation Authority of the Philippines: CAAP)
  - Runway Strip Width : 300m(150m+150m)
  - Coordinate of end of runway and elevation
    WGS 84 System
    N 14° 31' 21.7"
    E121° 00' 18.2"
    Elevation 3.00m above Mean Sea Level

- Height Limit along Andrews Ave. and Domestic Road and Available net height is shown in **Figure 3.1.1-2**.

- The Concessionaire is required to obtain a "Height Clearance Permit (HCP)" from
  - Aerodrome Development and Management Service
  - Air Navigation Service
  - Air Traffic Service

- Controls for vertical alignment planning for the Expressway is shown in **Figure 3.1.1-3**.
  - Special type of structure for the expressway is required for about 600 m along Andrews Avenue and Domestic Road.
  - Space under the expressway cannot be used for the at-grade road, along Domestic Road for about 480 m, thus additional ROW for the at-grade road is required.

- Land development condition is shown in **Figure 3.1.1-4**.

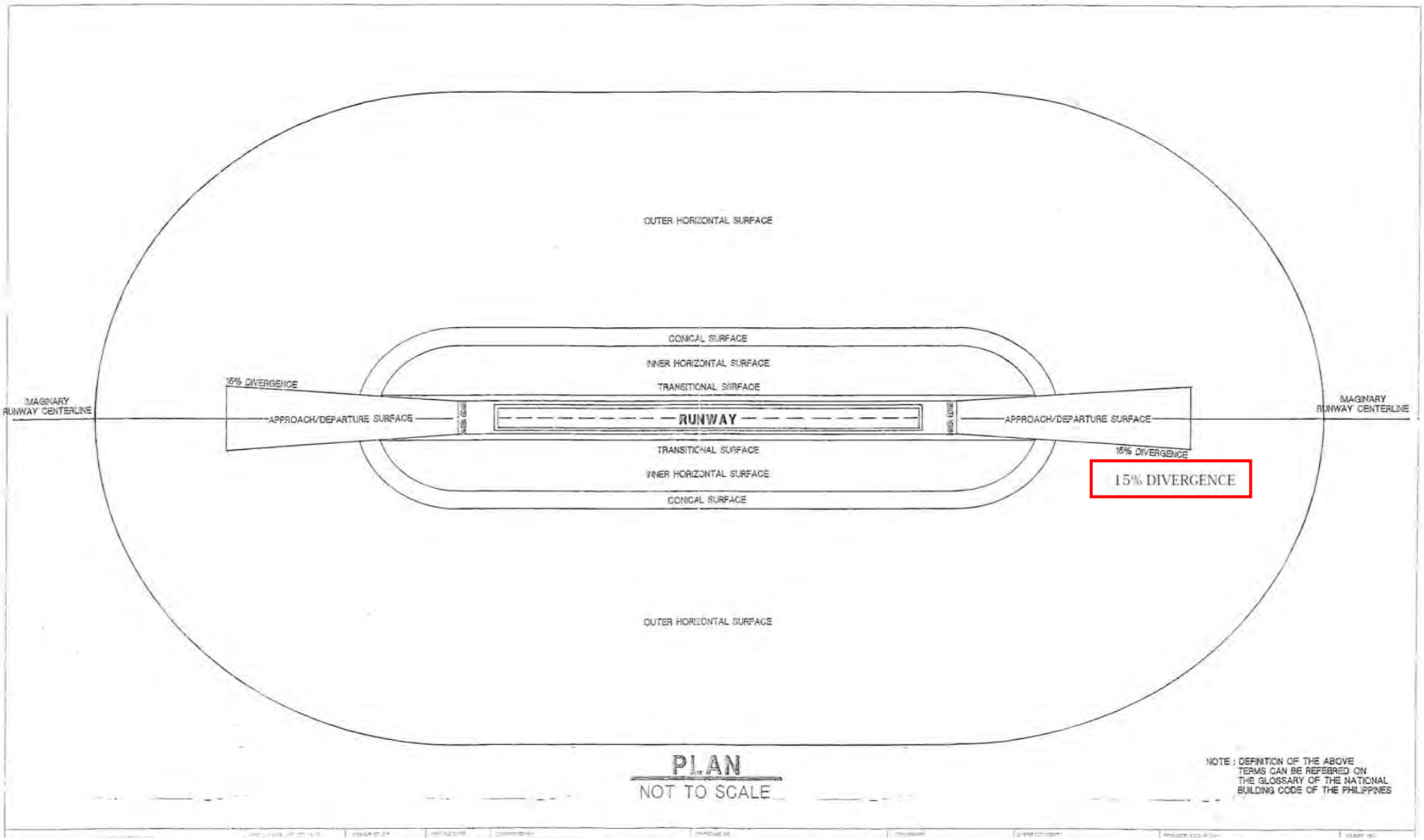


FIGURE 3.1.1-1 (1) NAIA NAVIGATIONAL CLEARANCE

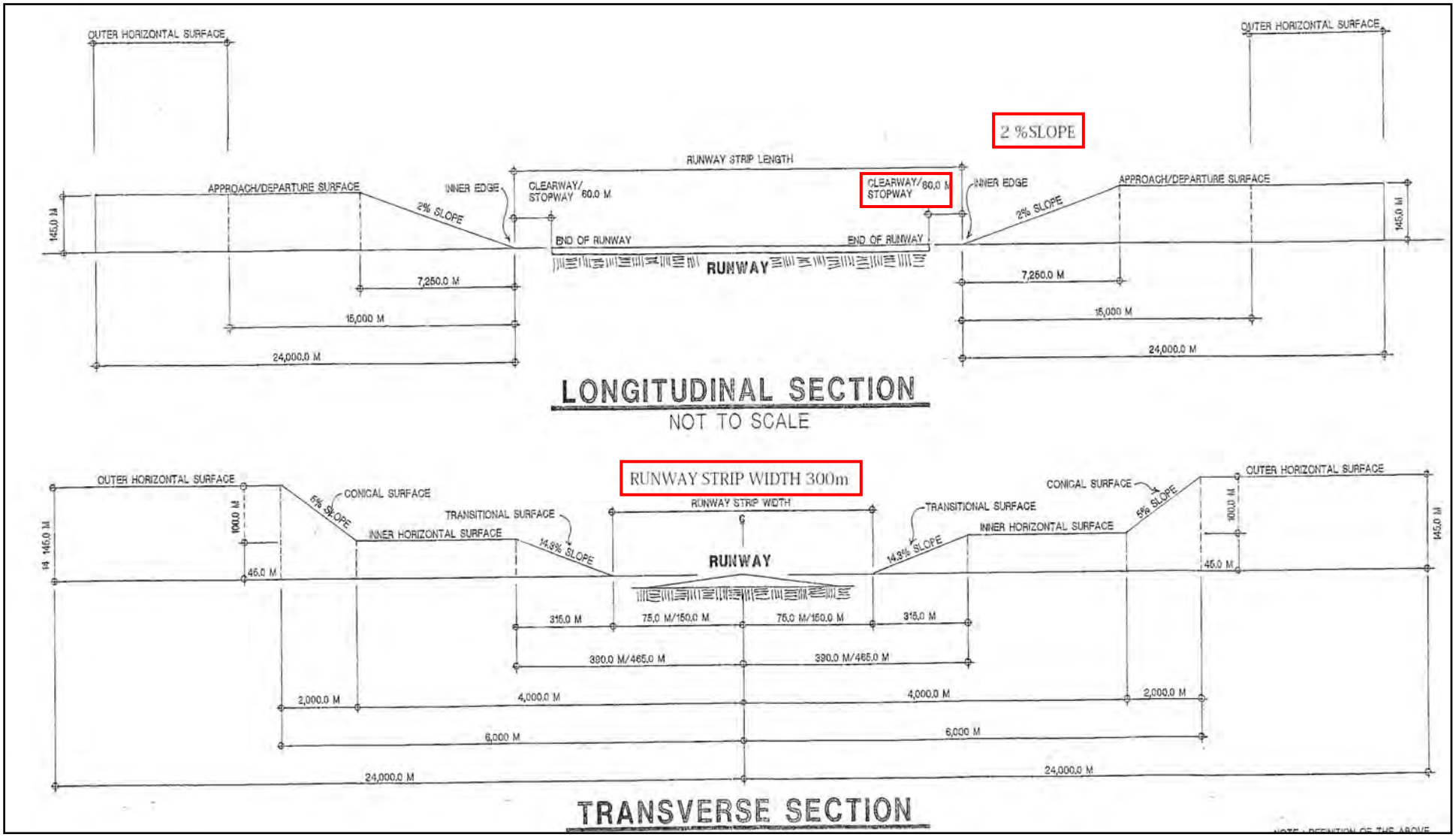


FIGURE 3.1.1-1 (2) LONGITUDINAL AND TRANSVERSE SECTION

Available net height

No	Navigation clearance from Mean Sea level	Road Elevation	Available net height
1	14.463	2.92	11.54
2	15.256	2.90	12.36
3	16.274	2.34	13.93
4	15.627	2.33	13.30
5	12.613	2.24	10.37
6	10.595	2.69	7.91
7	10.513	2.75	7.76
8	20.65	2.99	17.66

FIGURE 3 . 1.1-2 HEIGHT LIMIT ALONG ANDREWS AVE. AND DOMESTIC ROAD AND AVAILABLE NET HEIGHT

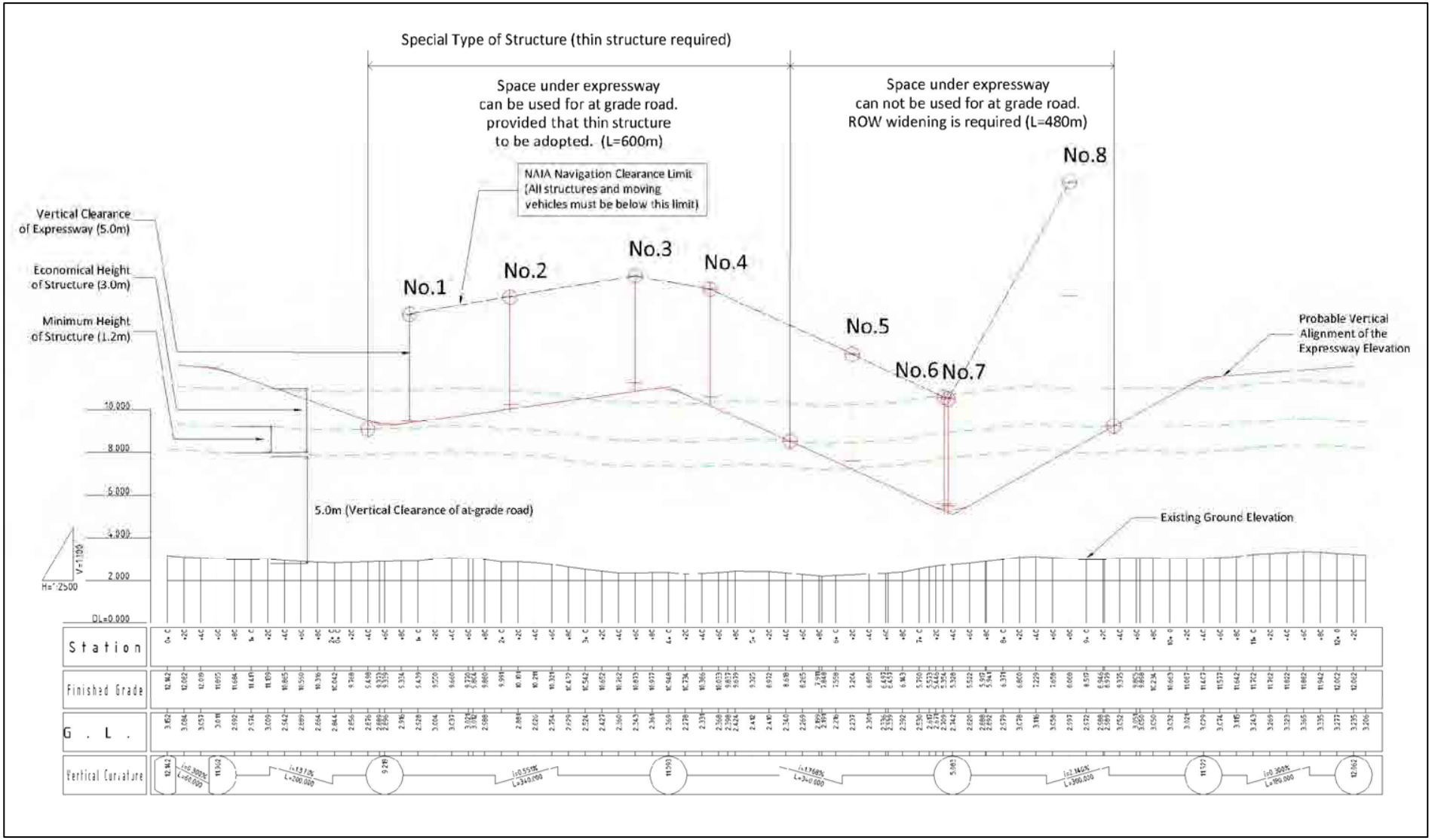


FIGURE 3 . 1.1-3 CONTROLS FOR VERTICAL ALIGNMENT PLANNING AND EXPRESSWAY

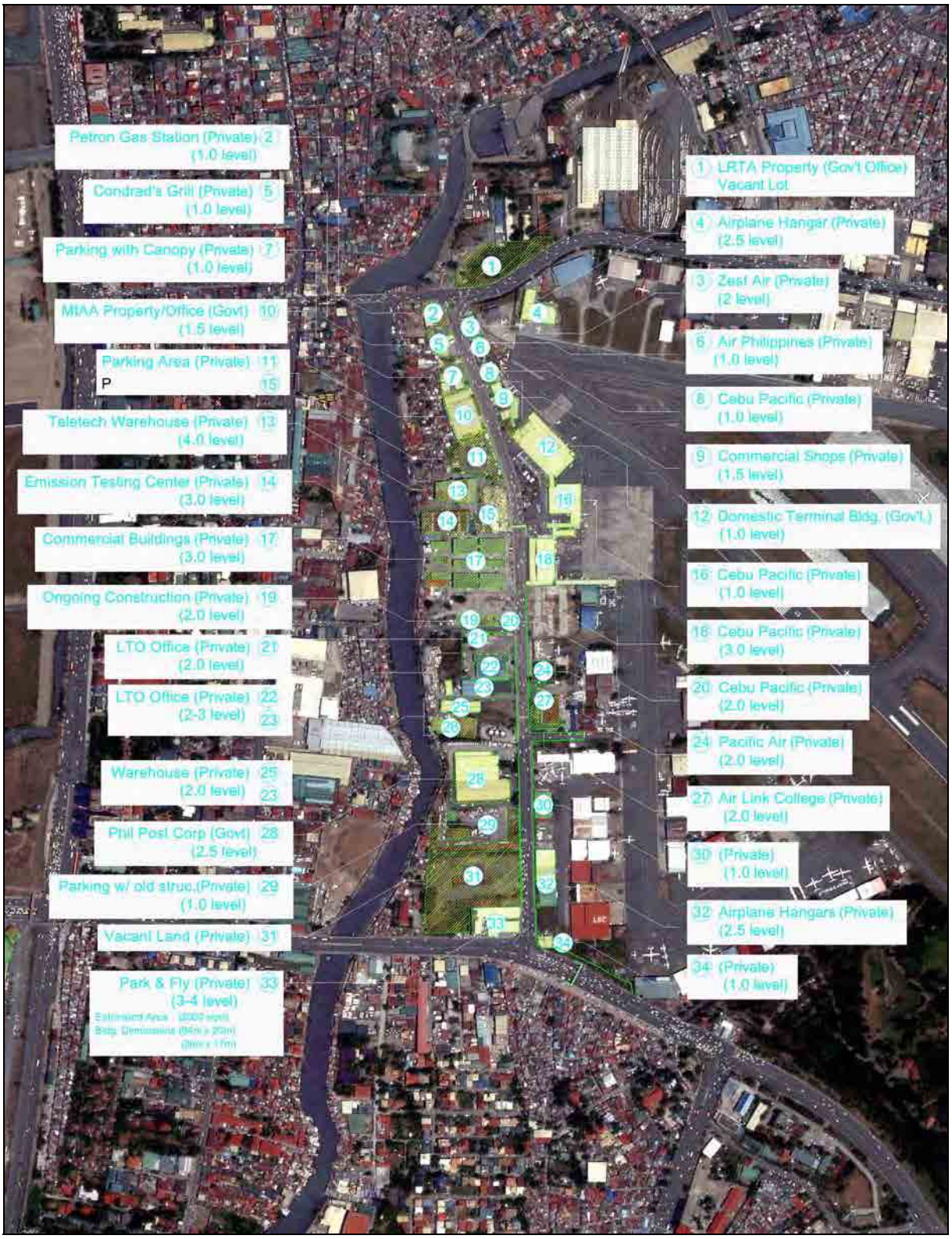


FIGURE 3.1.1-4 LAND DEVELOPMENT CONDITION

3.1.2 Alternative River alignment and Domestic Road Alignment

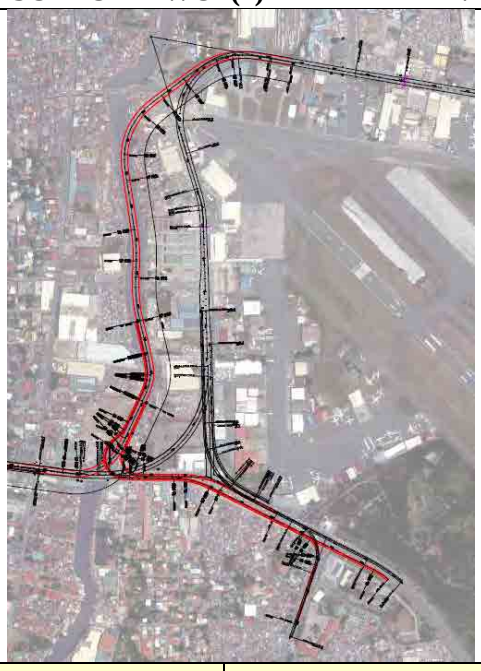
In order to ensure the above vertical clearance, two route alignments were studied.

Alternative-1 Expressway alignment along Parañaque River.

Alternative-2 Expressway alignment along Domestic Road.

Table 3.1.2-1 shows the comparison table of Alternatives and Alternative-2 was recommended..

TABLE 3.1.2-1 COMPARISON OF TWO (2) ALTERNATIVES

Plan				
	Alternative 1		**Alternative 2**	
Concept	Expressway alignment along Paranaque River		Highway express alignment along Domestic Road	
Road length (Main)	1702m		1780m	
Ramp length	2514m		1984m	
Construction Cost (including ROW)	1.2 Billion Php		1.0 Billion Php	
Geometric Design Condition	**Fair**	Rmin =150m (main)	**Fair**	Rmin= 190 (main)
Traffic flow	**Poor**	Accessibility to Terminal 1 and 2 is low due to long ramp	**Good**	Accessibility to terminal 1 and 2 is better
Social Impact	**Poor**	Relocation and compensation of squatters along Paranaque River(more than 100 household) necessary.	**Fair**	Needs land acquisition along Domestic Road but large building remains without demolition Access to facilities along road remains the same
Environmental Impact	**Poor**	Due to construction of bridge piers (50nos) in the Paranaque river, risk of inundation increases(impediment ratio 11%). River widening and protection is necessary with road construction. Influence to upper and down stream needs to investigate.	**Good**	No negative impact to the Paranaque river.
Constructability	**Poor**	Due to construction in the river, construction is more difficult than Alternative-2 and it takes longer time	**Good**	The expressway can be constructed by familiar construction method.
Maintenance	**Poor**	Difficult due to piers in river	**Good**	Easy
Evaluation	**Poor**		**Good**	This scheme is recommended

3.1.3 Alternatives Along Domestic Road

Since the alignment along Domestic Road is recommended, three alternatives were studied in due consideration of height limit requirement of NAIA as follows;

Alternative-1: Expressway passes at west side of Domestic Road
(see **Figure 3.1.3-1 (A)** and **(B)**)
Alternative-2: Expressway passes at east side of Domestic Road (Airport side)
(see **Figure 3.1.3-2 (A)** and **(B)**)
Alternative-3: Expressway passes at the center of Domestic Road
(see **Figure 3.1.3-3 (A)** and **(B)**)

TABLE 3.1.3-1 COMPARISON OF THREE (3) ALTERNATIVES

	Alternative-1	**Alternative-2**	**Alternative-3**
Expressway Alignment	• West side of Domestic Road	• East side (airport side) of Domestic Road	• Center of domestic Road
ROW Acquisition	• West side: 11.5 m. • East side: 1.1 m.	• West side: 11.5 m. • East side: 3.5 m.	• West side: 10.5 m. • East side: 1.0 m.
Impact to Large Buildings	• No large buildings are affected.	• No large buildings are affected.	• No large buildings are affected.
Accessibility to Abutting Area	• West side area: by 1-lane road • East side area by 2x2=4 lane road.	• West side area: by 2x2=4 lane road • East side area by 1-lane road	• West side area: by 2-lane road • East side area by 2 lane road.
Accessibility to NAIA Terminal-4	• By 2x2=4 lane road	• By 1-lane road. • U-turn area needs to be provided between Section (A) and Section (B)	• By 2-lane road. • U-turn area needs to be provided between Section A and (B) and Section (B) and (C).
Recommendation	• Access to West area is not good. • Not recommended.	• Access to East area and NAIA Terminal-4 is not good. • Not recommended.	• Best option to provide access to both West and East areas and NAIA Terminal-4. • **Recommended.**

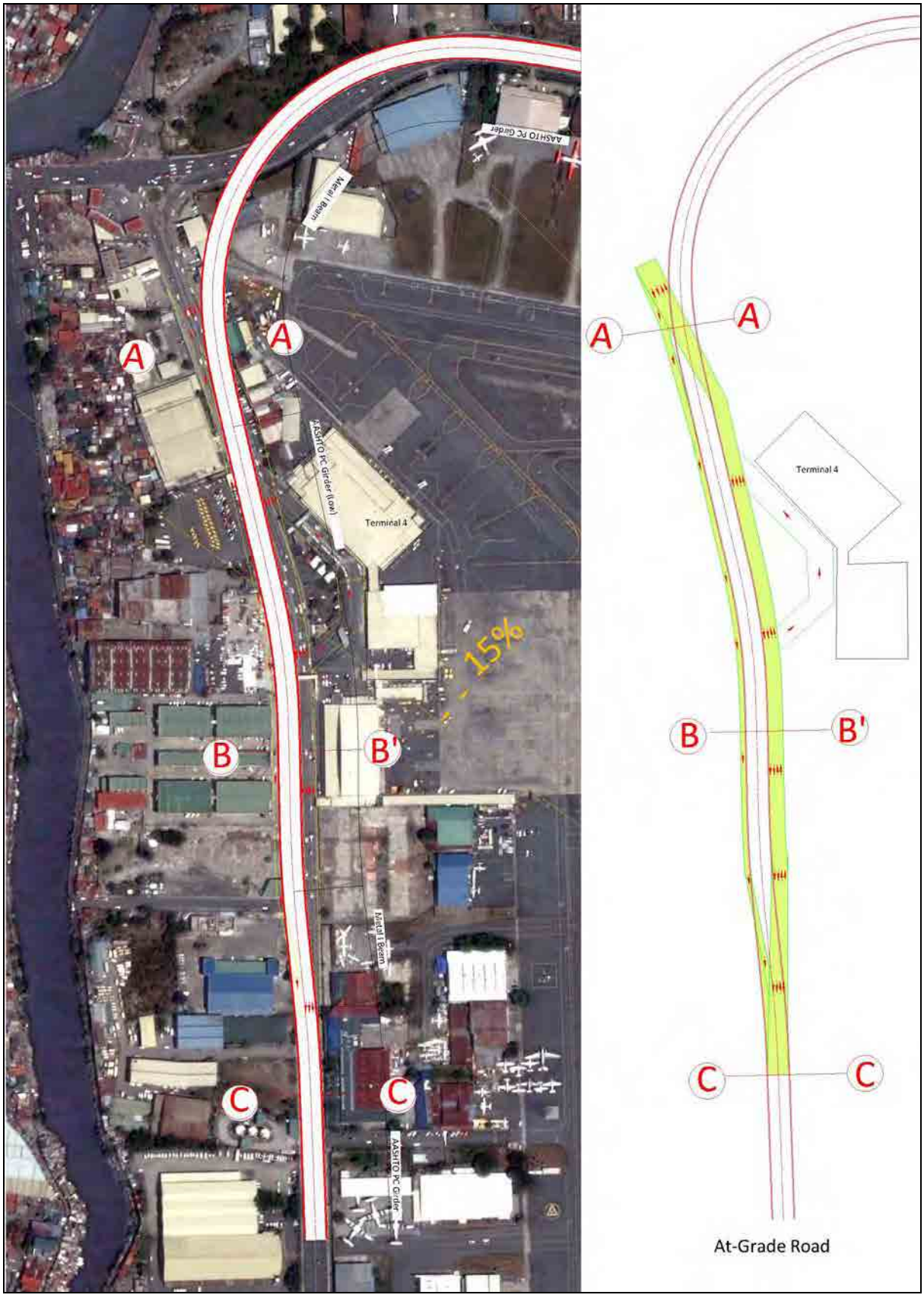


FIGURE 3.1.3-1 (A) ALTERNATIVE-1 AT NAIA NAVIGATIONAL CLEARANCE (PLAN)

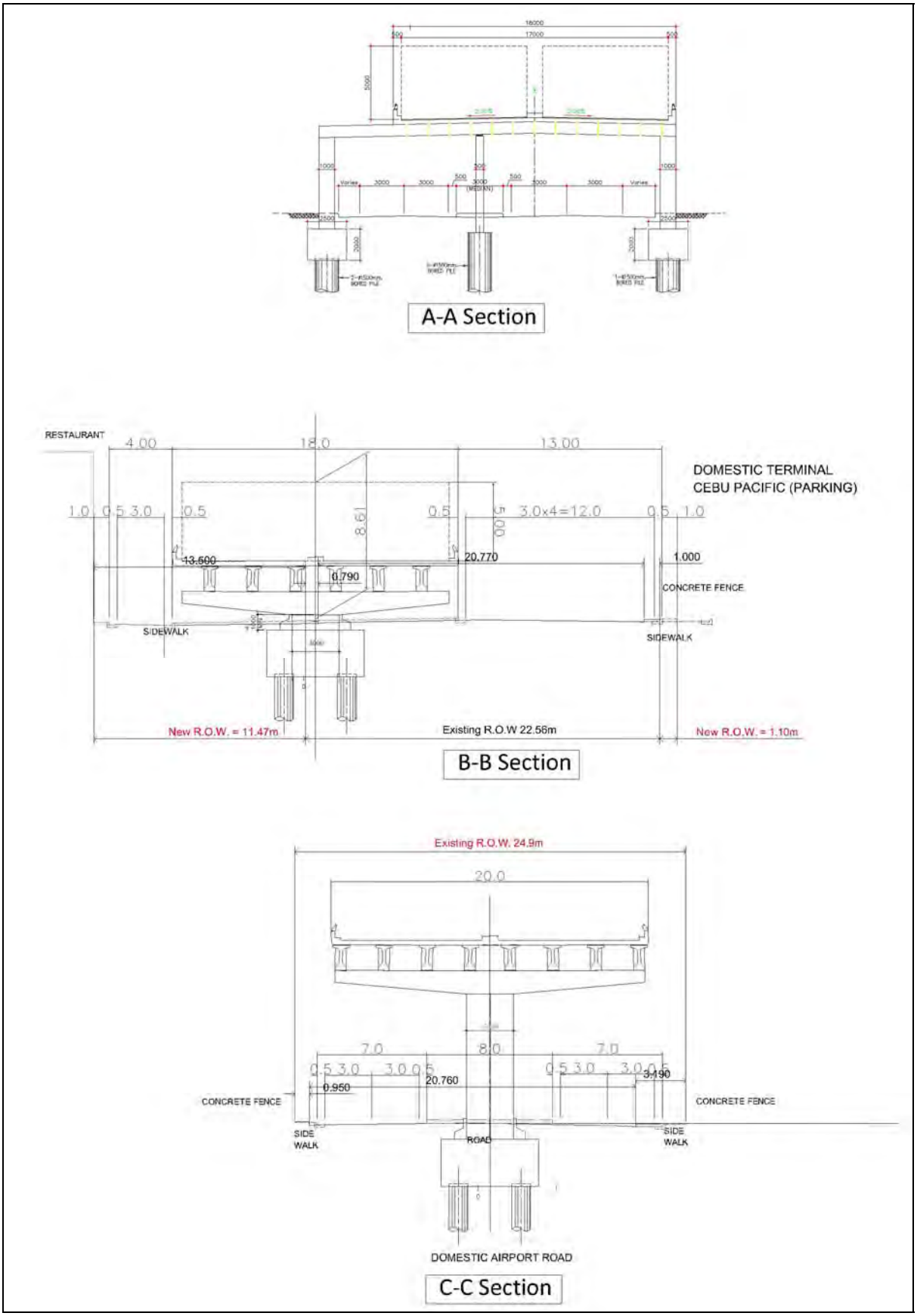


FIGURE 3.1.3-1 (B) ALTERNATIVE-1 AT NAIA NAVIGATIONAL CLEARANCE (CROSS SECTION)

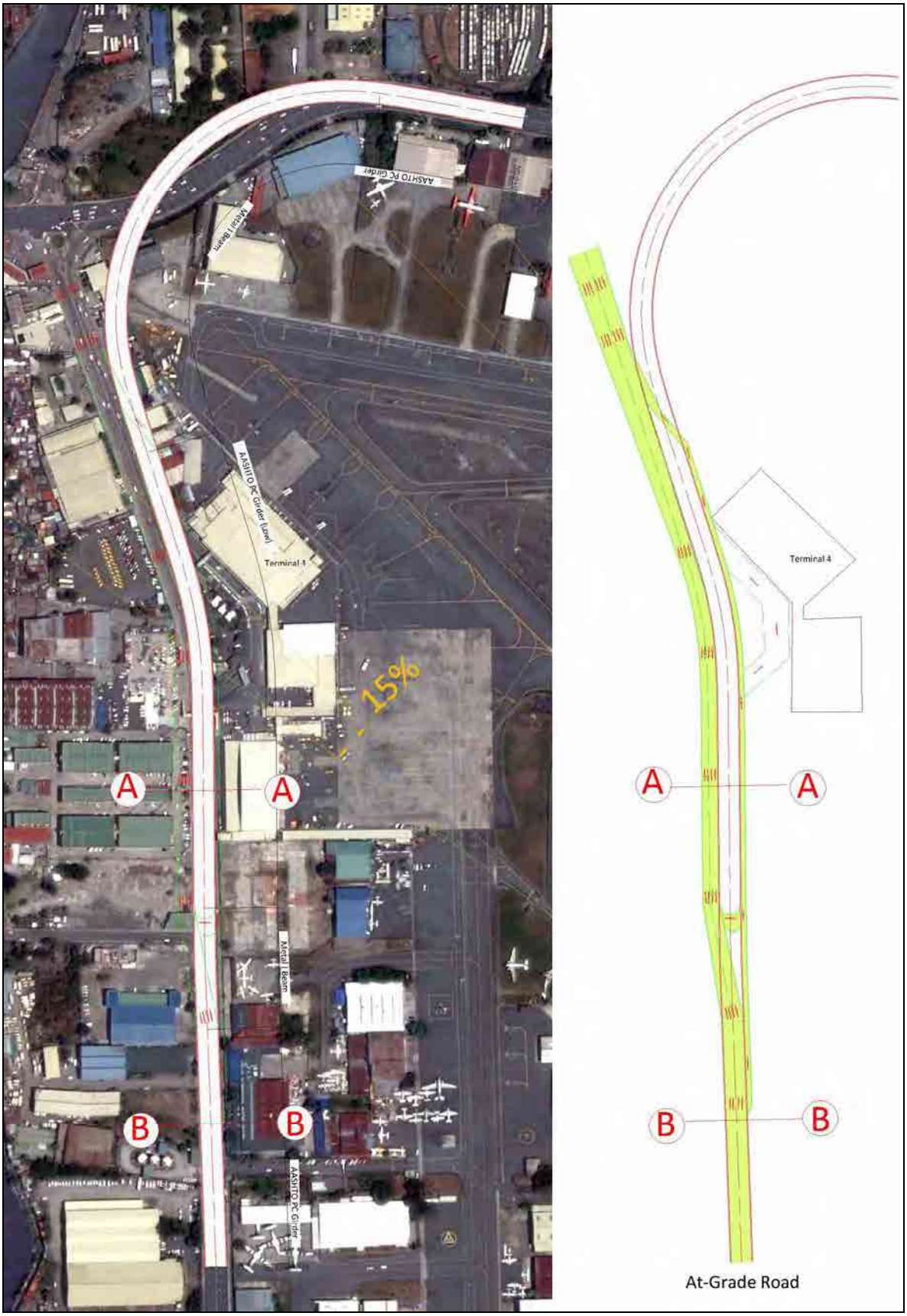


FIGURE 3.1.3-2 (A) ALTERNATIVE-2 AT NAIA NAVIGATIONAL CLEARANCE (PLAN)

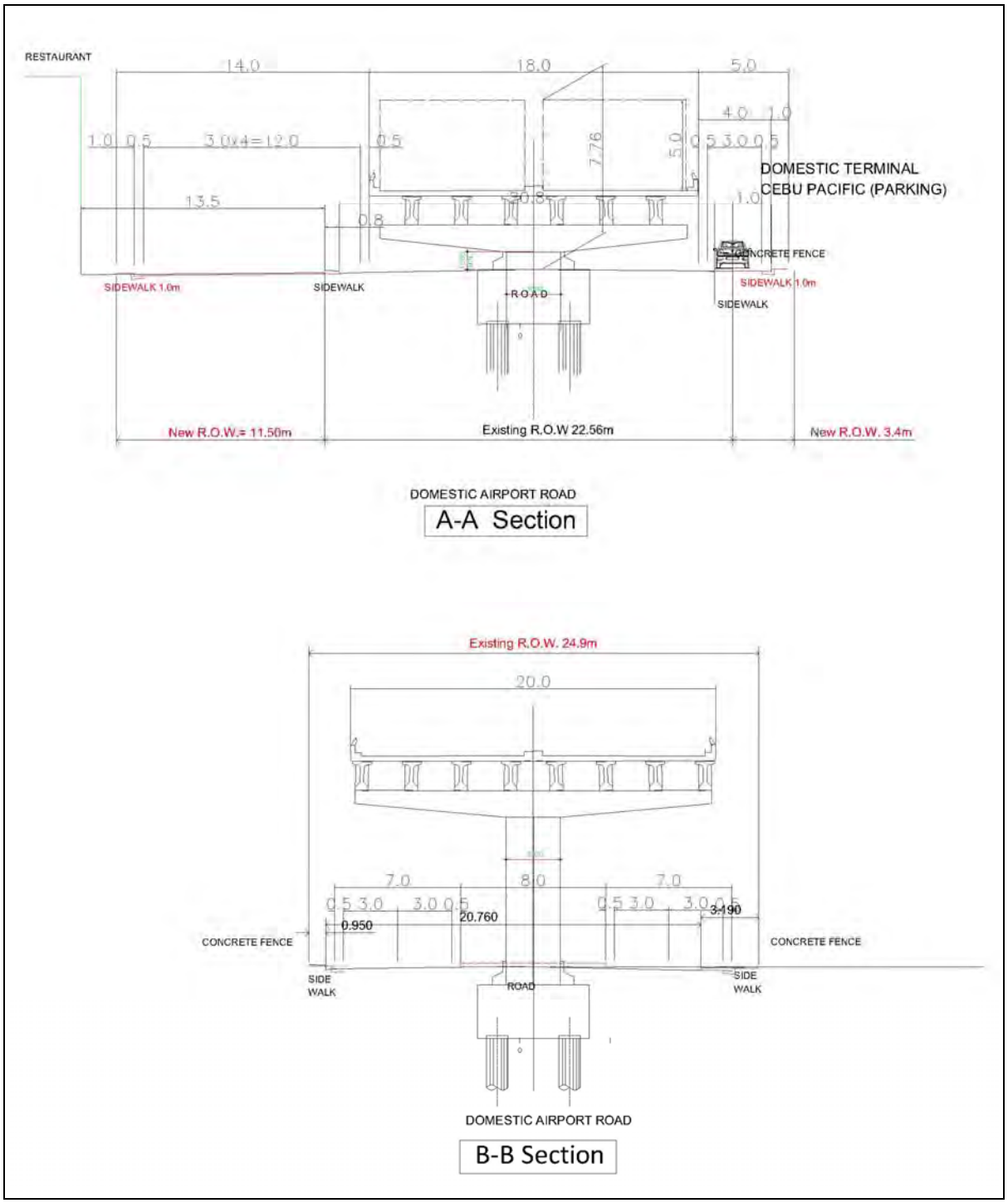


FIGURE 3.1.3-2 (B) ALTERNATIVE-2 AT NAIA NAVIGATIONAL CLEARANCE (CROSS SECTION)

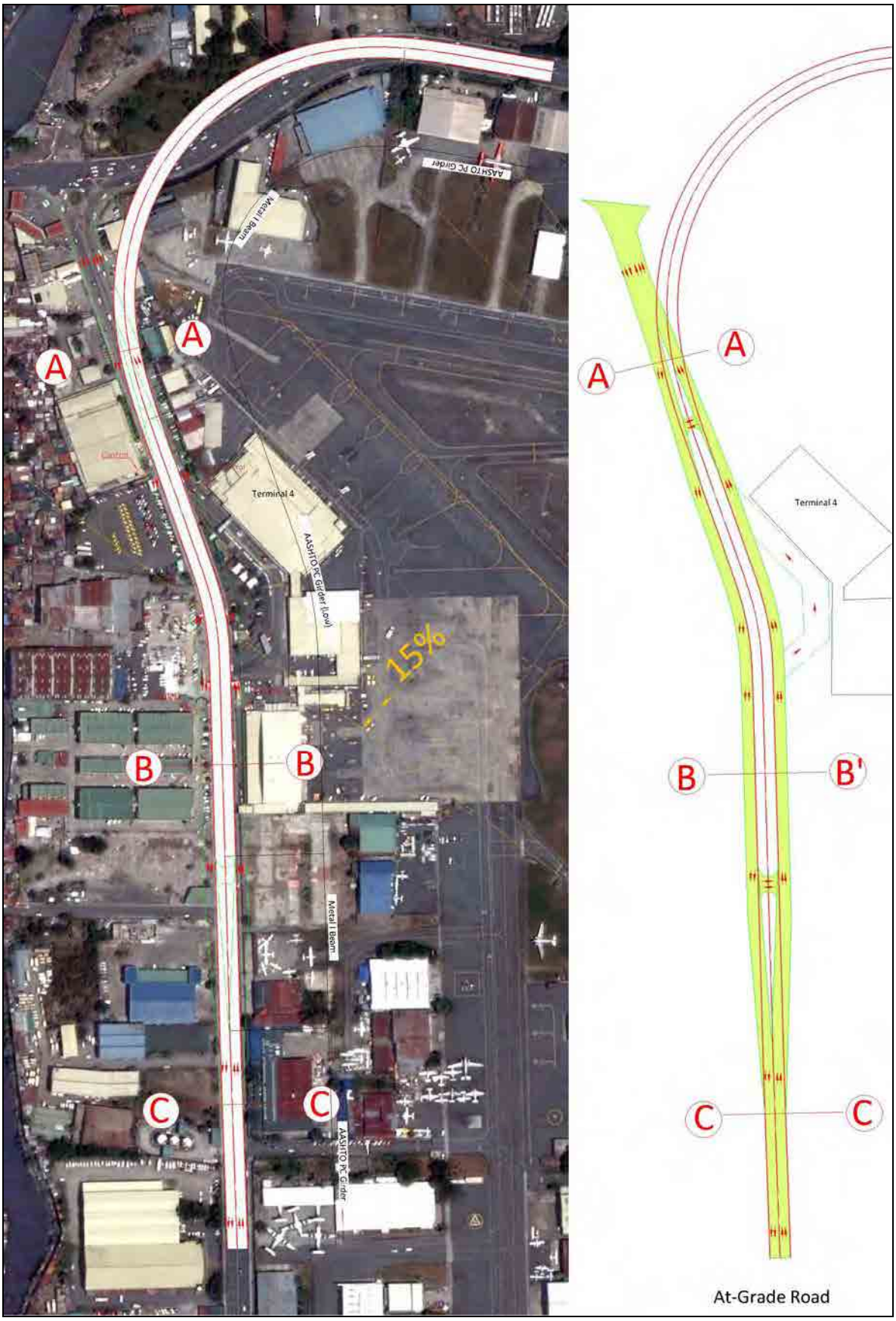


FIGURE 3.1.3-3 (A) ALTERNATIVE-3 AT NAIA NAVIGATIONAL CLEARANCE (PLAN)

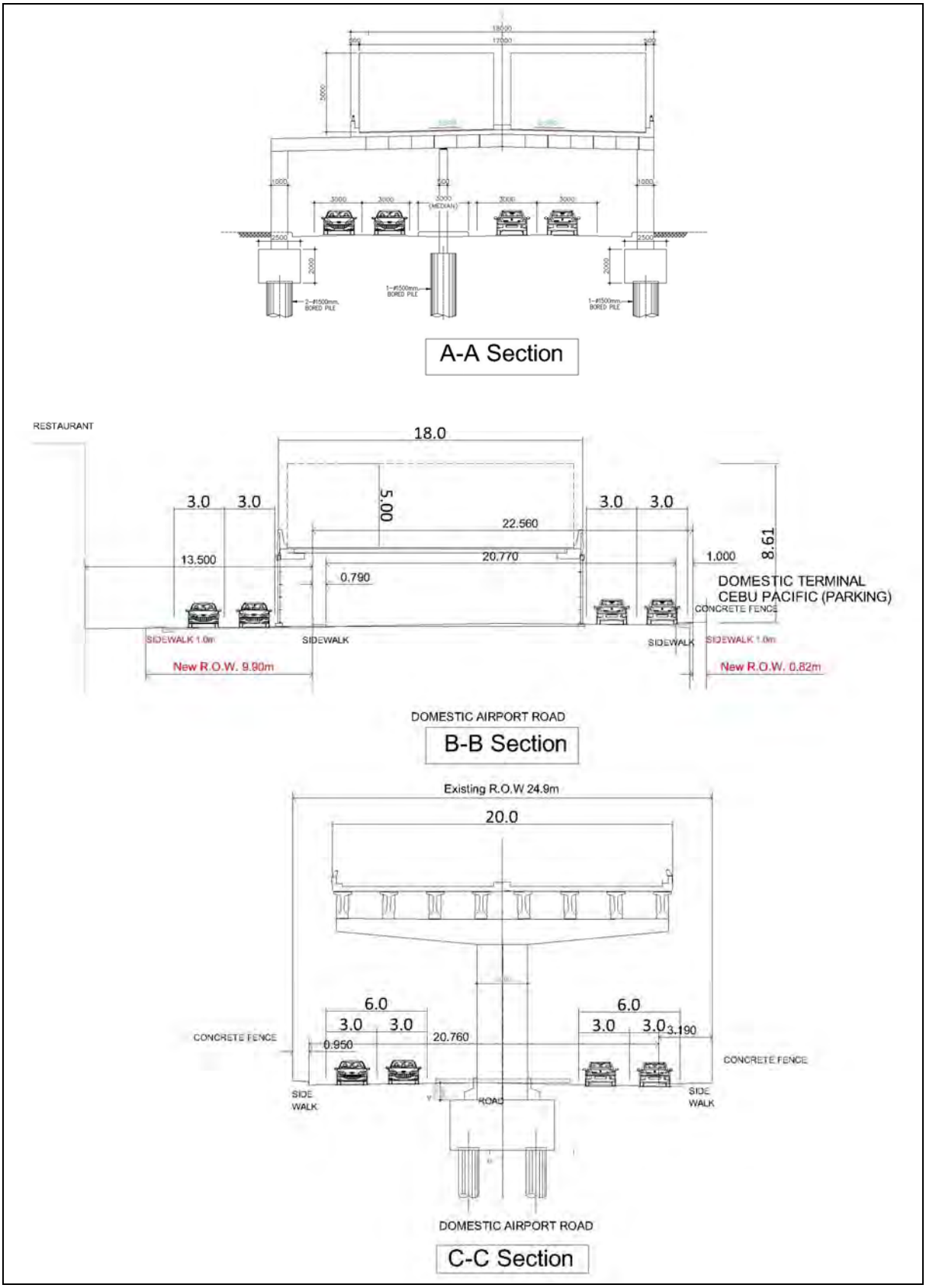


FIGURE 3.1.3-3 (B) ALTERNATIVE-3 AT NAIA NAVIGATIONAL CLEARANCE (CROSS SECTION)

After these comparison studies, the JICA Team explained the design and alignment of NAIAX to Pasay City Mayor and city engineers. They requested that the number of lanes of Domestic Road to be 6 lanes after construction. JICA Team re-studied the alignment to provide 6 lanes for the at-grade road without affecting large buildings in the area. **Figure 3.1.3-4(A)** and **(B)** shows the final alignment and the cross section.

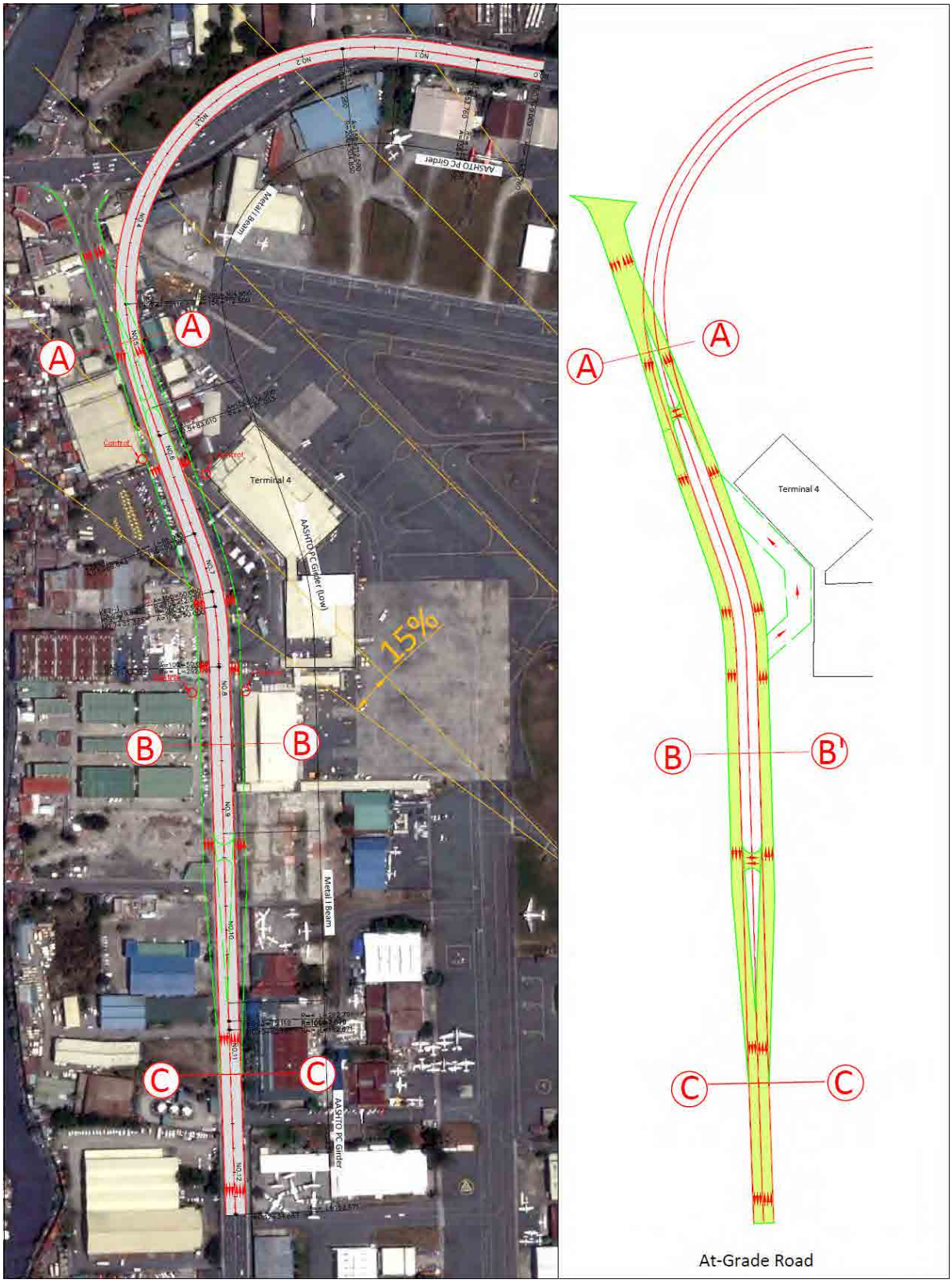


FIGURE 3.1.3-4 (A) ALTERNATIVE-3 AT NAIA NAVIGATIONAL CLEARANCE (PLAN)

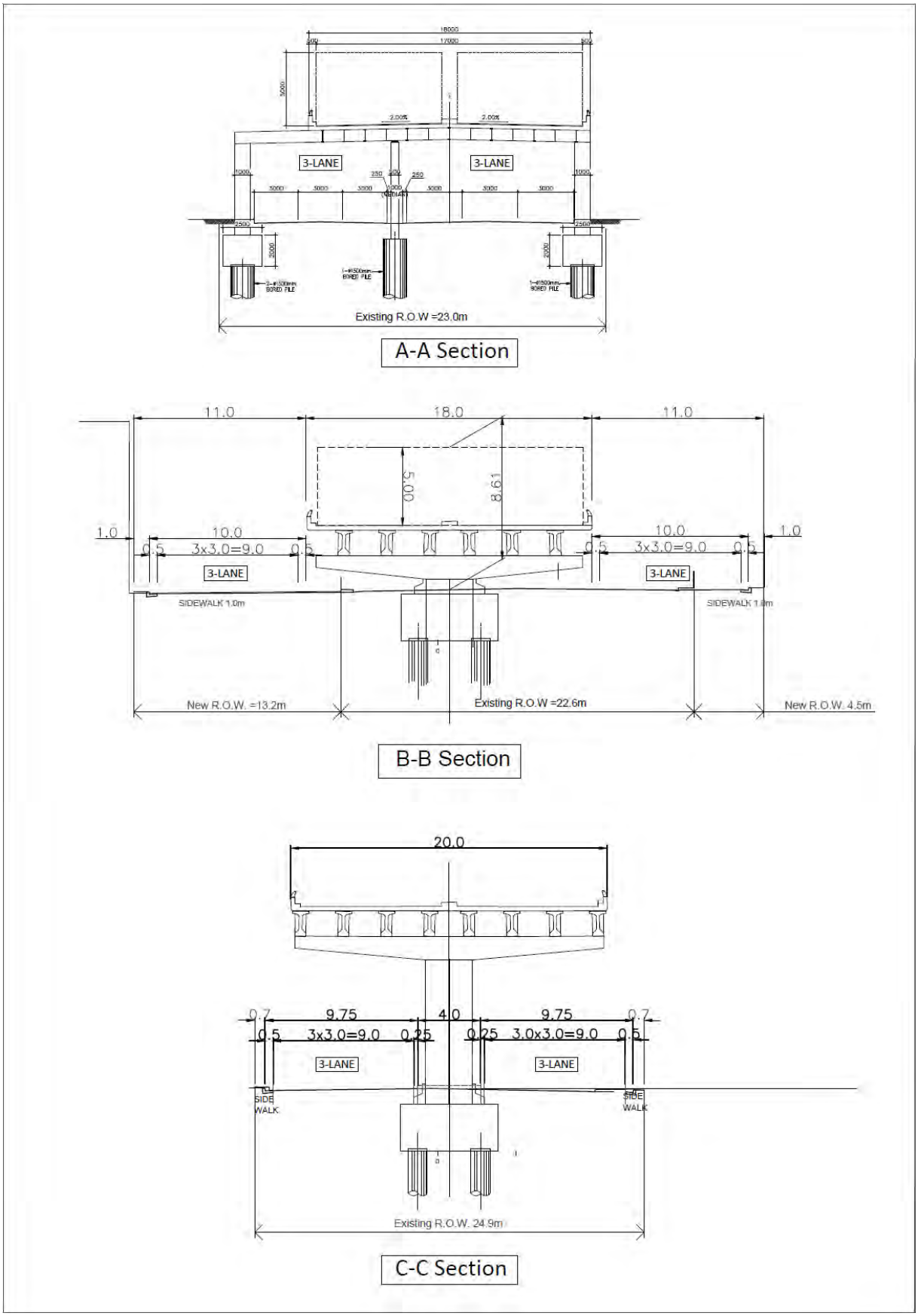


FIGURE 3.1.3-4 (B) ALTERNATIVE-3 AT NAIA NAVIGATIONAL CLEARANCE 6-LANE AT-GRADE (CROSS SECTION)

3.2 WEST END ALTERNATIVES

3.2.1 LRT Line-1 Cavite Extension Plan

LRT Line-1 Cavite Extension and Land Ownership is shown in **Figure 3.2.1-1 (1)** and **(2)).**

LRT Line-1 Cavite Extension

- LRT Line-1 Cavite Extension will be constructed along Roxas Blvd and Manila-Cavite Coastal Expressway. LRT will not affect existing ROW of both roads.
- LRT MIA Station will be constructed over the NAIA (MIA) road west extension.
- MIA Station will occupy (**Figure 3.2.1-2**);

  Width = 20.8 m.

  Height = 15.712 m.

Land Ownership

- Subject land is owned by Manila Bay Development Corp. (MBDC).
- Coastal Mall (or Uniwide) leased land from MBDC and lease contract is going to be expired in 2015.
- Annex building of Coastal Mall is not used anymore.
- Second and Third Floor of Coastal Mall is closed and only a part of ground floor is open for business.

Manila Bay Blvd

- MBDC and PAGCOR have a plan to construct Manila Bay Blvd.

3.2.2 Alternatives

There are two alternatives.
Alternative-1: The expressway is to end at Macapagal Blvd.
Alternative-2: The expressway is to end at Roxas Blvd.

Alternative-1 has two sub-alternatives;

Alternative-1(A): Ramp A and B utilizes MBDC land which is currently vacant.

Alternative-1(B): Ramp A and B utilizes Annex Building Area of Coastal Mall.

Vertical Clearance control of Alternative-1 is shown in **Figure 3.2.2-1.**
Alternative-1(A) plan is shown in **Figure 3.2.2-2 (1), (2), and (3).**
Alternative-1(B) plan is shown in **Figure 3.2.2-3 (1), (2), and (3).**
Alternative-2 plan is shown in **Figure 3.2.2-4 (1) and (2).**

FIGURE 3.2.1-1 LRT LINE-1 CAVITE EXTENSION AND LAND OWNERSHIP

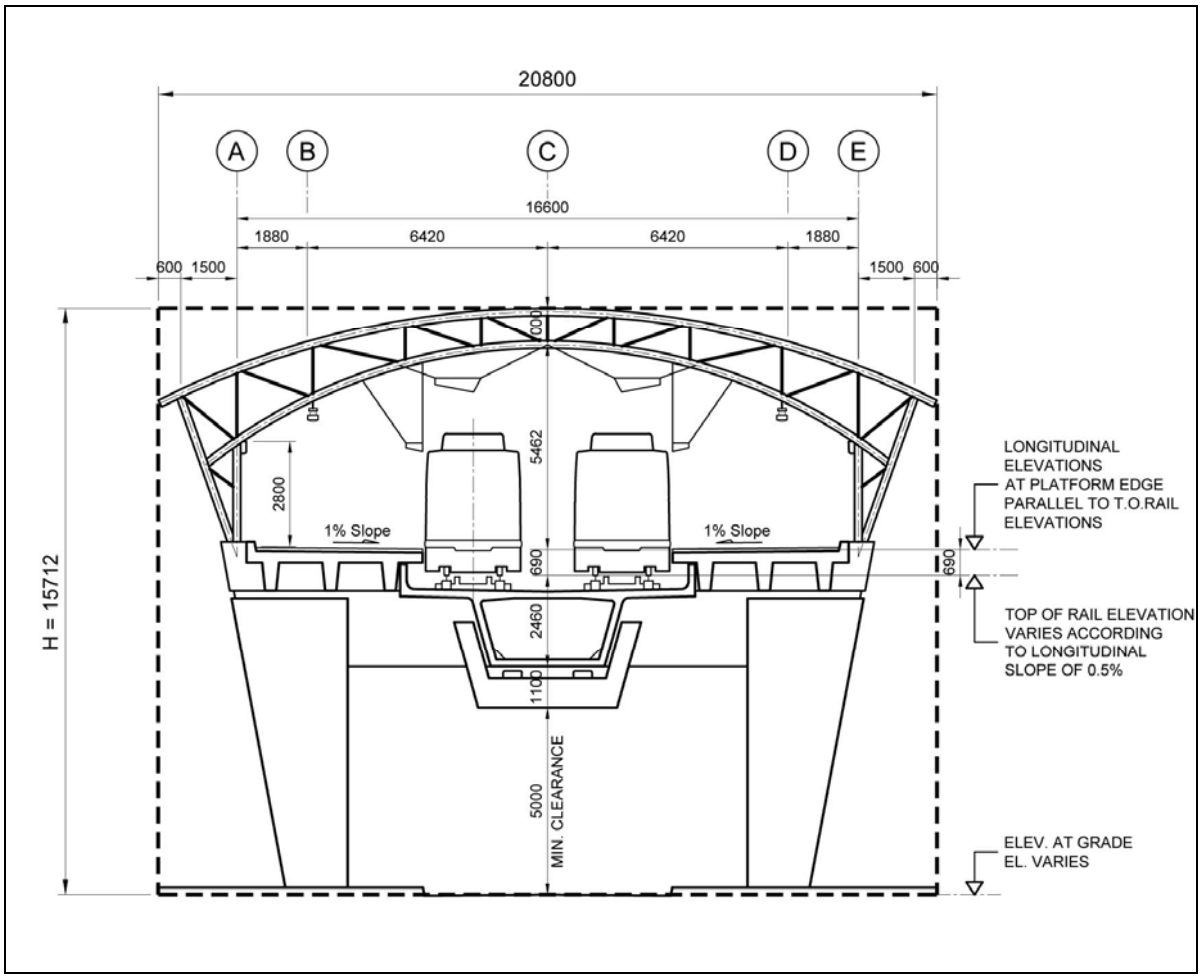


FIGURE 3.2.1-2(1) LRT LINE-1 CAVITE EXTENSION LINE MIA STATION OVER NAIA (MIA) ROAD EAST EXTENSION

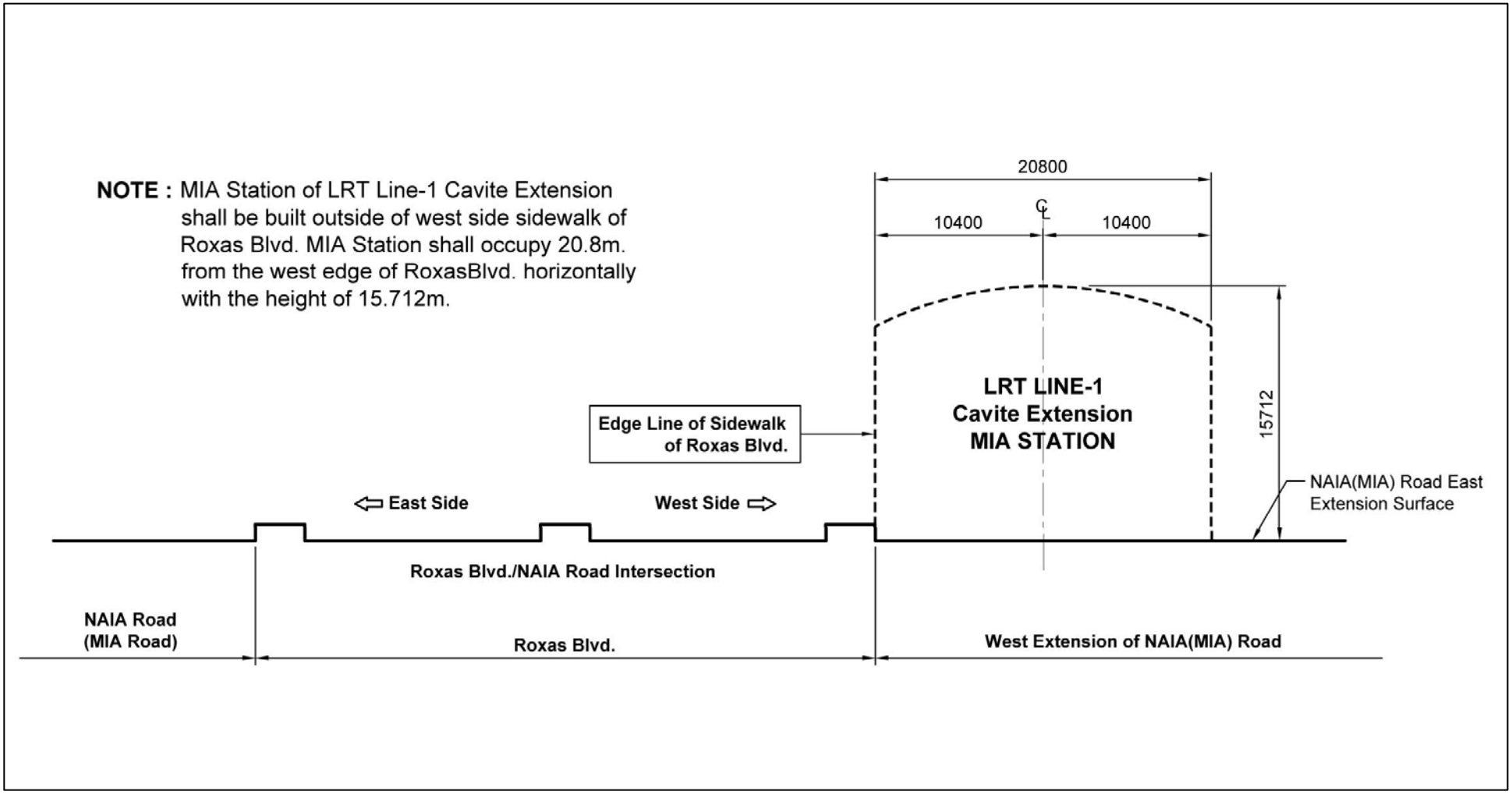


FIGURE 3.2.1-2 (2) HORIZONTAL LOCATION OF MIA STATION

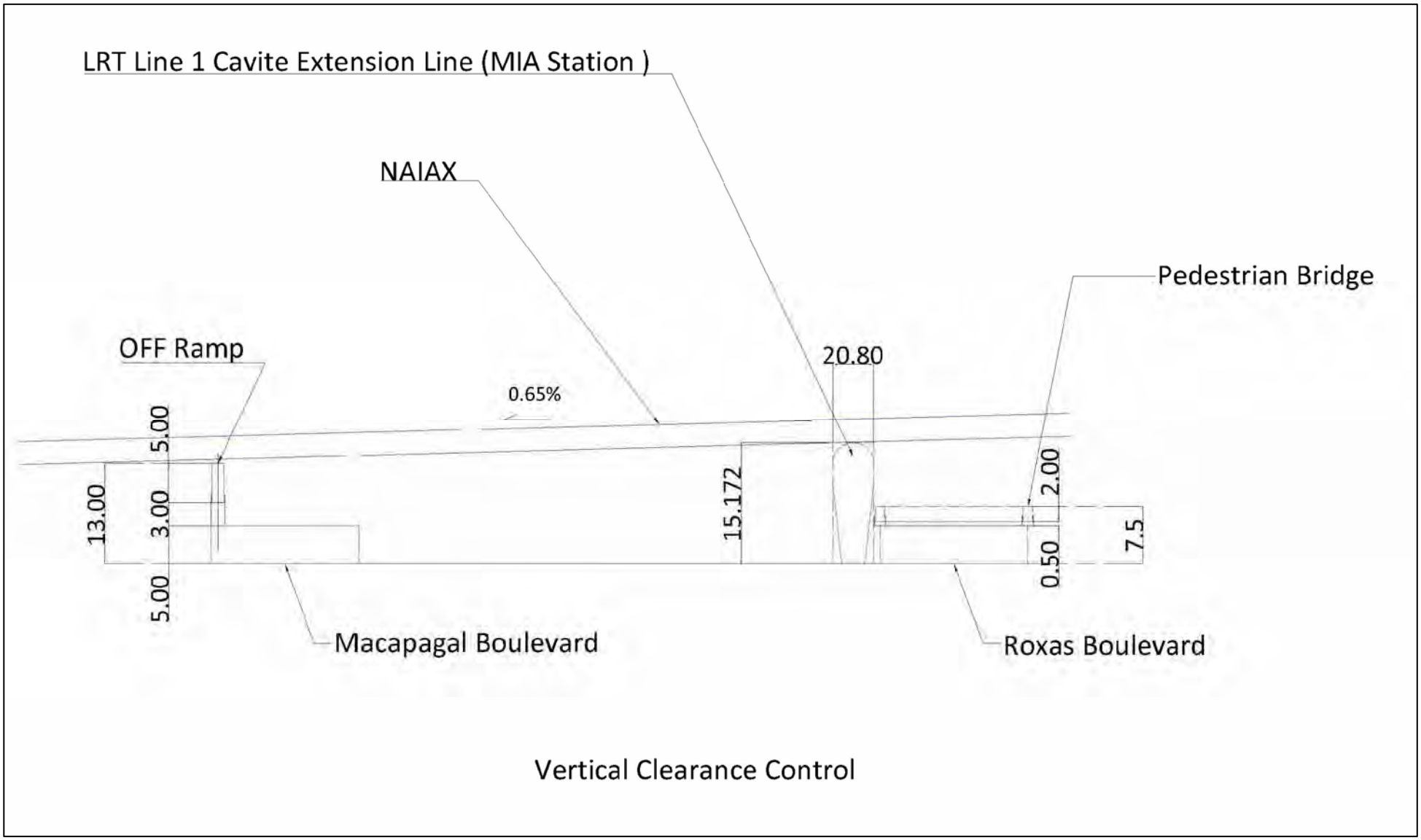


FIGURE 3.2.2-1 VERTICAL CLEARANCE OF CONTROL OF ALTERNATIVE-1

FIGURE 3.2.2-2(1) ALTERNATIVE-1 (A) INTERCHANGE PLAN END AT MACAPAGAL BLVD (PLAN)

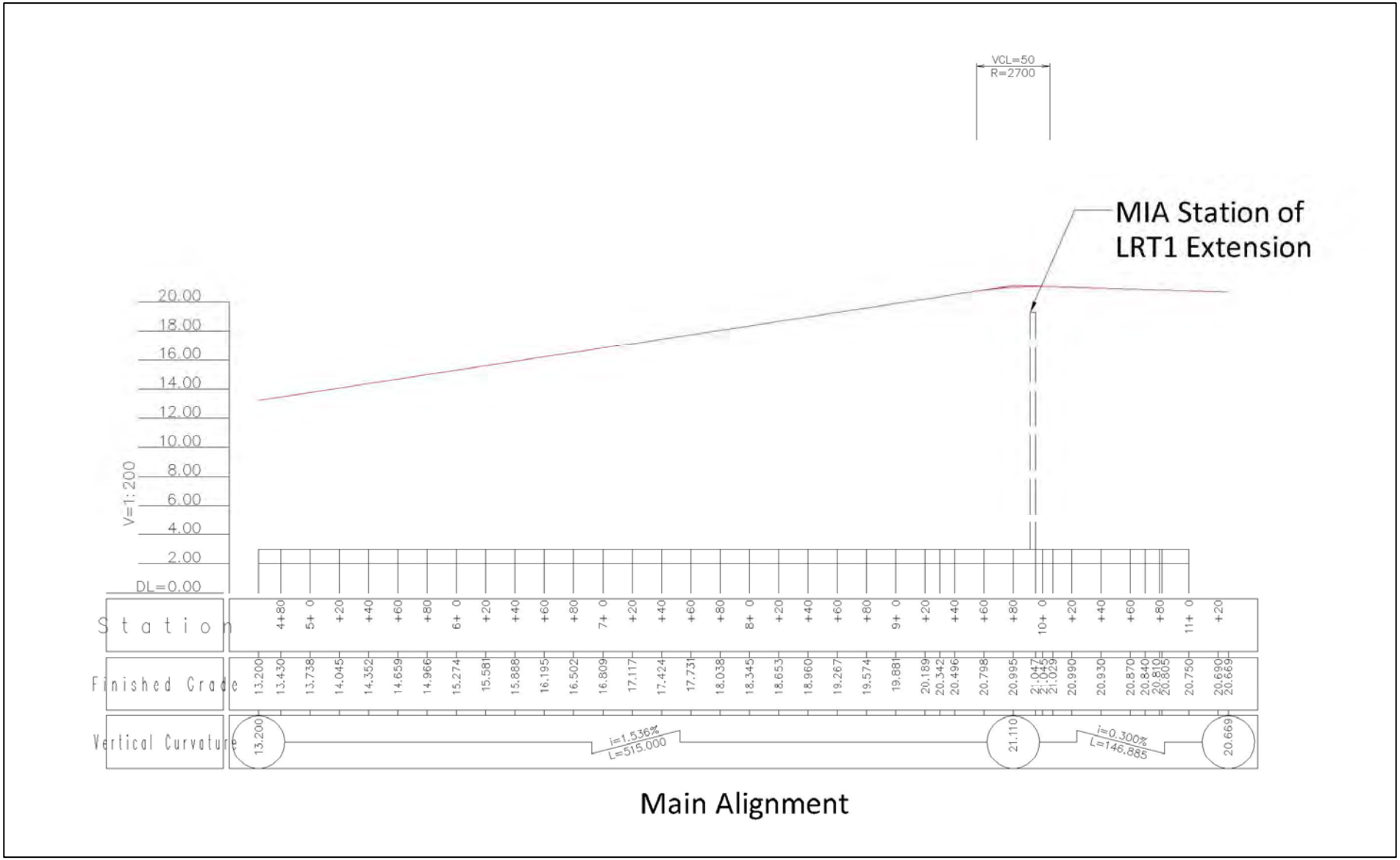


FIGURE 3.2.2-2(2) ALTERNATIVE-1 (A) INTERCHANGE PLAN END AT MACAPAGAL BLVD (PROFILE)

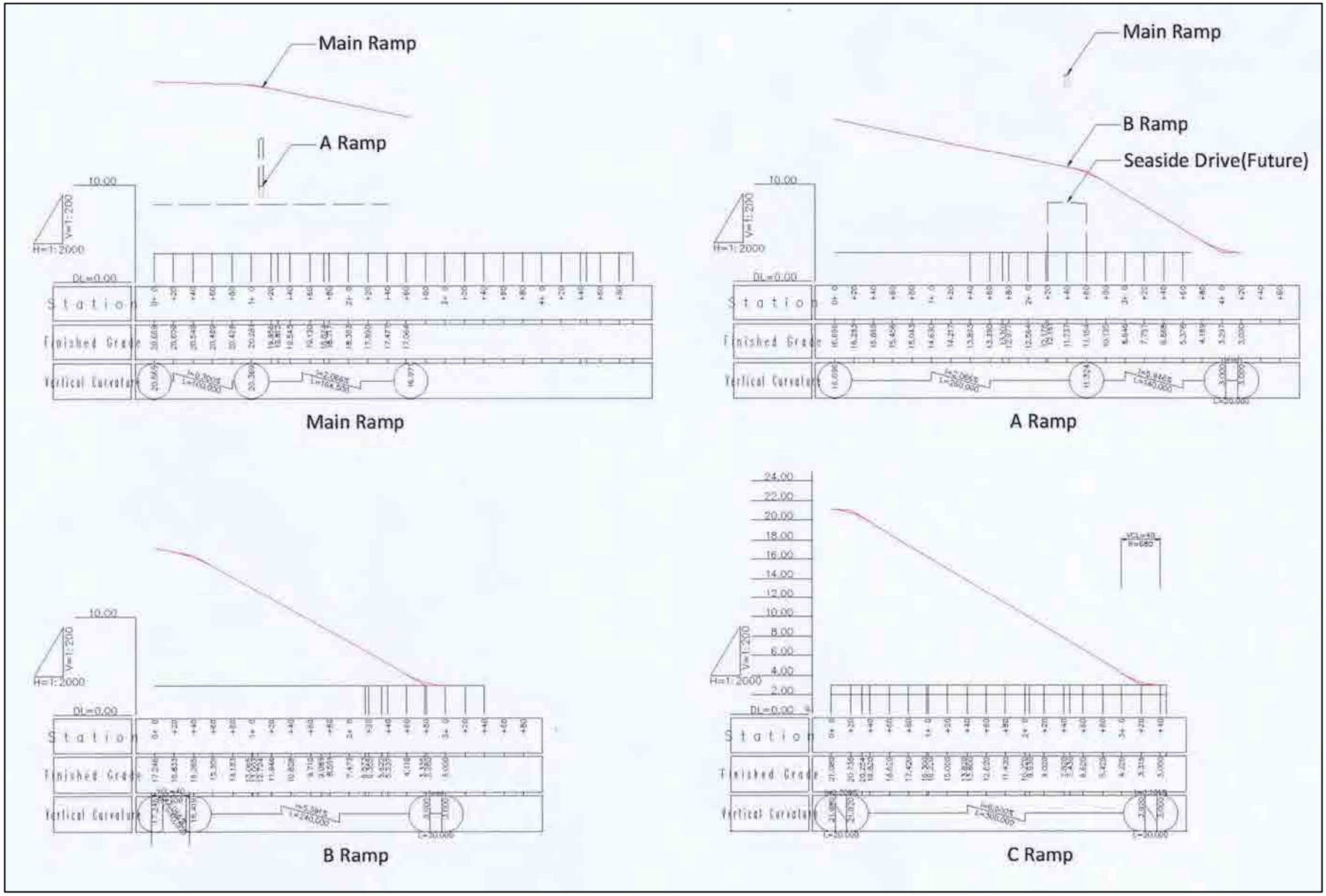


FIGURE 3.2.2-2(3) ALTERNATIVE-1 (A) INTERCHANGE PLAN END AT MACAPAGAL BLVD (PROFILE)

FIGURE 3.2.2-3(1) ALTERNATIVE-1 (B) INTERCHANGE PLAN END AT MACAPAGAL BLVD PLAN

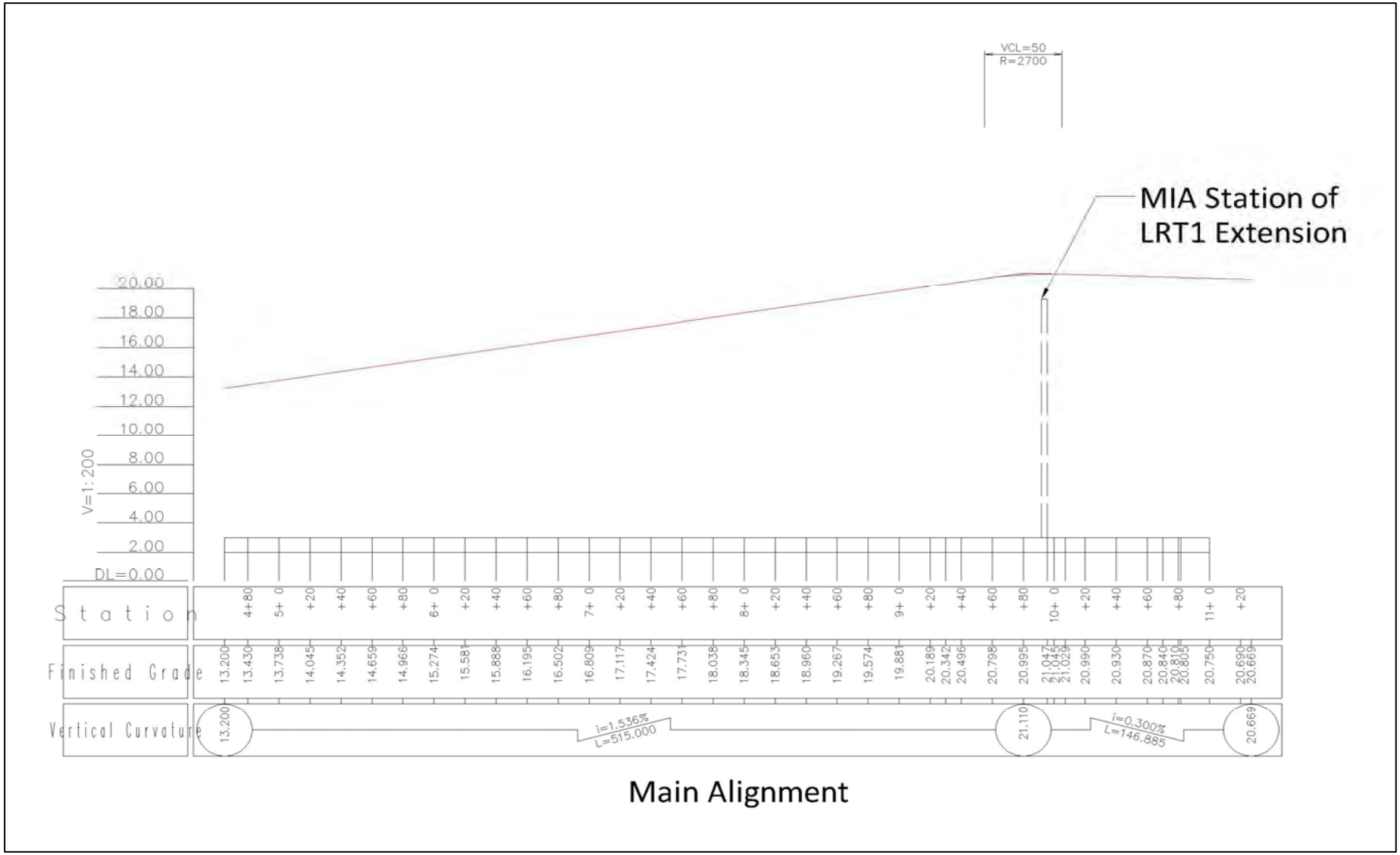


FIGURE 3.2.2-3(2) ALTERNATIVE-1 (B) INTERCHANGE PLAN END AT MACAPAGAL BLVD (PROFILE)

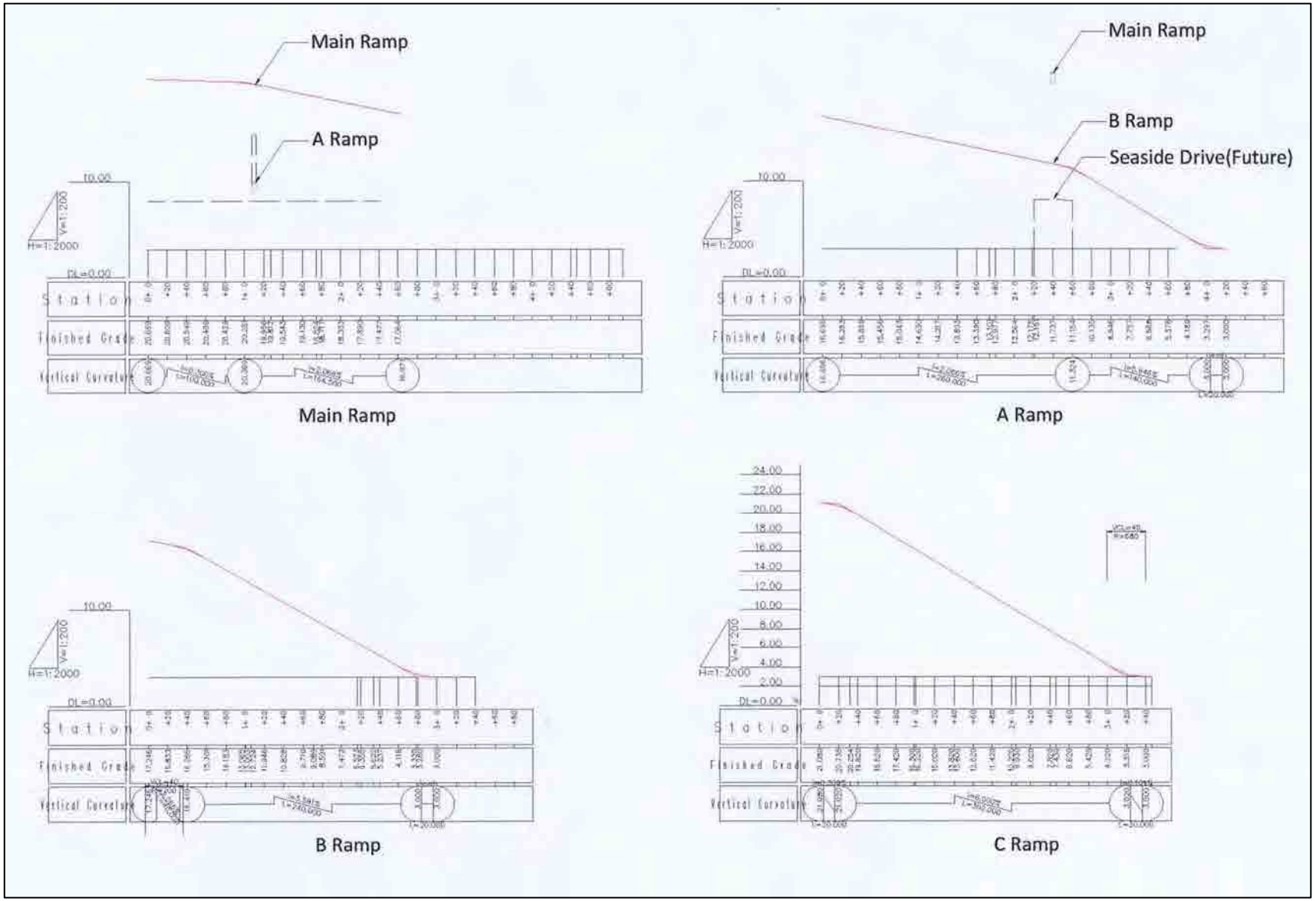


FIGURE 3.2.2-3(3) ALTERNATIVE-1(B) INTERCHANGE PLAN END AT MACAPAGAL BLVD (PROFILE)

FIGURE 3.2.2-4 (1) ALTERNATIVE-2 INTERCHANGE PLAN END AT ROXAS BLVD (PLAN)

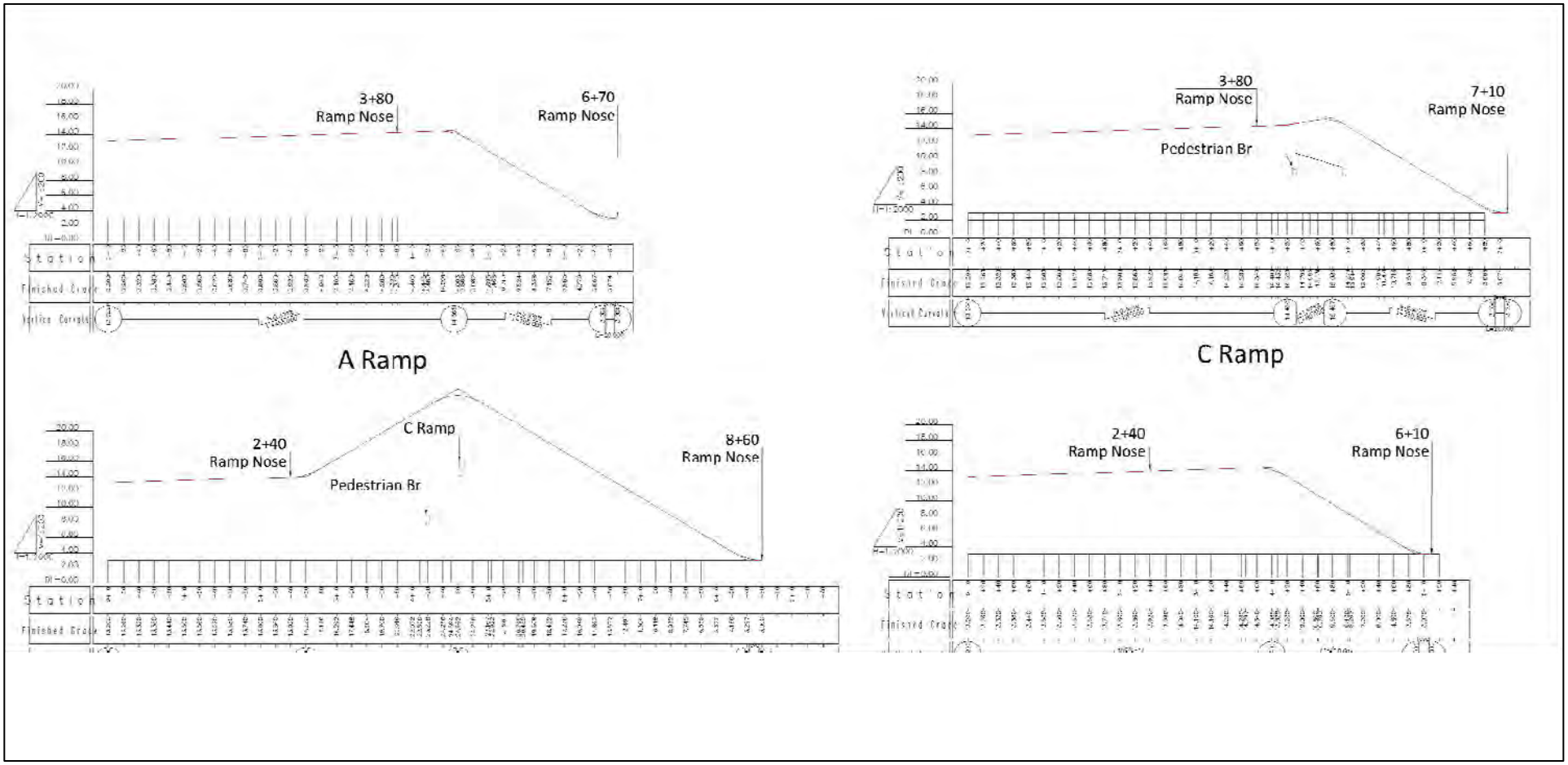


FIGURE 3.2.2-4 (2) ALTERNATIVE-2 INTERCHANGE PLAN END AT ROXAS BLVD (PROFILE)

TABLE 3.2.2-1 COMPARISON FOR OF END POINT OF NAIAX PHASE-2

Description	Alternative-1A Expressway Ends at Macapagal Blvd.	Alternative-1 B Expressway Ends at Macapagal Blvd.	Alternative-2 Expressway Ends at Roxas Blvd.
Section			
Traffic Functionality	• Traffic from Reclamation Area to Makati direction or vis-Macapagal Blvd. • Accessibility to the Reclamation Area is much better than • Traffic on Roxas Blvd. will be reduced.	• Same as Alternative-1A.	• All expressway-related traffic uses Roxas Blvd., and Roxas Blvd. • Measures to divert to Macapagal Blvd. will be needed, Coastal Expressway to Macapagal Blvd.
Traffic Control Center & Maintenace Equipment Depot	• Space between A ramp and Macapagal Blvd. can be used Maintenance Equipment Depot, etc.	• Same as Alternative-1A.	• Such space needs to ba found in other area along the
Construction Cost up to Parañaque River	**Php 2, 112.3 Million** (2.11 times, or + Php 1,113.2 M) 3rd Level Structure =1.610 lane-km 2nd-3rd Level Structure =2.169 lane-km Ground to 2nd Level Structure =1.026 lane-km 4.805 lane-km	**Php 2,123.8 Million** (2.13 times, or + Php 1,124.7M) 3rd Level Structure = 1.620 lane-km 2nd-3rd Level Structure = 2.230 lane-km Ground to 2nd Level Structure = 1.008 lane-km 4.858 lane-km	**Php 999.1 Million** (1.00) 3rd Level Structure = 0.170 lane-km 2nd-3rd Level Structure =1.710 lane-km Ground to 2nd Level Structure =1.090 lane-km 2.970 lane-km
ROW Acquisition Cost	26,179 sq. m. x Php 35,000/sq.m = **Php 916 Million** *Note: ROW acquisition negotiation may take long time.*	25,140 sq. m. and demolition of 19,128 sq. m. 25,140 sq. m. x Php 35,000/sq.m. + 19,128 x Php 5,900/sq.m. = **Php 993 Million** *Note: ROW acquisition negotiation may take long time.*	872 sq. m. x Php 35,000/sq.m. = **Php 30.5 Million**
Recommendation	Δ Traffic functionality is better than Alternative-2, however, construction cost is quite high, thus financial viability will be affected an higher Government Financial Support will be required.	Δ Same as Alternative-1A.	O Although traffic functionality will be sacrified to some extent, financial viability will be much improved than the other alternatives. This alternative was recommended.

3.3 ALTERNATIVES AT PARK 'N FLY BUILDING AREA

3.3.1 Park 'n Fly Building

- The land is owned by MIAA.
- The land is leased to Park 'n Fly, of which the lease contract will be expired in the near future.
- Park 'n Fly is requesting extension of the lease contract for another 50 years.
- Approximate building size is 84 m x 20 m and 26 m x 17 m. The building is a RC structure with 3 to 4 stories (floor area is about 8,000 sq. m.)
- Area at the backside of Park 'n Fly is still vacant and the land is owned by MIA.

3.3.2 Expressway Alignment Alternatives

Alternative-1: Expressway Alignment affects Park 'n Fly Building (see **Figure 3.3.2-1**)
Alternative-2: Expressway Alignment does not affect Park 'n Fly Building (see **Figure 3.3.2-2**)

TABLE 3.3.2-1 COMPARISON OF TWO ALTERNATIVES

	Alternative-1	**Alternative-2**
Park 'n Fly Building	Affected	Not Affected
Ramp B Length	708 m	886 m (+14.9 Million Php)
Ramp C Length	372 m	467 m (+ 8.0 Million Php)
ROW Acquisition and Compensation of Building	• Land Acquisition from MIAA • Negotiation with Park 'n Fly Building owner needed. (a) Replacement cost (b) Business compensation cost (c) Demolition cost	• Land acquisition from MIAA • Negotiation only with MIAA is needed. • Relocation of informal settlers (about 50 households) is required.
Recommendation	• It is expected that negotiation with Park 'n Fly Building owner will take a long time and ROW delivery will be delayed. • Park 'n Fly Building is quite useful for Terminal-s and 2 passengers. • Alternative-2 was recommended, provided that resettlement sites for informal settlers be provided. (MIAA has designated resettlement site.)	

FIGURE 3.3.2-1 ALTERNATIVE-1 MAIN ALIGNMENT TO AFFECT THE PARK 'N FLY BUILDING

FIGURE 3.3.2-2 ALTERNATIVE-2 MAIN ALIGNMENT TO AVOID THE PARK N' FLY BUILDING

3.4 ALTERNATIVES AT INTERFACE BETWEEN PHASE-1 AND PHASE-2

3.4.1 NAIA Expressway Phase I

NAIA Expressway Phase I was completed in 2010 as shown in **Figure 3.4.1-1.** The Phase II must be extended from this condition. Available space is 19.0 m at Section A and 18.78 m at Section B. Profile of existing ramps is shown in **Figure 3.4.1-2**.

3.4.2 Phase I and Phase II Connection Alternatives

Phase I and Phase II connection alternatives are schematically shown in **Figure 3.4.2-1**.

Alternative-1: Recommended plan by FS in 2010

Alternative-2(A): Improved Plan of Alternative-1 (see **Figure 3.4.2-2**)

Alternative-2(B): Modification of Alternative-2(B) (see **Figure 3.4.2-3** and **Figure 3.4.2-4 (A)** and **(B)**)

Alternative-3: To utilize Existing On-ramp (see **Figure 3.4.2-5** and **Figure 3.4.2-6**)

The comparison table for Alternatives 1 to 3, is shown in **Table 3.4.2-1.**

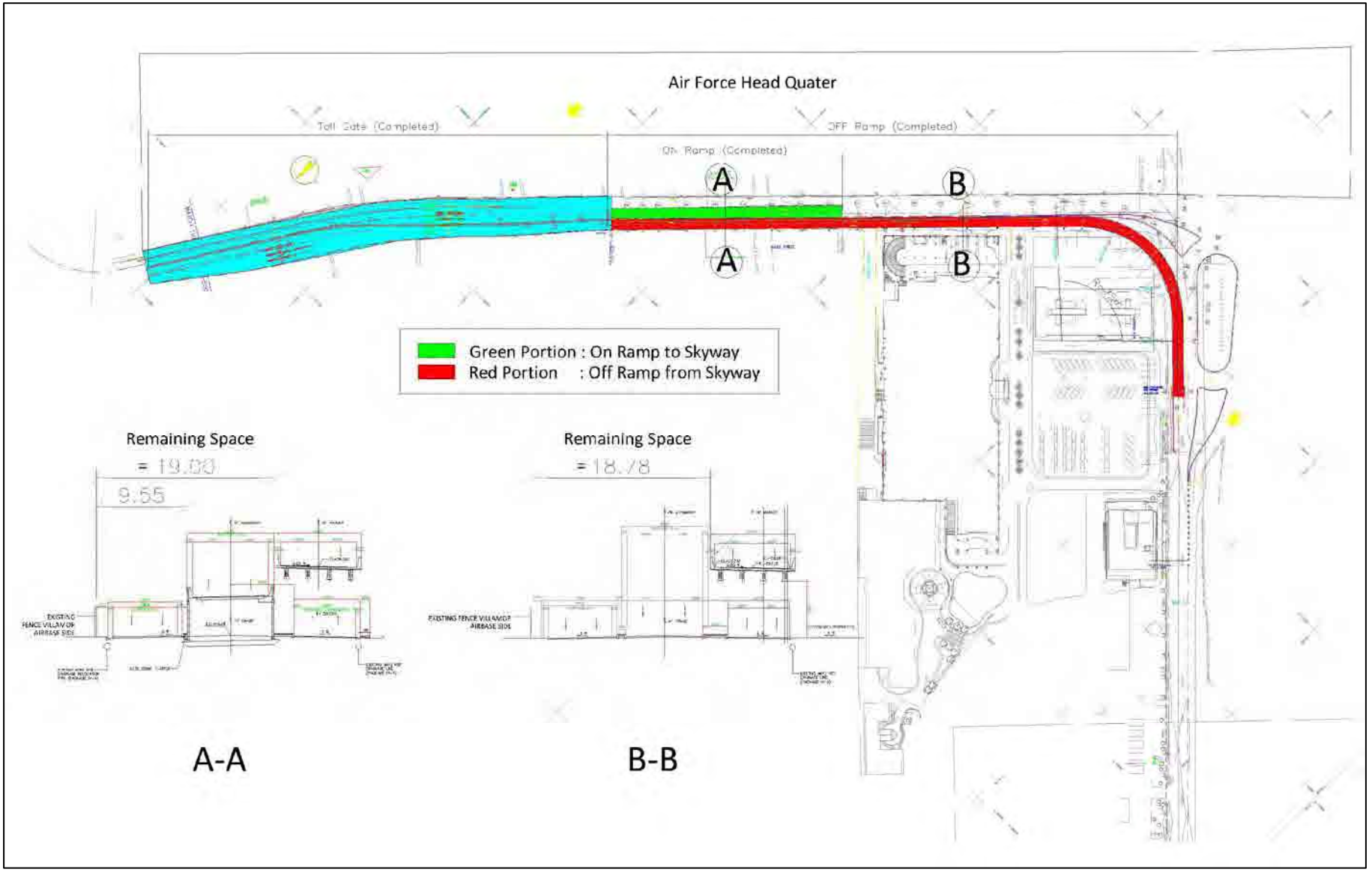


FIGURE 3.4.1-1 CURRENT CONDITION AT PHASE I AND PHASE II CONNECTION

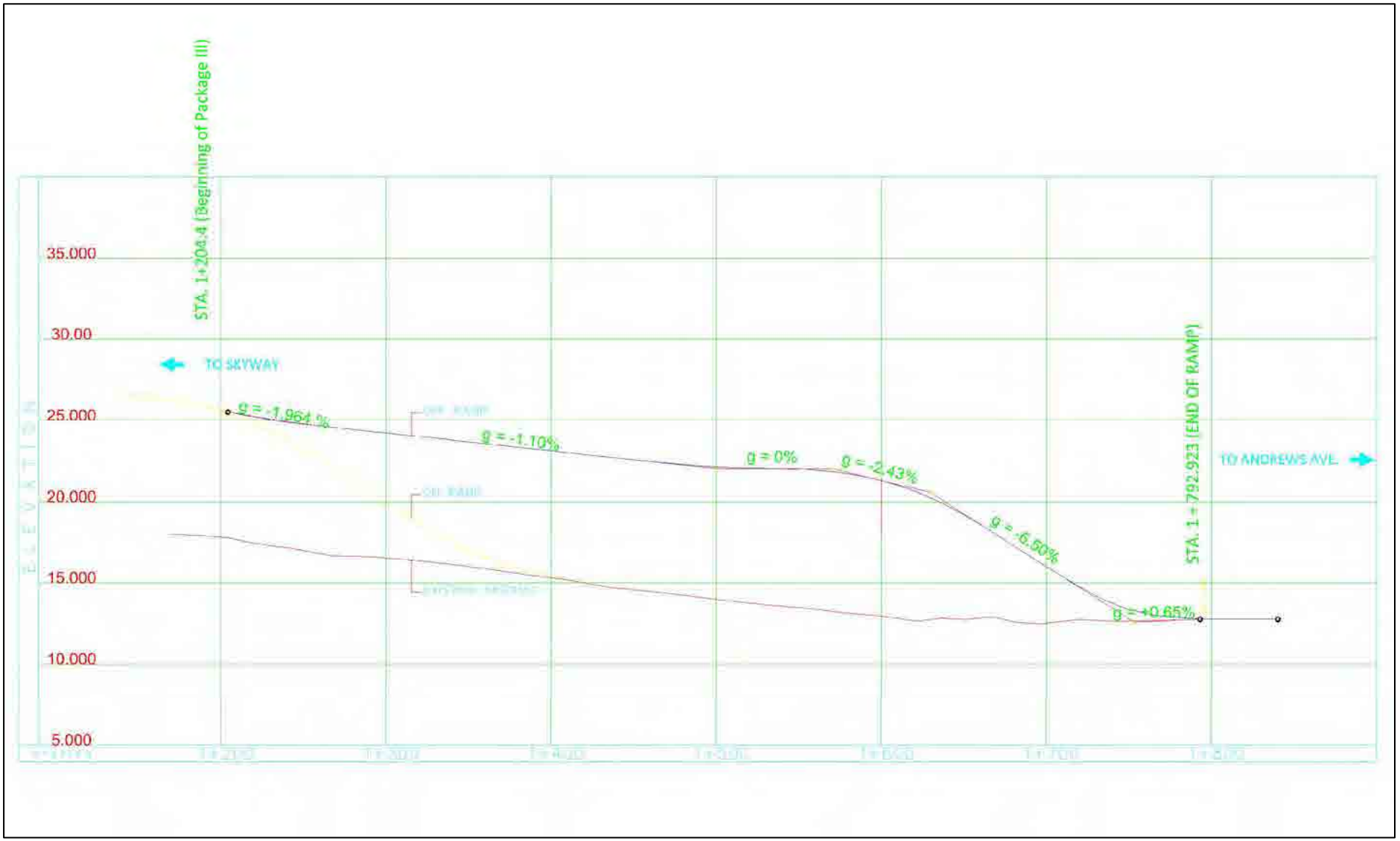


FIGURE 3.4.1-2 PROFILE OF EXISTING MAP

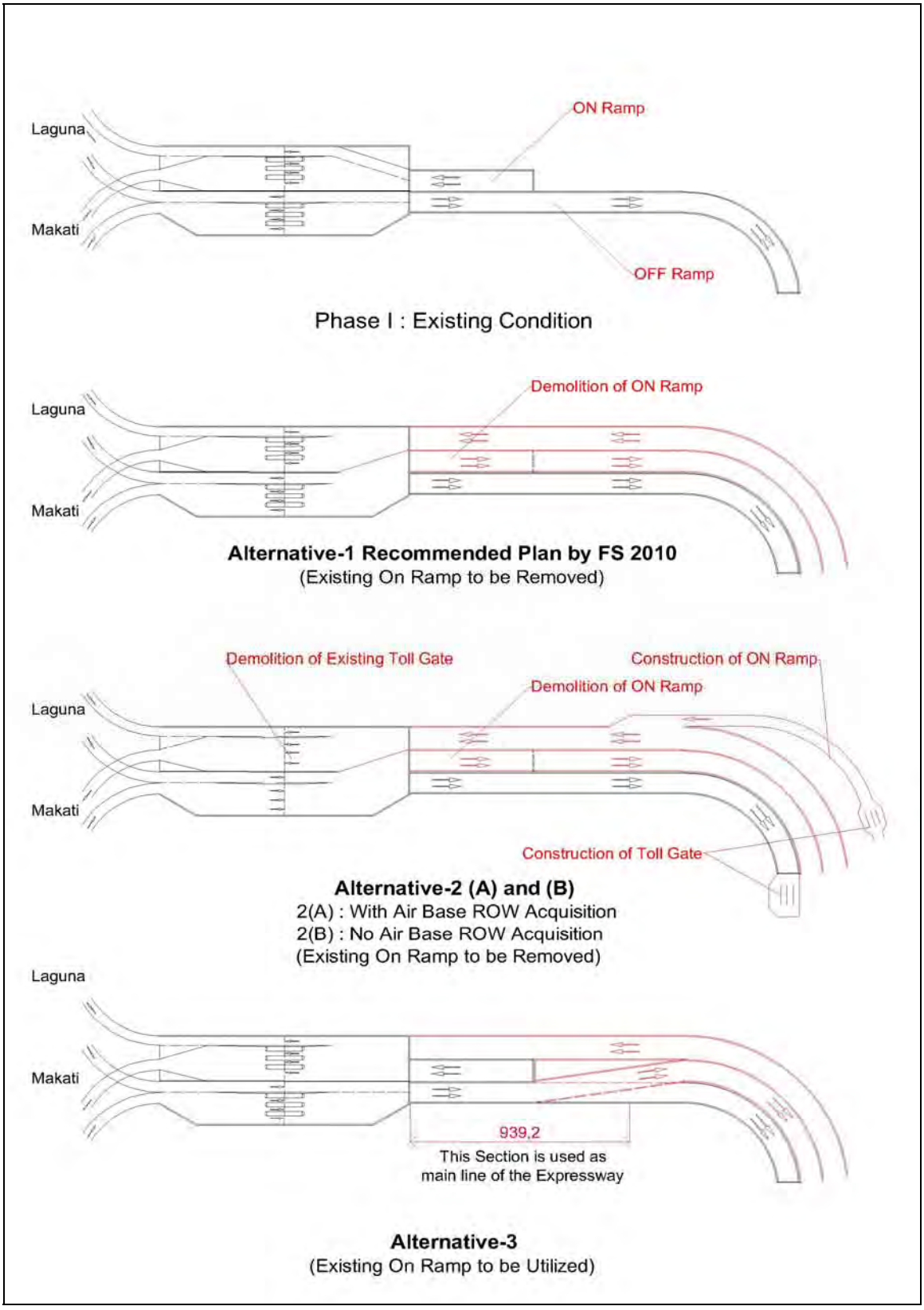


FIGURE 3.4.2-1 PHASE I AND PHASE II CONNECTION ALTERNATIVES

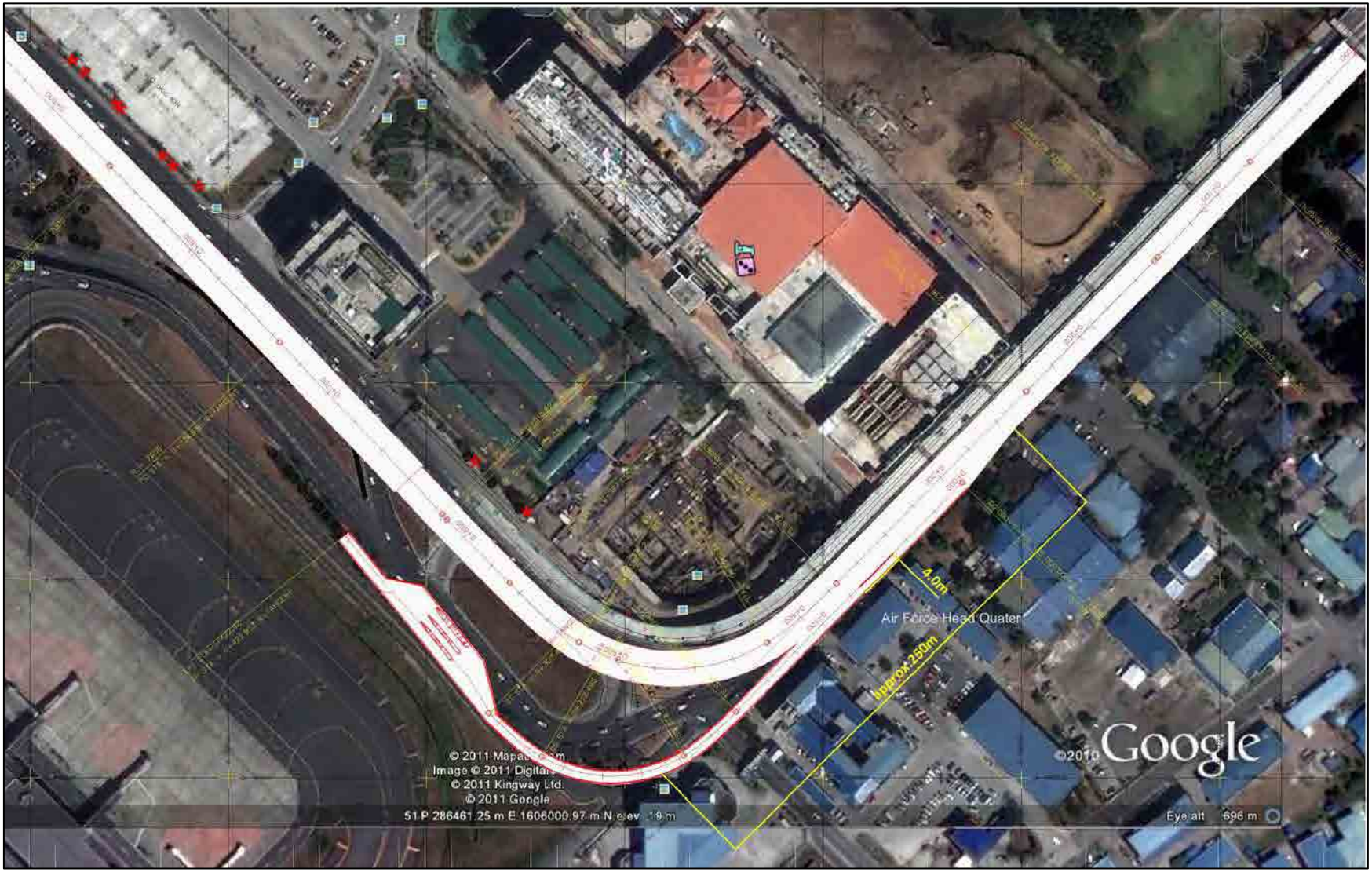


FIGURE 3.4.2-2 ALTERNATIVE-2(A) ON-RAMP FROM TERMINAL 3

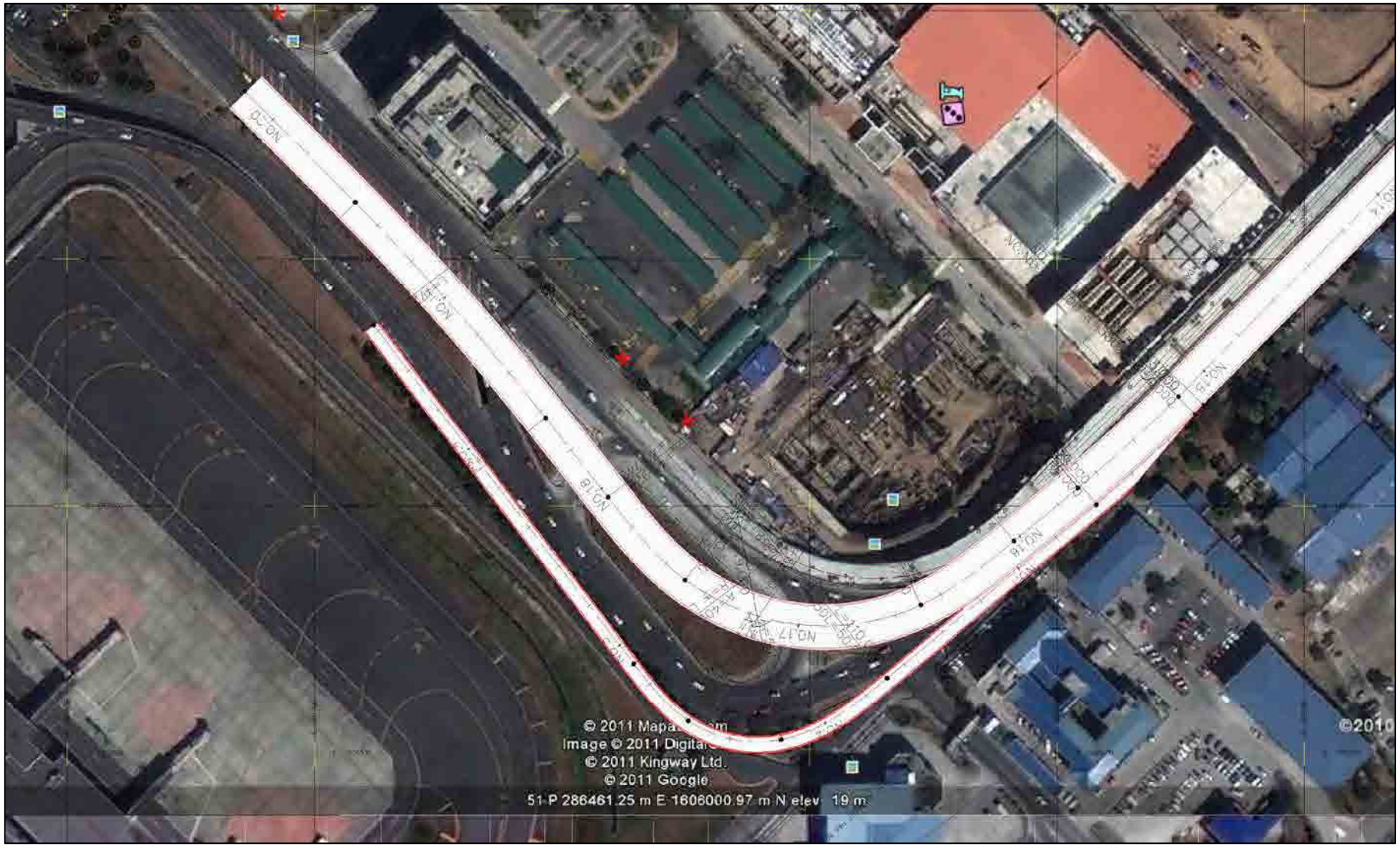


FIGURE 3.4.2-3 ALTERNATIVE-2 (B) AVOID AIRFORCE HEADQUARTER

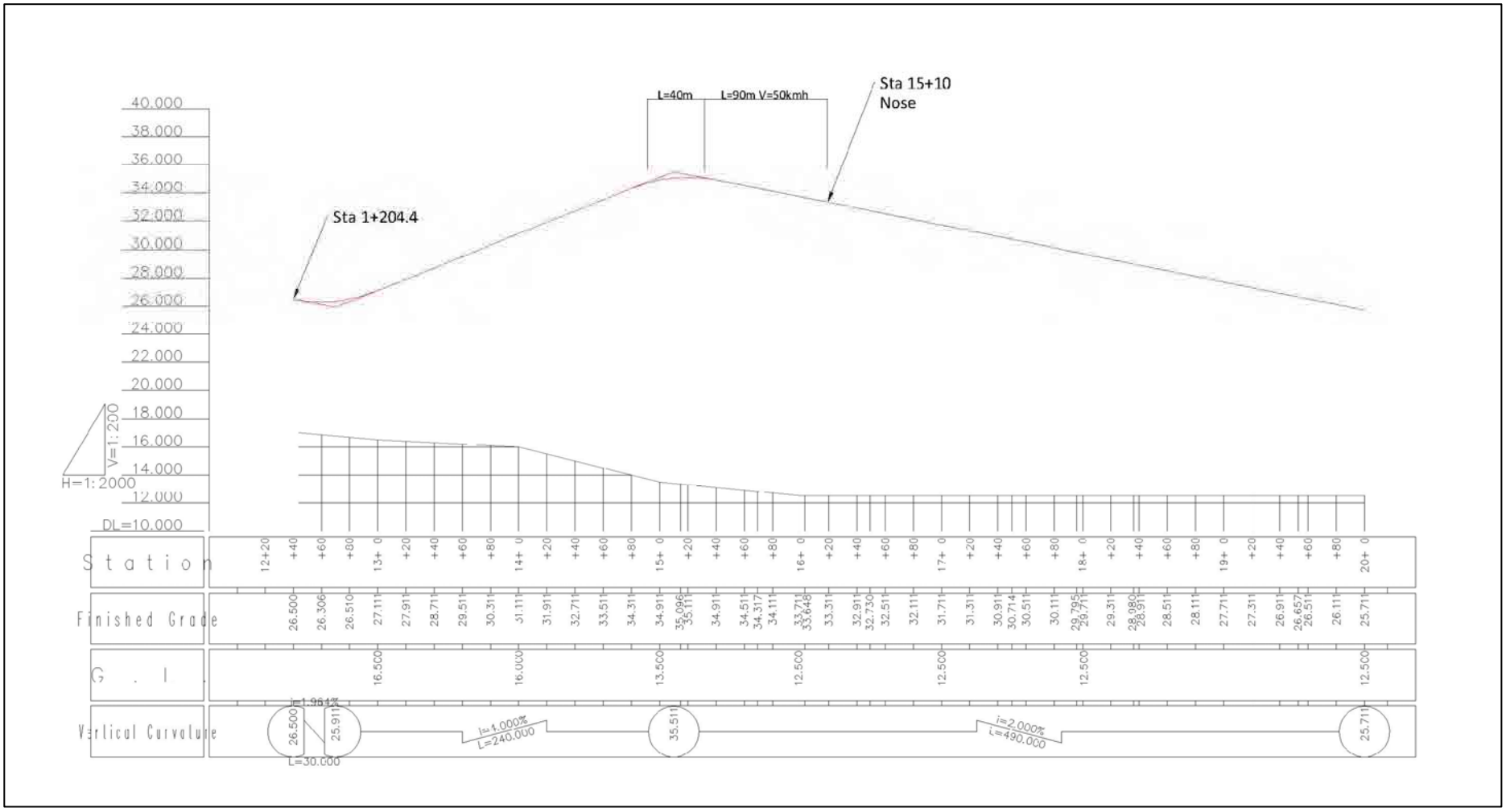


FIGURE 3.4.2-4 (1) ALTERNATIVE-2 (B) AVOID AIRFORCE HEADQUARTER (PROFILE MAIN ALIGNMENT)

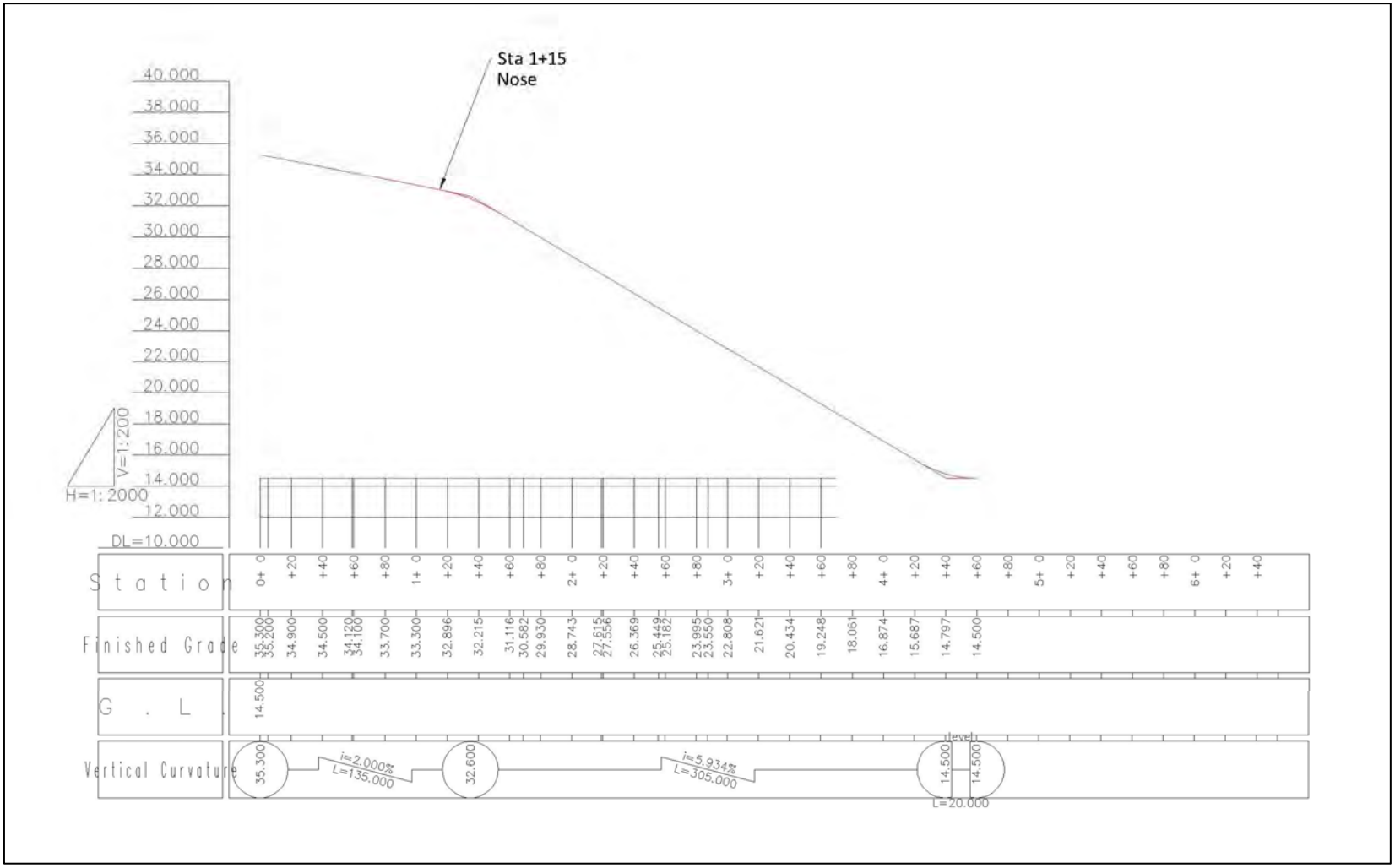


FIGURE 3.4.2-4 (2) ALTERNATIVE-2 (B) AVOID AIRFORCE HEADQUARTER (PROFILE RAMP)

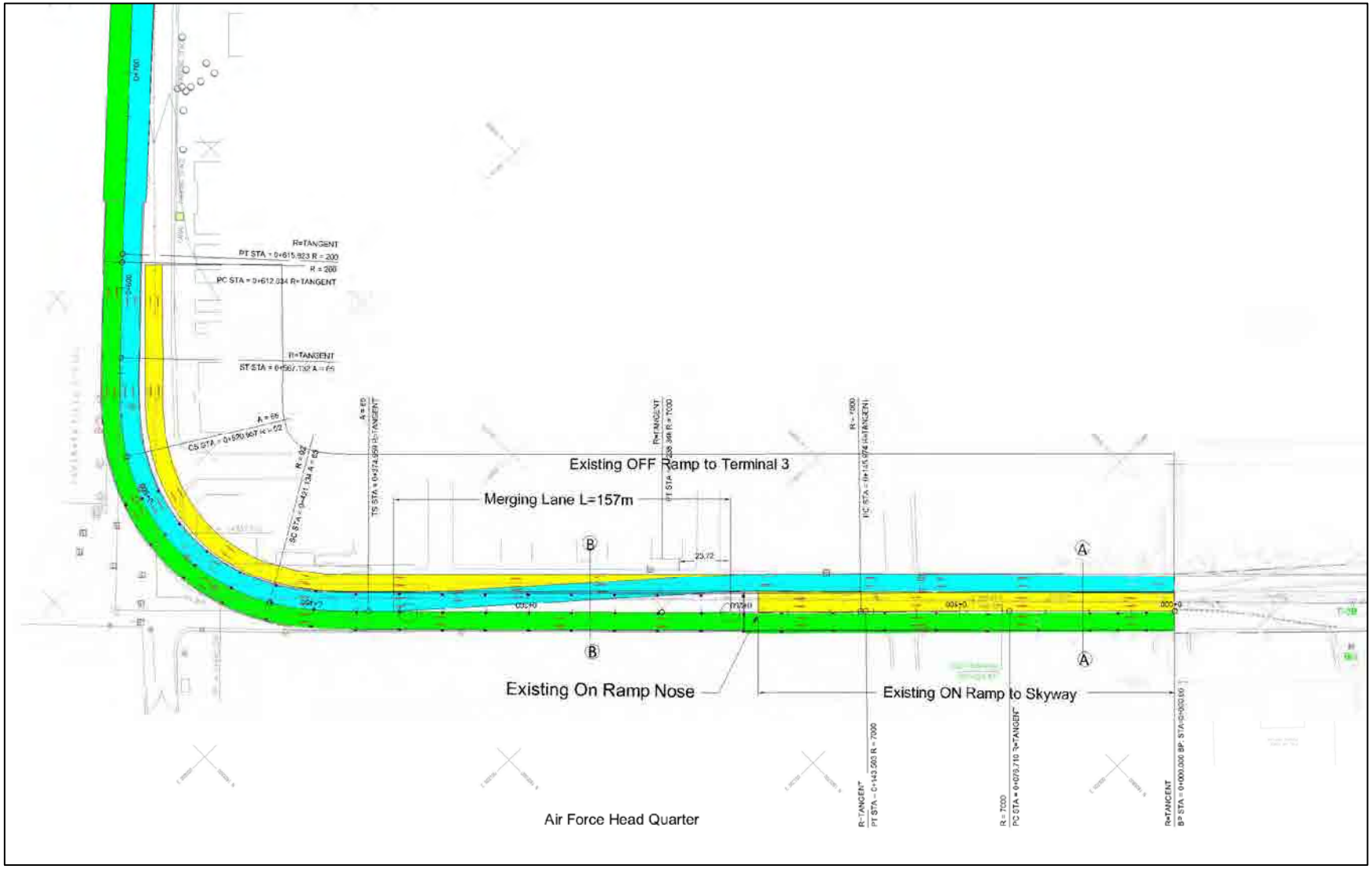


FIGURE 3.4.2-5 ALTERNATIVE-3 USE OF EXISTING ON-RAMP

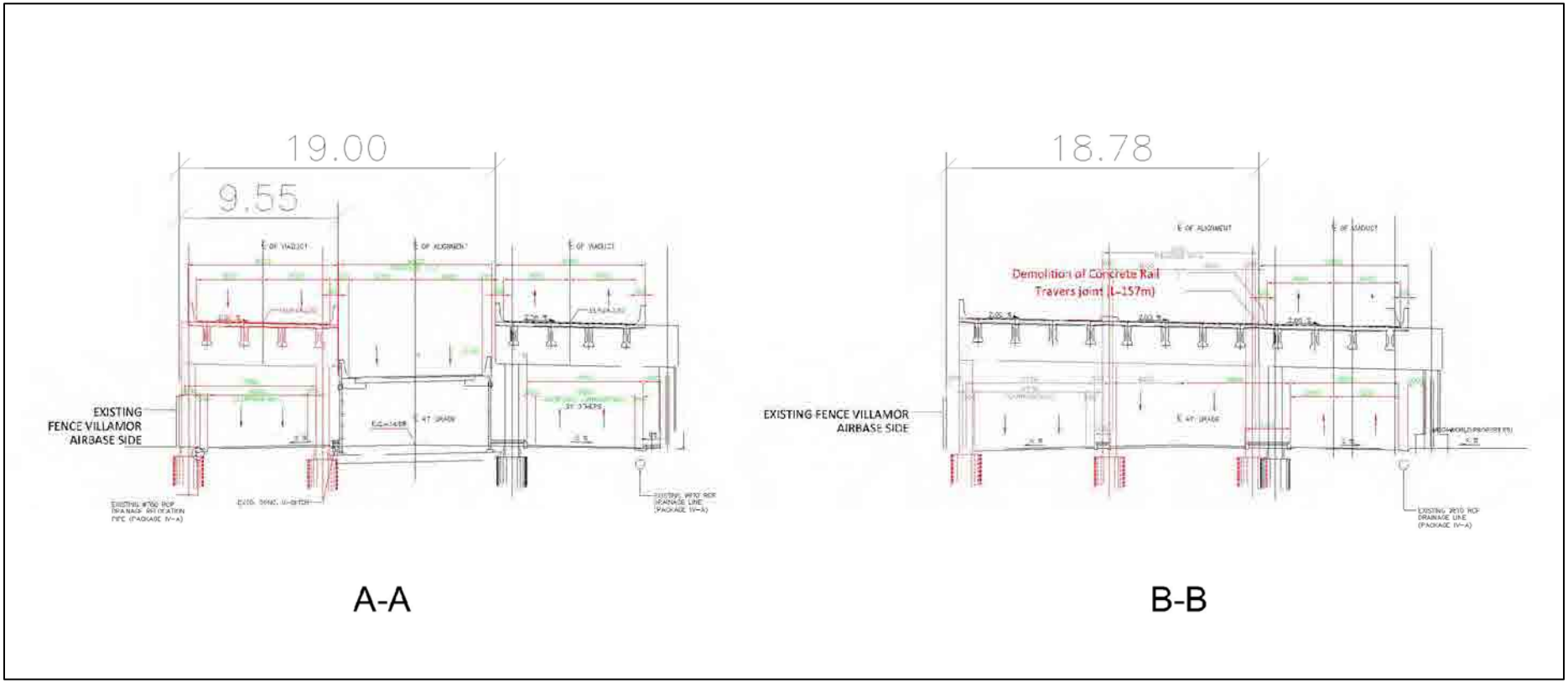


FIGURE 3.4.2-6 ALTERNATIVE-3 USE OF EXISTING ON-RAMP (TYPICAL CROSS SECTION)

3.4.3 Evaluation of Alternatives

Evaluation of alternatives is shown in **Table 3.4.3-1.** Alternative-2(A) was recommended.

TABLE 3.4.3-1 COMPARISON OF ALTERNATIVES 1 TO 3

	Alternative-1 Recommended plan by FS in 2010	Alternative-2(A) Improved Plan of Alternative-1	Alternative-2(B) Modification of Alternative-2(B)	Alternative-3 To utilize Existing On-ramp
Feature	• Existing on-ramp to be removed. • Available space is used for the expressway (2-lane x 2 direction = 4-lane)	• Existing on-ramp to be removed. • Available space is used for the expressway (2-lane x 2 direction = 4-lane) • Removed on-ramp is constructed at the NAIA Terminal III exit.	• In order to avoid acquisition of Villamor Air Base Headquarter, the expressway alignment partly utilizes the space over the existing off-ramp. Thus, the expressway has to go up and shifted toward the existing off-ramp, then go down again.	• A part of the existing off-ramp (2-lane, 6 m) is used as the main carriageway of the expressway. • Number of existing toll booths will not be enough to accommodate the expressway traffic. • Distance from toll booths to on-ramp is too short to maneuver main traffic and on-ramp traffic
On-ramp location and Accessibility	**Poor** • Removed on-ramp is constructed along Andrews Ave. Exit traffic from Terminal III needs to go around the at-grade road and make a U-turn at the round-about with the monument to enter the expressway.	**Good** • Traffic from NAIA Terminal III can enter directly to the on-ramp.	**Fair** • Traffic from NAIA Terminal III can enter directly to the on-ramp. • Removed on-ramp is constructed at the NAIA Terminal III. Since the expressway is located at high elevation, this ramp needs to be long which makes it difficult to get traffic from NAIA Terminal III.	**Good** • Traffic from NAIA Terminal III can enter directly to the on-ramp.
Main Route Alignment	**Good** • Vertical alignment is the same as the Phase-1 section.	**Good** • Vertical alignment is the same as the Phase-1 section.	**Poor** • The expressway has to go up and shifted toward the existing off-ramp, then go down again.	**Fair** • Horizontal alignment for main traffic is not so well.
Land Acquisition	**Good** • No land acquisition	**Fair** • Villamor Air Base Headquarter land is affected (width = 4 m, Length = 250 m). No building affected.	**Good** • No land acquisition	**Good** • No land acquisition
Environment	**Poor** Exit traffic from Terminal III needs to go around the at-grade road and make a U-turn at the round-about with the monument to enter the expressway. Traffic must take long trip compared with other alternatives.	**Good** • Traffic from NAIA Terminal III can directly enter the on-ramp	**Good** • Traffic from NAIA Terminal III can directly enter the on-ramp	**Good** • Traffic from NAIA Terminal III can go directly enter the on-ramp
Cost	• Cheapest	• Almost Same as Alternative-1	**Expensive** • Complicated substructure is required resulting in high cost.	**Expensive** • Though off-ramp will not be removed, the complicated structure will be required, resulting in high cost.
Recommendation	Not recommended.	**Recommended**	Not recommended	Not recommended

3.5 ALIGNMENT AT MMDA MONUMENT

3.5.1 Monument at Circulo del Mundo

A monument was built by MMDA at Circulo del Mundo along Andrews Ave. (see **Figure 3.5.1-1**).

3.5.2 Alternative Alignment at Monument Section

Two (2) alternative alignments are shown:
Alternative-1 is shown in **Figure 3.5.2-2** which is the plan of two-direction combined expressway. DPWH is communicating with MMDA on this alternative.

Alternative-2 is shown in **Figure 3.5.2-3**, which is the plan of expressway splited by direction. This alternative is recommended by MMDA.

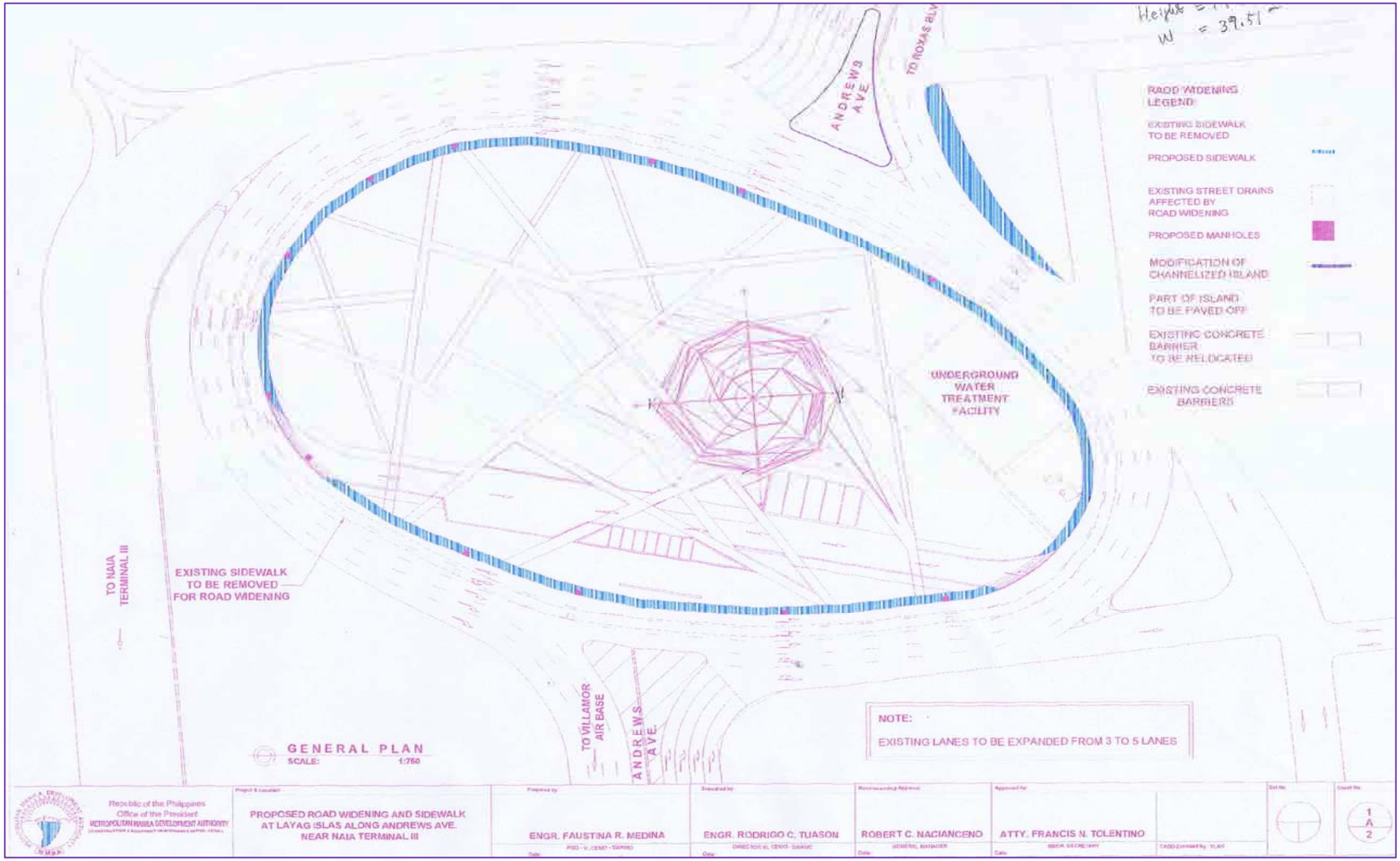


FIGURE 3.5.1-1 MONUMENT AT CIRCULO DEL MUNDO

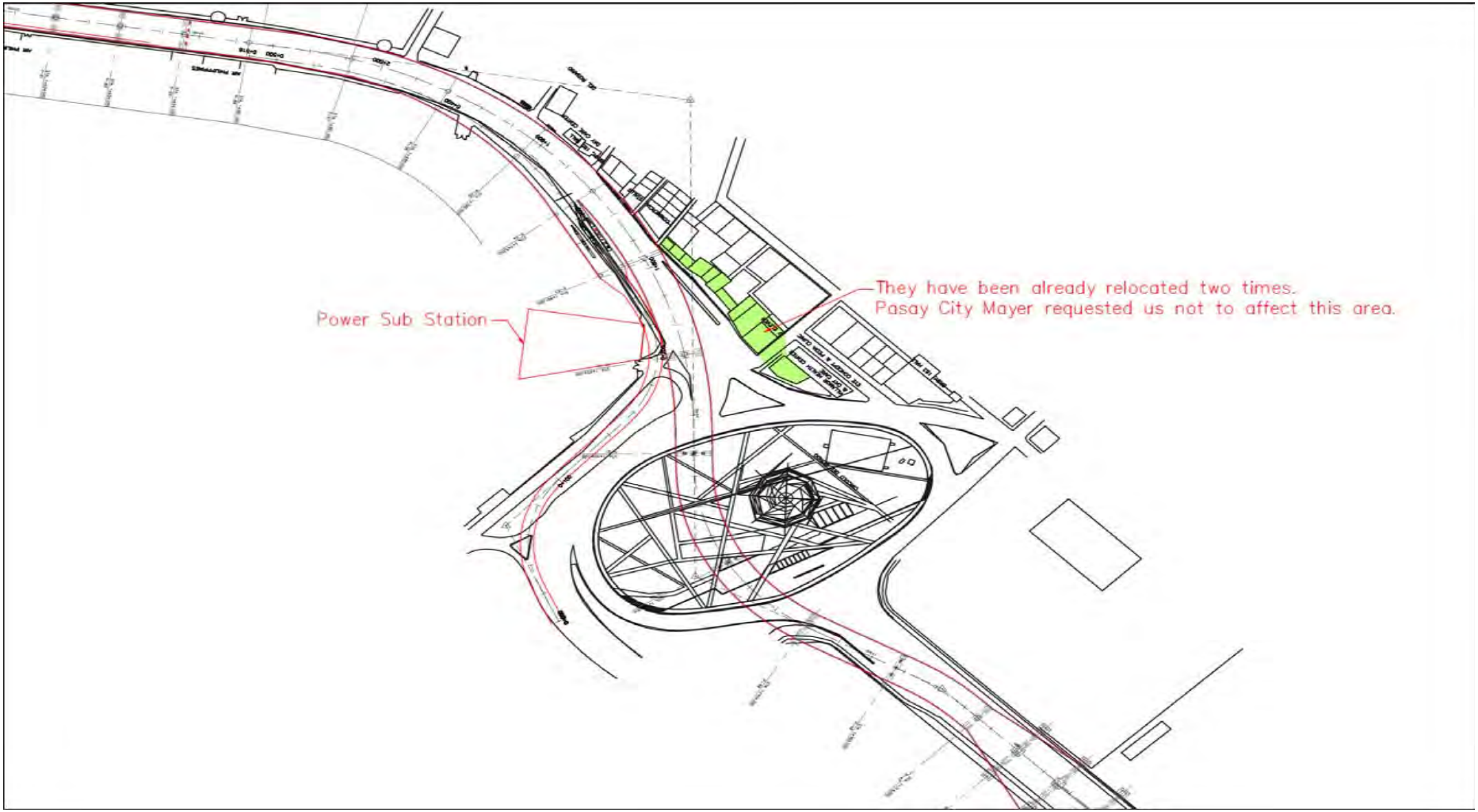


FIGURE 3.5.2-2 ALTERNATIVE-1: TWO-DIRECTION COMBINED EXPRESSWAY

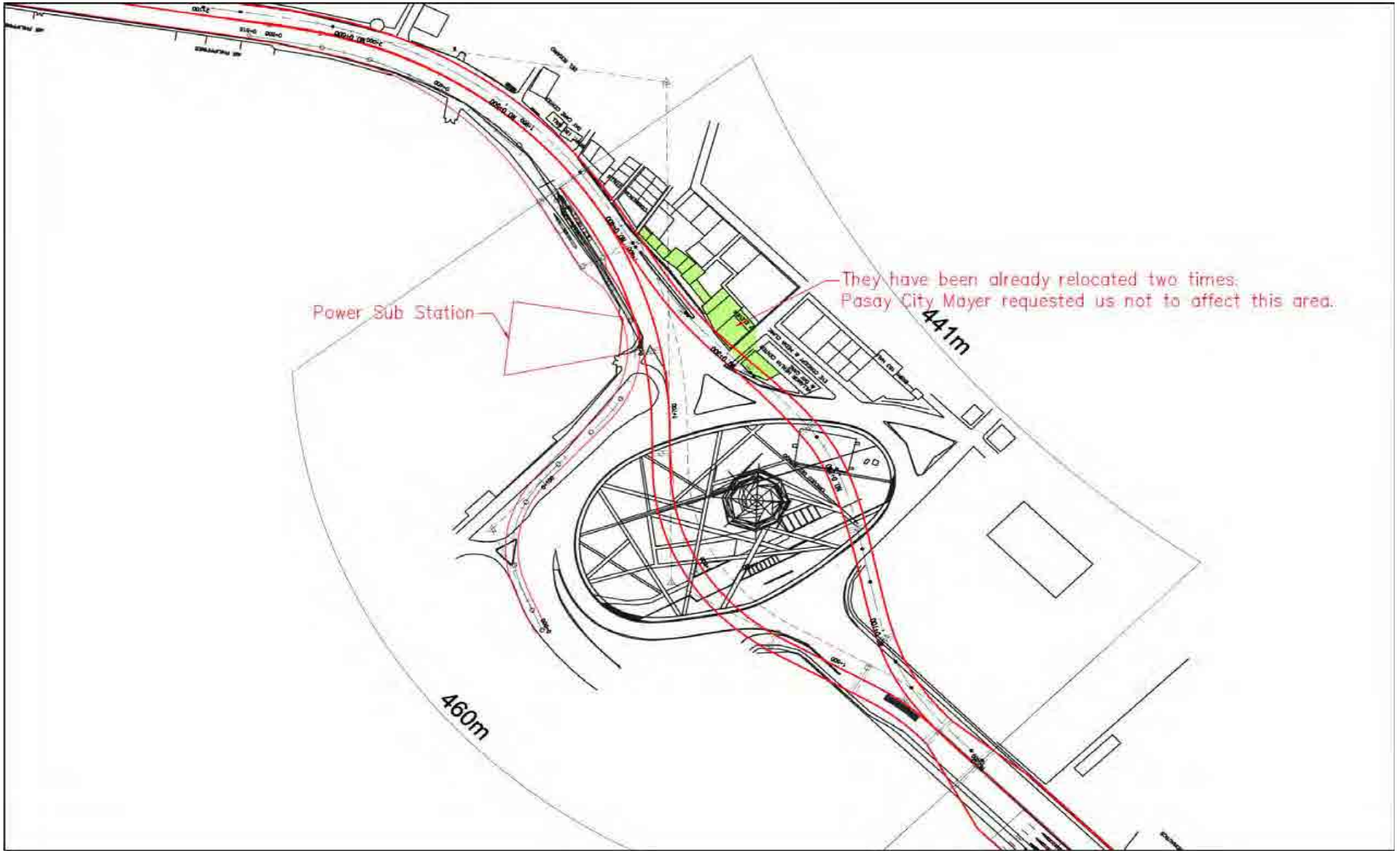
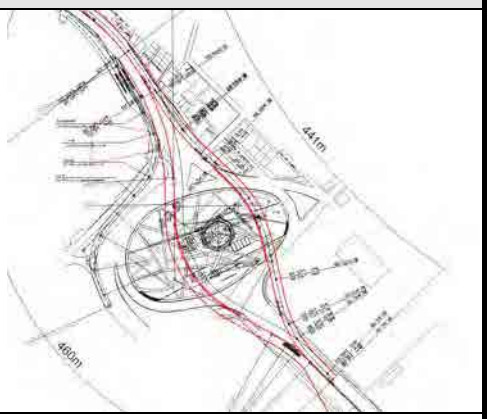


FIGURE 3.5.2-3 ALTERNATIVE-2: EXPRESSWAY SPLITED BY DIRECTION

TABLE 3.5.2-1 ALTERNATIVE STUDY AT MMDA LANDMARK

Scheme	Scheme 1		Scheme 2	
Plan				
Concept	Scheme1: Both direction combined structure		Scheme2: Expressway splited by direction.	
Bridge length	460m		900m(460m+440m)	
Construction Cost	812.3MP(1.00)		829.4MP(1.02)	
ROW acquisition	683m2(MIAA)		1,157m2(Commercial)	
Number of relocation houses	0		3 houses • They have already been relocated two times, so there is strong objection against third relocation.	
Geometric Condition	**Fair**	Rmin =123m	**Fair**	Rmin=123m, *The inner shoulder require widening of 1.35m for stopping distance at R123m
Social Impact	**Good**	No private land acquisition	**Poor**	Some private commercial land acquisition required. Relocation of 3 houses required.
Constructability	**Good**	Constriction will be concentrate in one alignment at the round-about.	**Poor**	Construction will be separated at the round-about which may cause traffic congestion
Aesthetic view	**Fair**	There will be no obstacle of view from Pasay City side	**Poor**	The highway will be obstacle to the monument from both sides
Evaluation	**Recommended**		**Not recommended**	

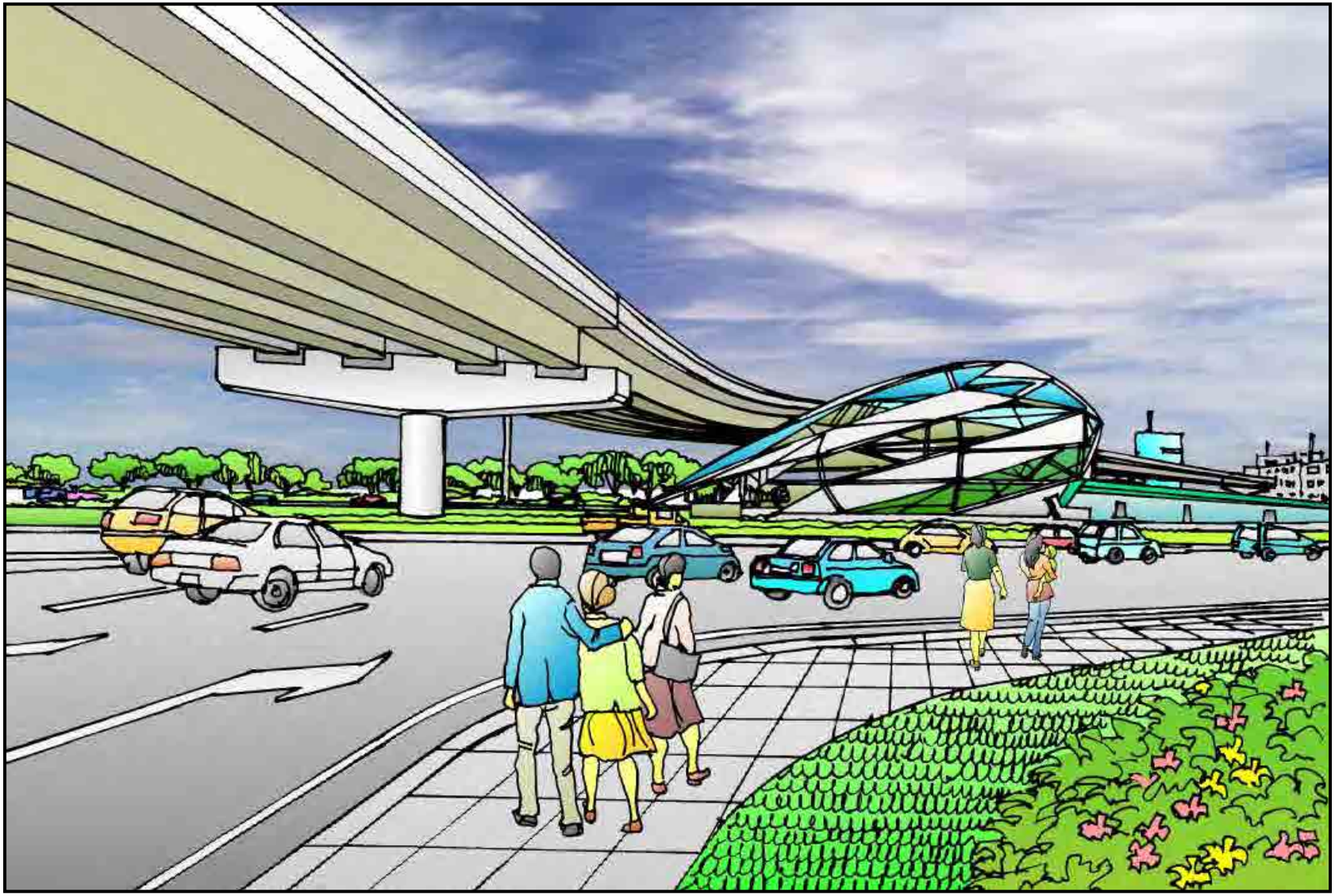


FIGURE 3.5.2-4 IMAGE OF ALTERNATIVE-1

3.6 RAMP LAYOUT

3.6.1 2010 FS Ramp Layout

2010 FS Ramp Layout is shown in **Figure 3.6.1-1.**

- Seven (7) on (entrance)-ramps and seven (7) off (exit)-ramps were proposed.

ISSUES OF RAMP LAYOUT

<table>
<tr><th>Ramp Number</th><th>Issues</th></tr>
<tr><td>(1) Ramp No. 10 (off-ramp from 3rd level to the ground level) (see Figure 3.6.1-2, B-ramp in the figure)</td><td>• End of ramp is located too close to the intersection (only 65 m).
• Intersection traffic queue will be extended to up to the end of the ramp, thus free exit of traffic on this ramp will be affected.
• There will be definitely conflict of traffic (through traffic and left-turn traffic as shown in Figure 3.6.1-3), which will cause traffic congestion and traffic accidents.
• Recommended to extend this ramp towards NAIA Terminal 1 and 2. See Figure 3.6.1-4.</td></tr>
<tr><td>(2) Ramp No. 11 (off-ramp from 2nd level to the ground level) (see Figure 3.6.1-2, A-ramp in the figure) Is this ramp needed?</td><td>• This ramp ends within the intersection.
• Since traffic which utilize this ramp has very short travel distance, resulting in low traffic demand, recommended to be removed. Travel distance which utilizes this ramp;
Ramp (3) to Ramp (11) = 1.4 km.
Ramp (4) to Ramp (11) = 1.2 km.</td></tr>
<tr><td>(3) Ramp No. 2 (on-ramp from Aurora Blvd.) Is this ramp needed?</td><td>• Travel distance and traffic demand which utilizes this ramp is;
<table><tr><th></th><th>Travel Distance</th><th>Traffic Demand (2015)</th></tr><tr><td>Ramp (2) ~ Ramp (10)</td><td>1.9 km.</td><td>1,761</td></tr><tr><td>Ramp (2) ~ Ramp (12) & (13)</td><td>2.6 km.</td><td>53</td></tr></table>• Traffic demand is not so high, and ROW acquisition is required, thus recommended to be removed.</td></tr>
<tr><td>(4) Ramp No. 6 (on-ramp from Terminal 3)</td><td>• To utilize this ramp from Terminal 3 to Skyway, traffic must go around the at-grade road as shown in Figure 3.6.1-5, since the existing on-ramp is proposed to be removed.
• Under the above condition, exit traffic from Terminal 3 will be discouraged to utilize this ramp.
• It is recommended that this ramp should be located at the exit of Terminal 3. (This is studied in section 3.4. Alternatives at Connection Point of Phase-1 and Phase-2.)</td></tr>
</table>

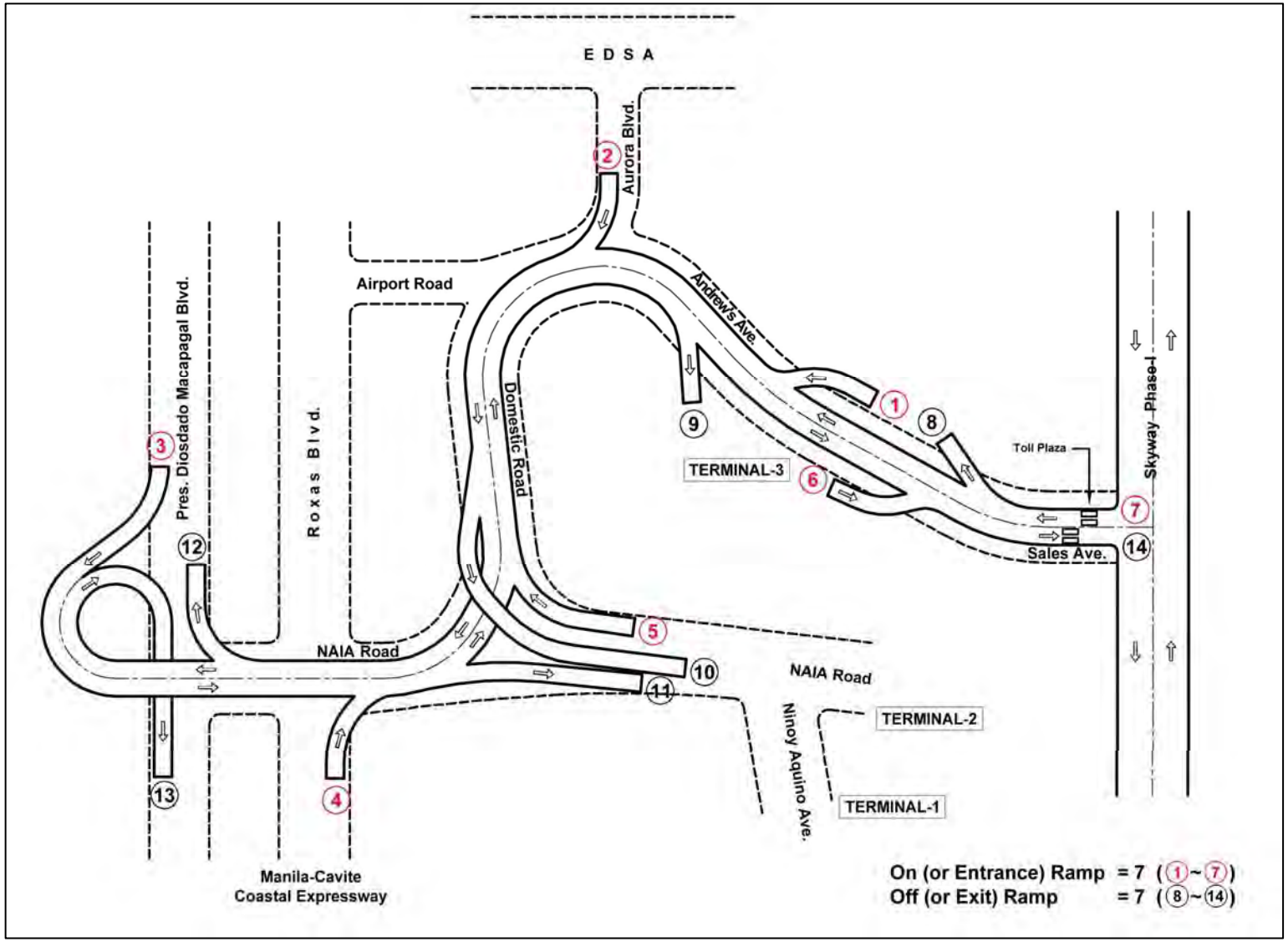


FIGURE 3.6.1-1 SCHEMATIC NAIAX RAMP LAYOUT (2010 FS)

FIGURE 3.6.1-2 ISSUE OF OFF RAMP TO NAIA TERMINAL 1 AND 2 (2010 FS)

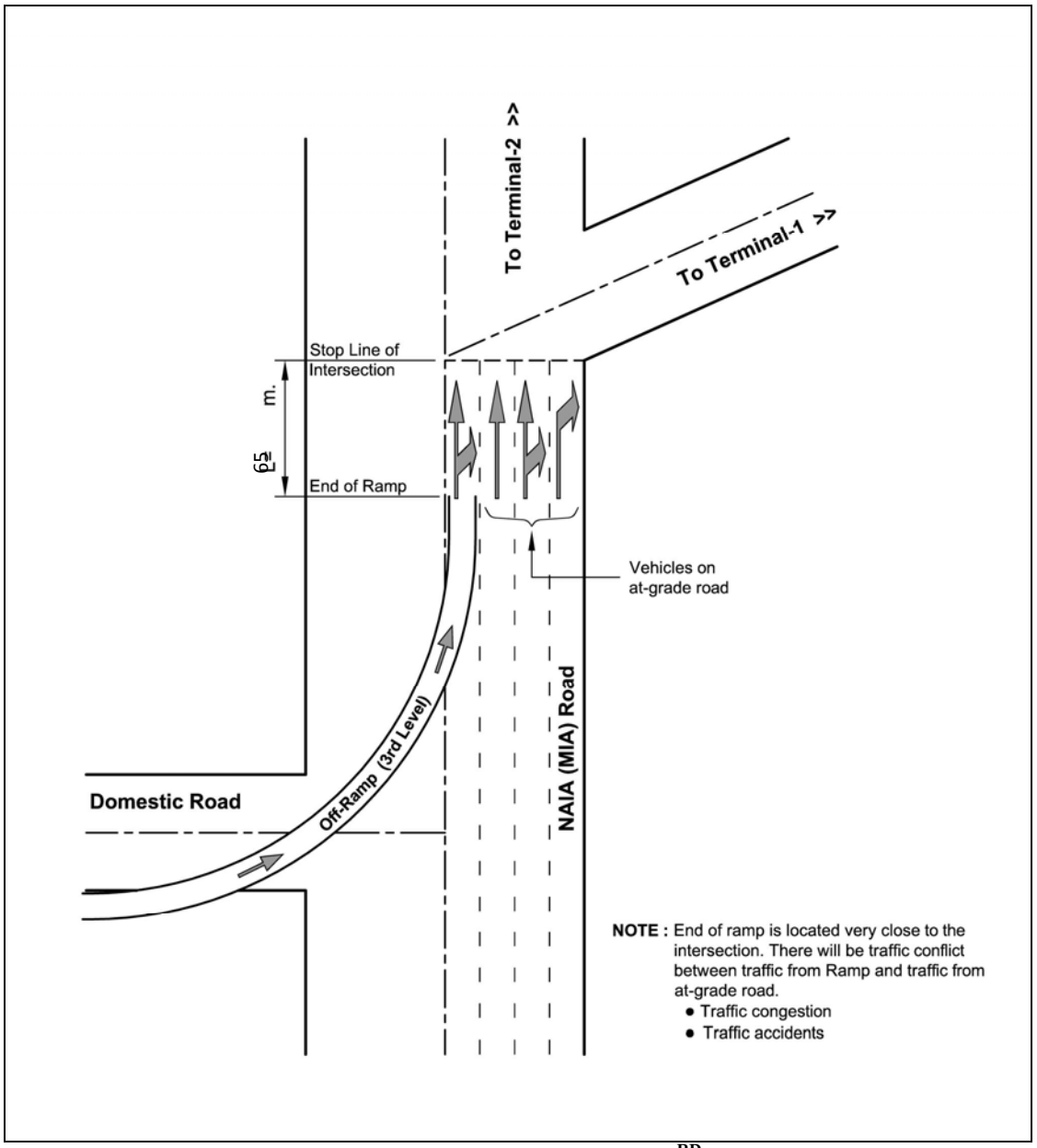


FIGURE 3.6.1-3 SCHEMATIC DRAWING AT 3RD LEVEL OFF-RAMP AND THE INTERSECTION

FIGURE 3.6.1-4 ALTERNATIIVE -2 RAMP LAYOUT (ALIGNMENT TO AVOID THE PARK 'N FLY

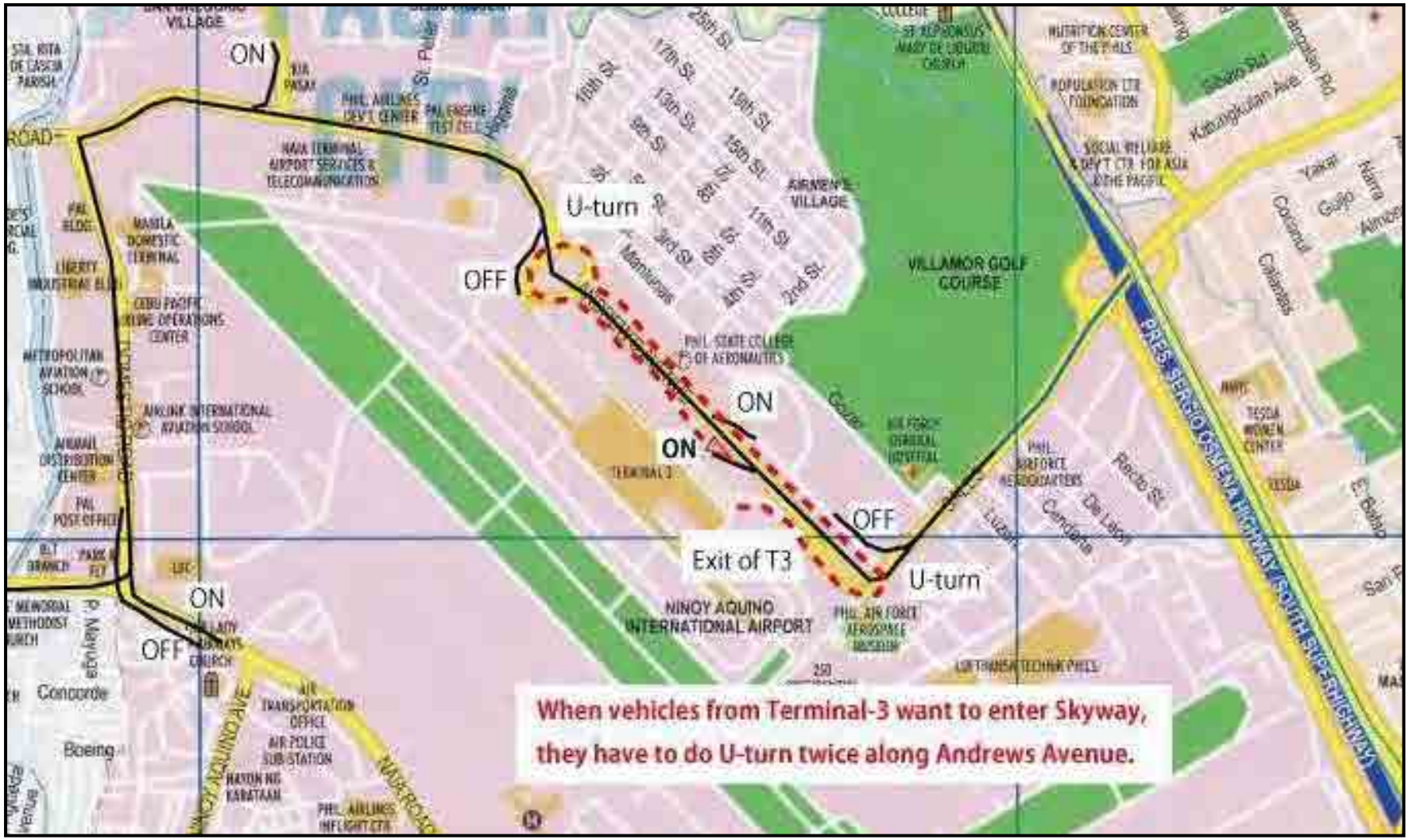


FIGURE 3.6.1-5 ISSUE OF OFF RAMP TO NAIA TERMINAL 3 (2010 FS)

3.6.2 Estimated Ramp Traffic

Estimated ramp traffic volume based on 2010 FS ramp layout is shown in **Figure 3.6.2-1.** Estimated ramp traffic volume based on the revised ramp lay out (ramp (5) and ramp (8) are removed) is shown in **Figure 3.6.2-2.** Future demand forecast is described in Chapter 4.3.

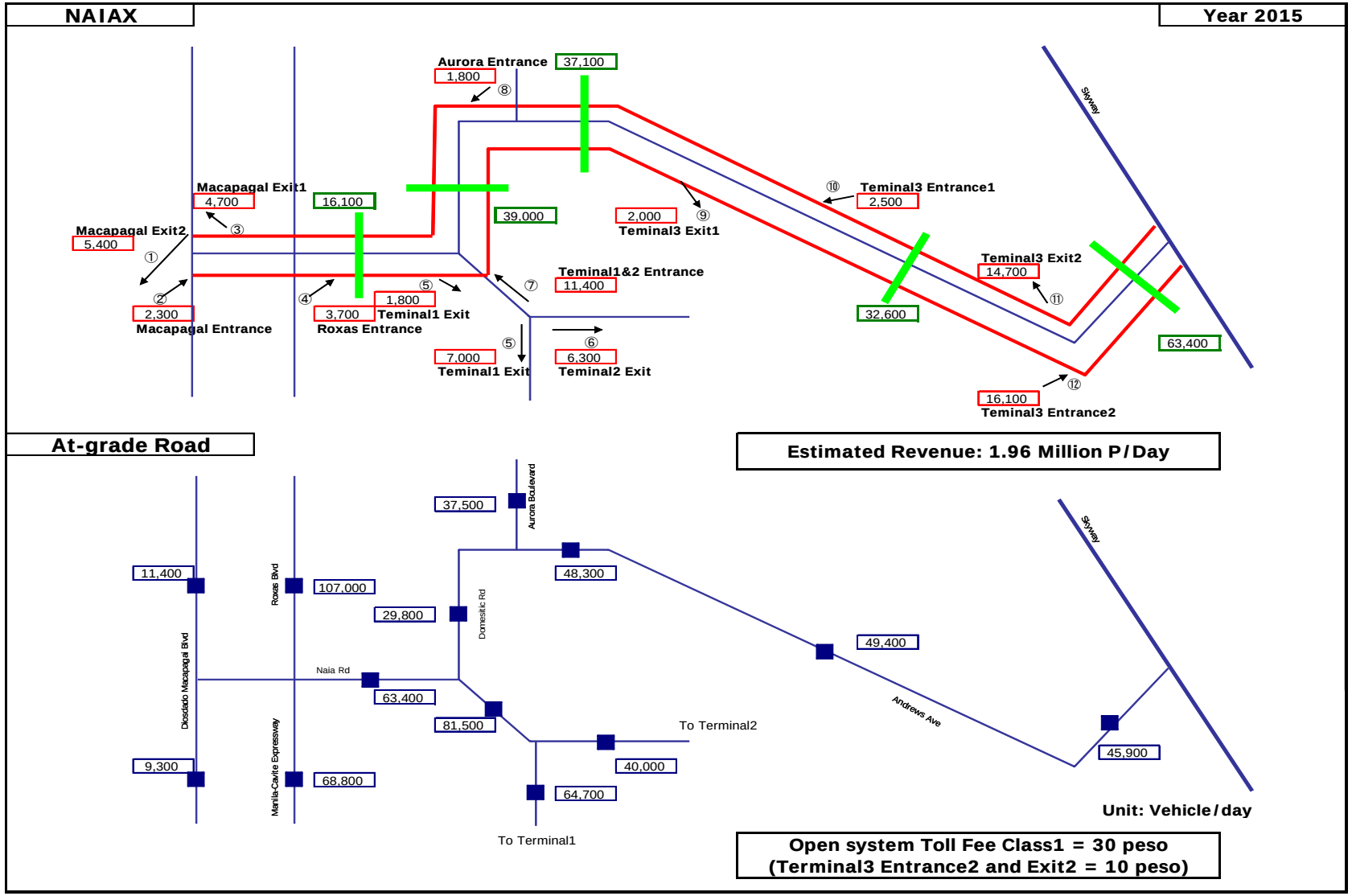


FIGURE **3.6.2-1 TRAFFIC PROJECTION (2010 FS RAMP LAYOUT)**

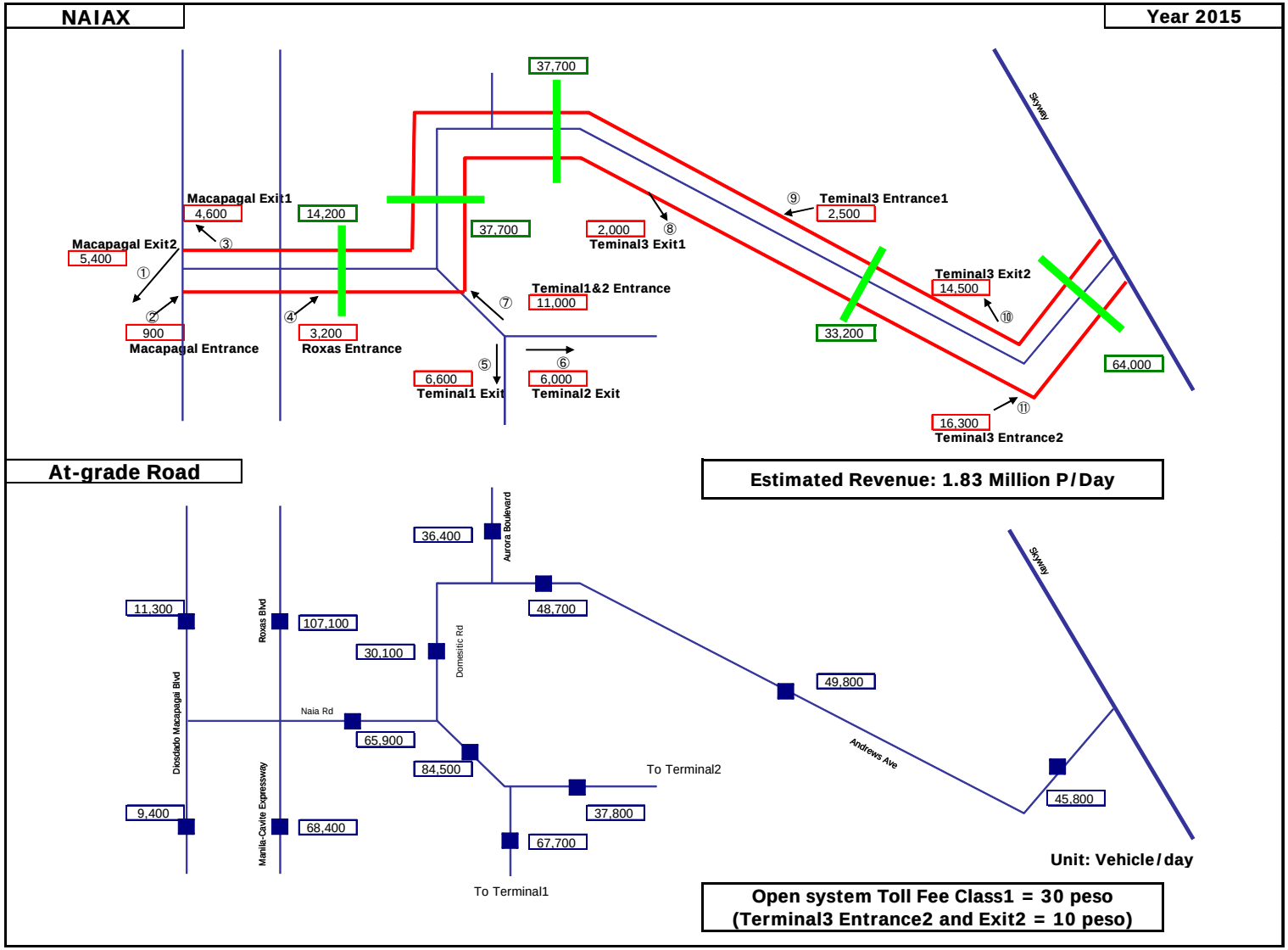


FIGURE 3.6.2-2 TRAFFIC PROJECTION (WITHOUT AURORA ON-RAMP AND OFF-RAMP NEAR PARK 'N FLY BLDG

3.7 DESIGN STANDARDS

3.7.1 Design Speed

In case of urban expressways, design speed is greatly controlled by the availability of ROW. When higher design speed is selected, bigger radius is required, thus new ROW acquisition is required.

In case of the NAIA Expressway, Phase-1 was completed, thus design speed is rather controlled by Phase-1 design.

Horizontal radius adopted by Phase-1 and 2010 FS for Phase-2 is shown in **Figure 3.7.1-1.**

	Expressway Main Alignment (Minimum Radius Adopted)	Ramp Section
Phase 1	R_{min} = 91.5 m ⇨ Design Speed = 50 km/hr	R_{min} = 50 m ⇨ Design Speed = 40 km/hr
2010 FS	R_{min} = 125 m ⇨ Design Speed = 60 km/hr	R_{min} = 50 m ⇨ Design Speed = 40 km/hr

DESIGN SPEED OF OTHER STANDARD

	AASHTO (Urban Freeway)	Japan (Urban Expressway)	
Expressway Main Alignment	100 km/hr	80 km/hr	60 km/hr
Ramp	-	40 km/hr	40 km/hr

Design speed is recommended as follows;

- Expressway Main Alignment: Phase I = 50 km/hr.; Phase II = 60 km/hr.
- Ramp: 40 km/hr.

3.7.2 Typical Cross Section

Typical cross sections adopted by 2010 FS and those recommended by the JICA Study Team is shown in **Table 3.7.2-1.**

Recommended typical cross sections are also shown in **Figure 3.7.2-1.**

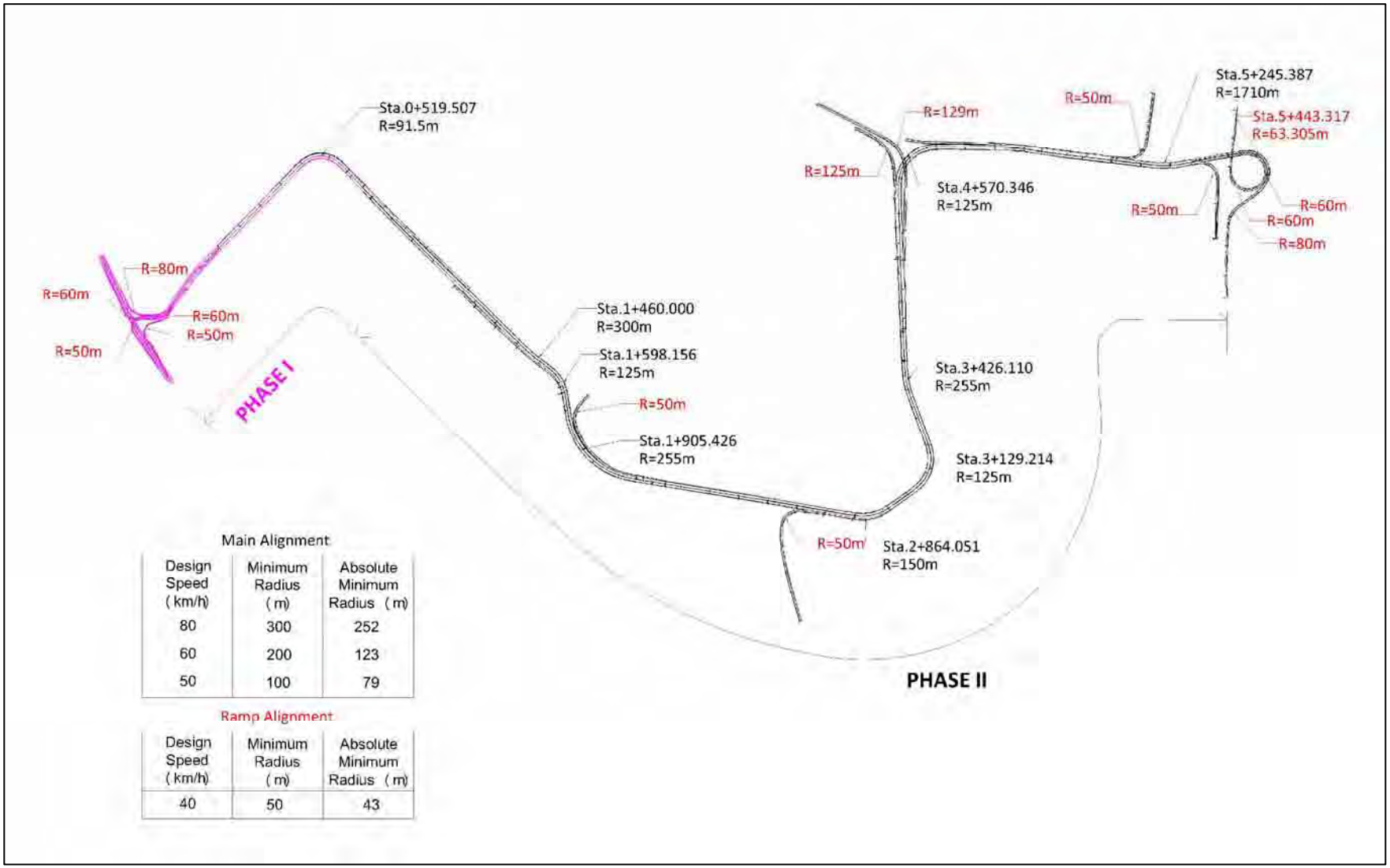
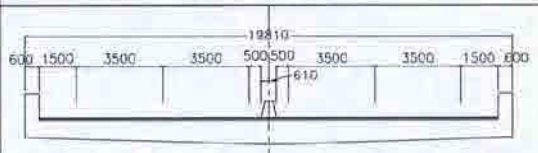
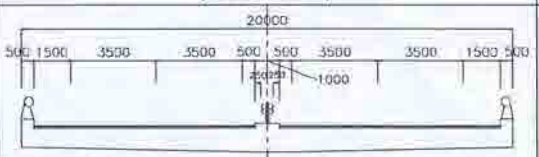
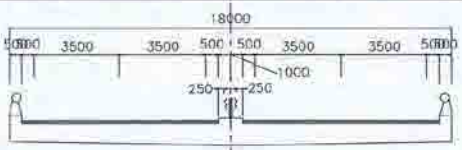
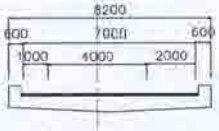
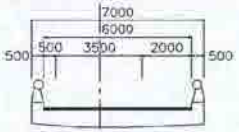
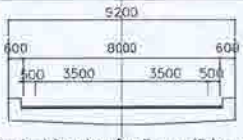
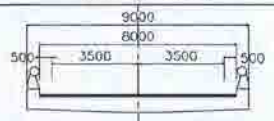
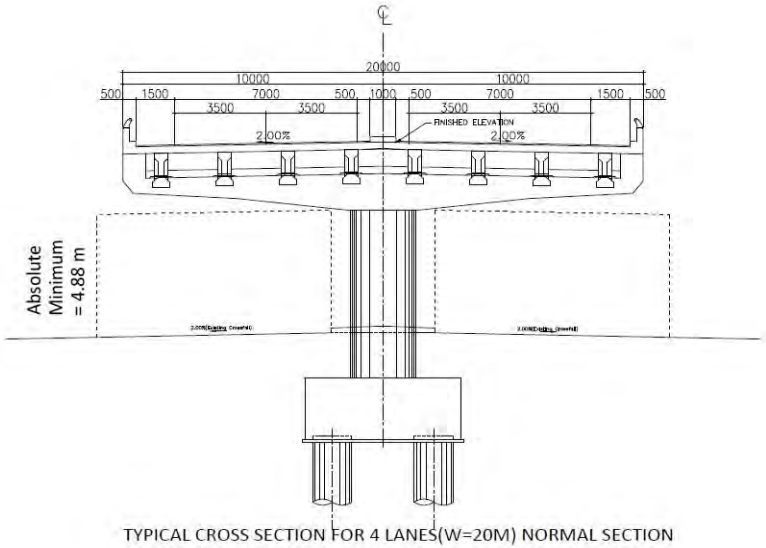


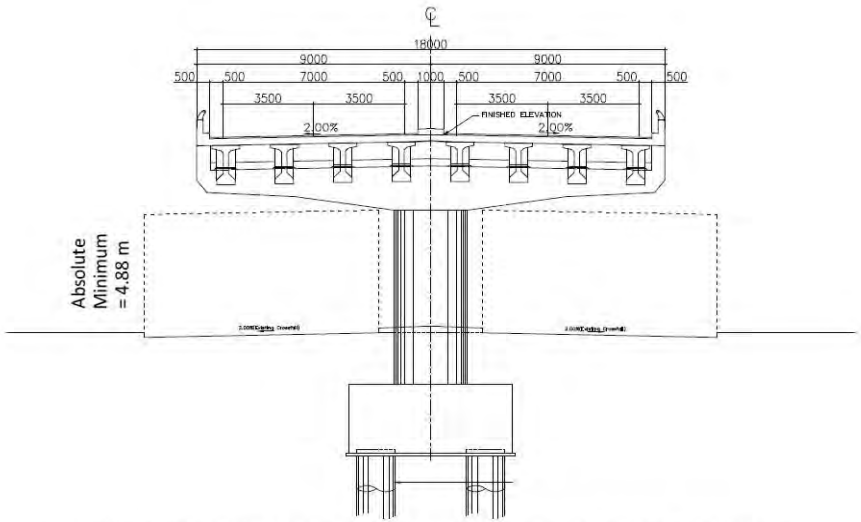
FIGURE 3.7.1-1 HORIZONTAL RADIUS ADOPTED BY PHASE-1 AND 2010 FS

TABLE 3.7.2-1 NAIA EXPRESSWAY PHASE II – TYPICAL CROSS SECTION

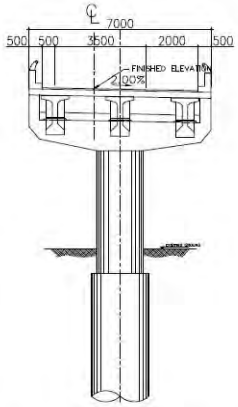
Section	NAIA Expressway Phase II Project (2010 Feasibility Study)	Original Design and Engineering Issues	NAIA Expressway Phase II Project (Recommended)	Solution
Main (Standard)	 Typical Section for 4 Lanes (W = 19.81 m)	Median: New Jersey Type W = 610 mm Shoulder: New Jersey Type W = 600 mm Obstacle for Stopping Sight Distance (75m (at V=60km/h)) Needs widening of shoulder	 Typical Section for 4 Lanes (Standard Section) (W = 20.0 m)	Median: Guard Rail Post Type W = 1000 mm Shoulder: Metal Railing Type W = 500 mm Keep Stopping Sight Distance No need widening of shoulder
Main (Narrow Section)		Preferable to minimize land acquisition at Domestic Road due to NAIA Navigation Clearance and Existing ramp from Phase I	 Typical Section for 4 Lanes (Sub Standard Section) (W = 18.0 m)	Reduce outer shoulder to 0.5m for specific distance
Ramp (1 lane)	 Typical Section for Ramp (1 lane)	Enough to apply same cross sectional configuration as Phase I	 Typical Section for Ramp (1 lane) (W = 7.0 m) (same as Phase I)	Reduce inner shoulder to 0.5 m Carriage way to 3.5 m (same as main alignment) Total width 7.0 m to 6.0 m 6.0m allows to pass two cars (0.25+2.75+2.75+0.25)
Ramp (2 lanes)	 Typical Section for Ramp (2 lanes)	Enough to apply same cross sectional configuration as Phase I	 Typical Section for Ramp (2 lanes) (W = 9.0 m) (same as Phase I)	No change



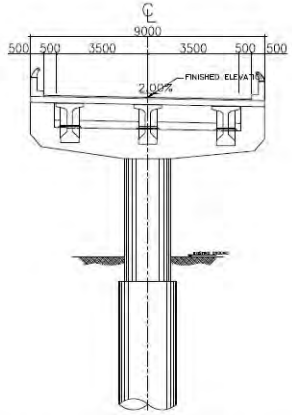
TYPICAL CROSS SECTION FOR 4 LANES(W=20M) NORMAL SECTION



TYPICAL CROSS SECTION FOR 4 LANES(W=18M) NAIA HEIGHT RESTRICTION SECTION



TYPICAL CROSS SECTION OF RAMPS FOR 1 LANE (W=7M)



TYPICAL CROSS SECTION OF RAMPS FOR 2 LANES (W=9M)

FIGURE 3.7.2-1 NAIA EXPRESSWAY PHASE II – TYPICAL CROSS SECTION

3.8 VERTICAL CLEARANCE FOR AT-GRADE ROADS AND EXPRESSWAY

3.8.1 Vertical Clearance Standards of Various Countries

VERTICAL CLEARANCE STANDARDS

Philippines	USA (AASHTO)	Japan	Asian Highway
Desirable: 5.2 m (considering future overlay) Standard: 5.0 m (considering future overlay) If vertical clearance of less than 5.0 m is adopted, traffic control measures must be proposed. *Source: BOD*	Arterial Street and Freeway: 4.88 m Local and Collector Streets: 4.27 m In highly developed urban areas, a minimum clearance of 4.27 m of arterial street may be allowed, provided that an alternative route with 4.88 m clearance is available.	4.5 m	4.5 m

Existing Vertical Clearances;

LRT Line-1: EDSA/Taft Ave. = 4.70 m., Recto/Rizal = 4.27 m.

Delpan Bridge: 4.60 m.

3.8.2 Recommendation

Since the project has to cope up with NAIA navigational height limit, vertical clearance of 4.88 m is recommended for both at grade roads and the expressway, provided that pavement overlay shall be prohibited.

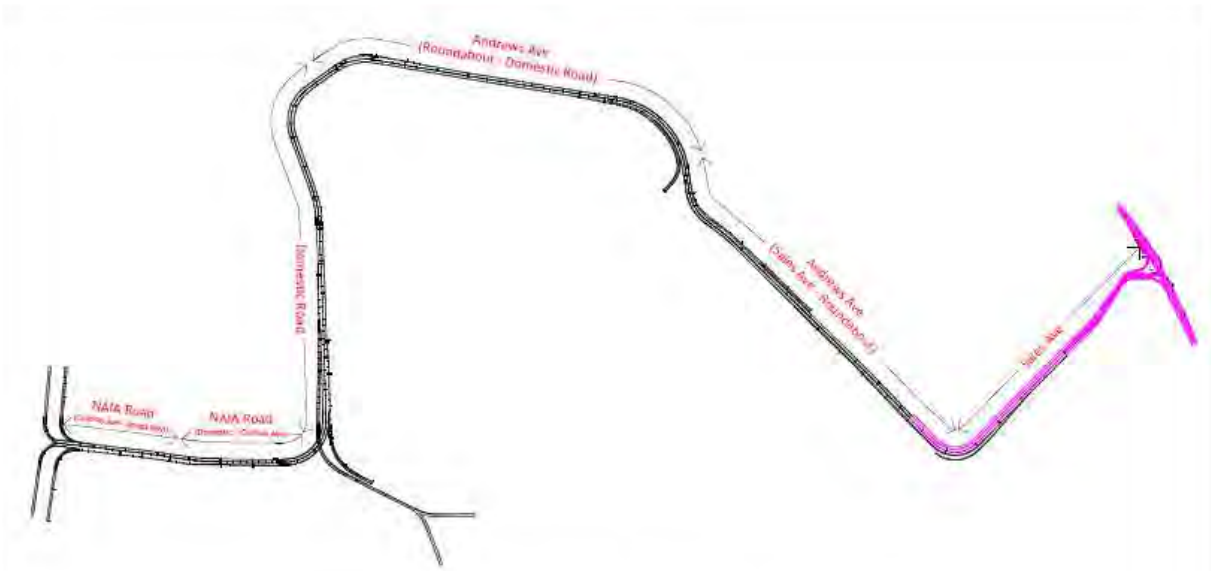
3.9 NUMBER OF TRAFFIC LANES OF AT-GRADE ROADS

Table 3.9-1 shows the number of traffic lanes of at-grade roads after completion of the Expressway. The same number of traffic lanes as the existing condition shall be provided for the at-grade roads even after the Expressway is completed.

TABLE 3.9-1 NUMBER OF TRAFFIC LANES OF AT-GRADE ROADS

At-grade Road		Existing No. of Traffic Lanes	No. of Traffic Lanes During Construction	No. of Traffic Lanes After Construction
Sales Avenue	East Bound	3 (Before on-ramp) 2 (After on-ramp)	2	3
	West Bound	3 (Under off-ramp) 2 (Under off-ramp)	2	3
Andrews Avenue (Sales Ave. – Roundabout)	East Bound	3-4	3	3-4
	West Bound	3	3	3
Andrews Avenue (Roundabout – Domestic Road)	East Bound	3	2	3
	West Bound	3	2	3
Domestic Road	North Bound	3	2	3
	South Bound	3	2	3
NAIA (MIA) Road (Domestic Road – Quirino Avenue)	East Bound	4	2	4
	West Bound	4	2	4
NAIA (MIA) Road (Quirino Avenue – Roxas Boulevard)	East Bound	4	2	4
	West Bound	3	2	3

Figure 3.9-1 shows the number of traffic lanes required for at-grade roads.



Number of Lane of At-grade Road NAIA Expressway (Phase II)

At-grade Road Name	Existing	During Const.	After Const.
Sales Ave	4 - 6	4	6
Andrews Ave (Sales Ave to Roundabout)	6 - 7	6	6 - 7
Andrews Ave (Roundabout to Domestic Rd)	6	4	6
Domestic Road	6	4	6
NAIA Road (Domestic Rd - Quirino Ave)	8	4	8
NAIA Road (Quirino Ave - Roxas Blvd)	7	4	7

FIGURE 3.9-1 NUMBER OF TRAFFIC LANES AT-GRADE ROADS

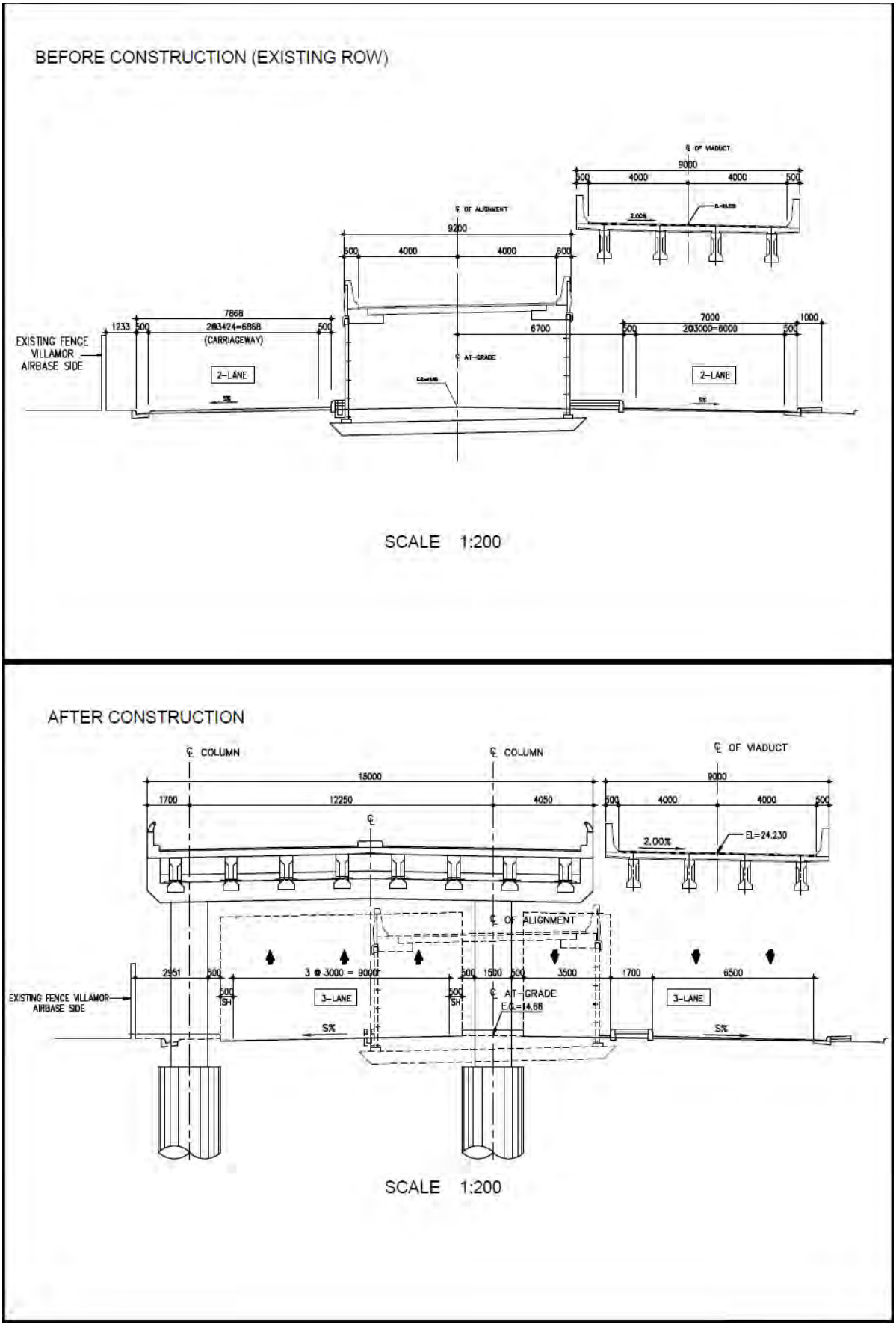


FIGURE 3.9-2 (1) CROSS SECTION OF SALES STREET

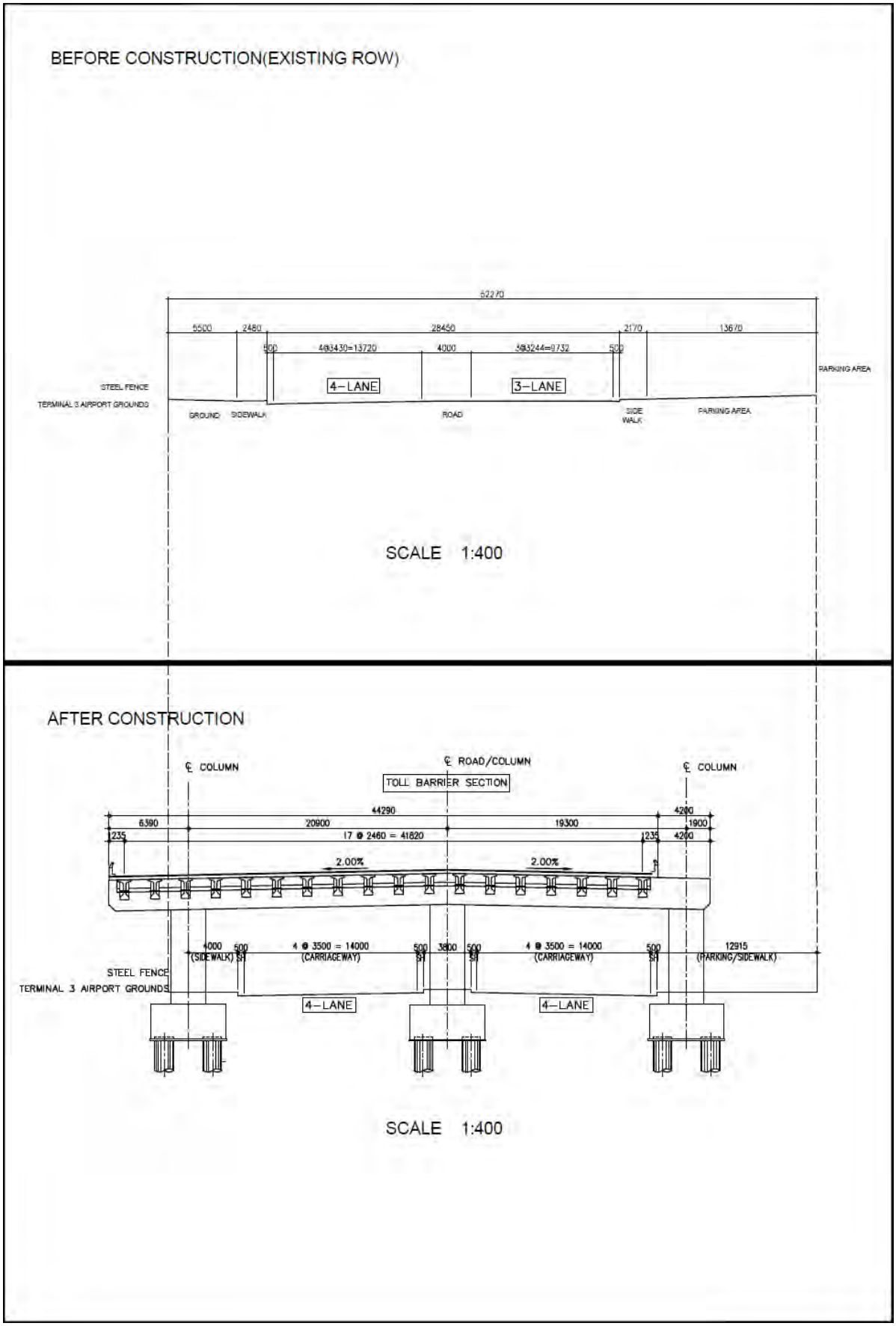


FIGURE 3.9-2 (2) CROSS SECTION OF ANDREWS AVENUE-2 (TERMINAL 3)

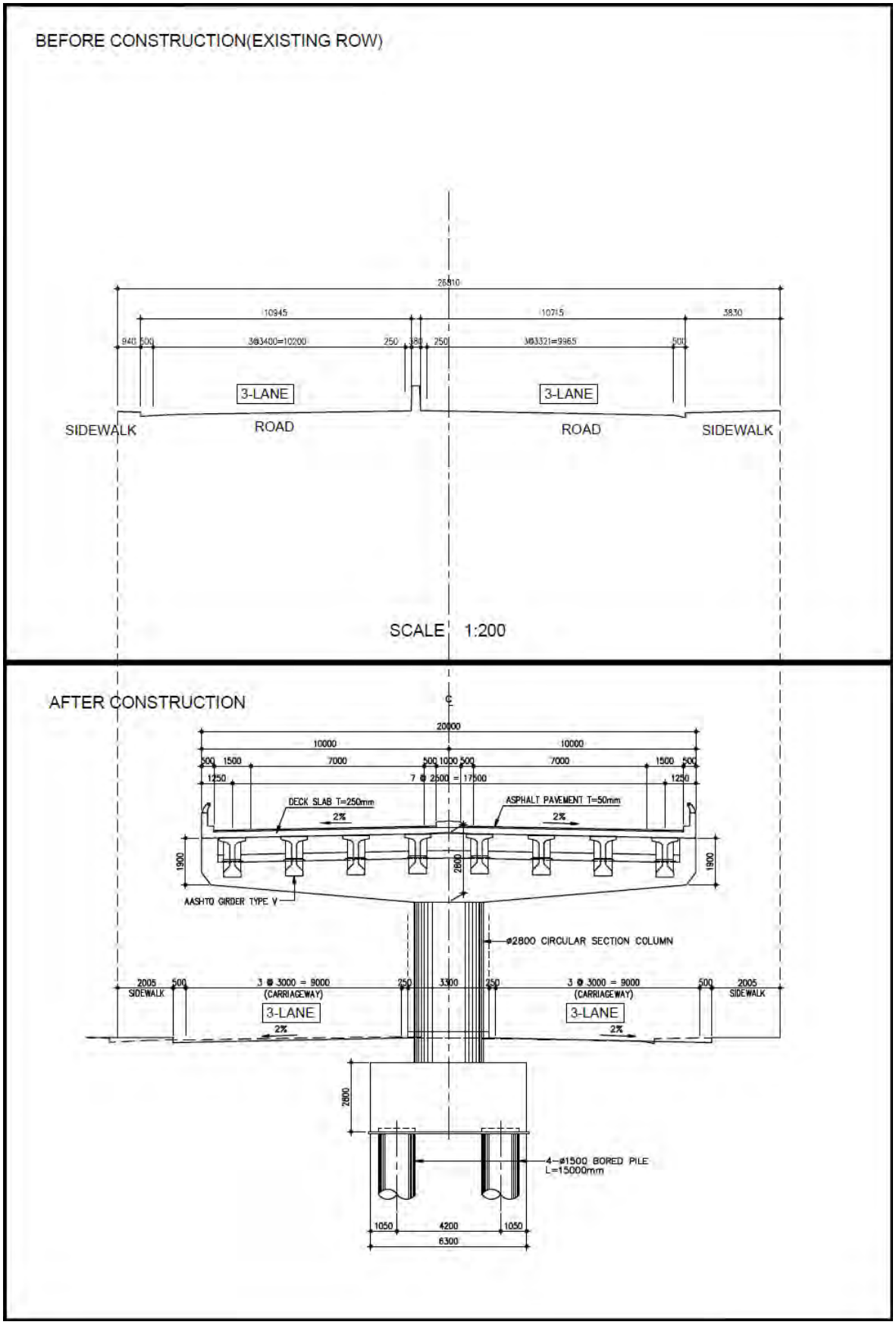


FIGURE 3.9-2 (3) CROSS SECTION OF ANDREWS AVENUE-1

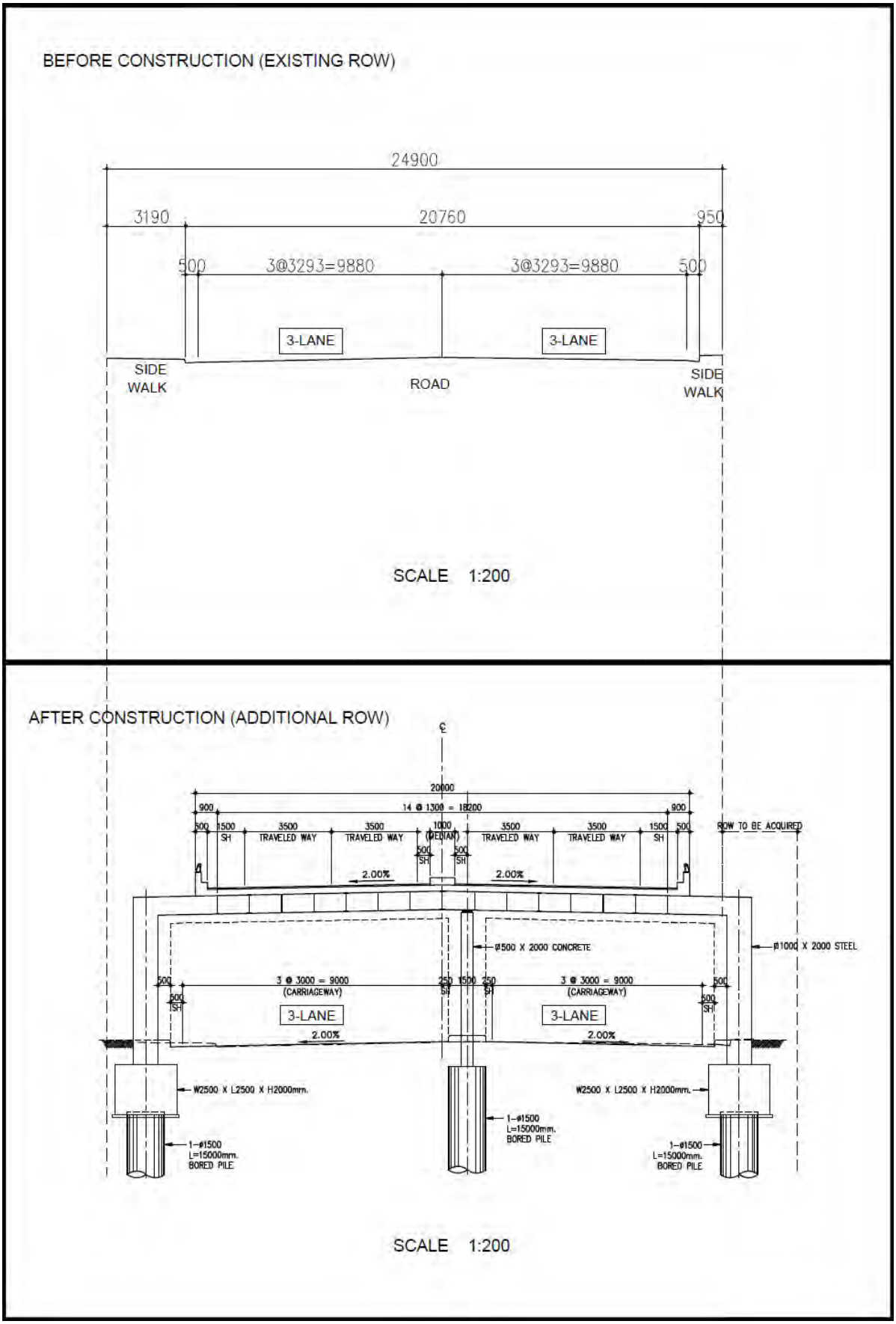


FIGURE 3.9-2 (4) CROSS SECTION OF DOMESTIC ROAD-1

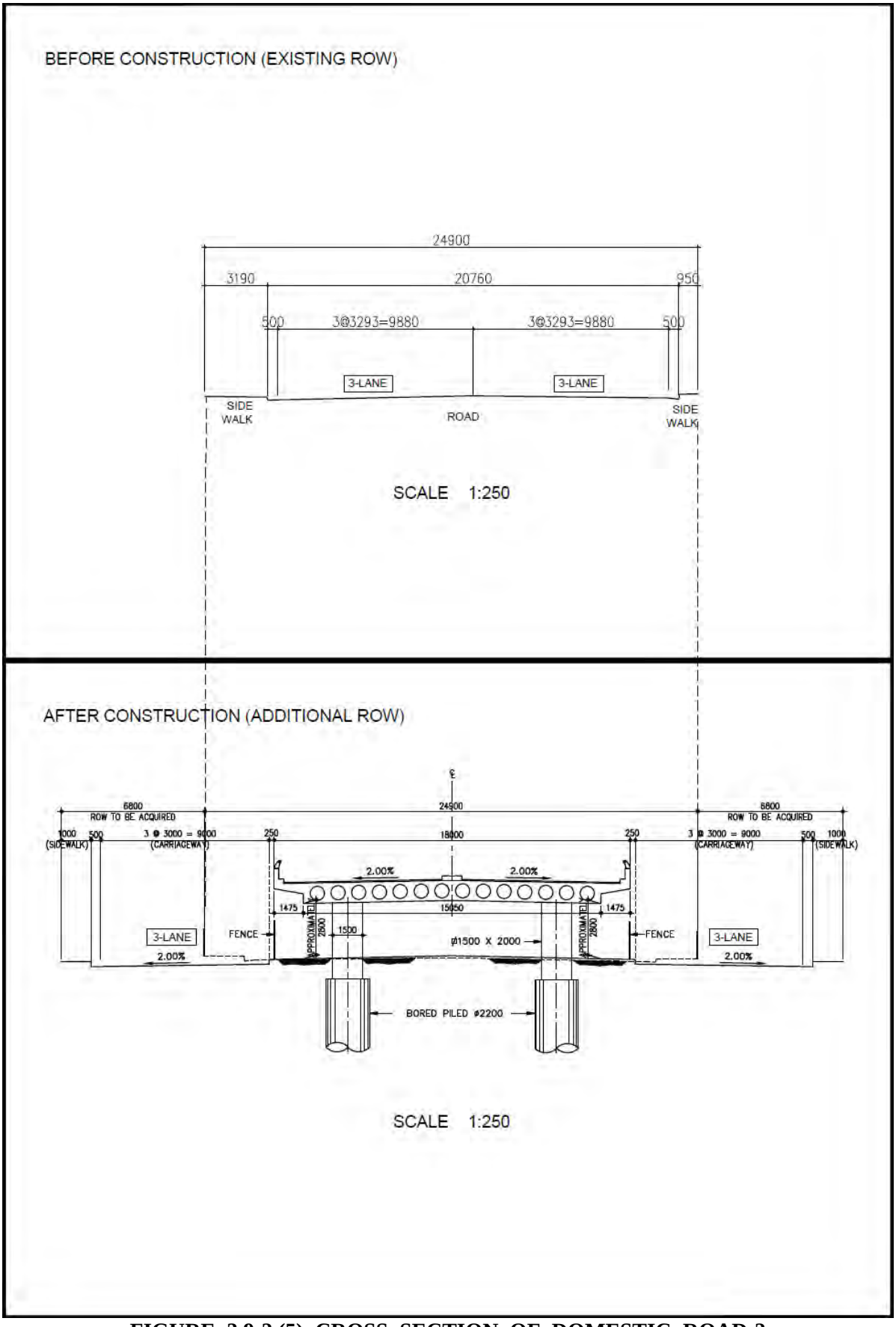


FIGURE 3.9-2 (5) CROSS SECTION OF DOMESTIC ROAD-2

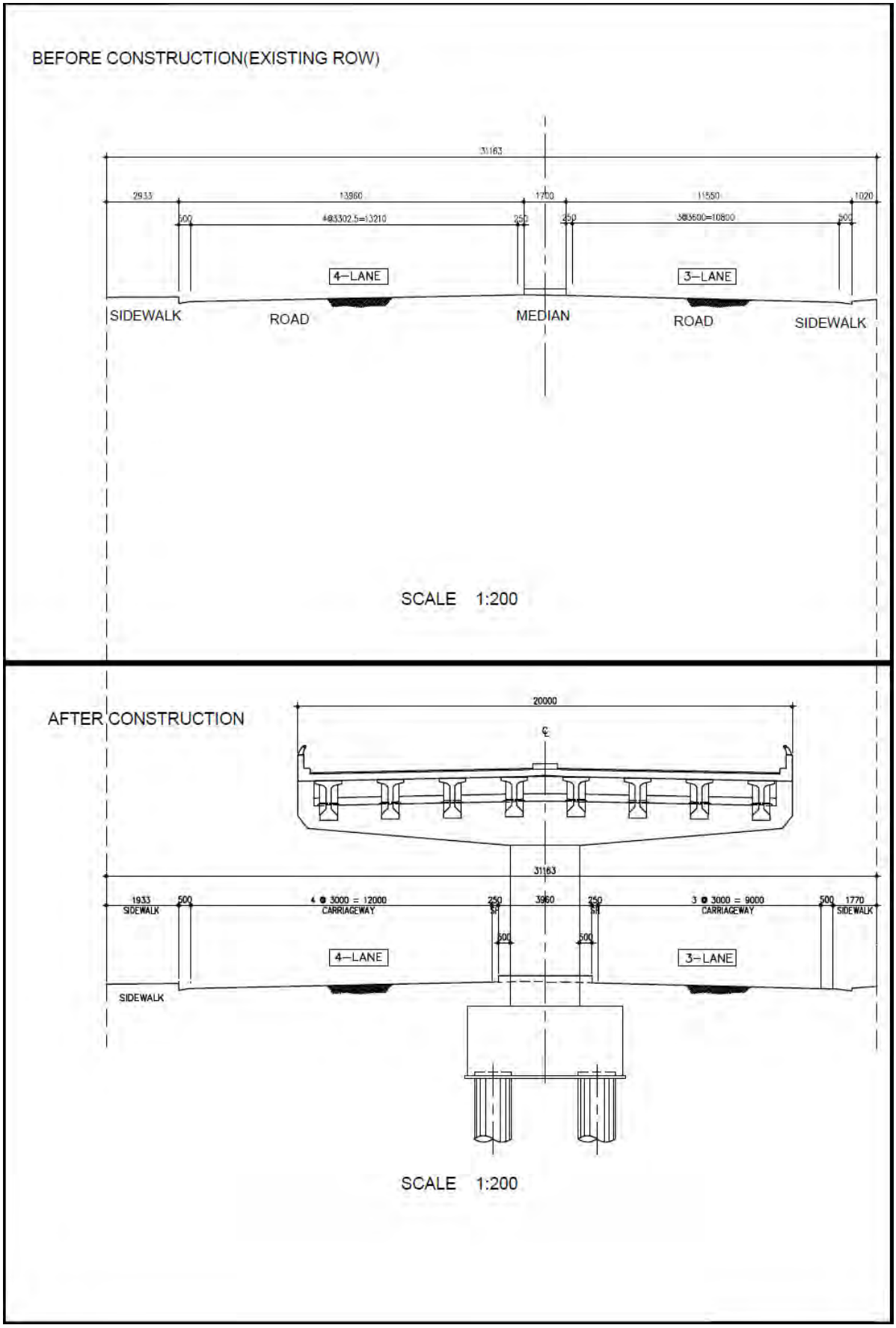


FIGURE 3.9-2 (6) CROSS SECTION OF NAIA ROAD

3.10 TOLL COLLECTION SYSTEM

3.10.1 Closed System (2010 FS)

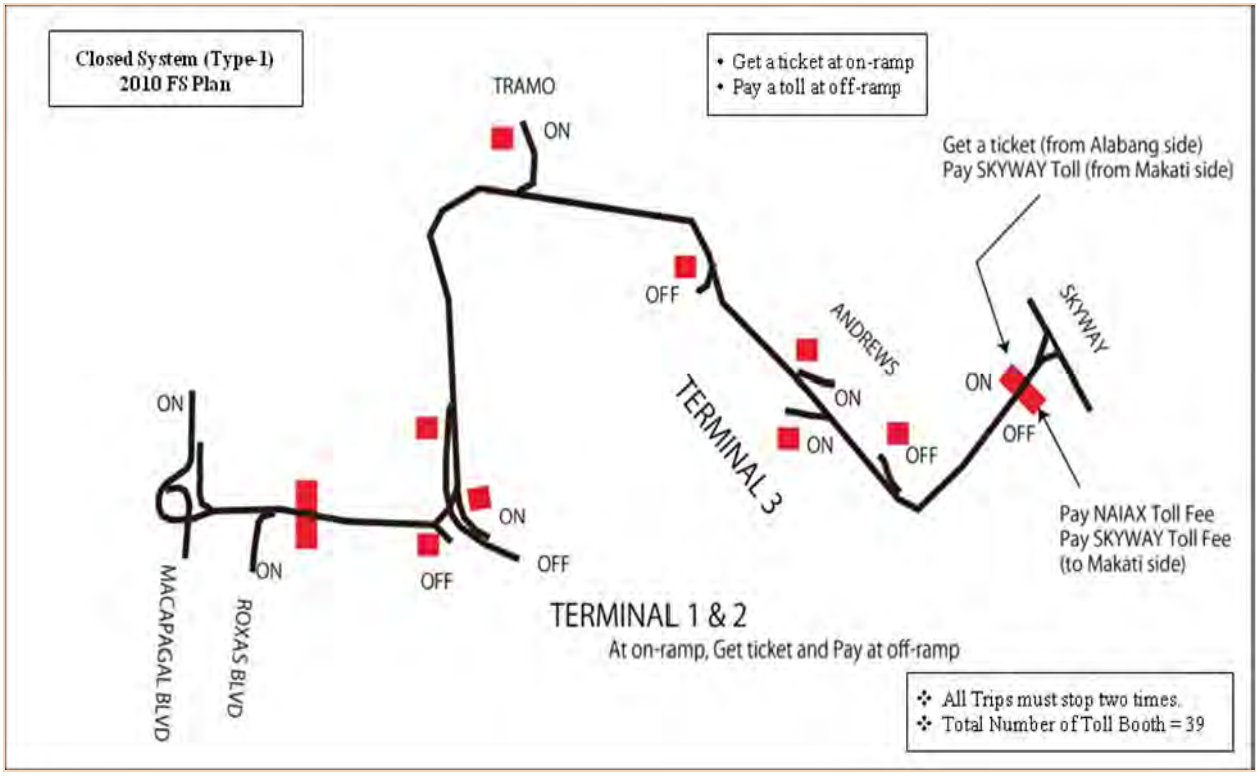


FIGURE 3.10.1-1 CLOSED SYSTEM PROPOSED BY 2010 FS

TABLE 3.10.1-1 NUMBER OF TOLL BOOTH PROPOSED BY 2010 FS

Ramp Name	No. of Toll Booth
1 Andrews 1 On	1
2.Andrews 2 On	1
3.Andrews 2 Off	1
4.Tramo On	1
5. Domestic Rd 1. Off	1
6. Domestic Rd 2. Off	1
7. NAIA Off	1
8. Roxas Blvd.(On & Off)	2+2
Total	11

Based on the analysis of projected traffic and booth capacity, total 39 booths will be needed in case closed system.

3.10.2 Open System

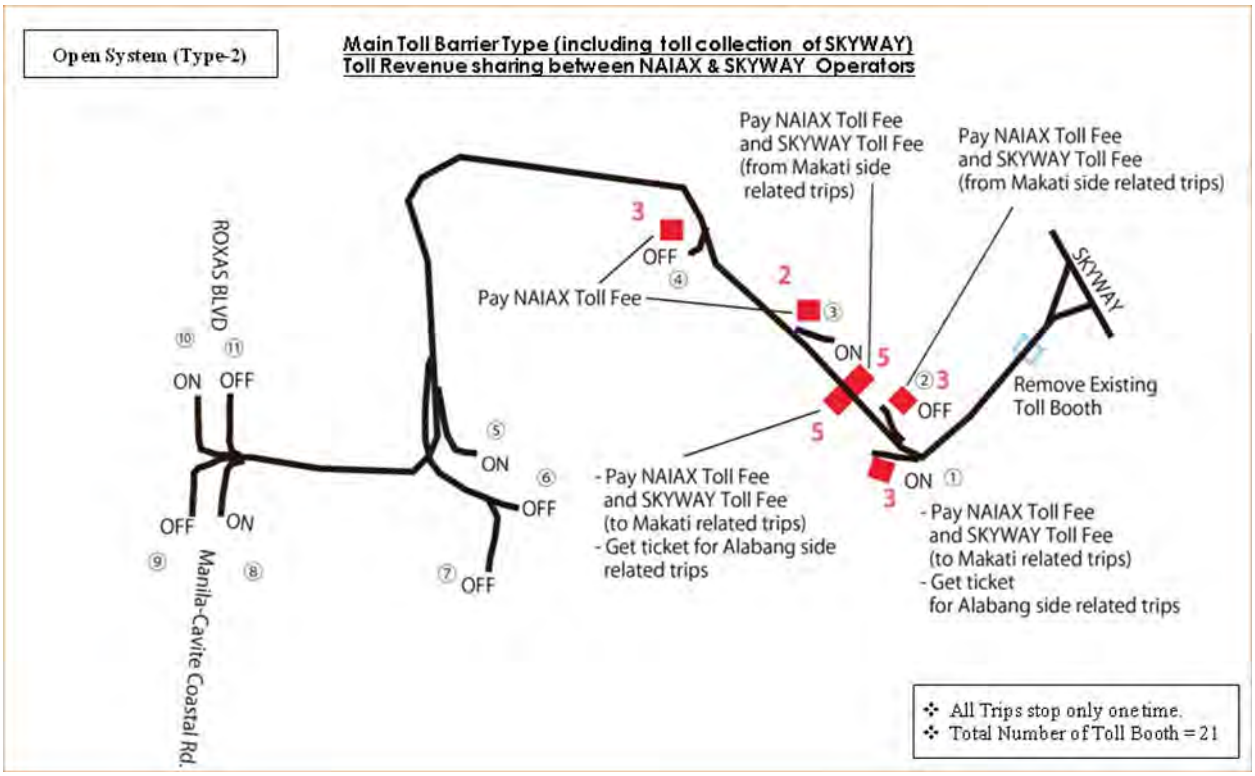


FIGURE 3.10.2-1 OPEN SYSTEM TYPE-2

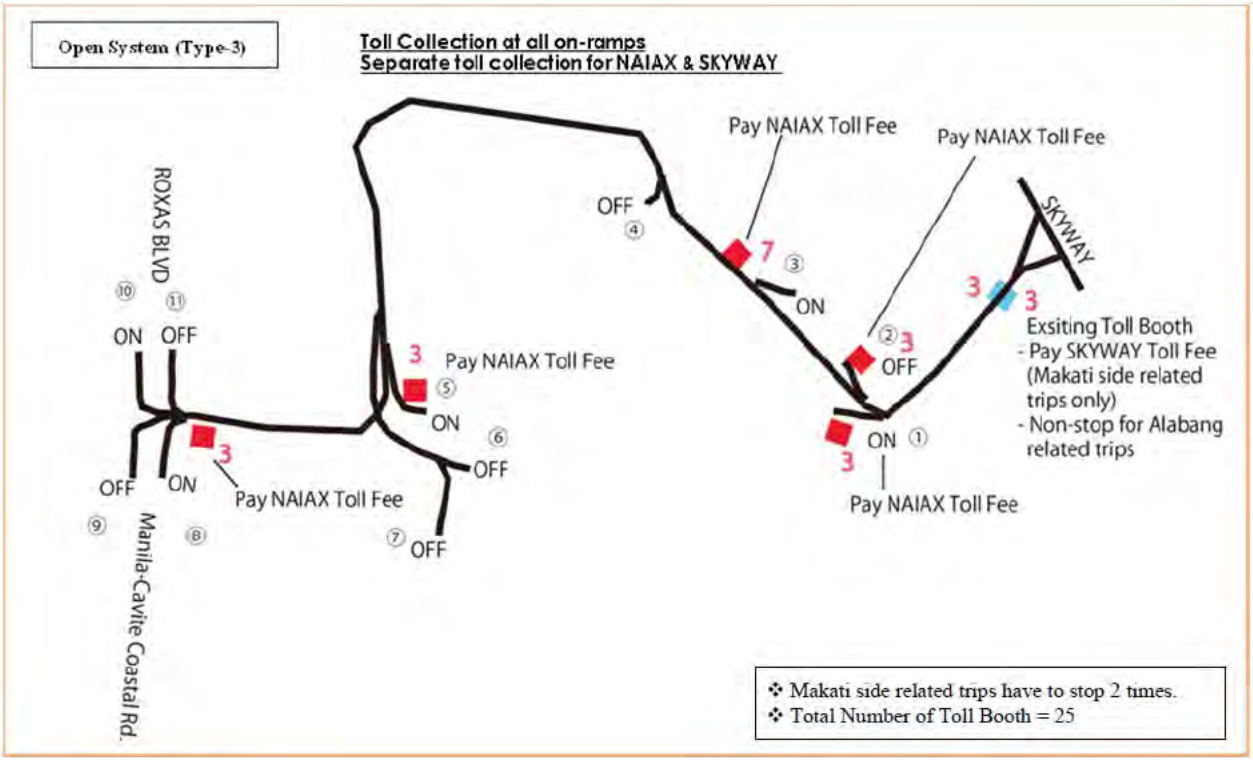


FIGURE 3.10.2-2 OPEN SYSTEM TYPE-3

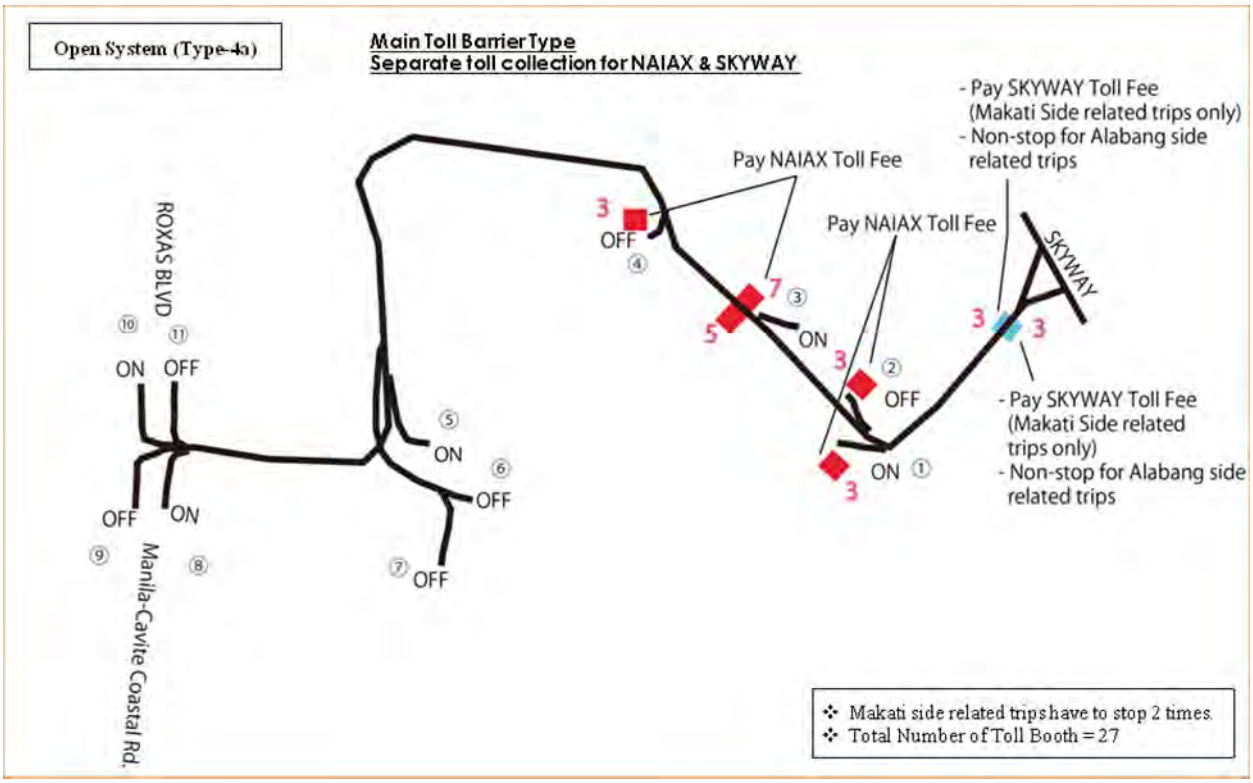


FIGURE 3.10.2-3 OPEN SYSTEM TYPE-4A

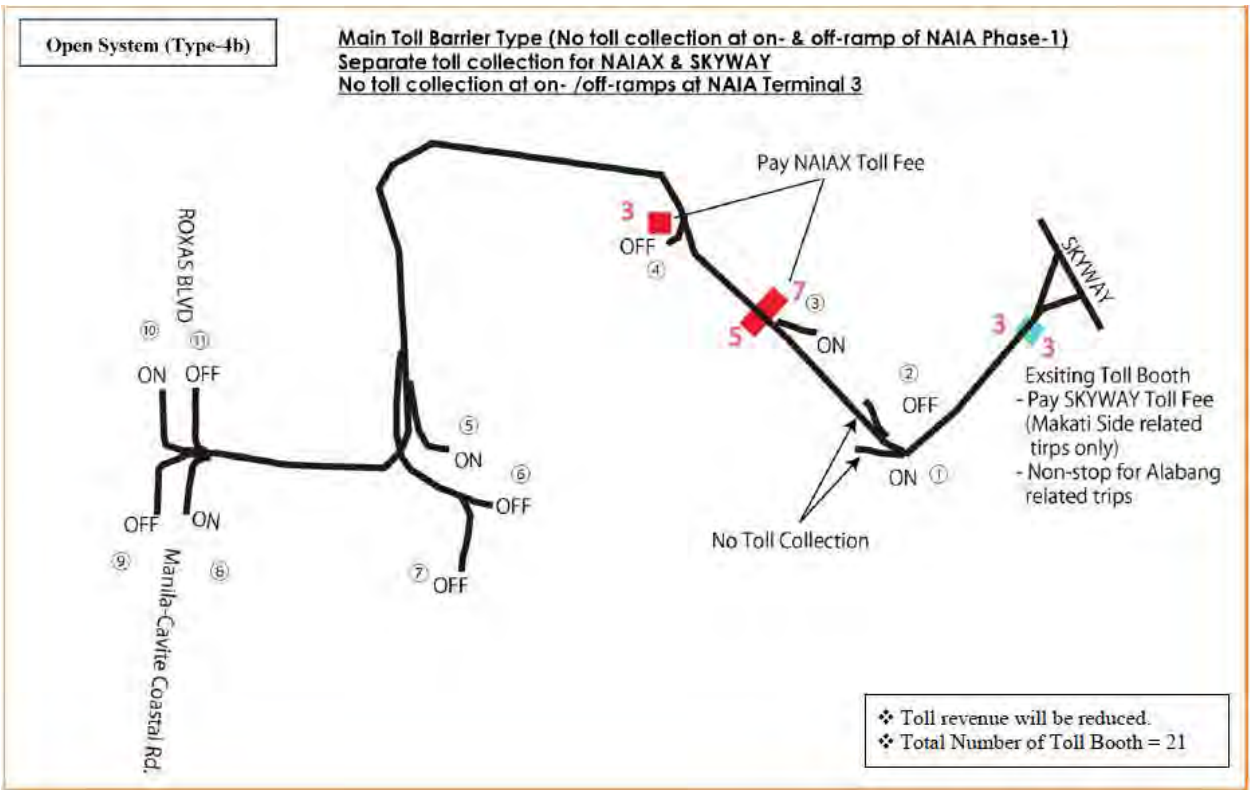


FIGURE 3.10.2-4 OPEN SYSTEM TYPE-4B

3.10.3 Comparison of Toll Collection System

Comparison of toll collection system is shown in **Table 3.10.3-1.**

TABLE 3.10.3-1 COMPARISON OF TOLL COLLECTION SYSTEM

Toll Collection System	No. of Toll Booth	Characteristics of the System	Recommendation
Type-1: Closed System (2010 FS Plan)	39	• Toll fee in proportion to travel distance can be applied. • All trips must stop 2 times, which discourages usage of expressway. • Control of overloaded trucks is practically difficult. • Toll collection transaction time is longer. • Higher operation cost.	Not Recommended
Type-2: Open System	21	• Flat toll rate • Toll collection of both NAIAX and Skyway, thus toll revenue sharing between NAIAX and Skyway Operators need to be agreed. • All trips stop only 1 time, thus convenient for expressway users. • Facility of toll booths of NAIAX Phase-1 can be transferred to other toll booths. • Toll collection transaction time at main toll barrier and NAIA Terminal 3 related toll booths is longer. • Control of overloaded trucks is difficult. • Least ROW acquisition. • Least operation cost.	Recommended, if both operators of NAIAX and Skyway agree on revenue sharing system.
Type-3: Open System	25	• Flat toll rate. • Separate toll collection for NAIAX and Skyway. • All trips stop 1 time except Makati-side related traffic. • Toll booth location for No. 8 & 10 and for No. 5 requires additional ROW acquisition. • Control of overloaded trucks is practically difficult. • Second least operation cost.	Not recommended, because of toll booth location for No. 8 and 10 and for No. 5 which requires additional ROW acquisition.
Type-4a: Open System	27	• Similar to Type-2 • Separate toll collection for NAIAX and Skyway. • All trips stop 1 time except Makati-side related traffic.	Recommended, when toll revenue sharing between operators of NAIAX and Skyway cannot be reached.
Type-4b: Open System	21	• Similar to Type-4a • No toll collection at No.1 and No. 2 (or NAIA Terminal 3 related traffic)	Not recommended, since this reduces toll revenue.

3.11 PEDESTRIAN OVERPASS BRIDGES

There are five (5) pedestrian overpass bridges along NAIAX.

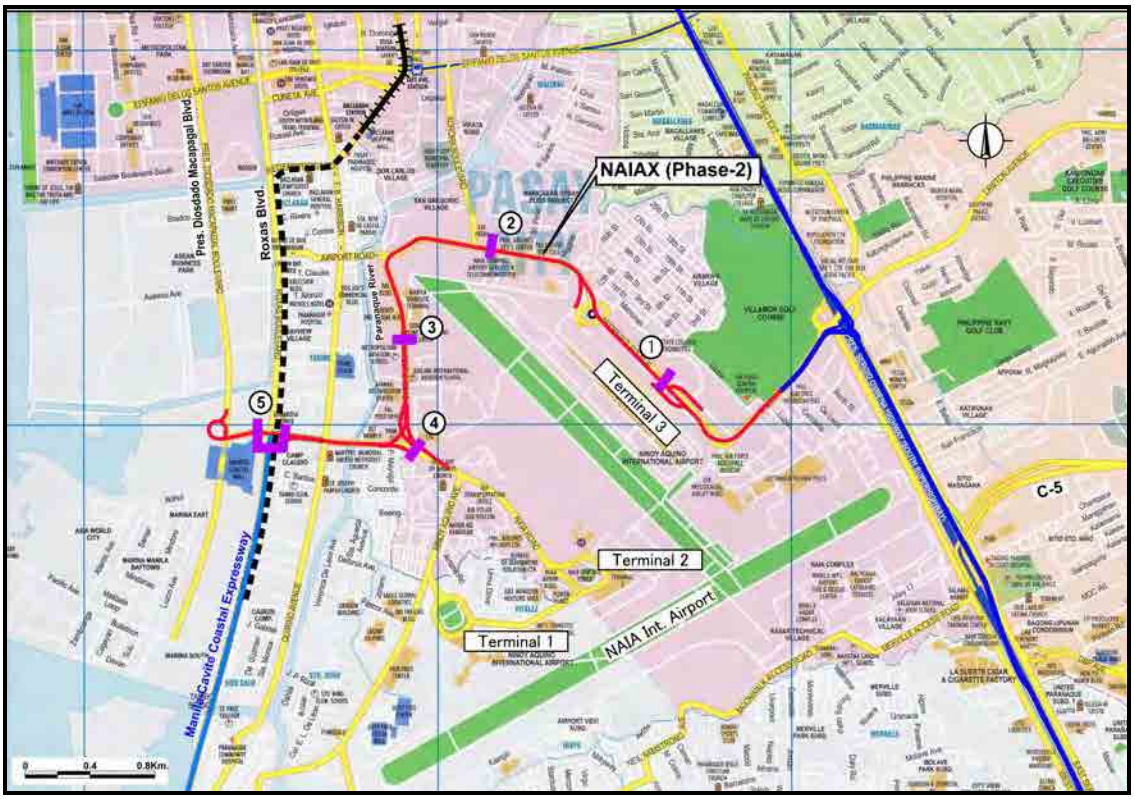


FIGURE 3.11-1 LOCATION MAP OF PEDESTRIAN OVERPASS BRIDGE

1. Pedestrian Overpass Bridge near Terminal 3

- Megaworld started construction without permit.
- MIAA objected the construction of this pedestrian bridge.
- This pedestrian overpass bridge was already removed.

2. Pedestrian Overpass Bridge along Andrew Road

- Constructed by PAL to connect two offices of PAL with the approval of MMDA.
- Recommended to remain.

4. Pedestrian Overpass Bridge at intersecting NAIA Road and Domestic Road

- Constructed by NCR, DPWH.
- Recommended to remove and replaced at another location nearby the intersection.

3. Pedestrian Overpass Bridge along Domestic Road

- Constructed by MMDA.
- Recommended to remove and convert it to pedestrian crossing due to NAIA navigational clearance

5. Pedestrian Overpass Bridge at Costal Mall (Roxas Blvd.)

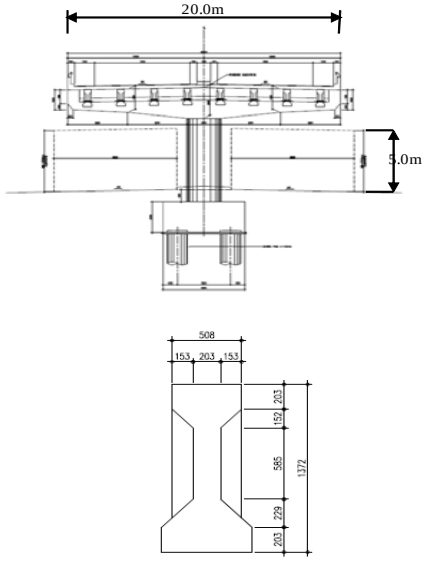
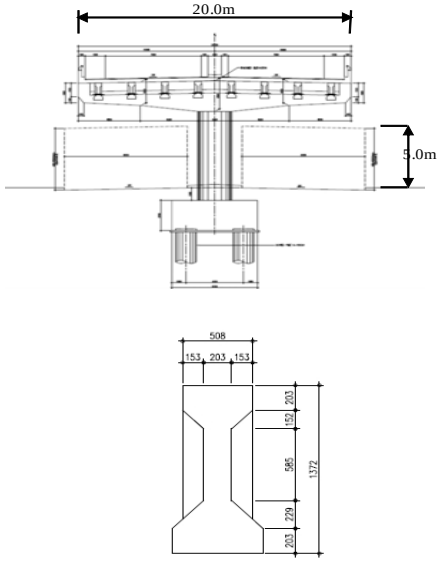
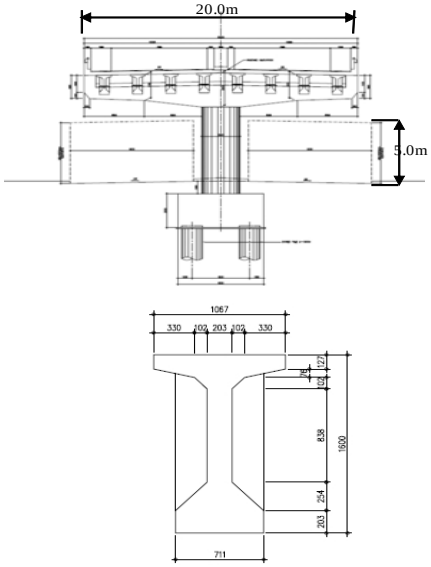
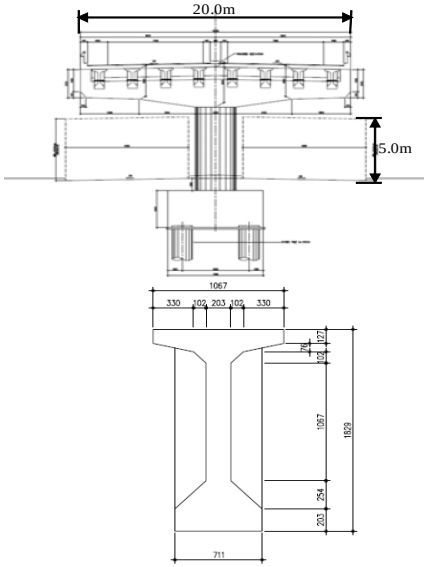
- Constructed by MMDA.
- Recommended to remain.

3.12 ECONOMICAL SPAN LENGTH FOR THE STANDARD EXPRESSWAY SECTION

When a span length is longer, construction cost becomes higher unless deep foundation (say more than 30 m) is required. 2010 FS is adopting AASHTO PC Girder of 40 m span length for the standard (or straight) viaduct section, which seems to be an expensive solution. Cost comparison for various span lengths was made as shown in **Table 3.12-1.**

The most economical span is 35 m, thus this study adopts 35 m AASHTO PC Girder for the construction cost estimate.

TABLE 3.12-1 COST COMPARISON OF SPAN LENGTH FOR PC GIRDER

Description	Alternative-1	Alternative-2	Alternative-3	Alternative-4
	L=28m	L=30m	L=35m	L=40m
Section	 Girder Section	 Girder Section	 Girder Section	 Girder Section
Structural Features	- AASHTO Type-IV Girder (H=1,372mm) - Superstructure depth: minimum 1,882mm - Pierhead height: 2.8m - Circular section column ϕ2.5m - Four (4) ϕ 1,500 bored piles foundation	- AASHTO Type-IV Girder (H=1,372mm) - Superstructure depth: minimum 1,882mm - Pierhead height: 2.8m - Circular section column ϕ2.5m - Four (4) φ1,500 bored piles foundation	- AASHTO Type-V Girder (H=1,600mm) - Superstructure depth: minimum 2,110mm - Pierhead height: 3.2m - Circular section column ϕ2.8m - Four (4) φ1,500 bored piles foundation	- AASHTO Type-VI Girder (H=1,829mm) - Superstructure depth: minimum 2,339mm - Pierhead height: 3.5m - Circular section column ϕ3.0m - Four (4) φ1,800 bored piles foundation
Cost per 1,000m (per sq.m) <Rate>	P 920,950,827 (P 51,164) <1.050>	P 906,186,554 (P 50,344) <1.033>	P 877,404,163 (P 48,745) <1.000>	P 982,795,854 (P 54,600) <1.120>
Recommendation	3	2	1	4

3.13 REGULATION OF OVER-LOADING

(1) Vehicle Regulation

Vehicle regulation shall be conducted in accordance with the country's rules (including Laws and Acts), and following standard procedures. As necessary, it shall be taken actions co-operating with Police, Fire or other organizations. The highest concern about highways in Philippines (especially at NAIAX) is over-loading vehicle. This section states that examples and proposal of over-loading regulation.

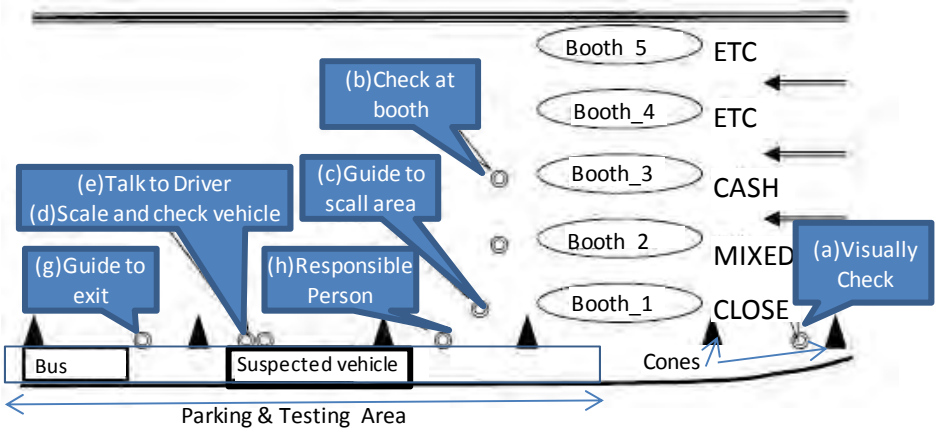
The most common and simplest method of regulation of over-loading is taking actions at toll plazas. Vehicles should stop at toll booths. This time vehicle weight can be easily scaled, and prohibit entering the highway. However, when "open system" or aggregation of toll plaza are adopted for highway, entrances do not always have toll plaza. In addition, ETC vehicles which do not need to stop at toll plaza for payment can easily pass through toll plaza without stopping.

In Japan, enforcement of over-loading is conducted with Police regularly twice or third per month at the large toll barriers. The example is shown in **Figure 3.13-1**. In order to conduct enforcement, large spaces ARE required (parking and scaling area). In preparation for enforcement, procedures and alignment of traffic control officers are defined in details as shown in **Figure 3.13-2** as well. At ETC lanes, motorists basically do not stop, thus enforcement is not conducted at ETC lanes.

In the Philippines, Tollways Management Corporation (TMC) (operating company of NLEX) conducts inspection of over-loading vehicles. They limit lane for large vehicles. The right end lane only (which is the most far from median), NLEX has also been successful EC-tag for class 1 vehicles only (i.e. class3 vehicles cannot use ETC). If EC-tag is installed in NAIAX, the similar method can be used.

However, E-pass system which is used in SKYWAY allowed all classes for ETC usage. There are two large differences from Japanese ETC situation; 1) ETC usage is not so high still 20-30%, and 2) even at ETC lane, motorists have to stop if their accounts are less than minimum (red light flashes on toll booth). These differences indicate that it could be relatively easy to stop traffic even at ETC lane, at least by posting temporary notice sign boards upstream toll booths (such as "ALL VEHICLE STOP AT BOOTH" or so on). Taking into account the second difference it is estimated that capacity at ETC lane could be quite low. From TMC's experience they observe ETC lane hourly capacity to be around 600vehicles (comparing with Japanese case which is 800-1000 vehicles/hour at ETC lane).

Therefore, in this report, to conduct regular enforcement actions, to control large vehicle lane upstream of toll plaza when enforcement actions are on-going, and to stop each vehicle at a toll plaza are recommended.



[EXAMPLE assigning tasks for each role]
(a)Visually check: find suspected vehicles, and report (b)
(b)Check at Booth: pass warning brochure (within a certain limits)
or Guide to scale & testing area (over a certain limits)
or Stop traffic when suspected vehicle is guided to scale area
(c) Guide to scale and check area
(d) Scale a suspected vehicle and create survey sheet.
(e) Check the permission with driver, question and interview with driver
(g) Guide to exit from scale & testing area
(h) Responsibile person: overview the whole enforcement, order promptly each staff as necessary, and check the safety

FIGURE 3.13-1 ONE EXAMPLE OF OVER-LOADING REGULATION AT TOLL BARRIERS (MEX IN JAPAN)

※In Japan, the road company issue permission with conditions even though a vehicle is over regulation length, width, weight, or height, when there is some special reason for the issued vehicle. However, if the issued vehicle is over the permission sizes, or permission conditions, the vehicle should be apprehended.

The other option for over-loading regulation is automatic weigh in motion scale (WIM), which can scale vehicle axle weight with slow speed at toll booths. One example of WIM facilities at toll plaza and recorded image of over-loading vehicles are shown in **Figure 3.13-2**, which is Tokyo Metropolitan Expressway's (MEX) example. Almost 80% of toll booths are installed at MEX, because it has a significant large number of trucks or large vehicles (eg. 2.5 times number of vehicles of other highways and 10 times of general national roads). WIM scales all vehicles passing toll booths and record number plates and drivers' figures if over-loaded vehicles are detected. In case of that drivers have broken this law three times, the operating company send warning letter and at the same time send the District Transport Bureau (similar organization to Land Transportation Office) requesting for administrative penalties. Total cost for one lane including cameras and recording system is approximately 50M yen (i.e. Php25M). It is very expensive, but it might be one option for over-load vehicle regulation. If lanes are limited for large vehicles, it might reduce the number of lane for installation.

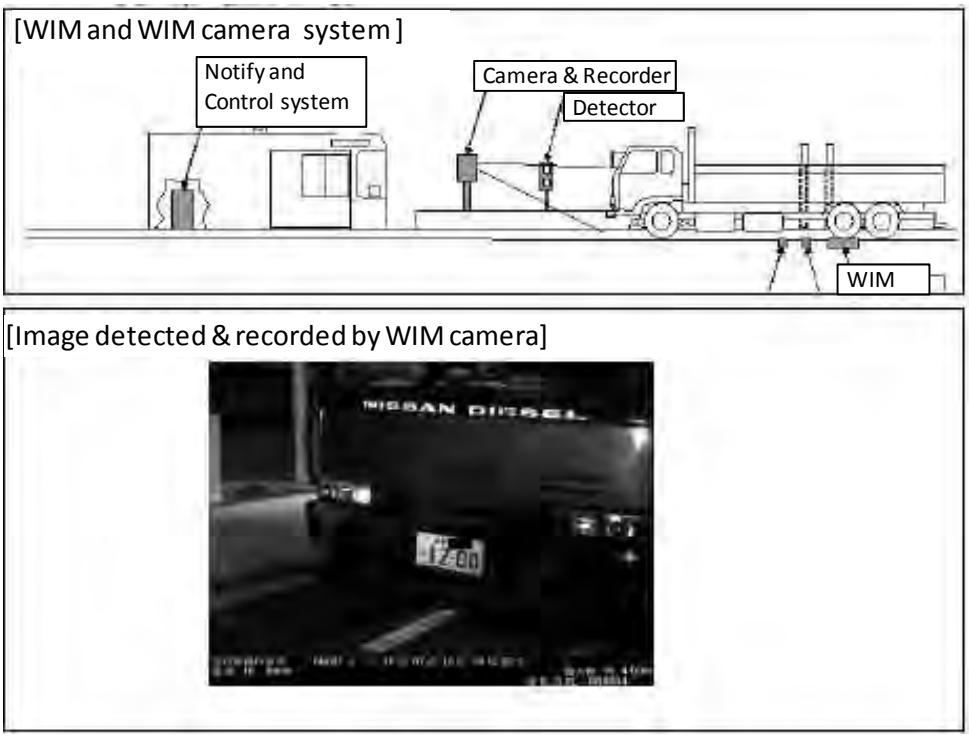


FIGURE 3.13-2 ONE EXAMPLE OF WIM AND IMAGES RECORDED BY WIN SYSTEM (MEX IN JAPAN)

CHAPTER 4
TRAFFIC STUDY

4.1 PRESENT TRAFFIC CONDITION

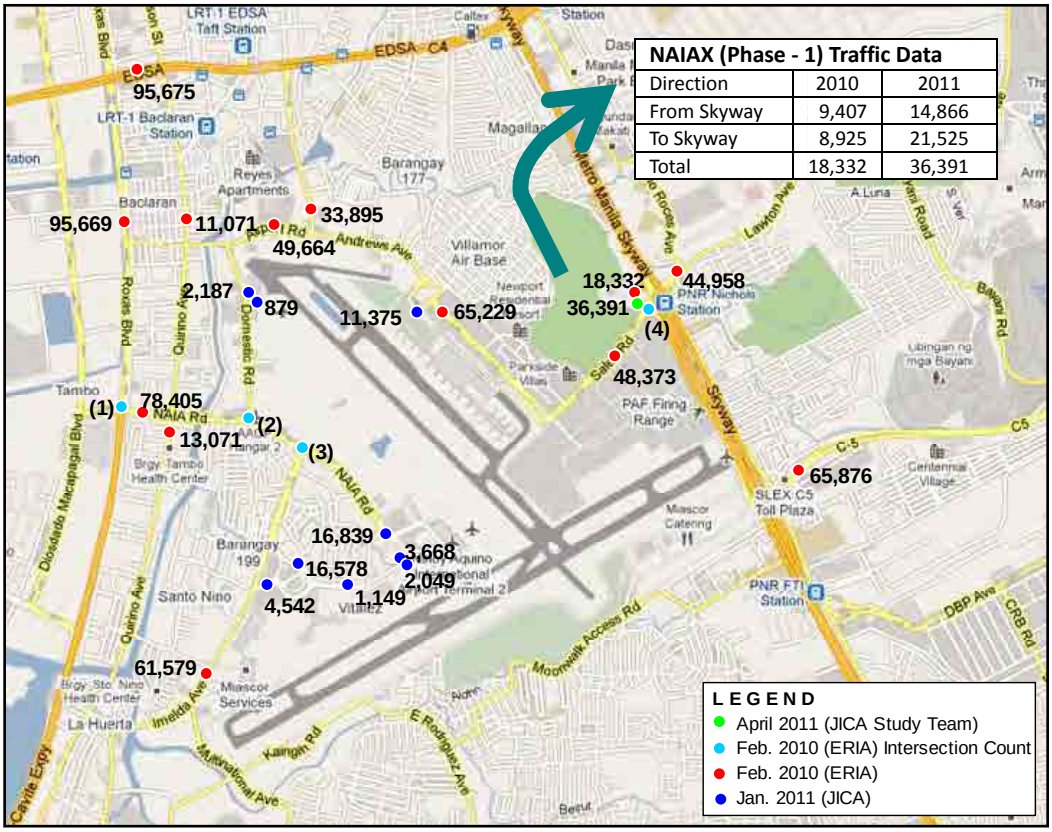
4.1.1 Traffic Count

a. Traffic Volume

Traffic volume of roads surrounding the NAIA airport is shown in **Figure 4.1.1-1**. As seen in the figure, there is high number of vehicles to the corridor where the future expressway runs over – 48,373 at Sales Road, 65,229 at Andrew's Avenue, 78,405 at NAIA Road (Seaside Drive). Data denotes the number of vehicles.

Recorded traffic at NAIA Expressway (Phase - 1) in 2010 is 18,332 vehicles in both directions. This number increases to 36,391 this year with 60% of traffic moving in the direction of Skyway. Most of these vehicles entering Skyway are exiting to Makati exits of Skyway (Magallanes exit and Osmena exit). At present, use of the entire stretch of NAIA expressway is free of charge as well as use of portion of Skyway (from NAIA Expressway to Skyway Makati exits) is also free of charge. However, a 50 pesos fee might be collected by Skyway management in future if their request is approved by the Toll Regulatory Board (TRB). Skyway management said that the fee is for the use of Skyway's portion and not intended for the use of NAIA Expressway.

Number of vehicles recorded at the main entrance of terminals of the airport is also significant: 16,578 (Terminal 1), 16,839 (Terminal 2) and 11,375 (Terminal 3). Likewise, traffic recorded at the gate of Cargo Terminal (at Terminal 1) is 1,149 vehicles. Meanwhile, observed traffic volume at the major corridors in vicinity of the airport is high: 95,669 in Roxas Boulevard and 95,675 in EDSA. The traffic volumes in the four intersections are shown from **Figure 4.1-2** to **4.1-5**.



Note: Feb 2010 data (NAIA - FS by ERIA), Jan. 2011(Study on Airport Strategy for Greater Capital Region by JICA). ***Both data are in ADT (Average Daily Traffic)****.*

FIGURE 4.1.1-1 TRAFFIC VOLUME OF ROADS SURROUNDING NAIA AIRPORT

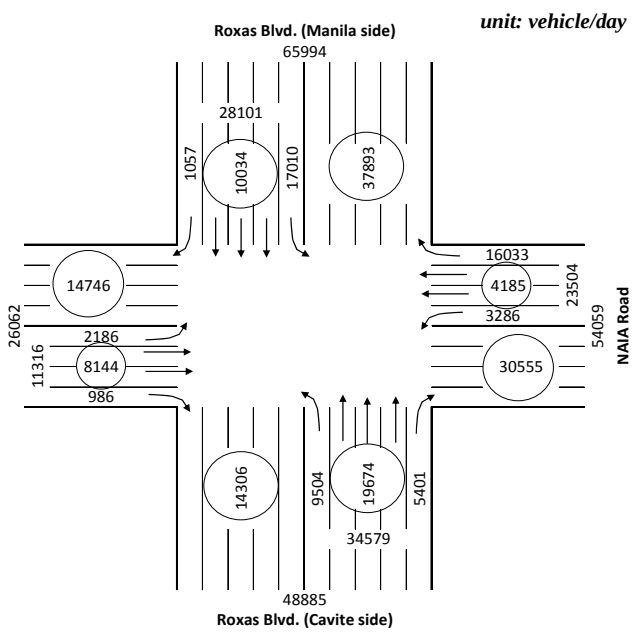
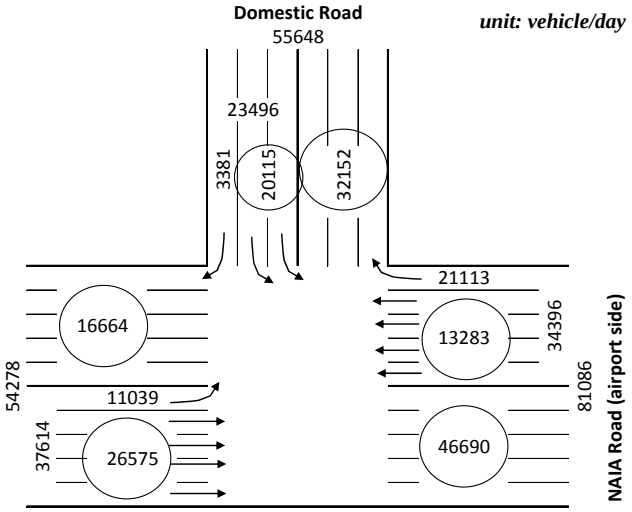


FIGURE 4.1.1-2 ROXAS -NAIA INTERSECTION



Note: All counts are expanded 24-hr from 16-hr count

FIGURE 4.1.1-3 NAIA-DOMESTIC INTERSECTION

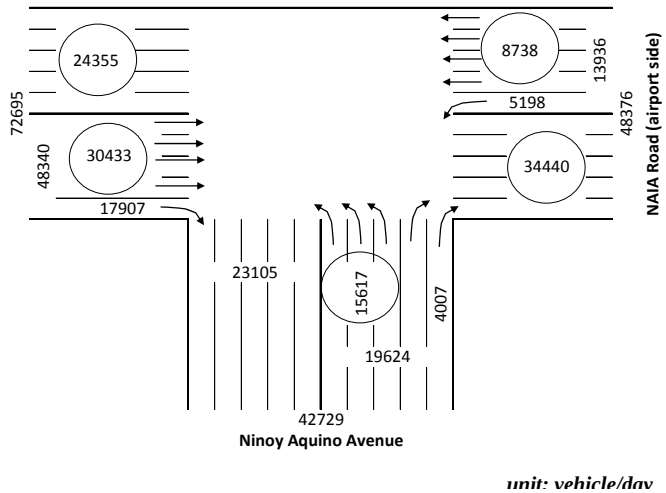


FIGURE 4.1.1-4 NAIA-NINOY AQUINO AVE. INTERSECTION

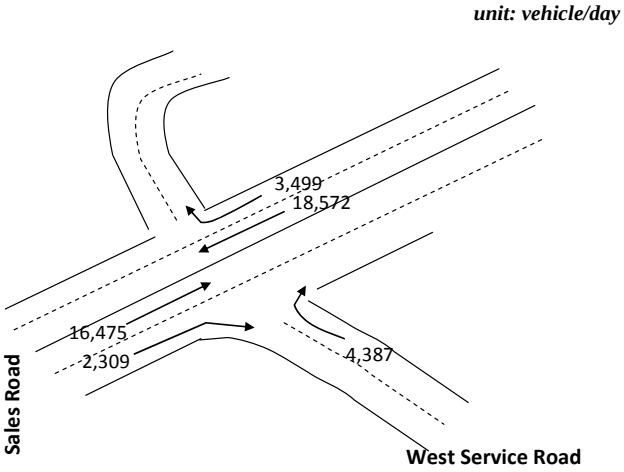


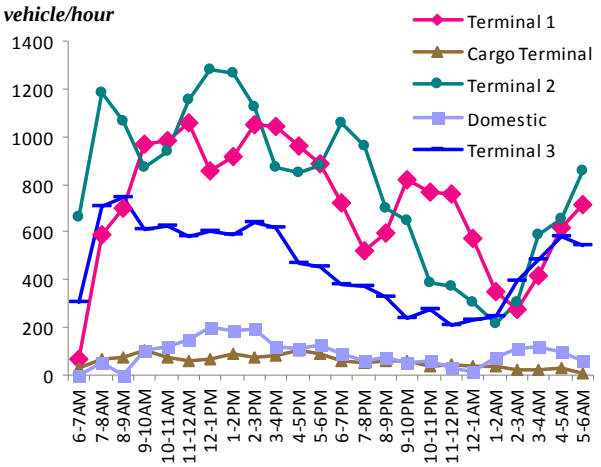
FIGURE 4.1.1-5 SALES ROAD-WEST SERVICE ROAD INTERSECTION

b. Hourly Variation of Traffic

The hourly variation of traffic accessing terminals of the NAIA airport is shown in **Figure 4.1.1-6** and **Figure 4.1.1-7**. Peak hours to almost all terminals are noon time (11:00AM to 3:00PM) and traffic drastically decreases at midnight (1:00AM to 3:00AM). The highest number of vehicles recorded in an hour is 1,283 at Terminal 2. There is no observed difference of traffic characteristics between weekday and weekend day.

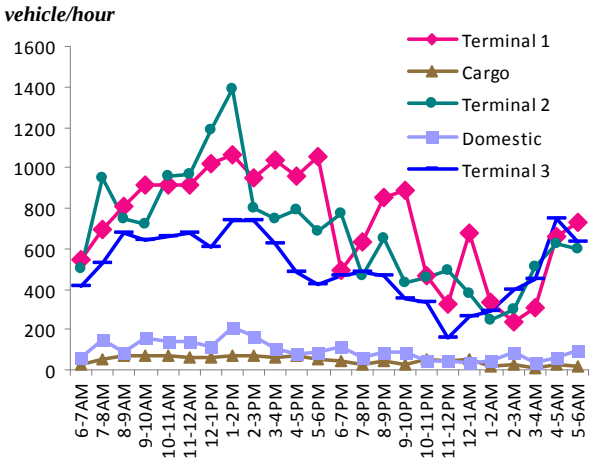
The variations of traffic on the road where the expressway will run over are shown in the **Figure 4.1.1-8** and **Figure 4.1.1-9**. At Sales Road, peak hours of traffic are between 8:00AM to 11:00AM during weekday. On weekend day however, there is an observed very high volume of vehicles from 5:00PM onwards moving in the direction of Andrew's Avenue.

At Andrew's Avenue (near Aurora Road), both on weekday and weekend day, there is a constant high volume of vehicles from 6:00AM to 7:00PM with each direction has more than 1000 vehicles per hour as presented in **Figure 4.1.1-10** and **Figure 4.1.1-11**. Highest recorded number of vehicles in an hour is 2,119 on weekday and 2,862 on weekend.



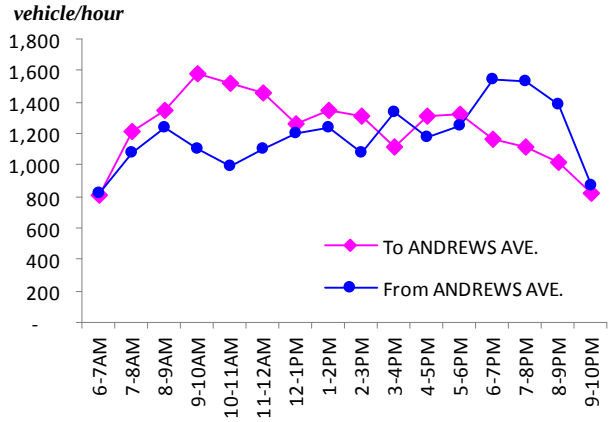
(Week day)

FIGURE 4.1.1-6 HOURLY VARIATION OF TRAFFIC AT AIRPORT TERMINALS



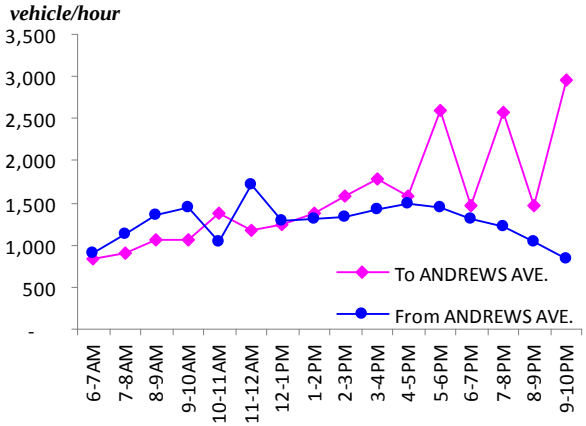
(Weekend day)

FIGURE 4.1.1-7 HOURLY VARIATION OF TRAFFIC AT AIRPORT TERMINALS



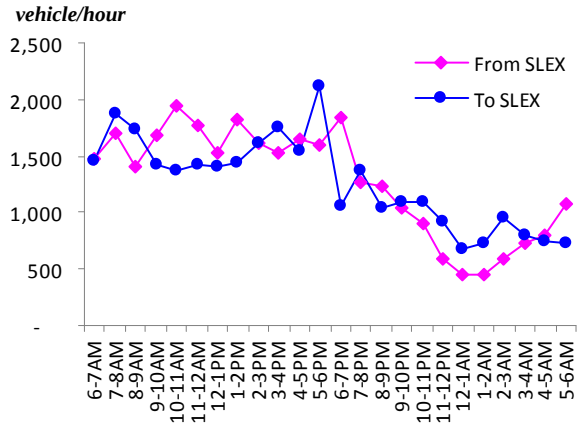
(Week day)

FIGURE 4.1.1-8 HOURLY VARIATION OF TRAFFIC AT SALES ROAD



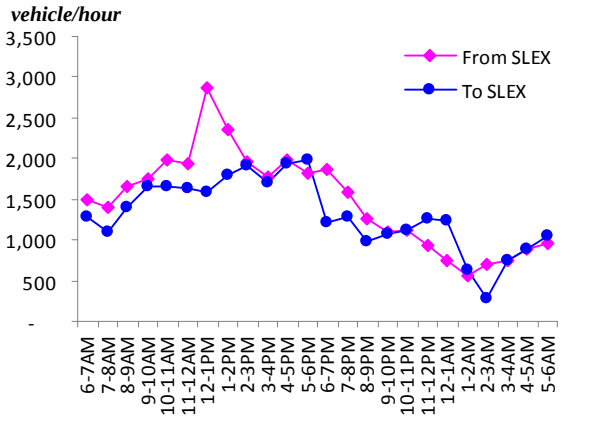
(Weekend day)

FIGURE 4.1.1-9 HOURLY VARIATION OF TRAFFIC AT SALES ROAD



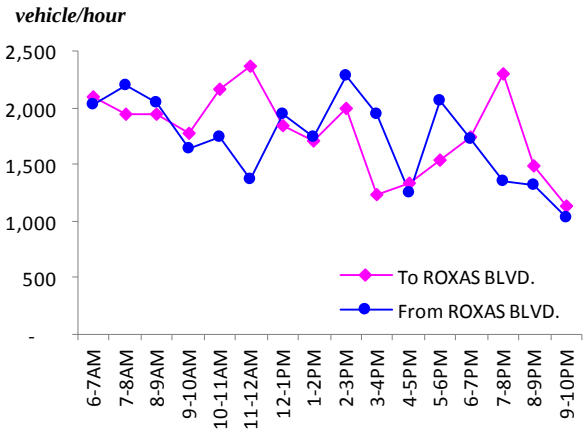
(Week day)

FIGURE 4.1.1-10 HOURLY VARIATION OF TRAFFIC AT ANDREW'S AVENUE (NEAR AURORA ROAD)



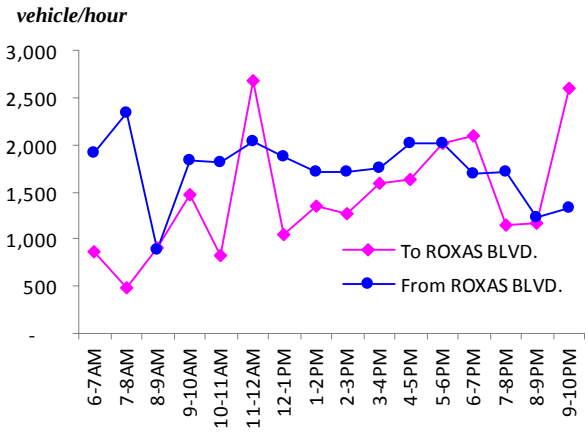
(Weekend day)

FIGURE 4.1.1-11 HOURLY VARIATION OF TRAFFIC AT ANDREW'S AVENUE (NEAR AURORA ROAD)



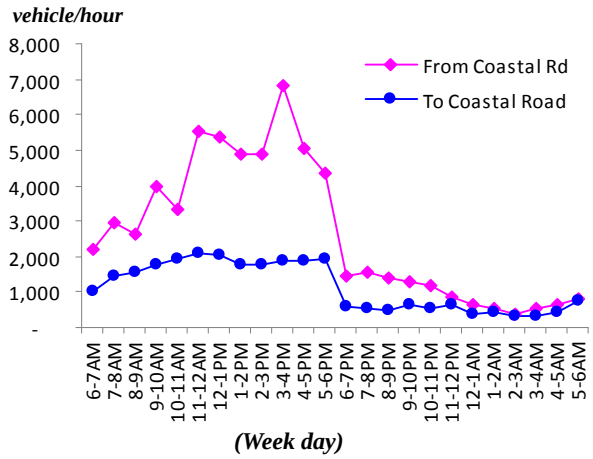
(Week day)

FIGURE 4.1.1-12 HOURLY VARIATION OF TRAFFIC AT ANDREW'S AVENUE (NEAR DOMESTIC ROAD)



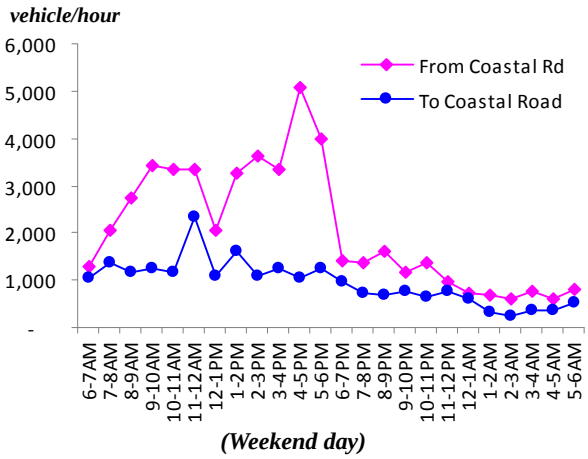
(Weekend day)

FIGURE 4.1.1-13 HOURLY VARIATION OF TRAFFIC AT ANDREW'S AVENUE (NEAR DOMESTIC ROAD)



(Week day)

FIGURE 4.1.1-14 HOURLY VARIATION OF TRAFFIC AT NAIA ROAD



(Weekend day)

FIGURE 4.1.1-15 HOURLY VARIATION OF TRAFFIC AT NAIA ROAD

Traffic volume at Andrew's Avenue near Domestic Road is also very high and number of vehicles recorded constantly exceeded 1,000 vehicles an hour from 6:00AM to 9:00PM on weekdays as shown in **Figure 4.1.1-12** and **Figure 4.1.1-13**. On weekend day however, traffic characteristics changes and there is a very high peak of traffic at noon time in the direction of Roxas Boulevard. Traffic's peak hour is again observed at 9:00PM to 10:00PM in the same direction. This peak hour might have something to do with airlines schedule.

At NAIA Road (Seaside Drive), both weekday and weekend day have the same traffic characteristics, i.e. flow in the direction of coastal road is higher than the opposite traffic and traffic volume substantially decreases from 6:00PM onwards. Peak hours of traffic however are different – peak hours on weekday are from 11:00AM to 5:00PM and from 9:00AM to 5:00PM on weekend day. See **Figure 4.1.1-15** and **Figure 4.1.1-16**.

c. Vehicle Composition

Most of the vehicles recorded at the main gates of airport terminals were composed of private cars. At Terminal 1, 99% were cars and the remaining 1% is composed of buses. At Cargo Terminal, cars share is 70% and truck's share is 30%. It should be noted that car, van and jeep were categorized under car. And under the category of cars, vans and private jeeps have the highest share (80%). These vans and jeeps were used to transport small volume of cargoes. See **Figure 4.1.1-17**.

At Terminal 2, share of cars is 86%, jeepneys is 7%, buses is 4% and trucks is 3%. At Domestic Airport, 99% of the traffic is cars. At Terminal 3, share of car is about 98% and the remaining 2% is shared by bus and truck.

The main users of the corridor where the future NAIA expressway runs above are cars as shown in **Figure 4.1.1-18**. Share of cars at Sales Road is 69%, 67% at Andrew's Ave. (near Aurora St.), 58% at section of Andrew's Ave. near Domestic Road, and 66% at NAIA Road (Seaside Drive).

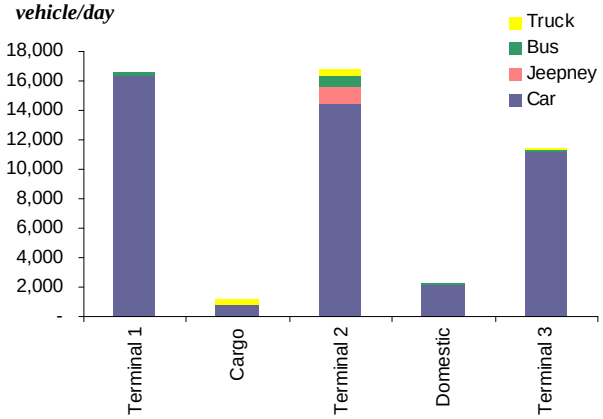


FIGURE 4.1.1-16 TRAFFIC COMPOSITION AT NAIA TERMINALS' MAIN GATES

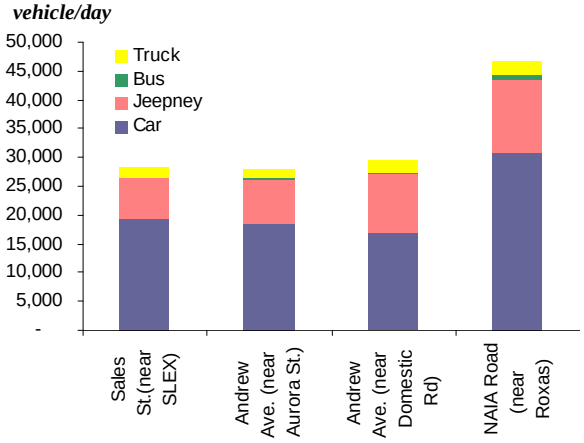


FIGURE 4.1.1-17 TRAFFIC COMPOSITION AT ROADS WHERE THE FUTURE NAIA EXPRESSWAY RUNS OVER

4.1.2 Travel Time Survey

Travel time survey was conducted in April 15, 2011 (Friday) from 7:00AM to 9:00PM. A single run every hour was carried out to determine the most congested period. **Figure 4.1.2-1** shows the 5:00PM travel speed of roads where the future NAIA Expressway runs over.

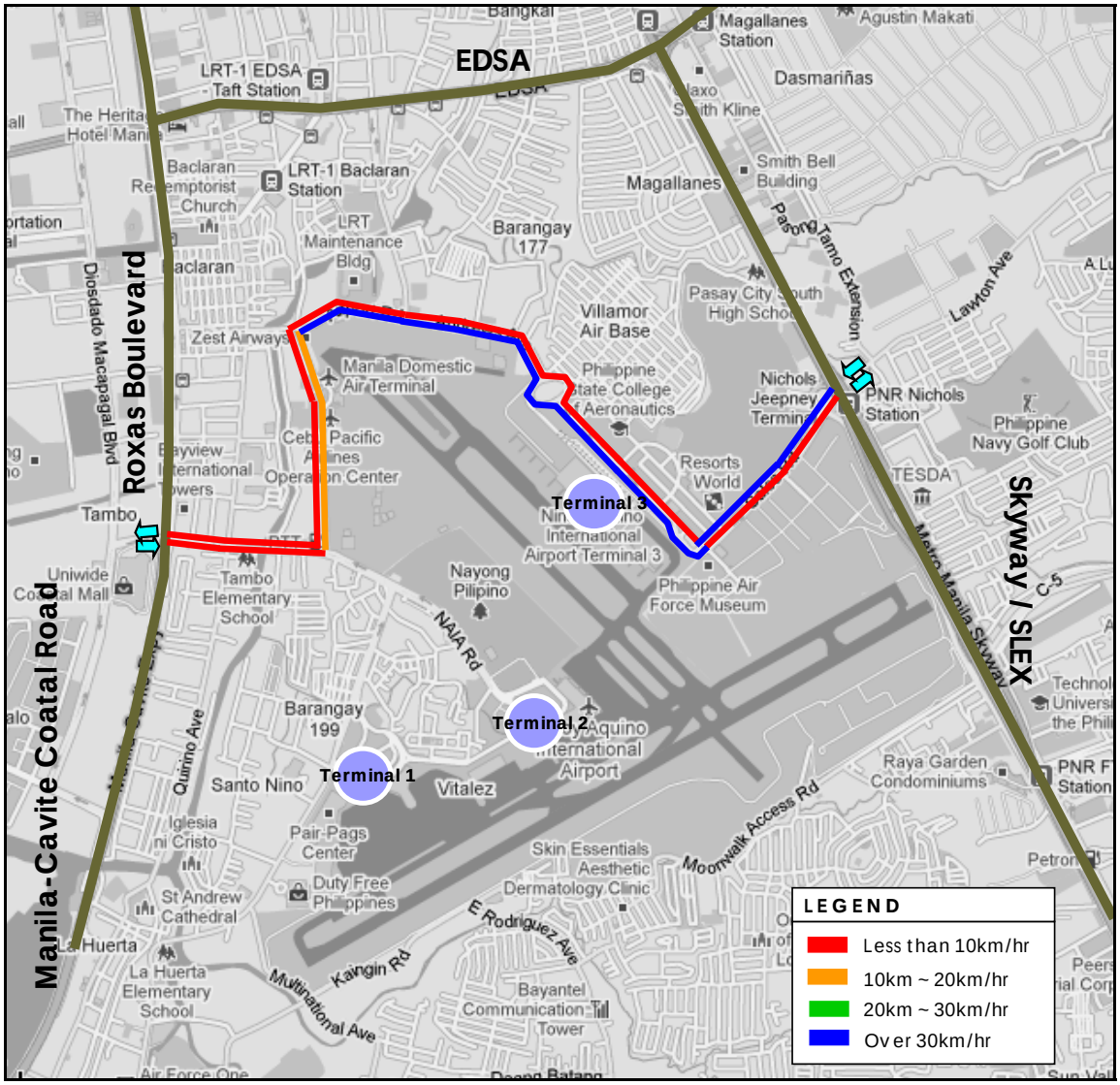
a. Travel Time Survey Results

Roxas Boulevard to SLEX

This road (MIA/NAIA Road) serves as main access road to Terminal 1 and Terminal 2 of passengers coming from Roxas Boulevard and Cavite Coastal Road. Recorded traffic reaches almost 80,000 a day. Motorists using this road had travel time speed of barely over 5 km/hr which indicates that the road is very congested. Turning into Domestic Road, the travel speed improved to 15.5 km/hr and accelerated to over 30 km/hr at some portion of Domestic Road and Andrew's Avenue. However, serious traffic congestion is again experienced before traffic merges with SLEX.

SLEX to Roxas Boulevard

Motorists departing from SLEX to Roxas Boulevard have to endure heavy traffic congestion where the average travel speed of the entire stretch is just 9.9 km/hr. Since the figure reflects travel speed between 5:00PM to 6:00PM, perhaps the road network is absorbing substantial number of commuters on their way home after work.



Source: JICA Study Team; Note: Travel speed above is from 5:00pm to 6:00pm period

FIGURE 4.1.2-1 TRAVEL SPEED FROM ROXAS BOULEVARD TO SLEX

b. Comparison of Travel Time and Travel Speed between Ordinary Road and NAIA Expressway

As mentioned, a single run was carried out from 7:00AM to 9:00PM to observe the changes of travel speed along the alignment of the NAIA Expressway and identify the peak hours of congestion (**Figure 4.1.2-2**). The following were the main findings of the survey:

- The longest travel time spent in the section is 36.7 minutes (5:00 PM) and the direction is from SLEX to Roxas Boulevard. This means travel speed is just 9.9 km/hr for the entire 5.8 km stretch (See **Figure 4.1.2-3**).
- The shortest travel time is just 11.4 minutes (12:00PM) in the direction of Roxas Boulevard to SLEX. Average travel speed is 30.9 km/hr.
- If NAIA expressway is built expected travel time is just 7.5 minutes (without stop time at toll both) from Roxas Boulevard to Skyway. The travel speed is about 45 km/hr for the entire 5.6 km expressway stretch.

Figure 4.1.2-3 shows the travel speed of ordinary road and expressway. The compared section is from SLEX to Off-ram at Terminal 1. The second section compared is from On-ramp of Terminals 1 and 2 to SLEX. From the figure, the following were observed:

- From SLEX exit to NAIA Road (at the location of Off-ram for Terminal 1) using ordinary road, the most congested period is 5:00PM where it took almost 40 minutes to traverse the entire section. Travel speed is merely 8.8 km/hr (See **Figure 4.1.2-4**).
- If expressway is built, travel time is about 8.0 minutes (without the stop time at toll both) which means motorists will save about 32 minutes during this peak period.
- From NAIA Road (at the location of On-ramp for Terminal 1 and 2) to SLEX using ordinary road, the longest travel time is 21.7 minutes (5:00PM) and the shortest travel time is 9.5 minutes. Travel speed is about 15.0 km/hr.
- If expressway is used, the travel time is around 7 minutes (without the stop time at toll both). Motorists will save around 14 minutes during this peak hour.

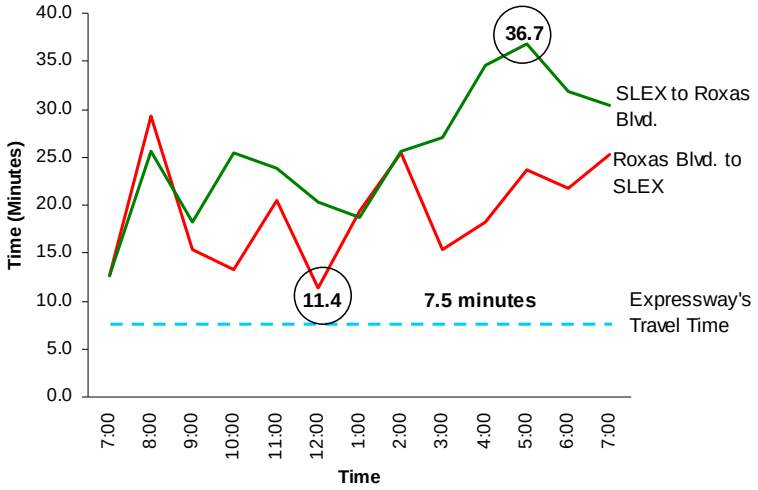
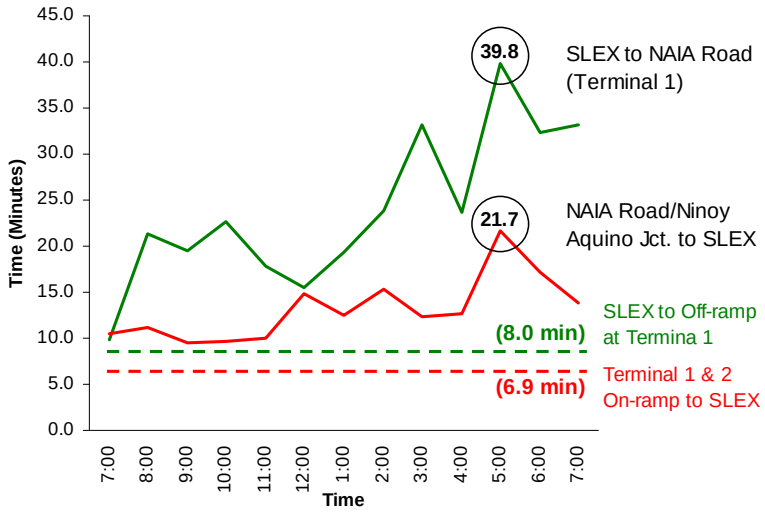


FIGURE 4.1.2-2 TRAVEL TIME FROM ROXAS BLVD. TO SLEX



Note: SLEX to Off-ram has higher travel time (8 minutes) than SLEX to Roxas (7.5 minutes) due to long down-ramp (1.18 km) which only have 35 km/hr allowable travel speed

FIGURE 4.1.2-3 TRAVEL TIME FROM SLEX TO ON-RAMP AND OFF-RAMP (TERMINAL 1 AND 2)

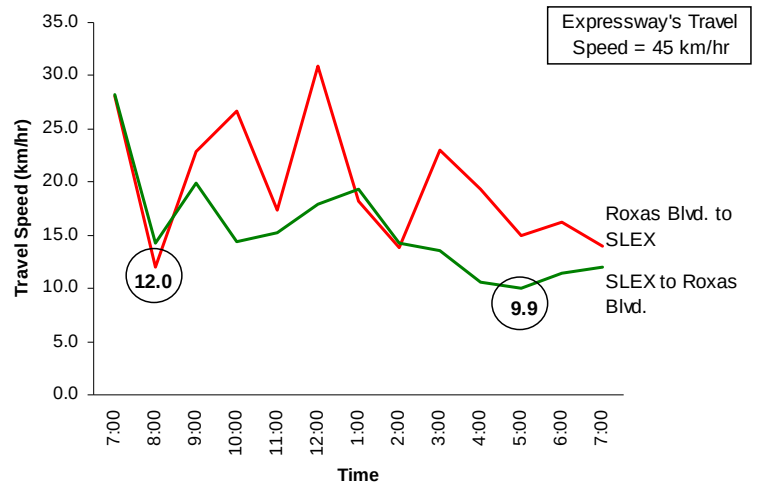
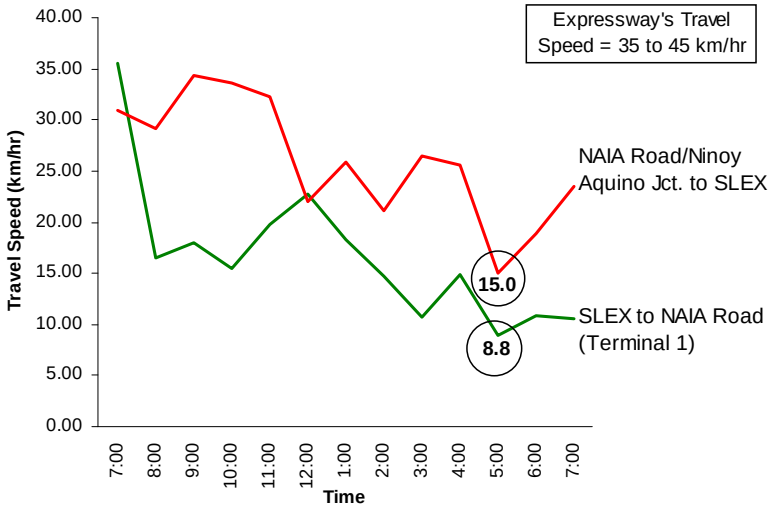


FIGURE 4.1.2-4 TRAVEL SPEED FROM ROXAS BLVD. TO SLEX



Note: 35 km/hr speed is at the branch section to Terminal 1 and 2

FIGURE 4.1.2-5 TRAVEL SPEED FROM SLEX TO ON-RAMP AND OFF-RAMP (TERMINAL 1 AND 2)

c. Current Condition of Airport Access Road

The on-going JICA study entitled “The Study on Airport Strategy for Greater Capital Region in the Republic of the Philippines” carried out analysis of the current condition of access road to NAIA airport. As seen from **Table 4.1.2-1**, there are several roads where volume of traffic has almost reached the road’s capacity. These roads are: Sales Street (0.84), Andrews Avenue (0.91), Domestic Road (0.86), NAIA Road (0.82) and Imelda Avenue and Ninoy Aquino Road (0.81). Likewise, arterial roads for access such as EDSA (1.00) and Roxas Boulevard (1.00) have almost reached their capacity.

Source: The Study on Airport Strategy for Greater Capital Region in the Republic of the Philippines, JICA (2011)

FIGURE 4.1.2-6 ROAD NETWORK OF NAIA AIPORT

TABLE 4.1.2-1 CURRENT CONDITION OF MAJOR ACCESS ROADS TO NAIA

No	Name of access road	Lanes	Width (m)	Volume/Capacity		Ratio
				Volume	Capacity	
1	NAIA Expressway	4	3.50	18,332	72,000	0.25
2	Sales St.	6	3.25	48,373	57,600	0.84
3	Andrews Ave	6	3.25	65,229	72,000	0.91
4	Aurora Blvd	6	3.25	33,895	57,600	0.59
5	Airport Road	4	3.25	N.A.	38,400	N.A.
6	Domestic Road	6	3.25	49,664	57,600	0.86
7	NAIA Road	10	3.25	78,405	96,000	0.82
8	Imelda Ave & Ninoy Aquino Ave	8	3.25	61,579	76,400	0.81
9	EDSA	10	3.25	95,675	96,000	1.00
10	Roxas Blvd	10	3.25	95,669	96,000	1.00
11	Quirino Ave	6	3.00	11,071	57,600	0.19
12	Manila-Cavite Expressway	6	3.50	62,856*	86,400	0.73

Source: Adapted from "Study on Airport Strategy for Greater Capital Region in the Republic of the Philippines, JICA (2011)".

Note:
1) Data is daily basis. "No. of vehicle" is based on traffic survey conducted under "Feasibility Study Report NAIA Expressway (Phase2)-2010" and "Capacity" is calculated based on no. of lanes and "Road construction ordinance (Japanese standard)". For Expressway, classification 2-1(expressway in urban area) is applied (18,000 veh/lane/day) while, for other roads, classification 4-1(urban road with more than 10,000 veh/day) is applied (12,000 veh/lane/day). In case of there is/are intersection(s) with signal(s) within 1km to 2km distance, the estimated capacity is deducted by 20%.

*2) * Data taken from High Standard Highway Study, JICA (2010)*

4.2 PREPARATION OF PRESENT OD MATRIX

In order to estimate accurate traffic volume of roads surrounding NAIA airport, the following were carried out:

a. Procedure in Preparation of Present OD Matrix

The process applied in establishing current origin and destination (OD) matrix involves the following:

- Present OD matrix was prepared by combination of (i) High Standard Highway Study's OD and (ii) Airport Strategy for Greater Capital Region's NAIA related OD (on-going study assisted by JICA).
- The OD matrix is then updated using the NAIA related OD of Airport Strategy for Greater Capital Region.
- The adjusted OD matrix is assigned on the network and the assigned traffic volume is compared with the result of the traffic count survey - recorded in the Feasibility Study Report NAIA Expressway (Phase-II), 2010 by ERIA - so that the adequacy for traffic assignment simulation can be justified.

Figure 4.2-1 illustrates the process of preparing present OD Matrix. Summary of present OD table is presented in **Table 4.2-1**.

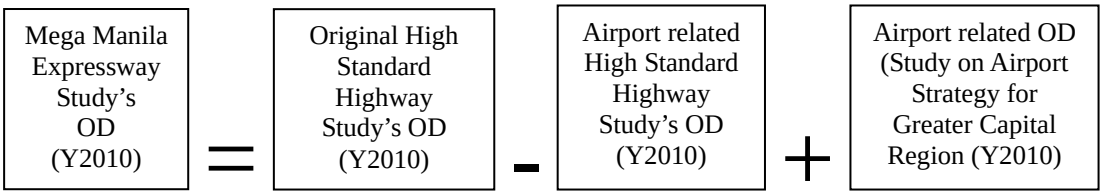


FIGURE 4.2-1 PROCESS OF PREPARATION OF PRESENT OD MATRIX

Procedure for the preparation of present traffic assignment and future traffic assignment is presented in **Figure 4.2-2**. After obtaining the accuracy of present traffic assignment, future traffic assignment is estimated as illustrated in **Figure 4.2-2**. In estimating the future traffic volume, traffic growth as well future road network development was taken into account. Likewise, since the project is a toll expressway, the results of willingness-to-pay survey were accounted to ensure that the survey result is replicated in the model.

TABLE 4.2-1 SUMMARY OF OD TABLE (2010)

Unit: '000 veh/day

	City of Manila	Quezon City	Makati City	Taguig	Las Pinas City	Pasay City	Tarlac	Bulacan	Rizal	Cavite	Laguna	Total
City of Manila	523	104	74	30	11	17	6	26	23	8	16	836
Quezon City	87	848	140	24	10	16	2	21	28	6	8	1,189
Makati City	100	92	281	43	18	40	0	6	30	8	9	628
Taguig	54	20	46	153	32	34	0	1	3	11	16	370
Las Pinas City	8	9	13	32	249	6	0	0	2	30	10	360
Pasay City	17	16	21	9	9	55	9	3	3	8	6	155
Tarlac	6	2	0	0	0	9	74	14	0	1	0	106
Bulacan	24	22	3	1	1	3	14	518	2	2	2	590
Rizal	21	28	32	4	2	3	0	2	331	2	4	428
Cavite	9	7	6	12	33	7	1	2	1	446	25	548
Laguna	7	7	5	9	7	6	1	1	7	28	292	369
Total	855	1,154	622	317	371	196	107	594	429	549	387	5,580

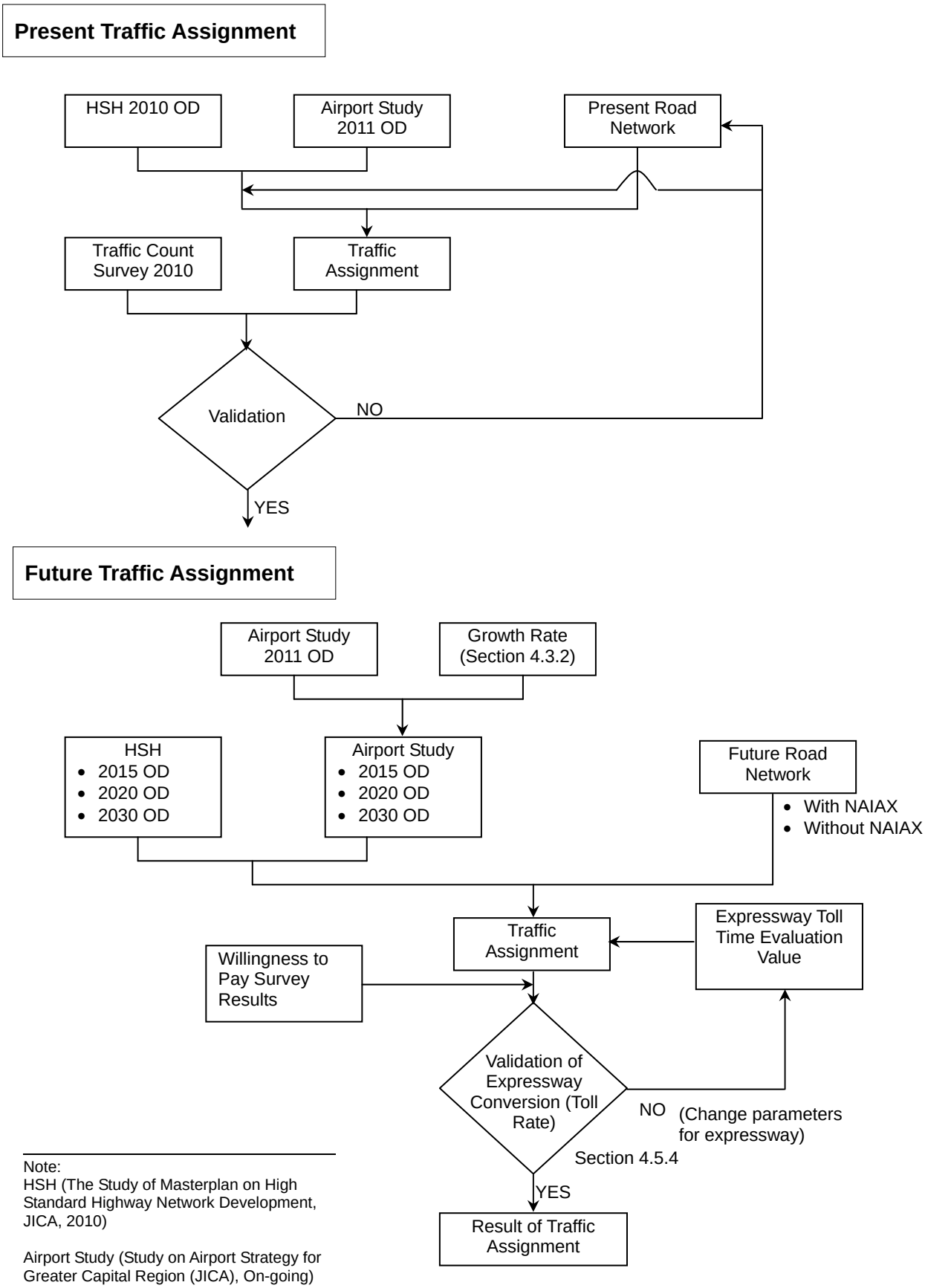


FIGURE 4.2-2 PROCEDURE FOR PREPARATION OF PRESENT AND FUTURE TRAFFIC ASSIGNMENT

b. Traffic Model Validation

The procedure of model validation entails two steps: first, the current OD matrix is assigned on an existing network. Second, the assigned traffic volume is compared with the result of the traffic count surveys at each corresponding location. This verification aims to check the accuracy of both the current OD matrix and an existing network model representing the existing transport situation.

Table 4.2-2 presents traffic volumes generated from traffic assignment and observed traffic (traffic count survey). **Figure 4.2-3** shows the result of comparison between the assigned traffic volumes and observed traffic volume. This comparison between observed traffic count and assigned traffic flow at individual sites is done via the Mean Absolute Difference (MAD)[1] Ratio. For daily traffic counts, the value of the MAD ratio is 0.12 which is considered to reflect a good calibration. By all indicators, the assignment is acceptable level to replicate year 2010.

TABLE 4.2-2 COMPARISON OF OBSERVED (SURVEY DATA) AND ASSIGNED TRAFFIC VOLUME (Veh/day)

Road Name	Observed Traffic Volume	Assigned Traffic Volume	Difference	Rate
Roxas Blvd	95,700	96,905	1,205	1%
NAIA Road	78,400	81,297	2,897	4%
Ninoy Aquino Ave	37,200	35,950	(1,250)	-3%
Airport Road	70,400	61,331	(9,069)	-15%
Aurora Road	33,900	43,430	9,530	22%
Andrews Ave	65,200	55,578	(9,622)	-17%
Total	**380,800**	**374,490**	**(6,310)**	**-2%**

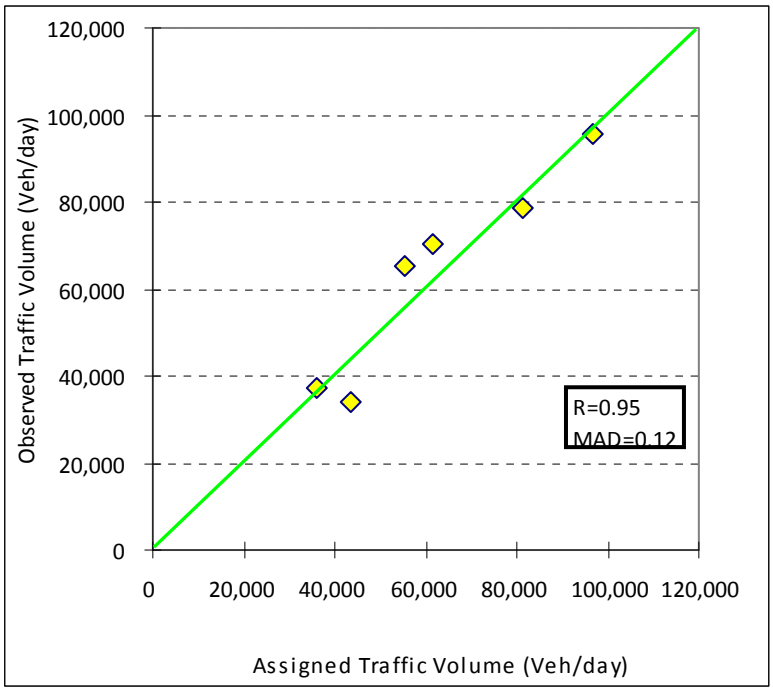


FIGURE 4.2-3 COMPARISON OF OBSERVED AND ASSIGNED TRAFFIC VOLUME (Veh/day)

[1] MAD Ratio is defined by the following formula: MAD Ratio = $\sum \left| \frac{Count - assignment}{assignment} \right| / n$ where n is the number of observations.

4.3 FUTURE TRAFFIC DEMAND FORECAST

As mentioned in the previous sections, the present OD matrix is a combination of the OD of High Standard Highway Study and the OD of Airport Strategy for Greater Capital Region' OD (or NAIA related traffic). Likewise, future traffic OD is also a combination of future OD of High Standard Highway Study and OD of Airport Strategy for Greater Capital Region's Study.

The OD matrix of High Standard Highway Study has already been prepared in the 2010 report. The future OD estimation of High Standard Highway Study is described in the succeeding section for reference.

4.3.1 Future OD Estimation by High-standard Highway Study

(1) Future OD Estimation Approach

The future OD Matrix was prepared by the following steps/procedure as shown in **Figure 4.3.1-1**.

- Trip Generation and Attraction – the prediction of trips produced and attracted to each zone;
- Trip Distribution – the prediction of origin-destination flows, the linking of trip ends predicted by trip generation;
- Modal Split – the estimation of percentages of trip flows made by each transportation mode in the model.

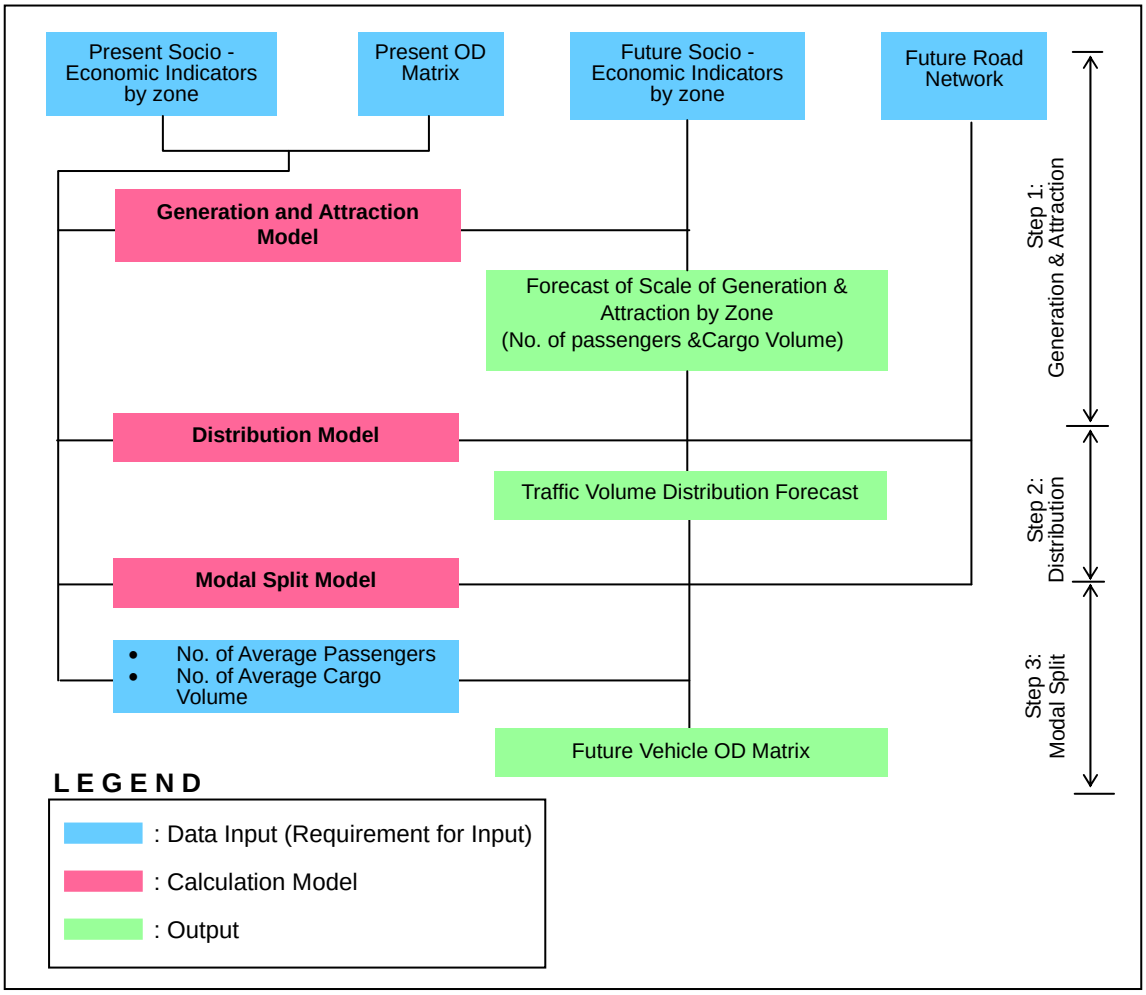


FIGURE 4.3.1-1 FUTURE OD MATRIX ESTIMATION PROCEDURE

(2) Modeling and Forecasting tolls

In all steps of travel model calibrations and demand forecast, JICA STRADA system was employed. JICA STRADA is a software tool for planning, managing, and analyzing of transportation systems. The software provides a set of tools for traffic demand modeling as well as capabilities for presentation graphics and transportation models. Modeling and forecasting in trip generation, trip distribution and traffic assignment was computed by JICA STRADA system.

(3) Traffic Demand Forecast Modeling

1) Trip Generation and Attraction Model

The objective of trip generation and attraction model is to forecast the number of trips that will start and arrive in each traffic zone within the study area. The linear regression models were adopted in the HSH Study. The model parameters are calibrated shown in **Table 4.3.1-1** and **Table 4.3.1-2**.

$$G_i = a_i * X1_i + b_i * X2_i + c_i * D_i + C$$
$$A_j = a_j * X1_j + b_j * X2_j + c_j * D_j + C$$

Where,

G_i – Trip Generation in zone i — D_i, D_j – Dummy Variables
A_j – Trip Attraction in zone j — a_i, a_j, b_i,b_j – Coefficients
$X1_i$, $X2_j$ – Attributes in zone i,j — C – Constant

TABLE 4.3.1-1 GENERATION/ATTRACTION MODELS (PASSENGER TRIPS)

Model Type	Subject Area	Attributes		Dummy Variable	Constant	R^2 Multiple Correlation Coefficient
		Population	Employment			
Trip Generation	Metro Manila (MM)	2.0928	1.0289	-1,005,653	-206,717	0.9860
	Neighboring Province of MM (Cavite, Rizal, Laguna, Bulacan)	1.3837	-	619,554	-164,274	0.9378
	Other Areas	0.0680	-	47,542	-6,448	0.9013
Trip Attraction	Metro Manila (MM)	1.9863	1.0075	-835,149	-238,716	0.9829
	Neighboring Province of MM (Cavite, Rizal, Laguna, Bulacan)	1.3981	-	612,567	-168,183	0.9375
	Other Areas	0.0616	-	55,612	-4,920	0.9117

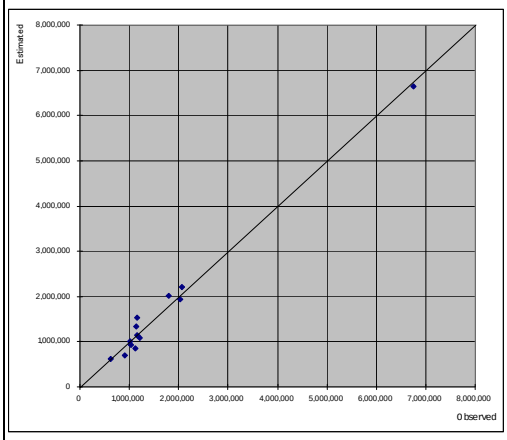
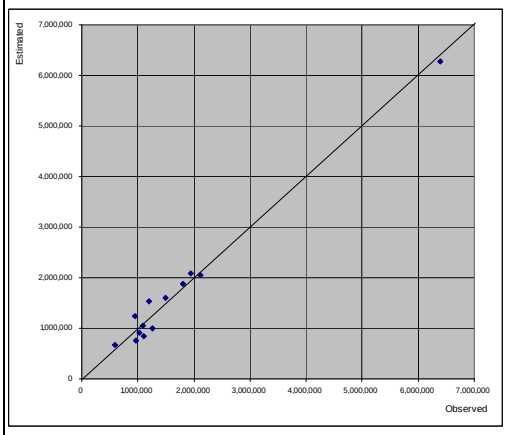
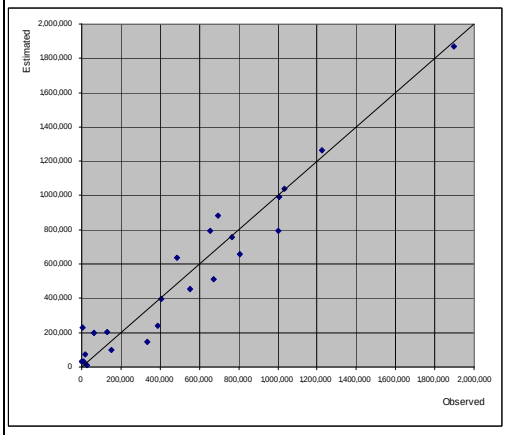
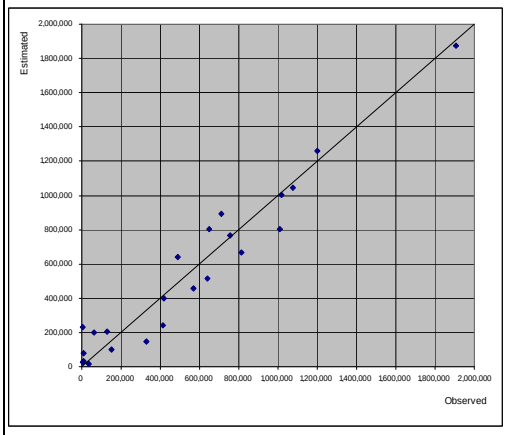
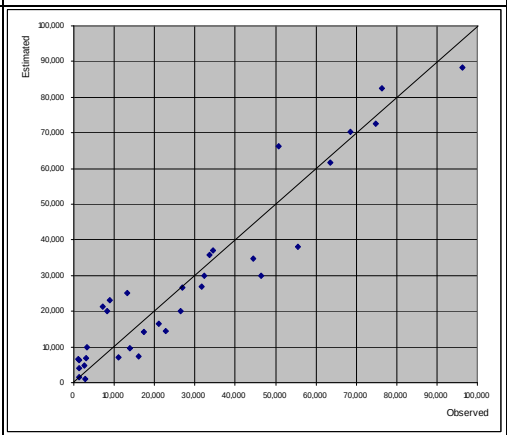
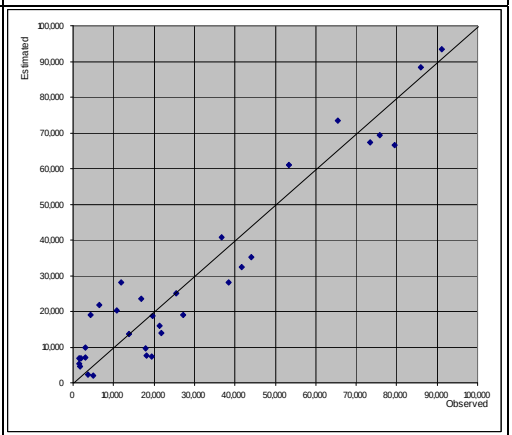
Source: JICA HSH Study (2010)

TABLE 4.3.1-2 GENERATION/ATTRACTION MODELS (CARGO MOVEMENT)

Model Type	Subject Area	Attributes		Dummy Variable	Constant	R^2 Multiple Correlation Coefficient
		Population	Employment			
Trip Generation	Metro Manila (MM)	-	271.5	201,652	-206,717	0.9808
	Neighboring Province of MM (Cavite, Rizal, Laguna, Bulacan)	-	135.9	66,565	-164,274	0.8267
	Other Areas	-	17.2	5,910	-6,448	0.7675
Trip Attraction	Metro Manila (MM)	-	241.4	-835,149	195,530	0.9638
	Neighboring Province of MM (Cavite, Rizal, Laguna, Bulacan)	-	156.8	612,567	66,185	0.8171
	Other Areas	-	19.7	55,612	6,269	0.7934

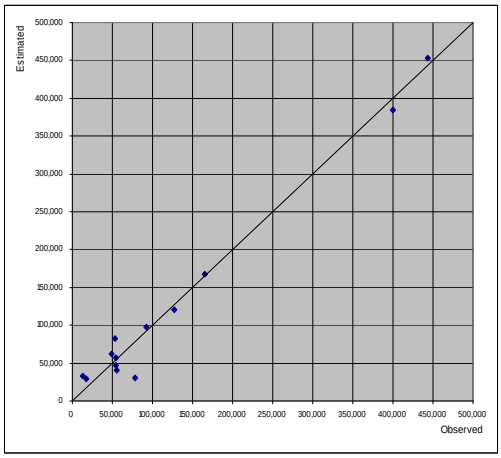
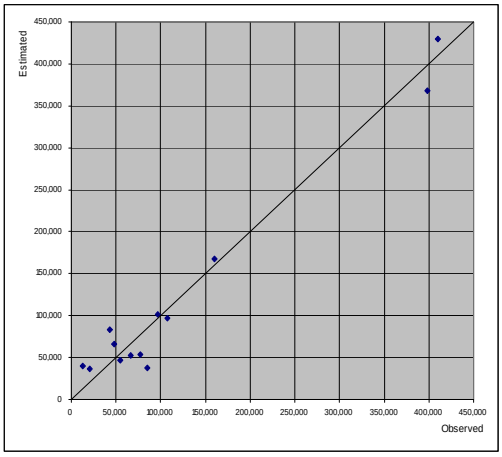
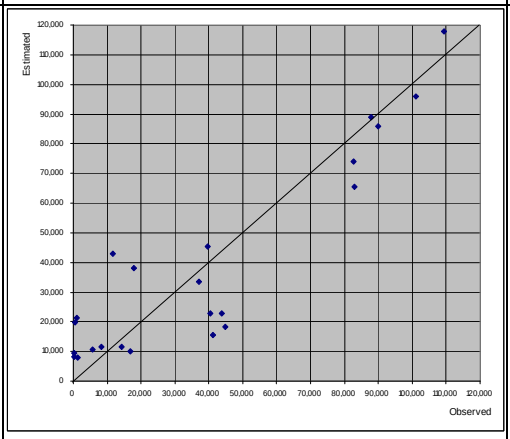
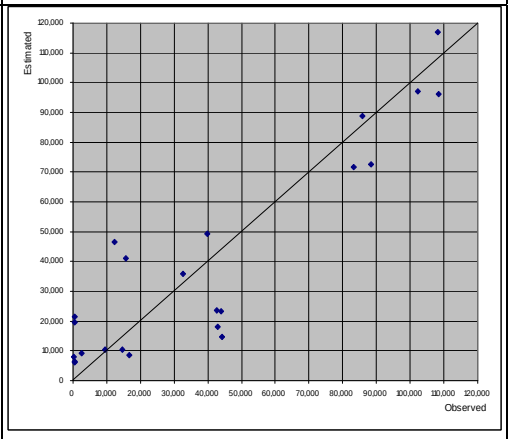
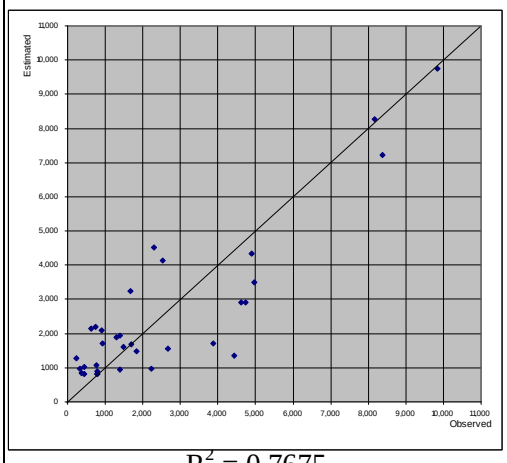
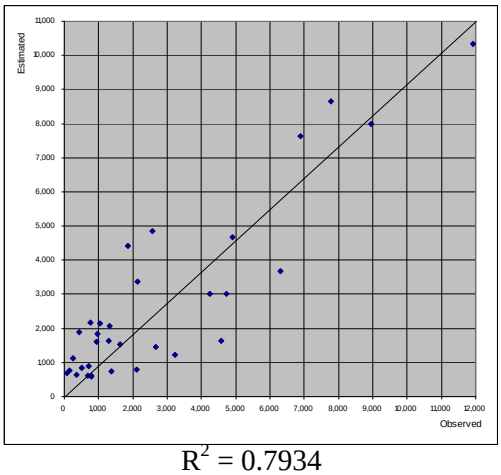
Source: JICA HSH Study (2010)

Figure 4.3.1-2 shows the verification results between observed and estimated trips for passenger trips. Likewise, **Figure 4.3.1-3** shows the verification results between observed and estimated trips for cargo movement.

		Trip Generation Model	Trip Attraction Model
Passenger Trips	Metro Manila (MM)		
		$R^2 = 0.9860$	$R^2 = 0.9829$
	Neighbo-ring Province of MM		
		$R^2 = 0.9378$	$R^2 = 0.9375$
	Other Areas		
		$R^2 = 0.9013$	$R^2 = 0.9117$

Source: JICA HSH Study (2010)

FIGURE 4.3.1-2 VERIFICATION OF TRIP GENERATION AND ATTRACTION MODEL (PASSENGER TRIPS)

		Trip Generation Model	Trip Attraction Model
Cargo Movement	Metro Manila (MM)		
		$R^2 = 0.9808$	$R^2 = 0.9638$
	Neighbo-ring Province of MM		
		$R^2 = 0.8267$	$R^2 = 0.8171$
	Other Areas		
		$R^2 = 0.7675$	$R^2 = 0.7934$

Source: JICA HSH Study (2010)

FIGURE 4.3.1-3 VERIFICATION OF TRIP GENERATION AND ATTRACTION MODEL (CARGO MOVEMENT)

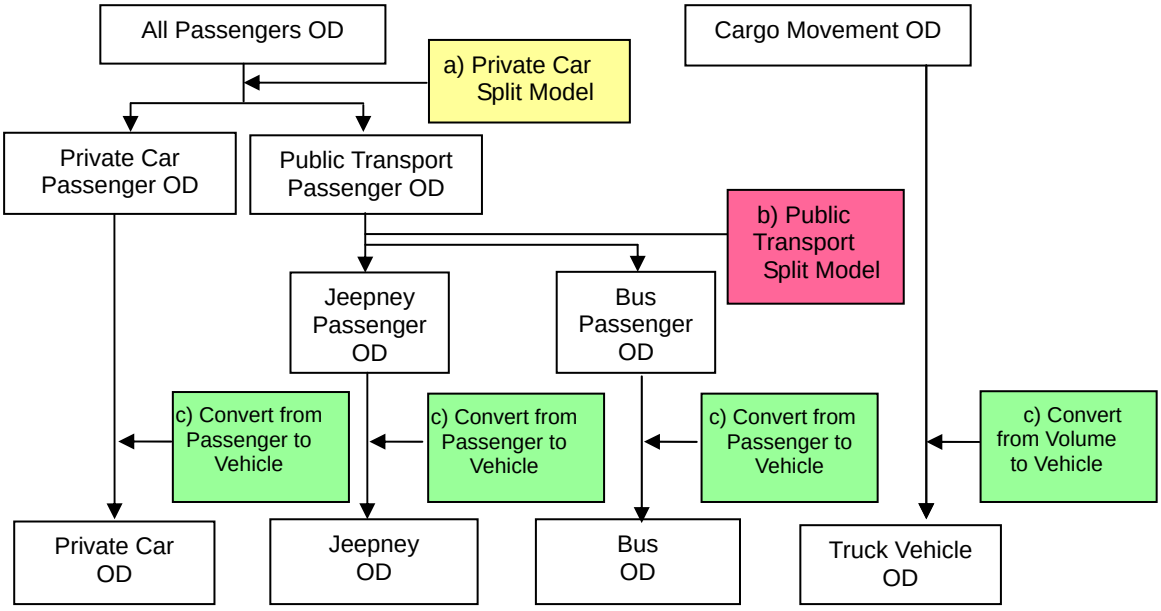
2) Forecasting Trip Distribution Model

Trip distribution is the second major step in the traffic demand modeling process. Trip production (the first major step) provided methodology for estimating trip generations and attractions within each zone. Trip distribution is the process that links the generations and attractions with each zone.

The distribution model was applied using the present pattern to estimate the future trip distribution.

3) Modal Split Model

Figure 4.3.1-4 shows the procedure of Modal Split Model.



Source: JICA HSH Study (2010)

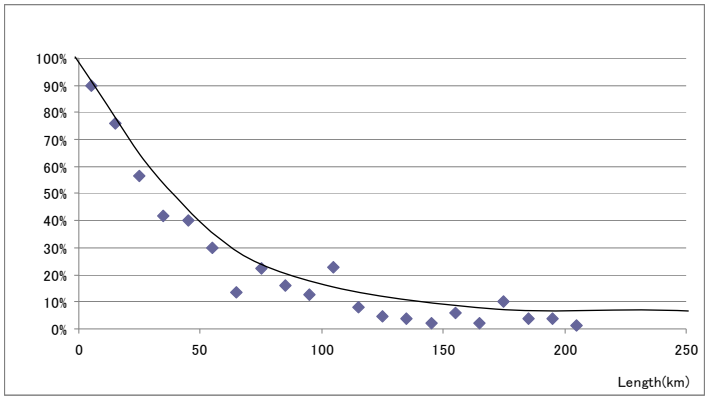
FIGURE 4.3.1-4 STRUCTURE OF MODAL SPLIT MODEL

a) Private Car Split Model

Based on the trend of vehicle registration, the number of private car passenger was estimated. Number of public transport passenger was estimated by subtracting number of private car passenger from all passengers.

b) Public Transport Split Model

The modal split between bus and jeepney was estimated by using the relationship between zone *i* and zone *j* in distance calculated on the basis of Present OD matrix. **Figure 4.3.1-5** shows the modal share of jeepney to the public transport trips.



Source: JICA HSH Study (2010); Note: Year 2009, Roadside OD Survey Result.

FIGURE 4.3.1-5 MODAL SHARES OF JEEPNEY TRIPS TO TOTAL PUBLIC TRANSPORT TRIPS

c) Convert from Passenger, Cargo Movement to Vehicle

The vehicle trips are estimated by converting passenger trips and cargo movement into equivalent number of vehicle traffic. Conversion rate is presented in **Table 4.3.1-3**.

TABLE 4.3.1-3 CONVERSION RATE

Vehicle Type	Conversion Rate
Private Car	3.5 person/vehicle
Jeepney	9.3 person/vehicle
Bus	30.8 person/vehicle
Truck	4,008 kg/vehicle

Source: JICA HSH Study (2010)

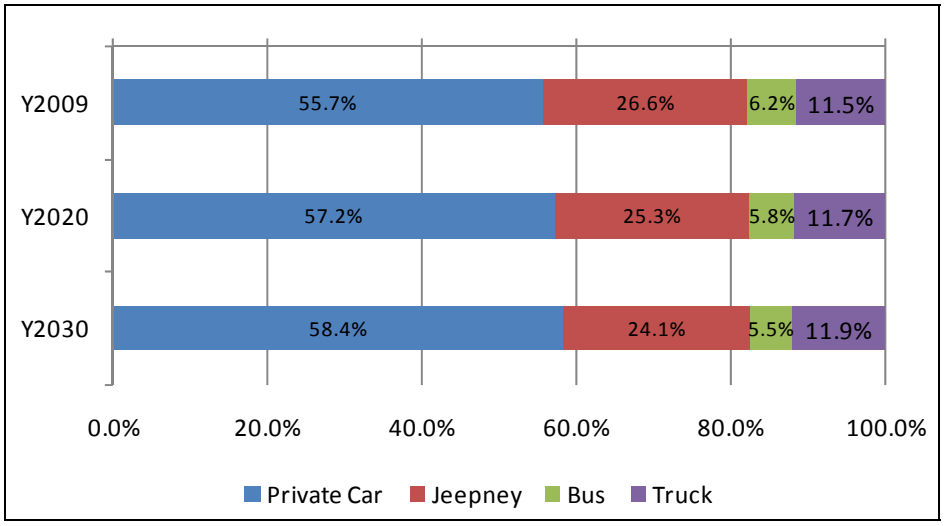
Future Vehicle OD Trips of HSH

As shown in **Table 4.3.1-4**, the total vehicle trips by applying average passenger occupancy and loading weight are estimated to be 9 million trips per day in 2030, which will be about 1.62 times of the current demand. Of these, growth rate of private cart trips will be high, thus, modal share of private car to the total vehicle will increase from 55.7% at present to 58.4% in 2030 as exhibited in **Figure 4.3.1-6**. Modal share by zone is shown in **Figure 4.3.1-7**.

TABLE 4.3.1-4 TOTAL VEHICLE TRIPS

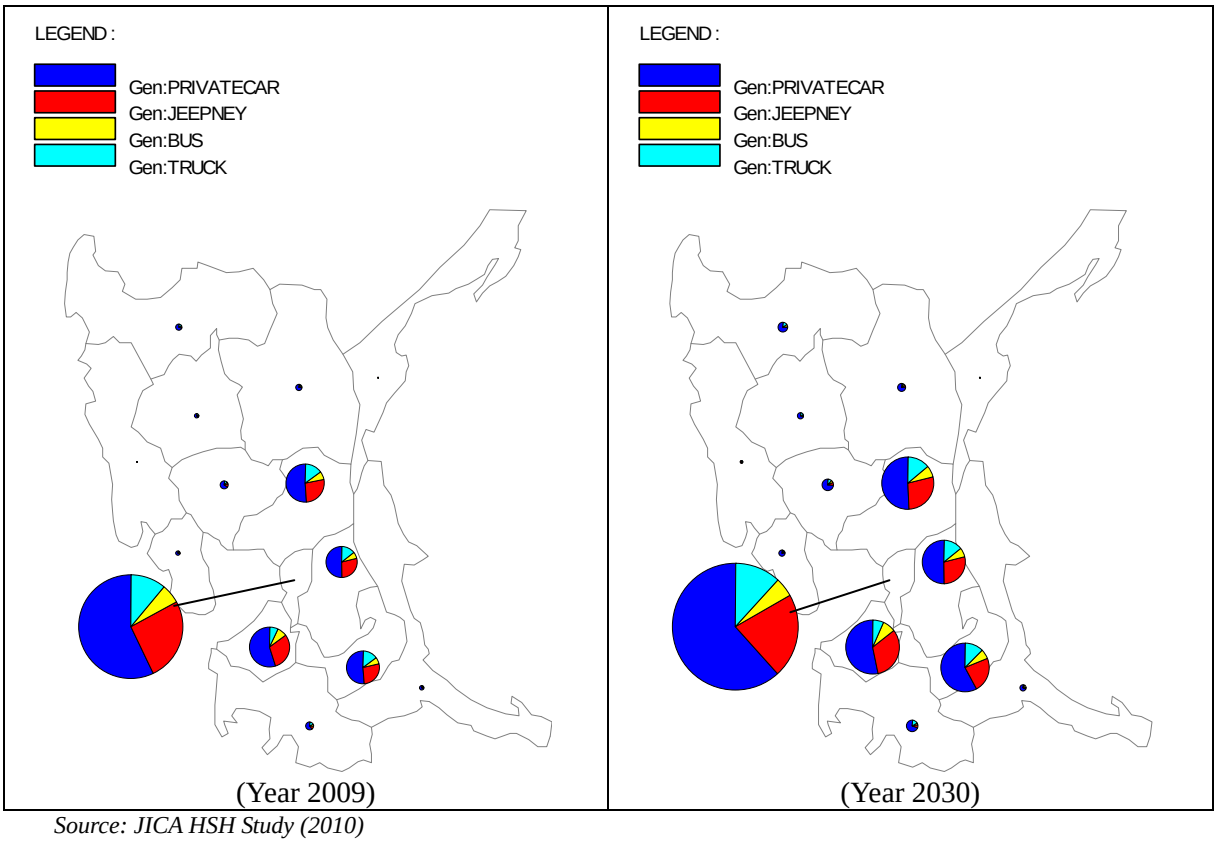
Vehicle Type	Y2009		Y2020		Y2030		Increased Ratio	
	Trips	Share	Trips	Share	Trips	Share	20/09	30/09
	1000 veh/day	%	1000 veh/day	%	1000 veh/day	%		
Private Car	3,095	55.7	4,243	57.2	5,248	58.4	1.37	1.70
Jeepney	1,476	26.6	1,873	25.3	2,170	24.1	1.27	1.47
Bus	347	6.2	431	5.8	498	5.5	1.24	1.44
Truck	641	11.5	868	11.7	1,074	11.9	1.35	1.68
Total	**5,559**	**100.0**	**7,415**	**100.0**	**8,990**	**100.0**	**1.33**	**1.62**

Source: JICA HSH Study (2010)



Source: JICA HSH Study (2010)

FIGURE 4.3.1-6 MODAL SHARE IN 2009, 2020 AND 2030 (VEHICLE BASE)



Source: JICA HSH Study (2010)

FIGURE 4.3.1-7 MODAL SHARES BY ZONE (GENERATION BASE) IN 2009 AND 2030

4.3.2 Future OD Estimation of related NAIA Traffic

Based on the present OD of related NAIA Traffic (**Table 4.2-2**), future OD was prepared by multiplying it to vehicle's growth rate as shown in **Table 4.3.2-1**.

TABLE 4.3.2-1 ANNUAL GROWTH RATE OF NAIA RELATED TRAFFIC

	2010 - 2020	2021 - 2030
Private Car	2.9%	2.1%
Jeepney	2.0%	1.5%
Bus	2.0%	1.5%
Truck	2.8%	2.2%

4.3.3 Future OD of Related NAIA Traffic

Future OD of related NAIA traffic is shown in **Table 4.3.3-1** (2015), **Table 4.3.3-2** (2020) and **Table 4.3.3-3** (2030).

TABLE 4.3.3-1 SUMMARY OF OD TABLE (2015)

Unit: '000 veh/day

	City of Manila	Quezon City	Makati City	Taguig	Las Pinas City	Pasay City	Tarlac	Bulacan	Rizal	Cavite	Laguna	Total
City of Manila	682	117	75	24	9	14	7	32	24	9	15	1,009
Quezon City	100	1,045	133	26	8	18	4	38	31	7	15	1,424
Makati City	89	84	358	47	15	37	0	5	27	11	9	681
Taguig	42	24	56	219	32	26	0	2	4	11	21	436
Las Pinas City	8	10	17	36	248	8	0	1	2	41	10	380
Pasay City	17	19	26	11	10	63	10	4	6	10	7	182
Tarlac	7	4	1	1	0	10	73	18	0	1	1	115
Bulacan	30	35	3	2	2	4	18	583	1	3	2	683
Rizal	22	27	32	4	1	2	0	2	361	3	15	470
Cavite	12	14	8	11	37	9	1	2	1	601	39	736
Laguna	7	12	7	13	6	6	1	1	13	48	357	471
Total	1,016	1,391	715	392	370	197	115	687	469	744	490	6,587

TABLE 4.3.3-2 SUMMARY OF OD TABLE (2020)

Unit: '000 veh/day

	City of Manila	Quezon City	Makati City	Taguig	Las Pinas City	Pasay City	Tarlac	Bulacan	Rizal	Cavite	Laguna	Total
City of Manila	825	126	75	18	7	13	8	38	24	10	14	1,158
Quezon City	110	1,216	122	27	7	24	6	54	32	9	21	1,627
Makati City	75	73	426	50	12	35	0	3	24	13	9	720
Taguig	28	27	66	279	32	18	1	2	5	11	25	494
Las Pinas City	7	11	20	38	241	10	0	1	2	50	9	390
Pasay City	18	26	33	14	12	70	15	5	8	14	9	224
Tarlac	8	6	1	1	0	15	69	21	0	1	1	124
Bulacan	36	47	3	3	3	5	21	635	1	3	2	760
Rizal	23	26	32	3	1	2	0	3	382	3	25	500
Cavite	15	21	10	10	41	12	1	2	1	743	53	908
Laguna	7	18	8	16	6	9	2	1	18	67	413	563
Total	1,152	1,597	794	460	360	213	123	764	499	923	582	7,468

TABLE 4.3.3-3 SUMMARY OF OD TABLE (2030)

Unit: '000 veh/day

	City of Manila	Quezon City	Makati City	Taguig	Las Pinas City	Pasay City	Tarlac	Bulacan	Rizal	Cavite	Laguna	Total
City of Manila	968	146	88	21	8	15	10	47	29	12	18	1,364
Quezon City	128	1,424	144	32	8	30	7	66	39	10	25	1,913
Makati City	88	86	501	60	14	41	0	4	30	16	11	852
Taguig	33	31	79	336	38	22	1	3	6	14	32	595
Las Pinas City	8	12	23	46	277	11	0	2	3	62	12	456
Pasay City	21	30	38	16	14	81	18	6	10	16	11	261
Tarlac	10	8	1	1	1	18	89	27	0	1	2	159
Bulacan	44	58	4	4	3	6	26	824	1	4	3	978
Rizal	27	32	38	4	1	2	0	3	497	5	34	644
Cavite	19	26	13	12	50	14	1	2	2	962	72	1,173
Laguna	8	21	10	19	7	10	2	1	24	89	549	741
Total	1,356	1,874	939	553	419	251	155	985	642	1,191	769	9,135

4.4 WILLINGNESS-TO-PAY (WTP) SURVEY

This survey is carried out to passengers inside the terminals of NAIA. Only passengers who have declared to own a car is considered as respondents. The idea is to solicit their opinion as future expressway users. The plan of the government to build an expressway is explained to respondents by showing a large map shown in the figure below. Likewise, they were also informed that the expressway is assumed to open in 2015 and that certain amount has to be paid for its use. See figure below for the hypothetical questions on willingness to pay.

The survey's purpose is to gauge the public's acceptance of toll rate applied at the NAIA Expressway. **Figure 4.4-1** shows the NAIAX Willingness to pay Survey Questionnaire Form.

Expressway Projects in Mega Manila Region in the Republic of the Philippines

WILLINGNESS TO PAY SURVEY (FORM 4) — **FOR STUDY PURPOSE ONLY**

General Info.

Sample ID No: ___ Date (month/day) ___

Location (1) Terminal I (2) Terminal II (Dom) (3) Terminal II (Intn'l) (4) Terminal III (Dom) (5) Terminal III (Intn'l) Time ___

Personal Information and Trip Characteristics

1- How did you come to airport?
1) Car 2) Taxi

2-Sex 1-Male 2-Female

3-Age 1)20-29 2)30-39 3)40-49 4)50-59 5)>60

4-Total number of cars your family has

5-Occupation
1- Admin. 2- Professional 3- Tech./assist. 4- Clerk 5- Sale/Services 6- Farmer/fisher
7- Craftman 8- Production 9- Unskilled 10- Student 11- House wife 12- Retired
13- Jobless 14- Other (specify):

6-Monthly Income (Pesos)
1) None 4) 10,000 - 14,999 7) 30,000-39,999 10) 100,000-149,000
2) Under 5,000 5) 15,000 - 19,999 8) 40,000-59,999 11) 150,000 and above
3) 5,000-9,999 6) 20,000 - 29,999 9) 60,000-99,9999

7- What time did you arrive in the airport? ___ Hour ___ Minutes

8- Trip OD Where did you start this trip? _____ *(City/Municipality)*

9-Travel Time
How long did it take from your origin to this airport? ___ Hour ___ Minutes

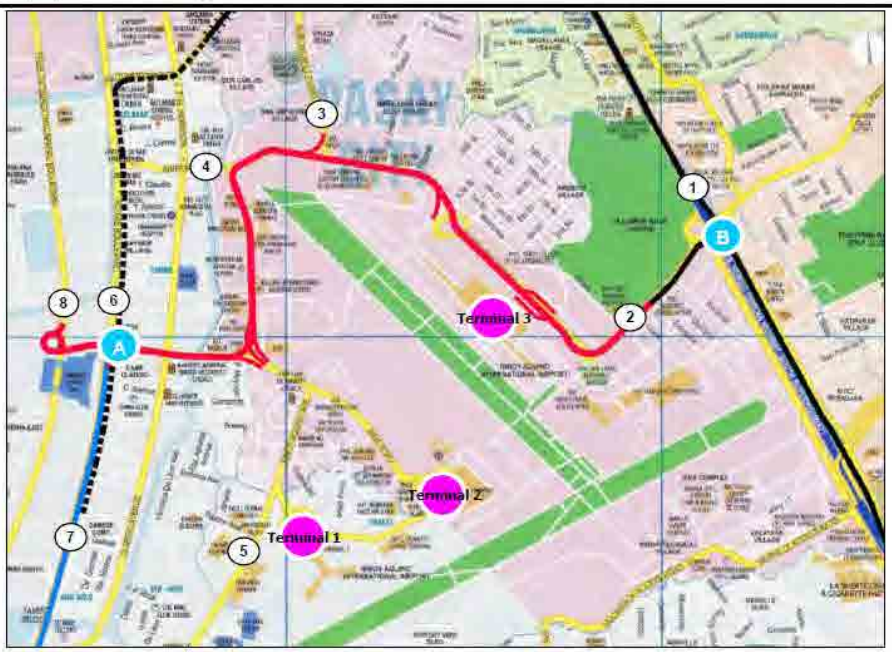
10- Which road did you take to get into airport? see Map below
1) Skyway 3) Aurora Road 5) Ninoy Aquino Ave. 7) Coastal Road 9) Others, specifiy: ___
2) Sales Road 4) Airport Road 6) Roxas Blvd 8) Macapagal Blvd _____

11- If expressway is built as shown in the map, will you use it getting into airport instead of the road you used today ?
1) Yes → If Yes, how much are you willing to pay: Pesos _____
2) No, I will take the same road (ordinary road)

Willingness to Pay

12- Hypothetical Question
The government is planning to construct the NAIA Expressway (Phase 2) to link Skyway to Cavite Coastal Expressway and to connect Terminals 1, 2 and 3 to an expressway. This will reduce travel time getting into the airport. For instance, from Coastal Road (A) to Skyway (B), travel time will be reduced to just 10 minutes or so. If you travel from A to B, will you use the expressway? **And how much you are willing to pay to use the expressway?**

A) Yes 1) 20 2) 30 3) 50 4) 80
B) No, I will take ordinary road



That's All. Thank You Very Much for Your Cooperation.

FIGURE 4.4-1 NAIAX WILLINGNESS TO PAY SURVEY QUESTIONNAIRE

a. Sample Size

The sample size is shown in the **Table 4.4-1**. Terminal 2 has the highest number of sample (301), followed by Terminal 3 (250) and the remaining samples come from Terminal 1.

TABLE 4.4-1 SAMPLE SIZE

Terminal	International / Domestic	Sample	Share (%)
Terminal 1	International	200	26.6%
Terminal 2	Domestic	150	20.0%
	International	151	20.1%
Terminal 3	Domestic	150	20.0%
	International	100	13.3%
	Total	751	100.0%

b. Mode to Airport (Q.1)

Since the idea is to capture car users, most of the respondents arrived to the airport by car and followed by those used taxi as shown in **Table 4.4-2**.

TABLE 4.4-2 TRANSPORT MODE TO AIRPORT

Mode	Sample	Share (%)
Car	467	62.2%
Taxi	284	37.8%
Total	751	100.0%

c. Sex Distribution (Q.2)

For sex distribution of the respondents, more than half are male (52.3%) and the remaining are female. See **Table 4.4-3**.

TABLE 4.4-3 SEX DISTRIBUTION

Sex	Sample	Share (%)
Male	393	52.3%
Female	358	47.7%
Total	751	100.0%

d. Age Distribution (Q.3)

As shown in the table below, the highest number of respondents belongs to 30 to 39 years old (35.75%). This is followed by those belonging to age group of 20-29 years old and closely followed by those in 40-49 years old. See **Table 4.4-4**.

TABLE 4.4-4 AGE DISTRIBUTION

Age Range	Sample	Share (%)
20-29	180	24.0%
30-39	268	35.7%
40-49	174	23.2%
50-59	88	11.7%
>60	41	5.5%
Total	751	100.0%

e. Car Ownership Distribution (Q.4)

As mentioned, since car owning individual is expected as one of the main users of the expressway, only passengers with car were interviewed. As shown in the figure below, more than half of the respondents owned a car followed by the respondents with two cars. Individuals with more than three cars are quite significant (9.1%). Refer to **Figure 4.4-2**.

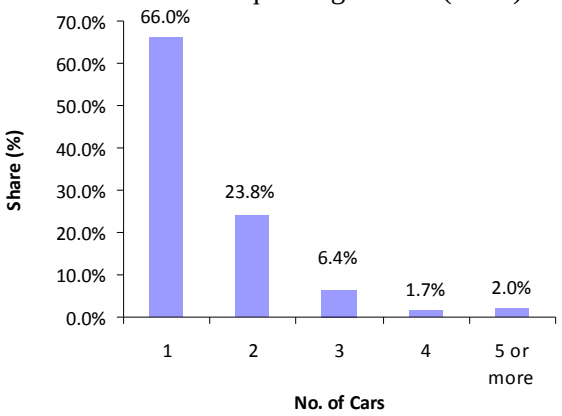


FIGURE 4.4-2 CAR OWNERSHIP DISTRIBUTION

f. Occupation Distribution (Q.5)

For occupation of respondents, most of them are professional (40.9%). Other notable professions by the respondents are sales/services, technical works/assistant, and administrative works. See **Figure 4.4-3**.

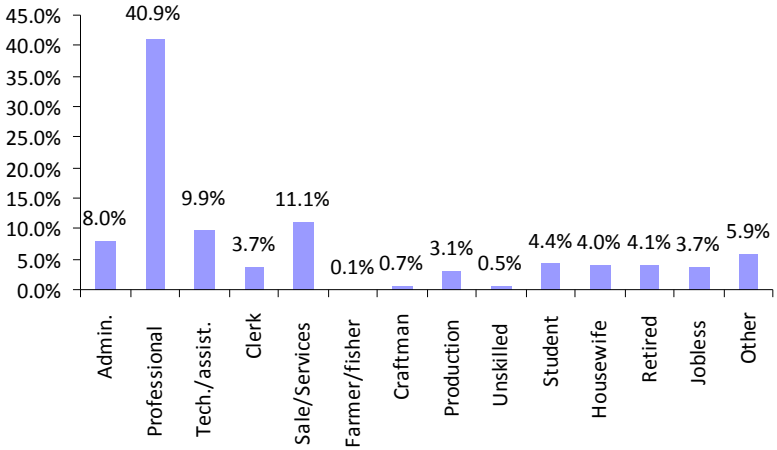


FIGURE 4.4-3 OCCUPATION OF RESPONDENTS

g. Monthly Income Distribution (Q.6)

The highest share of respondents has a monthly income between 40,000 to 59,999 pesos. Combining the share of respondents with monthly income of 30,000 pesos or more, their share is about 56% to the total samples. Respondents without income (none) are mostly students, retirees, and housewives. See **Figure 4.4.-4.**

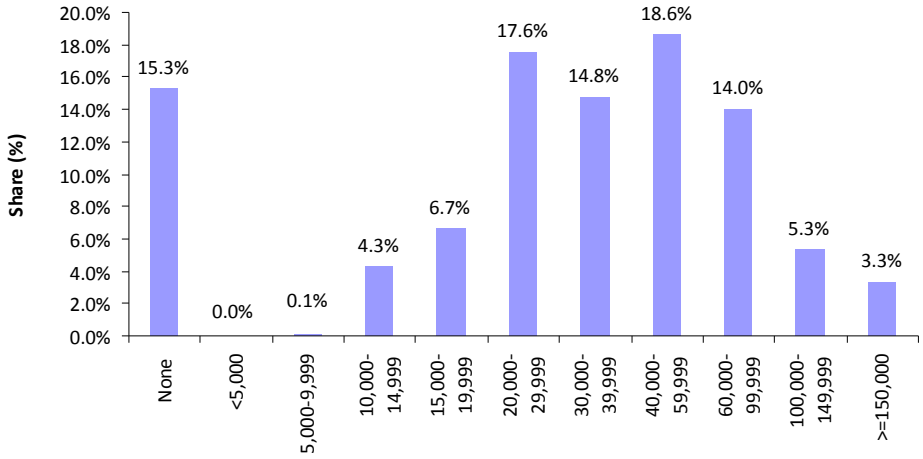


FIGURE 4.4-4 MONTHLY INCOME

h. Places of Origin (Q.8)

More than half of the respondents have their origin within Metro Manila (66.6%) while the rest comes from the neighboring provinces in Region I, Region II, Region III, Region IV, Region V and CAR. Within Metro Manila, notable cities with high number of respondents are Manila City, Makati City and Quezon City. On the other hand, provinces with high number of respondents in Region IV-A comes from Cavite and Laguna.

It is interesting to note that air passengers coming from neighboring provinces as far as Baguio City (CAR), Albay and Batangas were travelling directly to the airport without spending a night in Metro Manila. This change in travel behavior of commuters might be due to the speedy travel provided by the expressways. Refer to **Figure 4.4-5**.

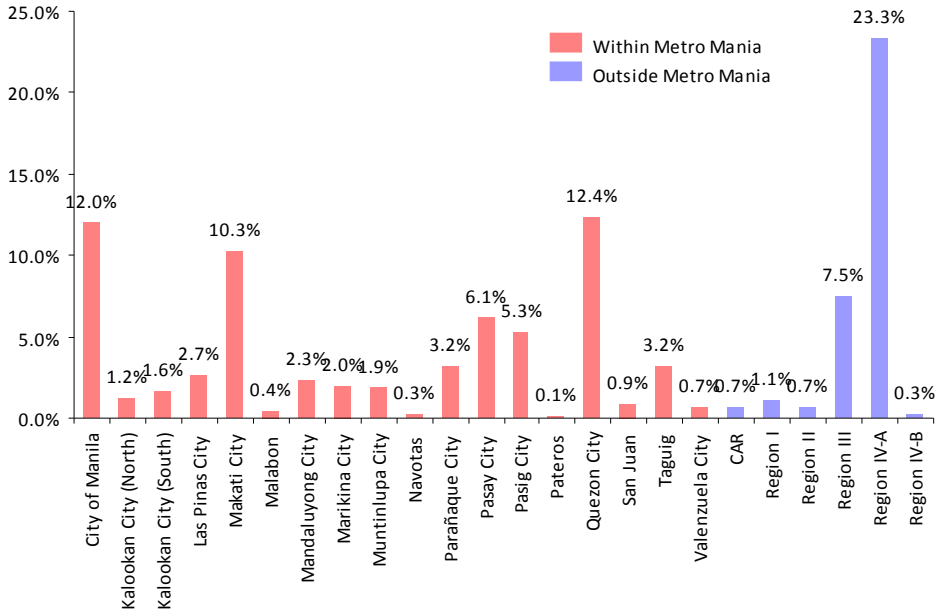


FIGURE 4.4-5 ORIGIN OF RESPONDENTS

i. Travel Time to Airport (Q.9)

More than half of respondents have travel time of one (1) hour or less from origin to NAIA. Most of these respondents had their origin from Metro Manila and a few came from Imus, Kawit, Dasmarinas, Bacoor (Cavite), Cabuyao (Laguna), and Cainta (Rizal). See **Figure 4.4-6**.

The average travel time of respondents coming from Metro Manila is 1.1 hour. Air passengers coming from nearby provinces of Cavite, Laguna and Rizal were also able to get into the airport terminals with an hour or so. The recorded highest average travel time is more than 10 hours which comes from provinces of Ilocos Sur, Isabela and some provinces in Region IV-B. See **Figure 4.4-7**.

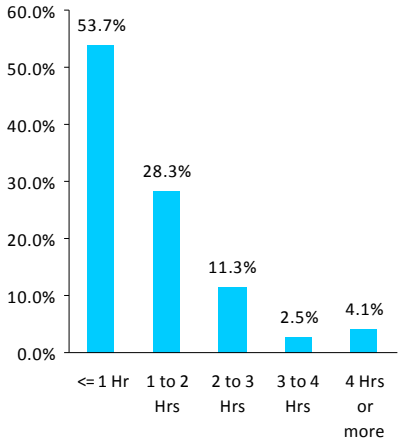


FIGURE 4.4-6 TRAVEL TIME TO NAIA

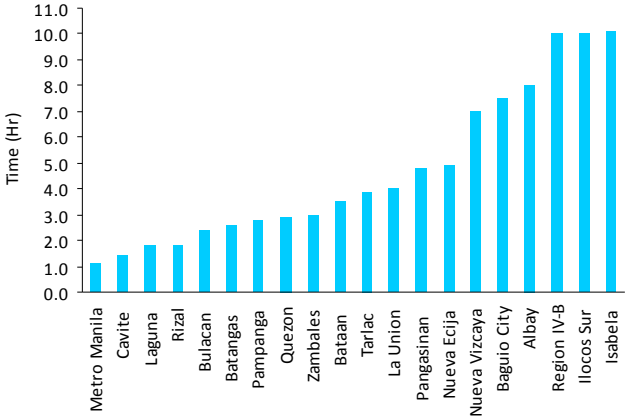


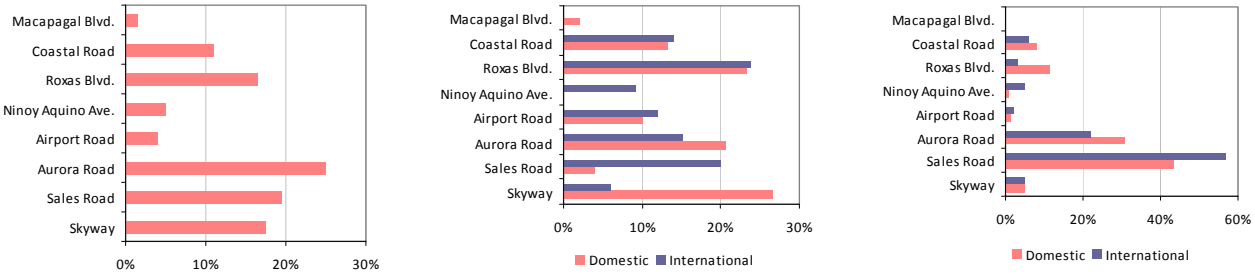
FIGURE 4.4-7 TRAVEL TIME TO NAIA BY ORIGIN

Note: Region IV-A, province and city or municipality name were not captured but only the Region's name

j. Access Road to Airport (Q.10)

For road access to airport, the following were observed (See **Figure 4.4-8**):

- Terminal 1 – main access roads were Aurora Road (25%); Sales Road (20%), and Skyway via NAIA Expressway (Phase I).
- Terminal 2 (Domestic) – main access roads were Skyway (27%), Roxas Boulevard via MIA Road (23%), and Aurora Road (21%).
- Terminal 2 (International) – main access roads were Roxas Boulevard via MIA Road (24%), Sales Road (20%), and Aurora Road (15%).
- Terminal 3 (Domestic) – main access roads were Sales Road (43%), Aurora Road (31%), and Roxas Boulevard via MIA Road (11%).
- Terminal 3 (International) – main access roads were Sales Road (57%), Aurora Road (22%), and Coastal Road via MIA Road (6%).



Terminal 1 *Terminal 2* *Terminal 3*

FIGURE 4.4-8 ACCESS ROAD USED TO AIRPORT

k. Will they Use NAIA Expressway Going to Airport? (Q.11)

When the respondents were asked if they would use the expressway to be built in future in going to airport terminals, **almost 92%** expressed their willingness to use the expressway in their future travel to airport terminals (**Figure 4.4-9**).

l. How Much They Are Willing to Pay Until Airport? (Q.11)

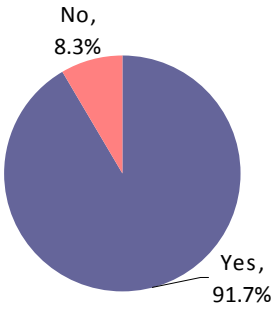


FIGURE 4.4-9 PERCENTAGE OF WILLING AND NOT WILLING TO PAY

Those willing to pay to use the expressway were further given a follow-up question which is how much they are willing to pay to use the expressway until to airport's terminals. Eighty five percent (85%) are willing to pay 20 pesos as shown in the table and figure below. At 22 pesos, the number shrinks to only 49%. The lowest amount given by respondents is five (5) pesos and the highest is two hundred (200) pesos as shown in **Figure 4.4-10** and **Table 4.4-5**. Taking into account the terminal location of respondents, the intersecting point is at 21 pesos as presented in **Figure 4.4-11**. Note that in this question, respondents were not given an amount to choose from but asked instead an open question of how much they are willing to pay.

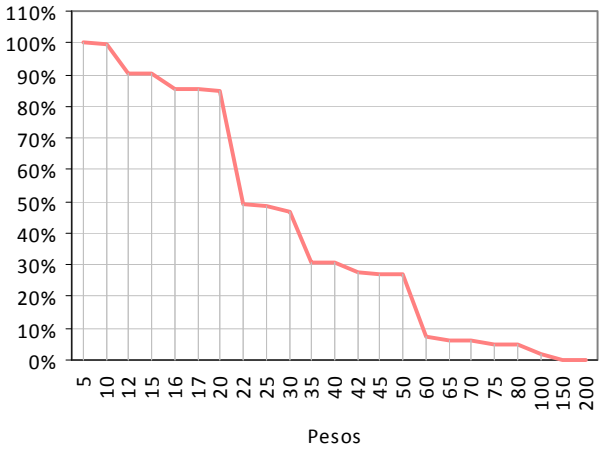


FIGURE 4.4-10 AMOUNT OF TOLL FEE MOTORIST WILLING TO PAY UNTIL NAIA

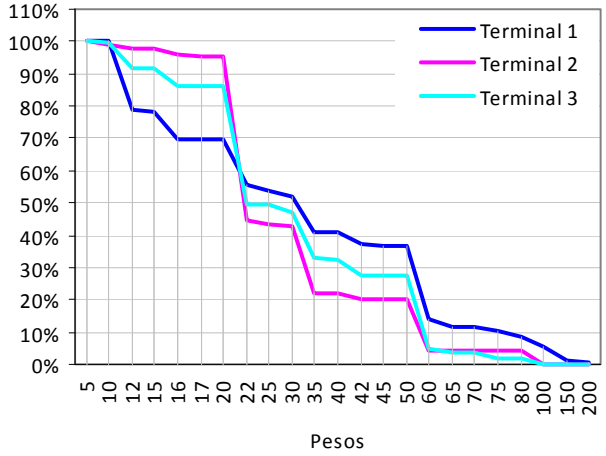


FIGURE 4.4-11 AMOUNT OF TOLL FEE MOTORIST WILLING TO PAY UNTIL NAIA PER TERMINAL

TABLE 4.4-5 AMOUNT OF TOLL FEE MOTORISTS ARE WILLING TO PAY UNTIL NAIA EXPRESSWAY

(₱)	Sample	Share (%)	Amount (%)
5	4	0.6%	100%
10	62	9.0%	99%
12	1	0.1%	90%
15	34	4.9%	90%
16	1	0.1%	85%
17	1	0.1%	85%
20	245	35.6%	85%
22	7	1.0%	49%
25	12	1.7%	48%
30	108	15.7%	47%
35	1	0.1%	31%
40	23	3.3%	31%
42	1	0.1%	27%
45	1	0.1%	27%
50	138	20.1%	27%
60	6	0.9%	7%
65	1	0.1%	6%
70	7	1.0%	6%
75	3	0.4%	5%
80	21	3.1%	5%
100	9	1.3%	2%
150	1	0.1%	0%
200	1	0.1%	0%
Total	688	100.0%	

m. Will they Use Entire NAIA Expressway in their Other Trips, say exiting from Coastal Road going to Skyway? (Q.12)

Respondents were also asked if they would use the expressway in their regular or daily trips aside from going to airport say exiting from Skyway and going to Mall of Asia in Manila. Again, **a high positive response (91.6%)** is obtained indicating the readiness of car users to spend some amount to enjoy comfort of an expressway. See **Figure 4.4-12**.

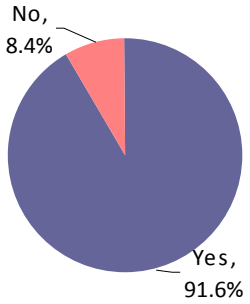


FIGURE 4.4-12 PERCENTAGE OF WILLING AND NOT WILLING TO PAY

n. How Much They Are Willing to Pay to Use Entire NAIA Expressway for Other Trips?

Those willing to pay to use the expressway have the following preference: 27.2% are willing to pay 20 pesos; 40.4% are willing to pay 30 pesos; 26.2% are willing to pay 50 pesos; 6.2% are willing to pay 80 pesos. Refer to **Table 4.4-6** and **Figure 4.4-13**.

By plotting the amount of fee motorists willing to pay, it is easy to understand the total percentage of those willing to pay at certain amount. For instance, at 20 pesos, all the 91.6% who have declared their intention to use expressway are expected to pay the said amount. So in the figure, at 20 pesos, 100% are expected willing to pay. As the amount of toll fee increases, the number of those willing to use expressway for a fee also decreases. **At 30 pesos, 73% are still expected to use the expressway and at 41 pesos, only 50% are expected to use the expressway at that amount of fee.** This number is further reduced to around 32% when toll fee is 50 pesos.

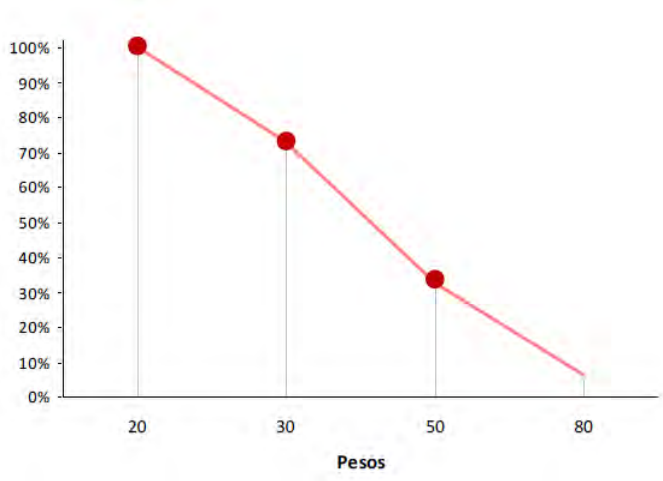


FIGURE 4.4-13 AMOUNTS OF TOLL MOTORISTS WILLING TO PAY TO USE ENTIRE EXPRESSWAY FOR THEIR OTHER TRIPS

TABLE 4.4-6 AMOUNT OF TOLL MOTORISTS WILLING TO PAY/ TO USE ENTIRE NAIA EXPRESSWAY

(₱)	Sample	Share (%)	Amount (%
20	180	27.1%	100.0%
30	268	40.4%	72.9%
50	174	26.2%	32.4%
80	41	6.2%	
Total	663	100.0%	6.2%

o. Income vs Average Amount of Willing to Pay per Income Group

It is interesting to note the valuation of interviewed motorists to the expressway is closely similar irrespective of income bracket - the average amount fee they are willing to pay is 31.6 pesos. This is the average amount they are willing to pay to use NAIA expressway on their way to airport terminals.

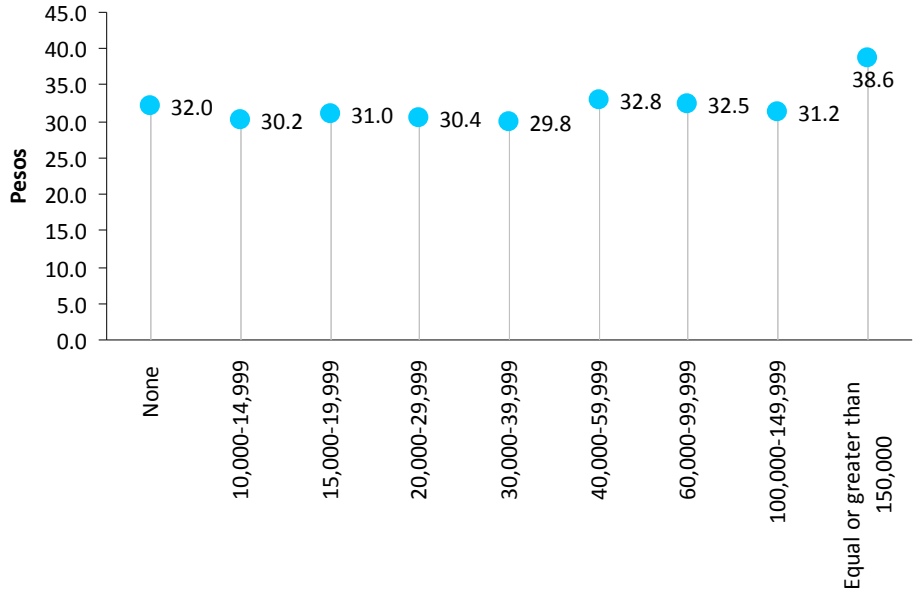


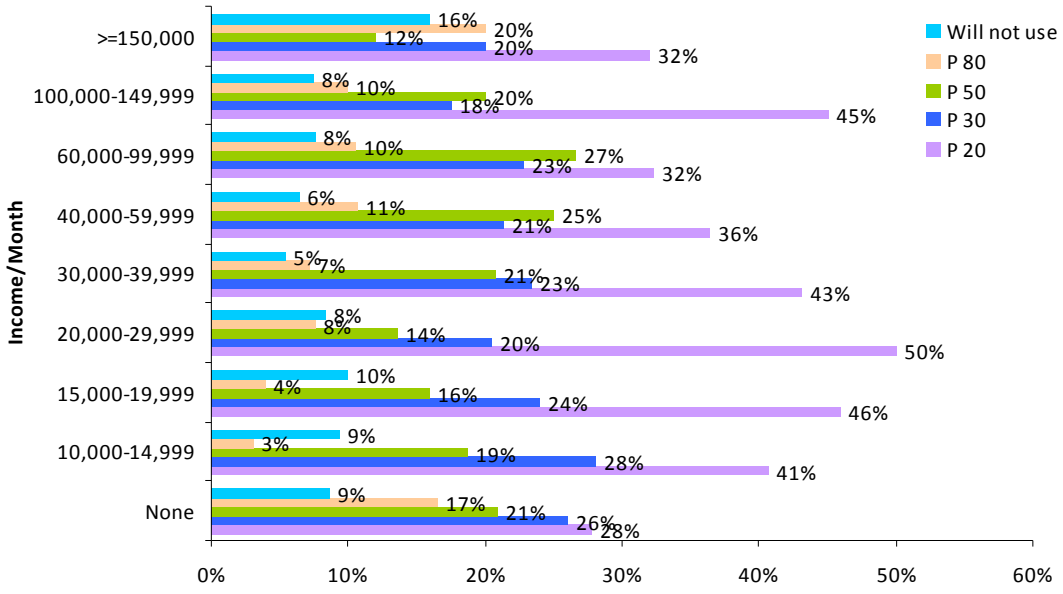
FIGURE 4.4-14 AVERAGE FEES WILLING TO PAY PER INCOME GROUP

When the average amount of toll fee respondents willing to pay is segregated based on individual's income, the lowest average comes from those earning from the range of 30,000-39,999 pesos which is 29.8 pesos. The highest average of amount willing to pay comes from individuals with monthly income of equal or higher than 150,000 pesos (38.6 pesos). It should be noted that individuals composing the 'none' income group are mostly students, retirees and housewives. Most retirees and housewives have financial resources which could explain their ability to declare such amount to pay for the use of NAIA expressway. See **Figure 4.4-14**.

p. Amount of Toll Fee Willing to Pay per Income Group

The figure below shows response of respondents based on their income. By looking at **Figure 4.4-15**, the following were observed:

- As expected, twenty (20) pesos is the most popular choice among the respondents.
- Respondents with income of up to 39,999 pesos per month follow the order of lowest to highest in toll fee preference. However, when respondents' income is above 39,999 pesos per month, preference for 50 pesos as toll fee overtook preference for 30 pesos. Perhaps as the income increases, valuation of time also increases.
- When the toll fee is at 80 pesos, respondents belong to lower income bracket's (10,000 to 14,999) share shrinks to 3%. However share of respondents with monthly income of higher than 40,000 pesos is still notable. In particular, 20% of individual with monthly income of higher than 150,000 pesos signified their willingness to pay 80 pesos.



Note: None = composed mostly of students, retirees, housewives

FIGURE 4.4-15 DISTRIBUTION OF TOLL FEE PREFERENCE PER INCOME GROUP

4.5 ESTIMATION OF TRAFFIC ON EXPRESSWAY

4.5.1 Traffic Assignment Model

The traffic assignment procedure allocates vehicle traffic into individual road links. This step uses as input the matrix of flows (vehicles) that indicate the volume of traffic between origin and destination pairs. Refer to sections 4.2 and 4.3 for overall procedure of preparation of traffic assignment.

1.) Assignment Method

There are many assignment techniques that can be used to estimate traffic volume ranging from manual methods to complex iterative procedures by computer programs. In this study, the capacity restraint assignment which is the most straightforward for use in network models was applied. This assignment technique is based on the speed – flow relationship. Flowchart of the applied methodology is presented in **Figure 4.5.1-1**.

In this assignment technique, and by calculating the required travel time for each link according to its travel speed and road conditions, the program determines the fastest routes between each origin and destination by evaluating the consuming time on links, and assigns the trips between the given origin and destination. As congestion increases until a certain level, alternative routes are introduced to handle the unassigned traffic. Zone-to-zone routing is built, which is the fastest path from each zone to any other, and all trips are assigned to these optimum routes.

Regarding tolled expressway, travel time adds the sum up of travel time conversion from toll fee (= toll fee divided by time evaluation value) and time calculation from travel speed.

Since the link-travel time varies with the traffic volume of vehicles using that link, which can be explained as a degree of link congestion, the OD tables are divided to apply an iteration procedure on ten stages. At each iteration, and depending upon the current link loadings, the flows are divided between all the shortest routes generated and a new travel time is computed for the average assigned link flow at each pass. The iteration continues to re-estimate the speed on that links considering the assigned traffic on links, and to produce alternative routes so that

more accurate allocation can be achieved. The accumulated assigned traffic volume from each OD pair on the links composes the total assigned traffic volumes per direction for the network. As mentioned in section 4. 2, JICA STRADA is used to estimate traffic volumes.

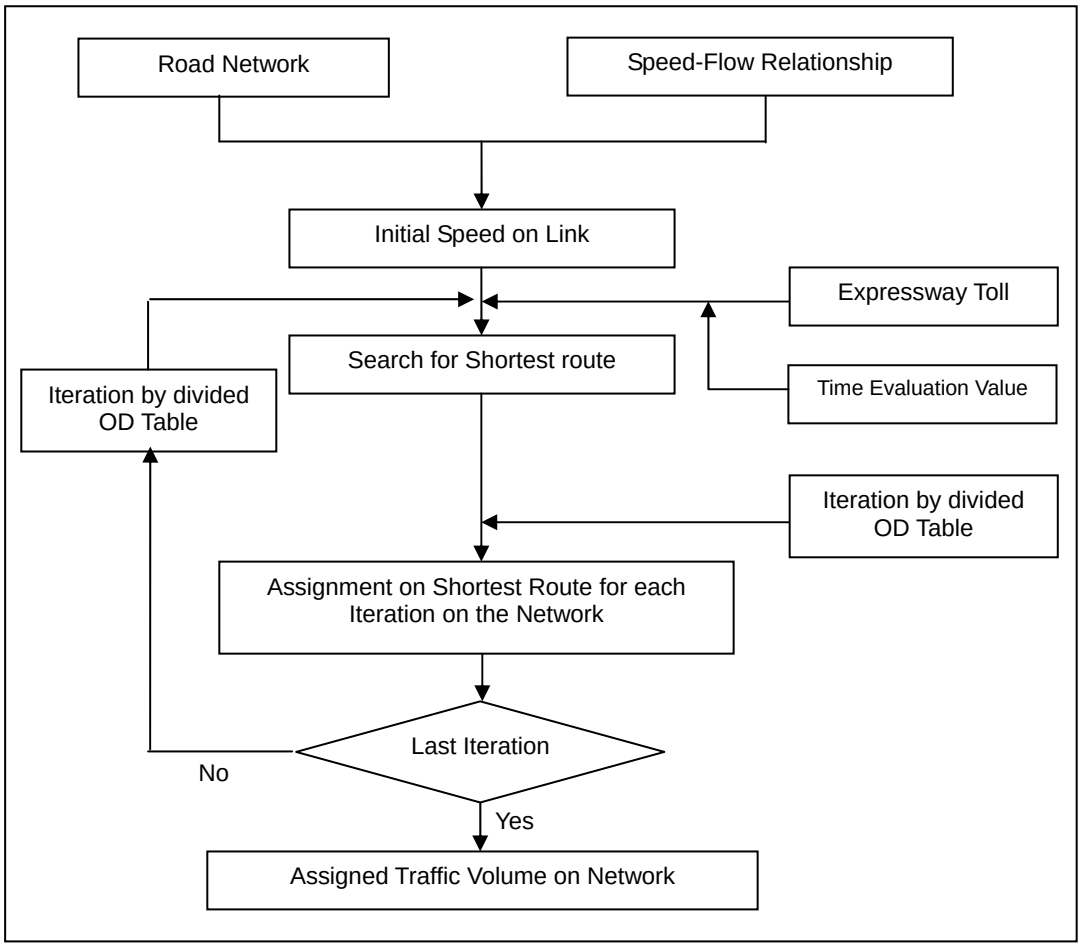


FIGURE 4.5.1-1 TRAFFIC ASSIGNMENT PROCEDURE

2.) Speed Flow Relationship

The speed-flow relationship used in the traffic assignment procedure is shown in **Figure 4.5.1-2**. When the traffic volumes are over the maximum capacity 0.3*Qmax, it is assumed that vehicle speed drastically reduces. The basic free flow and capacity is shown in **Table 4.5.1-1**.

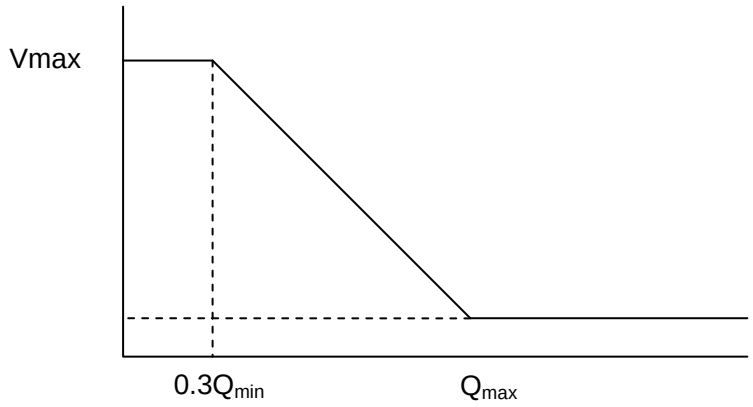


FIGURE 4.5.1-2 SPEED – FLOW RELATIONSHIP

TABLE 4.5.1-1 FREE SPEED AND CAPACITY BY ROAD TYPE

QV Type	Pavement	Road Class	Topography	Lane	Vmax	Qmax
1	Paved	Center Expressway	Plain	4	100	80,000
2				3	100	60,000
3				2	100	40,000
4				1	70	15,000
5			Mountains	2	70	28,000
6				1	60	10,500
7		Urban Expressway	Plain	3	80	60,000
8				2	60-80	40,000
9				1	60	15,000
10		Interstate Highway	Plain	4	40	60,000
11				2	30	18,000
12			Mountains	4	30	42,000
13				2	25	12,600
14		Urban Arterial	Mountains	10	60	120,000
15				8	60	96,000
16				6	50	72,000
17				4	40	48,000
18				2	30	14,400
19		Local	Plain	4	40	40,000
20				2	30	12,000
21			Mountains	2	30	8,400
22	Unpaved		Plain	2	20	6,000
23			Mountains	2	10	4,200

3.) Passenger Car Unit

Table 4.5.1-2 shows the Passenger Car Unit (PCU) used in vehicle traffic conversion. This value is the same used by the DPWH.

TABLE 4.5.1-2 PASSENGER CAR UNIT (PCU)

Vehicle Type	Passenger Car Unit
Passenger Car	1.0
Jeepney	1.5
Bus	2.2
Truck	2.5

4.) Time Evaluation Value

An important input for the demand forecast is the trip maker's time value. This time value is the basis for a trip maker to decide whether to use toll expressway or not. The time values were derived from MMUEN (JICA, The Development of the Public –Private Partnership Technique for the Metro Manila Urban Expressway Network) data. Supposing time value will increase in accordance with inflation rate of 5% per year, the figures in **Table 4.5.1-3** will be the time value.

TABLE 4.5.1-3 TIME EVALUATION VALUE BY VEHICLE TYPE

Unit: Peso/hour

Mode	Y2015	Y2020	Y2030
Car	428.4	566.8	923.3
Jeepney	600.0	796.9	1,298.1
Bus	1999.9	2,606.9	4,246.4
Truck	1200.0	1,493.5	2,432.7

4.5.2 Toll Rate vs. Revenue

1.) Toll Expressway Conversion Model Validation

In order to estimate the accurate traffic of NAIAX, conversion rate to NAIAX were validated. **Figure 4.5.2-1** presents conversion rate from traffic assignment result and the willingness to pay (WTP) survey result. Conversion rate is calculated the rate of NAIAX traffic volume when toll is imposed and NAIAX traffic volume when toll is free.
This graph proves the assignment model has accurately replicated the WTP result.
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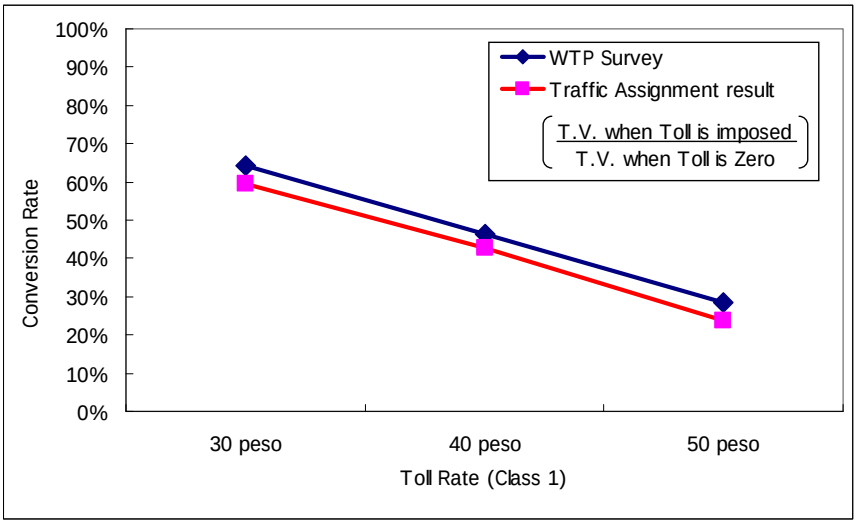

FIGURE 4.5.2-1 NAIAX CONVERSION RATE COMPARISON OF ASSIGNMENT AND WTP SURVEY

2.) Toll Rate vs. Revenue

The estimated traffic volume and expected amount of revenue generated from the expressway is shown in **Figure 4.5.2-2**. Amount of revenue per day will be 1.75 million for 30 pesos toll fee, 1.79 million for 40 pesos toll fee, and 1.54 million for 50 pesos toll fee.

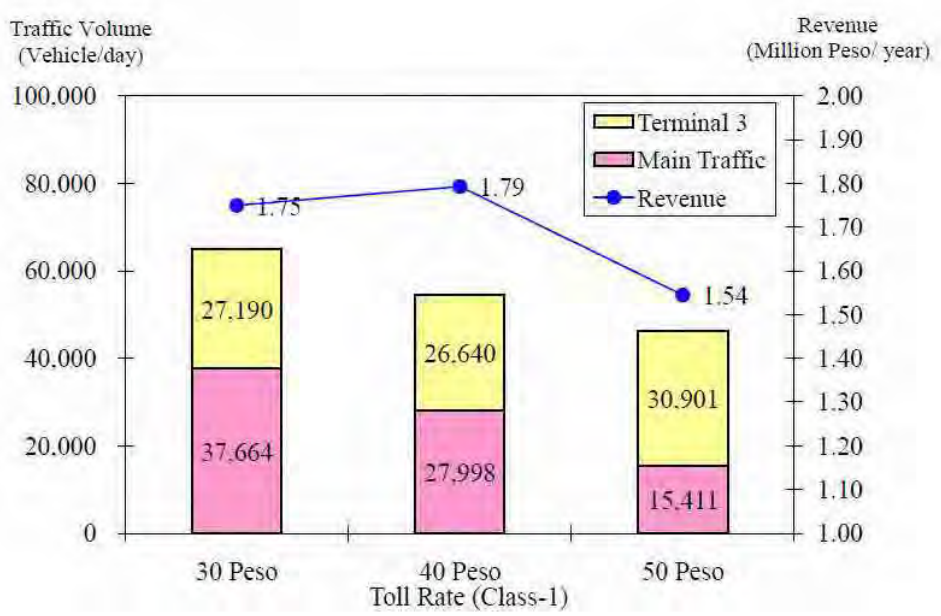

FIGURE 4.5.2-2 TOLL RATE VS. REVENUE (2015)

3.) Conclusion

Traffic assignment will conduct the condition of toll rate 30 and 40 peso of Class -1

- Average willingness to pay for NAIAX is 31.6 peso and 70% of respondent pay for more than 30 peso (see **Figure 4.4-13**).
- Though maximum amount of revenue is 40 peso case, it was not so different with 30 peso case.
- Toll rate of NAIAX (P6/km = 30peso/5km, 40 Peso case is P8/km, is the almost same as that of present Skyway and it will be acceptable rate.(see **Table 4.5.2-1**)
- In order to maximize the revenue, 40 peso case is desirable. In order to be more attractive for NAIAX, 30 peso case is desirable.

TABLE 4.5.2-1 PRESENT TOLL RATE

(Peso/km)

Toll Road		Class 1 *Car, Jeep, Pick-up*	Class 2 *Light Truck*	Class 3 *Heavy Truck, Trailer*	Remarks
Metro Manila Skyway (MMS)	Elevated Phase 1	6.84	13.68	20.53	Skyway/Buendia - Bicutan (9.50 km)
	Elevated Phase 2	11.92	23.84	35.76	Alabang - Bicutan (6.88 km)
	At grade	7.85	15.70	23.56	Magallanes - Alabang (13.50 km)
North Luzon Expressway (NLEX)		2.38	5.92	7.08	
South Luzon Expressway (SLEX)		3.02	6.04	9.10	
Manila Cavite Toll Expressway (MCTE)	Phase 1	3.33	6.82	9.85	R-1 Extension to Bacoor (6.6 km)
	Phase 2	8.96	17.92	26.87	Bacoor Bay to Kawit (6.475 km)
Southern Tagalog Arterial Road (STAR)		1.43	2.86	4.26	
Subic-Clark-Tarlac Expressway (SCTEX)		2.68	5.36	8.04	

Source: TRB, 2011 May

4.5.3 Impact of other Road Projects

The estimated traffic of NAIAX may change the related other road development. Therefore in order to impact by other road projects, traffic assignment with/without other project case was conducted.

Table 4.5.3-1 shows the difference revenue of with or without other project case.

If NLEx-SLEx connector expressway is open, the traffic volume and revenue of NAIAX will increase. On the other hand, the traffic and revenue of NAIAX will decrease if C-5 extension road is open.

TABLE 4.5.3-1 IMPACT OF OTHER ROAD PROJECTS

Project Case	Revenue of NAIAX (Million Peso/day)	Difference of Revenue [W-WO] (Million Peso/day)	Impact for NAIAX
Without other road projects	*3.09*		
FTI Connector	3.11	+0.02	Very Minor Positive Impact
C-6 Exp(South Section)	3.05	-0.04	Very Minor Negative Impact
CALAX (Cavite Section)	3.26	+0.17	Positive Impact
CALAX (Whole Section)	3.35	+0.26	High Positive Impact
N-S Connector Exp.	3.38	+0.29	High Positive Impact
C-5 Extension	2.94	-0.15	Negative Impact

Note: Estimated by traffic assignment in base case of road network (year 2015) and OD table (year 2020).

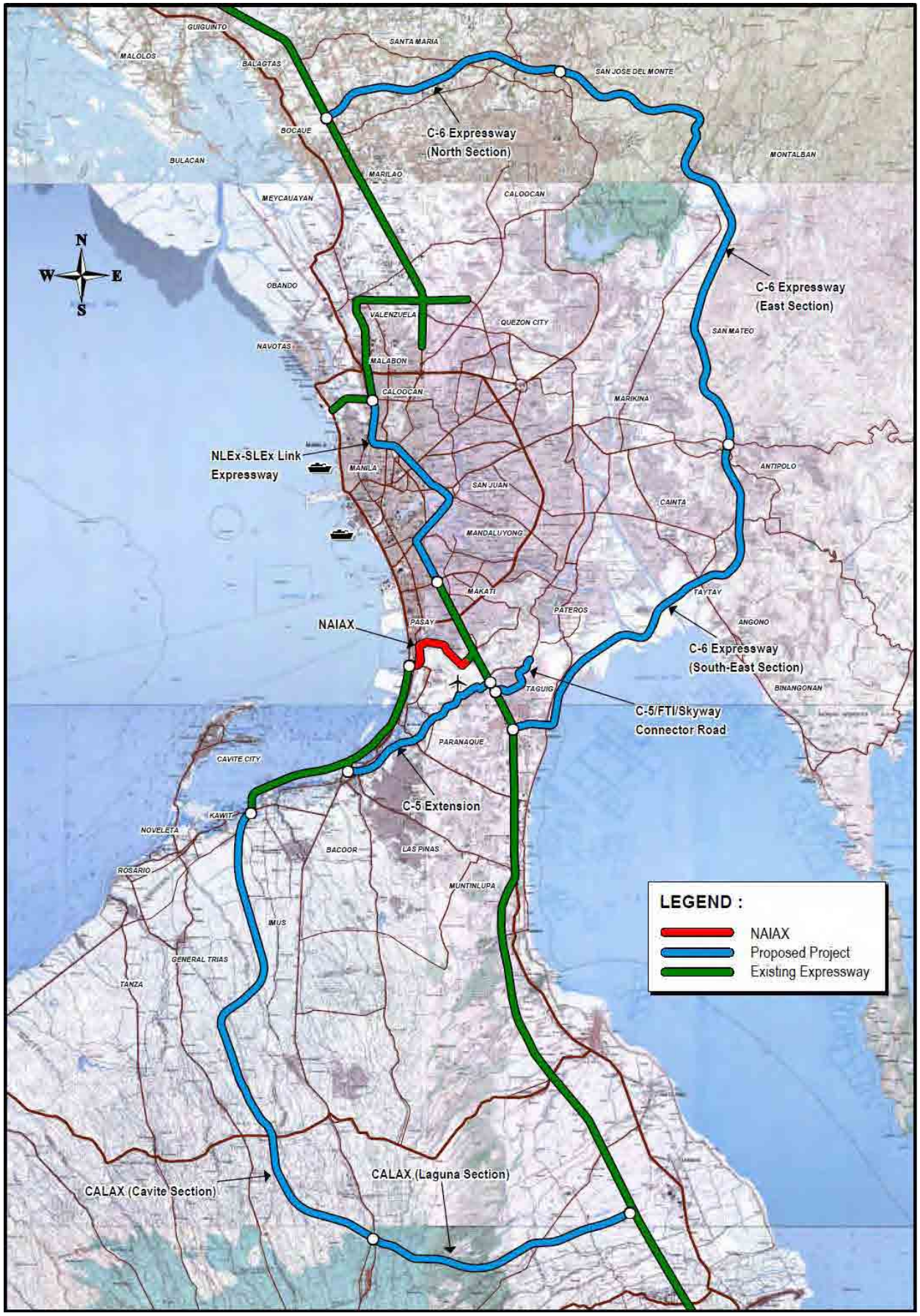

FIGURE 4.5.3-1 LOCATION MAP OF OTHER ROAD PROJECTS

4.5.4 Road Network Assumptions

Based on the other road project maturity and the degree of impact for NAIAX, road network assumptions are prepared.

Open Year	Road Project
Year 2015	NAIAX
Year 2017	C-5 Extension NLEx SLEx Connector CALAX (Cavite section)
Year 2020	FTI connector CALAX(Laguna section) C-6 Expressway(South Section)

4.5.5 Traffic Assignment Result and Toll Revenue

(1) 30 Peso Case

Table 4.5.5-1 shows the estimated traffic volume and toll revenue of 30 Peso Case. **Figure 4.5.5-1** to **4.5.5-3** shows the estimated traffic volume of NAIAX.
It is assumed to estimate toll revenue that toll fee will increase 10% per 2 years.

(2) 40 Peso Case

Table 4.5.5-2 shows the estimated traffic volume and toll revenue of 40 Peso Case. **Figure 4.5.5-4** to **4.5.5-6** shows the estimated traffic volume of NAIAX.

TABLE 4.5.5-1 ESTIMATED VOLUME AND REVENUE (30 PESO CASE) (CLASS 1)

Traffic Voulme of NAIA Phase 2

Year	Volume (vehicle per day)												Revenue (Million Peso/
	Class 1			Class 2			Class 3			Total			
	Main	Terminal 3	Total	Main	Terminal 3	Total	Main	Terminal 3	Total	Main	Terminal 3	Total	
2015	29,183	22,695	51,878	7,183	3,547	10,730	1,298	948	2,246	37,664	27,190	64,854	**1.75**
2016	30,730	22,052	52,782	7,946	3,573	11,519	1,576	971	2,547	40,253	26,596	66,849	**1.86**
2017	30,143	23,981	54,124	10,325	5,403	15,728	2,559	1,793	4,352	43,027	31,177	74,204	**2.37**
2018	31,369	23,038	54,408	10,721	5,717	16,438	2,755	1,933	4,688	44,845	30,689	75,534	**2.46**
2019	32,646	22,132	54,778	11,146	6,054	17,200	2,967	2,085	5,051	46,758	30,271	77,029	**2.81**
2020	33,974	20,369	54,343	11,603	5,613	17,216	3,194	1,926	5,121	48,771	27,909	76,680	**2.88**
2021	34,597	20,704	55,301	12,054	5,724	17,778	3,327	1,954	5,281	49,978	28,382	78,360	**3.25**
2022	35,231	21,045	56,276	12,523	5,836	18,359	3,465	1,983	5,448	51,219	28,865	80,084	**3.34**
2023	35,877	21,392	57,269	13,010	5,952	18,962	3,609	2,012	5,621	52,496	29,355	81,852	**3.77**
2024	36,535	21,744	58,279	13,516	6,070	19,586	3,759	2,041	5,800	53,810	29,855	83,665	**3.87**
2025	37,205	22,102	59,307	14,042	6,190	20,232	3,916	2,071	5,986	55,162	30,363	85,525	**4.38**
2026	37,887	22,466	60,353	14,589	6,313	20,902	4,078	2,101	6,179	56,554	30,880	87,434	**4.50**
2027	38,582	22,836	61,417	15,157	6,439	21,596	4,248	2,132	6,379	57,986	31,407	89,393	**5.08**
2028	39,289	23,211	62,501	15,747	6,568	22,315	4,424	2,163	6,587	59,460	31,943	91,403	**5.23**
2029	40,009	23,594	63,603	16,360	6,700	23,060	4,608	2,194	6,802	60,978	32,488	93,466	**5.91**
2030	40,743	23,982	64,725	16,997	6,835	23,832	4,799	2,226	7,026	62,540	33,043	95,583	**6.07**
2031	41,490	24,377	65,867	17,660	6,973	24,632	4,999	2,259	7,258	64,149	33,608	97,757	**6.87**
2032	42,251	24,778	67,029	18,348	7,114	25,462	5,207	2,292	7,498	65,805	34,184	99,989	**7.06**
2033	43,025	25,186	68,211	19,063	7,258	26,321	5,423	2,325	7,748	67,512	34,769	102,281	**7.99**
2034	43,814	25,601	69,415	19,806	7,405	27,212	5,648	2,359	8,007	69,269	35,365	104,634	**8.22**
2035	44,618	26,022	70,640	20,579	7,556	28,135	5,883	2,393	8,276	71,079	35,972	107,051	**9.30**
2036	45,436	26,451	71,886	21,381	7,711	29,092	6,127	2,428	8,556	72,944	36,590	109,534	**9.57**
2037	46,269	26,886	73,155	22,216	7,869	30,084	6,382	2,464	8,846	74,866	37,218	112,085	**10.83**
2038	47,117	27,329	74,446	23,082	8,030	31,113	6,647	2,500	9,147	76,847	37,859	114,705	**11.14**
2039	47,981	27,779	75,759	23,983	8,196	32,179	6,923	2,536	9,459	78,888	38,510	117,398	**12.61**
2040	48,861	27,779	76,639	24,919	8,196	33,115	7,211	2,536	9,747	80,991	38,510	119,501	**12.95**
2041	49,757	27,779	77,535	25,892	8,196	34,088	7,511	2,536	10,047	83,159	38,510	121,670	**14.64**
2042	50,669	27,779	78,447	26,903	8,196	35,099	7,823	2,536	10,359	85,395	38,510	123,905	**15.04**
2043	51,598	27,779	79,376	27,954	8,196	36,150	8,148	2,536	10,684	87,700	38,510	126,210	**17.00**
2044	52,544	27,779	80,322	29,046	8,196	37,242	8,486	2,536	11,022	90,076	38,510	128,587	**17.47**
2045	53,507	27,779	81,286	30,181	8,196	38,377	8,839	2,536	11,375	92,527	38,510	131,038	**19.76**
2046	54,488	27,779	82,267	31,361	8,196	39,556	9,206	2,536	11,742	95,055	38,510	133,566	**20.31**

Note: Main = Traffic on Main Expressway
Terminal 3 = Terminal 3 related ramps (1 on-ramp and 1 off-ramp)

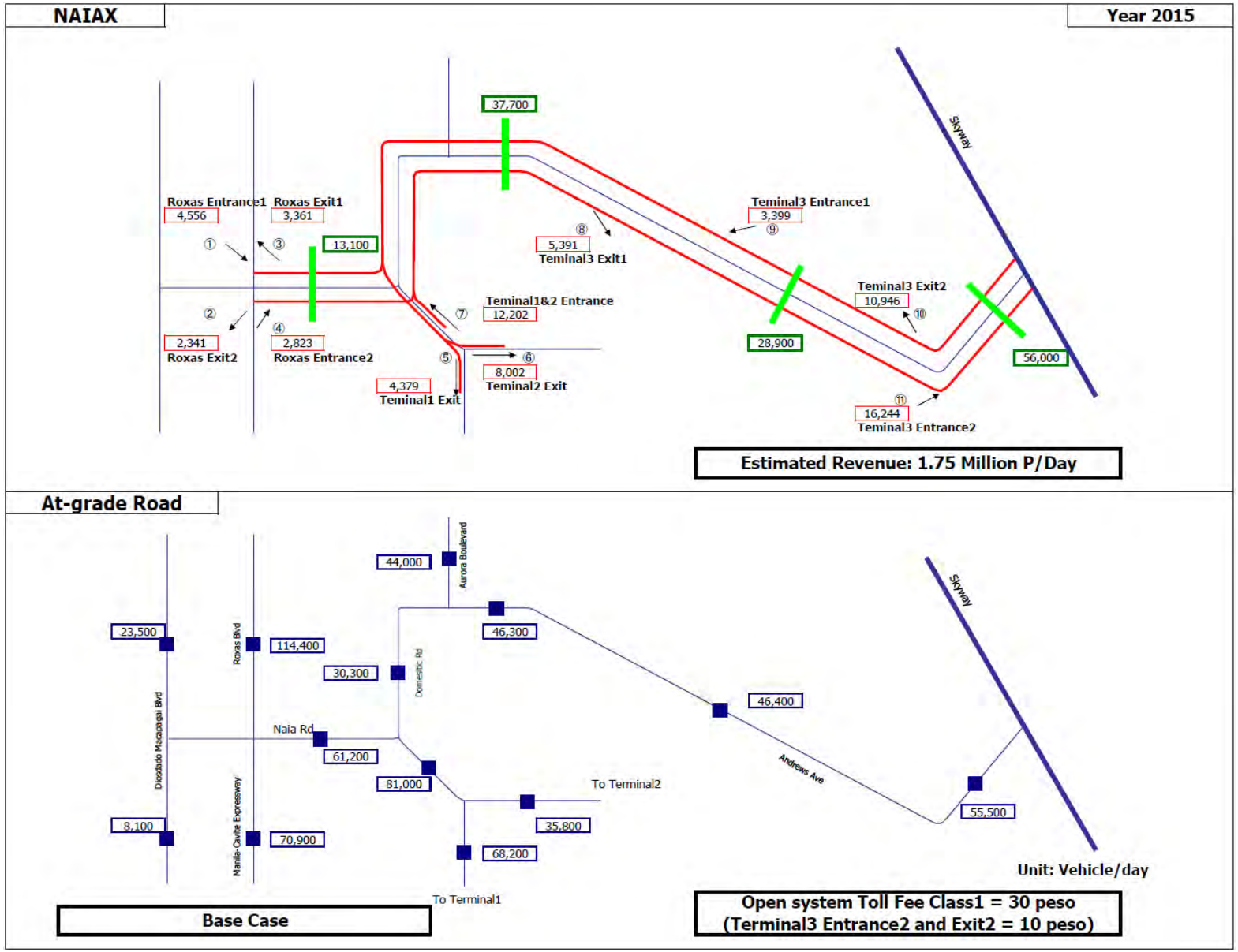

FIGURE 4.5.5-1 TRAFFIC PROJECTION (30 PESO CASE) (YEAR 2015)

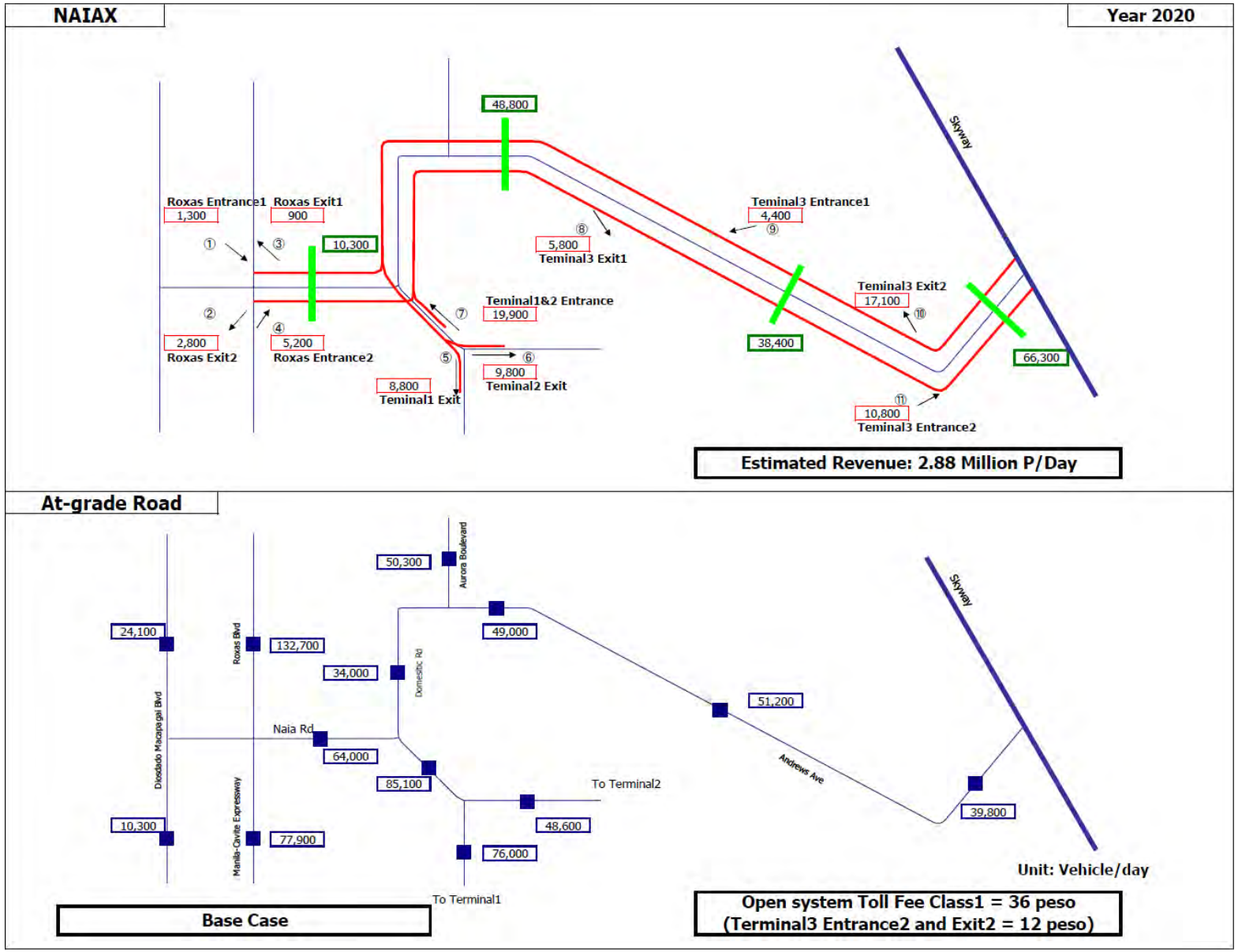

FIGURE 4.5.5-2 TRAFFIC PROJECTION (30 PESO CASE) (YEAR 2020)

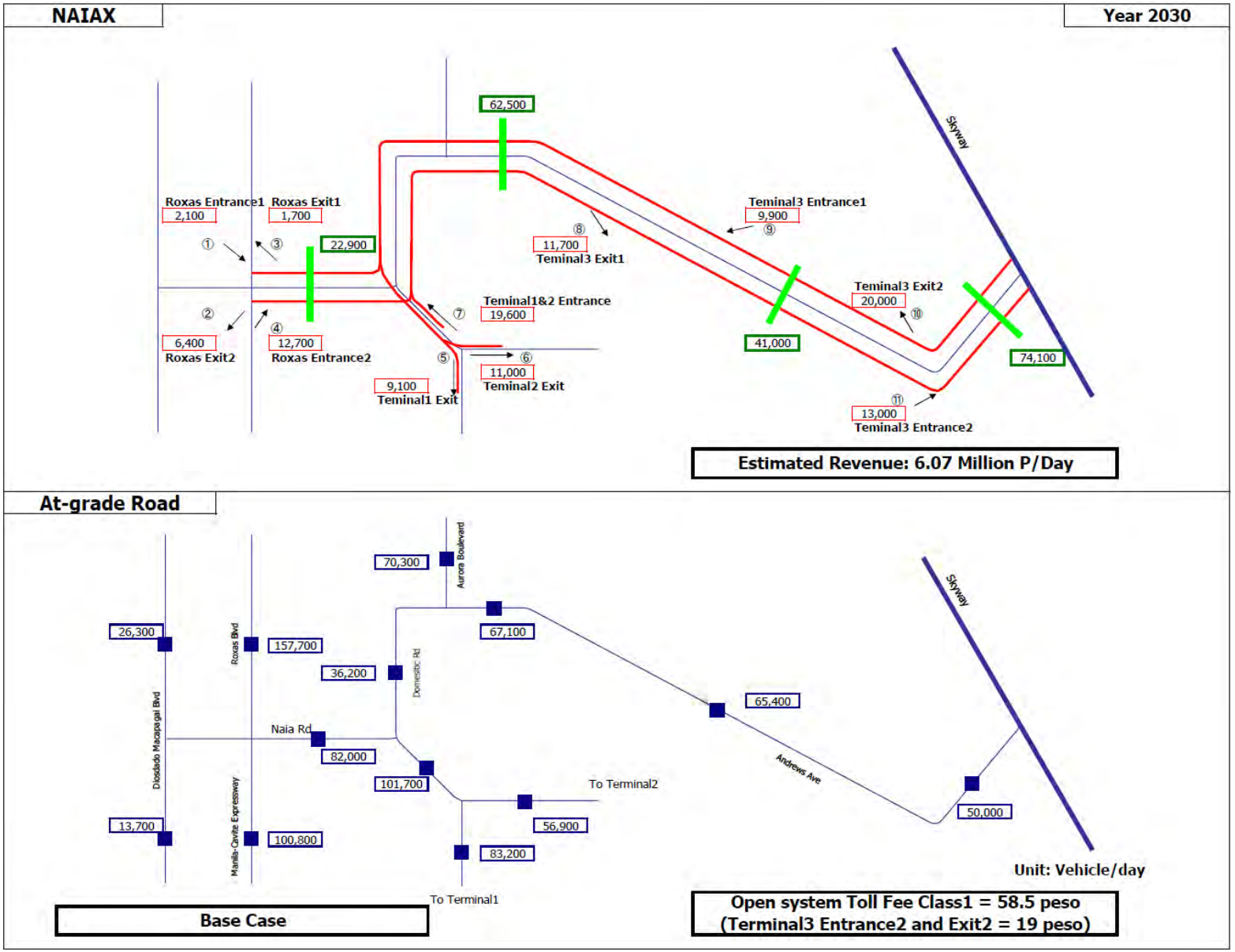

FIGURE 4.5.5-3 TRAFFIC PROJECTION (30 PESO CASE) (YEAR 2030)

TABLE 4.5.5-2 ESTIMATED VOLUME AND REVENUE (40 PESO CASE) (CLASS 1)

Traffic Voulme of NAIA Phase 2

Year	Volume (vehicle per day)												Revenue (Million Peso/
	Class 1			Class 2			Class 3			Total			
	Main	Terminal 3	Total	Main	Terminal 3	Total	Main	Terminal 3	Total	Main	Terminal 3	Total	
2015	20,258	23,192	43,450	6,380	2,776	9,156	1,361	672	2,032	27,998	26,640	54,638	**1.79**
2016	22,185	22,020	44,206	7,253	2,758	10,012	1,428	680	2,108	30,867	25,459	56,326	**1.93**
2017	17,937	25,407	43,344	11,562	4,077	15,639	3,102	1,271	4,373	32,601	30,755	63,356	**2.63**
2018	20,142	22,844	42,986	12,983	4,337	17,320	3,483	1,420	4,903	36,607	28,602	65,209	**2.88**
2019	22,617	20,540	43,156	14,578	4,632	19,210	3,911	1,587	5,498	41,106	26,759	67,865	**3.49**
2020	26,884	16,182	43,066	10,685	7,217	17,902	2,537	2,663	5,200	40,106	26,061	66,168	**3.17**
2021	27,379	16,303	43,682	11,171	7,063	18,234	2,698	2,590	5,287	41,247	25,956	67,203	**3.59**
2022	27,882	16,425	44,308	11,681	6,914	18,595	2,868	2,519	5,387	42,432	25,858	68,290	**3.69**
2023	28,395	16,548	44,944	12,218	6,768	18,986	3,050	2,450	5,499	43,663	25,766	69,429	**4.18**
2024	28,918	16,672	45,590	12,783	6,626	19,409	3,242	2,382	5,625	44,943	25,681	70,624	**4.30**
2025	29,450	16,797	46,247	13,377	6,488	19,865	3,448	2,317	5,765	46,274	25,602	71,877	**4.88**
2026	29,992	16,923	46,915	14,002	6,353	20,355	3,666	2,253	5,919	47,660	25,530	73,189	**5.03**
2027	30,544	17,050	47,594	14,660	6,222	20,882	3,897	2,192	6,089	49,101	25,463	74,565	**5.71**
2028	31,106	17,178	48,283	15,353	6,094	21,447	4,144	2,131	6,275	50,603	25,403	76,006	**5.89**
2029	31,678	17,306	48,984	16,082	5,970	22,052	4,406	2,073	6,479	52,167	25,349	77,515	**6.70**
2030	32,261	17,436	49,697	16,851	5,848	22,699	4,685	2,016	6,701	53,797	25,300	79,097	**6.92**
2031	33,222	17,567	50,789	17,353	5,730	23,083	4,824	1,961	6,785	55,400	25,257	80,657	**7.81**
2032	34,213	17,698	51,911	17,870	5,614	23,485	4,968	1,907	6,875	57,051	25,220	82,271	**8.02**
2033	35,232	17,831	53,063	18,403	5,502	23,905	5,116	1,855	6,971	58,751	25,187	83,939	**9.05**
2034	36,282	17,964	54,247	18,951	5,392	24,344	5,269	1,804	7,072	60,502	25,161	85,663	**9.29**
2035	37,364	18,099	55,463	19,516	5,286	24,802	5,426	1,754	7,180	62,305	25,139	87,444	**10.49**
2036	38,477	18,235	56,712	20,098	5,182	25,279	5,587	1,706	7,294	64,162	25,122	89,284	**10.78**
2037	39,624	18,371	57,995	20,697	5,080	25,777	5,754	1,659	7,413	66,074	25,111	91,185	**12.17**
2038	40,805	18,509	59,314	21,313	4,981	26,295	5,925	1,614	7,539	68,044	25,104	93,147	**12.50**
2039	42,021	18,647	60,668	21,949	4,885	26,833	6,102	1,570	7,672	70,072	25,102	95,173	**14.12**
2040	43,273	18,787	62,060	22,603	4,791	27,393	6,284	1,526	7,810	72,160	25,104	97,264	**14.51**
2041	44,563	18,928	63,491	23,276	4,699	27,975	6,471	1,485	7,956	74,310	25,112	99,422	**16.39**
2042	45,891	19,070	64,961	23,970	4,610	28,580	6,664	1,444	8,108	76,525	25,123	101,648	**16.84**
2043	47,259	19,213	66,471	24,684	4,523	29,207	6,863	1,404	8,267	78,806	25,139	103,945	**19.04**
2044	48,667	19,357	68,024	25,420	4,438	29,858	7,067	1,366	8,433	81,154	25,160	106,314	**19.56**
2045	50,117	19,502	69,619	26,178	4,355	30,532	7,278	1,328	8,606	83,573	25,184	108,757	**22.12**
2046	51,611	19,648	71,259	26,958	4,274	31,232	7,495	1,292	8,786	86,064	25,213	111,277	**22.73**

Note: Main = Traffic on Main Expressway
Terminal 3 = Terminal 3 related ramps (1 on-ramp and 1 off-ramp)

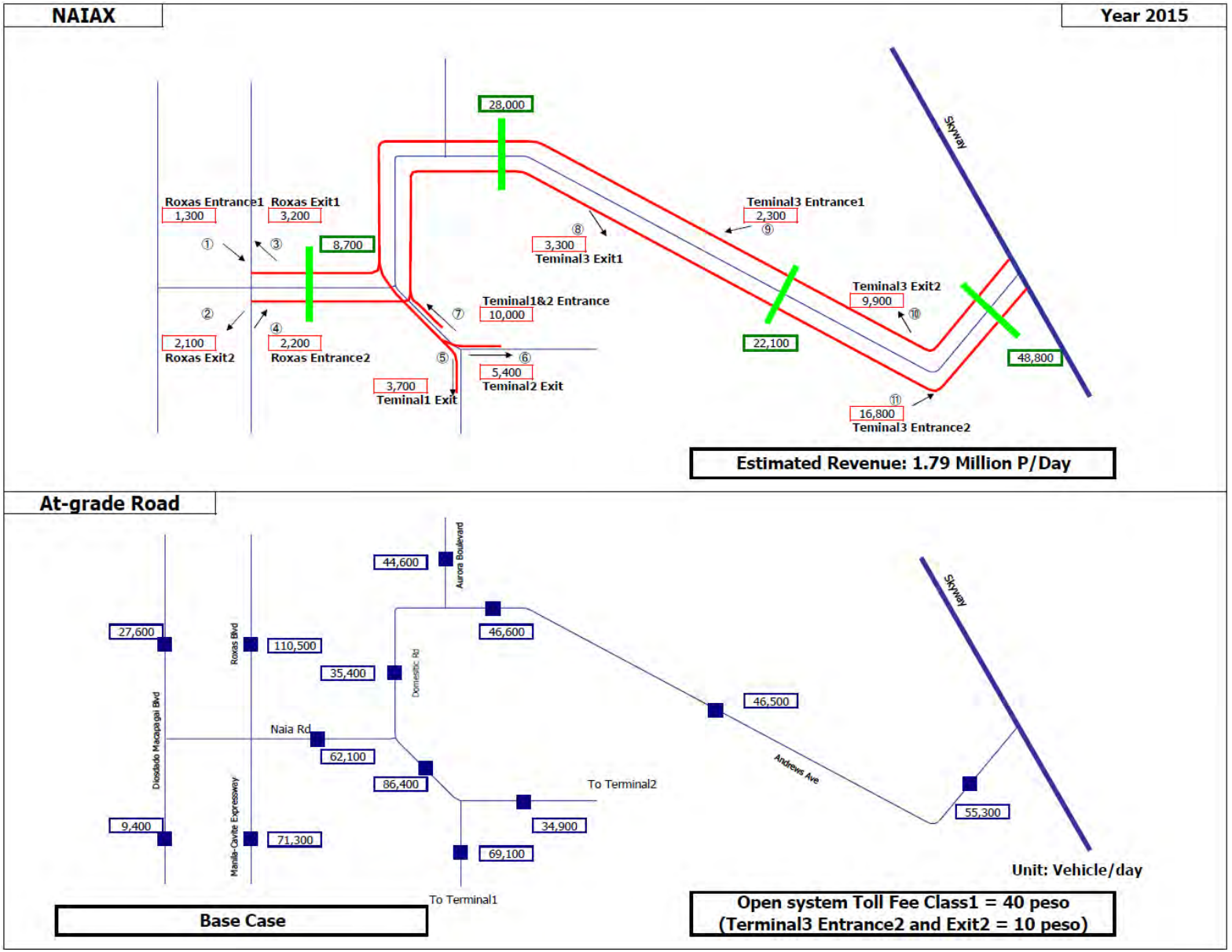

FIGURE 4.5.5-4 TRAFFIC PROJECTION (40 PESO CASE) (YEAR 2015)

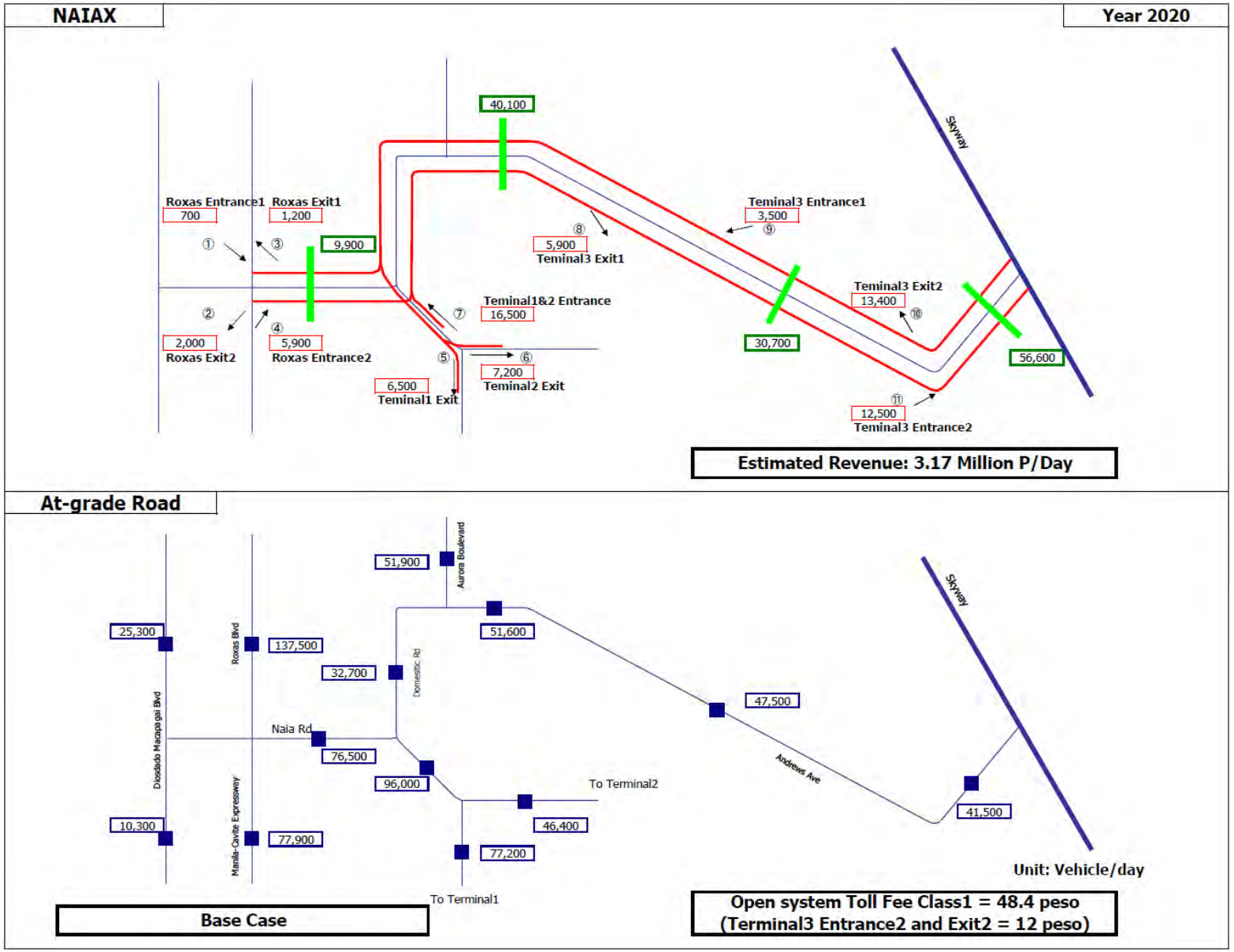

FIGURE 4.5.5-5 TRAFFIC PROJECTION (40 PESO CASE) (YEAR 2020)

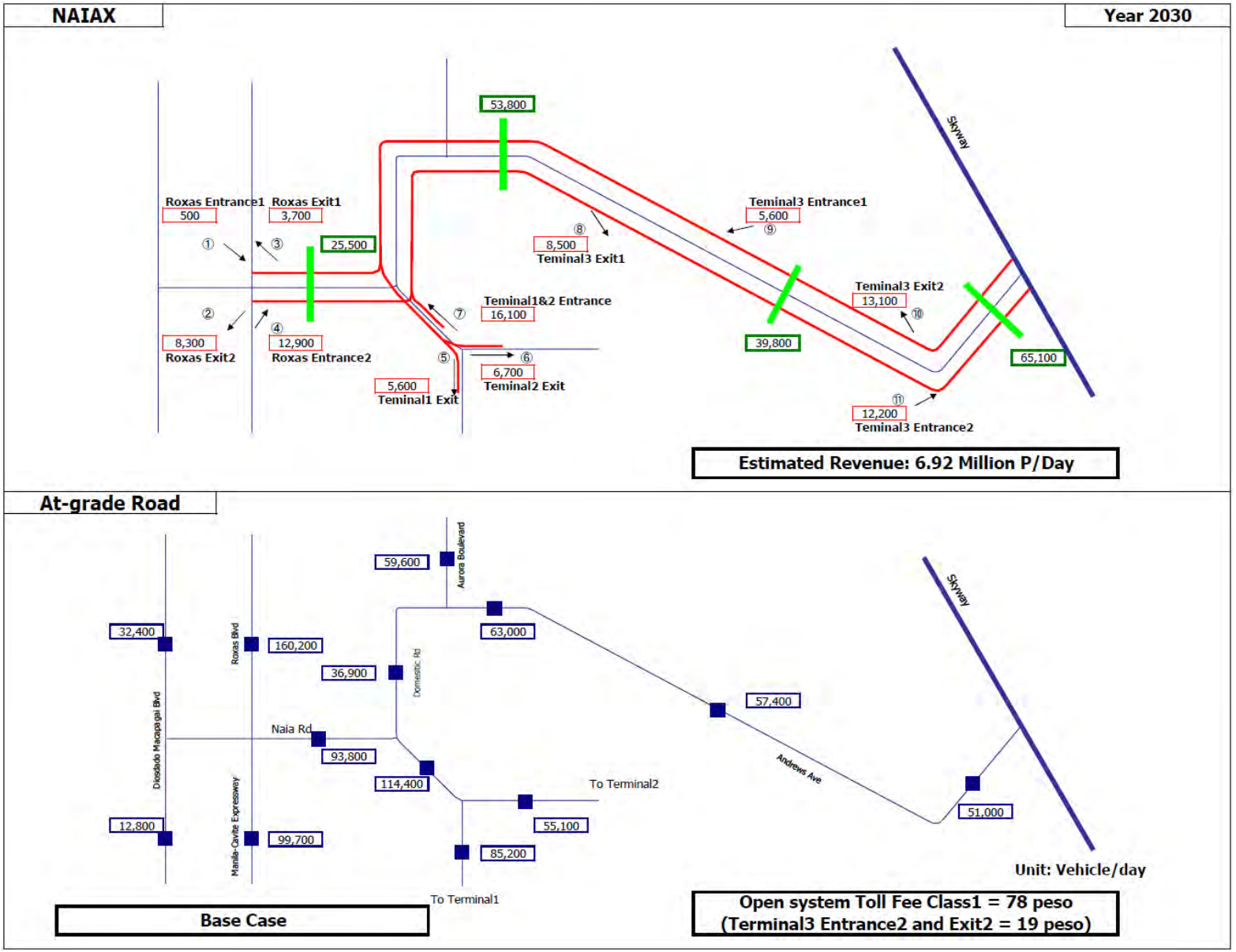

FIGURE 4.5.5-6 TRAFFIC PROJECTION (40 PESO CASE) (YEAR 2030)