

CHAPTER 5

PROJECT SCOPE OF WORK

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5.1 MINIMUM EXPRESSWAY CONFIGURATION

5.1.1 Project Component of the Project

The project is implemented under the Public-Private Partnership (PPP) Scheme in accordance with the Philippine BOT Law (R.A. 7718) and its Implementing Rules and Regulations.

The project is composed of the following components;

Component 1: Maintenance of Phase I facility for the period from the signing of Toll Concession Agreements (TCA) to Issuance of Toll Operation Certificate (TOC)

Component 2: Design, Finance with Government Financial Support (GFS), Build and Transfer of Phase II facility and Necessary Repair/Improvement of Phase I facility.

Component 3: Operation and Maintenance of Phase I and Phase II facilities.

5.1.2 Minimum Expressway Configuration of Phase II

1) Expressway Alignment

Phase II starts at the end point of Phase I (Coordinate: North = 1605866.31486, East 502268.99378), runs over Sales Avenue, Andrews Avenue, Domestic Road, NAIA (MIA) Road and ends at Roxas Boulevard/Manila-Cavite Coastal Expressway (see **Figure 5.1.2-1**).

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 5.1.2-1**. One (1) on-ramp constructed under Phase I 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 I 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.

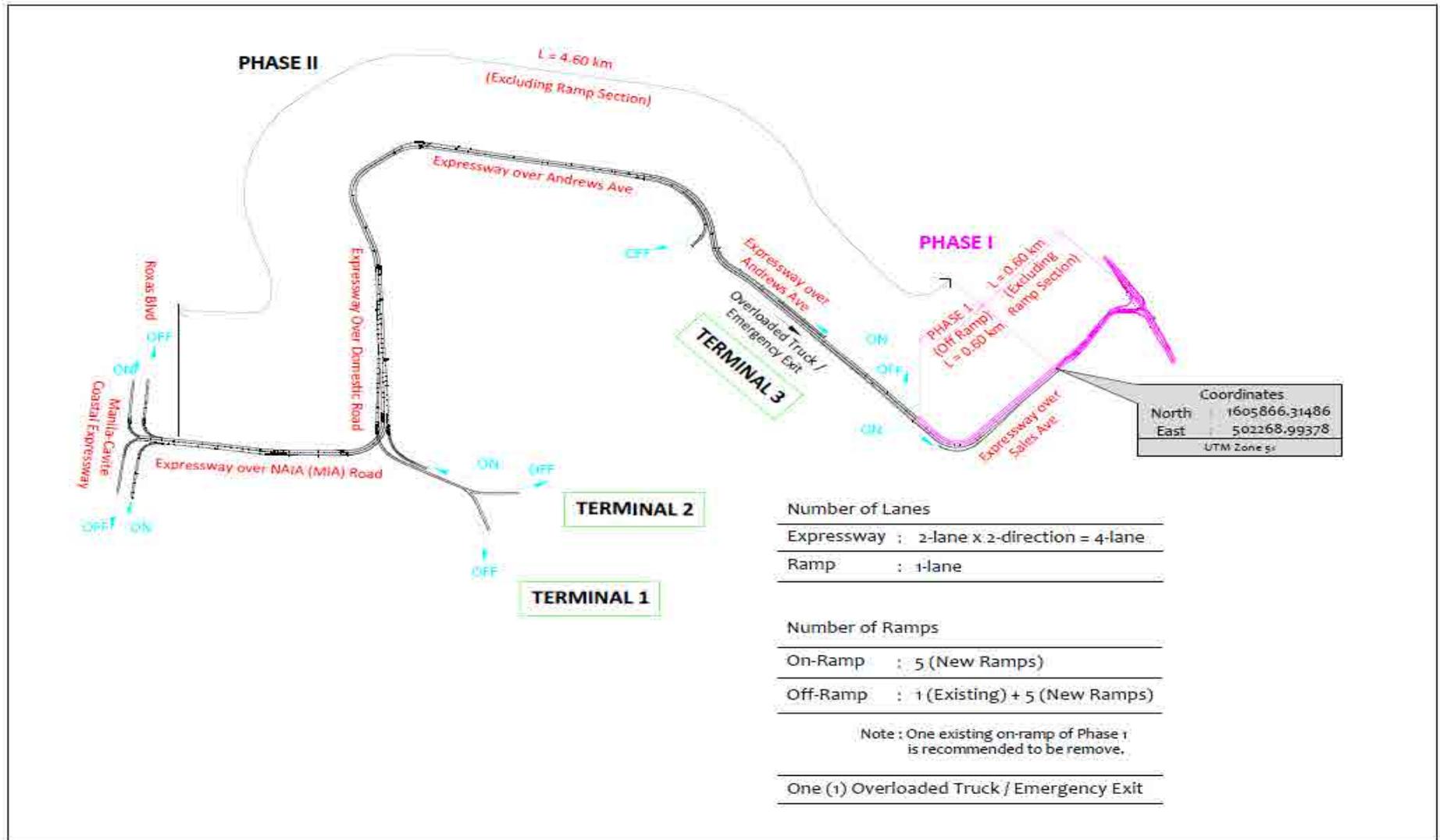


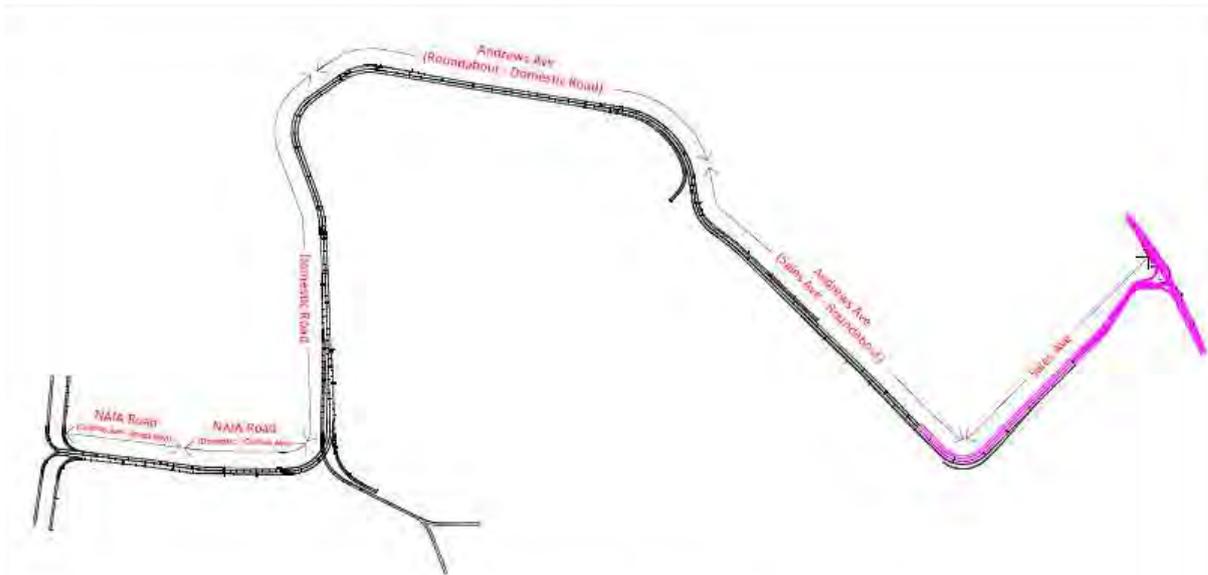
FIGURE 5.1.2-1 MINIMU EXPRESSWAY CONFIGURATION

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

Number of traffic lanes of at-grade roads are as shown in **Table 5.1.2-1** and **Figure 5.1.2-2**.

TABLE 5.1.2-1 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



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 5.1.2-2 NUMBER OF TRAFFIC LANES AT-GRADE ROADS

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-1: applicable only to the section controlled by NAIA Navigational Height Limit.

6) Pedestrian Overpass Bridge

Existing pedestrian overpass bridges are treated as follows;

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.

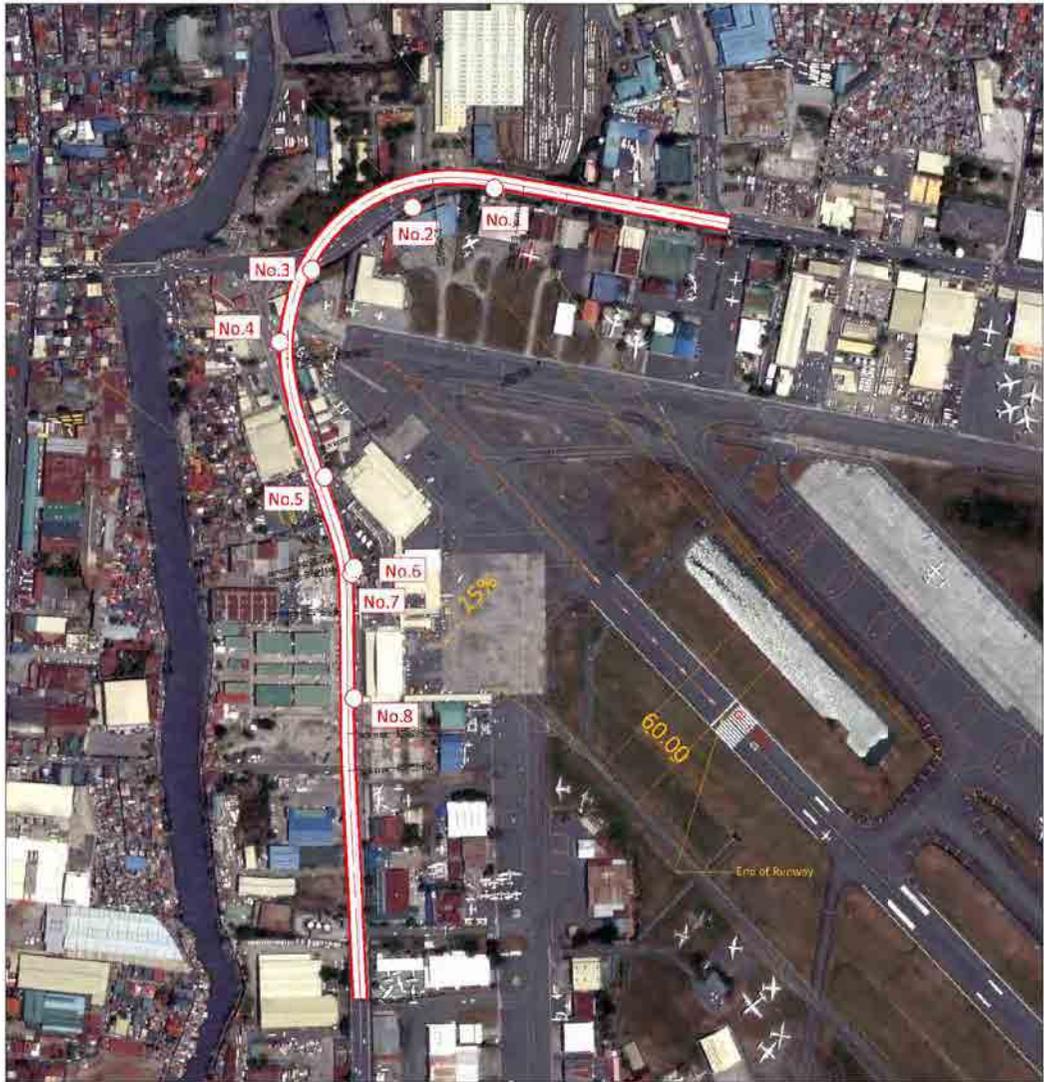
Pedestrian Overpass Bridge near the Intersection between Domestic Road and NAIA Road: To be removed and replaced with new one near the intersection.

Pedestrian Overpass Bridge at the Intersection between NAIA Road and Roxas Boulevard: To remain as is.

Minimum vertical clearance on the pedestrian overpass bridge is 2.00 m.

7) NAIA Navigational Height Limit

NAIA navigational height limit is shown in **Figure 5.1.2-3** 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 5.1.2-3 HEIGHT LIMIT ALONG ANDREWS AVE. AND DOMESTIC ROAD AND AVAILABLE NET HEIGHT

5.2 MINIMUM DESIGN STANDARDS

5.2.1 Geometric Design Standards

1) Design Standard

The following standard is mainly used as reference in NAIA Express Highway Phase II 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

2) Design Speed

Main Expressway Alignment

Minimum design speed of the main expressway alignment is **60 km/hour**, except for the short section from Sales Avenue to Andrews Avenue of which design speed is **50km/hour**.

(a) On and Off Ramps

The on and off ramp design speed is **40kph**.

3) Design Vehicle

A single-unit truck is considered as design vehicle of the main alignment and ramps.

4) Geometric Design Standards

Geometric design standards are summarized in **Table 5.2.1-1** and **Table 5.2.1-2**.

5) Typical Cross Section

Typical cross sections of main expressway for normal section, main expressway for NAIA navigational height limit section and a ramp are shown in **Figure 5.2.1-1**.

**TABLE 5.2.1-1 GEOMETRIC DESIGN STANDARDS FOR NAIAX PHASE-II:
MAIN EXPRESSWAY ALIGNMENT**

Geometric Design Standards: Main Expressway Alignment

Item	Unit	Standard	Absolute Minimum	Remark
Design Speed	kmh	60		
Design Vehicle	-	SU		
Stopping Sight Distance	m	85	75	page 56, Table 16.3, DPWH Rad Safety Design Manual
Passing Sight Distance	"	410		Page 69, Table 16.4 DPWH Road Safety Design Manual

1. Cross Section Elements

Item	Unit	Standard	Absolute Minimum	Remark
Lane Width	m	3.50		
Median Width	"	1.00		
Inner Shoulder Strip	"	0.50		
Outer Shoulder Strip	"	1.50	0.5	0.5m shall be adopted for NAIA Navigational height limit section and section over Sales Ave.
Number of Lanes	nos	2		
Normal Crossfall	%	2.00		
Maximum super elevation	%	6.00		page 53, table 16.1 DPWH Road Safety Design Manual
Super elevation	%	exhibit 3-26		page 168, exhibit 3-26, ASSHTO 2004
Maximum relative gradients	%	0.60		page 62, super elevation DPWH, Road Safety Design Manual

2. Horizontal Alignment

Item	Unit	Standard	Absolute	Remark
Minimum Radius	m	123		Page 147, exhibit 3-15, ASSHTO 2004
Min. Transition Curve Length	"	30		Page 61, Figure 16.3 DPWH Road Safety Design Manual
Min. Radius not requiring Transition Curve	"	1030	500	page 168, exhibit 3-26, ASSHTO 2004 (2.0%), JPN Standard
Superelevation run off		1/125		JPN Standard

3. Vertical Alignment

Item	Unit	Standard	Absolute Maximum	Remark
Max Vertical Gradient	%	5	7	Page 53, Table 16.1 DPWH Road Safety Design Manual
Min. K value	Crest	"	18.0	1500(1000) JPN Standard
	Sag	"	18.0	2000(1400) JPN Standard
Min. Vertical Curve Length	"	60		Page 636, DPWH Design Guidelines, Criteria and Standards Vol II
Max. Composition Grade	%	11.5		

4. Curve Radius and Widening (per 1 carriage way)

Radius Curve(m)	400	300	250	200	150	140	130	120	90
Widening(m)	0.1	0.2	0.2	0.3	0.5	0.6	0.6	0.6	0.7

AASHTO 2004 p211 ,p213 adjusted to SU, roadway width 7.0m

Values less than 0.6m may be disregarded

**TABLE 5.2.1-2 GEOMETRIC DESIGN STANDARDS FOR NAIAX PHASE-II:
RAMPS**

Geometric Design Standards: Ramps

Item	Unit	Standard	Absolute Minimum	Remark
Design Speed	"	40		
Design Vehicle	-	SU		Exhibit 2-4, p22 AASHTO 2004
Stopping Sight Distance	"	50		page 56, Table 16.3, DPWH Rad Safety Design Manual
Passing Sight Distance	"	270		Page 69, Table 16.4 DPWH Road Safety Design Manual

1. Cross Section Elements

Item	Unit	Standard	Absolute Minimum	Remark
Pavement Type				PCCP
Lane Width	m	3.50		
Median Width	"	-		
Inner Shoulder Strip	"	0.50		
Outer Shoulder Strip	"	2.00	0.5	0.5m for 2 lanes Ramp
Number of Lanes	nos	1		
Normal Crossfall	%	2.00		
Maximum super elevation	%	6.00		page 53, table 16.1 DPWH Road Safety Design Manual
Super elevation	%	exhibit 3-26		page 168, exhibit 3-26, ASSHTO 2004
Maximum relative gradients	%	0.66		page 62, super elevation DPWH, Road Safety Design Manual

2. Horizontal Alignment

Item	Unit	Standard	Absolute Minimum	Remark
Minimum Radius	m	43		Page 147, exhibit 3-15, ASSHTO 2004
Min. Transition Curve Length	"	22		Page 61, Figure 16.3 DPWH Road Safety Design Manual
Min. Radius not requiring Transition Curve	"	525		page 168, exhibit 3-26, ASSHTO 2004 (2.0%)
Superelevation run off		1/125		JPN Standard

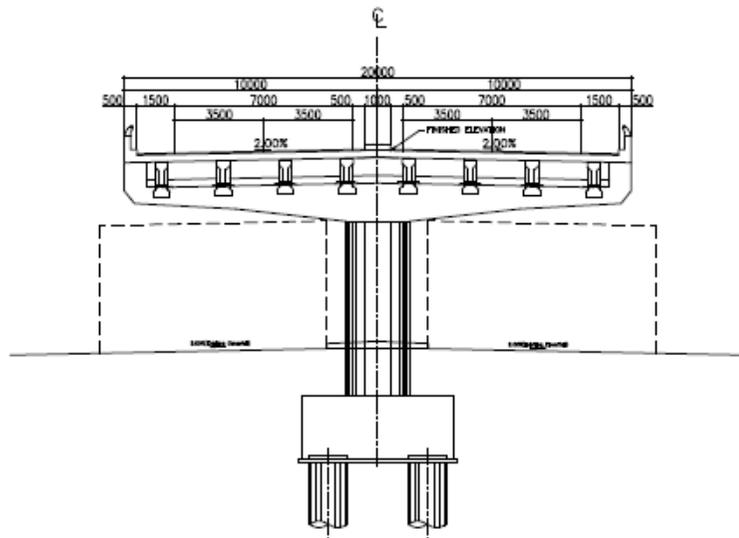
3. Vertical Alignment

Item	Unit	Standard	Absolute Maximum	Remark
Max Vertical Gradient	%	6	7	Page 53, Table 16.1 DPWH Road Safety Design Manual
Min.K value	Crest	"	6.0	() is recommended value
	Sag	"	9.0	() is recommended value
Min. Vertical Curve Length	"	60		Page 636, DPWH Design Guidelines, Criteria and Standards Vol II
Max. Composition Grade	%	11.5		

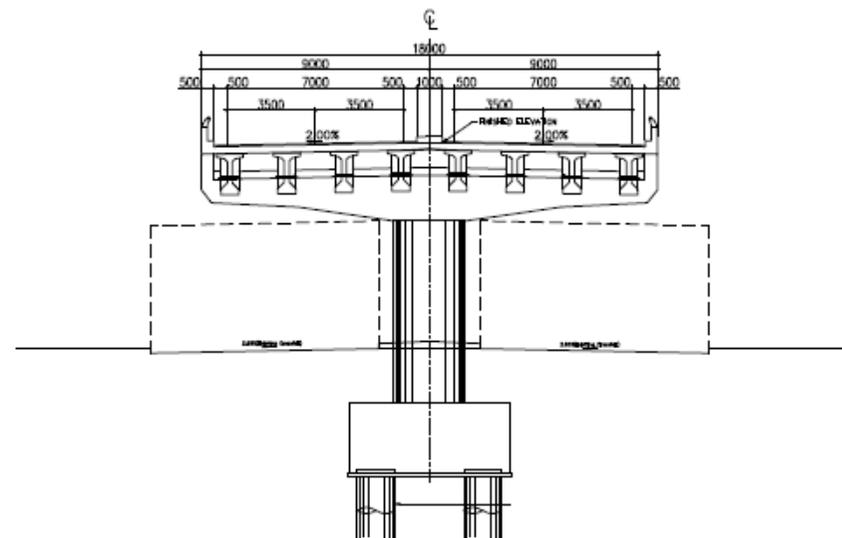
4. Curve Radius and Pavement Width

Radius (m)	15	25	30	50	75	100	125	150	
Pavement Width (m)	6.0	5.6	5.5	5.3	5.2	5.2	5.1	5.1	

Caseell, Condition A, p839 AASHTO 2004

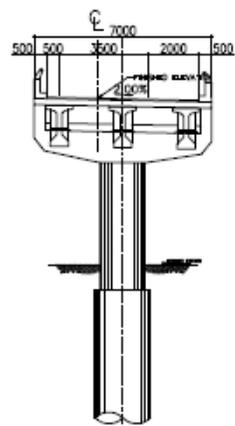


TYPICAL CROSS SECTION FOR 4 LANES(W=20M) Normal Section



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

- Section from End of Phase I to End of Sales Ave/Andrews Avenue Curve (L=700m)
- Height Restricted Section Due to NAIA Navigational Clearance (L=300m)



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

FIGURE 5.2.1-1 TYPICAL CROSS SECTION

6) Crossfall Development

Superelevation of the carriageway shall be considered to accommodate recommendation of AASHTO 2004 as shown in **Table 5.2.1-3**. The maximum value of super elevation is 6.0% as guided in Road Safety Manual (2004) in page 53.

In principle, the super elevation is attained within spiral curve. The runoff rate of super elevation is considered 1/125 from Japan Road Association, Road Structure Ordinance, 2004.

TABLE 5.2.1-3 MINIMUM RADII FOR DESIGN SUPER ELEVATION RATES, EMAX = 6.0%

Super elevation (%)	Minimum Radius		
	Design Speed = 40km/h	Design Speed = 50km/h	Design Speed = 60km/h
1.5	738	1050	1440
2.0	525	750	1030
2.2	465	668	919
2.4	415	599	825
2.6	372	540	746
2.8	334	488	676
3.0	300	443	615
3.2	269	402	561
3.4	239	364	511
3.6	206	329	465
3.8	177	294	422
4.0	155	261	380
4.2	136	234	343
4.4	121	210	311
4.6	108	190	283
4.8	97	172	258
5.0	88	156	235
5.2	79	142	214
5.4	71	128	195
5.6	63	115	176
5.8	56	102	156
6.0	43	79	123

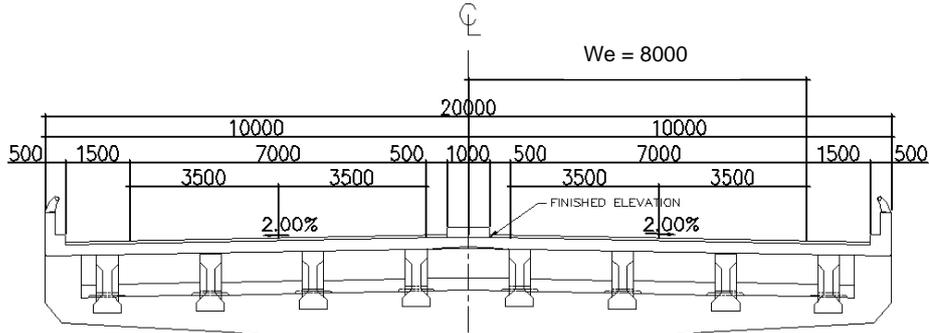
7) Minimum Curve length

The length of the spiral curve recommendation is to take for 2 seconds of the design speed by AASHTO 2004.

40km/h: $L_d = 11.1(\text{m/s}) \times 2(\text{sec}) = 22.2\text{m}(22\text{m})$

50km/h: $L_d = 13.9(\text{m/s}) \times 2(\text{sec}) = 27.8\text{m}(28\text{m})$

60km/h: $L_d = 16.7(\text{m/s}) \times 2(\text{sec}) = 33.3(33\text{m})$



The minimum length of spiral curve for runoff of the super elevation is calculated as shown in **Table 5.2.1-4**. This value is applied when it is larger than “Ld”. The design shortens spiral curve length where topographical and control condition is critical by allowing runoff till 2.0% at Ts points.

TABLE 5.2.1-4 MINIMUM SPIRAL CURVE LENGTH

Radius	Super elevation(%)	We(m)	e	Ls	e(min)*	Ls(min)*	Remark
92	6.00	8.0	0.480	60.000	0.320	40.000	50kmh
123	6.00	8.0	0.480	60.000	0.320	40.000	60kmh
190	5.60	8.0	0.448	56.000	0.288	36.000	60kmh
200	5.40	8.0	0.432	54.000	0.272	34.000	60kmh
250	4.60	8.0	0.368	46.000	0.208	26.000	60kmh
300	3.80	8.0	0.304	38.000	0.144	18.000	60kmh
500	2.80	8.0	0.224	28.000	0.064	8.000	60kmh

* e(min) and Ls(min) is the value when runoff till 2.0%(same as crossfall) at Ts points

* This value is only applied where topo and horizontal control condition is critical.

8) Speed Change Lanes

The deceleration and acceleration length requirements are calculated based of AASHTO (2004) as shown in **Table 5.2.1-5** and **Table 5.2.1-6**.

(a) Deceleration Lane Length and Acceleration Lane Length

TABLE 5.2.1-5 DECELERATION LENGTH

L (meters) for Design Speed of Exit Curve, V' (km/hr)									
Highway Design Speed, V (km/hr)	Speed Reached, Va (km/hr)	Stop Condition	20	30	40	50	60	70	80
		For Average Running Speed on Exit Curve, V'a (km/hr)							
		0	20	28	35	42	51	63	70
50	47	75	70	60	45	-			
60	55	95	90	80	65	55	-		
70	63	110	105	95	85	70	55	-	
80	70	130	125	115	100	90	80	55	-
90	77	145	140	135	120	110	100	75	60
100	85	170	165	155	145	135	120	100	85
110	91	180	180	170	160	150	140	120	105
120	98	200	195	185	175	170	155	140	120

Where:

- V=Design Speed of Tollway (km/hr)
- Va=Average Running Speed on Tollway (km/hr)
- V'=Design Speed of Exit (km/hr)
- V'a=Average Running Speed on Exit Curve (km/hr)

TABLE 5.2.1-6 ACCELERATION LENGTH

L (meters) for Entrance Curve Design Speed, V' (km/hr)									
Highway Design Speed, V (km/hr)	Speed Reached, Va (km/hr)	Stop Condition	20	30	40	50	60	70	80
		And Initial Speed, V'a (km/hr)							
		0	20	28	35	42	51	63	70
50	37	60	50	30	-	-			
60	45	95	80	65	45	-	-		
70	53	150	130	110	90	65	-	-	
80	60	200	180	165	145	115	65	-	-
90	67	260	245	225	205	175	125	35	-
100	74	345	325	305	285	255	205	110	40
110	81	430	410	390	370	340	290	200	125
120	88	545	530	515	490	460	410	25	245

Where:

- V=Design Speed of Tollway (km/hr)
- Va=Average Running Speed on Tollway (km/hr)
- V'=Design Speed of Entrance Curve (km/hr)
- V'a=Initial Speed on Entrance Curve (km/hr)

TABLE 5.2.1-7 (1) SPEED CHANGE LANE ADJUSTMENT FACTORS AS A FUNCTION OF GRADE

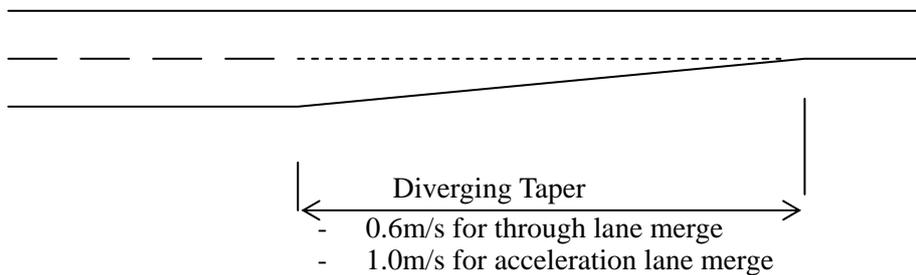
Highway Design Speed, V (km/hr)	Ratio of Length on Grade to Length on Level for Design Speed of Turning Curve (km/hr)	
All Speeds	3 to 4% Upgrade 0.90	3 to 4% Downgrade 1.20
All Speeds	5 to 6% Upgrade 0.80	5 to 6% Downgrade 1.35

TABLE 5.2.1-7 (2) SPEED CHANGE LANE ADJUSTMENT FACTORS AS A FUNCTION OF GRADE

Highway Design Speed, V (km/hr)	Ratio of Length on Grade to Length on Level for Design Speed of Turning Curve (km/hr)					
	40	50	60	70	80	All Speeds
3 to 4% Upgrade						3 to 4% Downgrade
60	1.3	1.4	1.4			0.70
70	1.3	1.4	1.4	1.5		0.65
80	1.4	1.5	1.5	1.5	1.6	0.65
90	1.4	1.5	1.5	1.5	1.6	0.6
100	1.5	1.6	1.7	1.7	1.8	0.6
110	1.5	1.6	1.7	1.7	1.8	0.6
120	1.5	1.6	1.7	1.7	1.8	0.6
5 to 6% Upgrade						5 to 6% Downgrade
60	1.5	1.5				0.6
70	1.5	1.6	1.7			0.6
80	1.5	1.7	1.9	1.8		0.55
90	1.6	1.8	2.0	2.1	2.2	0.55
100	1.7	1.9	2.2	2.4	2.5	0.5
110	2.0	2.2	2.6	2.8	3.0	0.5
120	2.3	2.5	3.0	3.2	3.5	0.5

(b) Diverging Taper

*Vertical Gradient less than 3.0%

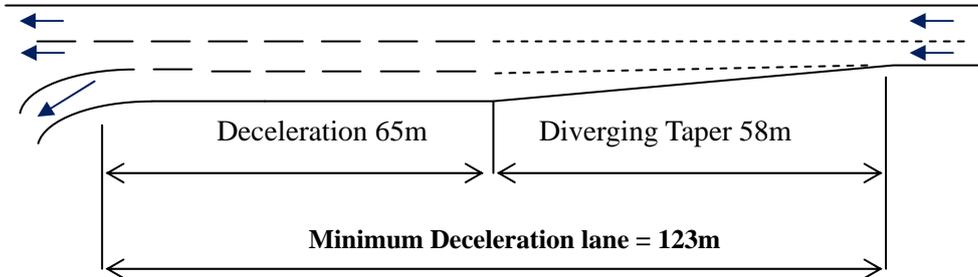


Design Speed	60 km/hr (16.67 m/s)
Lane width	3.5m
Diverging Taper	58m

Minimum Deceleration and Acceleration Lanes

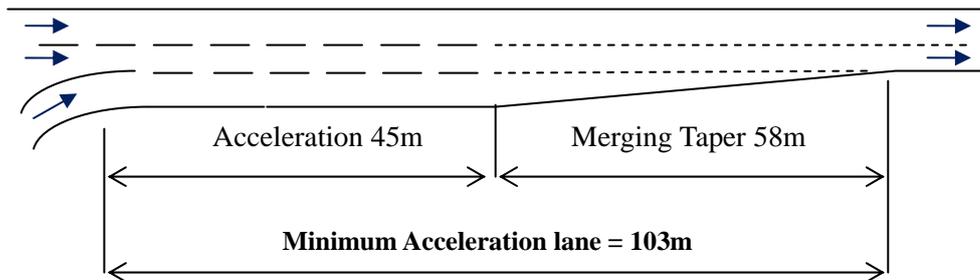
Deceleration lane

*Vertical Gradient less than 3.0%



Acceleration lane

*Vertical Gradient less than 3.0%



9) Maximum Gradient

For the main expressway alignment with design speed of 60kmh, the maximum vertical gradient could be **7%** by referring to Road Safety Manual (2004 DPWH), however, desirable max gradient is **5%**.

For On and Off Ramps, the maximum gradient recommended is **6.0%**, while absolute maximum gradient is **7.0%**.

5.2.2 Minimum Design Standards for Structure

1) Structure Design Standard

The Structure Design Standard shall be in accordance with the following codes and guidelines:

- AASHTO Standard Specifications for Highway Bridges 17th edition 2002,
- DESIGN Guidelines Criteria and Standard for Department of Public Works And Highways,
- Basic Specifications – DPWH Standard Specifications 2004, Highways, Bridges and Airports
- Alternatively, Japanese Standards also will be adopted as the structure design standards.

2) Loading Specifications

Structure shall be designed to carry the following loads and forces:

1) Dead Load

2) Live Load

Live Load shall be MS18 (HS-20-44)

3) Impact Load

$$I = 15.24/(L+38)$$

4) Sidewalk Live Load

4.07 KPa of sidewalk area

5) Earthquake Load

A = 0.5g, Seismic Performance Category = D

6) Earth Pressure

Coulomb's Formula

7) Wind Load

For the Superstructure design, 2,394Pa of wind load shall be applied horizontally at right angle to the longitudinal axis of girders and beams.

8) Thermal Forces

The range of temperature shall be as follows:

17.8 °C to 48.9 °C

16.7 °C temperature rise

22.2 °C temperature fall

3) Seismic Design

Seismic Design shall be in accordance with AASHTO Standard Specifications Division I-A. Acceleration coefficient of 0.50g shall be adopted to consider importance classification and past/recent experience in the Philippines.

4) Materials

All materials to be used in the project shall conform to DPWH Standard Specifications (2004), and AASHTO Code.

a) Concrete

DESCRIPTION	f_c' (Min.) MPa	MAXIMUM SIZE OF CONCRETE AGGREGATES (mm)	MINIMUM CONCRETE COVER (mm)
a. Superstructure			
- Deck slabs, Diaphragms	28	20	Deck slab with BWS Top: 50 Bottom: 50 Others: 35
- Sidewalk, railings, parapets, medians	21	20	
- PSC I-Girders	38	20	PSC I-Girders: 35
b. Substructure			
- PC Pier copings, columns, footings	28	20	Pier Copings, RC & PSC: 50
- PSC Pier copings, rotating pier head	38	20	PSC Hammerheads: 40
- RC Abutment walls, footings	28	20	RC columns: 50
- Bored piles	28	20	Footing and Bored Piles: 75 Abutment Walls: 50
c. Earth covered RC Box structures	28	20	Earth covered Box structures: 50
d. Other concrete (normal use)	21	20	
e. Lean concrete (for leveling)	17	25	
f. Non shrink grout	41	40	

b) Reinforcement Steel

All pre-stressing steel shall be high strength stress relieved wires or strands with an ultimate stress, $f_s' = 1860$ MPa

Pre-stressing steel shall be free from kinks, notches and other imperfections that will tend to weaken its strength or its bonding properties with concrete

c) Pre-stressing

All pre-stressing steel shall be high strength stress relieved wires or strands with an ultimate stress, $f_s' = 1860$ MPa.

Pre-stressing steel shall be free from kinks, notches and other imperfections that will tend to weaken its strength or its bonding properties with concrete.

d) Structural Steel

All structural steel shall conform to the requirements of AASHTO or ASTM Designations as follows:

- i. Structural Steel Shapes - AASHTO M 270 (ASTM A 36) Gr 36 and (ASTM A572) Gr 50.
 - ii. Steel Sheet Pile - AASHTO M 202 (ASTM A 328)
 - iii. Bridge Bearing - AASHTO M 270 (ASTM A 36) AASHTO M 106 (ASTM B 100)
AASHTO M 103 (ASTM A 27) (Copper Alloy Bearing Expansion Plates Grade 70 – 36 of Steel and Sheets)
 - iv. Deck Drain - AASHTO M 105 (ASTM A 46) Class No. 30 (Gray Iron Casting)
 - v. Bridge Railing - Sch. 40 Galvanized Steel Pipe
- e) Elastomeric Bearing Pads
Elastomeric bearing pads shall be 100% virgin chlorophene (neoprene) pads with durometer hardness 60. Unless otherwise specified in the plans, bearing pads shall be laminated type bearing pads consisting of layer of elastomer, restrained at their interfaces by bonded laminations are required on the plans, laminated plate shall be non-corrosive mild steel sheet.
- f) Joint Filler
Joint filler, hot poured elastic type, used for expansion joint shall conform to AASHTO M 213.
- g) Bituminous Wearing Course
Bituminous wearing course to be used as surface overlay shall conform to the requirements of DPWH Standard Item 307 with minimum dry compressive strength of 1.4 MPa (200 pal). The wearing course may be used to adjust elevations on the vertical grade by varying the thickness from 50mm (min.) to 75mm (max).

5.3 PRELIMINARY DESIGN OF PLAN AND PROFILE

5.3.1 Topographic Map Used

The horizontal control point was studied based on the same map as used in the feasibility study in 2010 by Filipinas Dravo Corporation in association with Philipp’s Technical Consultants Corp.

At grade road elevation along domestic road was re-surveyed by the JICA Study Team and this was integrated in the previous topographic survey result.

Cross sectional survey along Domestic Road and elevation survey of existing pedestrian bridges were also conducted by the JICA Study Team and reflected in the preliminary design.

5.3.2 Horizontal Alignment Study

(a) Sta. 0+000 to Sta.0+700

- The main alignment is connected with the end of Phase I. The beginning point of alignment is at the edge of the existing bridge. The elevation of the beginning points is set as same as FS in 2010.
- Available ROW in Sales Avenue is approximately 19.0m to 19.5m.
- The outer shoulder of the main alignment is, therefore, reduced from 1.5m to 0.5m (total width 18.0m) in order not to affect the Air Force Head Quarter property(Sta.0+000 to Sta.0+700).
- The main alignment was offset so as not to affect the existing off ramp bridge.
- R=92m is employed in order to connect ON ramp from terminal 3 towards Skyway (Andrew’s Avenue ON Ramp(1)) without affecting the air force museum building. The design speed of this section is **50kph** due to existing off-ramp constructed under Phase I.

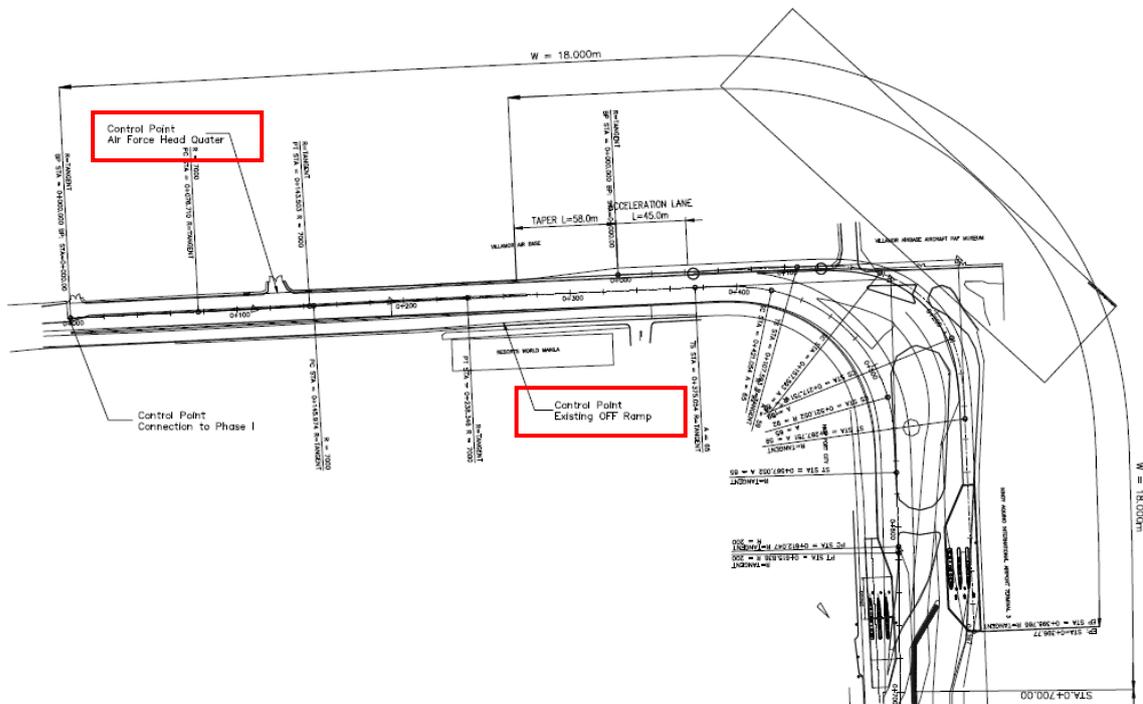
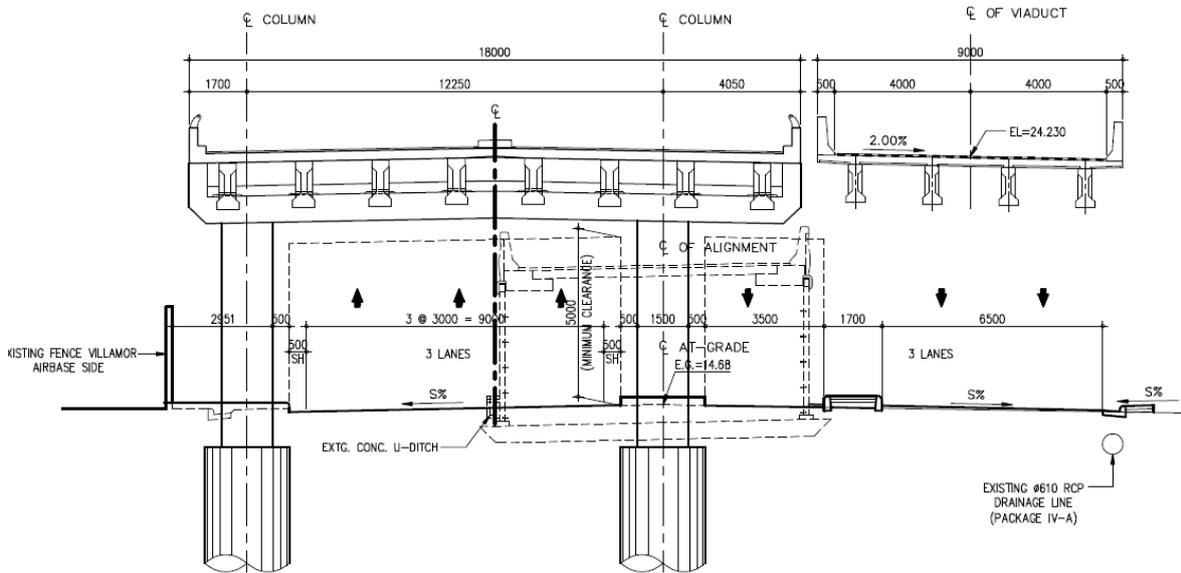




FIGURE 5.3.2-1 Sta.0+000 TO Sta.0+700



SCALE 1:200

FIGURE 5.3.2-2 CROSS SECTION AT EXISTING OFF RAMP SECTION

(b) Sta.0+700 to Sta.1+500

- The main alignment basically follows at-grade road centre line.
- Existing R.O.W limit of Marriot Hotel side (north side of Andrews Ave.) is set as control point.
- Andrew's ON Ramp (2) is designed within existing R.O.W.
- The toll gate is designed to be set in tangent section of the main alignment.

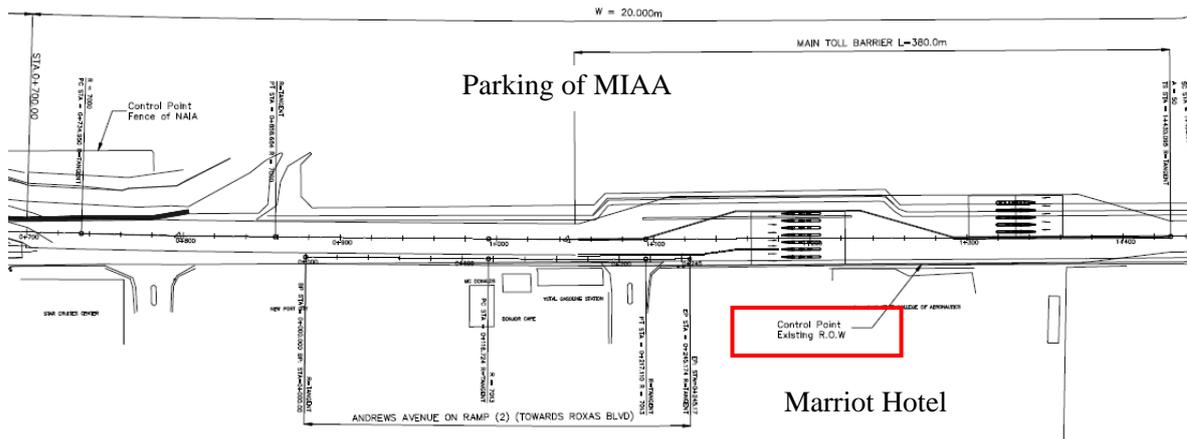


FIGURE 5.3.2-3 Sta.0+700 TO Sta.1+500

(1) Sta.1+500 to Sta.2+000 (MMDA Landmark)

- The alignment is selected to avoid traversing over the Landmark at Circulo del Mundo (under construction).
- Existing Electrical Transformer Station for MIAA and private houses on the other side of the road are considered as control points of the horizontal alignment design.
- These houses were already relocated before, so the Government of Pasay City strongly requested to avoid affecting these houses.
- The off ramp to Terminal 3 (Andrew's Avenue OFF Ramp) has also been designed without affecting abovementioned facilities.

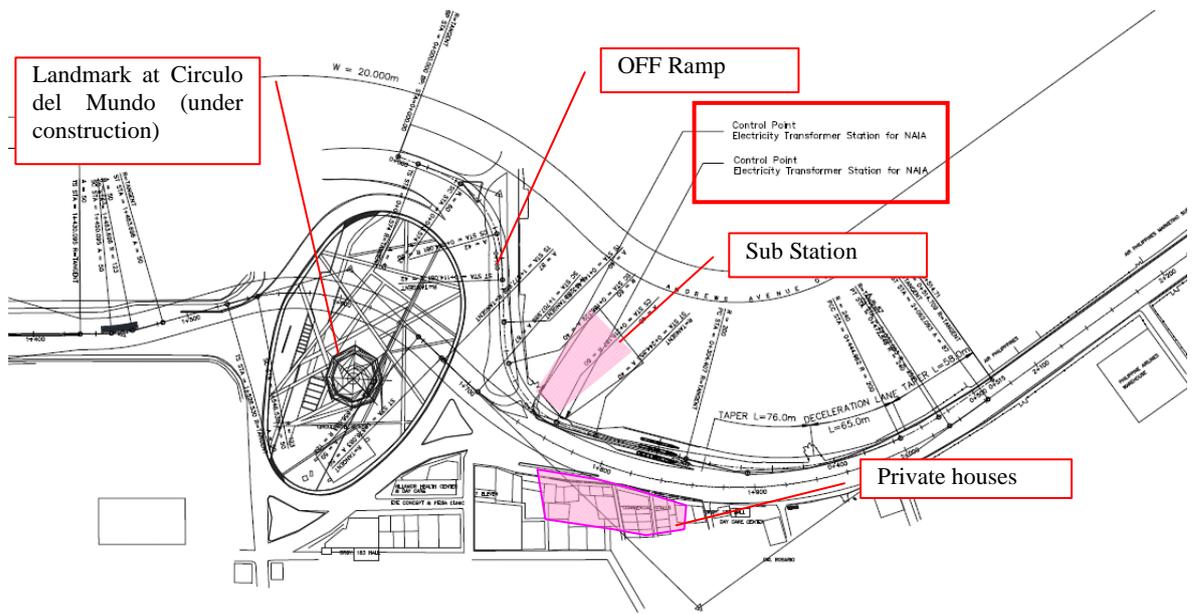


FIGURE 5.3.2-4 Sta.1+500 TO Sta.2+000 (MMDA LANDMARK)



FIGURE 5.3.2-5 LANDMARK AT CIRCULO DEL MUNDO

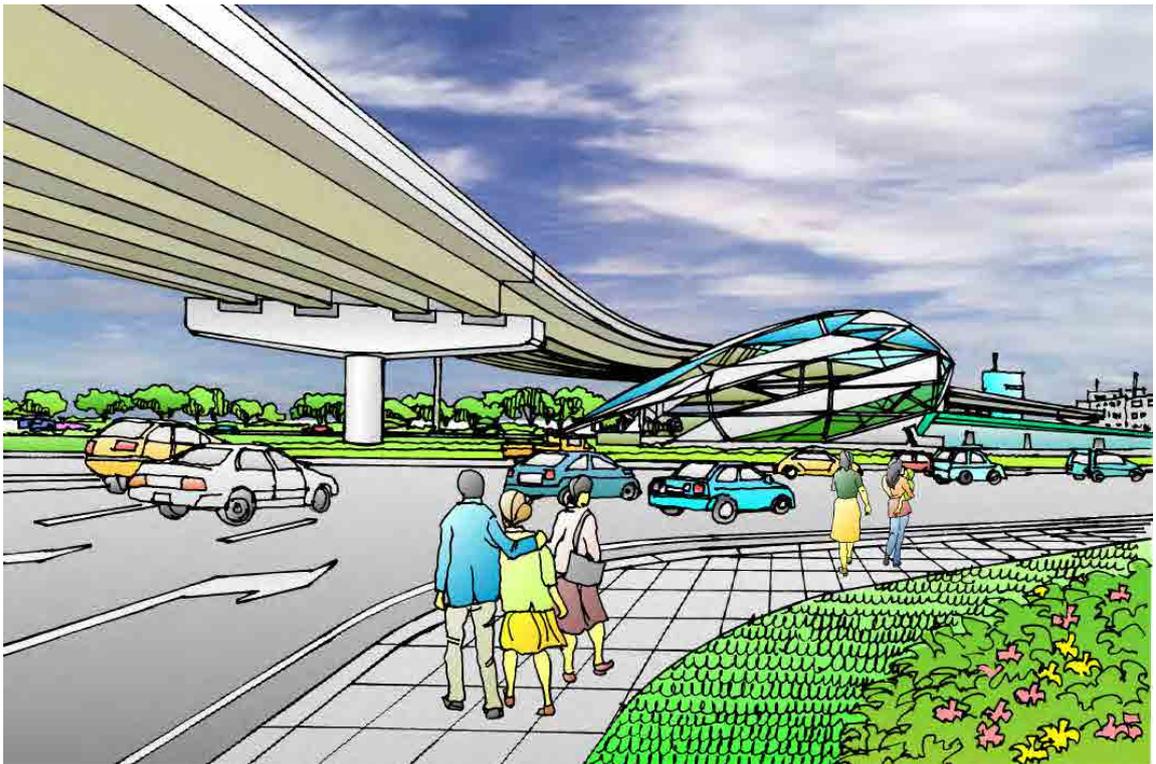


FIGURE 5.3.2-6 PERSPECTIVE VIEW OF LANDMARK AND RECOMMENDED EXPRESSWAY ALIGNMENT

(5) Sta.2+800 to Sta.3+300 (LRT Depot)

- The previous FS alignment was designed along the existing road (R = 125m).
- Since the vertical alignment shall be an up-and-down grade in short distance due to navigational clearance, the horizontal alignment is highly recommended to accommodate higher standard of geometry.
- The alignment was reviewed to accommodate with larger (R = 190m) radius by using some LRTA property.
- At the Domestic Road, the building of PAL DATA CENTER is considered as the control point (fronted at-grade road is critical).
- This section needs to consider the navigational height limit of NAIA.
- Pump station in MIAA property is one of the control points for profile design and pier layout. (Detail survey is necessary to identify associated facilities such as underground pipes for profile design and pier layout.)
- Several private buildings and airport facilities need to be relocated.

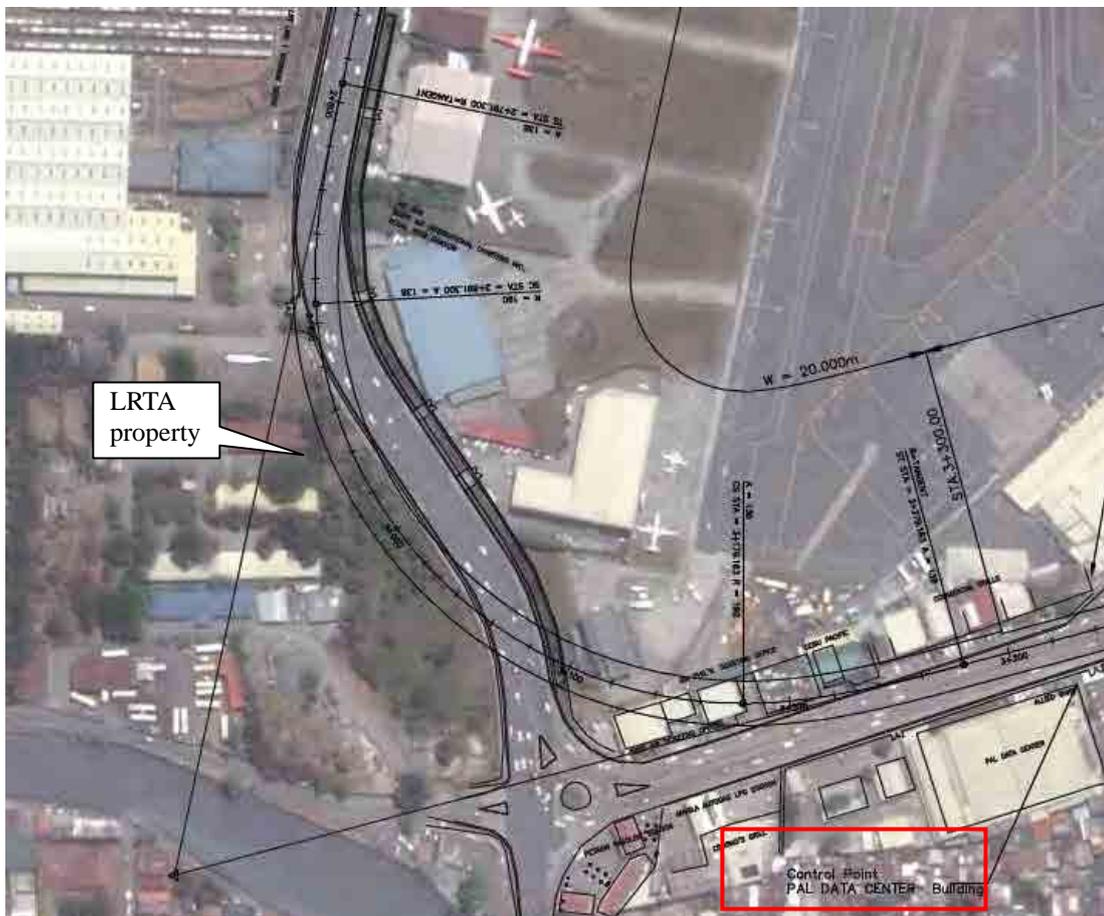


FIGURE 5.3.2-9 Sta.2+800 to Sta.3+300 (LRT DEPOT)

(6) Sta.3+300 to Sta.3+950 (Domestic Road)

- Due to NAIA navigational height limit, this section requires ROW acquisition to accommodate 6-lane at-grade road.
- In order to minimize the land acquisition, the outer shoulder of the expressway is reduced from 1.5m to 0.5m from Sta.3+300 to Sta.3+600.
- At-grade road was planned to maintain access to the abutting facility along the road.

- PAL DATA CENTER, CEBU PACIFIC OPERATION CENTER and Salem Complex building are considered as control point to avoid demolition of large scale buildings.
- The expressway alignment crosses post office land and vacant land owned by MIAA to avoid Park'n Fly building.

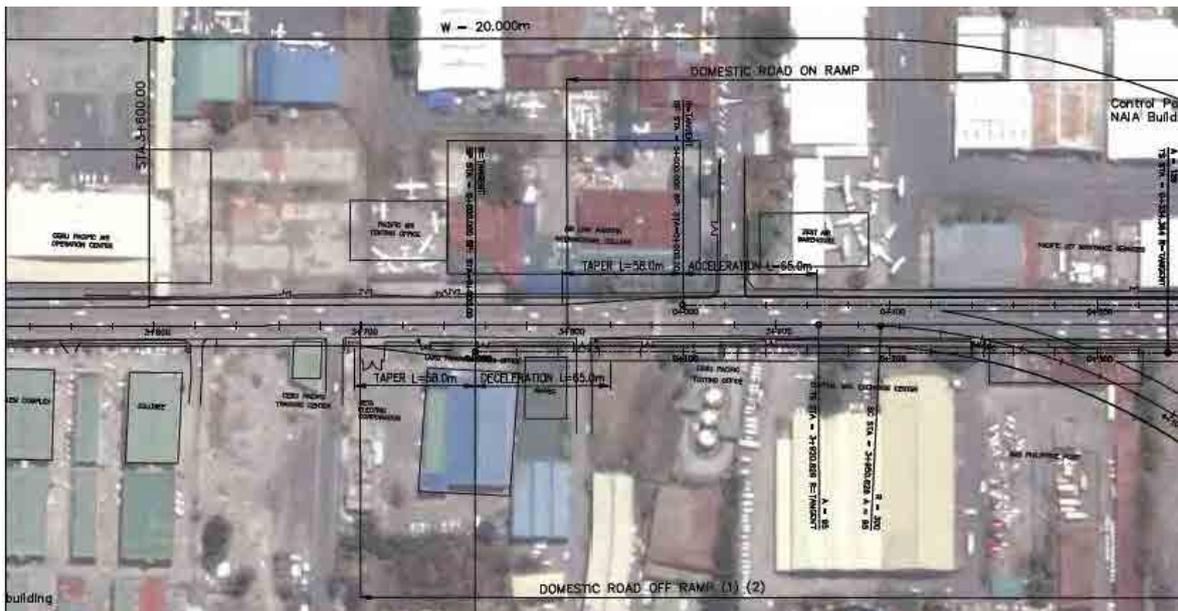


FIGURE 5.3.2-10 Sta.3+300 TO Sta.3+950 (DOMESTIC ROAD)

(7) Sta.3+950 to Sta.4+500 (Park 'n Fly and Paranaque River)

- The Park'n Fly Building and existing Paranaque River Bridge are set as control points for horizontal alignment design.
- Since the expressway over the existing Paranaque river bridge will require 80m-long span bridge, the main alignment is designed to be tangent (or spiral curve) as much as possible.



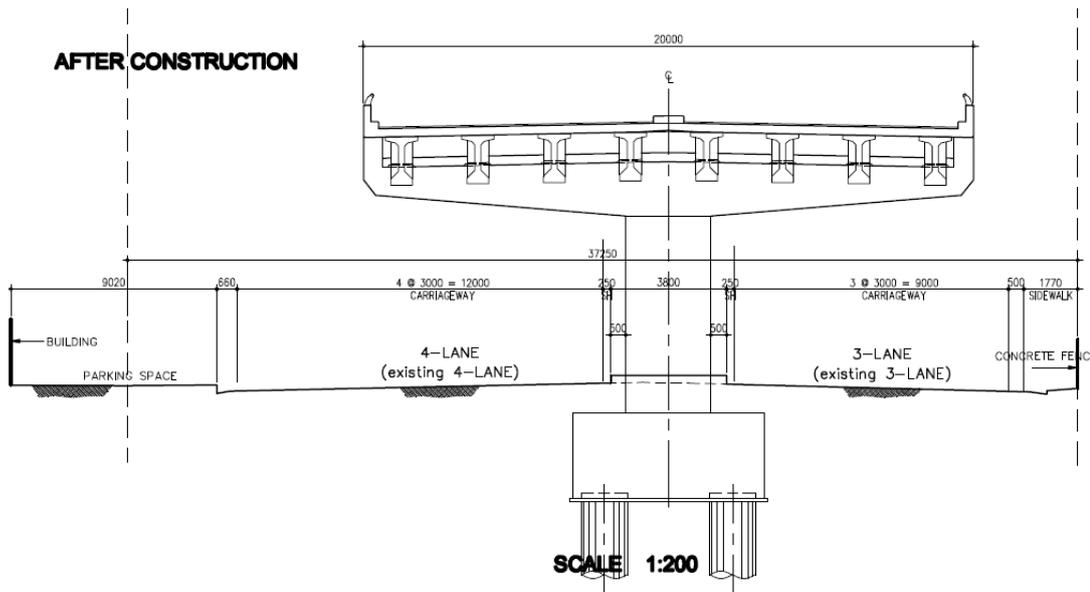
**FIGURE 5.3.2-11 Sta.3+950 TO Sta.4+500
(PARK 'N FLY AND PARANAQUE RIVER)**

(8) Sta.4+500 to Sta.4+913 (NIAA Road to Roxas Blvd)

- The main alignment is selected to follow the existing median of at-grade road in order to maintain same existing number of lanes without land acquisition, even after completion of the expressway. (See Figure 5.3.2-13)



FIGURE 5.3.2-12 Sta.4+500 to Sta.4+913 (NAIA ROAD TO ROXAS BLVD)



**NAIA ROAD
CROSS SECTION SEC. 109**

FIGURE 5.3.2-13 CROSS SECTION OF NAIA ROAD

5.3.3 Vertical Alignment Study

1) Vertical Height Requirement by Structure Type for Vertical Alignment Planning

For the planning of vertical alignment of the expressway, vertical height requirements by type of structure were studied as shown in **Figure 5.3.3-1**.

(2) Vertical Control Points

Vertical control points are shown in **Table 5.3.3-1**.

TABLE 5.3.3-1 VERTICAL CONTROL POINTS

Station	Control Point	Remark
0+000	Beginning Point	Maintain FS 2010
1+700	MMDA Monument	
2+384.5	Pedestrian Bridge	EL=10.53(Floor level)
2+550	Intersection with Aurora Blvd	Intersection
2+819.5	Navigational Clearance	No.1 (see Table 5.3.3-2)
2+938.4	Navigational Clearance	No.2 (see Table 5.3.3-2)
3+090	Intersection with Airport Road	Intersection
3+170	Intersection with Domestic Road	Intersection
3+092.8	Navigational Clearance	No.3 (see Table 5.3.3-2)
3+140	Navigational Clearance	No.4 (see Table 5.3.3-2)
3+330.8	Navigational Clearance	No.5 (see Table 5.3.3-2)
3+448.8	Navigational Clearance	No.6 (see Table 5.3.3-2)
4+450	Existing bridge of Paranaque River	
4+622	B-D Ramp of Roxas Interchange	Pedestrian Overpass Bridge
4+825	A-C ramp of Roxas Interchange	Pedestrian Overpass Bridge

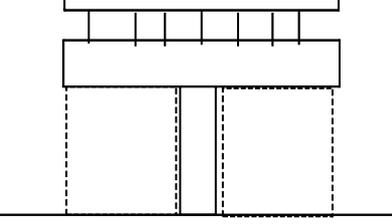
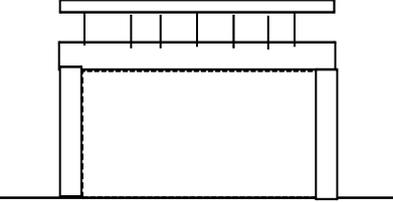
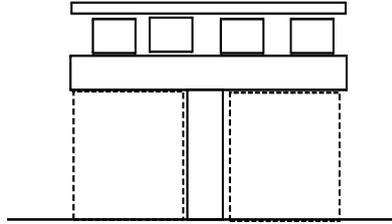
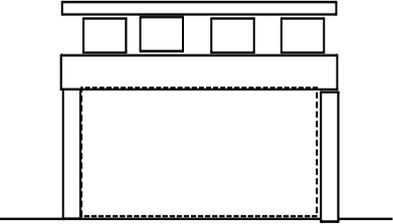
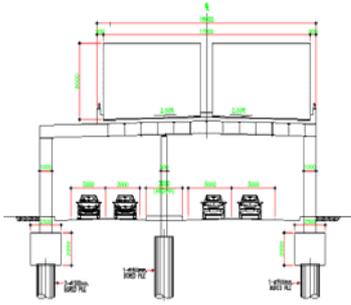
Type Name PC-1				Type Name PC-2							
Bridge Type	Superstructure	PC Girder		Bridge Type	Superstructure	PC Girder		Bridge Type	Superstructure		
	Substructure	Single Column Pier			Substructure	Multi Column Pier			Substructure		
Standard Type				Standard Type at Curve				Navigation Clearance			
											
No	Item	Value	Note	No	Item	Value	Note	No	Item	Value	Note
1	Ground Level	Varies		1	Ground Level	Varies		1	Ground Level	Varies	
2	Clearance(1)	5.00		2	Clearance(1)	5.00		2	Clearance(1)		
3	Coping Beam	3.00		3	Coping Beam	3.00		3	Coping Beam	0.00	
4	Pavement	0.08		4	Pavement	0.08		4	Pavement	0.00	
5	Bridge girder	1.60		5	Bridge girder	1.60		5	Bridge girder	0.00	
6	Bridge slab	0.25		6	Bridge slab	0.25		6	Bridge slab	0.00	
7	Cross Fall	0.60	10mx6%(max)	7	Cross Fall	0.60	10mx6%(max)	7	Cross Fall	0.00	
8	Total	10.53		8	Total	10.53		8	Total		
Type Name MT-1				Type Name MT-2				Type Name MT-3			
Bridge Type	Superstructure	Steel Box Girder		Bridge Type	Superstructure	Steel Box Girder		Bridge Type	Superstructure	Metal I Girder	
	Substructure	Single Column Pier			Substructure	Multi Column Pier			Substructure	Metal Box Pier	
Standard Type at Curve				Standard Type at Curve				Standard Type			
											
No	Item	Value	Note	No	Item	Value	Note	No	Item	Value	Note
1	Ground Level	Varies		1	Ground Level	Varies		1	Ground Level	Varies	
2	Clearance(1)	5.00		2	Clearance(1)	5.00		2	Clearance(1)	5.00	
3	Coping Beam	2.50		3	Coping Beam	3.00		3	Coping Beam	0.75	
4	Pavement	0.08		4	Pavement	0.08		4	Pavement	0.08	
5	Bridge girder	2.50		5	Bridge girder	2.50		5	Bridge girder	0.00	
6	Bridge slab	0.25		6	Bridge slab	0.25		6	Bridge slab	0.25	
7	Cross Fall	0.60	10mx6%(max)	7	Cross Fall	0.60	10mx6%(max)	7	Cross Fall	0.00	
8	Total	10.93		8	Total	11.43		8	Total	6.08	

FIGURE 5.3.3-1 VERTICAL HEIGHT REQUIREMENT

(3) Vertical Clearance Verification against NAIA Navigational Height Limit

The NAIA navigational height limit is calculated at six (6) points at the center of the road as shown in **Figure 5.3.3-2**. The vertical clearance is planned to be 5.0m for each of the expressway and the at-grade road. Clearance is verified at the road center elevation as shown in **Table 5.3.3-2**.

TABLE 5.3.3-2 VERIFICATION OF NAVIGATIONAL HEIGHT LIMIT

No	Sta	Distance from Runway End (m)	Slope I (2%)	Height Requirement from end of Runway	GL of Runway (m)	Height Limit Elevation from Mean	Elevation of Expressway (m)	Vertical Clearance for At-grade Road (m)	Remaining Net Clearance (m)
1	2+819.5	580.9961456	0.02	11.620	3.000	14.620	8.818	5.00	0.80
2	2+938.4	659.8962553	0.02	13.198	3.000	16.198	9.658	5.00	1.54
3	3+092.8	666.4735739	0.02	13.329	3.000	16.329	10.866	5.00	0.46
4	3+140	644.1480343	0.02	12.883	3.000	15.883	10.772	5.00	0.11
5	3+330.8	489.7937027	0.02	9.796	3.000	12.796	7.684	5.00	0.11
6	3+448.8	387.1335765	0.02	7.743	3.000	10.743	5.466	5.00	0.28

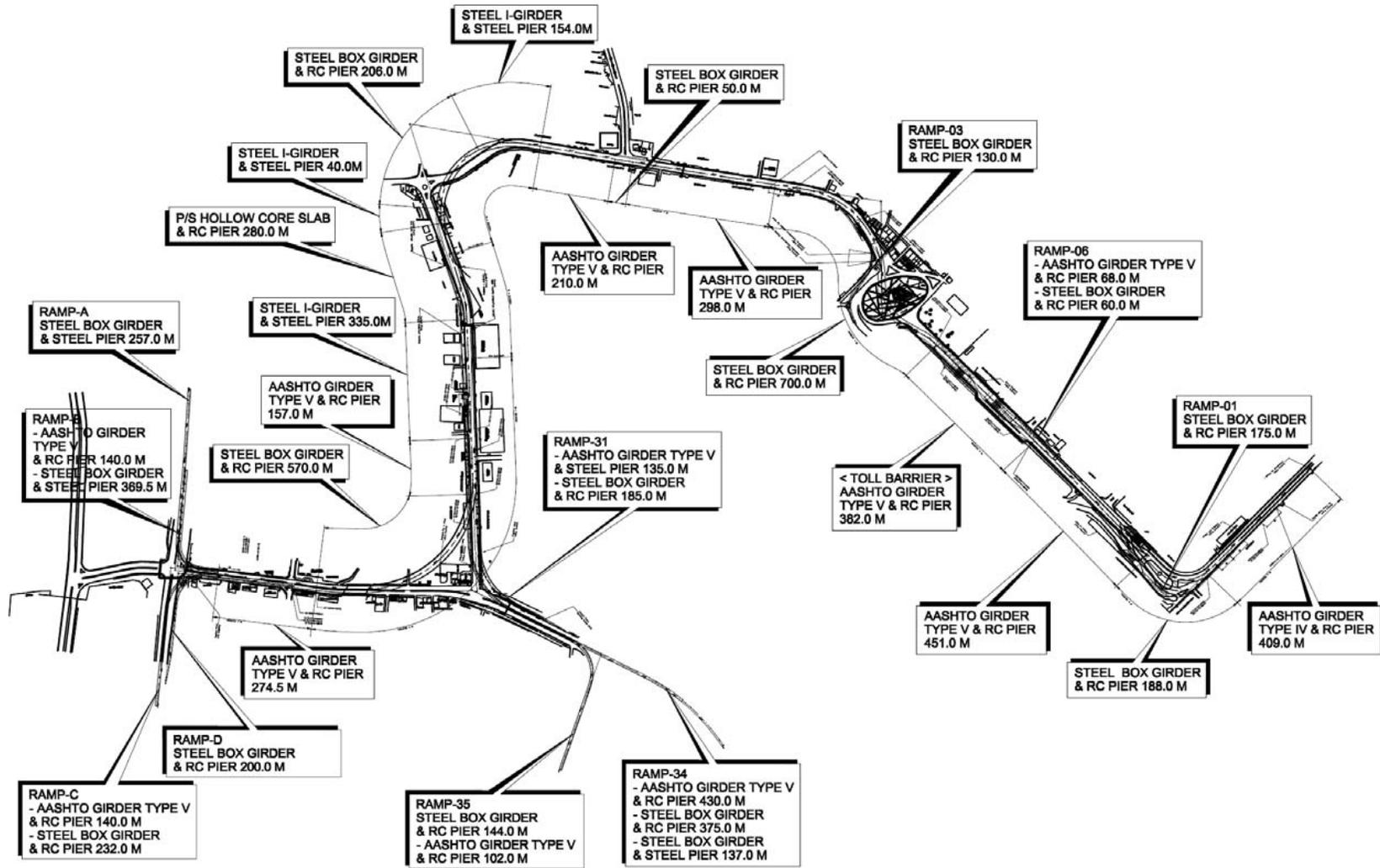


FIGURE 5.3.3-3 TYPE OF BRIDGE FOR MAIN ALIGNMENT

TABLE 5.3.4-1 RAMP TERMINAL TYPE

Terminal Type	Taper Type	Parallel Type
Schematic Image	<p style="text-align: center;">TAPER TYPE</p>	<p style="text-align: center;">PARALLEL TYPE</p>
Remark		Applied in the design

2) Geometry of main alignment at ramp terminal

The ramp terminal should be easily recognized by drivers from sufficiently away from the ramp terminal and should provide smooth and safe flow of ramp traffic. In this context, geometric condition of the main alignment at ramp terminal is important. **Table 5.3.4-2** shows the recommended geometry at ramp terminal by Japan Road Association, Road Structure Ordinance, 2004.

TABLE 5.3.4-2 RECOMMENDED MAIN ALIGNMENT GEOMETRY AT RAMP TERMINAL (V = 60KMH)

	Recommended	Absolute Value
Horizontal Curve Radius	500m	350m
Vertical Gradient	4.50%	5.50%
Minimum VCL(at crest)	6,000	3,000
(at sag)	4,000	2,000

However, the main alignment of the expressway is greatly restricted by the available ROW. The ramp terminal is located at the curve less than R = 300m. Basically, consideration of safe traffic flow of ramp terminal is very important in this respect.

On the other hand it is not economical and practical to fully set the main alignment by this recommendation. Therefore, to install marginal length between end of sharp curve and beginning of speed change lane is considered to design the ramp terminal in order to provide safe and smooth traffic flow.

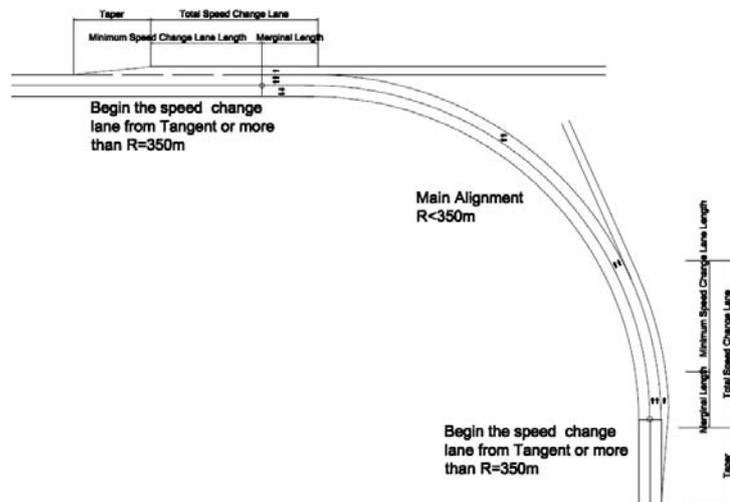


FIGURE 5.3.4-2 RAMP TERMINAL SPEED CHANGE LANE DESIGN

(c) Andrews Avenue ON Ramp (1) (to Skyway)

Andrews Avenue ON Ramp (1) is to provide access to the expressway for the traffic from Andrews Avenue and Terminal 3 (Arrival and Departure) to Skyway. The ramp alignment is set to avoid MIAA property (fence is considered as the control point). For connecting main alignment, the ramp acceleration lane requires air force property (approximately 4m in width).

Toll gate equipped with three (3) toll booths is designed at grade road level. Vertical clearance of 5.0m is considered under the ramp bridge for the air force access road.

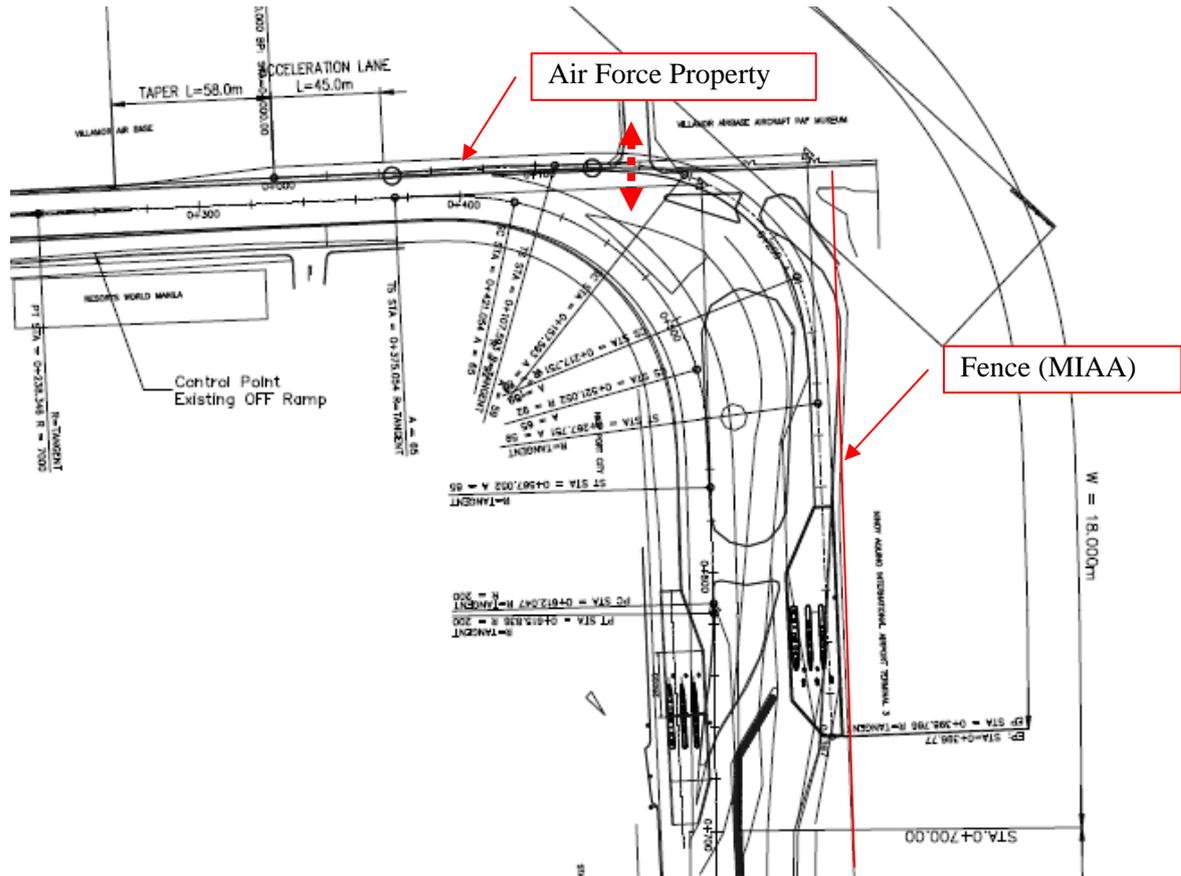


FIGURE 5.3.4-3 ANDREWS AVENUE ON RAMP (1)

(d) Andrews Avenue ON Ramp (2) (to Roxas Blvd)

Andrews Avenue ON Ramp (2) is to provide access to the expressway for the traffic from Andrews avenue and Terminal 3 to Roxas Blvd. and Manila-Cavite Coastal Expressway.

This ramp alignment is parallel to the main alignment. The existing ROW is considered as control point.

Vertical clearance of 5.0m is considered under the ramp bridge for the access to Marriot Hotel. The ramp toll booth is integrated in the main alignment toll barrier.

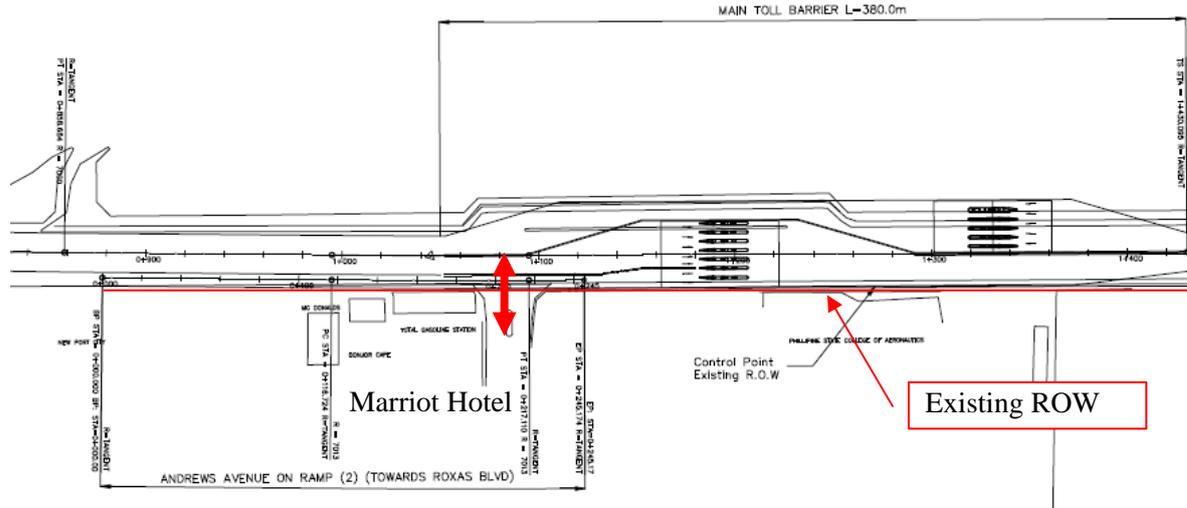


FIGURE 5.3.4-4 ANDREWS AVENUE ON RAMP (2)

(e) Andrews Avenue OFF Ramp

Andrew Avenue OFF Ramp is to provide access to Terminal 3 of Ninoy Aquino International Airport for the traffic from Roxas Blvd. and Manila-Cavite Coastal Expressway.

This ramp alignment has strict constrain with Power Sub-station of MIAA and Main Alignment set to avoid land acquisition to the houses along the road. (These are the control points.) (see **Figure 5.3.4-5**).

Vertical clearance of 5.0m is considered under the ramp bridge for the access road to the airport.

One toll gate equipped with three (3) ramp toll booths is designed on the elevated bridge level near the nose of the ramp due to restriction of available land at-grade level.

Deceleration length and taper to the toll gate is designed as shown in **Figure 5.3.4-6**.

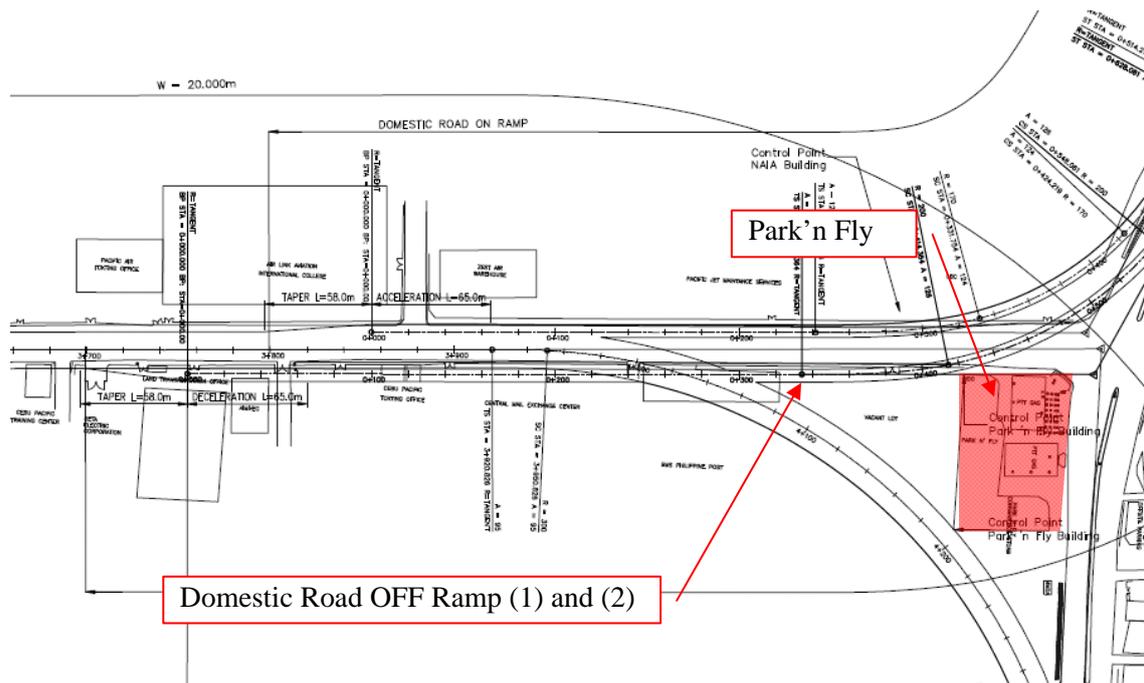


FIGURE 5.3.4-7 DOMESTIC ROAD OFF RAMP (1) AND (2)



FIGURE 5.3.4-8 NAIA ROAD OFF RAMP (1) AND (2) (CONTINUE)

(g) NAIA Road ON Ramp

NAIA Road ON Ramp is to provide access to the expressway from Terminal 1 and 2 of NAIA.

This ramp alignment has strict constrain with buildings in MIAA land and to minimize land acquisition.

The alignment of ramp is set at the shoulder or sidewalk space in the at-grade road to maintain number of lanes of the at-grade road.

One existing pedestrian bridge is required to be relocated to another location within the intersection.

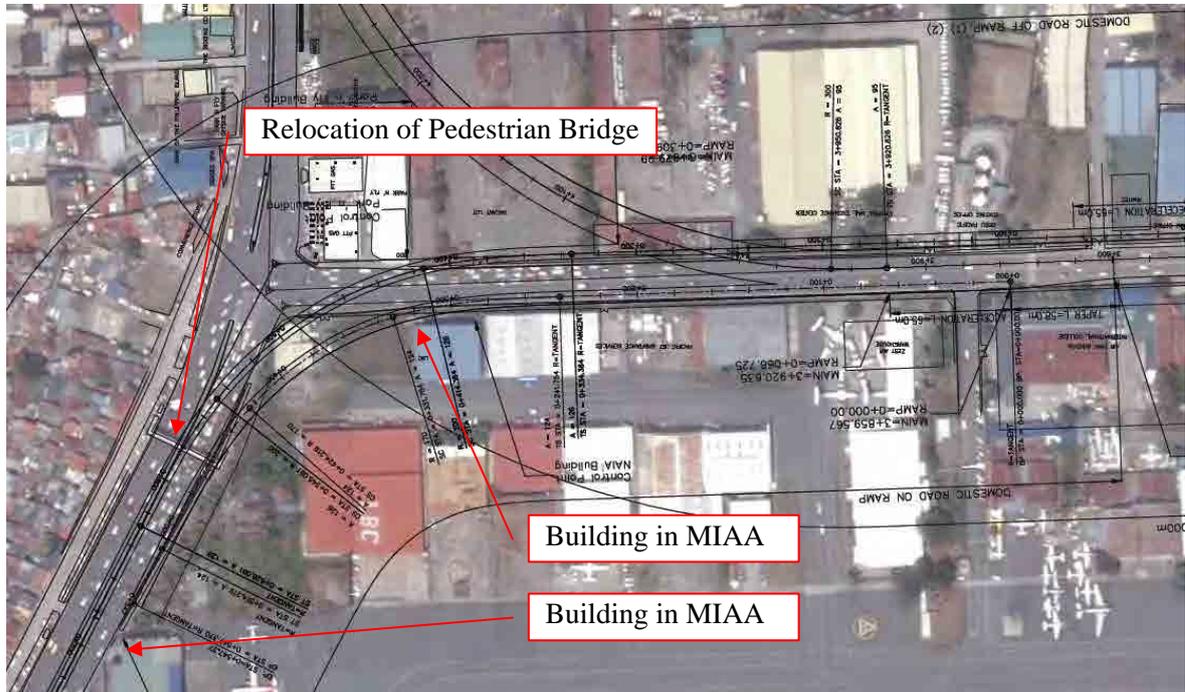


FIGURE 5.3.4-9 NAIA ROAD ON RAMP

(h) Ramps At End of the Expressway

1) Ramp Layout

Ramp layout is shown in **Figure 5.3.4-10**.

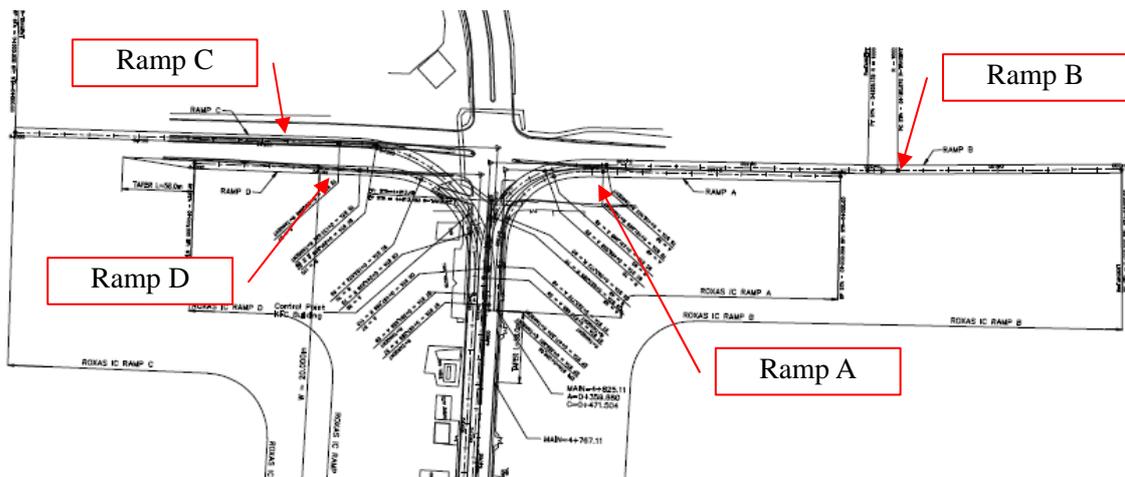


FIGURE 5.3.4-10 RAMP LAYOUT AT END OF EXPRESSWAY

2) Technical approach of each ramp

The horizontal control points considered for the design of the ramp alignment is described below;

- Ramp A and B
 - a) The A Ramp alignment is set in the median of existing road so as to not affect the access to existing condominium building and bus terminal function along the road.
 - b) The B Ramp alignment design consideration is to avoid acquisition of the land along Roxas Boulevard as well as not to affect to the LTR1 Extension and public water supply line at the shoulder.
 - c) The alignment considered bridge pier location to maintain smooth traffic at-grade road.
 - d) The existing pedestrian bridge is to be maintained without demolition.
 - e) The vertical clearance from C Ramp (under the B ramp) is 5.0 m minimum.

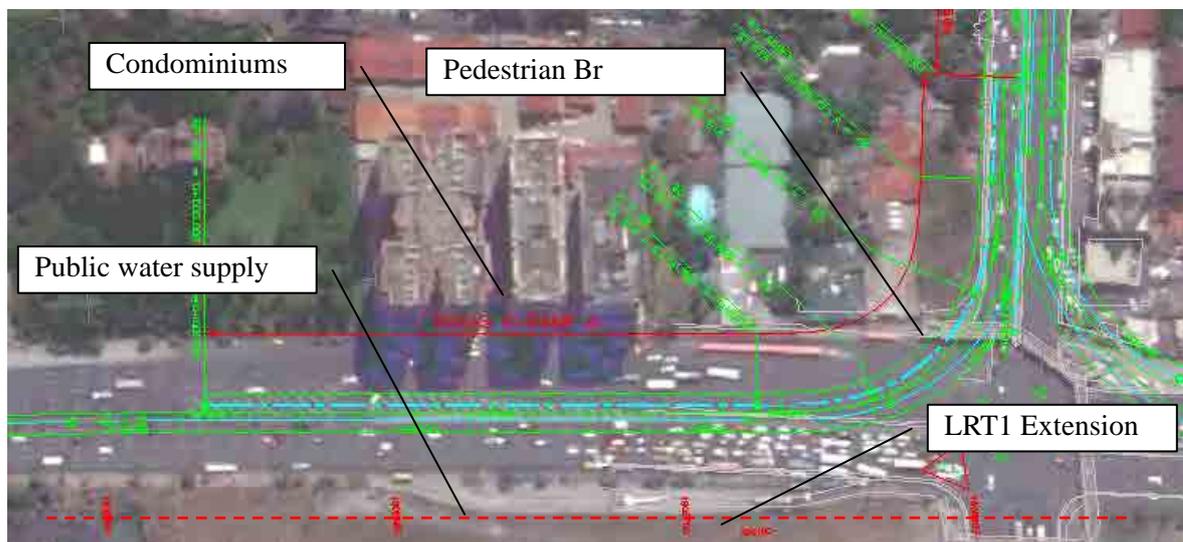


FIGURE 5.3.4-11 HORIZONTAL CONTROL POINTS OF A AND B RAMP

- Ramp C and D
 - a) The C Ramp alignment is set in the median of existing at-grade road to avoid affecting the LRT1 extension and under ground water supply line.
 - b) The D Ramp alignment is set in the existing ROW.
 - c) KFC restaurant is considered as control point of horizontal alignment to avoid relocation for D Ramp.
 - d) The existing pedestrian bridge is to be maintained.

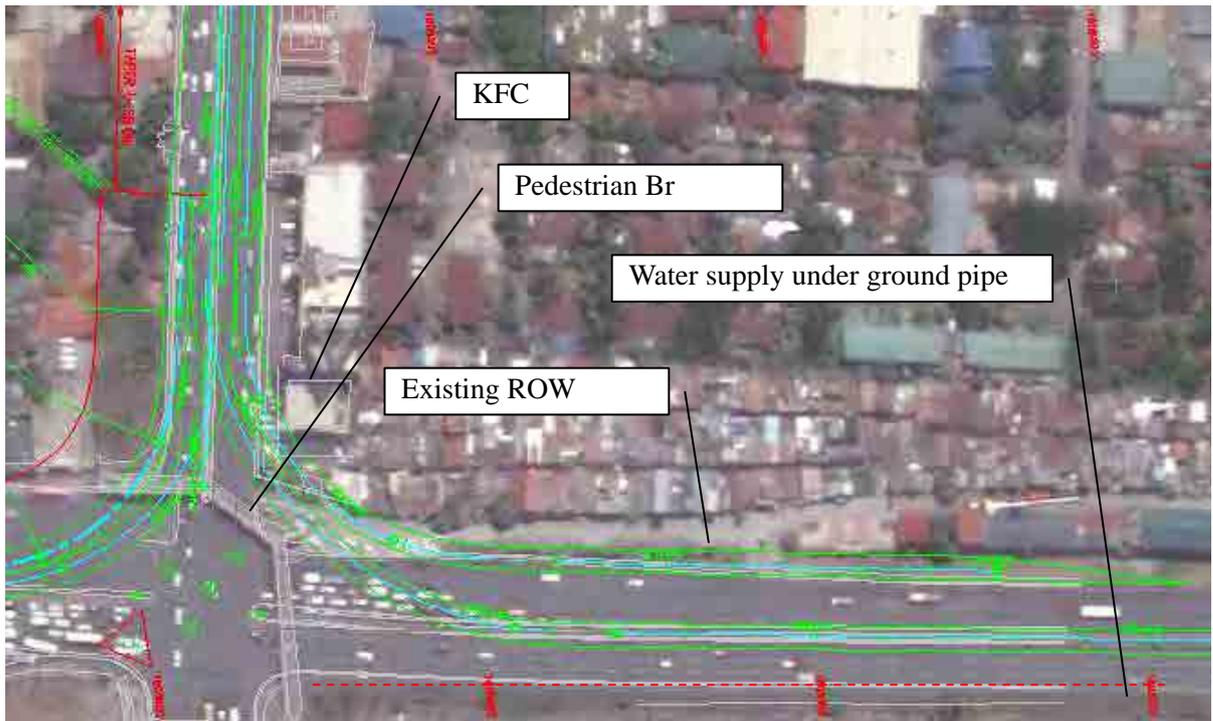


FIGURE 5.3.4-12 HORIZONTAL CONTROL POINTS OF C AND D RAMP

3) Ramp terminal cross sectional configuration

Ramp terminal cross sectional configuration is shown in **Figure 5.3.4-13**. Accordingly diverge taper is calculated as below;

Taper lengths@ 1.0m/s lateral shift ($V=60\text{km/s}$) $w=3.5\text{m}$

$$L=3.5 \times 16.67 \text{ (m/s)} = 58.3 \text{ m} \Rightarrow 58.0\text{m}$$

5.3.5 Preliminary Design of At-Grade Roads

(a) **Number of traffic lanes to be maintained after construction**

At least the same number of traffic lanes of at-grade road shall be maintained even after the construction of expressway.

The carriageway width may be reduced to a minimum 3.0 m.

TABLE 5.3.5-1 NUMBER OF LANES TO BE MAINTAINED

	Before construction	After construction
Sales Avenue	2 + 3 = 5	3 + 3 = 6
Andrews Avenue	3 + 3 = 6	3 + 3 = 6
Domestic Road	3 + 3 = 6	3 + 3 = 6
NAIA Road (at Paranaque Bridge)	4 + 4 = 8	4 + 4 = 8
NAIA Road (Bridge to Roxas Blvd)	3 + 4 = 7	3 + 4 = 7

The typical cross section is shown in **Section _._.**

(b) **Preliminary Design of At-Grade Road**

Preliminary design of Andrews Avenue, Domestic Road and Roxas Boulevard is shown in **Figure 5.3.5-1** to **Figure 5.3.5-4**

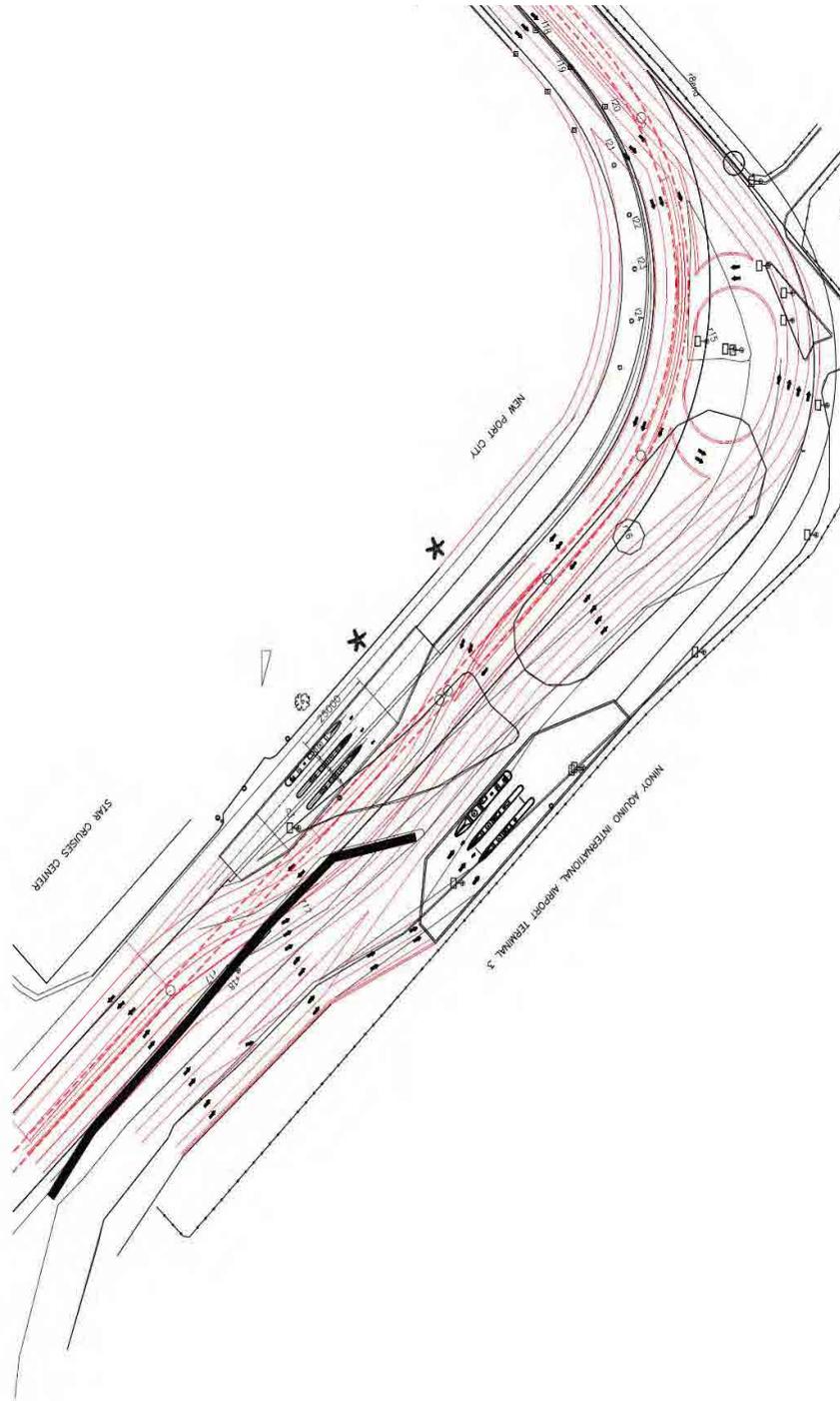


FIGURE 5.3.5-1 AT-GRADE ROAD PLAN (ANDREWS AVENUE)

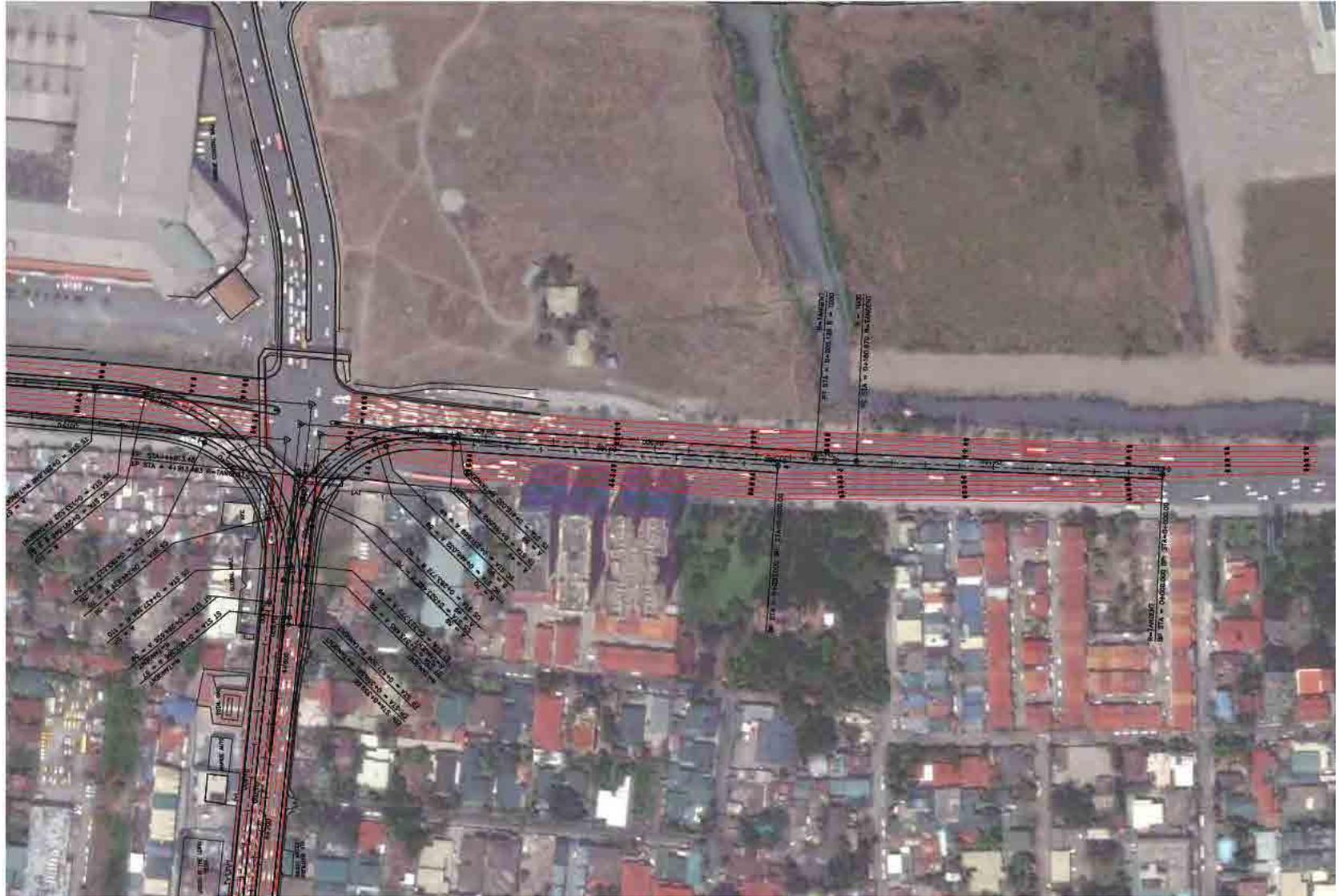


FIGURE 5.3.5-4 AT-GRADE ROAD PLAN (ROXAS BOULEVARD-2)

5.4 STRUCTURE TYPE STUDY

5.4.1 General

The general features of these structures are as follows:

1) AASHTO Girder

As the standard bridge type, AASHTO Girder – pre-stressed concrete I-section girder was adopted, because it is the most economical and widely used in the Philippines (many suppliers and local productions exist in the Philippines). And the erection is not affecting to the underneath traffic and consideration of transportation ease.

To apply the span ranged from 30 to 35 m length (pier center to center length) was determined by the cost comparison.

2) Single Column with Cantilevered Pier Head

Single column with cantilevered pier head constructed by adopting the rotating method was considered to minimize the working area and period.

3) Pile Foundation

According to the soil investigation result of the previous study (feasibility study in Year 2010), the assumed bearing strata exists 1.0m to 10.0m depth from the existing ground level. Although spread footing type of foundation can be adoptable, pile foundation was selected in consideration of traffic management during construction.

4) Pile Bent-up Type Pier

Single column type of with single large diameter pile pier for main expressway was not used in this study. This type was only used for multi column piers and ramp piers. The type should be determined by more detailed analysis and calculation with accurate data.

5) Steel Girder and Pier

Steel girder was adopted at long span section – 40m or longer, curved section and the height limited section. For high piers with over 20m in height from ground level and those of complex type, steel piers were adopted.

6) Bridge Approach

Mechanically Stabilized Earth Retaining Wall (MSE Wall) was adopted at the bridge approach, since it could be constructed in narrow working space with reasonable cost, and good aesthetic.

5.4.2 Bridge Type at Individual Section

Based on the above consideration, bridge types were proposed. The types of bridges are shown in **Figure 5.4.2-1**.

The individual features are described in **Table 5.4.2-1** and **5.4.2-2**, and the cross sections are shown in **Figure 5.4.2-2**.

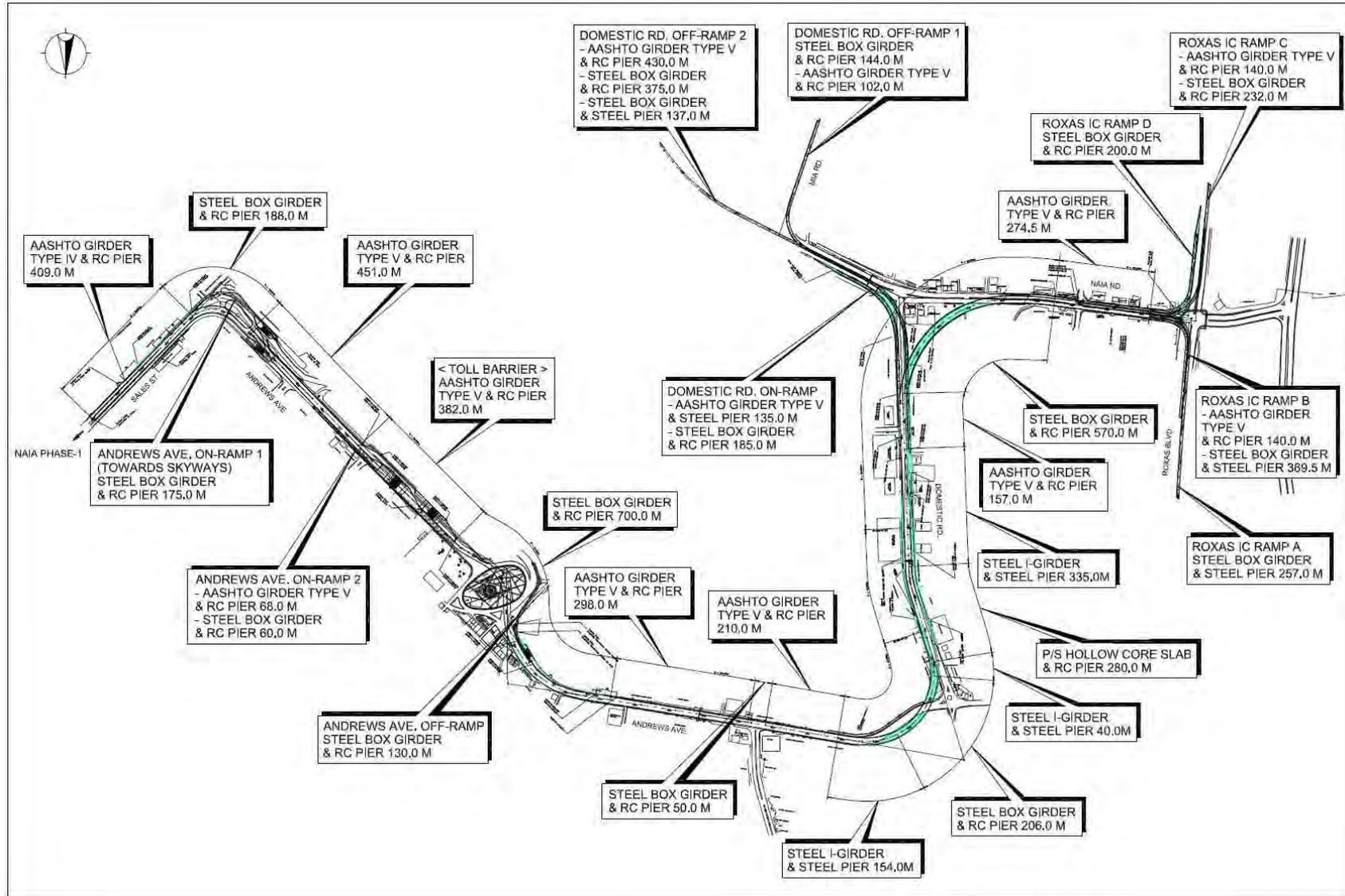


FIGURE 5.4.2-1 INDEX MAP FOR BRIDGE TYPE

TABLE 5.4.2-1 BRIDGE FEATURES AT EACH LOCATION TYPE

No.	Location	Features	Figure No. (see Figure 5.4.2-2)
Main Carriageway			
1	Sales Street	<ul style="list-style-type: none"> - AASHTO girder type IV and multi column (2 column) type with rectangular section pier was determined following to the piers of Phase-I, - 3 lane carriageway per each bound underneath the viaduct were considered to arrange the column location. 	1, 2
2	Sales St. – Andrew Ave.	Steel box girder in consideration of the curve configuration and concrete hammerhead & single column (circular section) type pier was adopted.	3
3	Andrew Avenue	<ul style="list-style-type: none"> - <i>At general section:</i> AASHTO girder type V and concrete hammerhead & single column (circular section) type pier was adopted, - <i>At toll barrier section:</i> AASHTO girder type V and concrete multi column (3 column) type pier was adopted, - <i>At MMDA Monument section:</i> it shall be followed the required long span and curve alignment, continuous steel box girder and concrete multi column type pier was mainly determined, - <i>At Aurora Boulevard intersection:</i> to consider the future operation of the road, 50m span by steel box girder was determined, - <i>At limited navigation clearance section:</i> Steel I-girder and steel pier (rigid frame type) was determined in consideration of the maximum superstructure depth of 1.0m. 	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16
4	Andrew Ave. – Domestic Rd.	<ul style="list-style-type: none"> - Steel box girder in consideration of the curve configuration and concrete hammerhead & single column (circular section) type pier was adopted. 	17
5	Domestic Road	<ul style="list-style-type: none"> - <i>At limited navigation clearance section:</i> Steel I-girder and steel pier (rigid frame type), and prestressed concrete hollow slab and concrete multi column (2 column) were determined to adopt, - <i>At Ramps to/from NAIA Terminal 1 & 2 transition section:</i> AASHTO girder type V and concrete multi column type pier was adopted. 	18, 19, 20, 21
6	Domestic Rd. – NAIA Rd.	<ul style="list-style-type: none"> - Steel box girder in consideration of the curve configuration and concrete hammerhead & single column (circular section) type pier was adopted. 	22
7	NAIA Road	<ul style="list-style-type: none"> - <i>At Ramp transition section:</i> AASHTO girder type V and concrete multi column type pier was adopted. 	23, 24

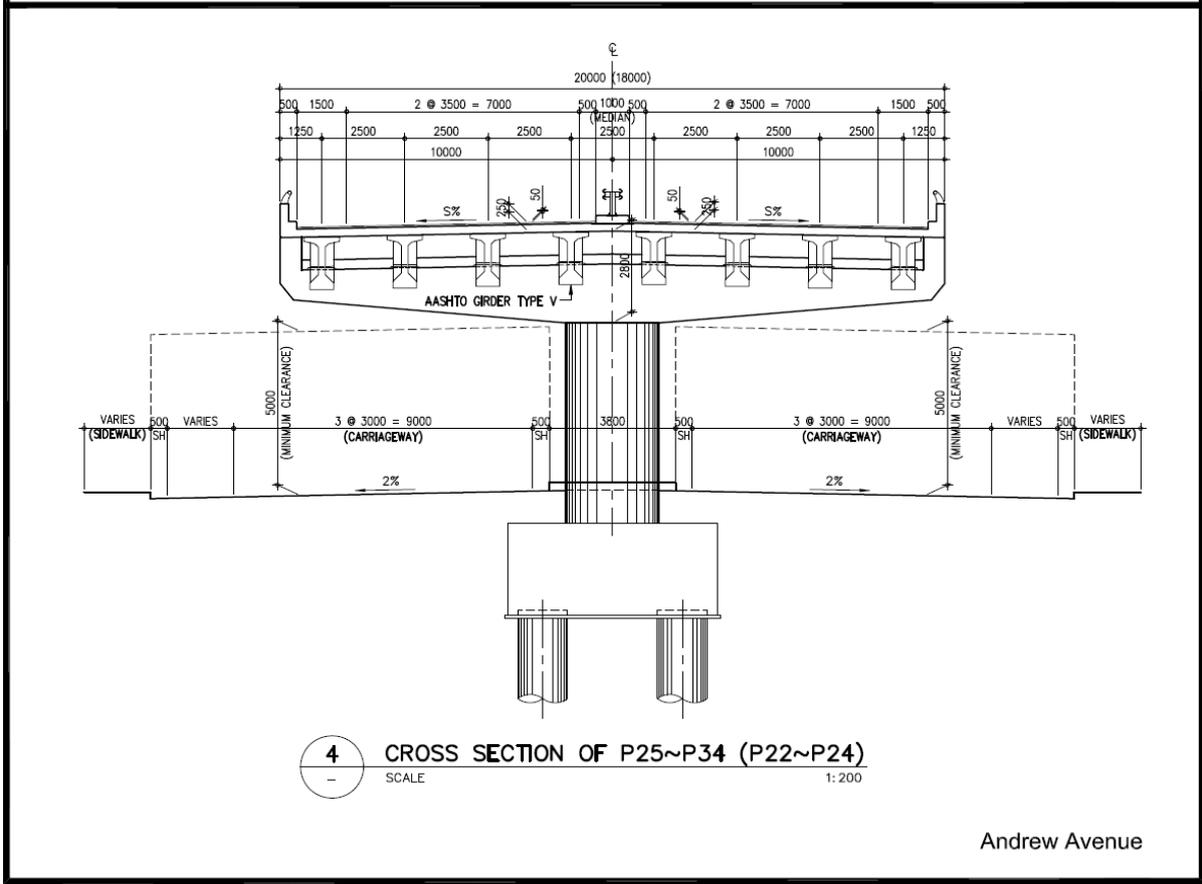
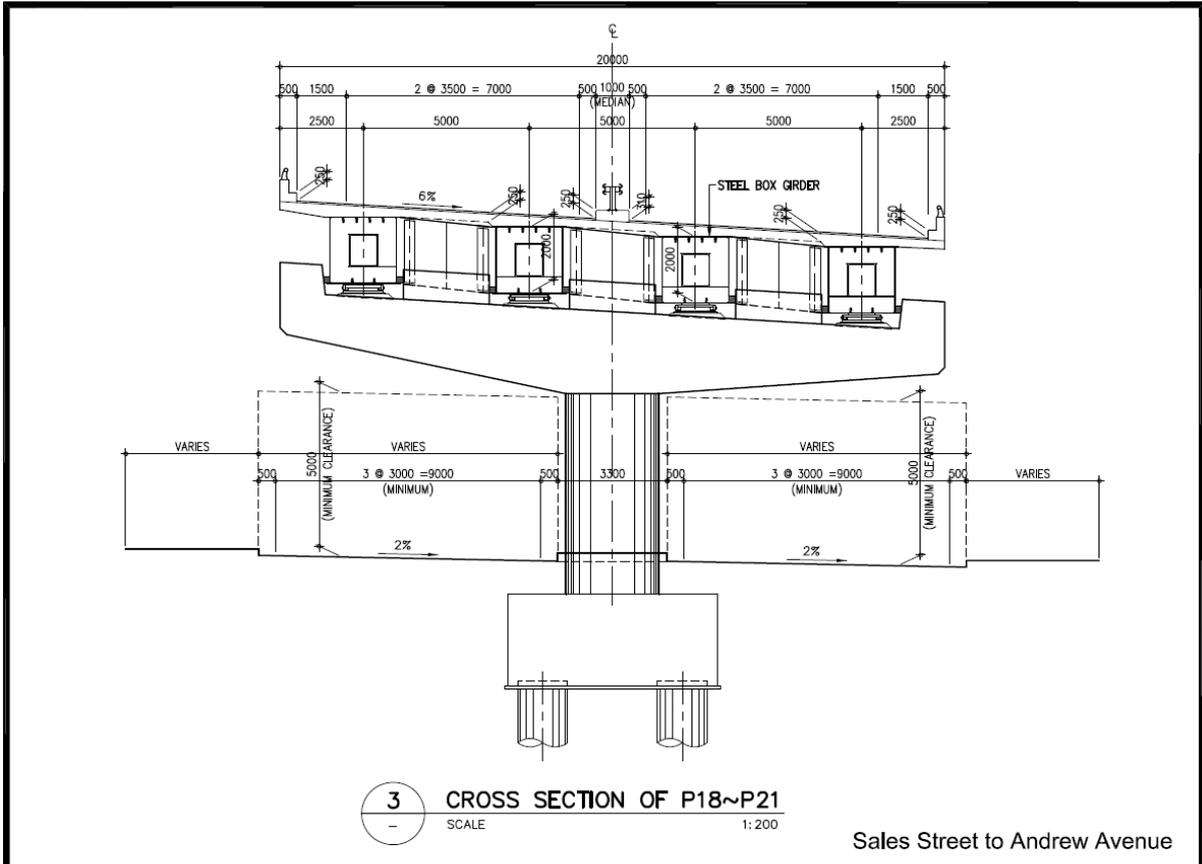


FIGURE 5.4.2-2 (2/12) CROSS SECTION

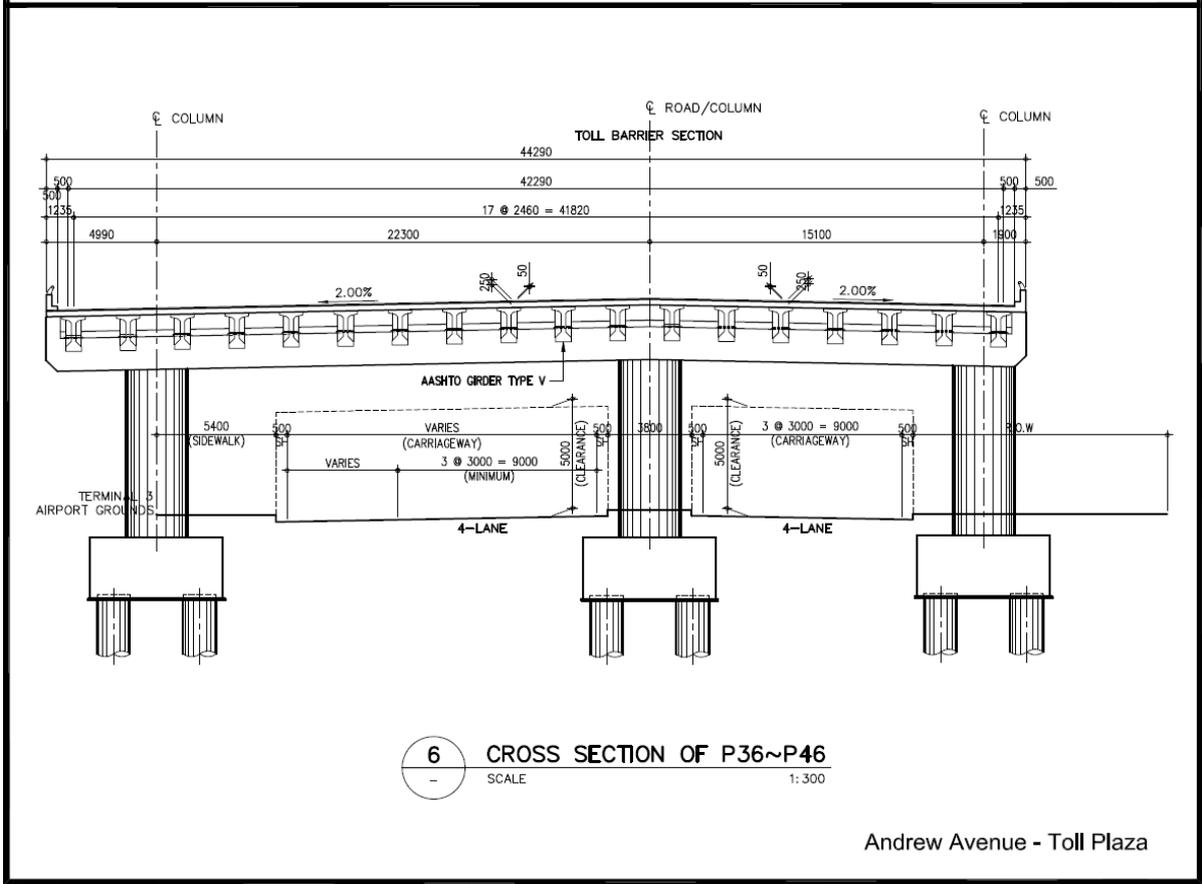
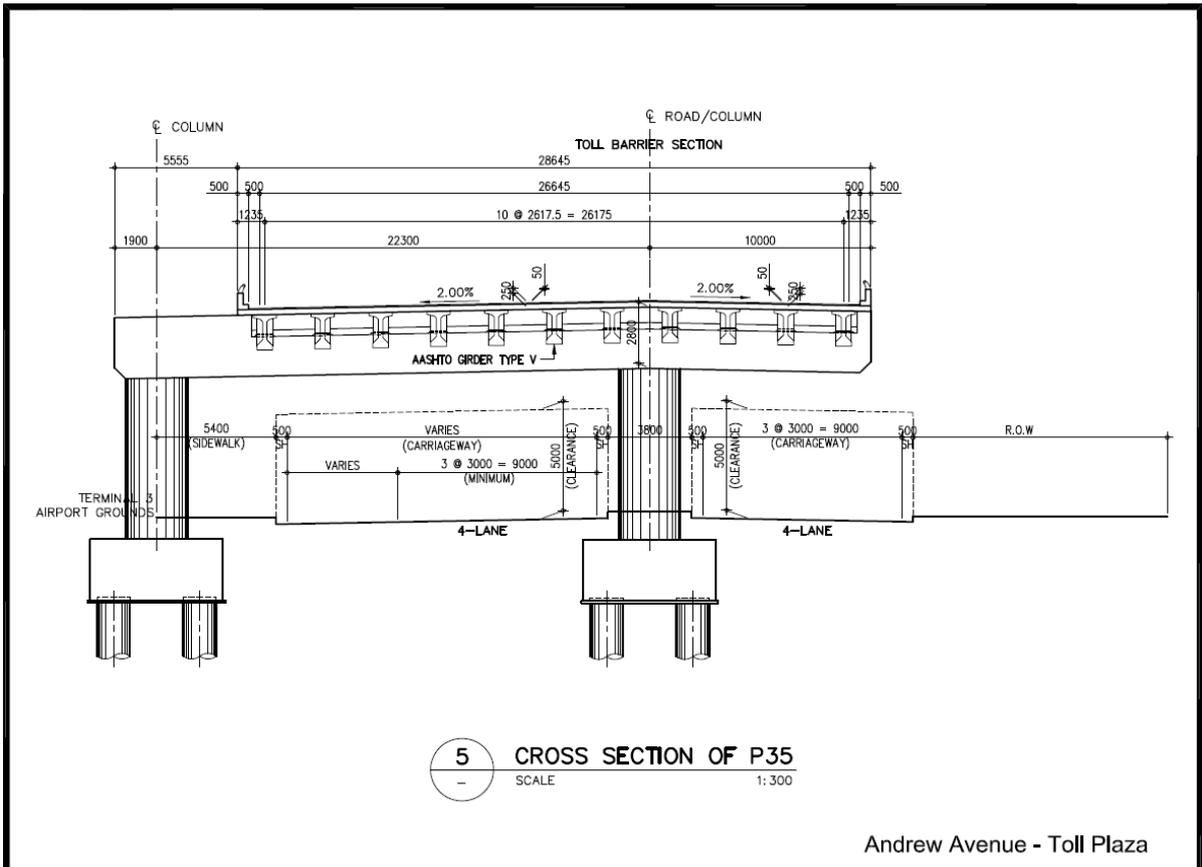


FIGURE 5.4.2-2 (3/12) CROSS SECTION

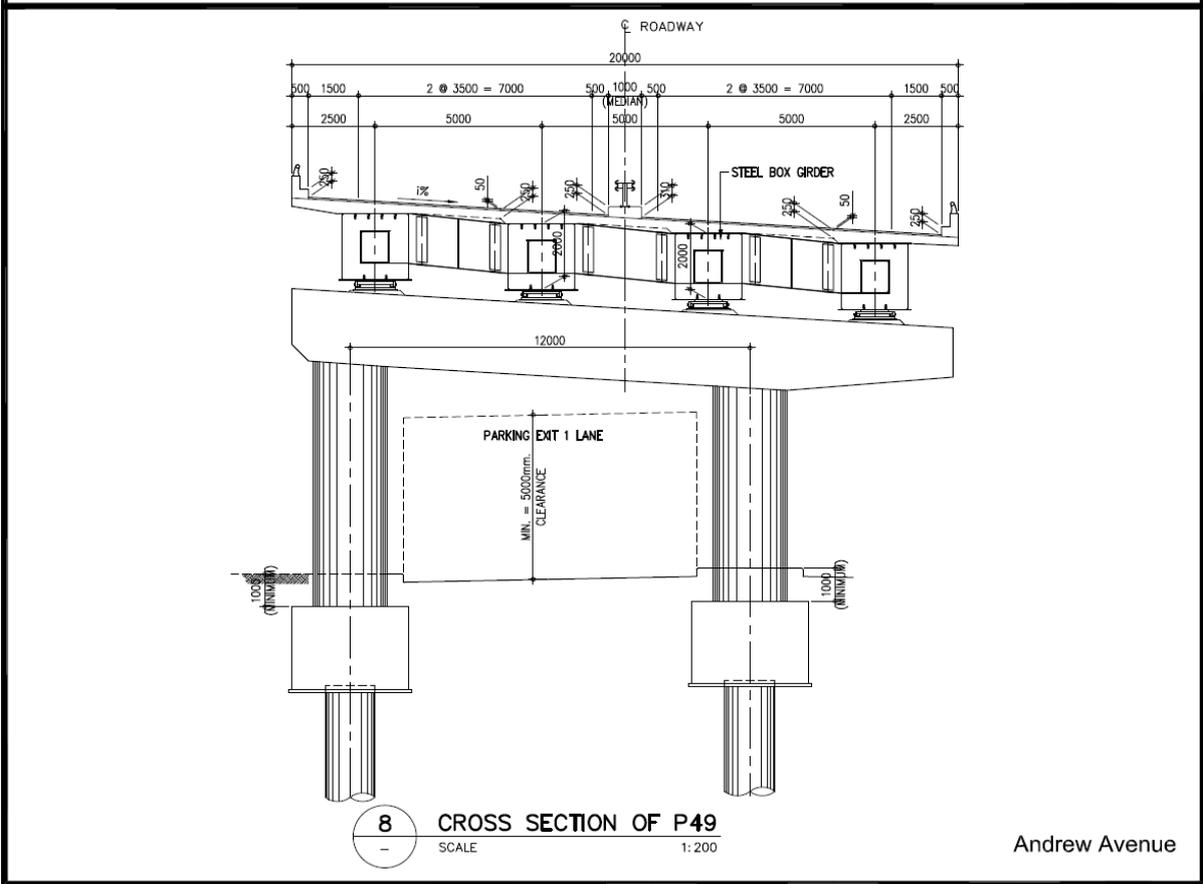
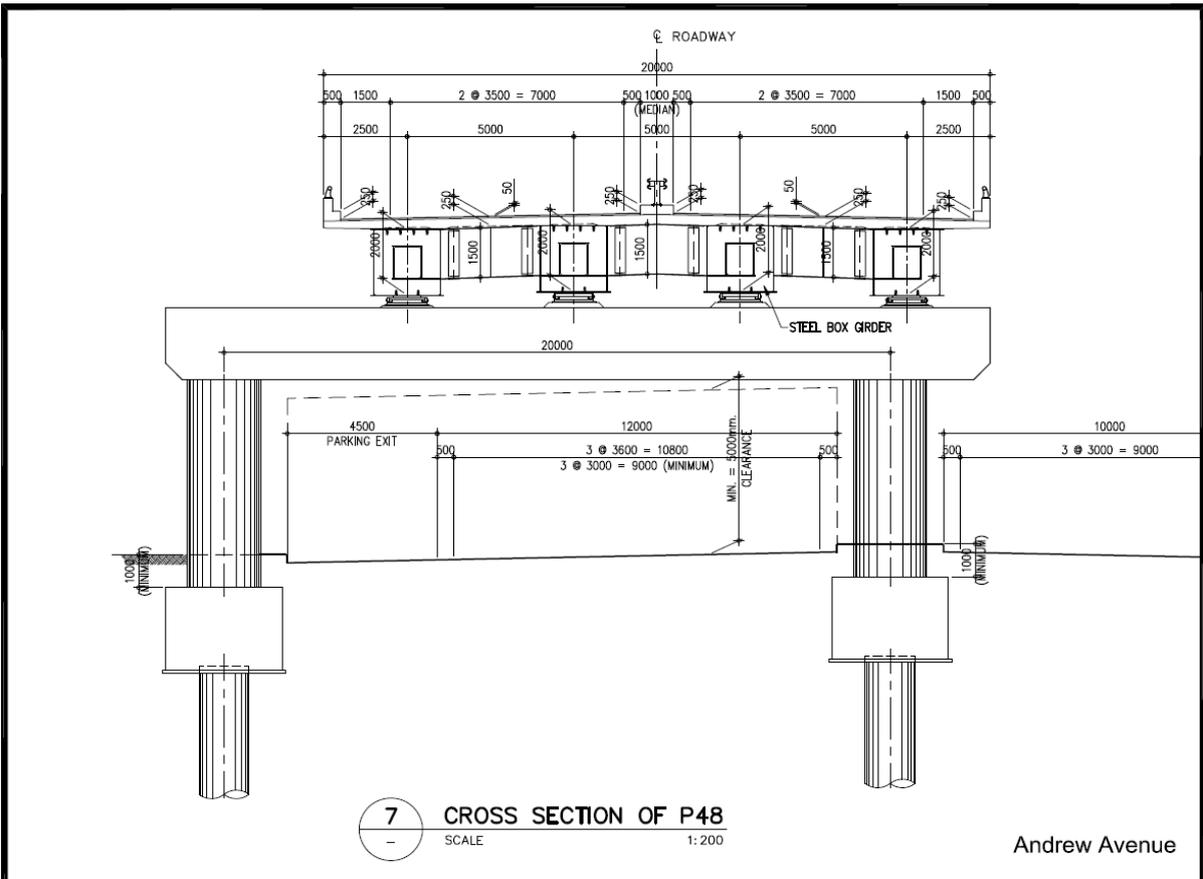
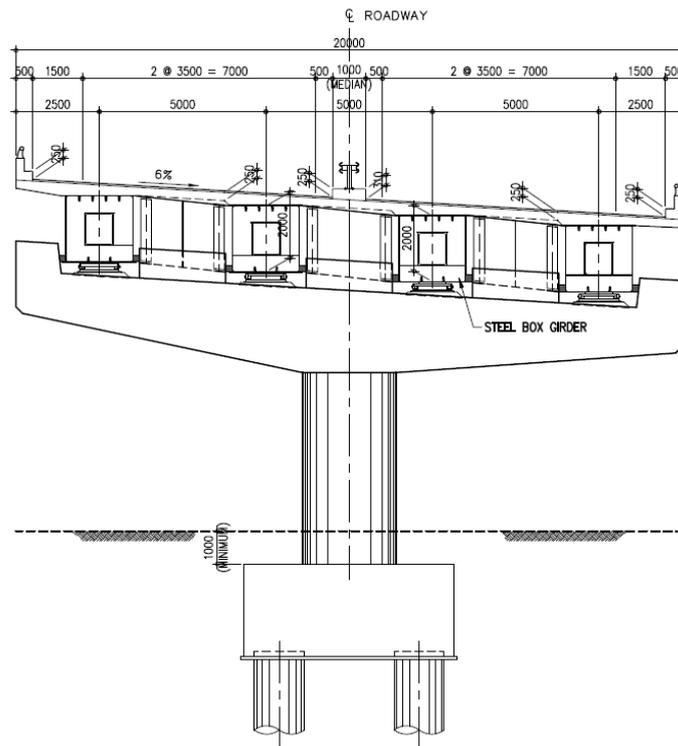
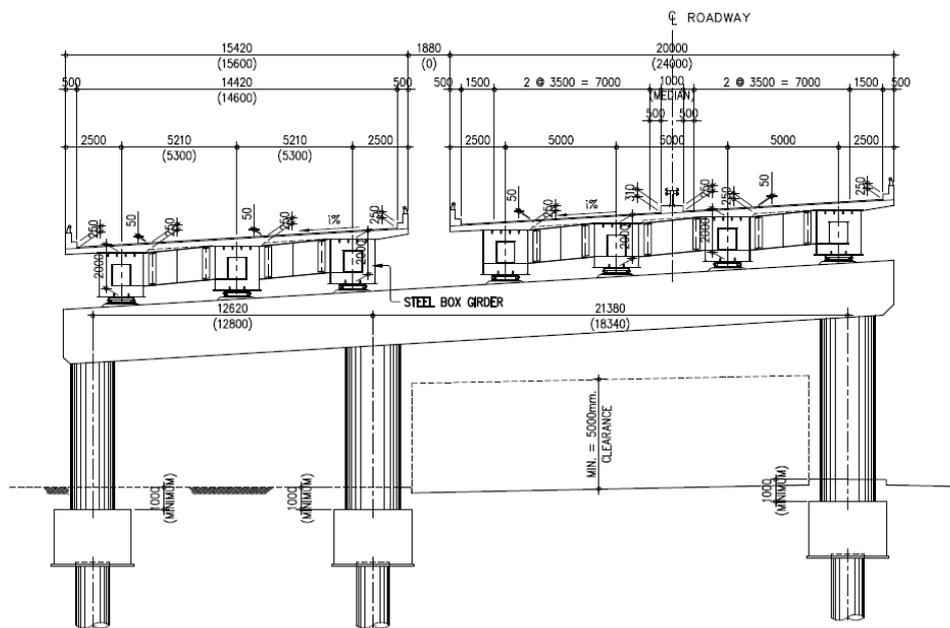


FIGURE 5.4.2-2 (4/12) CROSS SECTION



9 CROSS SECTION OF P50~P52
 SCALE 1:200

Andrew Avenue



10 CROSS SECTION OF P53 (P54)
 SCALE 1:300

Andrew Avenue

FIGURE 5.4.2-2 (5/12) CROSS SECTION

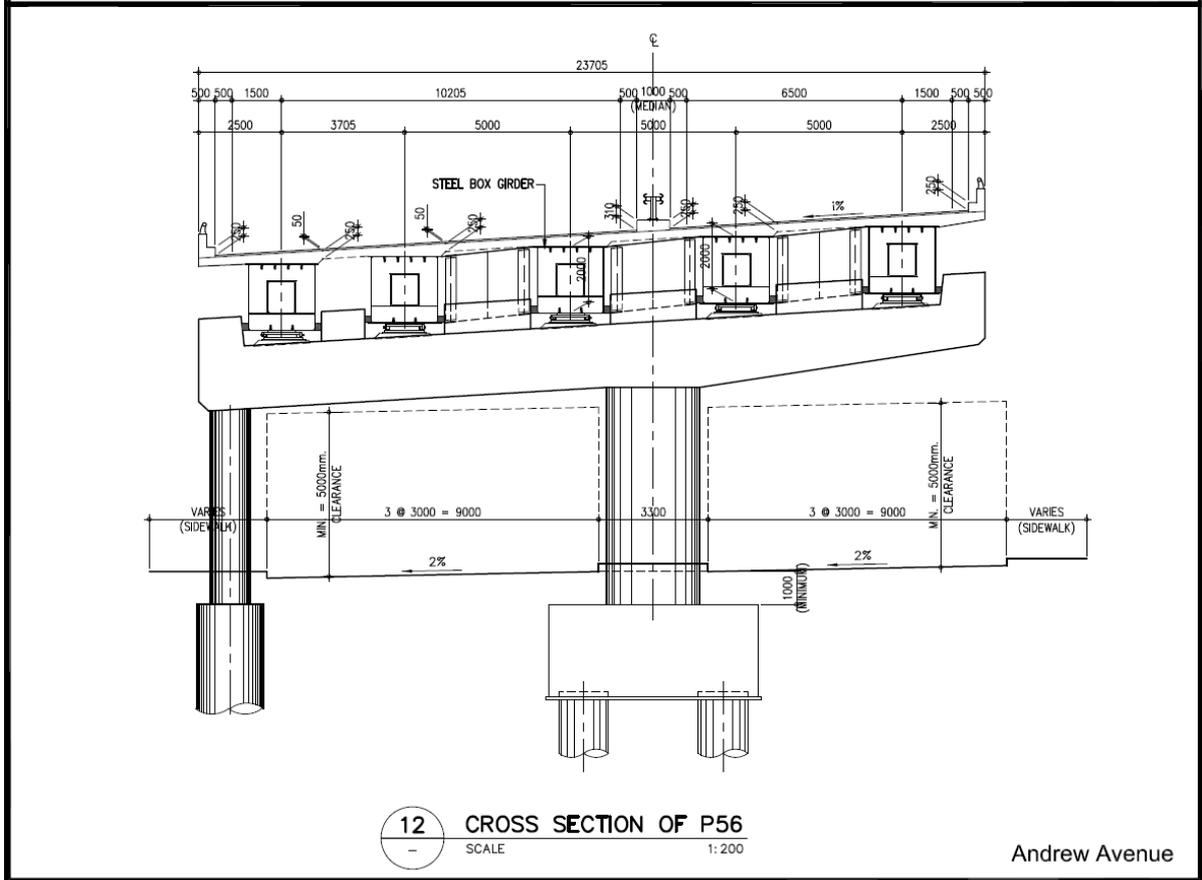
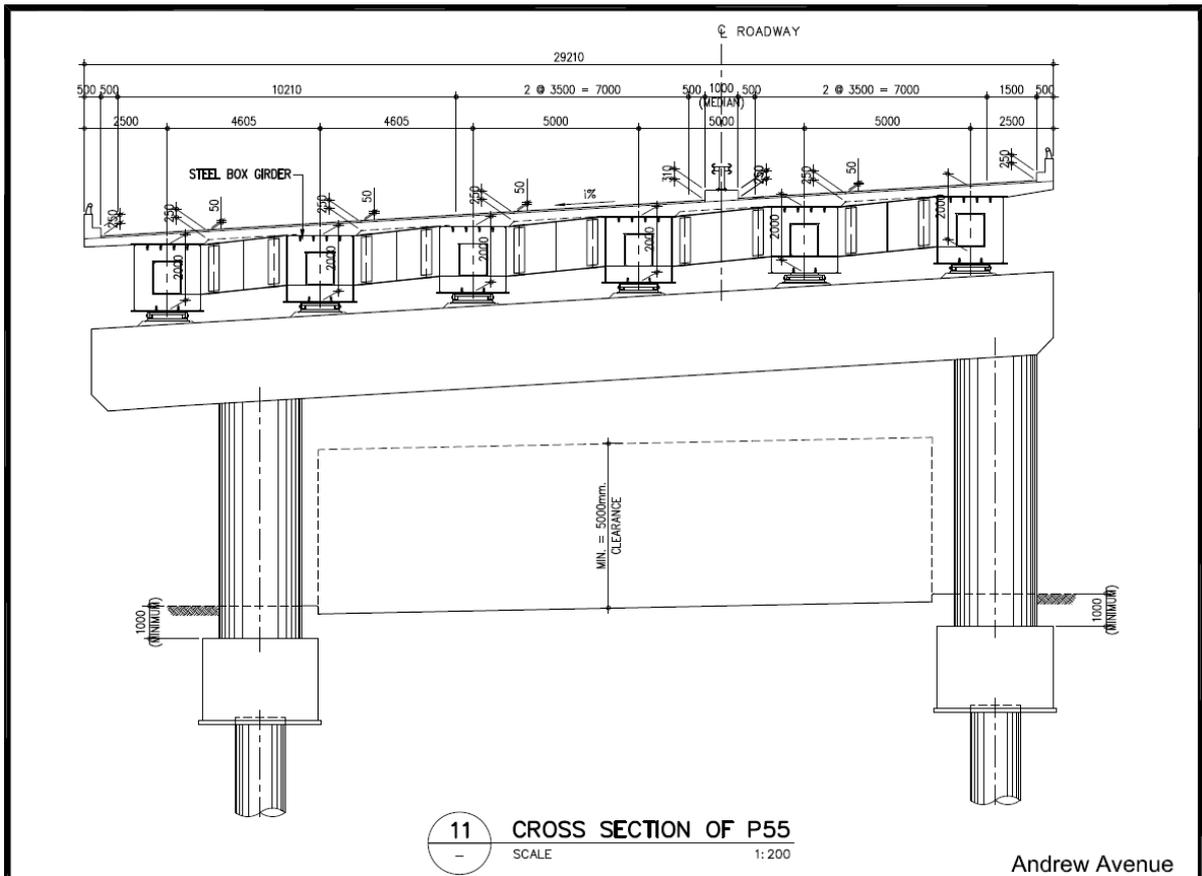
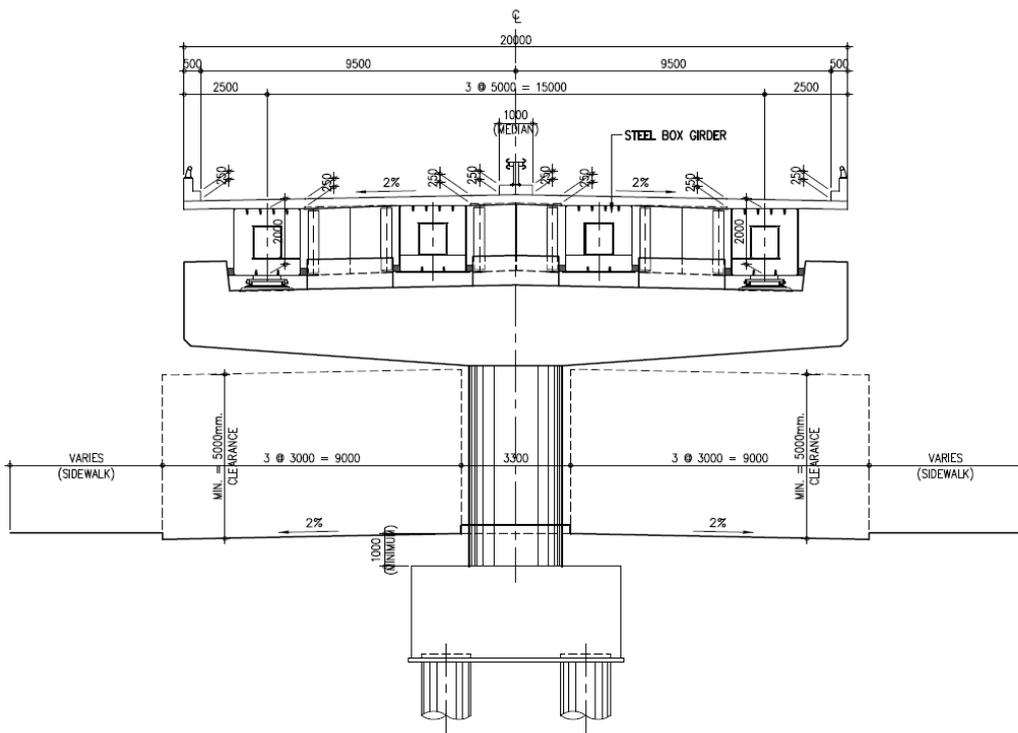
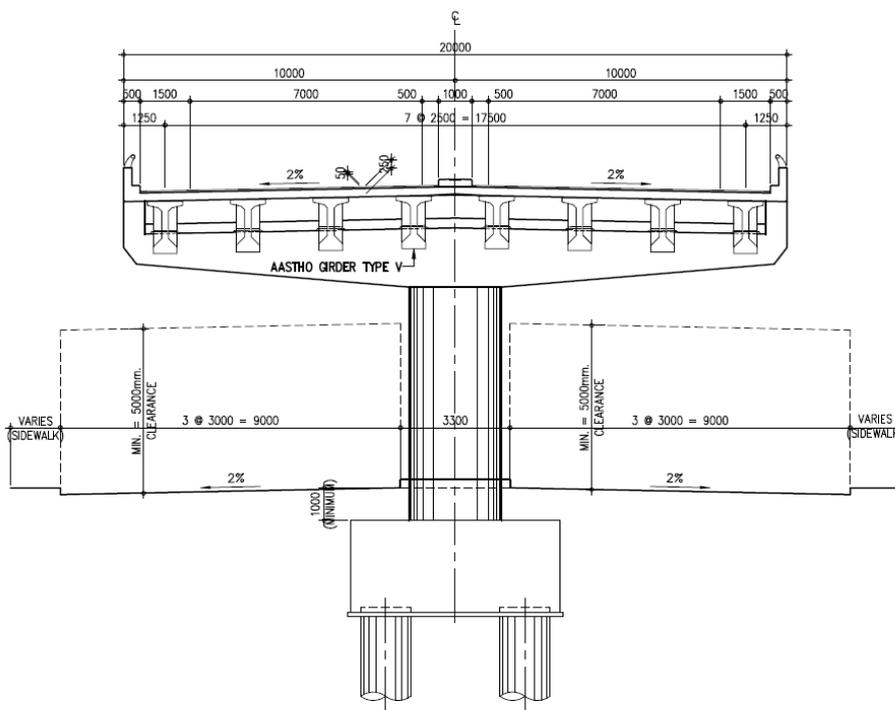


FIGURE 5.4.2-2 (6/12) CROSS SECTION



13 CROSS SECTION OF P57, P58, P71 & P72
SCALE 1:200

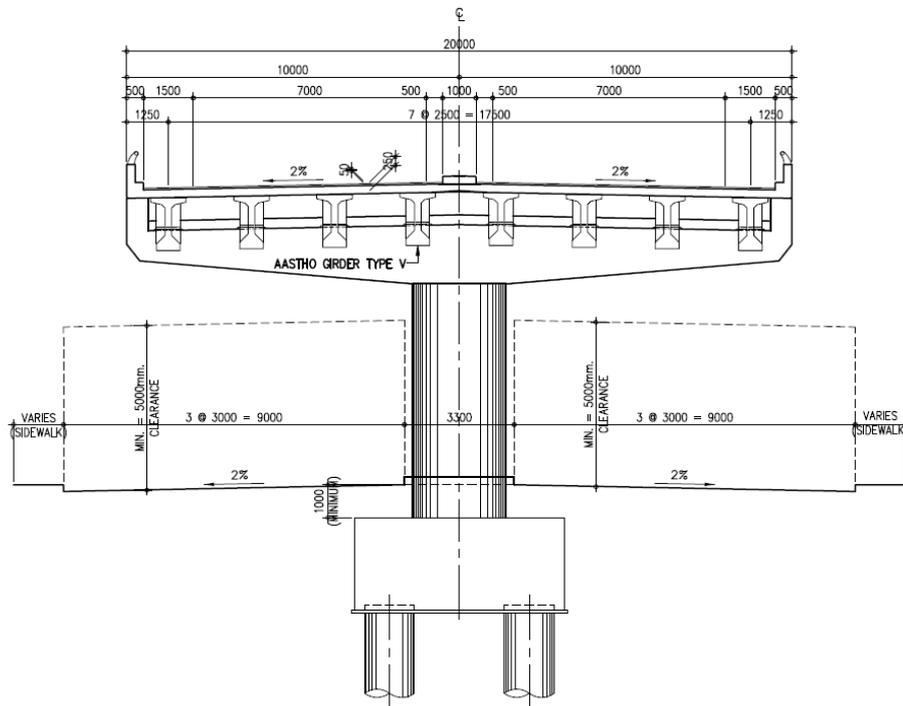
Andrew Avenue



14 CROSS SECTION OF P59~P70
SCALE 1:200

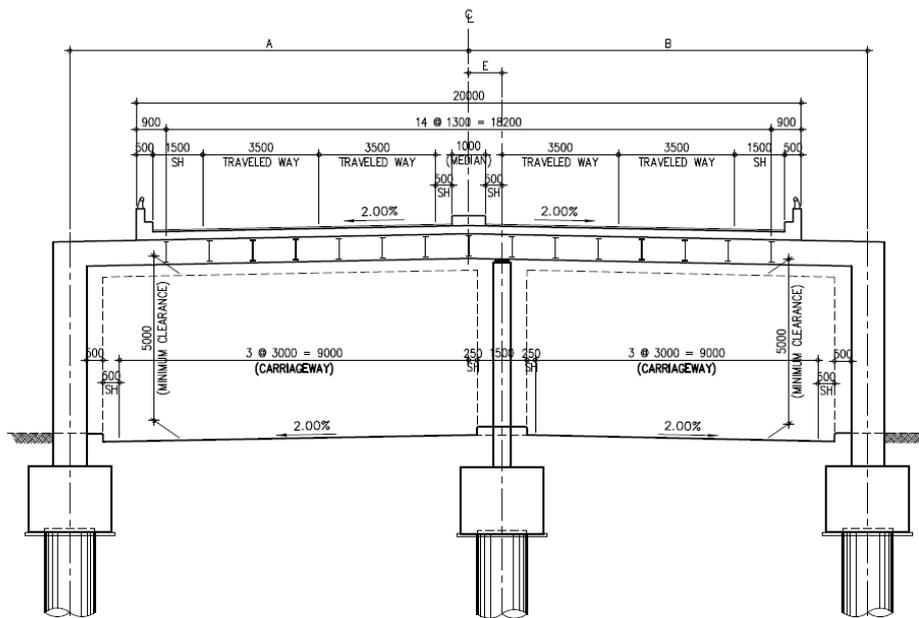
Andrew Avenue

FIGURE 5.4.2-2 (7/12) CROSS SECTION



15 CROSS SECTION OF P73~P78
SCALE 1:200

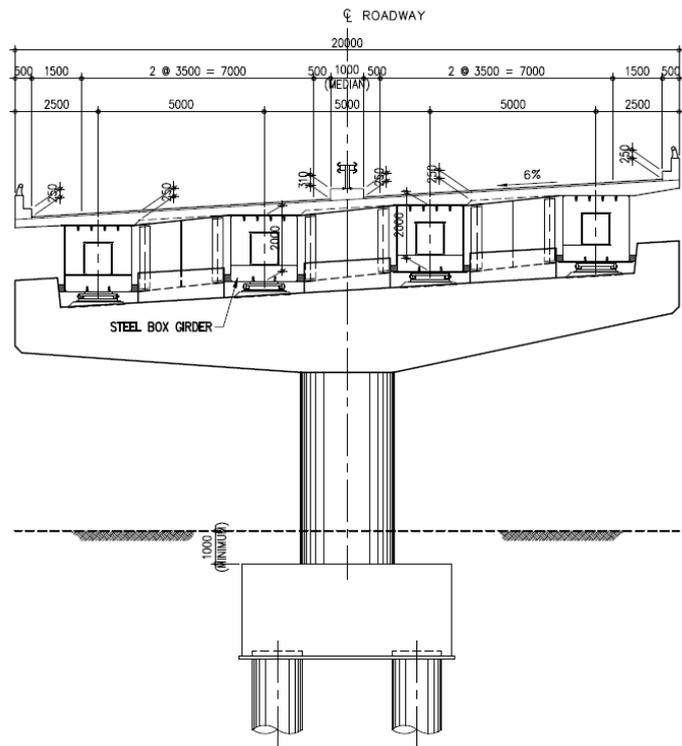
Andrew Avenue



16 CROSS SECTION OF P79~P85, P90 & P91
SCALE 1:200

Andrew Avenue

FIGURE 5.4.2-2 (8/12) CROSS SECTION



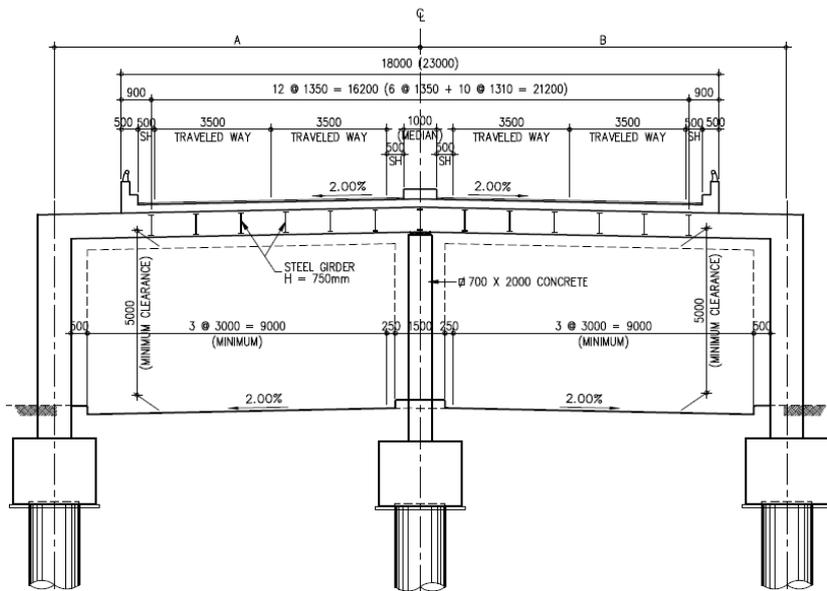
17

CROSS SECTION OF P86~P89

SCALE

1:200

Andrew Avenue to Domestic Road



18

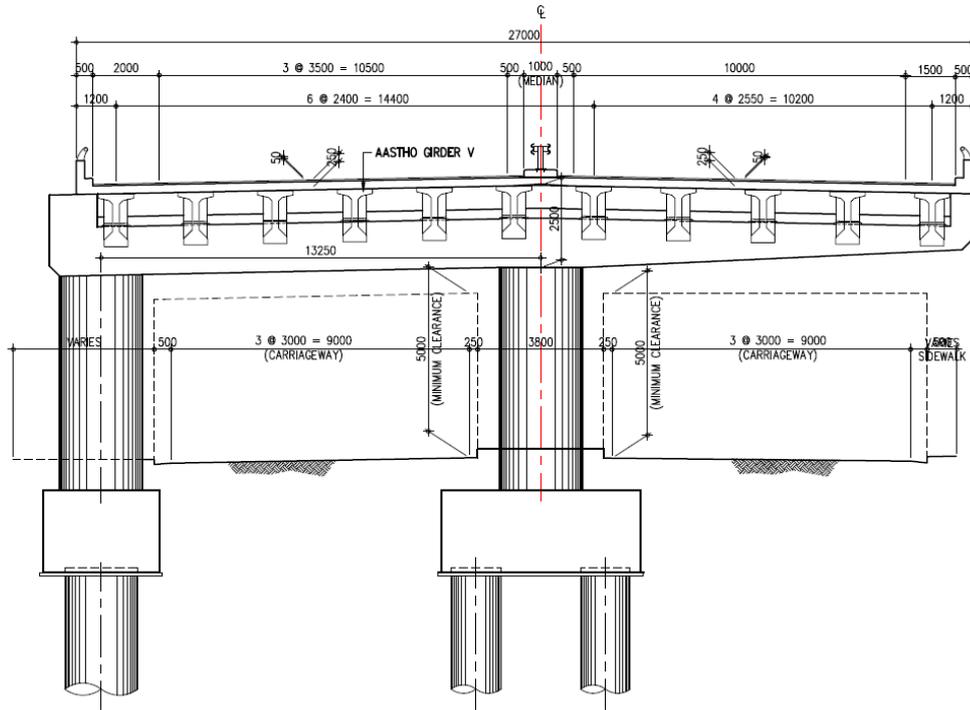
CROSS SECTION OF P92 ~ P95, P111 ~ P115 (P116 ~ P121)

SCALE

1:200

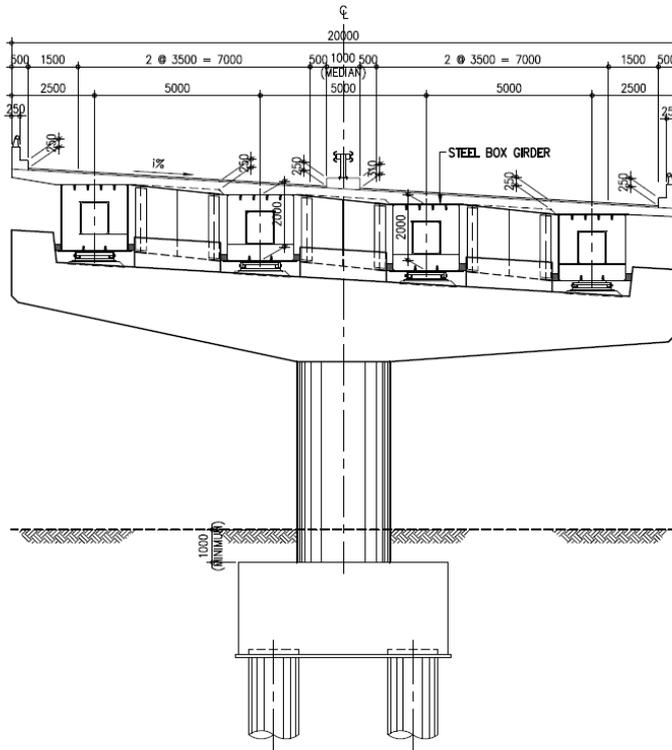
Domestic Road

FIGURE 5.4.2-2 (9/12) CROSS SECTION



21 CROSS SECTION OF P127
 SCALE 1:200

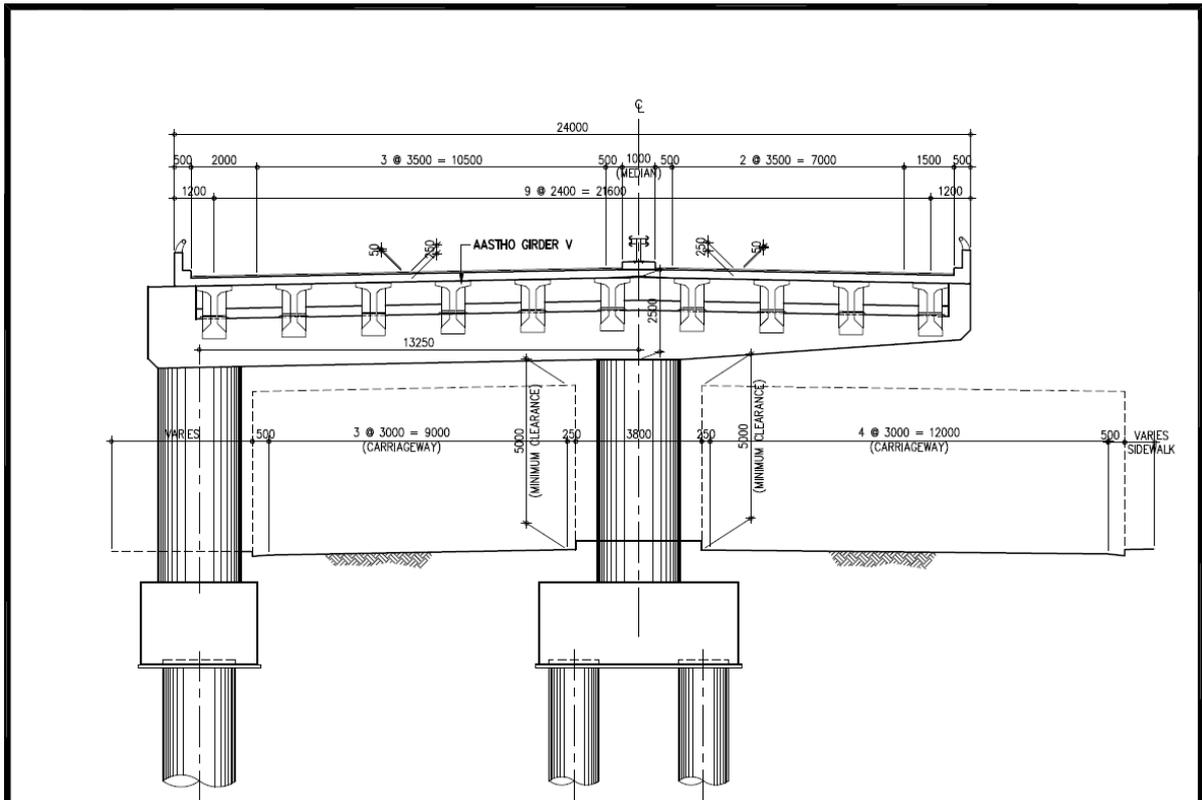
Domestic Road



22 CROSS SECTION OF P128~P137
 SCALE 1:200

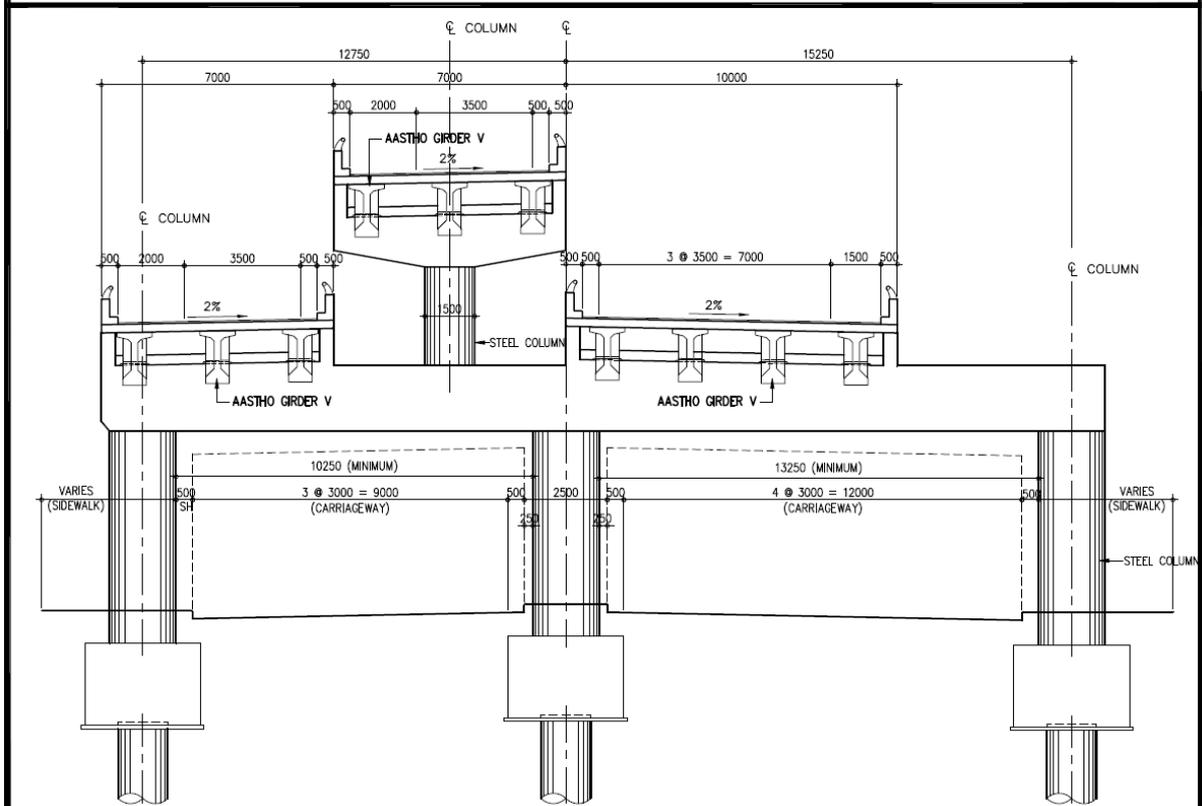
Domestic Road to NAIA Road

FIGURE 5.4.2-2 (11/12) CROSS SECTION



23 CROSS SECTION OF P139
SCALE 1:200

NAIA Road



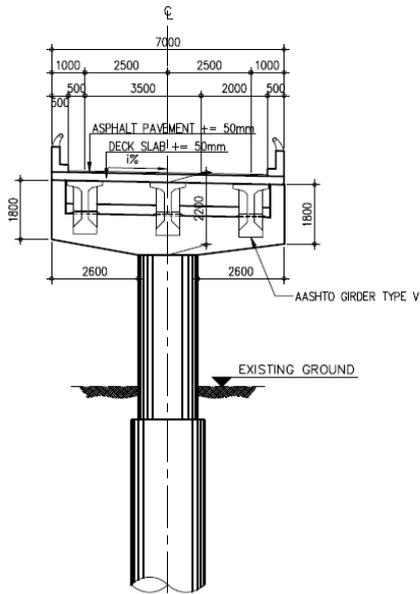
24 CROSS SECTION OF P140~P146
SCALE 1:200

NAIA Road

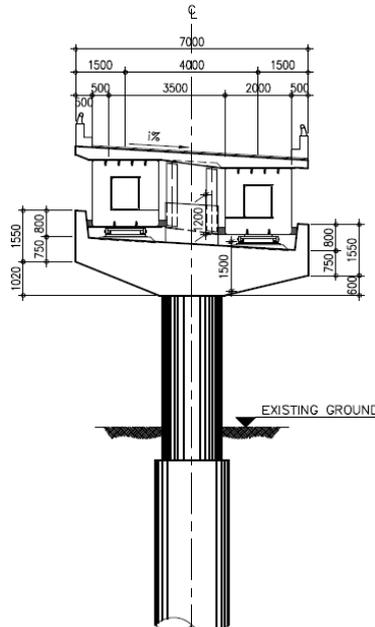
FIGURE 5.4.2-2 (12/12) CROSS SECTION

TABLE 5.4.2-2 BRIDGE TYPE: RAMP

No.	Location	Features	Figure No. (see Figure 5.4.2-2)
Main Carriageway			
1	Sales Street	<ul style="list-style-type: none"> - AASHTO girder type IV and multi column (2 column) type with rectangular section pier was determined following to the piers of Phase-I, - 3 lane carriageway per each bound underneath the viaduct were considered to arrange the column location. 	1, 2
2	Sales St. – Andrew Ave.	Steel box girder in consideration of the curve configuration and concrete hammerhead & single column (circular section) type pier was adopted.	3
3	Andrew Avenue	<ul style="list-style-type: none"> - <i>At general section:</i> AASHTO girder type V and concrete hammerhead & single column (circular section) type pier was adopted, - <i>At toll barrier section:</i> AASHTO girder type V and concrete multi column (3 column) type pier was adopted, - <i>At MMDA Monument section:</i> it shall be followed the required long span and curve alignment, continuous steel box girder and concrete multi column type pier was mainly determined, - <i>At Aurora Boulevard intersection:</i> to consider the future operation of the road, 50m span by steel box girder was determined, - <i>At limited navigation clearance section:</i> Steel I-girder and steel pier (rigid frame type) was determined in consideration of the maximum superstructure depth of 1.0m. 	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16
4	Andrew Ave. – Domestic Rd.	- Steel box girder in consideration of the curve configuration and concrete hammerhead & single column (circular section) type pier was adopted.	17
5	Domestic Road	<ul style="list-style-type: none"> - <i>At limited navigation clearance section:</i> Steel I-girder and steel pier (rigid frame type), and prestressed concrete hollow slab and concrete multi column (2 column) were determined to adopt, - <i>At Ramps to/from NAIA Terminal 1 & 2 transition section:</i> AASHTO girder type V and concrete multi column type pier was adopted. 	18, 19, 20, 21
6	Domestic Rd. – NAIA Rd.	- Steel box girder in consideration of the curve configuration and concrete hammerhead & single column (circular section) type pier was adopted.	22
7	NAIA Road	- <i>At Ramp transition section:</i> AASHTO girder type V and concrete multi column type pier was adopted.	23, 24

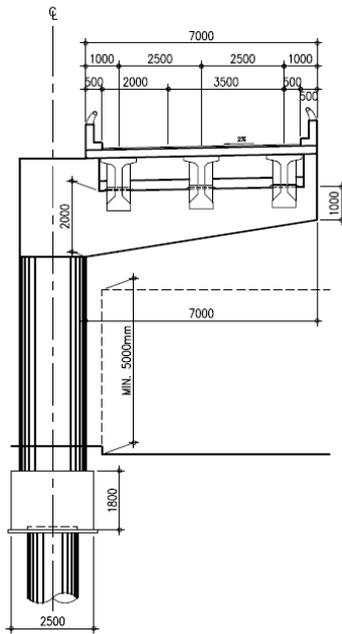


R1
 -
 CROSS SECTION OF RAMP
 AASHTO GIRDER SECTION
 SCALE 1:200

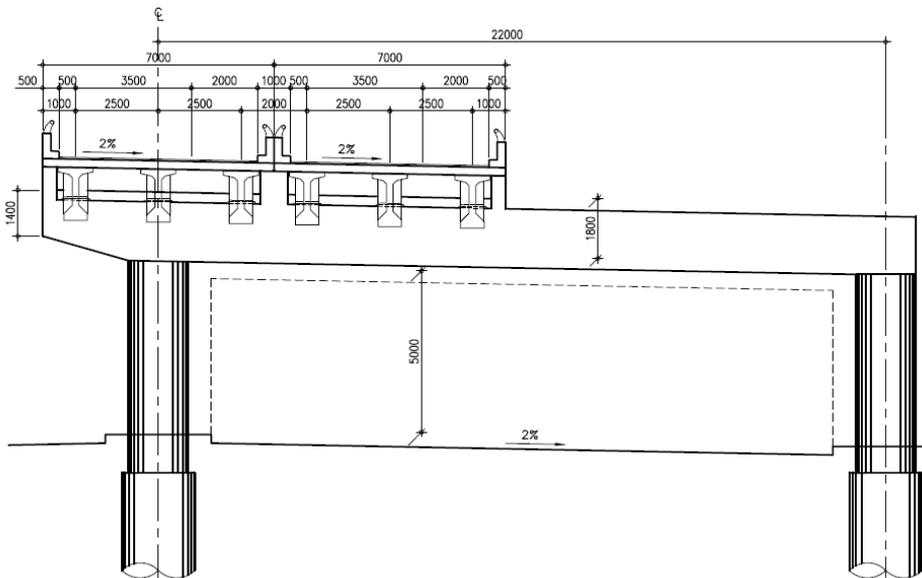


R2
 -
 CROSS SECTION OF RAMP
 STEEL GIRDER SECTION
 SCALE 1:200

FIGURE 5.4.2-3 (1/4) RAMP CROSS SECTION

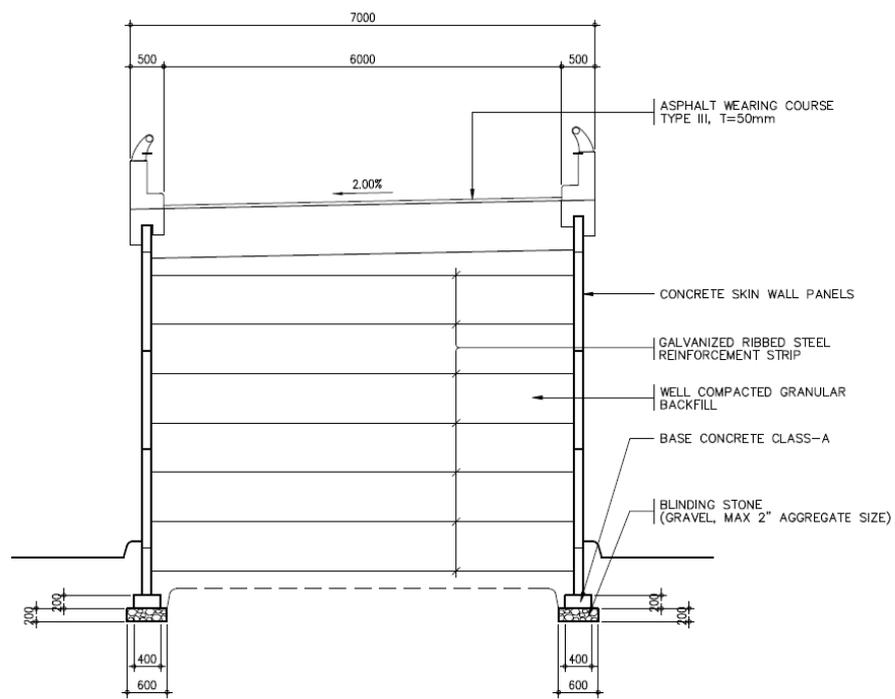


R3 CROSS SECTION OF DOMESTIC ON-RAMP
SCALE 1:200



R4 CROSS SECTION OF DOMESTIC OFF-RAMP (2)
SCALE 1:200

FIGURE 5.4.2-3 (2/4) RAMP CROSS SECTION



R7
-
 CROSS SECTION OF MSE WALL
 SCALE 1:100

FIGURE 5.4.2-3 (4/4) CROSS SECTION

5.5 PRELIMINARY DESIGN OF PAVEMENT STRUCTURE

The pavement design includes restoration of pavement structures affected by construction of expressway foundation and drainage.

The existing at-grade road pavement (PCCP with AC overlay) affected will be replaced by the same pavement structure.

For the elevated structure, 8 cm thickness of the AC pavement is considered on the concrete slab.

5.6 PRELIMINARY DESIGN OF DRAINAGE

Basic concept to drainage design is shown below;

1. The drainage design shall be carried out to collect water efficiently and discharge it without aggravating present flood situation.
2. The water flow in accordance with runoff of bridge surface and collect at the drop in let normally installed every column.
3. From downspout end the collected water shall be discharged to the existing drainage line at the side of the road.
4. In case, the existing drainage is not effecting or insufficient capacity, a new line or improvement of the drainage line shall be considered.

5.7 TOLL BARRIER AND TOLL BOOTH

5.7.1 Toll Booth Layout

The number of toll booth of each ramp terminal is shown in **Table 5.7.1-1**.

TABLE 5.7.1-1 NUMBER OF TOLL BOOTH

No	Ramp name	Number of Toll Booth
1	Andrews Avenue On Ramp(1)	3
2	Andrews Avenue OFF Ramp	3
3	Toll gate from Skyway	7
4	Toll gate from Roxas	5
5	Andrews Avenue OFF Ramp(existing)	3

- One toll gate booth is composed of one (1) maxi-booth equipped with toilet. The size is set by referring to the Phase I toll gate. (**Figure 5.7.1-1**)
- Concrete pavement is designed at the length of 25m for each approach and departure zone side.
- Minimum interval of each booth is 3.0m for passenger car carriage way.
- Minimum interval for truck is 3.5m.
- The vertical grade at toll gate is recommended less than 2.0% and absolute value is 3.0% (Highway design manual, NEXCO, Japan) for the minimum length of 50m. The vertical curve radius is recommended more than 700m at the toll gate. This standard has been considered, however, due to restriction of R.O.W and at-grade road condition, some elements of this requirement may not be accommodated.

- With recommendation from TRB (Toll Regulation Board), the minimum distance from the centre of the toll booth to the approach zone taper is **30m** which allows **5 cars** waiting for fee collection control.

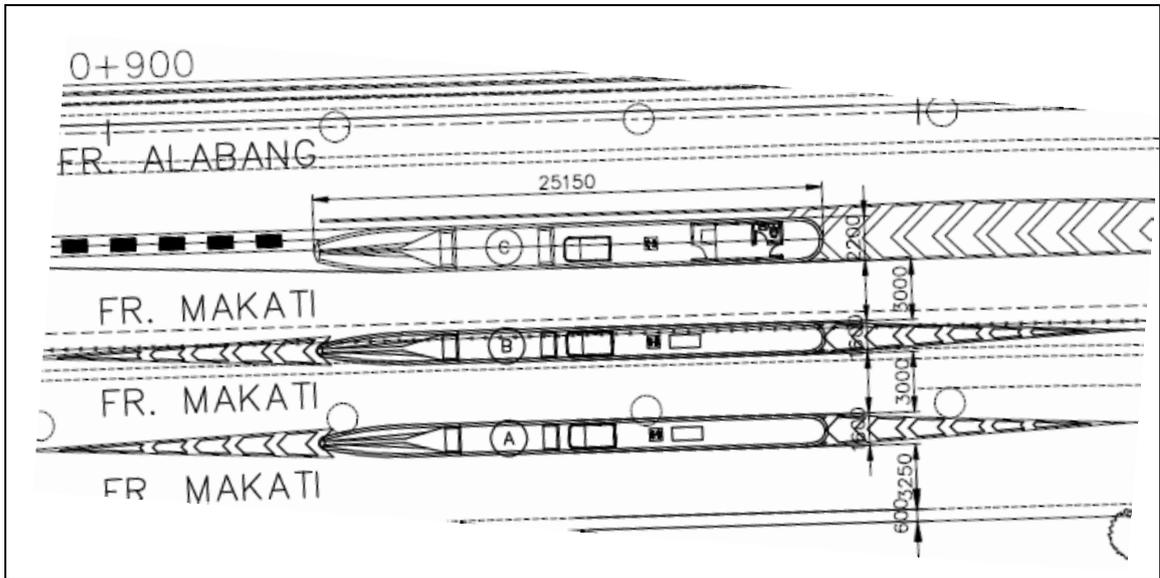


FIGURE 5.7.1-1 LAYOUT OF TOLL BOOTH (PHASE I)

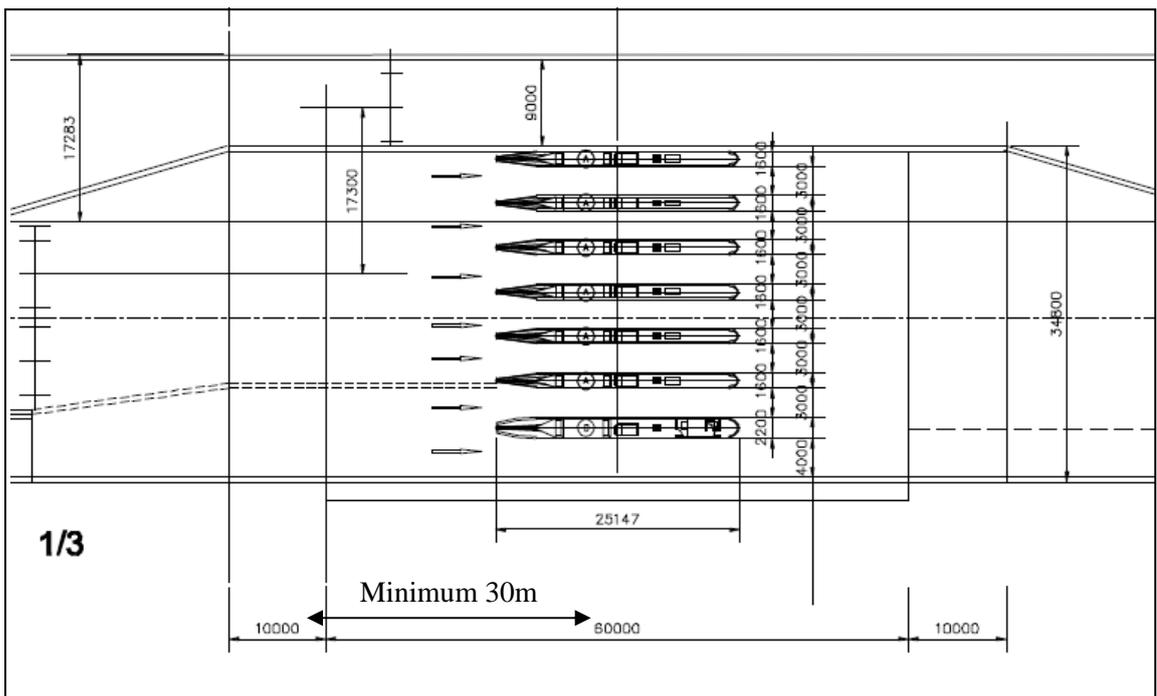


FIGURE 5.7.1-2 LAYOUT OF TOLL BOOTH (TOLL BARRIER)

5.7.2 Toll Barrier Layout

Toll barrier with 10 booths is designed at Andrew's Avenue. This toll barrier is integrated with an on ramp from Andrews Avenue towards Roxas Blvd (2 booths). The total number of toll booths shall be 12.

The size and interval of booths are the same as described **Section 5.7.1**.

Taper of the approach and the departure zone is designed with a 1:3 tangent slope.

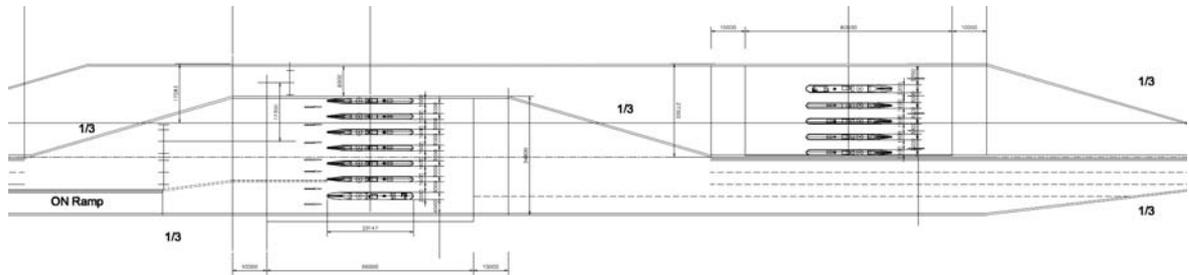


FIGURE 5.7.2-1 LAYOUT OF TOLL BARRIER

5.8 ROW REQUIREMENT BASED ON PRELIMINARY DESIGN

ROW requirement based on the preliminary design is shown in **Figure 5.8-1**.

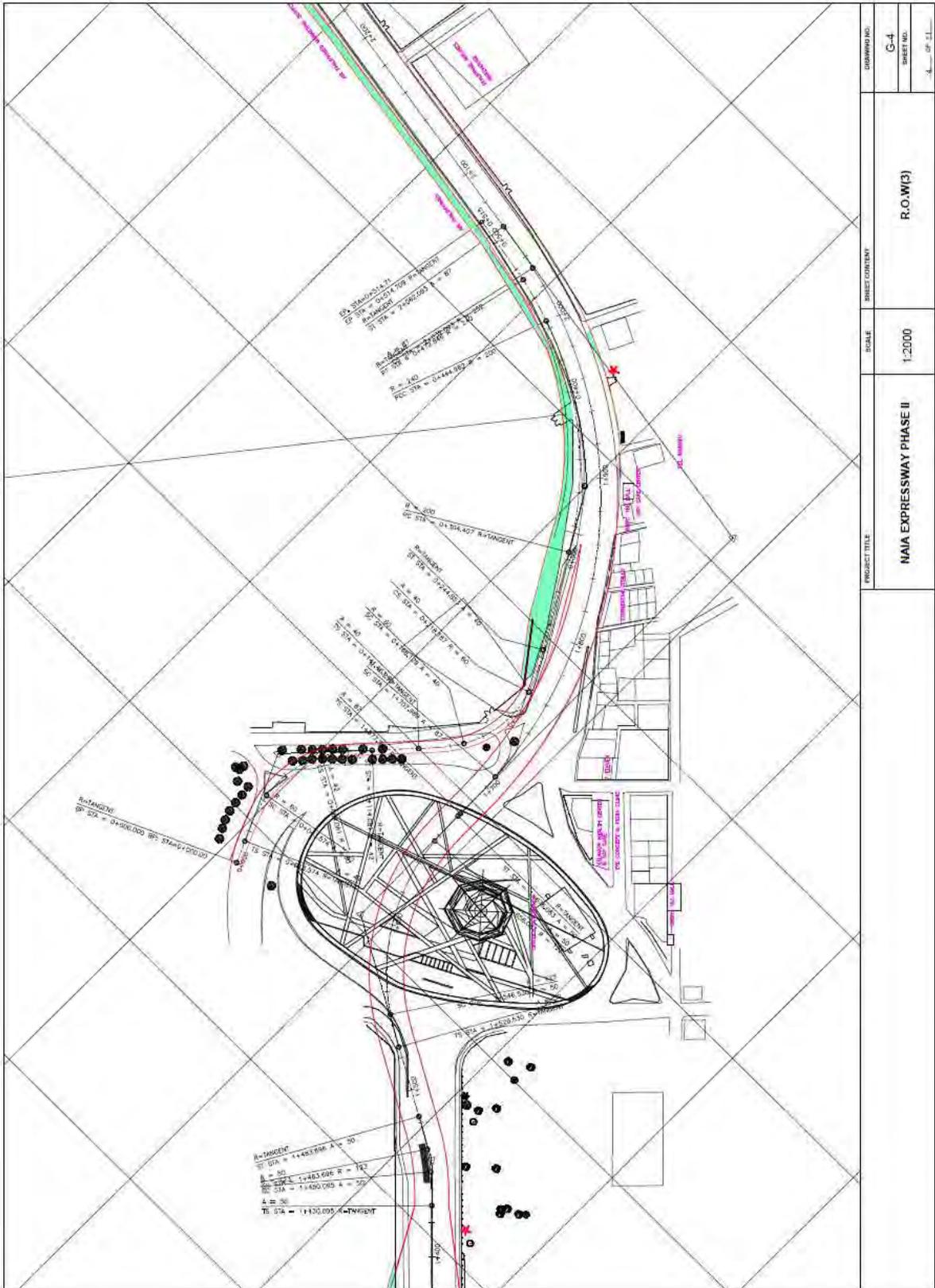


FIGURE 5.8-1 (3/10) ROW REQUIREMENT

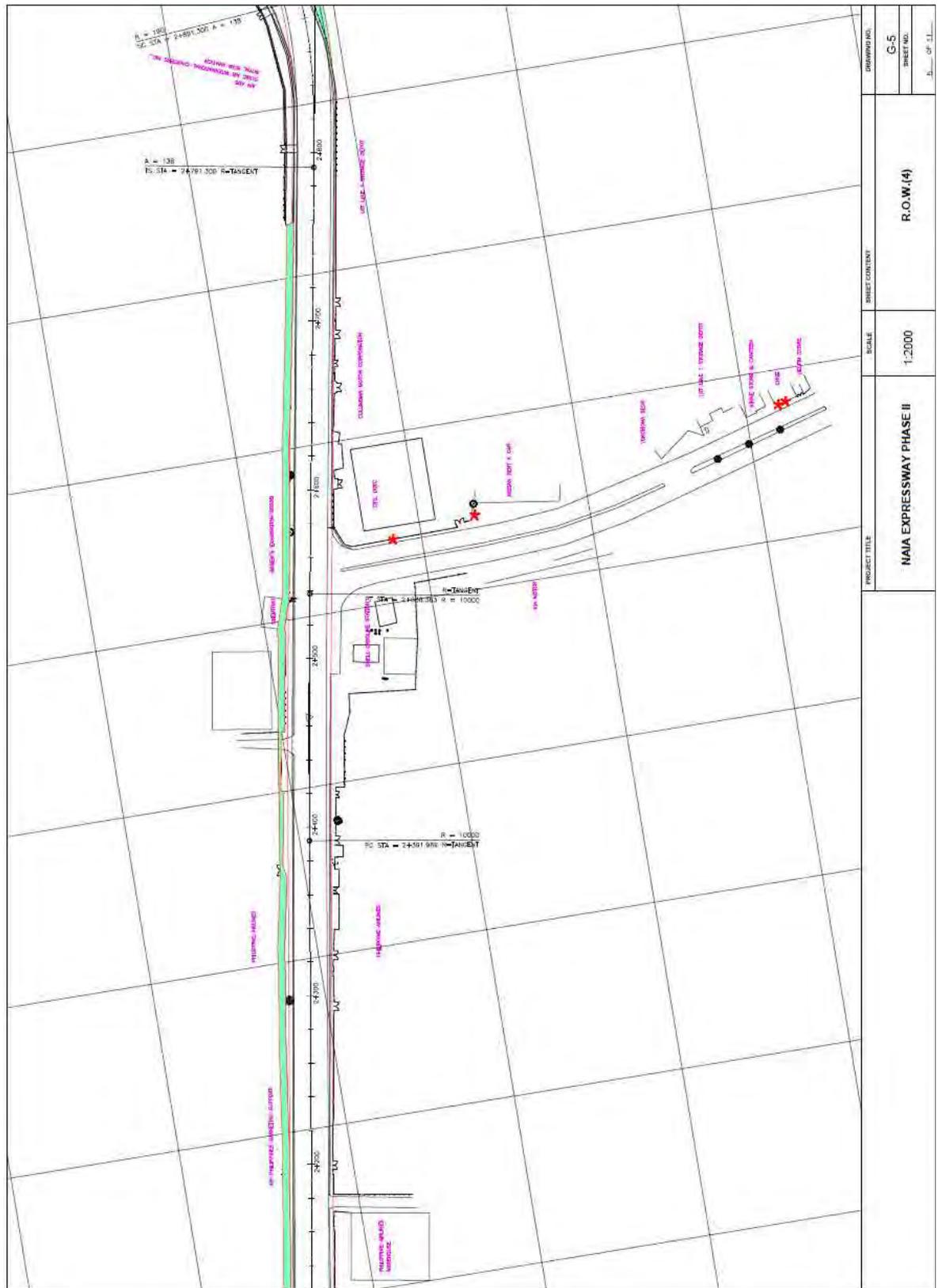


FIGURE 5.8-1 (4/10) ROW REQUIREMENT

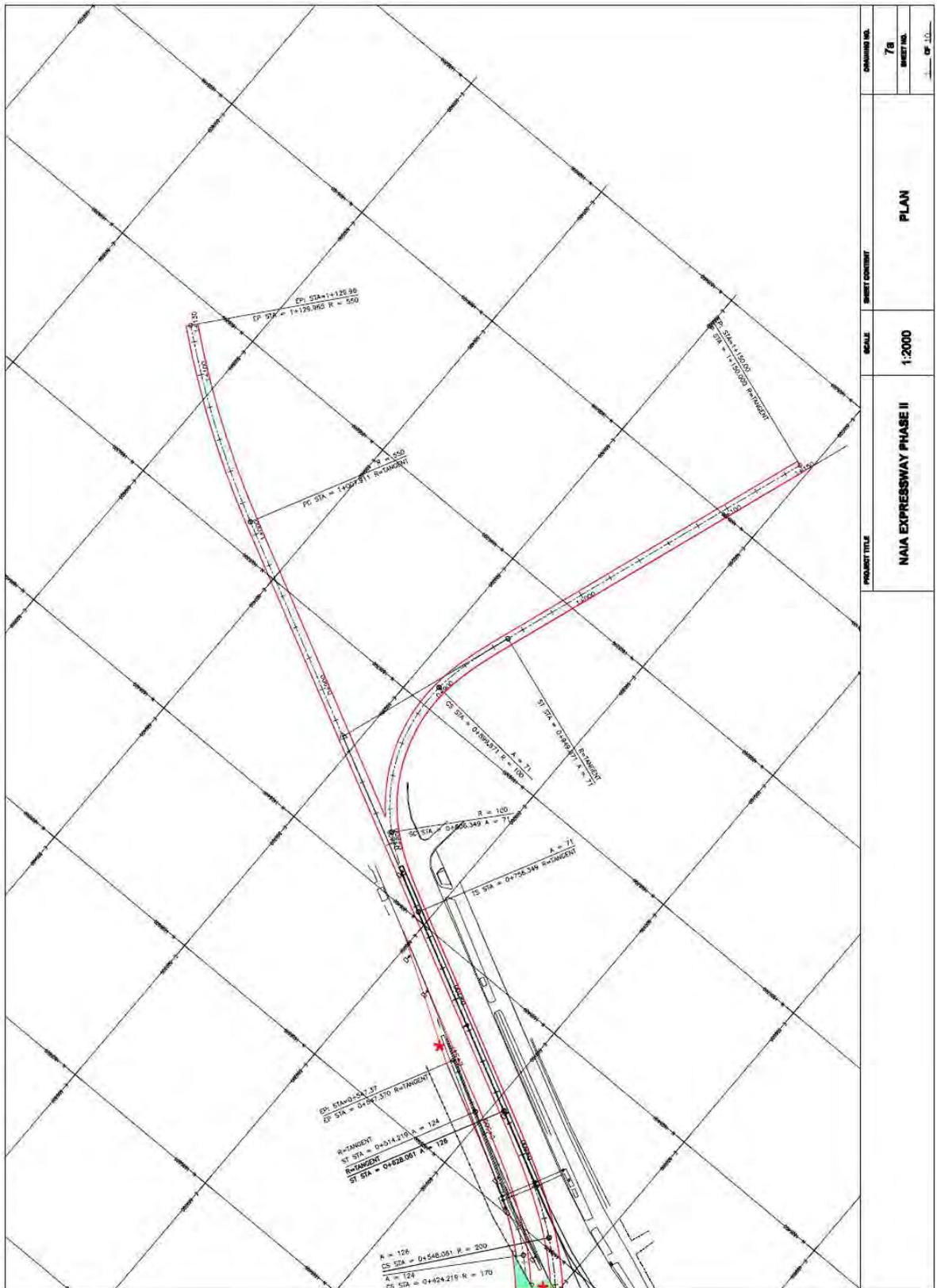


FIGURE 5.8-1 (8/10) ROW REQUIREMENT



PROJECT TITLE	SCALE	SHEET NUMBER	DRAWING NO.
NAIA EXPRESSWAY PHASE II	1:2000	PLAN	0
			SHEET NO.
			1 OF 10

FIGURE 5.8-1 (10/10) ROW REQUIREMENT

5.9 RISKS

Risks allocation matrix and how these risks are incorporated in the Draft Toll Concession Agreement are summarized in **Table 5.9-1**.

TABLE 5.9-1 RISK ALLOCATION MATRIX

Note: Section numbers refer to those in the Draft Concession Agreement.

Nature of Risk	Government (DPWH)	Private Sector (Concessionaire)
Financial risks	<p><u>*Government counterpart financing.</u> DPWH is responsible and bears the risks for financing the following counterpart costs: (a) cost of the Basic Right-of-Way (ROW), (b) Government Financial Support (GFS) for Construction, (c) ½ of the fee of the Project Consultant (PC), and (d) expenses for DPWH technical supervision of the Project. (Sec. 5.0, 9.4 and 9.5).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Understated Basic ROW prices. • Failure to provide adequate GFS on time – Ground for Default and Termination • Extraordinary inflation and forex fluctuation. 	<p><u>*Project financing.</u> The Concessionaire is responsible and bears the risk for Financing of the Project, covering the cost of DED, Construction, O&M, and Additional ROW - net of the Government counterpart financing (for the Basic ROW, GFS, ½ of fee of IC, and technical supervision expenses). (Sec. 6.(a)).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Overrun in costs of DED, Construction, and Additional ROW. • Extraordinary inflation and forex fluctuation. <p><u>*Financing Agreements.</u> The Concessionaire may enter into agreements with Financiers/ Lenders for the Financing of the Project as it may deem desirable or necessary (Sec. 9.2).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Delay in meeting Financiers’ pre-requisites. <p><u>*Financial closure.</u> The Concessionaire shall achieve financial closure not later than 12 months after the signing of the Agreement, with the following evidence: (a) Concessionaire’s Shareholders Agreement and receipt of payment of shareholders (equity), (b) Project Financing Agreements with Financiers/ Lenders (Sec. 9.3).</p> <p><u>Major risk:</u></p> <ul style="list-style-type: none"> • Failure to submit complete Shareholders Agreements and financing Agreements as evidence of Financial Closure within the 12-month period –Ground for Default and Termination.
ROW risks	<p><u>*Responsibility for Basic ROW.</u> DPWH is responsible and bear the risks for the acquisition and delivery to the Concessionaire of the Basic ROW, clear of any liens and obstructions, not later than 6 months after the signing of the Agreement. This includes the relocation of informal settlers</p>	<p><u>* Responsibility for Additional ROW.</u> The Concessionaire shall be responsible and bear the risks, at its sole cost, for the acquisition of Additional ROW which it needs, aside from the Basic ROW to be provided by DPWH (Sec. 11.2).</p>

Nature of Risk	Government (DPWH)	Private Sector (Concessionaire)
	<p>and other occupants, removal/relocation of utilities, removal of obstacles, and settlement of third party claims (<i>Sec. 5.0(b), 11.1 and 18.3</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Non-delivery, incomplete delivery or late delivery of Basic ROW – Ground for Default and Termination • Resistance of informal settlers for removal and relocation. • Uncertain conditions and costs of underground utilities to be removed/relocated. • Increased Basic ROW costs. 	<p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Substantial area and cost of Additional ROW to be acquired. • Delay in the acquisition of Additional ROW.
Design risks	<p>*<u>Minimum Expressway Configuration</u>. DPWH shall be responsible and bear the risks, including cost consequences, for any changes that it will introduce, after the bidding, in the Minimum Performance Standards and Specifications (MPSS) including the Minimum Expressway Configuration (<i>Sec. 12.1(c)</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Changes, after bidding, in the Minimum Expressway Configuration, e.g., alignment and location of (i) main expressway, (ii) roundabout/Circulo del Mundo, (iii) NAIA height limitation section, (iv) alignment at Domestic Rd/MIA Rd., (v) ramps. • Difficulties/delay in getting clearance/consultation from entities concerned – MMDA, MIAA, CAAP, LRTA, LGUs, general public. • Change in toll collection system from open to closed system. <p>*<u>Approval/action on DED</u>. DPWH shall approve/act on the Concessionaire’s Detailed Engineering Design (DED), certified by the PC, within 15 days after its submission (<i>Sec. 5.0c, 12.2, and 18.3</i>).</p>	<p>*<u>Preparation and submission of DED</u>. The Concessionaire is responsible and bear the risks for the preparation - by itself or its designated Designer – of the DED of the Project in accordance with the MPSS for Design, and for the submission of the DED to DPWH - certified by the PC - within 10 months after the signing of the Agreement (<i>Sec. 6.0(e) and 18.2(a)</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Inadequate geotechnical and other engineering investigations. • Requests of LGUs for additional/relocation of ramps/facilities. • Over-design with resulting high construction cost. • Under-design resulting in early deterioration, higher maintenance, and lower level of service. • Difficulty/delay in securing a new ECC if DED differs significantly from the original configuration covered by existing ECC. • Failure to submit compliant, PC-certified DED within the 10-month period – Ground for Default and Termination. <p>*<u>Undiminished responsibility for DED integrity</u>. DPWH’s approval of the DED shall not diminish the responsibility of the Concessionaire for the integrity of the DED, or transfer any part of such responsibility to DPWH (<i>Sec. 12.2(d)</i>).</p>

Nature of Risk	Government (DPWH)	Private Sector (Concessionaire)
	<p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Failure to approve/take action on the PC-certified DED on time – Ground for Default and Termination. • Changes in MPSS after submission of DED. • DPWH-initiated changes in design, e.g., new/relocation of ramps, realignment, after submission of DED. 	<p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Design error, affecting the structural integrity. • Delayed submission of compliant DED
Construction and completion risks	<p><u>*Technical supervision.</u> DPWH is responsible for technical supervision and monitoring of the Construction undertaken by the Concessionaire (<i>Sec. 13.5</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Poor technical supervision by DPWH/IC. <p><u>*DPWH-initiated variations.</u> DPWH is responsible for extra costs and time extensions due to variations initiated by DPWH in the following cases: (a) changes in the MPSS for Design and Construction or the Scope of Construction, and (b) change in law such that the variation is necessary to ensure compliance (<i>Sec. 13.6</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Significant DPWH-variations, e.g., resulting in considerable extra costs, ROW, and implementation delays to be borne by DPWH. <p><u>*Certificate of Completion.</u> DPWH shall issue the Certificate of Final Completion (CFC) within 7 days after the PC's certification of Concessionaire's compliance with the requirements and recommendation <i>Sec. 13.8</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Delay in the issuance of the CFC despite Concessionaire's compliance with requirements as certified by the PC. 	<p><u>*Responsibility for Construction.</u> The Concessionaire is responsible and bear the risks for the Construction of the Facility - by itself or its designated Contractor - in accordance with the Concessionaire's DED as approved by DPWH, and in conformance with the MPSS for Construction, which shall be completed not later than 24 months after the Notice to Proceed to Construct (<i>Sec. 6.0c, 13.0, and 18.2</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Slippage of 20% or more due to the Concessionaire's fault – Ground for Default and Termination.. • Failure to remedy major defects/deviations from the approved DED whose cost is 20% or more or the value of work within 6-month period - Ground for Default and Termination.. • Failure to complete the Project satisfactorily and secure a CFC before the target completion date due to Concessionaire's fault - Ground for Default and Termination. • Substandard quality of Construction. • Confiscation of Performance Security for Construction because of Concessionaire's failure to fulfil its above obligations. • Liquidated damages due to delayed completion beyond d target date. • Cost overruns in Construction. • Unexpected changes in geotechnical and other engineering conditions, with consequent extra costs and delays. • Concessionaire-initiated variations, resulting in extra costs, ROW and delays to be assumed by the Concessionaire. • Inadequate traffic management during Construction, resulting in

Nature of Risk	Government (DPWH)	Private Sector (Concessionaire)
		<p>congestion, accidents, and business slowdown.</p> <ul style="list-style-type: none"> • Unexpected heavy/prolonged rains, causing floods, jams and delays. <p><u>*Responsibility for Contractors and sub-contractors.</u> The Concessionaire shall assume full responsibility and accountability for the actions and quality of works of its Contractors and sub-contractors, which shall be in compliance with the MPSS and other provisions of the Agreement (<i>Sec. 13.4(b)</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Substandard performance of Contractor and sub-contractors. <p><u>*Construction permits and other approvals.</u> The Concessionaire is responsible for securing all necessary Construction permits, licenses, authorization, and approvals from concerned national agencies and LGUs, and for assuming their attendant costs and fees, prior to the start of Construction activities (<i>Sec. 13.4(c)</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Difficulties/delays in obtaining permits and other approvals. <p><u>*Undiminished responsibility for Facility integrity and performance.</u> DPWH's issuance of the Certificate of Final Completion does not diminish the responsibility of the Concessionaire for the structural integrity and performance of the Facility during the Concession Period, or transfer any part of that responsibility to DPWH (<i>Sec. 13.8(h)</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Structural failure due to faulty Construction. <p><u>*Insurance.</u> The Concessionaire shall secure insurance coverage during Construction against all insurable risks, including contractor's all-risk insurance, force majeure, and third-party liability (<i>Sec. 15.1(1)</i>).</p> <p><u>Major risks:</u></p>

Nature of Risk	Government (DPWH)	Private Sector (Concessionaire)
		<ul style="list-style-type: none"> • Failure to secure the required insurance coverage - Ground for Default and Termination. • Insufficient insurance coverage.
Operation and maintenance risks	<p><u>*Grant of franchise and TOC.</u> DPWH automatically grants the franchise through a Concession under the Agreement. DPWH shall ensure that, within 15 days after the signing of the Agreement, TRB grants to the Concessionaire a TOC to operate and maintain the Facility, including the collections of Tolls at the Toll Rates and use of Toll Rate adjustment formula provided in the Agreement. The TOC shall become effective only upon the issuance by DPWH of the CFC in accordance with Sec. 13.8 (<i>Sec. 3.0, 5.0(c), 13.1, and 18.3</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Failure to deliver the TOC on time –Ground for Default and Termination... <p><u>*Technical supervision.</u> DPWH is responsible for the technical supervision and monitoring over the O&M undertaken by the Concessionaire (<i>Sec. 14.8</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Inadequate technical supervision by DPWH of O&M. • Failure to impose penalties on the Concessionaire for non-compliance with KPIs. 	<p><u>*Responsibility for O&M.</u> The Concessionaire is responsible and bear the risks for the O&M of the Facility - by itself or its designated Facility Operator and/or Maintenance Provider - in accordance with the approved O&M Manuals and other provisions of MPSS for O&M, during the Operation Period (<i>Sec. 6.0(i) and 14.0</i>).</p> <p>Major risks:</p> <ul style="list-style-type: none"> • Failure to operate the Expressway within 15 days from effective date of TOC due to Concessionaire’s fault - Ground for Default and Termination.. • Failure to establish or maintain the required Maintenance Fund Trust Account - Ground for Default and Termination. • Persistent or flagrant failure to meet material obligations in approved O&M Manuals or to comply with KPIs with significant cumulative penalties therefor - Ground for Default and Termination. • Confiscation of Performance Security for O&M for above violations. • Higher maintenance costs due to substandard DED and poor Construction. <p><u>*Undiminished responsibility for O&M performance.</u> The technical supervision and monitoring by DPWH over the O&M undertaken by the Concessionaire neither diminishes the responsibility of the Concessionaire nor transfers any part of that responsibility to DPWH (<i>Sec. 14.8(h)</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Inferior O&M performance resulting in substandard level of service. <p><u>*Insurance.</u> The Concessionaire shall secure insurance coverage during the Operation Period against force majeure, including damage or destruction, casualty insurance for the toll operations facilities, and third party liability insurance in connection with the use by third persons of the Facility (<i>Sec. 15.1(b)</i>).</p>

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		<p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Failure to secure the required insurance coverage - Ground for Default and Termination. • Insufficient insurance coverage. <p><u>*Facility Turnover.</u> The Concessionaire shall turnover of the Facility in good condition to DPWH in accordance with the MPSS at the end of the Concession Period (<i>Sec. 6.0(m) and 21.1</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Failure to put the Facility in good condition per MPSS at the time of turnover.
Market and revenue risks	<p><u>*Revenue loss for Government's disallowance of Toll Rates.</u> If the actual Toll Rate allowed by Government is less than the Toll Rate authorized in the Agreement, DPWH is responsible for effecting (a) compensation to the Concessionaire or (b) extension of Concession Period, to offset the Concessionaire's revenue loss (<i>Sec. 5.0(f) and 15.3</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Political intervention preventing the implementation of authorized toll rates. • Insufficient/delayed funding of compensation for disallowance of authorized toll rates. <p><u>*Termination payment in case of DPWH default.</u> Concessionaire shall have the option to require DPWH to acquire the former's rights and obligations under the Agreement (<i>Sec. 18.4</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Inadequate financial capacity of DPWH to pay acquisition price in case of termination due to DPWH's default. 	<p><u>*Market or traffic risk.</u> The Concessionaire shall assume the market risks in terms of the actual traffic volume using the Facility (<i>Sec. 6.0</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Actual traffic significantly less than the projected traffic. <p><u>*Revenue based on authorized Toll Rates, with adjustments.</u> The Concessionaire's revenues will come from Tolls applied to the actual traffic using the Facility, at the Toll Rates authorized in the Agreement, subject to (a) periodic Toll Rate adjustments due to inflation based on CPI and (b) extraordinary adjustments due to change in law/taxes and DPWH-initiated variations (<i>Sec. 15.1 and 15.2</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Insufficient revenues due to low traffic and/or allowed toll rates below those authorized.

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Political risks	<p><u>*Change-in- law/acts of Government.</u> Govt shall bear the risk of any change in existing laws, regulations, policies, or other acts of the Govt which make the Concessionaire's performance of its obligations impossible, materially more difficult or expensive, or which adversely affect the Project viability. DPWH and the Concessionaire shall meet to remedy the remedy the situation or compensate the Concessionaire, which includes adjustment of the toll rate, extension of Concession Period, revision of Project schedule, and other remedies as mutually agreed by the parties.</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Inadequate capacity of DPWH to compensate the Concessionaire. <p><u>*Requisition or similar act.</u> Government shall bear the risk of any requisition, nationalization, or expropriation of the Concessionaire or its properties. The Agreement shall be terminated, and DPWH shall take over the Project, assume all attendant liabilities, pay the Concessionaire the fair market value/just compensation (<i>Sec. 20.1(a)(iii)</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> • Lack of technical and financial capacity of DPWH to take over the Project and bear all liabilities and compensation requirements, which will affect service to the users. <p><u>*Judicial declaration.</u> Government shall assume the risk of the Agreement being declared void/invalid/ unenforceable by a final judicial declaration, or the Concessionaire's rights under the Agreement or its right to collect Tolls or Operate and Maintain the Project being adversely affected by any final judicial declaration thru no fault of the Concessionaire. Such event shall be a ground for Termination, and treated in the</p>	

Nature of Risk	Government (DPWH)	Private Sector (Concessionaire)
	<p>same manner as a requisition (<i>Sec. 20.1(a)(iii)</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> Insufficient technical and financial capacity of DPWH to take over the Project and assume all liabilities and compensation requirements, which will affect service to the users. 	
Force majeure risks	<p><u>*Excuse from performance.</u> For force majeure events, DPWH shall be excused from performing its obligations under the Agreement, but shall not be released from its monetary obligations (<i>Sec. 20.1(b)</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> Inadequate DPWH capacity to meet its monetary obligations in case of force majeure. <p><u>*Responsibility for repair or reconstruction.</u> If the Concessionaire is unable to raise funds for any required reconstruction and/or repair work on the damaged Toll Facility, DPWH shall undertake such reconstruction and/or repair work in order to reinstate the damaged Facility (<i>Sec. 20.3</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> Inadequate funding to undertake the repair work. 	<p><u>*Excuse from performance.</u> For force majeure events, the Concessionaire shall be excused from performing its obligations under the Agreement, but shall not be released from its monetary obligations (<i>Sec. 20.1(b)</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> Inadequate Concessionaire's capacity to meet its monetary obligations in case of force majeure. <p><u>*Funding of repair or reconstruction.</u> The Concessionaire is responsible for taking actions to mitigate any damage by utilizing any insurance proceeds covering force majeure. If the Concessionaire is unable to perform the required reconstruction or repair due to insufficient insurance proceeds, the Concessionaire has the option to provide any funding shortfall, and/or undertake the reconstruction/repair work. Any amount advanced/incurred by the Concessionaire in this regard shall be repaid by an appropriate extraordinary Adjustment in the Toll Rates, or extension of the Concession Period, or direct payment, or other means as mutually agreed by the parties (<i>Sec. 20.3</i>).</p> <p><u>Major risks:</u></p> <ul style="list-style-type: none"> Inadequate insurance proceeds and Concessionaire's funds for the repair work.