...NAL COOPERATION AGENCY (JICA)

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REPUBLIC OF THE PHILIPPINES

METRO MANILA URBAN EXPRESSWAY SYSTEM STUDY

FINAL REPORT

VOLUME IV

APPENDIX

OCTOBER 1993

KATAHIRA & ENGINEERS INTERNATIONAL

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REPUBLIC OF THE PHILIPPINES

METRO MANILA URBAN EXPRESSWAY SYSTEM STUDY

FINAL REPORT

VOLUME IV

APPENDIX

OCTOBER 1993

KATAHIRA & ENGINEERS INTERNATIONAL

LISTS OF APPENDICES

APPENDICES TO CHAPTER 3

APPENDICES TO CHAPTER 3

PAGE

Appendix 3.1.1 ESTIMATED SOIL PROFILE ALONG THE WEST-EAST AND THE NORTH-SOUTH CROSS SECTIONS

Table 3.1.1.1 shows geological classification and characteristics of layers which are oftenly found in Metro Manila.

Based on the available boring data (49 boreholes) and field reconnaissance, soil profiles along the west-east and the north-south cross sections (see Figure 3.1.1.1) were roughly estimated and shown in Figure 3.1.1.2 and Figure 3.1.1.3, respectively.

TABLE 3.1.1.1 GEOLOGICAL CLASSIFICATION AND CHARACTERISTICS OF LAYER

NAME OF LAYER	SYMBOL (1)	SYMBOL (2)	MATERIAL	EXISTING TYPICAL PLACE	THICKNESS (M)	N – VALUE (SPT – VALUE)	DESCRIPTION
Detritus	DT		• sand and gravel	• foot of the slope • thickness few meters	2 – 3	6 – 10	• loose gravel and sand
Alluvium Deposit	RD (River Deposit)		• existing river bed sediment clay, sand, silt	• river bed material as Pasig River	1– 5	1 – 2	• very loose • material is rich in organic
	AC (Clay)		• clay and silt and sand mixed cohesive soil with shell and organic material and sand	• deltaic, lagoonic, flooding deposit • alluvium lowland as elevation is lower than 4 – 5 meters	5 – 20	1 – 5	• very unhomoginius, lateral change to fine sand • including organic material
	AS (Sand)		• fine sand and gravel sand with shell • volcanic ash including organic material	Same	5 – 10	1 – 10 (2 – 5)	• homoginius thickness is different
	AG (gravel)		• sand and gravel gravel is size 1 – 3 (cm)	Same	3 – 5	20 – 30	• there are nothing this layer changing material with clay, silt
	VA (Ash)		volcanic ash (loam, sand)	• upper terrace deposit and rolling hill	1 – 3	1 – 3	• top of hill and southern
Diluvium Deposit	DC (Clay)		• almost silt and sandy silt • including organic material	Same	10 – 20	10 – 30 (20)	• thickness is different at the place • unhomoginius • organic material including
	DS (Sand)		• sand with small gravel and silt and clay	• this layer's depth is deep than 20 meters • under alluvium deposits	5 – 10	30 – 40 (50 < N)	• with silt and clay
	TR (Terrace Deposit)		• gravel sand with silt and clay and ash	• rolling hill upper	2 – 5	30 – 50	• with silt and clay
	DG (Gravel)		• gravel sand with silt and clay and ash	• this layer's depth is deep than 20 meters	5 – 10	30 – 50	
Guadalupe Formation (Pliocen – Pleistocene)	GF – T (Tuff)		• tuff and tuffcius siltstone	• northern of Makati distribution	–	50 < N Impossible	• upper guadalupe formation is weathered to sail about 2 – 5 meters (N < 50)
	GF – S (Sandstone)		• tuffcius sandstone	• southern of Makati distribution	–	50 < N Impossible	• upper guadalupe formation (gf–s) is put between sandstone to ash (loam) by the thickness 0.30 – 50 m

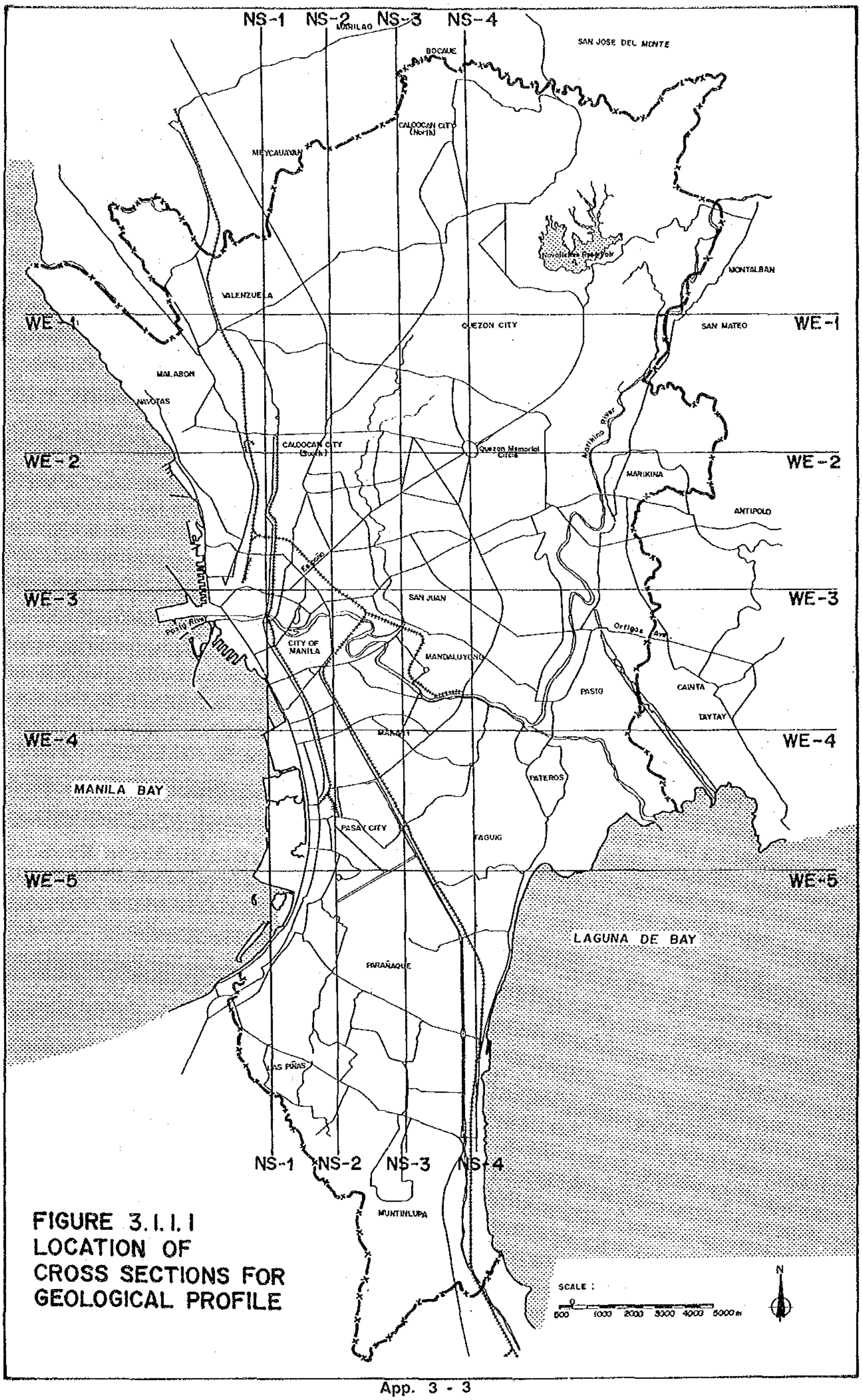


FIGURE 3.1.1.1
LOCATION OF
CROSS SECTIONS FOR
GEOLOGICAL PROFILE

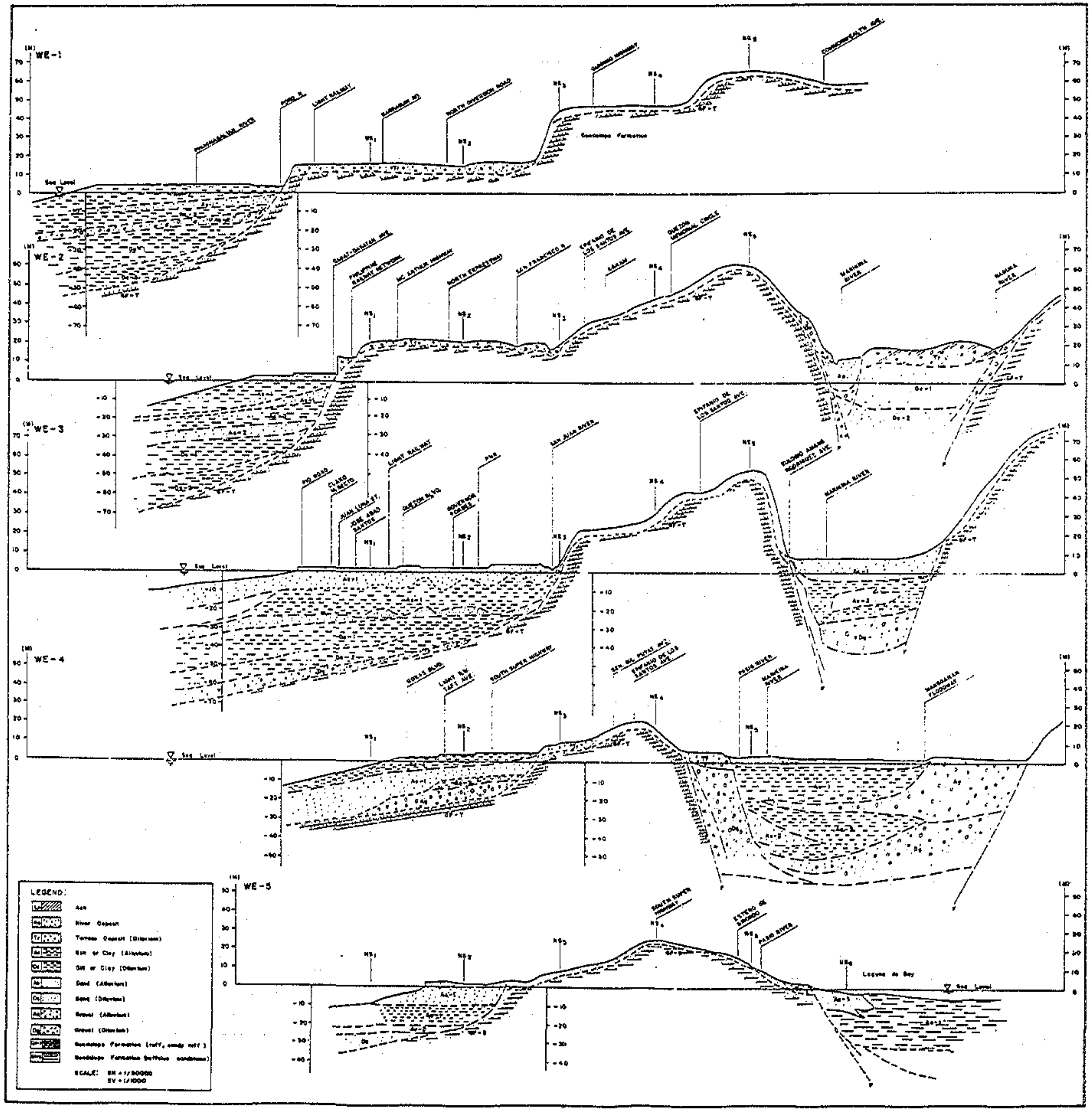


FIGURE 3.1.1.2
ESTIMATED SOIL
PROFILE ALONG WE
CROSS SECTIONS

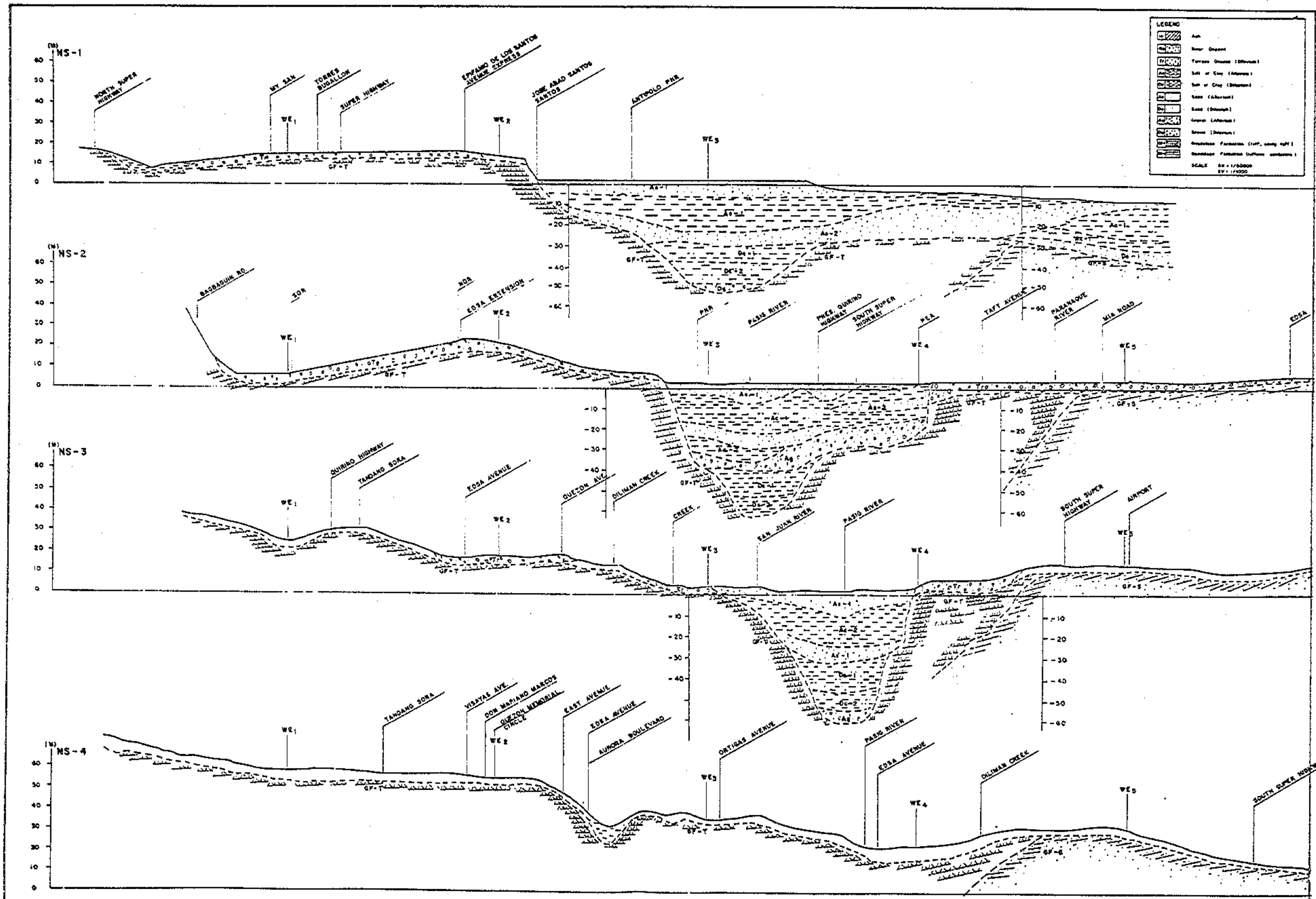


FIGURE 3.1.1.3 ESTIMATED SOIL PROFILE ALONG NS CROSS SECTIONS

Appendix 3.2.1 AREA COVERAGE AND INDEX MAP OF PHOTO-MOSAICS

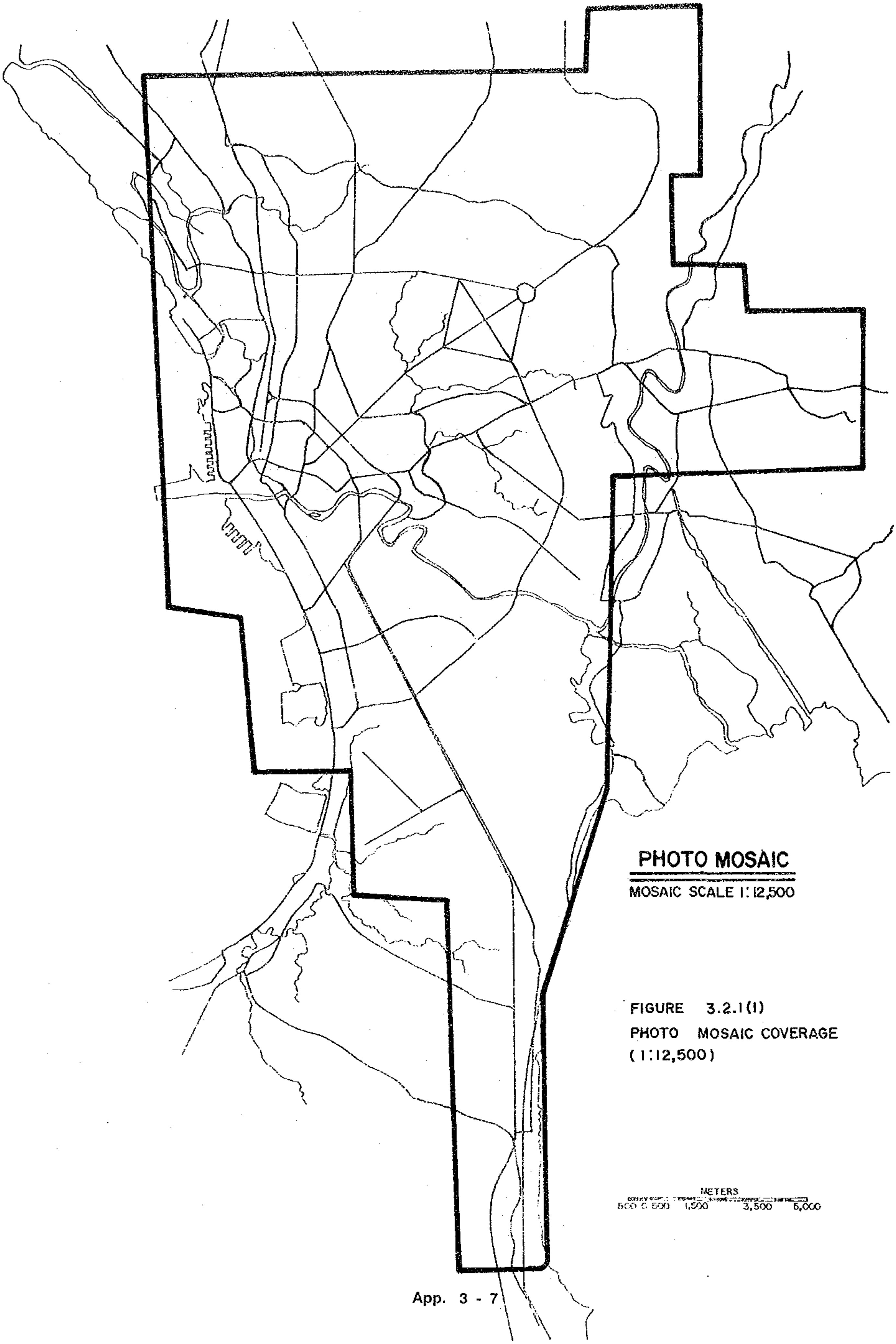


PHOTO MOSAIC

MOSAIC SCALE 1:12,500

FIGURE 3.2.1(1)
PHOTO MOSAIC COVERAGE
(1:12,500)

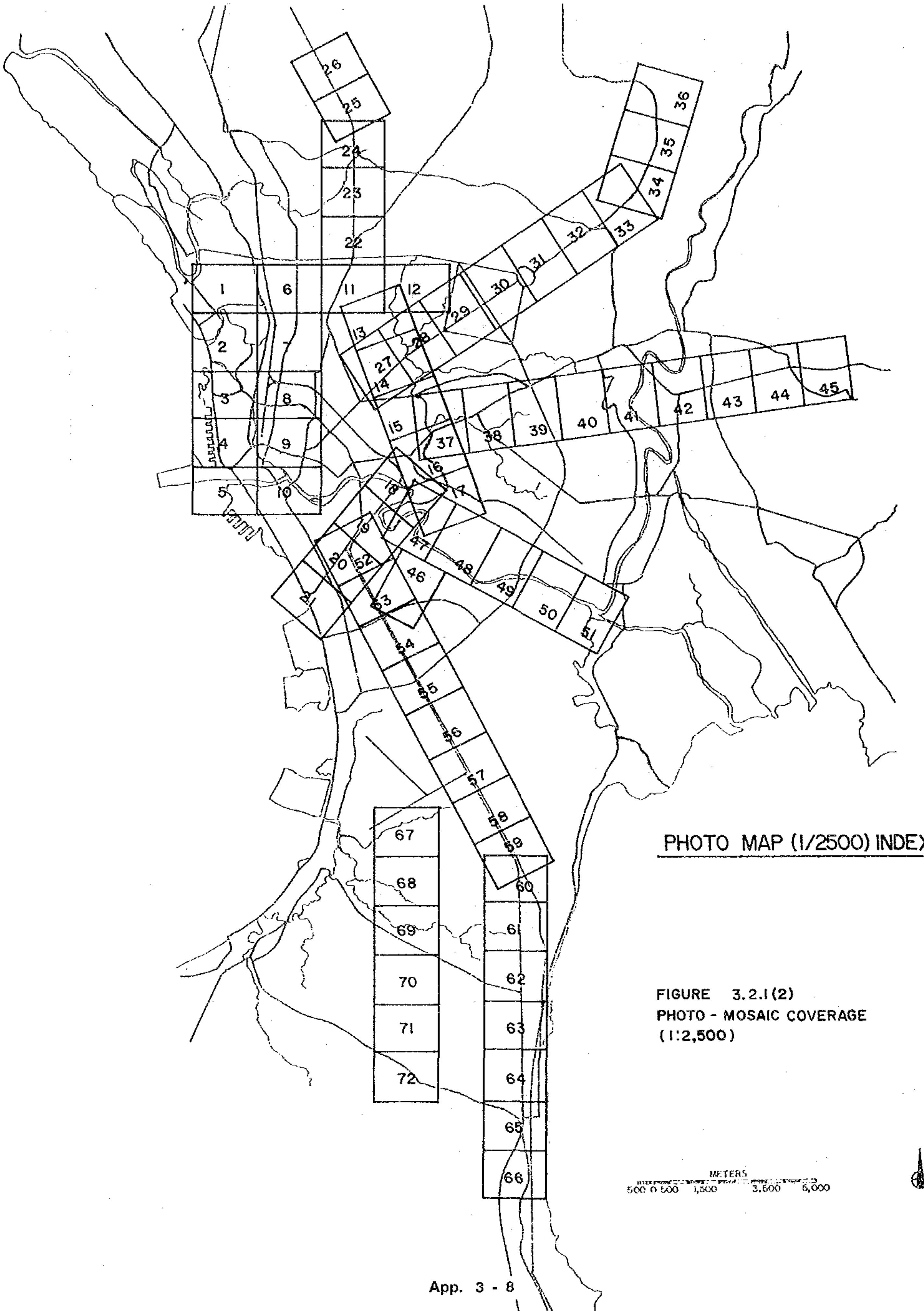


PHOTO MAP (1/2500) INDEX

FIGURE 3.2.1(2)
PHOTO - MOSAIC COVERAGE
(1:2,500)

Appendix 3.2.2 LOCATION MAP OF BORING HOLES AND SOIL PROFILE ALONG EXPRESSWAY CORRIDORS SELECTED FOR F/S.

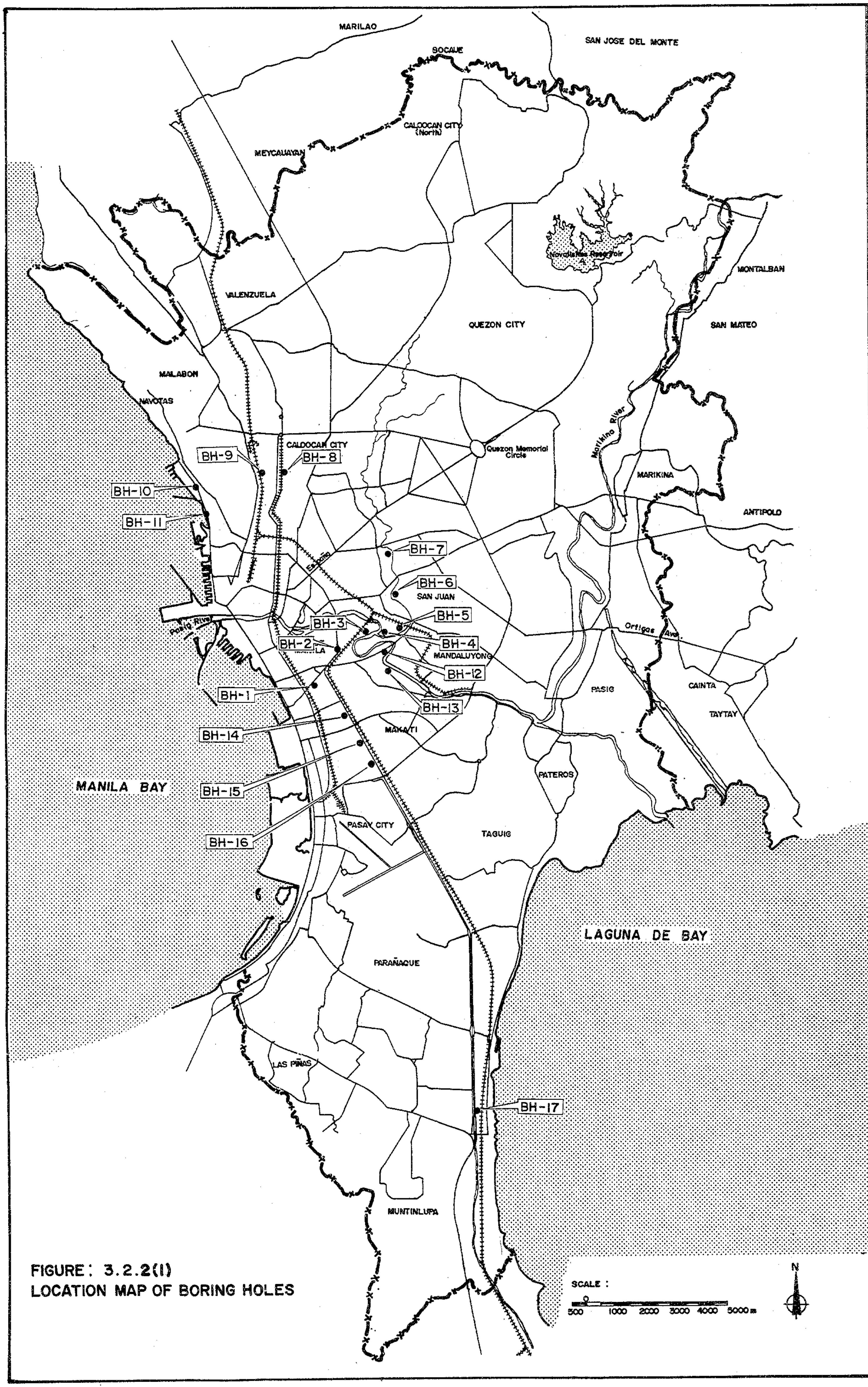


FIGURE : 3.2.2(1)
LOCATION MAP OF BORING HOLES

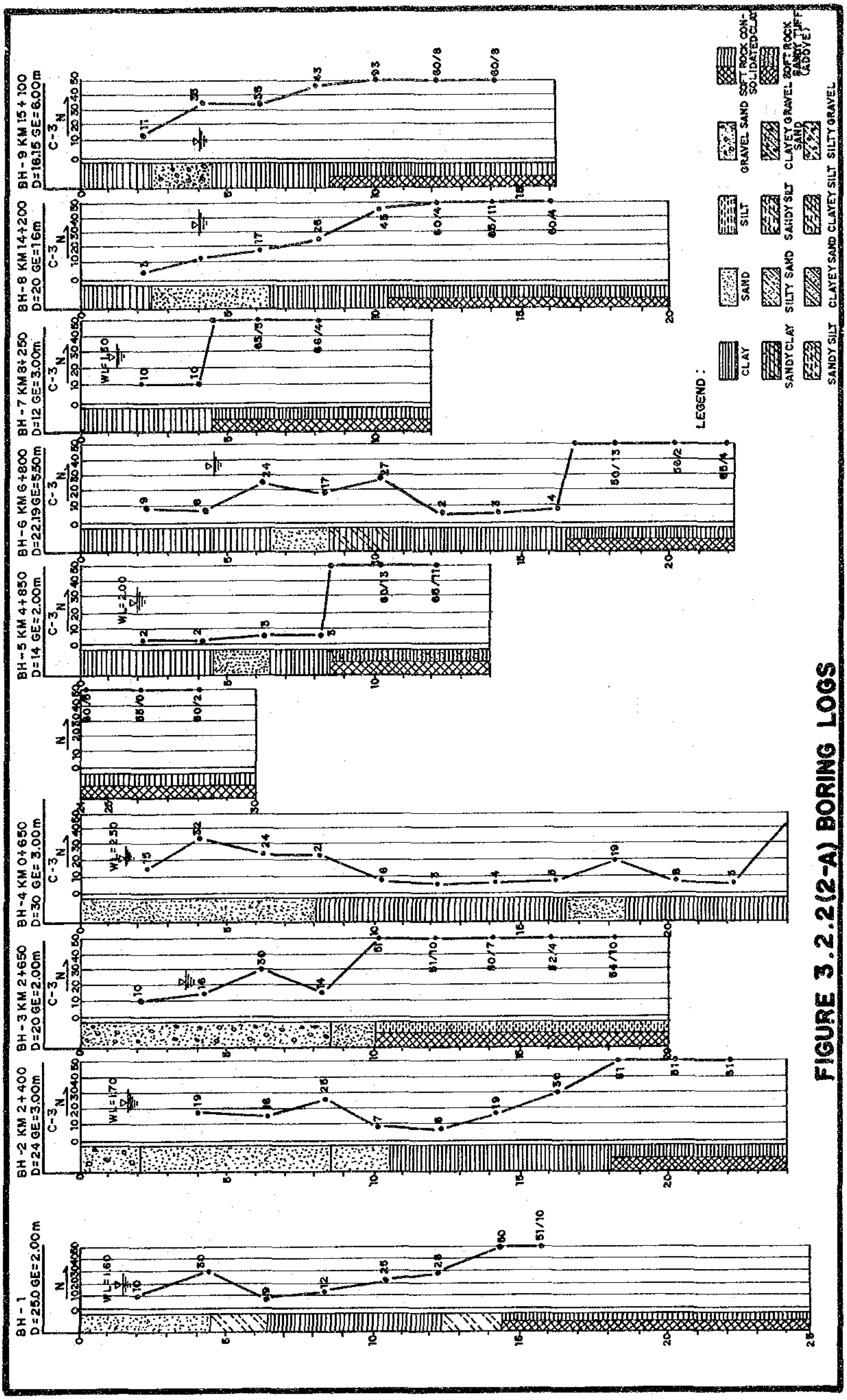


FIGURE 3.2.2(2-A) BORING LOGS

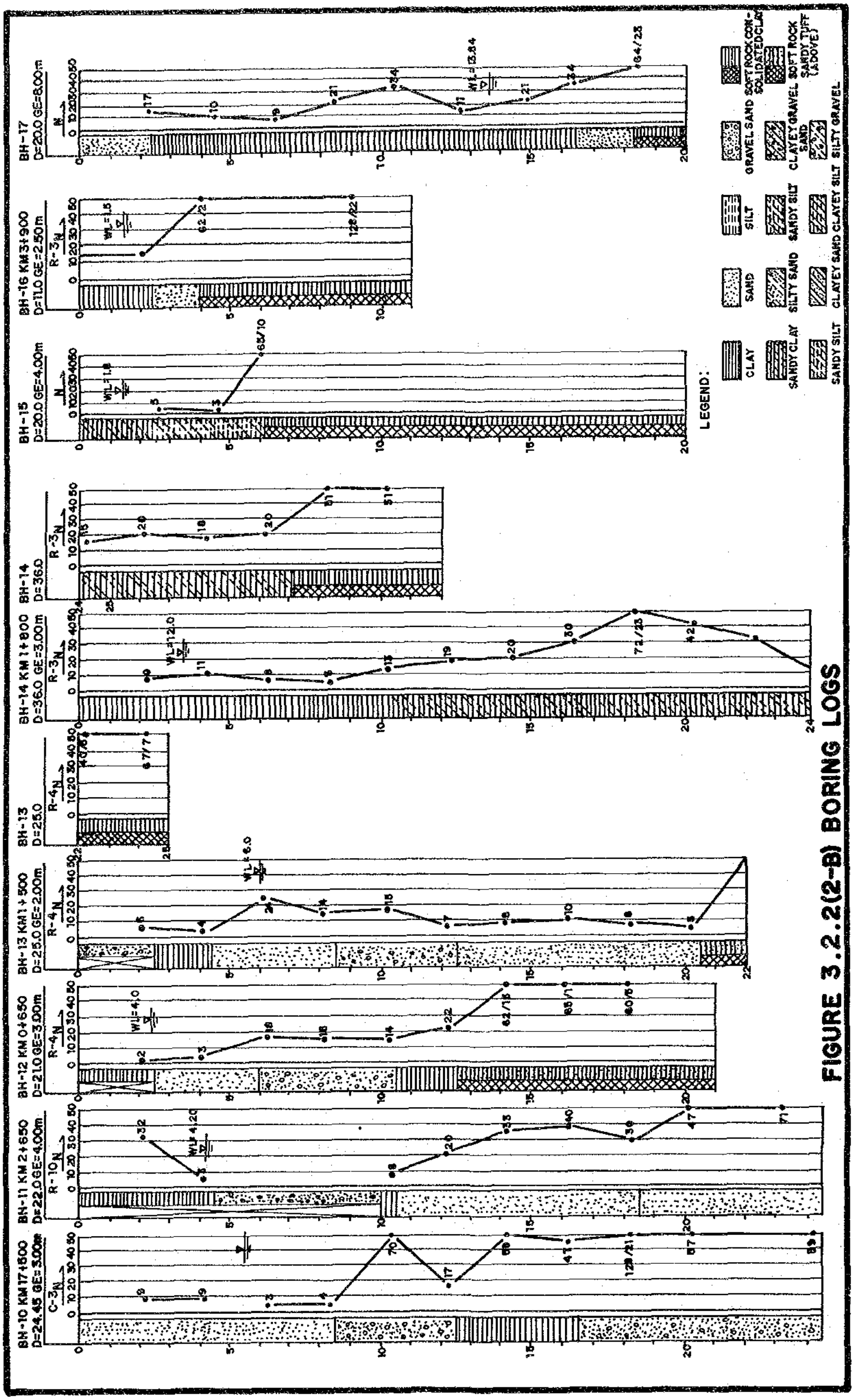
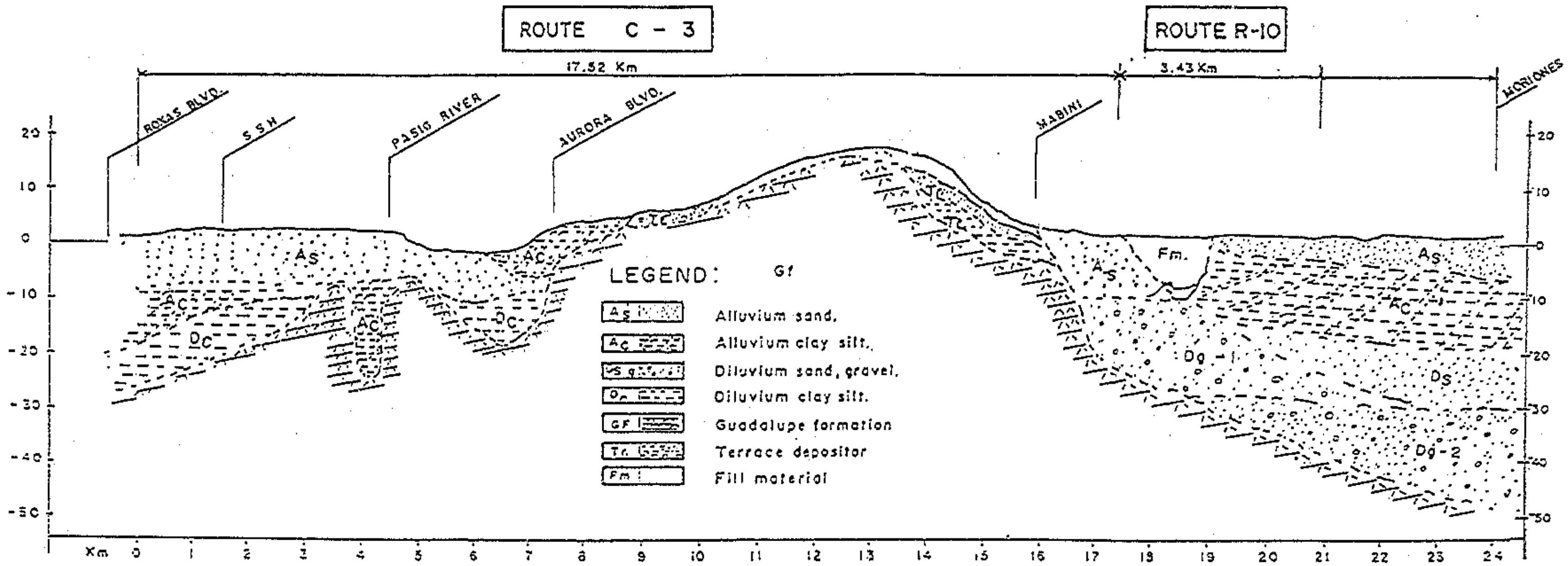
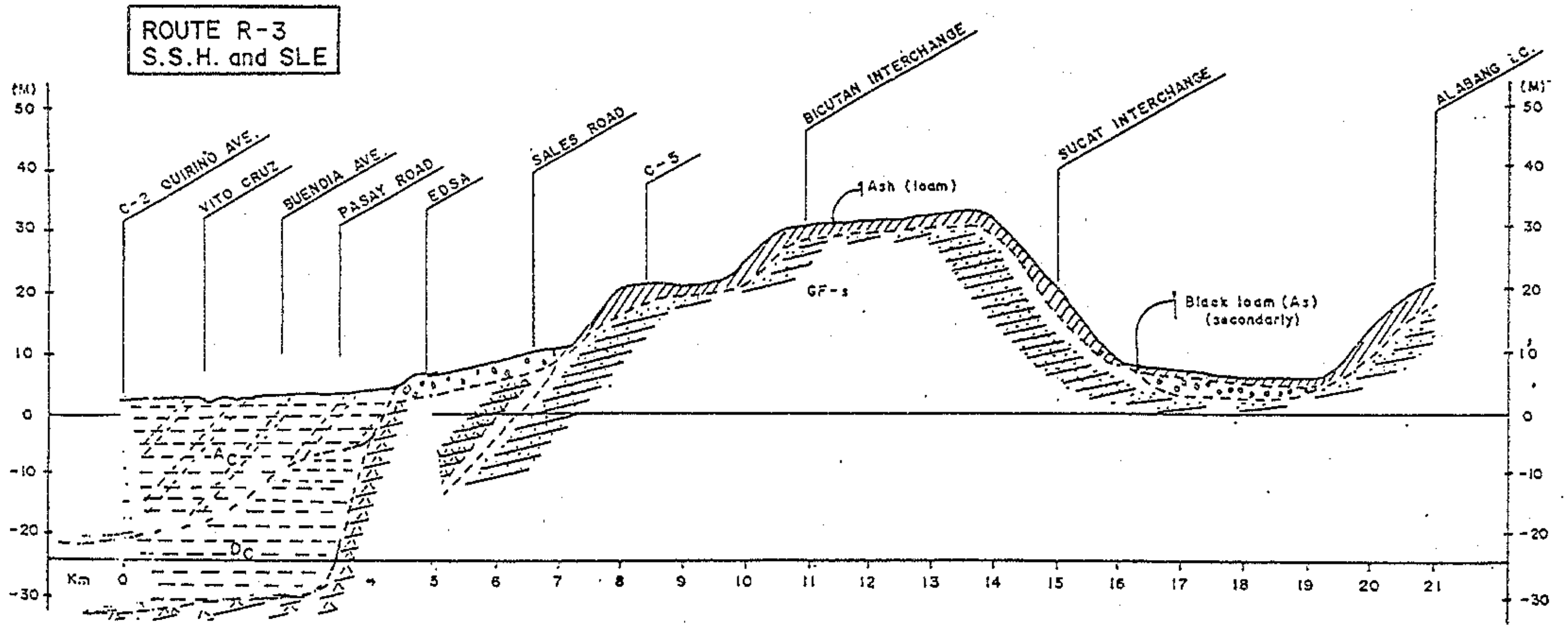


FIGURE 3.2.2(2-B) BORING LOGS



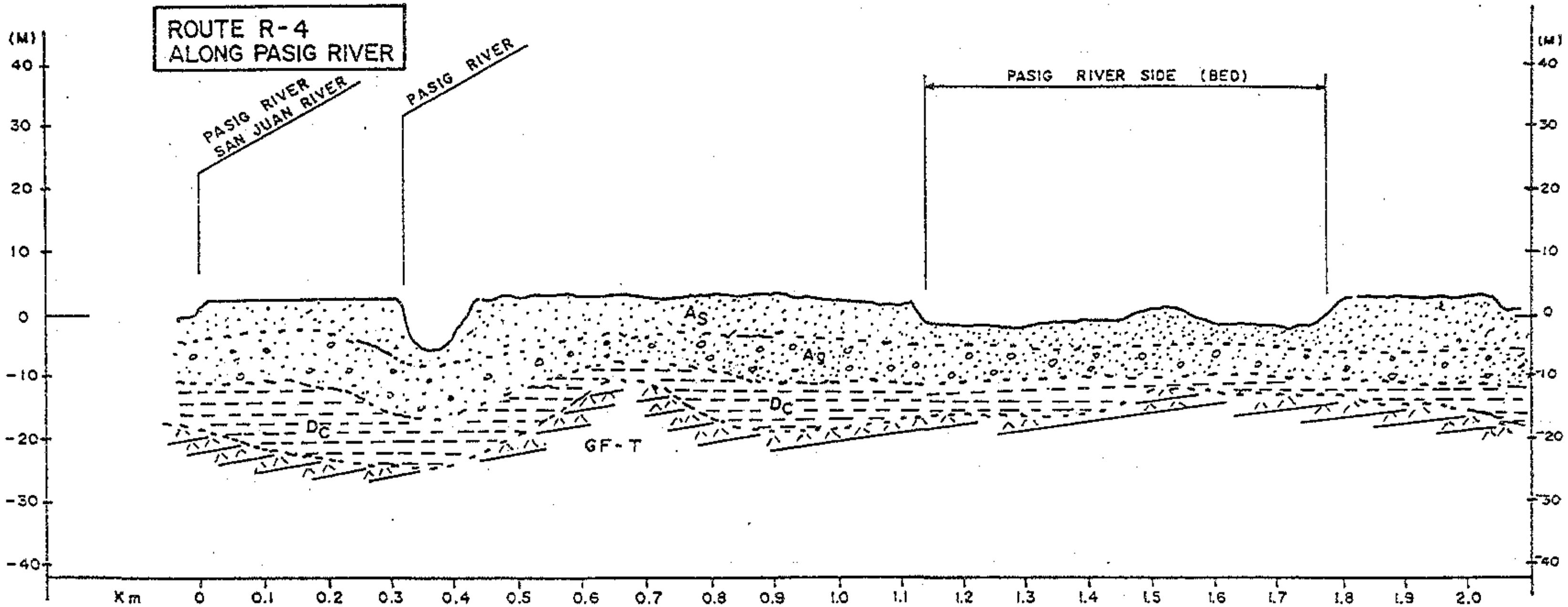
Km	0 – 6	6 – 9	9 – 15	15 – 21
Topographical Feature	• Alluvium lowland	San Juan river (along the river bed) lowland	Terrace plain Rolling hills	Alluvium lowland
Geology (Soil)	Deltaic deposits (sand, clay, silt)	Deltaic deposits sand and clay	Terrace deposits Guadalupe formation (tuff / tuffacius siltstone)	Deltaic deposits (sand, clay, silt)
Feature of Geology	• Depth of bearing layer for foundation varies • Upper Alluvium sand is suspicious of quicksand during earthquake		• Tuff and tuffacius sand is not permeable to rainfall water, one of the causes of flood at the small river • 2 – 3 meters at surface of Guadalupe formation from the surface is severely weathered and is equivalent to soil	• Depth of bearing layer of foundation varies • Upper Alluvium sand is suspicious of quicksand during earthquake

FIGURE 3.2.2(3) SOIL PROFILE ALONG ROUTES C–3 AND R–10



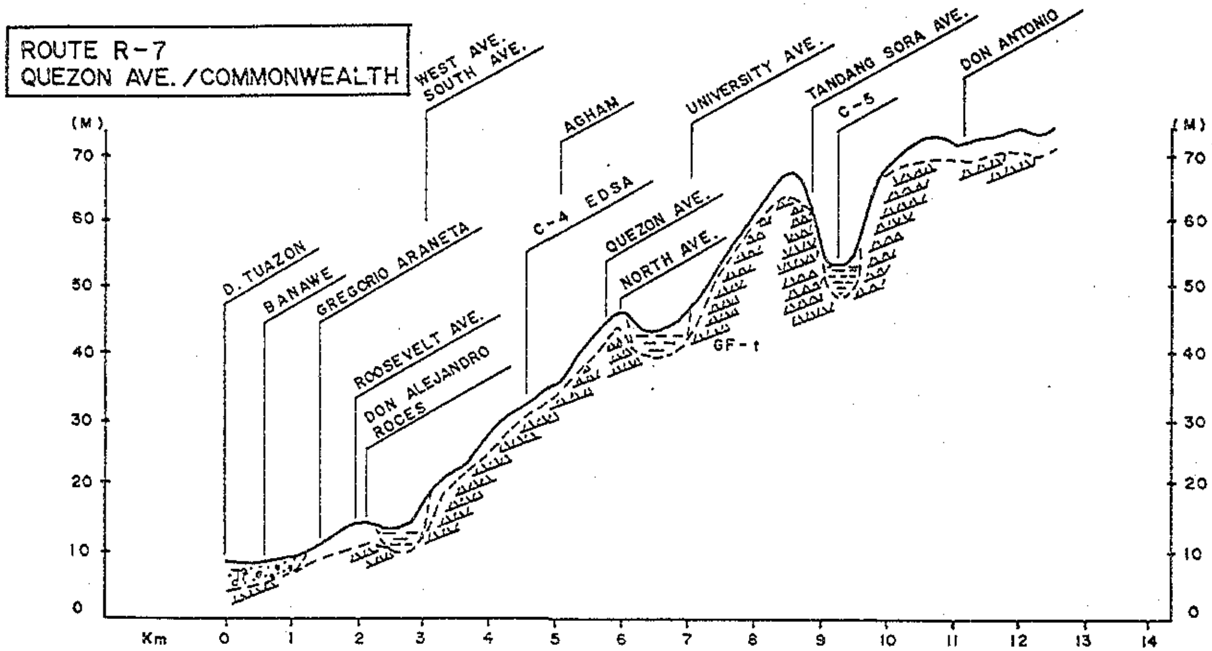
Km	0 – 2	2 – 6	6 – 15	15 – 18	18 – 21
Topographical Feature	Alluvium lowland	Terrace plain	Rolling hills	Valley lowland (eranded)	Rolling hills
Geology (Soil)	Deltaic Deposits	Terrace deposits Guadalupe formation tuff	Guadalupe formation tuffacius sandstone, sandstone, siltstone		
Feature of Geology	Alluvium layer consists of clay silt. Thickness is almost 20 meters.	• Terrace deposits consists of ash and gravel sand Thickness is less than 5 meters	• Mainly tuffeine sandstone • Rainfall water is soon runout because the Guadalupe formation is not permeable • Surface of rolling hill is covered ash (loam)	At valley side ash (loam) exists Terrace deposits consists of gravel, sand	Tuffacius sandstone

FIGURE 3.2.2 (4) SOIL PROFILE ALONG ROUTE R-3



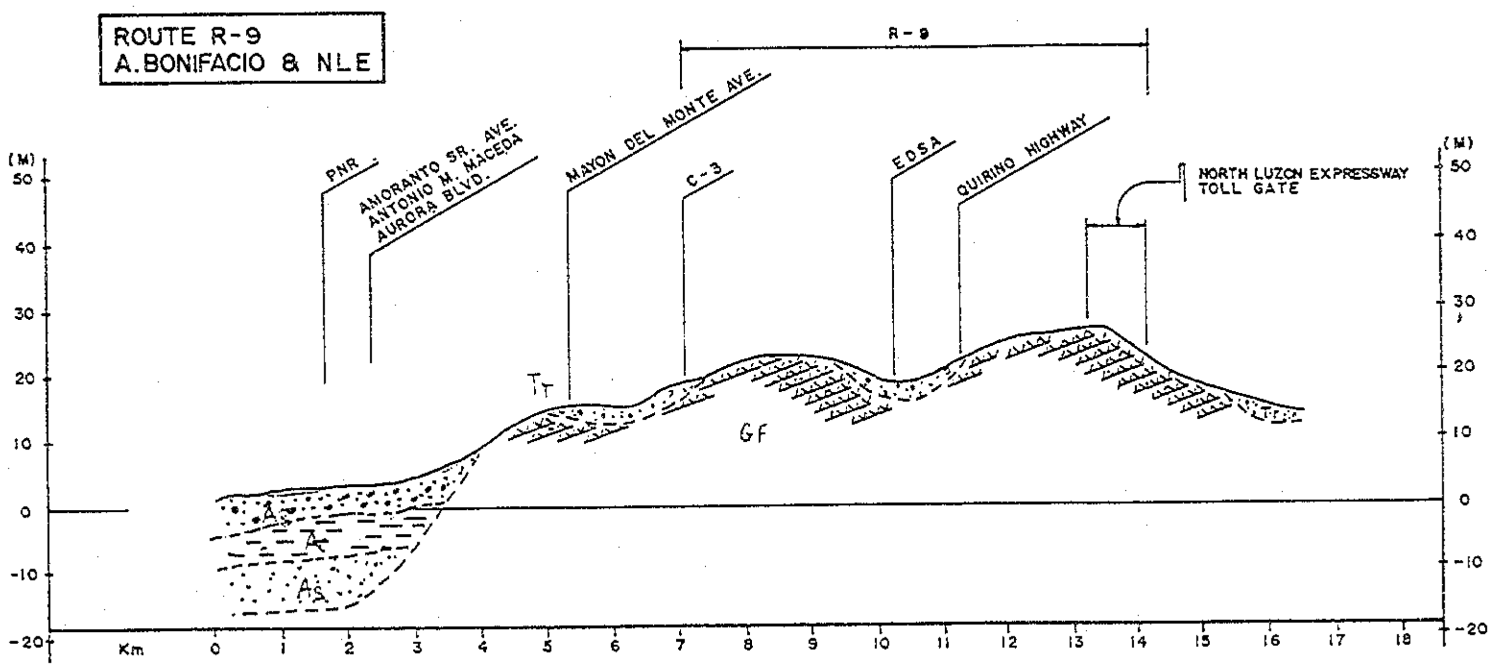
Km	0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Topographical Feature	Flood plain and deltaic plain
Geology (Soil)	Alluvium flood deposit and deltaic deposits and diluvium clay, Guadalupe formation
Feature of Geology	• There are rolling hills at upstream, where soil material varies, but consists of mostly excellent sand and sandy silt • Alluvium deposits thickness is about 15 – 20 meters with sand and gravel under which Dc is found with thickness of 5 – 20 meters

FIGURE 3.2.2(5) SOIL PROFILE ALONG ROUTE R–4



Km		0 – 2	2 – 14
Topographical Feature		Terrace Plain	Rolling hills
Geology (Soil)		Gravel and Sand	Guadalupe formation
Feature of Geology		Upper terrace deposit Lower tuff	• 2 – 5 meters of Guadalupe formation from the surface is weathered soil • There are detritus at the valley bottom which are consisting of clay and sand with the thickness of 2 – 3 meters • Guadalupe formation consists of tuff and tuffacius sandstone which is consolidate soft rock

FIGURE 3.2.2 (6) SOIL PROFILE ALONG ROUTE R-7



Km	0 1 2	3 4 5 6 7 8 9 10 11 12 13 14 15	16 17 18
Topographical Feature	Deltaic plain (Alluvium low land)	Rolling hills	Terrace
Geology (Soil)	Alluvium Deltaic deposits Soft ground Silt, sand, clay	Guadalupe formation Tuff and/or Tuffacius sandstone, siltstone	Terrace deposit
Feature of Geology	• Thickness of alluvium layers is variable in some place	• 2 to 5 meters upper layer of Guadalupe formation is weathered soil	Terrace deposit is rich in clay

FIGURE 3.2.2(7) SOIL PROFILE ALONG ROUTE R-9

APPENDICES

TO

CHAPTER 4

APPENDICES TO CHAPTER 4

Appendix 4.3.1 AVAILABLE PUBLIC SPACES CONTROL POINTS AND SPECIAL ISSUES OF SECTION - 1 OF EXPRESSWAY ROUTE C-3

1. Available Public Spaces, Control Points and Possible Alignment Corridors

Available public spaces, control points and possible alignment corridors are shown in Figure 4.3.1.1. Public spaces which can accommodate an expressway are as follows:

- PNR
- San Juan River
- Pasig River
- Estero de Pandacan
- Quirino Avenue
- R. Magsaysay Blvd./Aurora Blvd.

Major control points (class - A) are:

- Oil tanks scattered along Pasig River
- Permanent buildings of more than 5-story which are scattered along R. Magsaysay Blvd., Aurora Blvd., and PNR

In addition to these Class - A control points, a lot of factories (Class - B control point) are existing along Pasig River.

2. Special Issues along this section

There are following issues along this section for which special attention whould be paid:

Expressway along a river

As a strong candidate alignment for an expressway, rivers are planned to be utilized extensively to minimize ROW acquisition. However, construction of an expressway within a river space along a river alignment in order to totally avoid ROW acquisition was not recommended. Such scheme severely obstructs river water flow and becomes additional cause of flooding.

When utilization of a river is proposed, substructures of an expressway are constructed at a river bank as shown in Figure 4.3.1.2, although ROW acquisition becomes necessary.

Nagtahan Link Road Project

Nagtahan Link Road Project is on-going and outline of the project is presented in Figure 4.3.1.3. The project is to construct a 4-lane divided road along the PNR Line to connect Quirino Ave. at Pandacan with Valenzuela Ave. at Sta. Mesa. North-bound lanes and South-bound lanes cross over PNR independently at staggered locations. For alignments 1-1, 1-3(1) and 1-3(2), an expressway will be constructed over the PNR Line taking into account the features of this project.

It is assumed that squatters affected by this project are relocated, thus social impact of an expressway project is lessened to a great extent.

Possibility to utilize the second level of PNR

As Nagtahan Link Road crosses over PNR two times in the subject section and there are no crossings of major roads, it is assumed that PNR line would not need to be elevated in the future but stay at ground level, and an expressway could utilize second level of PNR line.

Expressway over a factory building

Some big factories along Pasig River are affected, however, their relocation would be very difficult. In such cases, vertical alignment of an expressway is planned to be raised over a factory building and expressway structures should be so planned as not to affect a factory building, thus operation of a factory is not affected. This solution would be much easier than acquiring factory property, if an agreement between the factory operator and the Government is reached.

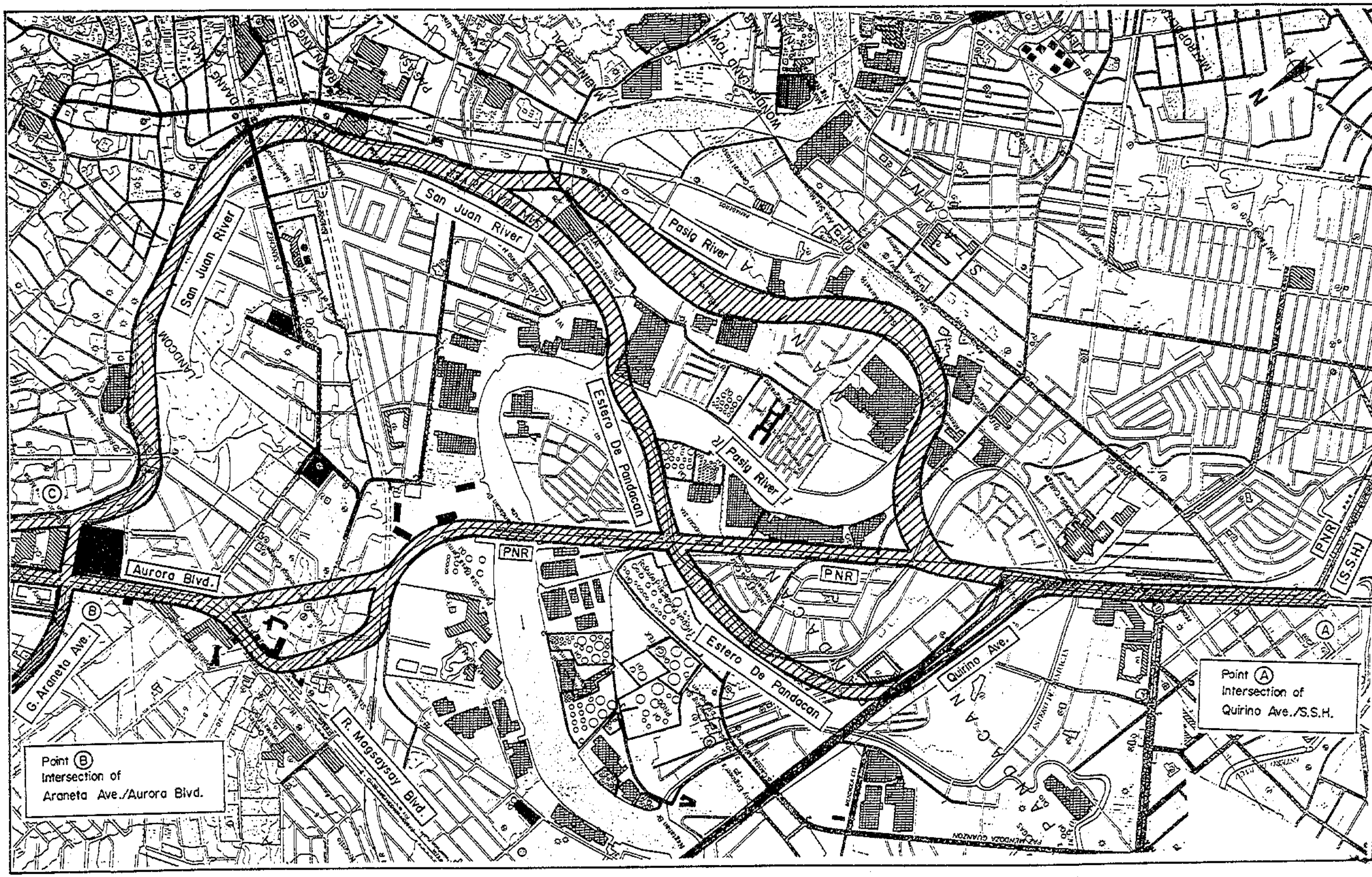


FIGURE 4.3.1.1 AVAILABLE PUBLIC SPACES, CONTROL POINTS AND POSSIBLE ALIGNMENT CORRIDORS (Section-1)

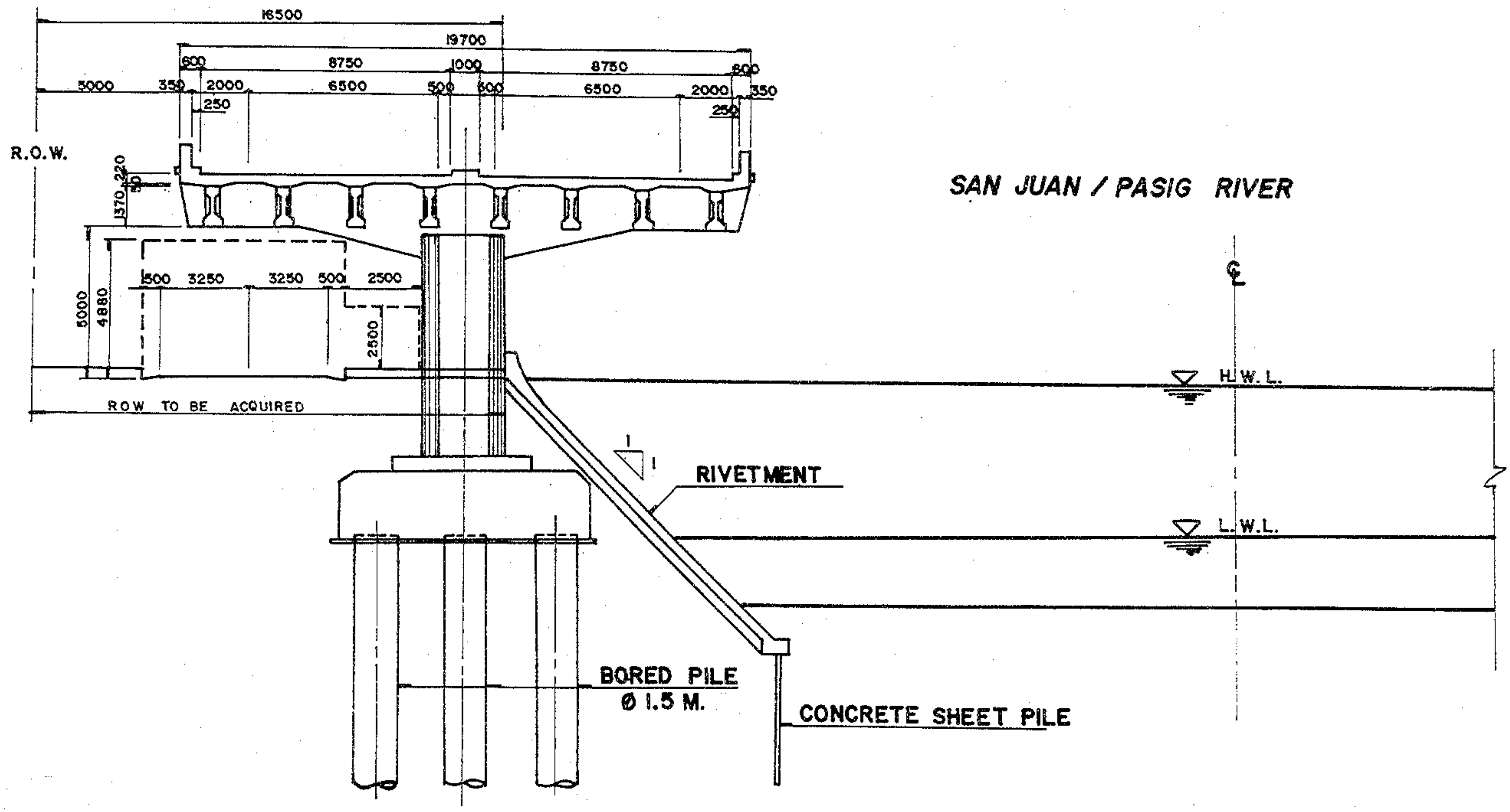
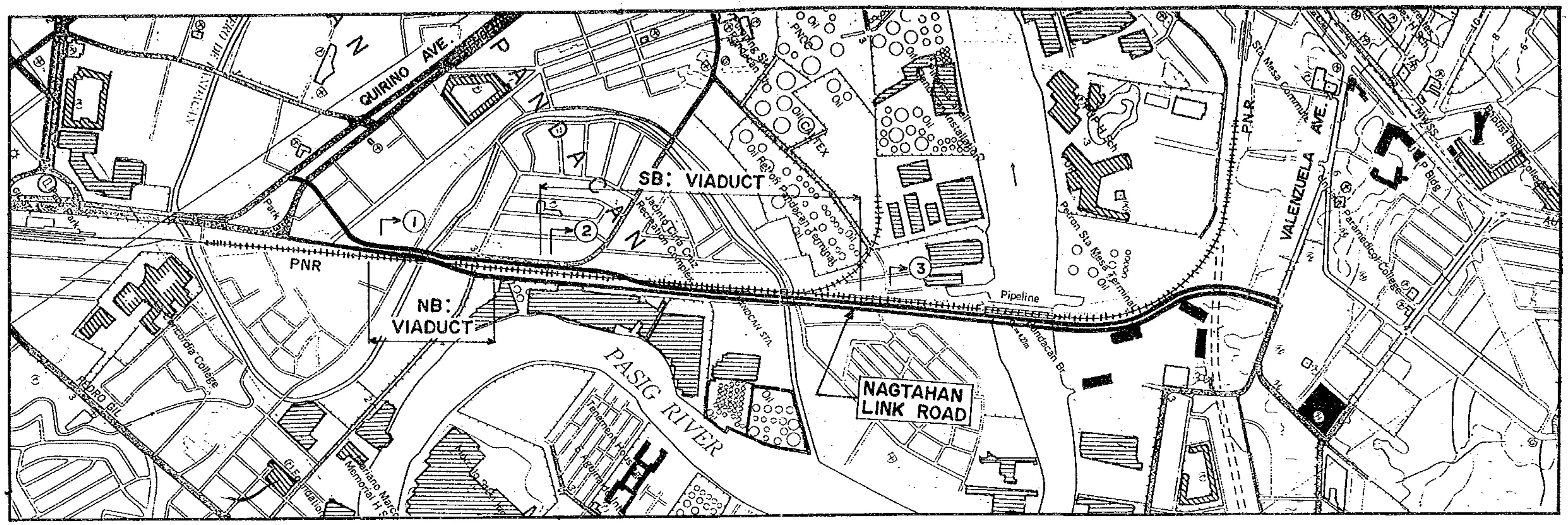
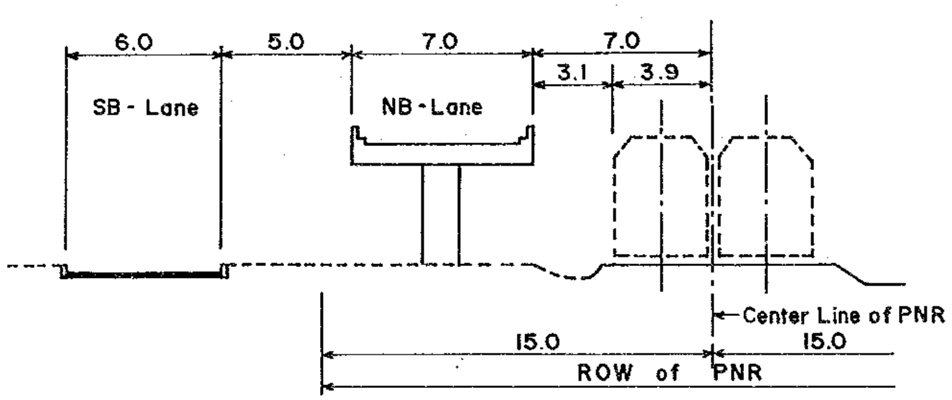
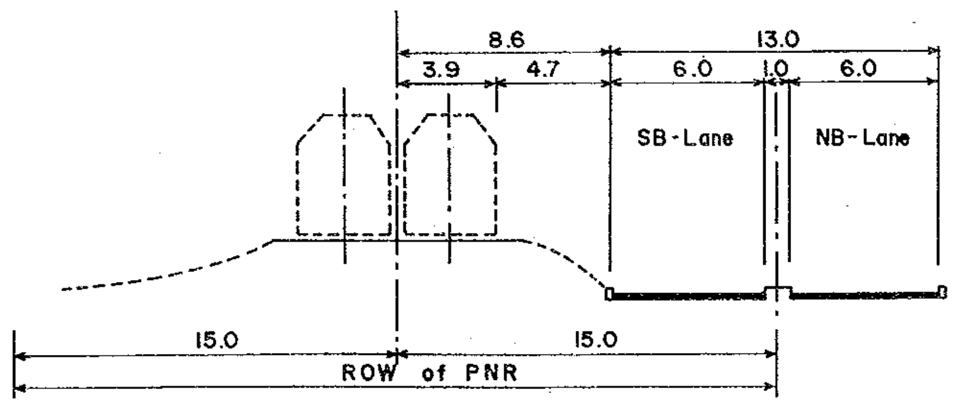


FIGURE 4.3.1.2 EXPRESSWAY ALONG RIVER BANK

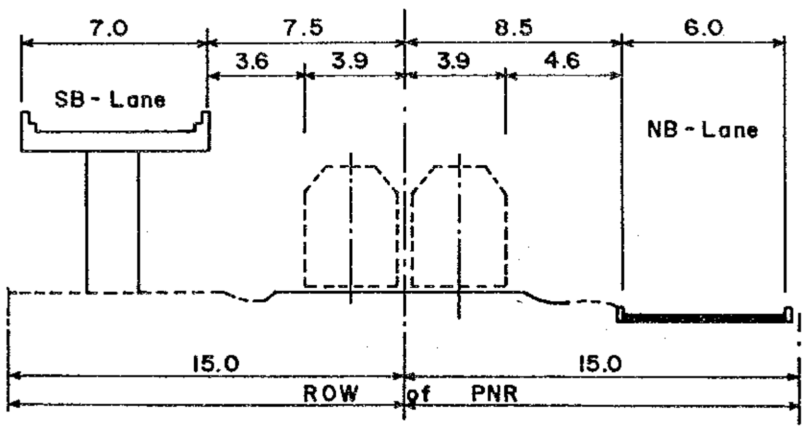




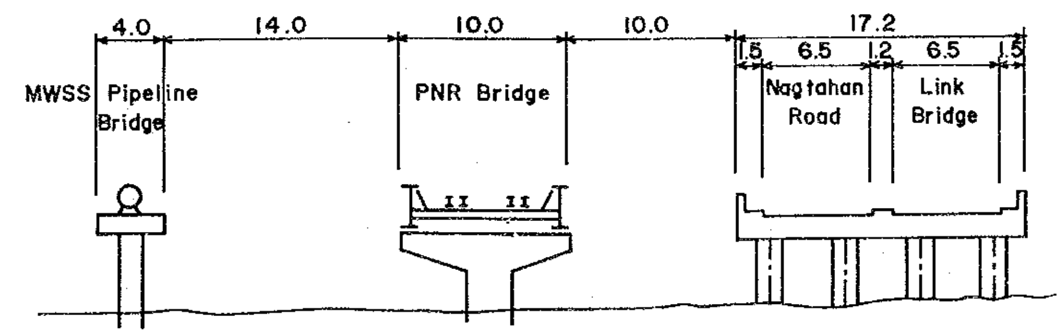
SECTION ①-①



SECTION ③ - ③



SECTION ② - ②



OVER PASIG RIVER

FIGURE 4.3.1.3 OUTLINE OF NAGTAHAN LINK ROAD PROJECT

Appendix 4.3.2 AVAILABLE PUBLIC SPACES, CONTROL POINTS, AND SPECIAL ISSUES OF SECTION - 2 OF EXPRESSWAY ROUTE C-3

1. Available Public Spaces, Control Points and Possible Alignment Corridors

Available public spaces, control points and possible alignment corridors are shown in Figure 4.3.2.1. Public spaces which can accommodate an expressway are as follows:

- Araneta Ave.
- San Juan River

Major control points are permanent buildings of more than 5-story which are scattered along Araneta Ave., E. Rodriguez Blvd. and Quezon Ave.

2. Special Issues

Special issues along this section are as follows:

LRT LINE - 2

LRT Line - 2 is proposed to be constructed along E. Rodriguez Blvd.. Any alternative alignment has to cross over LRT Line - 2, thus an expressway will be at 3rd level.

Existing E. Rodriguez Blvd. near Araneta Ave. is a 6-lane undivided road, which will have to be converted to a 4-lane divided road with an introduction of LRT Line - 2 (see Figure 4.3.2.2)

San Juan River From E. Rodriguez Blvd. to Del Monte Ave.

San Juan River from E. Rodriguez Blvd. to Del Monte Ave. is winding sharply at various locations, therefore, the bank alignment is not suitable for an expressway alignment. When an expressway is planned along San Juan River in the said section, prvate lands have to be affected.

Intersection between Araneta Ave. and Quezon Ave.

Traffic congestion at this intersection is becoming serious. If this intersection is grade separated ahead of construction of an expressway, it will become a serious physical constraint not only for Route C-3 but also for Route R-7, as the intersection is a proposed location for an interchange of both expressways. When a grade separation is planned to be constructed ahead of an expressway, type of a grade separation must be so selected that an expressway can be accommodated.

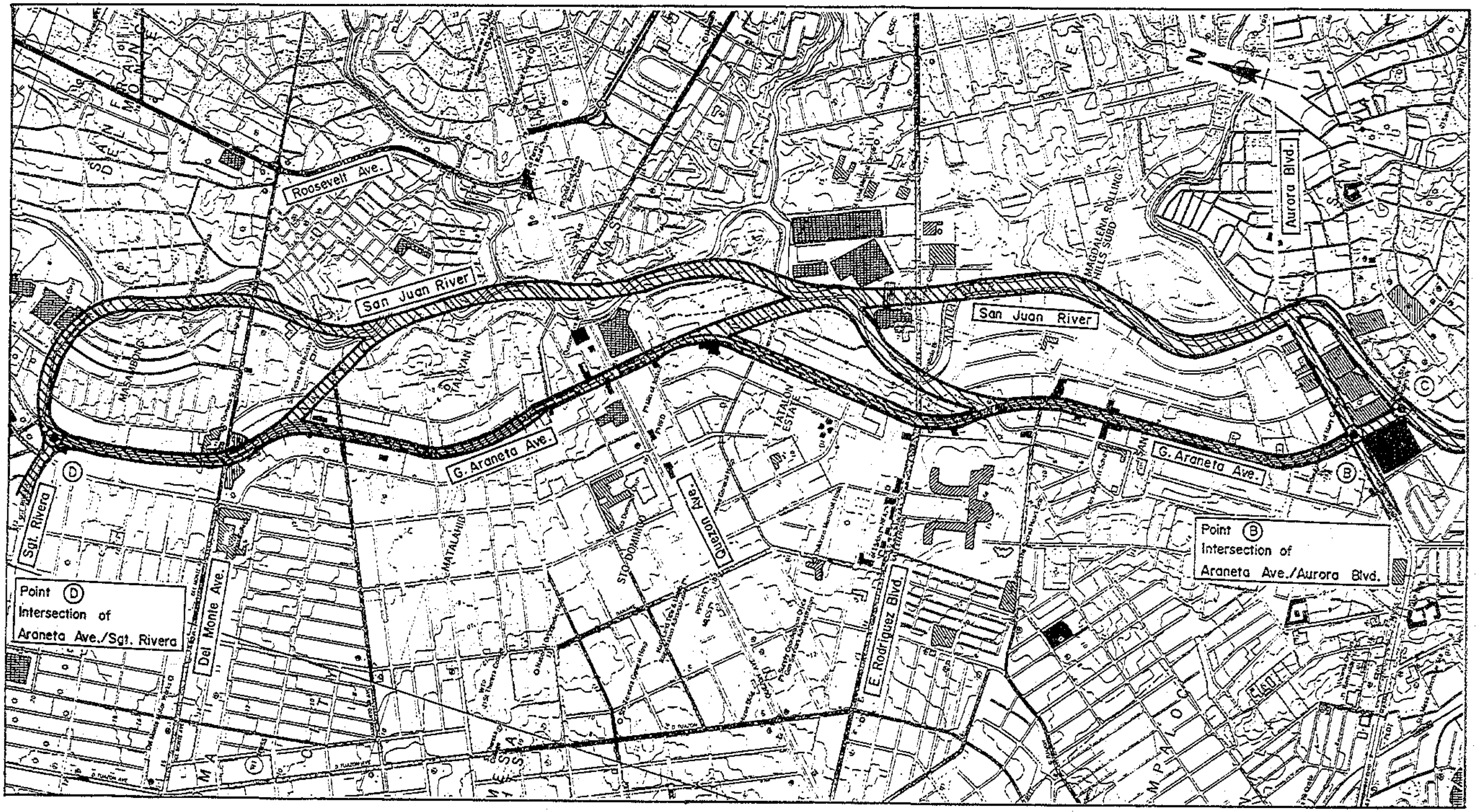
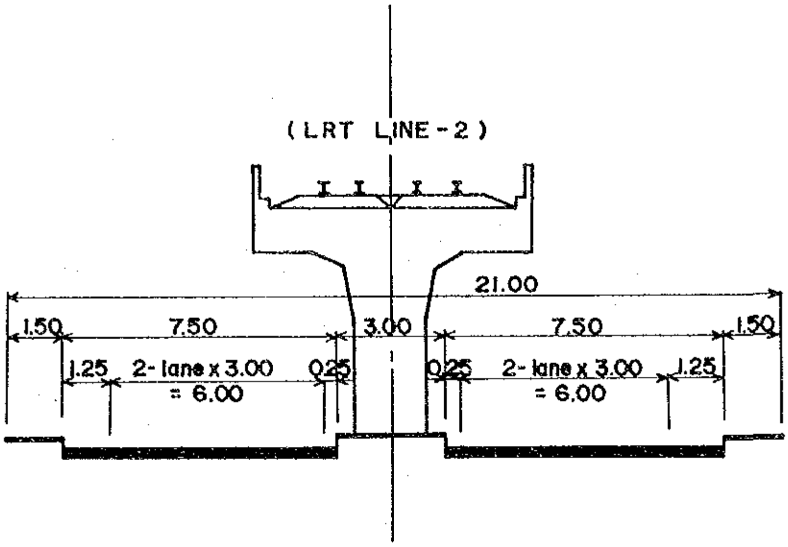
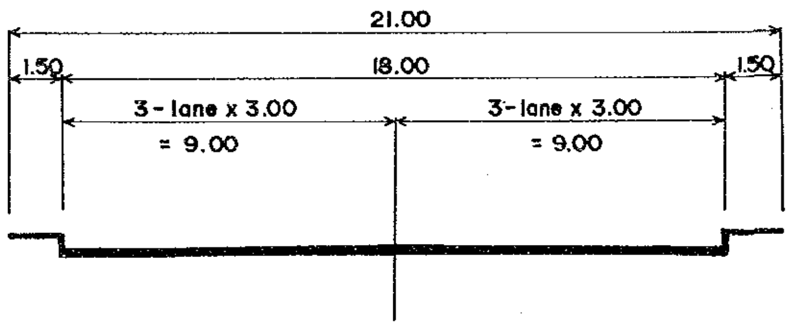


FIGURE 4.3.2.1 AVAILABLE PUBLIC SPACES, CONTROL POINTS AND POSSIBLE ALIGNMENT CORRIDORS (Section-2)



CROSS SECTION WITH LRT LINE - 2



EXISTING CROSS SECTION

FIGURE 4.3.2.2 CROSS SECTION OF E. RODRIGUEZ BLVD.

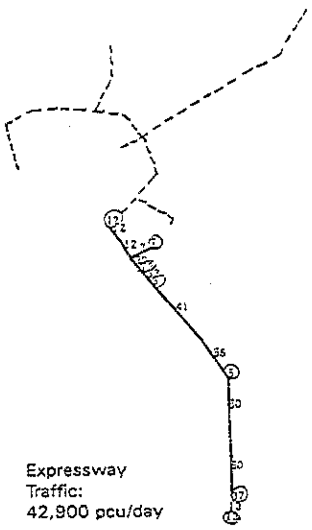
APPENDICES
TO
CHAPTER 5

APPENDICES TO CHAPTER 5

PAGE

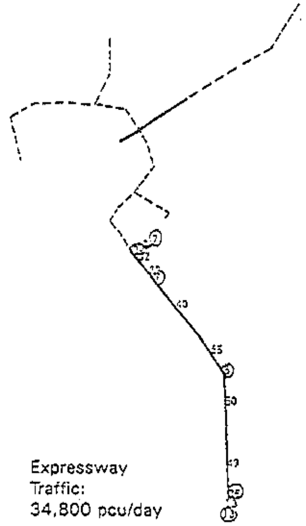
APPENDIX 5.1.1 PRELIMINARY TRAFFIC ASSIGNMENT ANALYSIS

RADIAL EXPRESSWAY ONLY



Expressway
Traffic:
42,900 pcu/day

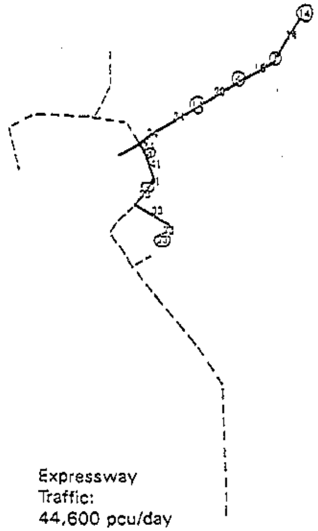
- EXP. R-3 (FULL STRETCH)



Expressway
Traffic:
34,800 pcu/day

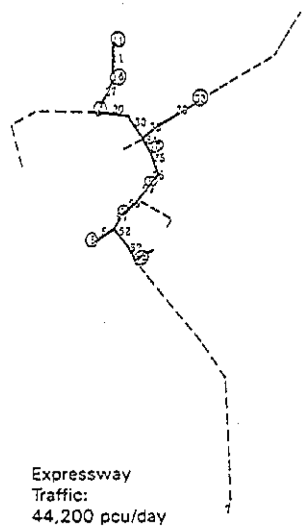
- EXP. R-3 from Buendia Ave. to Alabang I/C
- EXP. R-7 from C-3 to EDSA

COMBINATION OF CIRCUMFERENTIAL AND RADIAL EXPRESSWAYS



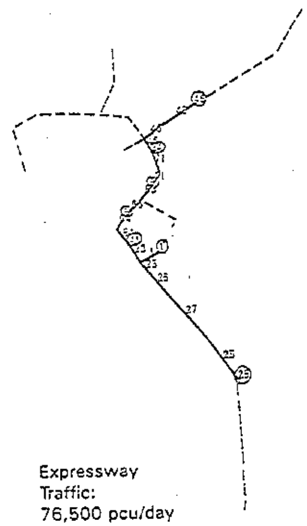
Expressway
Traffic:
44,600 pcu/day

- EXP. R-7 (FULL STRETCH)
- EXP. C-3 from EXP. R-7 to EXP. R-4
- EXP. R-4 from EXP. C-3 to Makati Access Ramp



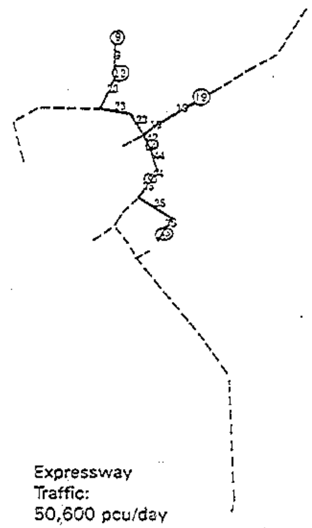
Expressway
Traffic:
44,200 pcu/day

- EXP. R-9 (FULL STRETCH)
- EXP. R-7 from C-3 to EDSA
- EXP. C-3 from EXP. R-9 to EXP. R-3
- EXP. R-3 from EXP. C-3 to Buendia Avenue



Expressway
Traffic:
76,500 pcu/day

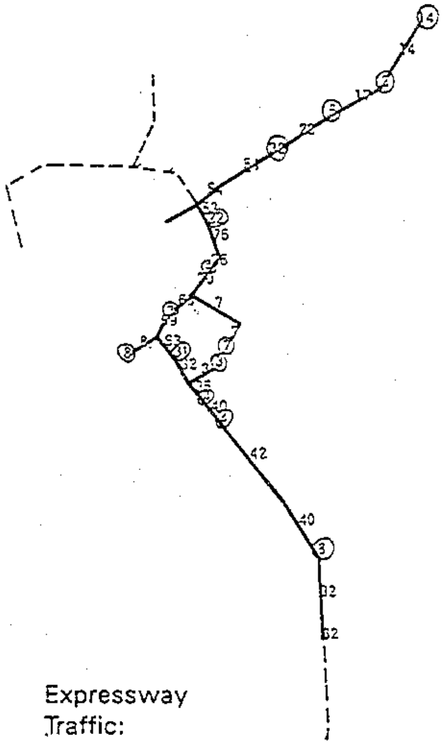
- EXP. R-7 from C-3 to EDSA
- EXP. C-3 from EXP. R-7 to EXP. R-3
- EXP. R-3 from EXP. C-3 to Bicutan I/C



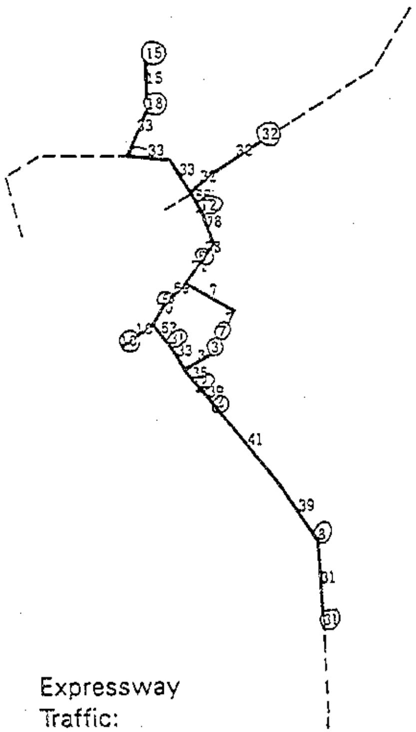
Expressway
Traffic:
50,600 pcu/day

- EXP. R-9 (FULL STRETCH)
- EXP. R-7 from C-3 to EDSA
- EXP. R-4 from EXP. C-3 to Makati Access Ramp
- EXP. C-3 from EXP. R-9 to EXP. R-4

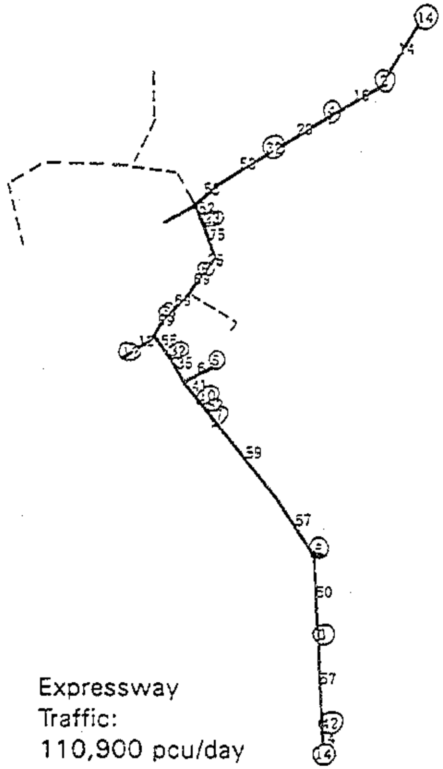
TRAFFIC DEMAND : YEAR 2000
TOLL : ₱ 10 Flat



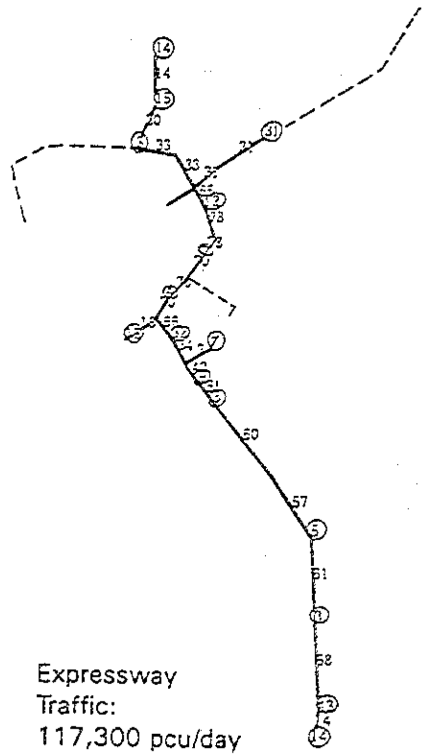
Expressway
Traffic:
92,300 pcu/day



Expressway
Traffic:
97,000 pcu/day



Expressway
Traffic:
110,900 pcu/day



Expressway
Traffic:
117,300 pcu/day

TRAFFIC DEMAND : YEAR 2005
TOLL : ₱ 15 Flat

APPENDICES
TO
CHAPTER 7

APPENDICES TO CHAPTER 7

APPENDIX 7.3.1 PROPOSED EXPRESSWAY ROUTES

APPENDIX 7.3.1 PROPOSED EXPRESSWAY ROUTE

Taking into consideration of the basic design requirements, preliminary design of the proposed six MMUES routes were conducted making the best use of aerial photo, scale 1:10,000 map and survey data.

• C-3 Route (15.93 km)	P. Quirino Avenue	-	Navotas
• R-3 Route (20.20 km)	Alabang	-	P. Quirino Avenue
• R-4 Route (2.32 km)	Pandacan	-	Makati, Sta. Ana
• R-7 Route (12.25 km)	Welcome Rotonda	-	Constitution Hill
• R-9 Route (4.51 km)	La Loma	-	Malabon
• R-10 Route (3.30 km)	Navotas	-	North Port

Plan and profile of the above proposed routes are shown in the drawing volume.

1. Expressway C-3 Alignment

Most of this corridor has been intensively developed with commercial facilities and residences. MMUES would follow basically existing C-3 road. In view of the potential cost and difficulty of obtaining right-of-way along C-3 existing road developed as commercial areas, all of proposed C-3 MMUES alignment is elevated on viaduct.

For the C-3 final alignment study, the following conditions have been taken into consideration, viz;

a) In section between Sta. 1+000 and Sta. 3+000, MMUES would have to occupy the PNR right-of-way at second level to minimize the ROW acquisition

b) DPWH has started Nagtahan Link Road Project and being acquiring ROW, MMUES would utilize the newly acquired ROW for the present project

c) Pasig River Bridge for MMUES shall be located within the best available space taking into account the existing PNR bridge and pipeline bridge

d) Corridor of C-3 road from Aurora Blvd. to R-10 road shall be basically adapted for MMUES alignment

e) Since the C-3 alignment and Quezon Blvd. at-grade will be made at second level, Expressway Route R-7 will go over the Expressway Route C-3 alignment

f) In section Sta. 7+100 and Sta. 8+800, existing Talayan Creek in the middle of C-3 road shall be considered for the location of viaduct to adjust the centerline of Expressway Route C-3 at the middle of ROW

g) For the Expressway Route R-9 passing the narrow A. Bonifacio road by adopted double deck viaduct, the main Expressway Route C-3 between Sta. 9+200 and Sta. 10+600 would be adjusted to accommodate R-9 interchange ramps

h) At Sta. 12+300 crossing Rizal Avenue Extension, Expressway Route C-3 will go over the existing LRT station at 3rd level just for crossing without any connection with at-grade streets since the existing road has no more capacity and space to accommodate any ramps for expressway

i) After Rizal Avenue Extension, Expressway Route C-3 will maintain second level over proposed C-3 at-grade road which is not yet completed due to ROW problems. This Expressway Route C-3 alignment is proposed on the assumption that C-3 at-grade road would be completed before construction of expressway

j) Between Sta. 11+900 and end of C-3 route, the right-of-way for C-3 road was already acquired and available also for MMUES

Figure 7.3.1.1 shows the proposed C-3 alignment based on the above conditions.

2. Expressway R-3 Alignment

The basic conditions to finalize the R-3 alignment can be summarized as follows:

a) To minimize the ROW cost and problems, corridor of PNR and/or SLE was utilized.

b) Buendia Access Ramp would be provided taking into consideration of existing a four lane Buendia Overpass carries through traffic on SLE.

c) Between President Quirino Avenue and EDSA, the MMUES would occupy over SLE since PNR has potential solution to separation of rail and road traffic; either the grade crossing are eliminated by providing flyovers for the streets, or the PNR is raised on a viaduct to pass over the streets at ground level. In case of elevated PNR solution, R-3 expressway have to be elevated at 3rd level and it is costly.

d) Since the connection of EDSA and MMUES is essential and there is existing MSDR interchange at the location, MMUES has to be elevated at fourth level to cross the existing 3rd level interchange structure.

e) Between EDSA and Nichols-Mckinley Road, MMUES would use over PNR ROW at second level.

f) At the C-5/SLE interchange now under construction, MMUES will have to use at grade under C-5 interchange structure since no third level structure shall be allowed due to NAIA runway navigation clearance.

g) Existing diamond interchange at Bicutan and Sucat shall not be complicated by the integration of on/off ramps for MMUES.

h) For future extension of MMUES, it should be expandable to southward by providing viaduct beyond the existing Alabang interchange flyover.

Figure 7.3.1.2 shows the proposed R-3 route plan and profile taking into consideration of the above conditions.

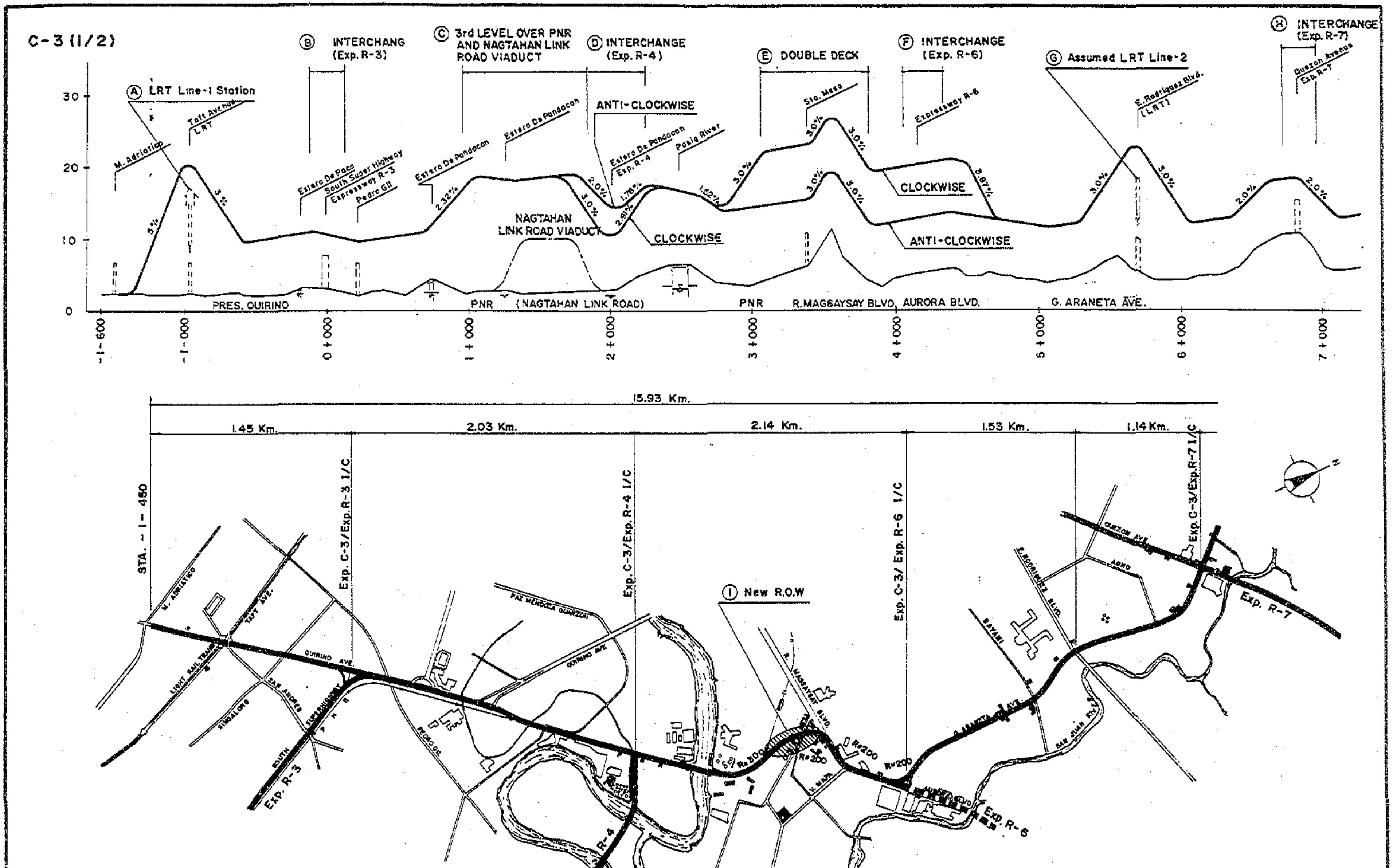


FIG. 7.3.1.1(1) C-3 ROUTE PLAN & PROFILE

FEASIBILITY STUDY ON METRO MANILA URBAN EXPRESSWAY SYSTEM

C-3 (2/2)

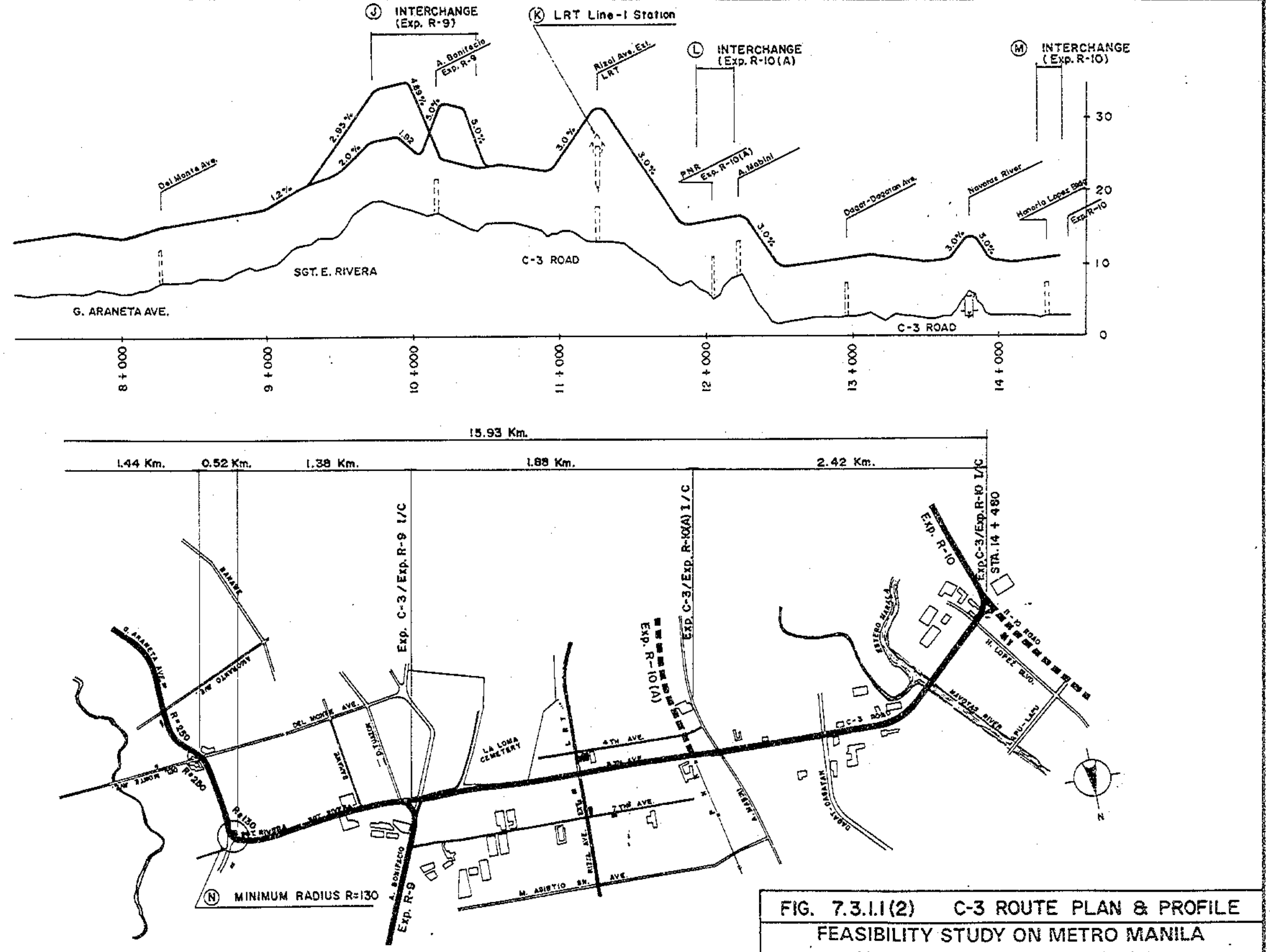


FIG. 7.3.1.1(2) C-3 ROUTE PLAN & PROFILE

FEASIBILITY STUDY ON METRO MANILA URBAN EXPRESSWAY SYSTEM

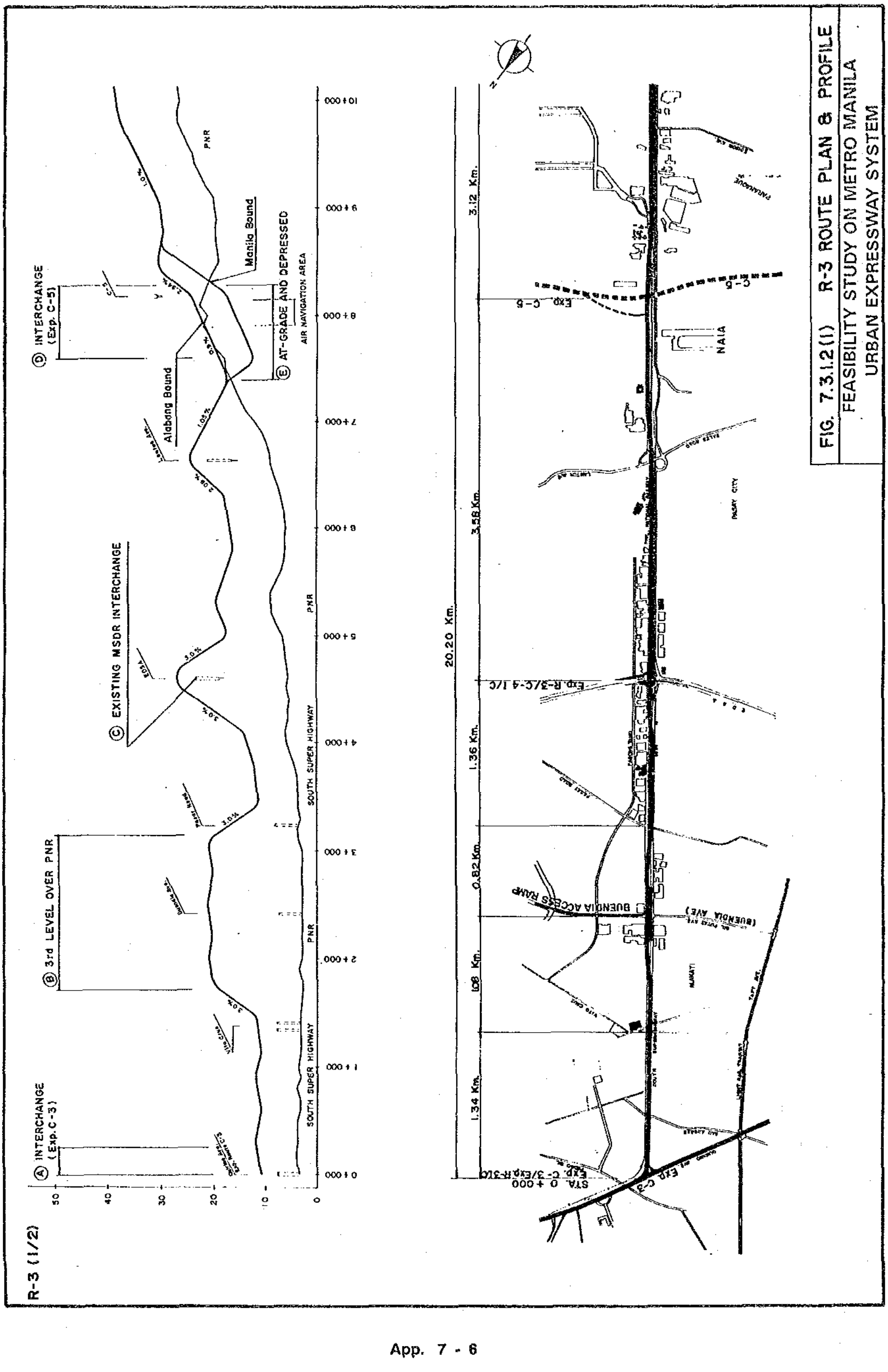


FIG. 7.3.1.2(1) R-3 ROUTE PLAN & PROFILE
FEASIBILITY STUDY ON METRO MANILA URBAN EXPRESSWAY SYSTEM

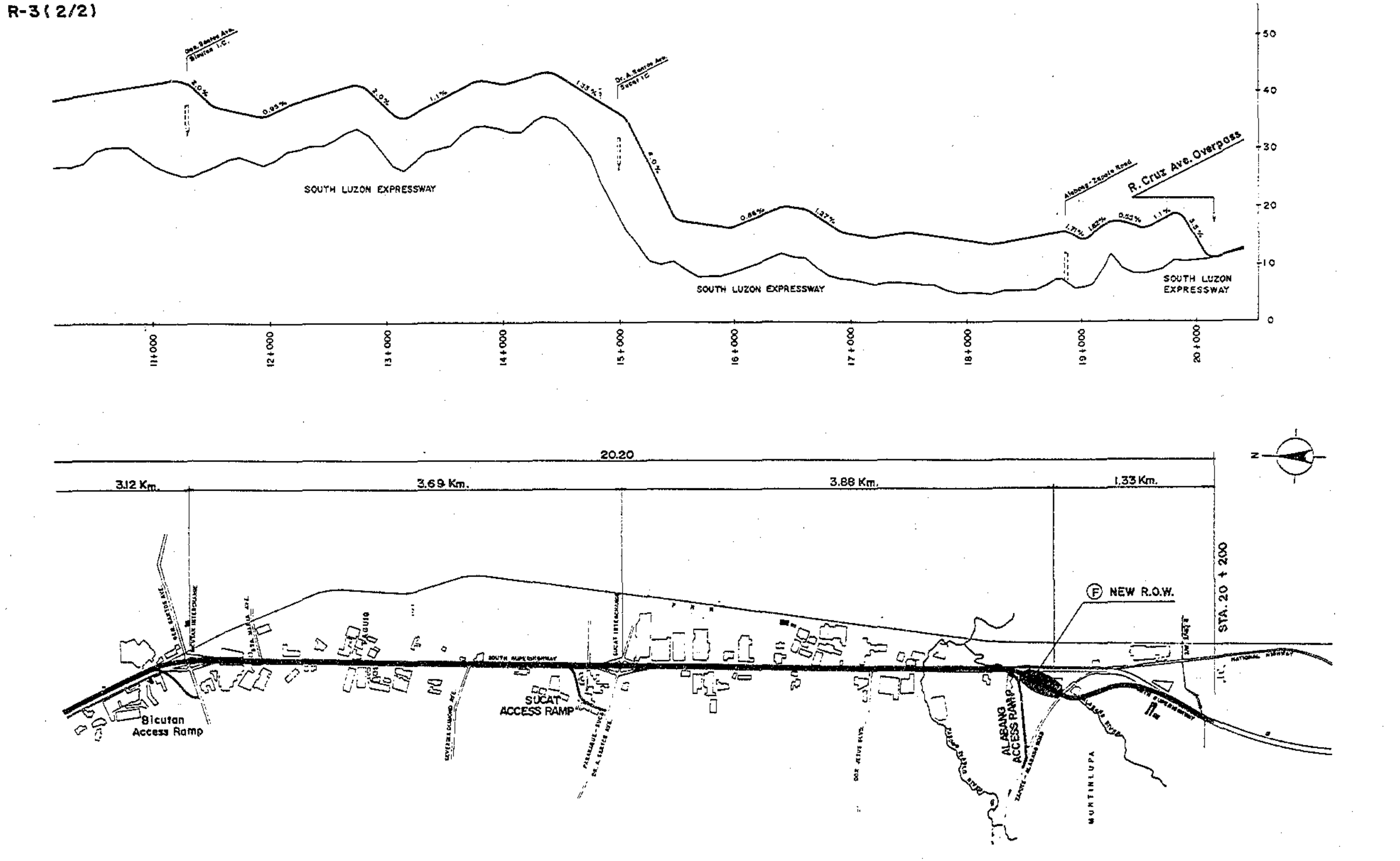


FIG. 7.3.1.2(2) R-3 ROUTE PLAN & PROFILE

FEASIBILITY STUDY ON METRO MANILA URBAN EXPRESSWAY SYSTEM

The maximum grade of this route is 4.0% at just after Sucat I/C to follow the existing grade of SLE. Minimum grade 0.3% was adapted for the requirement of drainage functionality.

In general 2.0 - 3.0% grade are adapted for adjusting elevation from 2nd to 3rd level or vis-a-vis.

Horizontal curvature for shifting alignment from SLE to PNR or vis-a-vis was adapted 2000 meters without clothoid curve. At the end of R-3 route, Alabang Interchange, R = 400 - 1000 meters were adapted with clothoid parameter A = 180 - 300 to divert toward western part of the existing interchange. Curvature adopted for ramps will be discussed in Chapter 7.6.

3. *Expressway R-4 Alignment*

This corridor has been developed with industrial and residential facilities. Since the corridor pass through the developed area, the alignment was selected to utilize open space over Estero de Pandacan and left side bank of Pasig River to minimize ROW acquisition for the MMUES.

Several conditions to fix the proposed alignment have been considered as follows:

a) Mobil Manila Terminal beside Estero de Pandacan must be undisturbed, since relocation of oil tank is very difficult

b) Utilization of Estero de Pandacan will be available if substructure for expressway can straddle both side of the estero and can maintain Pandacan Independent Flood gate

c) AG&P Steel & Marine Structures Group at the right side bank of Pasig River would be considered as possible space for corridor because other side fronting E. Jorge St. is highly developed as residential area

d) The alignment would pass Tiongson Compound and across Pedro Gil

e) Utilize left side bank of Pasig river and edge of International Plywood Corp.

f) Pass through between Sta. Ana Race Track and Pasig River left side bank

g) Proposed Makati Access Road have to be connected at C-3 road project

h) A great number of ROW acquisition would be involved in this alignment proposal, but this alignment is essential to connect C-3 route and Makati area

The proposed plan and profile for the R-4 route is shown in Figure 7.3.1.3.

4. Expressway Route R-7

Total length of this route is 12.25 km from España Avenue to Commonwealth Avenue, using existing Quezon Avenue.

R - 4

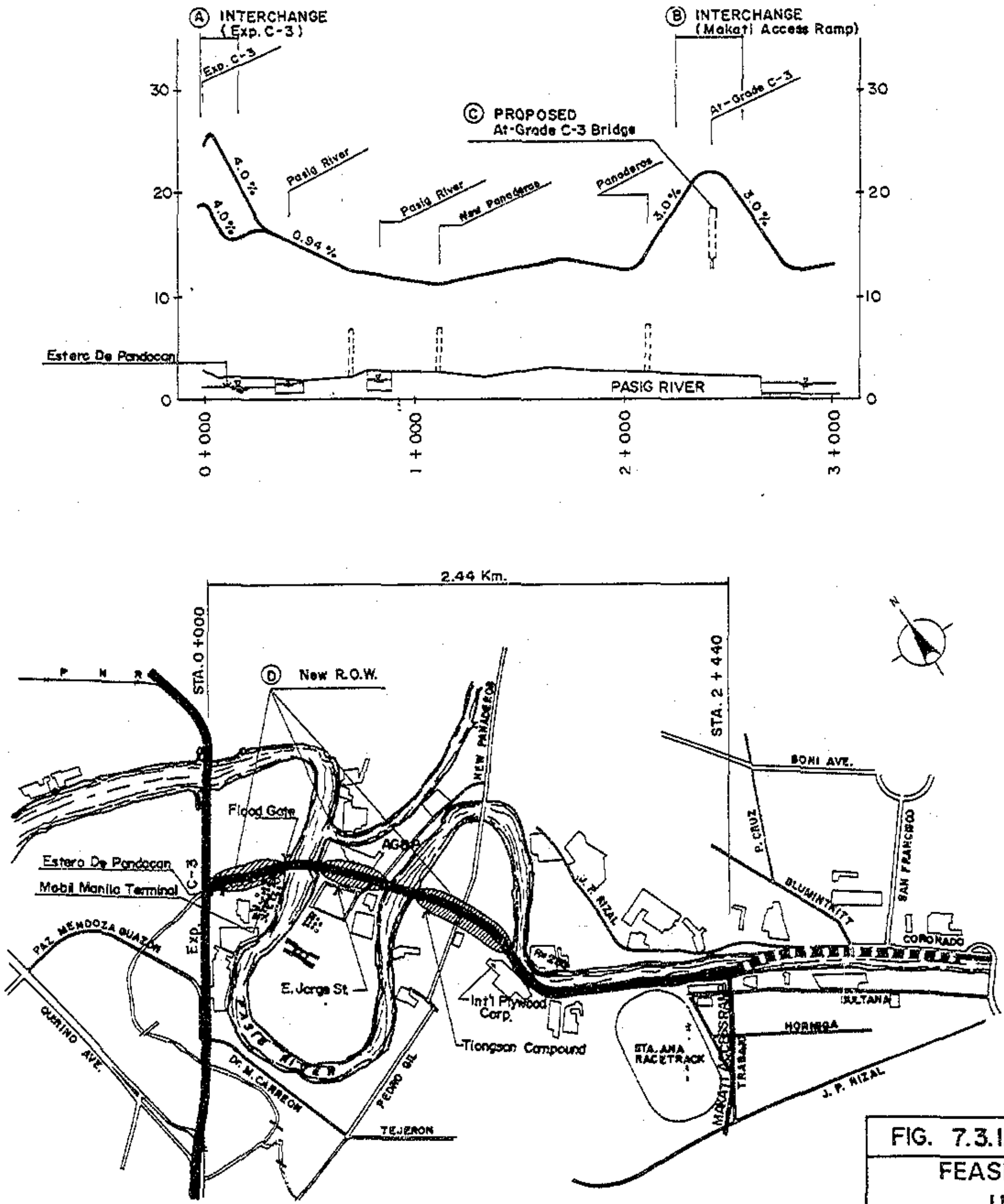


FIG. 7.3.1.3 R - 4 ROUTE PLAN & PROFILE

FEASIBILITY STUDY ON METRO MANILA URBAN EXPRESSWAY SYSTEM

Control points and conditions to be considered for the alignment finalization are as follows:

a) Interchange for C-3 route shall be considered. Since R-7 route just begin at España, connection between route C-3 and R-7 are not provided to make simple interchange for four-leg interchanges. R-7 route is proposed at third level viaduct over second-level C-3 route on viaduct

b) In section from C-3 to Quezon Memorial Circle, the vertical alignment of expressway would follow basically existing Quezon Blvd. profile

c) Taking into consideration of Quezon Memorial Circle tower and other facilities therein shall be maintained. Any demolition and relocation inside Quezon Memorial Circle would not be considered due to the importance of the monument

d) Exposed second level viaduct have not been recommended at Quezon Memorial Circle. Depressed semi-tunnel type structures are the most feasible scheme from the technically and environmentally points

e) The alignment utilizes 95 meters ROW of Commonwealth without any additional ROW acquisition

f) Existing Tandang Sora flyover shall be taken into consideration in the R-7 alignment

g) Connection with C-5 (R-7/C-5 interchange) would be implemented later in coordination with C-5 Northern Package which have been designed for implementation

Figure 7.3.1.4 shows the proposed R-7 route plan and profile.

5. Expressway Route R-9

This route is the principal connection with Route C-3 and NLE in the urban arterial system of Metro Manila. Since the traffic collected by Expressway C-3 Route have to be brought outside EDSA for traffic relieve therefrom, Route R-9 is essential link as radial direction of road network.

Several conditions to be considered are as follows, viz;

a) Both side of A. Bonifacio road has been highly developed with commercial/residential facilities and right-of-way acquisition would be quite difficult

b) Since this corridor is essential for radial direction of traffic movement, Route R-9 would be constructed under the condition of limited right-of-way

c) To eliminate any right-of-way acquisition, double deck structure would be adapted to accommodate 4-lane divided to 2-lane 2-level

d) Access to and from EDSA is limited due to the present Balintawak Cloverleaf Interchange which is regularly saturated

f) R-9 route is aimed to bring traffic collected by C-3 route to NLE beyond the toll plaza

The proposed plan and profile for the R-9 route is shown in Figure 7.3.1.5.

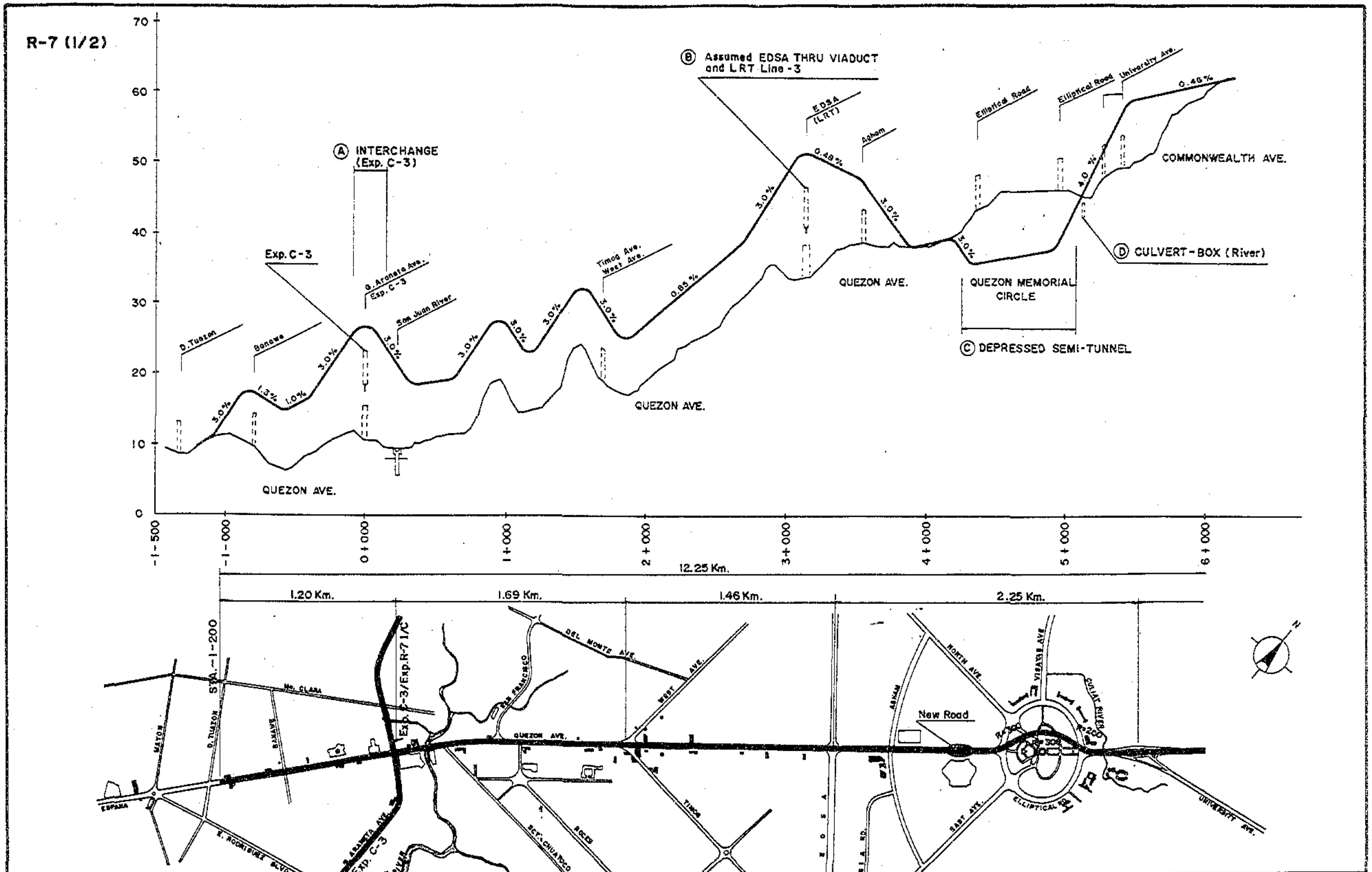


FIG. 7.3.1.4(1) R-7 ROUTE PLAN & PROFILE
FEASIBILITY STUDY ON METRO MANILA URBAN EXPRESSWAY SYSTEM

R-7 (2/2)

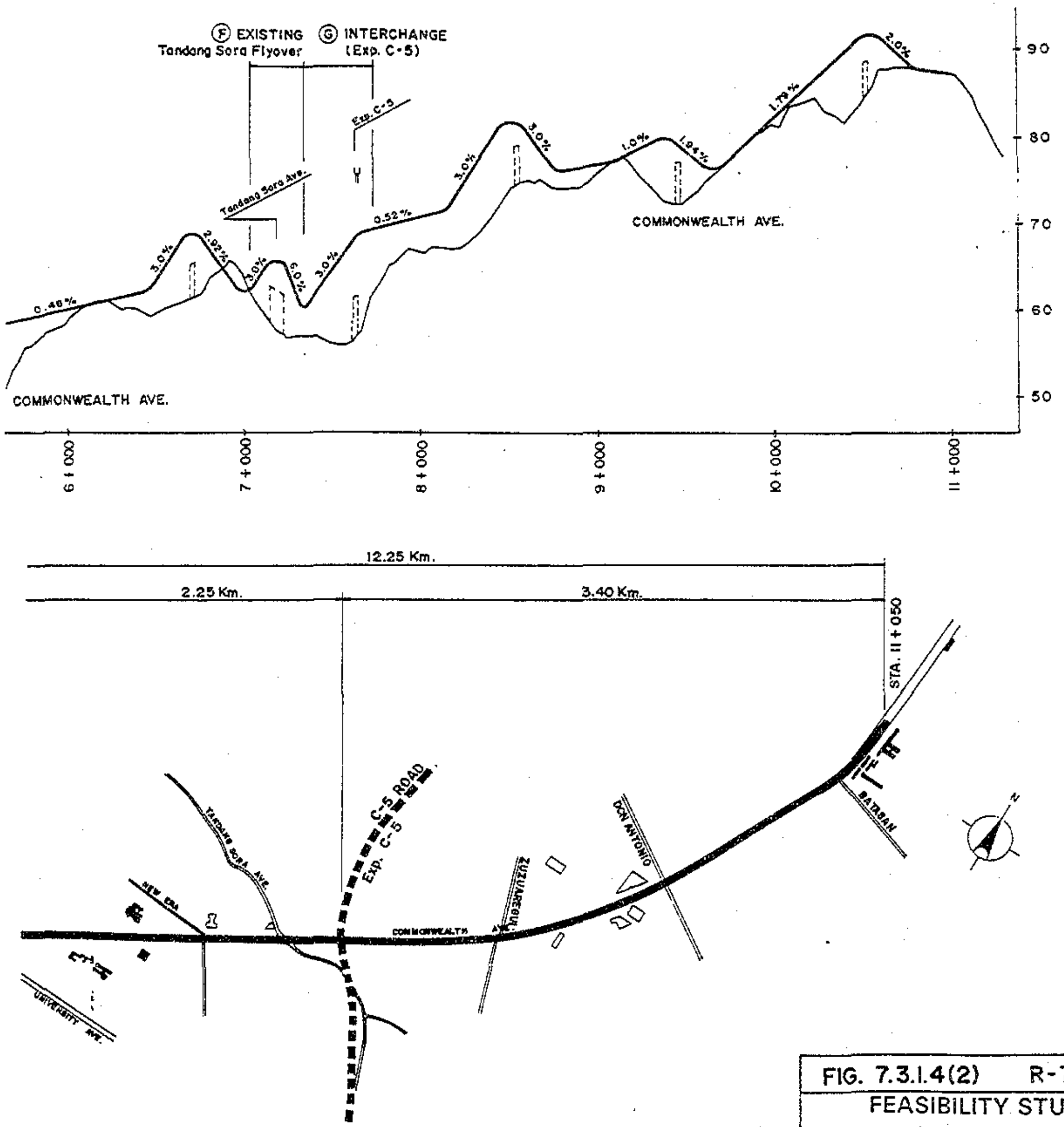


FIG. 7.3.1.4(2) R-7 ROUTE PLAN & PROFILE

FEASIBILITY STUDY ON METRO MANILA URBAN EXPRESSWAY SYSTEM

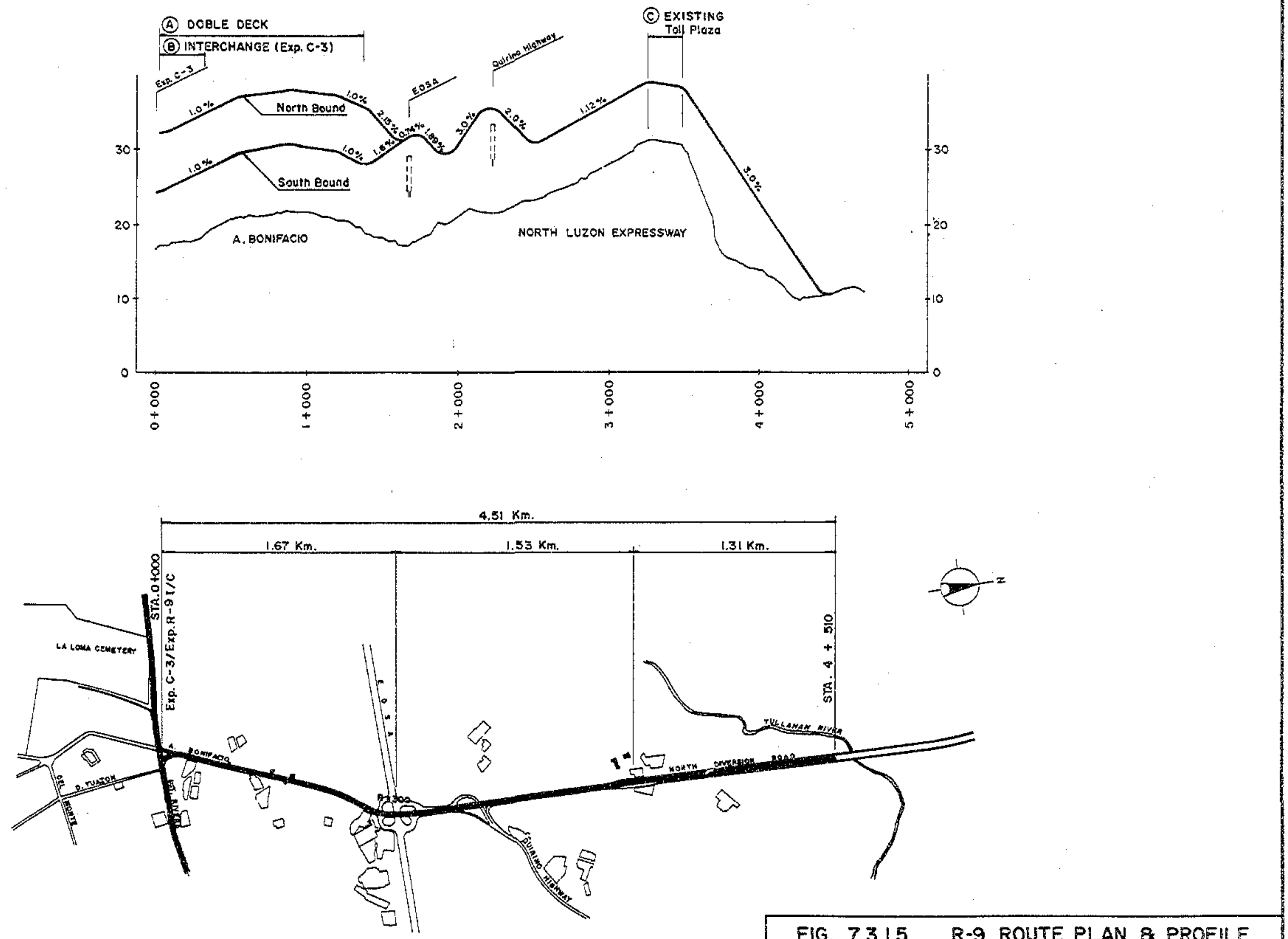


FIG. 7.3.1.5 R-9 ROUTE PLAN & PROFILE

FEASIBILITY STUDY ON METRO MANILA URBAN EXPRESSWAY SYSTEM

6. Expressway Route R-10

For the smooth traffic flow collecting and distributing from/to C-3 route, this route over existing R-10 road would certainly be necessary. Since the right-of-way along R-10 road is partially acquired, space for the expressway would be provided without any extraordinary problem on ROW.

Control points of vertical alignment for this route are as follows, viz:

a) Two esteros crossing R-10 road would be major control points for vertical alignments. Vertical clearance shall be provided from the top of existing two bridges as follows.

- Estero Malara Balut Bridge
- Estero De Vitas Bridge

b) Existing Intersection of C-2 and R-10 road would be maintained by providing R-10 route viaduct

c) R-10 route would be extended up to Moriones Street to provide sufficient space for entrance and exit

Figure 7.3.1.6 shows the proposed R-10 route plan and profile.

R-10

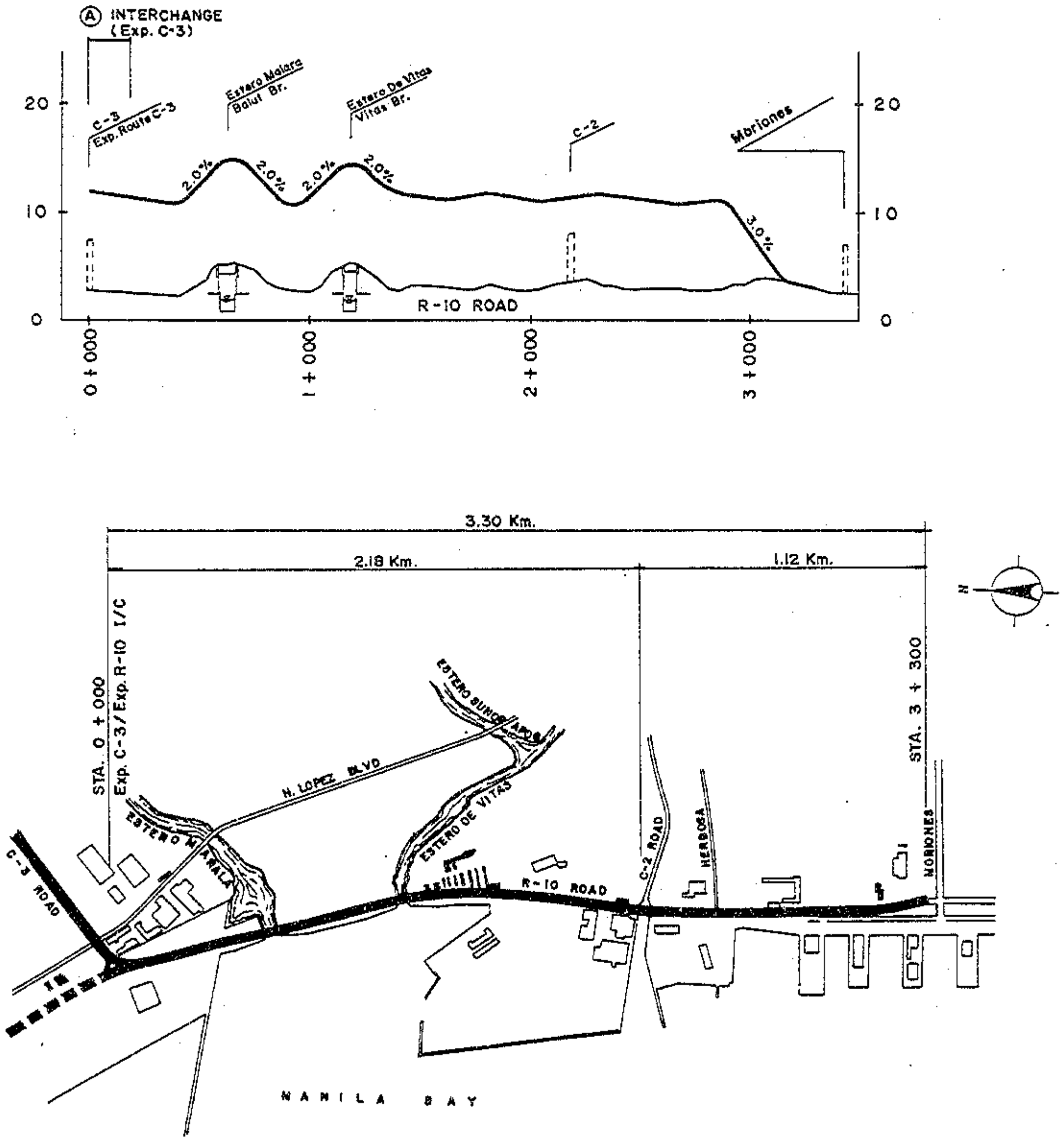


FIG. 7.3.1.6 R-10 ROUTE PLAN & PROFILE

FEASIBILITY STUDY ON METRO MANILA URBAN EXPRESSWAY SYSTEM

APPENDIX 7.5.1 STUDY ON INTERCHANGE TYPES

- Exp. C-3/Exp. R-4 Interchange
- Exp. C-3/Exp. R-7 Interchange
- Exp. R-3/C-4 (EDSA) Interchange
- Exp. R-7/C-5 Interchange

APPENDIX 7.5.1 STUDY ON INTERCHANGE TYPES

1. Exp. R-3/C-4 Interchange

   Connection of R-3 route and C-4 (EDSA) is one of the major impact to release the interchange congestion of Magallanes Interchange. There are several ideas of connection between R-3 route and C-4 at this interchange area. Three competitive schemes as shown in Figure 7.5.1.1 are compared and Scheme I is finally proposed for this interchange taking into account the constructability, less traffic disturbance and functionality of newly added on/off ramp lanes.

2. Exp. C-3/Exp. R-4 Interchange

   This interchange is located along the Nagtahan Link Road which is now under construction at the crossing point with Estero de Pandacan. Since Nagtahan Link Road is proposed to be constructed within PNR right-of-way area, the C-3 route have also to find available space within the same right-of-way to minimize the acquisition thereof.

   There are two proposed schemes of 3rd/4th level ramp and 2nd/3rd level. Through the comparison study as shown in Figure 7.5.1.2, scheme II, split type 2nd/3rd level ramp, was recommended because of lesser R.O.W. acquisition and less construction cost.

3. Exp. C-3/Exp. R-7 Interchange

   There is only one four-leg interchange along C-3 route where C-3 road (G. Araneta St.) and R-7 (Quezon Blvd.) are intersecting.

   Since C-3 route and R-7 route is connected as three-leg interchange in functional, partial cloverleaf type was recommended as best scheme at this location.

   Figure 7.5.1.3 shows the scheme comparison of this interchange.

4. Exp. R-7/C-5 Interchange

   There are two schemes considered for comparison of interchange schemes at the junction of R-7 route and C-5 road.

   Two basic concepts are studied on whether complete directional access interchange or partial directional access interchange.

   The proposed interchange location is already developed as residential and commercial area, right-of-way acquisition will be quite difficult for this interchange even it is located in sub-urban area.

   As shown in the evaluation results in Figure 7.5.1.4, partial directional interchange was proposed for this location taking into account the difficulty of R.O.W. acquisition and the major traffic flows at this interchange.

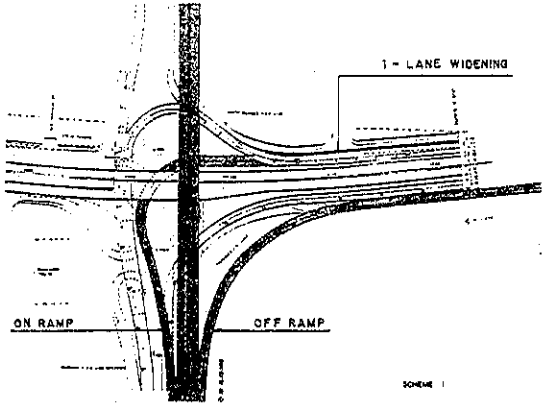
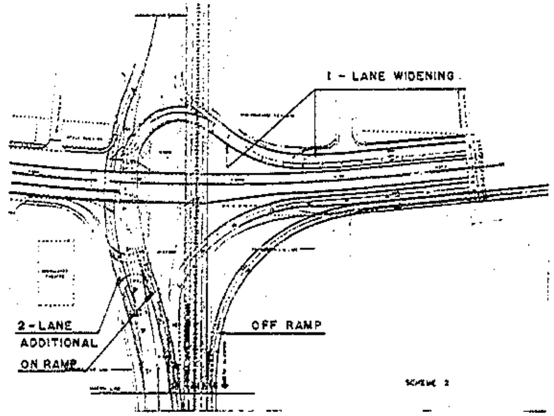
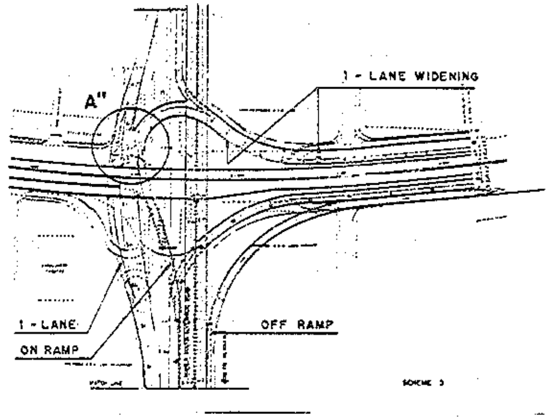
<table>
<tr><th></th><th>SCHEME I: ON & OFF RAMP</th><th>SCHEME II: ON & OFF RAMP WITH 2-LANE ADDITIONAL TO EXISTING RAMP</th><th>SCHEME III: ON & OFF RAMP WITH 1-LANE ADDITIONAL TO EXISTING RAMP</th></tr>
<tr><td>OUTLINE PLAN</td><td>
</td><td>
</td><td>
</td></tr>
<tr><td>EVALUATION</td><td>• Widening of southbound Magallanes ramp from 2-lane to 3-lane at the entrance is provided.
• Additional on ramp was proposed without widening of existing ramp except the above widening.
• Existing ramp for the traffic from Manila to Cubao was proposed to be eliminated in order to avoid weaving traffic and its space will be provided for on-ramp.</td><td>• Widening of southbound Magallanes ramp fro 2-lane to 3-lane at the entrance (same as Scheme I) is provided.
• Diversion of traffic from Manila to Alabang by new additional 2-lane ramp westside of existing loop.
• Existing ramp for the traffic from Manila to Cubao was eliminated (same as Scheme I).
• Construction of widening and additional parallel 2-lane ramp is difficult because of heavy traffic condition.</td><td>• Widening of southbound Magallanes ramp fro 2-lane to 3-lane at the entrance (same as Scheme I) is provided.
• Noses at the area "A" as indicate in the above are closely located and affected each traffic.
• Existing ramp for the traffic from Manila to Cubao was eliminated (same as Scheme I).
• Diversion of traffic from Manila to Alabang by one-lane ramp is less difficult than Scheme II, but widening and parallel ramp construction will be due to heavy traffic condition will be difficult (same as Scheme II).</td></tr>
<tr><td>RECOMMEN-DATION</td><td>Recommended for this study</td><td>Not recommendable</td><td>Not recommendable</td></tr>
</table>

FIGURE 7.8.1.1 SCHEME COMPARISON OF EXP. R-3/C-4 INTERCHANGE

FEASIBILITY STUDY ON METRO MANILA URBAN EXPRESSWAY SYSTEM

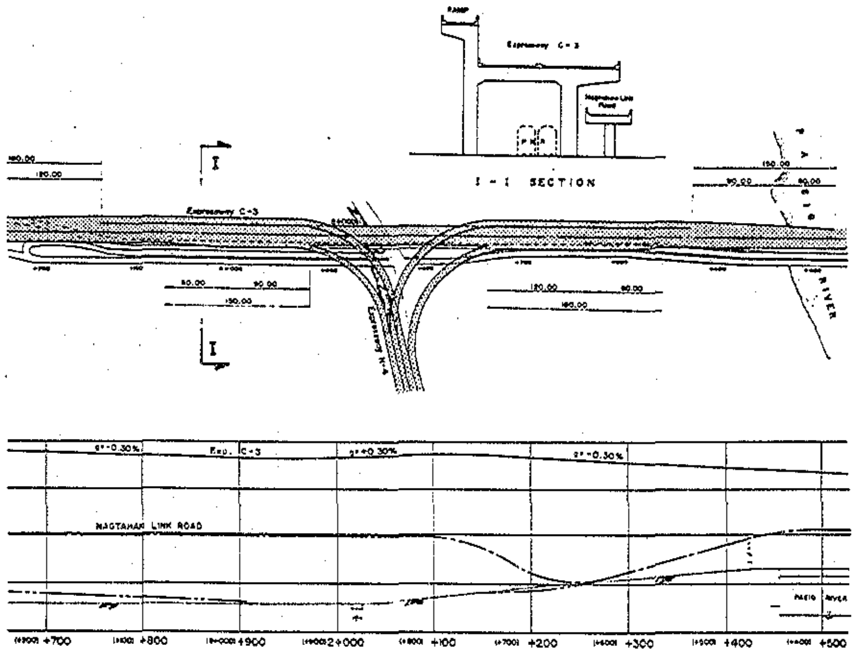
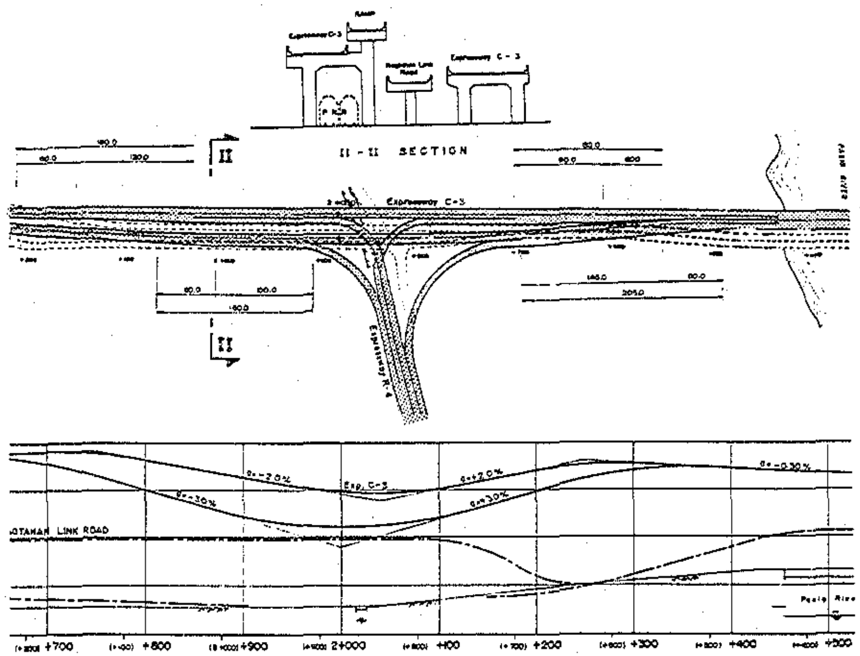
	SCHEME I: 3RD/4TH LEVEL RAMP	SCHEME II: SPLIT TYPE 2ND/3RD LEVEL RAMP
OUTLINE PLAN		
EVALUATION	• Exp. C-3 route was elevated at 3rd level due to the on-going Nagtahan Link Road • This scheme requires 4th level ramp for crossing above through lane of main expressway • Longer ramps would reach up to the Pasig River Bridge • R.O.W. acquisition area for the proposed ramps is same as Scheme II • Constructability is less advantageous than Scheme II because of high rise interchange (3rd & 4th level structure	• Exp. C-3 route was splitted beside the Nagtahan Link Road South Bound • Most of Interchange structures are second level by splitting C-3 route viaduct • Length of ramps are shorter than Scheme I because of 2nd level • This scheme will require same R.O.W. area of Scheme I • Construction cost is lesser than Scheme I
RECOMMEN-DATION	Not Recommendable	Recommended for this study

FIGURE 7.5.1.2 SCHEME COMPARISON OF EXP. C-3/EXP. R-4 INTERCHANGE

FEASIBILITY STUDY ON METRO MANILA URBAN EXPRESSWAY SYSTEM

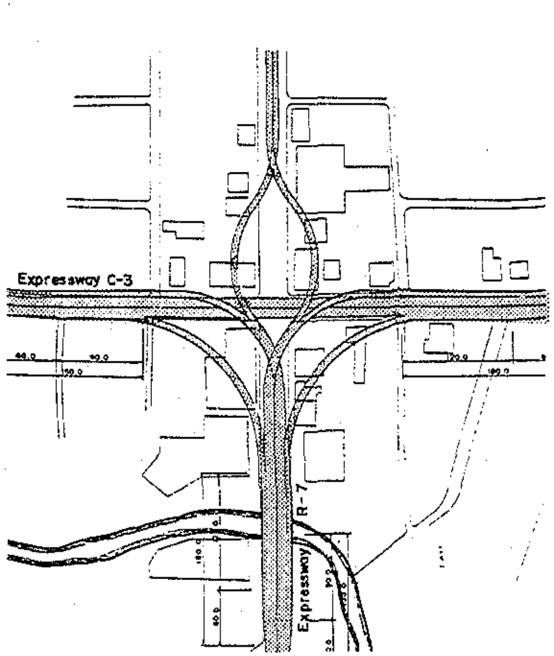
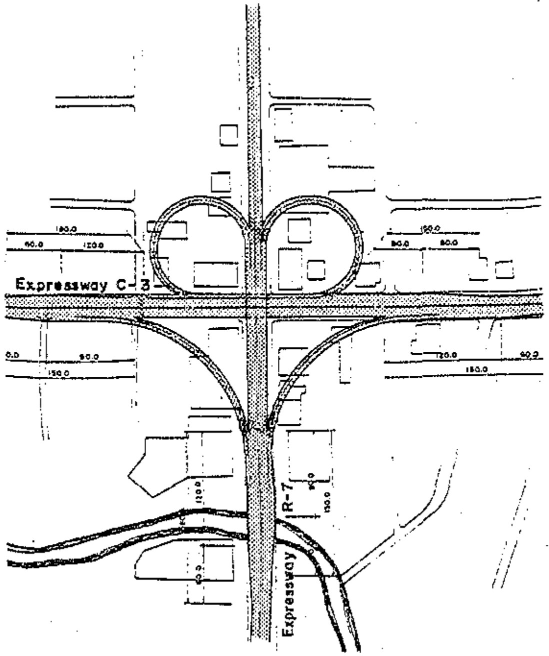
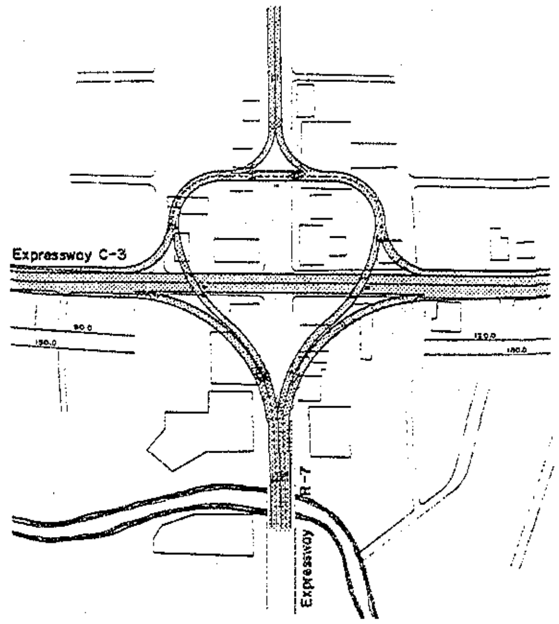
	SCHEME I: BRAIDED TYPE INTERCHANGE	SCHEME II: PARTIAL CLOVERLEAF INTERCHANGE	SCHEME III: ROTARY TYPE INTERCHANGE
OUTLINE PLAN			
EVALUATION	• Four level 3-leg interchange plan with on/off ramp at second level • Through traffic on R-7 route expressway would be twisted two times to ease junction for left turn to/from C-3 route expressway • R-7 through have to use braided type alignment which is not preferable for through traffic • R.O.W. acquisition area is smallest among three schemes but length of ramp is the longest	• 3rd level 2-loop ramps and 2nd level 2-directional ramps are adapted (semi-cloverleaf type interchange) • Establishment inside-loop will be retained to minimize R.O.W. acquisition and compensation cost • To avoid weaving along C-3 route, collector-distributor lane was provided • Due to R.O.W. constraint, radius of loop shall be reduced to 50 meters. Radius for direct ramp is 100 meters • Construction cost is lowest among three schemes	• Rotary type 3rd level ramps are considered • Weaving along R-7 route expressway would be created. It was considered to provide 2-lane ramps at weaving area • R.O.W. acquisition area is biggest among three schemes • Driver's operation is most difficult due to several S-curved alignments • Project cost would be biggest including R.O.W. acquisition cost
RECOMMENDATION	Not recommendable	Recommended for this study	Not recommendable

FIGURE 7.6.1.3 SCHEME COMPARISON OF EXP. C-3/EXP. R-7 INTERCHANGE

FEASIBILITY STUDY ON METRO MANILA URBAN EXPRESSWAY SYSTEM

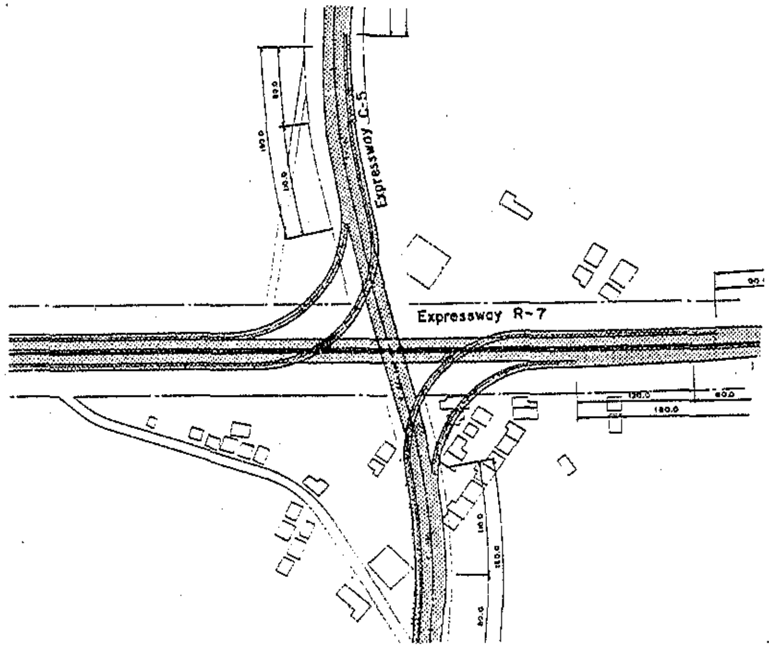
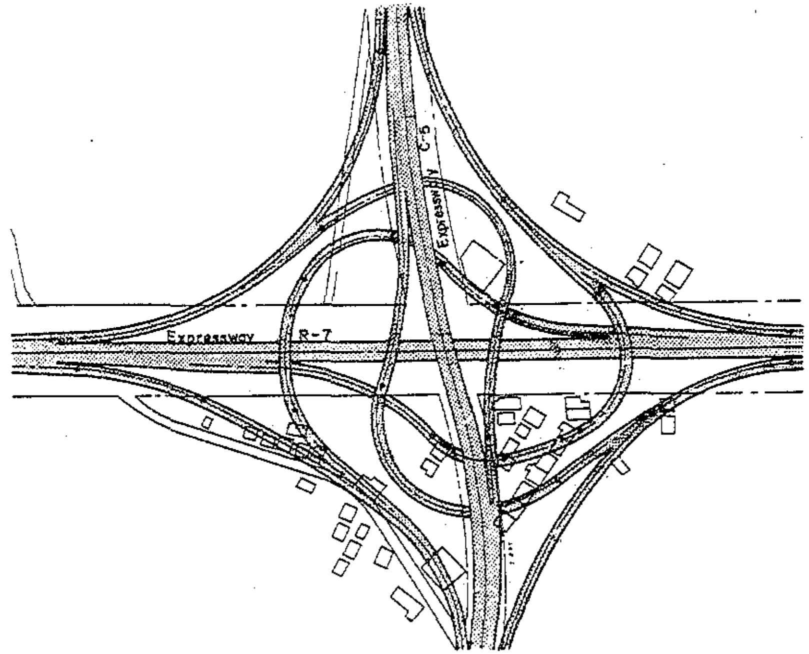
	SCHEME I: PARTIAL DIRECTIONAL INTERCHANGE	SCHEME II: ROTARY TYPE INTERCHANGE
OUTLINE PLAN		
EVALUATION	• Based on the future traffic forecast, directional ramps are provided only for major traffic movements, viz; west-south and east-north movements only. Other minor movement would utilize at-grade and take on/off ramps along R-7 route • This scheme is the most simple scheme to minimize R.O.W. acquisition while to satisfy service of major traffic movement • Impact to the vicinity is smaller than Scheme II due to small R.O.W. area required • Improvement at-grade road shall be considered to serve unconnected traffic movement • Approximate R.O.W. acquisition area = 23,000 m^2	• Full service Directional (Rotary) type interchange, 4-leg interchange • Since vicinity of the interchange is highly developed, this type of interchange would require a big amount of R.O.W. acquisition. Implementation of this type of full service interchange will be quite difficult due to high land cost and civil work cost • This type of interchange is not fit in urban area • Most of loop structure will be at 3rd level • Approximate R.O.W. acquisition area = 60,000 m^2
RECOMMEN-DATION	Recommended for this study	Not Recommendable

FIGURE 7.5.1.4 SCHEME COMPARISON OF EXP. R-7/C-5 INTERCHANGE

FEASIBILITY STUDY ON METRO MANILA URBAN EXPRESSWAY SYSTEM

APPENDIX 7.6.1 STUDY ON ON/OFF RAMPS

APPENDIX 7.6.1 STUDY ON ON/OFF RAMPS

Preliminary design of on/off ramps have been done predicated on the following basic design concepts and schemes as shown in Table 7.6.1.1 and 7.6.1.2.

1. On/off ramp Design Considerations

   Design speed is not always practicable and lower design speeds may be necessary, but they should not be less than the figures in Table 7.6.1.3.

2. Loops

   Minimum value of corresponding minimum radius usually control, but for expressway design speeds of 80 kph and 60 kph, the loop design speed preferably should not be less than 40 kph and 30 kph, respectively.

3. Semi-direct Connections

   Design speeds between the middle and upper ranges shown in Table 7.6.1.3 should be used. A design speed less than 50 kph should not be used.

4. Direct Connections

   Design speeds between the middle and upper ranges shown in Table 7.6.1.3 should be used. The minimum preferably should be 65 kph and in no case less than 55 kph.

5. Different Design Speeds on Interchange

   The expressway with the greater design speed should be the control in selecting the design speed for the whole of a ramp. However, the portion of the ramp closer to the lower speed road being designed for the lower speed, for example where the ramp is on an up-grade from the higher speed expressway to the lower speed expressway.

6. At-Grade Terminals

   Where a ramp joins a street/at-grade road, an intersection is formed and a stop or signal control is employed. This terminal design should be based on near minimum turning conditions at intersection.

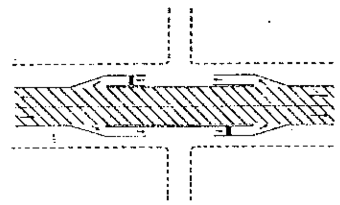
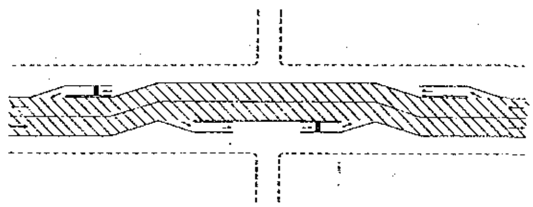
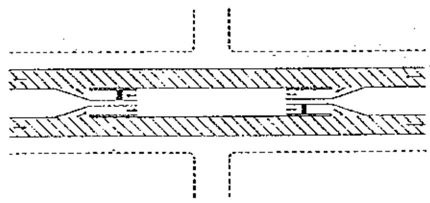
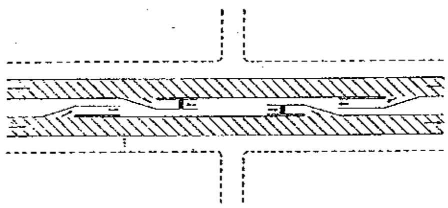
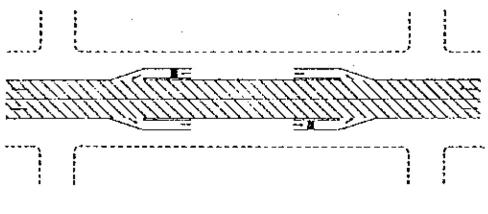
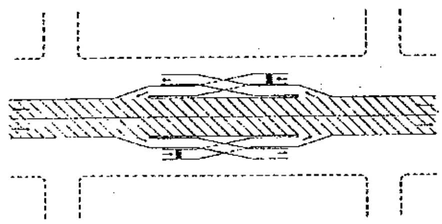
7. Curvature

   The geometric requirement of curvature for ramps is predicated on the design speed same as main expressway. Spiral transitions are desirable to effect the desired shape of ramps, to meet site conditions and to fit natural vehicle movement.

8. Site Distance

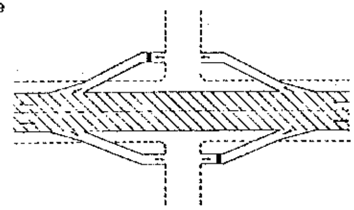
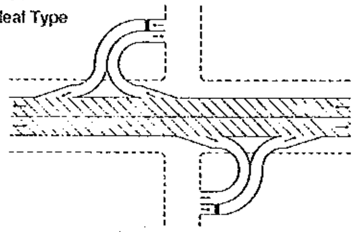
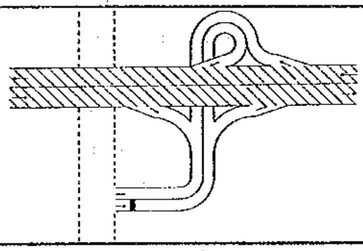
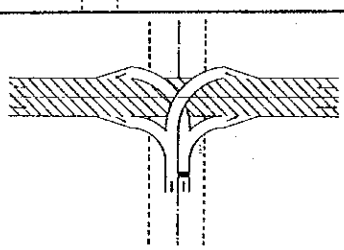
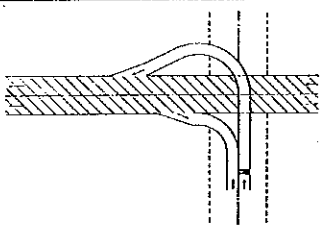
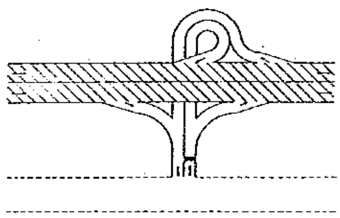
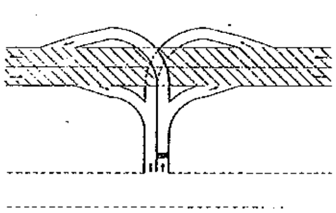
   There should be a clear view of the whole of the exit terminal, including the exit nose. The sight distance in an expressway preceding the approach nose of an exit ramp should exceed the minimum for the through traffic design speed, desirably by 25 percent or more. There should be a clear view of the whole of the exit terminal, including the exit nose.

TABLE 7.6.1.1 ON/OFF RAMP SCHEME (1/2)

LOCATION OF AT-GRADE ROAD WITH WHICH RAMPS ARE CONNECTED	RAMP LAYOUT	FEATURES
AT-GRADE ROAD UNDER AN EXPRESSWAY	Parallel Side Ramp : Type A 	• On- and off-ramps are placed parallel to each other at outer sides of an expressway and are connected with an at-grade road near an intersection • 59.1 meter R.O.W. required • Lane reduction of an at-grade road is required to accommodate a pair of on- and off-ramps, which results in inconsistent number of lanes along an at-grade road and reduces traffic capacity near an intersection • This type is functionally simple and recommended if an at-grade road is wide enough to accommodate ramps
	Staggered Side Ramp 	• On- and off-ramps are placed staggered each other at outer sides of an expressway and are connected with an at-grade road near an intersection • 45.1 meter R.O.W. required • An expressway is required to have an S-curved alignment which is not preferable for high speed traffic • Lane reduction of an at-grade road is required • This is one of solutions when 4 parallel side ramps are not accommodated with at-grade road R.O.W.
	Parallel Center Ramp 	• On- and off-ramps are placed parallel to each other at inner sides of an expressway and connected with an at-grade road near an intersection • 45.4 meter R.O.W. required • Left hand entrances and exits to/from an expressway are contrary to the general concept of driver's expectancy • Space under an expressway can be utilized for traffic lanes of an at-grade road, thus traffic capacity reduction of an at-grade road is minimized • When an exit is located too close to an intersection, complicated signal control of traffic is required
	Staggered Center Ramp 	• On- and off-ramps are placed staggered to each other and are connected with an at-grade road near an intersection • 39.5 meter R.O.W required • Left hand entrances and exits to/from an expressway are contrary to the general concept of drivers' expectancy • Space under an expressway can be fully utilized for traffic lanes of an at-grade road, thus traffic capacity reduction of an at-grade road is minimized • Advantageous when R.O.W. of not more than 40 meters are available
	Parallel Side Ramp : Type B 	• On- and off-ramps are placed parallel to each other at outer sides of an expressway and connected with an at-grade road inbetween intersections • 59.1 meter R.O.W. required • Exit traffic and entrance traffic from/to an expressway weaves each other. An appropriate weaving section between an exit and an entrance be provided • Distance from an exit to an intersection or from an intersection to an entrance becomes rather long • Lane reduction of an at-grade road is required to accommodate a pair of on- and off-ramps, which results in inconsistent number of lanes along an at-grade road and reduces traffic capacity at ramp section • Applicable when two intersections are both important, but are not apart each other long enough to provide ramps for each intersection
	Braided Side Ramp 	• This type is developed to eliminate problems of above type, i.e. to eliminate weaving section of at-grade road and to shorten distance from an exit/entrance to an intersection • 71.5 meter R.O.W. required • Complicated on- and off-ramps required, as they have to cross each other • Applicable for the same case as mentioned above

Note: Required R.O.W. width for the case of 4-lane expressway, 1-lane ramp, 6-lane at-grade road (10.5 meter on each side) and 2.5 m. sidewalk on each side

TABLE 7.6.1. 2 ON/OFF RAMP SCHEME (2/2)

LOCATION OF AT-GRADE ROAD WITH WHICH RAMPS ARE CONNECTED	RAMP LAYOUT	FEATURES
AT-GRADE ROAD CROSSING UNDER AN EXPRESSWAY	Diamond Type 	• On- and off-ramps are connected at 4 locations with an at-grade road crossing under an expressway • Additional two (2) 4-leg intersections are required • Type of ramp is simple and R.O.W. acquisition is lesser than other types under this category • Applicable when traffic on an at-grade road is light on an at-grade road is wide enough to provide left-turn lanes at intersections
	Semi-cloverleaf Type 	• On- and off-ramps are connected at 2 locations with an at-grade road crossing under an expressway • Additional two (2) 3-leg intersections are required • As loop ramps are required, wider R.O.W. is needed than the Diamond Type • Applicable when R.O.W. is available or is easily acquired at two quadrants located at opposite side of an expressway
	Trumpet Type 	• On- and off-ramps are connected at 1 location with an at-grade road crossing under an expressway • Additional one (1) 3-leg intersection is required • Toll plaza can be integrated at one place • Wider R.O.W. and longer ramps are required • Applicable where R.O.W. acquisition is easier
	Y-Type 	• On- and off-ramps are connected at one location with only one direction of an at-grade road crossing under an expressway • 3-level structures are required • Applicable when expressway traffic generating/attracting source is located at only one direction of an at-grade road
	L-Type 	• One pair of on- and off ramps is connected with only one direction of an at-grade road crossing under an expressway • Applicable when expressway traffic generating/attracting source is located at only one direction of an expressway as well as an at-grade road
AT-GRADE ROAD RUNNING PARALLEL TO AN EXPRESSWAY	Trumpet Type 	• On- and off-ramps are connected with an at-grade road running parallel to an expressway • One 3-leg intersection is required • Toll plaza can be integrated at one place • As loop ramps are required, wider R.O.W. is needed • Applicable where R.O.W. acquisition is easier
	Y-Type 	• On- and off-ramps are connected with an at-grade road running parallel to an expressway • One 3-leg intersection is required • Toll plaza can be integrated at one place • Though lesser R.O.W. is required than Trumpet Type, construction cost is higher as 3-level structures are required • Applicable when loop ramps are not feasible due to R.O.W. acquisition problem

9. Grade and Profile

Ramp gradients are directly related to design speed, however design speed is a general indication of the standards being used, and a gradient for a ramp with a high design speed should be flatter than for one with a low design speed.

10. Left Hand Entrances and Exits

In generally left-hand entrances and exits are contrary to driver expectancy, so that special attention should be given to signing and the provision for decision sight distance in order to alert the driver that an unusual situation exists. However, the center on and off ramp have great advantages for viaduct type expressway because of limited available R.O.W. space

Extreme care have been exercised to adapt left-hand entrances and exit in the design of interchanges providing sufficient safety measures for a driver. Left-hand entrances and exits were considered satisfactory for collector-distributor roads.

11. Distance Between Successive Ramps

There would be frequently a need for two or more ramp terminals in close succession along the through lanes on urban expressway. A reasonable distance shall be given to provide sufficient maneuvering length and adequate space for signing.

Spacing between successive outer ramp terminals is dependent on the classification of the interchanges, the function of the ramp combination (entrance or exit) and weaving potential.

The following distance requirements between adjacent noses are adopted in the study. Figure 7.6.1.1 shows the distance requirements for the above purpose.

12. Ramp Terminals

Ramp terminals may be the at-grade type, at the cross road terminal of interchanges, or the free-flow type where ramp traffic merges with or diverges from high speed through traffic at flat angles. Terminals are further classified according to the number of lanes on the ramp at the terminal, either single or multi-lane, and according to the configuration of the speed-change lane, either taper or parallel type.

13. Entrance and Exit Terminal

Ramp design and dimensioning is the subject of intensive study since urban expressway is a first experience in the Philippines. As usual drivers maneuver, unfortunately, higher vehicle speed than design speed have to be considered even controlled by traffic control. Taking into consideration of accident prone area of entrance and exit ramp terminal, adequate length of terminal shall be considered not only the length specified by geometric design standards.

They are designed either as a taper, blending into the through lane, or as an auxiliary lane parallel to the through lane.

In either case, sufficient length must be provided to permit the vehicle to accelerate and merge into the main flow traffic.

Figure 7.6.1.2 shows the proposed minimum length of on and off ramps for different design speeds.

Basically one-lane ramp is proposed taking into account the traffic volume, but if ramp and outer lane volumes are too great to be accommodated by a single lane, a two-lane ramp is employed by adding one lane to the expressway properly.

Vehicles leaving the expressway need a distance to decelerate from the main traffic flow. Proposed deceleration-lane length are given in Figure 7.6.1.2. A two-lane exit is called for in situations where one lane does not meet the demand as per traffic capacity analysis. It was recommended that an auxiliary lane be added to the expressway at least 750 meters before the point of exit if two lane exit is required.

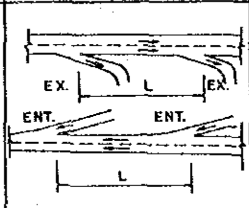
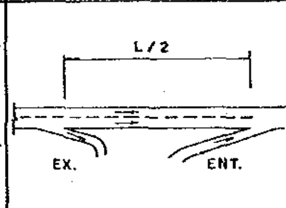
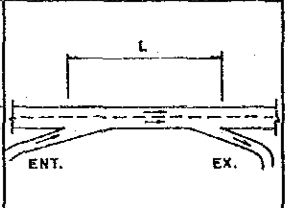
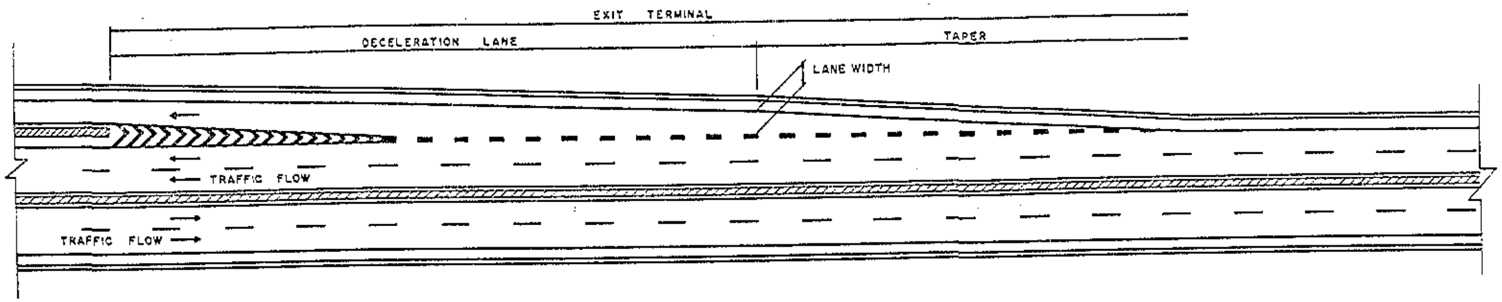
TYPE	EXIT - EXIT ENTRANCE-ENTRANCE	EXIT - ENTRANCE	ENTRANCE — EXIT
SKEMATIC DIAGRAM			
LENGTH BT. NOSE	L = 240 m	$\frac{L}{2}$ = 120 m	L = 300 m

FIGURE 7.6.1.1 DISTANCE REQUIREMENT FOR RAMPS

TABLE 7.6.1.3 RAMP DESIGN SPEED AND MINIMUM RADIUS

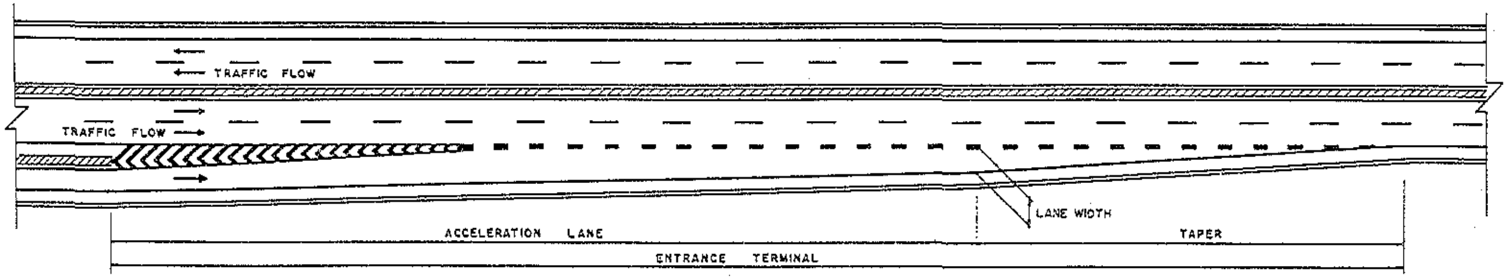
Expressway Design Speed (KPH)	Ramp Design Speed (KPH)		Minimum Radius(M)	
	60	80	60	80
Upper Range (85%)	50	70	130	230
Middle Range (70%)	40	55	90	130
Lower Range (50%)	30	40	40	65



EXIT TERMINAL
(PARALELL TYPE)

LENGHT OF DECELERATION LANE & TAPER

EXPRESSWAY DESIGN SPEED	DECELERATION LANE LENGHT (m) OFF - RAMP DESIGN SPEED			TAPER LENGHT (m)
	30	40	50	
80 KPH	110	95	75	80
60 KPH	90	55	30	60



ENTRANCE TERMINAL
(PARALELL TYPE)

LENGHT OF ACCELERATION LANE & TAPER

EXPRESSWAY DESIGN SPEED	ACCELERATION LANE LENGHT (m) ON - RAMP DESIGN SPEED			TAPER LENGHT (m)
	30	40	50	
80 KPH	160	120	60	80
60 KPH	120	100	40	50

FIG. 7.6.1.2 RAMP TERMINAL

FEASIBILITY STUDY ON METRO MANILA URBAN EXPRESSWAY SYSTEM

APPENDICES
TO
CHAPTER 9

APPENDICES TO CHAPTER 9

PAGE

APPENDIX 9.1.1 ESTIMATE OF BASE COSTS

A. BASE COSTS OF SUPERSTRUCTURE

B. BASE COSTS OF SUBSTRUCTURE/FOUNDATION

C. BASE COSTS OF EXPRESSWAY MISCELLANEOUS

A. BASE COSTS OF SUPERSTRUCTURE

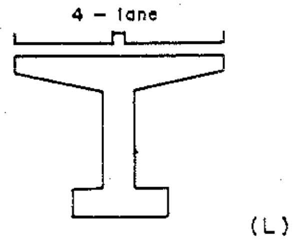
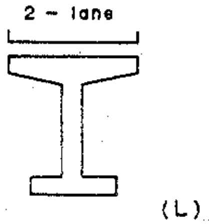
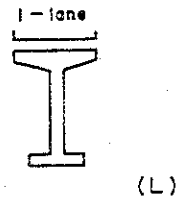
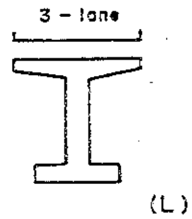
COST ESTIMATE OF SUPERSTRUCTURE (AASHTO GIRDER)

SPAN	I T E M	UNIT PRICE	QUANTITIES					COST (x ₱ 1,000)				
			1-LANE	2-LANES	3-LANES	4-LANES	6-LANES	1-LANE	2-LANES	3-LANES	4-LANES	6-LANES
	• PC-GIRDER (AASHTO TYPE IV)	₱369,000/pc	3	4	5	8	10	1,107.0	1,476.0	1,845.0	2,952.0	3,690.0
	• CONCRETE	4,200/m3	55.0	101.1	141.9	192.3	243.8	231.0	424.6	596.0	807.7	1,024.0
	DECK SLAB	-	(29.9)	(53.5)	(76.0)	(129.5)	(152.1)					
	DIAPHRAGM	-	(4.4)	(9.6)	(13.0)	(19.8)	(26.9)					
	CURB & PARAPET	-	(20.7)	(38.0)	(52.9)	(35.5)	(57.3)					
	CENTER MEDIAN	-	-	-	-	(7.5)	(7.5)					
30 M	• RE-BAR	₱ 28.8/KG	12,050	22,093	31,040	42,990	54,084	347.0	636.3	894.0	1,238.1	1,557.6
	• METAL BRIDGE RAILING	₱ 2,050/LM	60	60	60	60	60	123.0	123.0	123.0	123.0	123.0
	• CAST IRON PIPE	₱ 1,355/LM	6.56	6.56	6.56	6.56	6.56	8.9	8.9	8.9	8.9	8.9
	• GALVANIZED IRON PIPE	₱ 1,118/LM	21	30	32	54.7	60	23.5	33.5	35.8	61.2	67.1
	• OTHER ACCESSORIES	L.S. (5%)	-	-				92.0	135.1	175.1	259.5	323.5
	T O T A L	-	-	-	-	-	-	1,932.4	2,837.4	3,677.8	5,450.4	6,794.1
	• PC-GIRDER (AASHTO TYPE V)	₱500,000/pc	3	4	5	8	10	1,500.0	2,000.0	2,500.0	4,000.0	5,000.0
	• CONCRETE	4,200/m3	63.5	116.3	163.4	221.1	271.3	266.7	488.5	686.3	928.6	1,139.5
	DECK SLAB	-	(34.9)	(62.4)	(88.7)	(151.1)	(177.5)					
	DIAPHRAGM	-	(4.4)	(9.6)	(13.0)	(19.8)	(26.9)					
	CURB & PARAPET	-	(24.2)	(44.3)	(61.7)	(41.4)	(66.9)					
	CENTER MEDIAN	-	-	-	-	8.8	8.8					
35 M	• RE-BAR	₱ 28.8/KG	13,920	25,444	35,785	49,510	62,233	400.9	732.8	1,030.6	1,425.9	1,792.3
	• METAL BRIDGE RAILING	₱ 2,050/LM	70	70	70	70	70	143.5	143.5	143.5	143.5	143.5
	• CAST IRON PIPE	₱ 7,355/LM	6.56	6.56	6.56	6.56	6.56	8.9	8.9	8.9	8.9	8.9
	• GALVANIZED IRON PIPE	₱ 1,118/LM	24	33	35	61	66	26.8	36.9	39.1	68.2	73.8
	• OTHER ACCESSORIES	L.S. (5%)	-	-	-	-	-	117.3	170.5	220.4	328.8	407.9
	T O T A L	-	-	-	-	-	-	2,464.1	3,581.1	4,628.8	6,903.9	8,565.9
	• PC-GIRDER (AASHTO TYPE VI)	₱617,000/pc	3	4	5	8	10	1,851.0	2,468.0	3,085.0	4,936.0	6,170.0
	• CONCRETE	4,200/m3	72.7	133.4	187.3	252.3	311.1	305.3	560.3	786.7	1,059.7	1,306.6
	DECK SLAB	-	(39.9)	(71.3)	(101.3)	(172.7)	(202.8)					
	DIAPHRAGM	-	(5.2)	(11.4)	(15.5)	(22.3)	(31.9)					
	CURB & PARAPET	-	(27.6)	(50.7)	(70.5)	(47.3)	(76.4)					
	CENTER MEDIAN	-	-	-	-	10.0	10.0					
40 M	• RE-BAR	₱ 28.8/KG	15,940	29,176	41,006	56,505	69,318	459.1	840.3	1,181.0	1,627.3	1,996.4
	• METAL BRIDGE RAILING	₱ 2,050/LM	80	80	80	80	80	164.0	164.0	164.0	164.0	164.0
	• CAST IRON PIPE (Ø 20 cm)	₱ 1,355/LM	6.56	6.56	6.56	6.56	6.56	8.9	8.9	46.6	8.9	8.9
	• GALVANIZED IRON PIPE(Ø15cm)	₱ 1,118/LM	26	36	39	65	70	29.1	40.2	43.6	72.7	78.3
	• OTHER ACCESSORIES	L.S. (5%)	-	-				140.9	204.1	263.5	393.4	486.2
	T O T A L		-	-	-	-	-	2,958.3	4,285.8	5,532.7	8,262.0	10,210.4

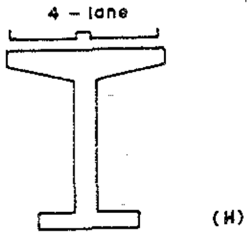
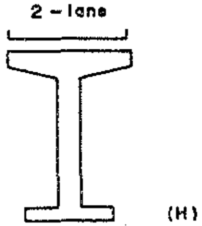
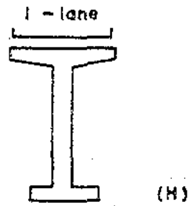
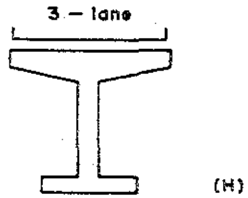
NOTE) RE-BAR : 235 KG/M3 for SLAB
200 KG/M3 for other member

B. BASE COSTS OF SUBSTRUCTURE/FOUNDATION

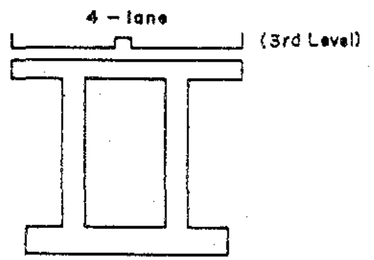
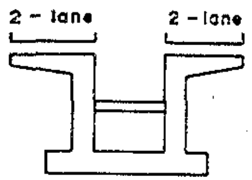
T – Shape : Second Level Structure

SPAN LENGTH	ITEM			NUMBER OF LANES 4-Lane	2-Lane	1-Lane (Ramp)	3-Lane
							
30 M	Quanti-ties	1) Excavation (m³)		11 x 7 x 3.1 = 238.7	7.0x6.0x2.6 = 109.2	6.5x6.0x2.4 = 93.6	9.0x7.0x2.6 = 163.8
		2) Lean Conc. (m³)		10.2x6.2x0.1 = 6.3	6.2x5.2x0.1 = 3.2	5.7x5.2x0.1 = 3.0	8.2x6.2x0.1 = 5.1
		3) Footing (m³)		10x6x1.5+(4.0+10)x0.5/2x6 = 111.0	6.5x5.0x1.5 = 48.8	5.5x5.0x1.3 = 35.8	8.0x6.0x1.5 = 72.0
		4) Column (m³)		4.0x2.5x5.8 = 58.0	2.5x2.0x6.1 = 30.5	2.0x2.0x6.7 = 26.8	3.0x2.2x6.5 = 42.9
		5) Coping (m³)		1.8x2.5x18.3+(10.3+4)x1.2/2x2.5 = 103.8	1.8x2x8.55+(8.55+2.5)x0.6/2x2.0 = 37.4	1.8x2.0x5.3 = 19.1	1.8x2.2x11.8+(3+11.8)x0.7/2x2.2 = 58.1
		6) Re-Bar (kg)		111x70+58.2x200+103.8x230 = 43284	48.8x70+30.5x200+37.4x230 = 18118	35.8x70+26.8x200+19.1x230 = 12259	72x70+42.9x200+58.1x230 = 26983
(Spread Footing)	Cost		Unit Price				
		1)	₱ 305 /m³	72,804	33,306	28,548	49,959
		2)	₱ 2710 /m³	17,138	8,737	8,032	13,778
		3)	₱ 4135 /m³	458,985	201,581	147,826	297,720
		4)	₱ 4510 /m³	261,580	137,555	120,868	193,479
		5)	₱ 4510 /m³	468,138	168,719	86,051	262,139
		6)	₱ 28.8 /kg	1,246,579	521,798	353,059	777,110
	TOTAL			2,525,224 (Say ₱ 2.53 M/pier)	1,071,697 (Say ₱ 1.07 M/pier)	744,385 (Say ₱ 0.74 M/pier)	1,594,185 (Say ₱ 1.59 M/pier)
35 M	1.2 x (cost of span 30 M)			₱ 3.03 M / pier	₱ 1.29 M / pier	₱ 0.89 M / pier	₱ 1.91 M / pier
40 M	1.4 x (cost of span 30 M)			₱ 3.54 M / pier	₱ 1.50 M / pier	₱ 1.04 M / pier	₱ 2.23 M / pier
Cost of Sub Struc-ture (on pile)	30 M	Unit Price of Pile ₱ 2960 / LM	L = 10	2.53 M + 240 x 2960 = 3.24 M	1.07 M + (120 x 2960) = 1.43 M	0.74 M + 80 x 2960 = 0.98 M	1.59 M + 160 x 2960 = 2.07 M
			L = 15	2.53 M + 360 x 2960 = 3.59 M	1.07 M + (180 x 2960) = 1.60 M	0.74 M + 120 x 2960 = 1.10 M	1.59 M + 240 x 2960 = 2.30 M
			L = 20	2.53 M + 480 x 2960 = 3.95 M	1.07 M + (240 x 2960) = 1.78 M	0.74 M + 160 x 2960 = 1.22 M	1.59 M + 320 x 2960 = 2.54 M
	35 M		10	3.03 M+(240x2960)x1.2 = 3.88 M	1.29 M + (120 x 2960) x 1.2 = 1.71 M	0.89 M + (80 x 2960) x 1.2 = 1.18 M	1.91 M + (160 x 2960) x 1.2 = 2.48 M
			15	3.03 M+(360x2960)x1.2 = 3.97 M	1.29 M + (180 x 2960) x 1.2 = 1.93 M	0.89 M + (120 x 2960) x 1.2 = 1.32 M	1.91 M + (240 x 2960) x 1.2 = 2.77 M
			20	3.03 M+(480x2960)x1.2 = 4.74 M	1.29 M + (240 x 2960) x 1.2 = 2.14 M	0.89 M + (160 x 2960) x 1.2 = 1.46 M	1.91 M + (320 x 2960) x 1.2 = 3.05 M
	40 M		10	3.54 M+(240x2960)x1.4 = 4.53 M	1.50 M + (120 x 2960) x 1.4 = 2.00 M	1.04 M + (80 x 2960) x 1.4 = 1.37 M	2.23 M + (160 x 2960) x 1.4 = 2.89 M
			15	3.54 M+(360x2960)x1.4 = 5.03 M	1.50 M + (180 x 2960) x 1.4 = 2.25 M	1.04 M + (120 x 2960) x 1.4 = 1.54 M	2.23 M + (240 x 2960) x 1.4 = 3.23 M
			20	3.54 M+(480x2960)x1.4 = 5.52 M	1.50 M + (240 x 2960) x 1.4 = 2.49 M	1.04 M + (160 x 2960) x 1.4 = 1.71 M	2.23 M + (320 x 2960) x 1.4 = 3.56 M
			10	24 L = 240 M	12 L = 120 M	8 L = 80 M	16 L = 160 M
			15	L = 360 M	L = 180 M	L = 120 M	L = 240 M
			20	L = 480 M	L = 240 M	L = 160 M	L = 320 M

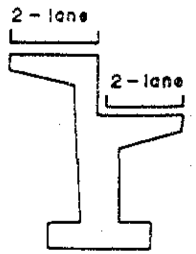
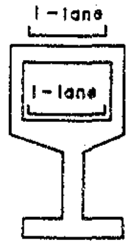
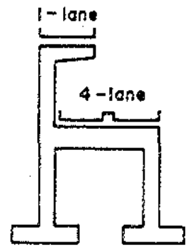
T – Shape : Third Level Structure

SPAN LENGTH	ITEM		NUMBER OF LANES: 4–Lane	2–Lane	1–Lane (Ramp)	3–Lane
						
30 M (Spread Footing)	Quantities	1) Excavation (m³)	13.0 x 9.0 x 3.6 = 421.2	8.0 x 7.0 x 2.6 = 145.6	7.0 x 7.0 x 2.6 = 127.4	9.0 x 7.0 x 2.9 = 182.7
		2) Lean Conc. (m³)	12.2 x 8.2 x 0.1 = 10.0	7.2 x 6.2 x 0.1 = 4.5	6.2 x 6.2 x 0.1 = 3.8	8.2 x 6.2 x 0.1 = 5.1
		3) Footing (m³)	12.0x8.0x1.8+(4.0+12.0)x0.7/2x2.5 = 186.8	7.0 x 6.0 x 1.5 = 63.0	6.0 x 6.0 x 1.5 = 54.0	8.0 x 6.0 x 1.8 = 86.4
		4) Column (m³)	(4.0 + 6.0) x 12.0/2 x 2.5 = 150.0	2.5 x 2.2 x 13.6 = 74.8	2.5 x 2.2 x 14.2 = 78.1	3.0 x 2.5 x 13.5 = 101.3
		5) Coping (m³)	1.8x2.5x18.3+(18.3+6.0)x1.2/2x2.5 = 118.8	1.8x2.2x8.55+(2.5+8.55)x0.6/2x2.2 = 41.2	1.8 x 2.2 x 5.3 = 21.0	1.8x2.5x11.8+(3.0+11.8)x0.7/2x2.5 = 66.1
		6) Re–Bar (kg)	186.8x70+150.0x200+118.8x230 = 70400	63.0x70+74.8x200+41.2x230 = 28846	54.0x70+78.1x200+21.0x230 = 24230	86.4x70+101.3x200+66.1x230 = 41511
		Unit Price				
	Cost	1) ₱ 305 /m³	128,466	44,408	38,857	55,724
		2) ₱ 2710 /m³	27,111	12,097	10,417	13,778
		3) ₱ 4135 /m³	772,418	260,505	223,290	357,264
		4) ₱ 4510 /m³	676,500	337,348	352,231	456,638
		5) ₱ 4510 /m³	535,788	185,591	94,656	297,886
		6) ₱ 28.8 /kg	2,027,520	830,765	697,824	1,195,517
	TOTAL		4,167,803 (Say ₱ 4.17 M/pier)	1,670,714 (Say ₱ 1.67 M/pier)	1,417,275 (Say ₱ 1.42 M/pier)	2,376,805 (Say ₱ 2.38 M/pier)
35 M	1.2 x (cost of span 30 M)		₱ 5.00 M / pier	₱ 2.00 M / pier	₱ 1.70 M / pier	₱ 2.85 M / pier
40 M	1.4 x (cost of span 30 M)		₱ 5.83 M / pier	₱ 2.34 M / pier	₱ 1.98 M / pier	₱ 3.33 M / pier
Cost of Sub Structure (on pile)	30 M	Unit Price of Pile ₱ 2960 / LM	L = 10 4.17 M + 320 x 2960 = 5.12 M	1.67 M + (150 x 2960) = 2.11 M	1.42 M + (120 x 2960) = 1.77 M	2.38 M + (220 x 2960) = 3.03 M
			L = 15 4.17 M + 480 x 2960 = 5.59 M	1.67 M + (230 x 2960) = 2.34 M	1.42 M + (180 x 2960) = 1.95 M	2.38 M + (330 x 2960) = 3.35 M
			L = 20 4.17 M + 640 x 2960 = 6.06 M	1.67 M + (300 x 2960) = 2.56 M	1.42 M + (240 x 2960) = 2.13 M	2.38 M + (440 x 2960) = 3.68 M
	35 M		10 5.00 M+(320x2960)x1.2 = 6.14 M	2.00 M + (150 x 2960) x 1.2 = 2.35 M	1.70 M + (120 x 2960) x 1.2 = 2.13 M	2.85 M + (220 x 2960) x 1.2 = 3.63 M
			15 5.00 M+(480x2960)x1.2 = 6.71 M	2.00 M + (230 x 2960) x 1.2 = 2.60 M	1.70 M + (180 x 2960) x 1.2 = 2.34 M	2.85 M + (330 x 2960) x 1.2 = 4.02 M
			20 5.00 M+(640x2960)x1.2 = 7.27 M	2.00 M + (300 x 2960) x 1.2 = 2.82 M	1.70 M + (240 x 2960) x 1.2 = 2.55 M	2.85 M + (440 x 2960) x 1.2 = 4.42 M
	40 M		10 5.83 M+(320x2960)x1.4 = 7.16 M	2.34 M + (150 x 2960) x 1.4 = 2.74 M	1.98 M + (120 x 2960) x 1.4 = 2.48 M	3.33 M + (220 x 2960) x 1.4 = 4.24 M
			15 5.83 M+(480x2960)x1.4 = 7.82 M	2.34 M + (230 x 2960) x 1.4 = 3.03 M	1.98 M + (180 x 2960) x 1.4 = 2.73 M	3.33 M + (330 x 2960) x 1.4 = 4.70 M
			20 5.83 M+(640x2960)x1.4 = 8.49 M	2.34 M + (300 x 2960) x 1.4 = 3.29 M	1.98 M + (240 x 2960) x 1.4 = 2.98 M	3.33 M + (440 x 2960) x 1.4 = 5.15 M
			10 32 L = 320 M	15 L = 150 M	12 L = 120 M	22 L = 220 M
			15 L = 480 M	L = 225 M	L = 180 M	L = 330 M
			20 L = 640 M	L = 300 M	L = 240 M	L = 440 M

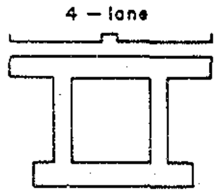
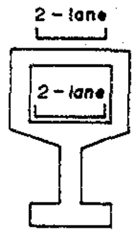
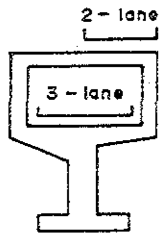
Rigid Frame : Third Level
Center Ramp

	ITEM	NUMBER OF LANES			
		4-Lane	4-Lane	2-Lane	1-Lane (Ramp)
SPAN LENGTH		Rigid Frame : Third Level 	Center Ramp 		
30 M	Quantities 1) Excavation (m³)	16.0 x 9.0 x 2.9 = 417.6	15.0 x 7.0 x 3.1 = 325.5		
	2) Lean Conc. (m³)	15.2 x 8.2 x 0.1 = 12.5	14.2 x 6.2 x 0.1 = 8.8		
	3) Footing (m³)	15.0 x 8.0 x 1.8 = 216.0	14.0 x 6.0 x 2.0 = 168.0		
	4) Column (m³)	2.5 x 2.5 x 16.5 x 2 = 206.3	3.0 x 2.5 x 6.5 x 2 = 97.5		
	5) Coping (m³)	1.8x2.5x18.3+(12+18.3)x0.7/2x2.5 = 108.9	1.8x2.5x24.7+(3.0+8.55)x1.2/2x2.5x2 = 145.8		
	6) Re-Bar (kg)	216x70+206.3x200+108.9x230 = 81427	168.0x70+97.5x200+145.8x230 = 64794		
	Unit Price				
(Spread Footing)	Cost 1) ₱ 305 /m³	127,368	99,278	0	0
	2) ₱ 2710 /m³	33,777	23,859	0	0
	3) ₱ 4135 /m³	893,160	694,680	0	0
	4) ₱ 4510 /m³	930,188	439,725	0	0
	5) ₱ 4510 /m³	490,970	657,558	0	0
	6) ₱ 28.8 /kg	2,345,098	1,866,067	0	0
	TOTAL	4,820,560 (Say ₱ 4.82 M/pier)	3,781,167 (Say ₱ 3.78 M/pier)	0 (Say ₱ 0.00 M/pier)	0 (Say ₱ 0.00 M/pier)
35 M	1.2 x (cost of span 30 M)	₱ 5.78 M / pier	₱ 4.54 M / pier	₱ 0.00 M / pier	₱ 0.00 M / pier
40 M	1.4 x (cost of span 30 M)	₱ 6.75 M / pier	₱ 5.29 M / pier	₱ 0.00 M / pier	₱ 0.00 M / pier
Cost of Sub Structure (on pile)	30 M — Unit Price of Pile ₱ 2960 / LM	L = 10 4.82 M + 360 x 2960 = 5.77 M	L = 10 3.78 M + 320 x 2960 = 4.73 M	0.00 = 0.00 M	0.00 = 0.00 M
		L = 15 4.82 M + 540 x 2960 = 6.25 M	L = 15 3.78 M + 480 x 2960 = 5.20 M	0.00 = 0.00 M	0.00 = 0.00 M
		L = 20 4.82 M + 720 x 2960 = 6.73 M	L = 20 3.78 M + 640 x 2960 = 5.68 M	0.00 = 0.00 M	0.00 = 0.00 M
	35 M	10 5.78 M+(360x2960)x1.2 = 6.93 M	10 4.54 M+(320x2960)x1.2 = 5.67 M	0.00 = 0.00 M	0.00 = 0.00 M
		15 5.78 M+(540x2960)x1.2 = 7.50 M	15 4.54 M+(480x2960)x1.2 = 6.24 M	0.00 = 0.00 M	0.00 = 0.00 M
		20 5.78 M+(720x2960)x1.2 = 8.07 M	20 4.54 M+(640x2960)x1.2 = 6.81 M	0.00 = 0.00 M	0.00 = 0.00 M
	40 M	10 6.75 M+(360x2960)x1.4 = 8.08 M	10 5.29 M+(320x2960)x1.4 = 6.62 M	0.00 = 0.00 M	0.00 = 0.00 M
		15 6.75 M+(540x2960)x1.4 = 8.75 M	15 5.29 M+(480x2960)x1.4 = 7.28 M	0.00 = 0.00 M	0.00 = 0.00 M
		20 6.75 M+(720x2960)x1.4 = 9.42 M	20 5.29 M+(6400x2960)x1.4 = 7.95 M	0.00 = 0.00 M	0.00 = 0.00 M
		10 36 L = 360 M	10 32 L = 320 M	L = 0 M	L = 0 M
		15 L = 540 M	15 L = 480 M	L = 0 M	L = 0 M
		20 L = 720 M	20 L = 640 M	L = 0 M	L = 0 M

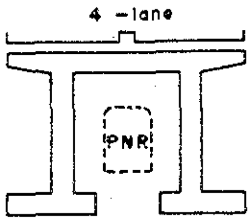
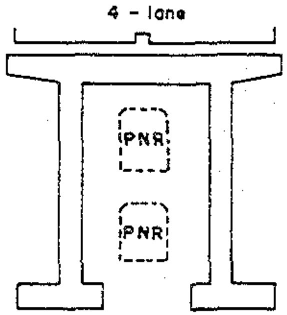
Special Type – 1

SPAN LENGTH	ITEM		NUMBER OF LANES: 2–Lane Separate	1–Lane Double	4–Lane + 1–Lane	3–Lane
						
30 M	Quantities	1) Excavation (m³)	13.0 x 8.0 x 3.4 = 353.6	9.0 x 9.0 x 3.1 = 251.1	6.0 x 8.0 x 2.9 x2 = 278.4	=
		2) Lean Conc. (m³)	12.2 x 8.2 x 0.1 = 10.0	8.2 x 8.2 x 0.1 = 6.7	5.2 x 7.2 x 0.1 x 2 = 7.5	=
		3) Footing (m³)	12.0x8.0x1.8+(5.0+12.0)x0.5/2x8.0 = 206.8	8.0x8.0x1.5+(3.5+8.0)x0.5/2x8.0 = 119.0	5.0x7.0x1.8x2+(3.5+2.5)x0.5/2x7.0 = 136.5	=
		4) Column (m³)	(4.0+5.0)x6.7/2x3.0+(2.5+3.0)x7.5/2x3.0 = 152.3	2.5x2.5x10.0+1.6x2.5x5.5x2 = 106.5	2.5x2.2x6.7x2+2.5x2.2x6.0 = 106.7	=
		5) Coping (m³)	1.8x3.0x9.95x2+1.0x2.5/2x3.0x2 = 115.0	1.8x2.5x9+1.8x2.5x10+(2.5+9)x1.5/2x2.5 = 107.1	1.8x2.2x26+1.8x2.2x9+(2.5+9)x1.2/2x2.2 = 153.8	=
		6) Re–Bar (kg)	206.8x70+152.3x200+115.0x230 = 71386	119x70+106.5x200+107.1x230 = 54263	136.5x70+106.7x200+153.8x230 = 66269	=
		Unit Price				
(Spread Footing)	Cost	1) ₱ 305 /m³	107,848	76,586	84,912	0
		2) ₱ 2710 /m³	27,111	18,222	20,292	0
		3) ₱ 4135 /m³	855,118	492,065	564,428	0
		4) ₱ 4510 /m³	686,986	480,315	481,217	0
		5) ₱ 4510 /m³	518,470	482,852	693,548	0
		6) ₱ 28.8 /kg	2,055,917	1,562,774	1,908,547	0
	TOTAL		4,251,449 (Say ₱ 4.25 M/pier)	3,112,814 (Say ₱ 3.11 M/pier)	3,752,944 (Say ₱ 3.75 M/pier)	0 (Say ₱ 0.00 M/pier)
35 M	1.2 x (cost of span 30 M)		₱ 5.10 M / pier	₱ 3.74 M / pier	₱ 4.50 M / pier	₱ 0.00 M / pier
40 M	1.4 x (cost of span 30 M)		₱ 5.95 M / pier	₱ 4.36 M / pier	₱ 5.25 M / pier	₱ 0.00 M / pier
Cost of Sub Structure (on pile)	30 M	Unit Price of Pile ₱ 2960 / LM	L = 10 4.25 M + (340 x 2960) = 5.26 M	3.11 M + (240 x 2960) = 3.82 M	3.75 M + (340 x 2960) = 4.76 M	0.00 M + (0 x 2960) = 0.00 M
			L = 15 4.25 M + (510 x 2960) = 5.76 M	3.11 M + (360 x 2960) = 4.18 M	3.75 M + (510 x 2960) = 5.26 M	0.00 M + (0 x 2960) = 0.00 M
			L = 20 4.25 M + (680 x 2960) = 6.26 M	3.11 M + (480 x 2960) = 4.53 M	3.75 M + (680 x 2960) = 5.77 M	0.00 M + (0 x 2960) = 0.00 M
	35 M		10 5.10 M + (340 x 2960) x 1.2 = 6.31 M	3.74 M + (240 x 2960) x 1.2 = 4.59 M	4.50 M + (340 x 2960) x 1.2 = 5.71 M	0.00 M + (0 x 2960) x 1.2 = 0.00 M
			15 5.10 M + (510 x 2960) x 1.2 = 6.91 M	3.74 M + (360 x 2960) x 1.2 = 5.01 M	4.50 M + (510 x 2960) x 1.2 = 6.32 M	0.00 M + (0 x 2960) x 1.2 = 0.00 M
			20 5.10 M + (680 x 2960) x 1.2 = 7.52 M	3.74 M + (480 x 2960) x 1.2 = 5.44 M	4.50 M + (680 x 2960) x 1.2 = 6.92 M	0.00 M + (0 x 2960) x 1.2 = 0.00 M
	40 M		10 5.95 M + (340 x 2960) x 1.4 = 7.36 M	4.36 M + (240 x 2960) x 1.4 = 5.35 M	5.25 M + (340 x 2960) x 1.4 = 6.66 M	0.00 M + (0 x 2960) x 1.4 = 0.00 M
			15 5.95 M + (510 x 2960) x 1.4 = 8.07 M	4.36 M + (360 x 2960) x 1.4 = 5.85 M	5.25 M + (510 x 2960) x 1.4 = 7.37 M	0.00 M + (0 x 2960) x 1.4 = 0.00 M
			20 5.95 M + (680 x 2960) x 1.4 = 8.77 M	4.36 M + (480 x 2960) x 1.4 = 6.35 M	5.25 M + (680 x 2960) x 1.4 = 8.07 M	0.00 M + (0 x 2960) x 1.4 = 0.00 M
			10 34 L = 340 M	24 L = 240 M	34 L = 340 M	0 L = 0 M
			15 L = 510 M	L = 360 M	L = 510 M	L = 0 M
			20 L = 680 M	L = 480 M	L = 680 M	L = 0 M

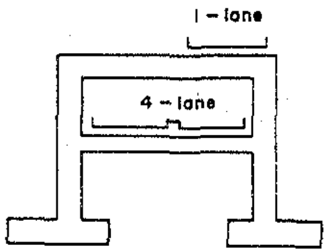
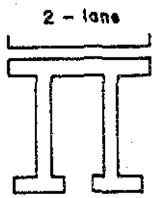
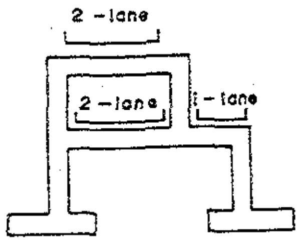
Double Deck and Rigid Frame : Second Level

SPAN LENGTH	ITEM		NUMBER OF LANES 4-Lane	2-Lane	1-Lane (Ramp)	3-Lane
						
30 M	Quantities	1) Excavation (m³)	17.0 x 7.0 x 2.6 = 309.4	11.0 x 10.0 x 3.5 = 385.0		12.0 x 10.0 x 3.8 = 456.0
		2) Lean Conc. (m³)	17.2 x 6.2 x 0.1 = 10.7	10.2 x 9.2 x 0.1 = 9.4		11.2 x 9.2 x 0.1 = 10.3
		3) Footing (m³)	16.0 x 6.0 x 1.5 = 144.0	10x9.x1.8 +(4+10)x.7/2x4.+2(4.9x2.5)/2 = 193.9		11x9x2 +(4+11)x.7/2x4+2x(5.25x2.5)/2 = 232.1
		4) Column (m³)	2.2 x 2.0 x 7.2 x 2 = 63.4	3.5x3x6.2 +2.0x3x5.8x2 = 134.7		3.5x3x6.2 +2.2x3x5.8x2 = 141.7
		5) Coping (m³)	1.8x2.0x18.3+(2.2+6.15)x0.7/2x30x2 = 83.4	1.8x3x13+(3.5+13.6)x15/2x3+1.8x3x14.4 = 189.7		1.8x3x16.9+(3.5+16.9)x15/2x3+1.8x3x17.7 = 232.7
		6) Re-Bar (kg)	144x70+63.4x200 +83.4x230 = 41942	193.9x70+134.7x200+189.7x230 = 84144		232.1x70+141.7x200+232.7x230 = 98108
		Unit Price				
(Spread Footing)	Cost	1) ₱ 305 /m³	94,367	117,425	0	139,080
		2) ₱ 2710 /m³	28,899	25,431	0	27,924
		3) ₱ 4135 /m³	595,440	801,570	0	959,837
		4) ₱ 4510 /m³	285,754	607,497	0	638,887
		5) ₱ 4510 /m³	376,202	855,434	0	1,049,657
		6) ₱ 28.8 /kg	1,207,930	2,423,347	0	2,825,510
	TOTAL		2,588,591 (Say ₱ 2.59 M/pier)	4,830,704 (Say ₱ 4.83 M/pier)	0 (Say ₱ 0.00 M/pier)	5,640,895 (Say ₱ 5.64 M/pier)
35 M	1.2 x (cost of span 30 M)		₱ 3.11 M / pier	₱ 5.80 M / pier	₱ 0.00 M / pier	₱ 6.77 M / pier
40 M	1.4 x (cost of span 30 M)		₱ 3.62 M / pier	₱ 6.76 M / pier	₱ 0.00 M / pier	₱ 7.90 M / pier
Cost of Sub Structure (on pile)	30 M	Unit Price of Pile ₱ 2960 / LM	L = 10 2.59 M + 260 x 2960 = 3.36 M	4.83 M + (360 x 2960) = 5.90 M	0.00 ≈ 0.00	5.64 M + 440 x 2960 = 6.94 M
			L = 15 2.59 M + 390 x 2960 = 3.74 M	4.83 M + (540 x 2960) = 6.43 M	0.00 ≈ 0.00	5.64 M + 660 x 2960 = 7.59 M
			L = 20 2.59 M + 520 x 2960 = 4.13 M	4.83 M + (720 x 2960) = 6.96 M	0.00 ≈ 0.00	5.64 M + 880 x 2960 = 8.25 M
	35 M		10 3.11 M+(260x2960)x1.2 = 4.03 M	5.80 M + (360 x 2960) x 1.2 = 7.08 M	0.00 ≈ 0.00	6.77 M + (440 x 2960) x 1.2 = 8.33 M
			15 3.11 M+(390x2960)x1.2 = 4.49 M	5.80 M + (540 x 2960) x 1.2 = 7.71 M	0.00 ≈ 0.00	6.77 M + (660 x 2960) x 1.2 = 9.11 M
			20 3.11 M+(520x2960)x1.2 = 4.95 M	5.80 M + (720 x 2960) x 1.2 = 8.35 M	0.00 ≈ 0.00	6.77 M + (880 x 2960) x 1.2 = 9.89 M
	40 M		10 3.62 M+(260x2960)x1.4 = 4.70 M	6.76 M + (360 x 2960) x 1.4 = 8.25 M	0.00 ≈ 0.00	7.90 M + (440 x 2960) x 1.4 = 9.72 M
			15 3.62 M+(390x2960)x1.4 = 5.24 M	6.76 M + (540 x 2960) x 1.4 = 9.00 M	0.00 ≈ 0.00	7.90 M + (660 x 2960) x 1.4 = 10.63 M
			20 3.62 M+(520x2960)x1.4 = 5.78 M	6.76 M + (720 x 2960) x 1.4 = 9.75 M	0.00 ≈ 0.00	7.90 M + (880 x 2960) x 1.4 = 11.54 M
			10 26 L = 260 M	36 L = 360 M	0 ≈ 0	44 L = 440 M
			15 L = 390 M	L = 540 M	≈ 0	L = 660 M
			20 L = 520 M	L = 720 M	≈ 0	L = 880 M

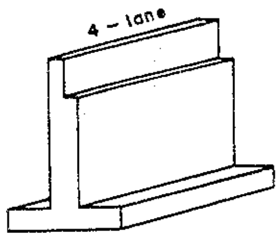
Structure Over PNR :

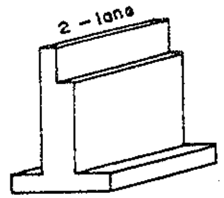
		ITEM	NUMBER OF LANES			
			4-Lane	4-Lane	2-Lane	1-Lane (Ramp)
SPAN LENGTH			**Second Level** 	**Third Level** 		
	Quanti-ties	1) Excavation (m³)	4.0 x 8.0 x 2.6 x 2 = 166.4	4.0 x 9.0 x 3.6 x 2 = 259.2		
		2) Lean Conc. (m³)	3.2 x 7.2 x 0.1 x 2 = 4.6	3.2 x 8.2 x 0.1 x 2 = 5.2		
		3) Footing (m³)	3.0 x 7.0 x 2.0 x 2 = 84.0	3.0 x 8.0 x 2.5 x 2 = 120.0		
		4) Column (m³)	2.5 x 2.5 x 6.0 x 2 = 75.0	2.5 x 2.5 x 14.0 x 2 = 175.0		
		5) Coping (m³)	1.8x2.5x18.3+(2.5+9.15)x0.7/2x2.5x2 = 102.7	1.8x2.5x18.3+(2.5+9.15)x0.7/2x2.5x2 = 102.7		
30 M		6) Re-Bar (kg)	84x70+75x200+102.7x230 = 44501	120x70+175x200+102.7x230 = 67021		
		Unit Price				
(Spread Footing)	Cost	1) ₱ 305 /m³	50,752	79,056	0	0
		2) ₱ 2710 /m³	12,488	14,222	0	0
		3) ₱ 4135 /m³	347,340	496,200	0	0
		4) ₱ 4510 /m³	338,250	789,250	0	0
		5) ₱ 4510 /m³	463,346	463,346	0	0
		6) ₱ 28.8 /kg	1,281,629	1,930,205	0	0
			2,493,805	3,772,279	0	0
		TOTAL	(Say ₱ 2.49 M/pier)	(Say ₱ 3.77 M/pier)	(Say ₱ 0.00 M/pier)	(Say ₱ 0.00 M/pier)
35 M		1.2 x (cost of span 30 M)	₱ 2.99 M / pier	₱ 4.53 M / pier	₱ 0.00 M / pier	₱ 0.00 M / pier
40 M		1.4 x (cost of span 30 M)	₱ 3.49 M / pier	₱ 5.28 M / pier	₱ 0.00 M / pier	₱ 0.00 M / pier
Cost of Sub Structure (on pile)	30 M	Unit Price of Pile ₱ 23175 / LM	L = 10 2.49 M + 60 x 23175 = 3.88 M	L = 10 3.77 M + 80 x 23175 = 5.63 M	0.00 = 0.00 M	0.00 = 0.00 M
			L = 15 2.49 M + 90 x 23175 = 4.58 M	L = 15 3.77 M + 120 x 23175 = 6.55 M	0.00 = 0.00 M	0.00 = 0.00 M
			L = 20 2.49 M + 120 x 23175 = 5.27 M	L = 20 3.77 M + 160 x 23175 = 7.48 M	0.00 = 0.00 M	0.00 = 0.00 M
	35 M		10 2.99 M+(60x23175)x1.2 = 4.66 M	10 4.53 M+(80x23175)x1.2 = 6.75 M	0.00 = 0.00 M	0.00 = 0.00 M
			15 2.99 M+(90x23275)x1.2 = 5.50 M	15 4.53 M+(120x23175)x1.2 = 7.86 M	0.00 = 0.00 M	0.00 = 0.00 M
			20 2.99 M+(120x23175)x1.2 = 6.33 M	20 4.53 M+(160x23175)x1.2 = 8.98 M	0.00 = 0.00 M	0.00 = 0.00 M
	40 M		10 3.49 M+(60x23175)x1.4 = 5.44 M	10 5.28 M+(80x23175)x1.4 = 7.88 M	0.00 = 0.00 M	0.00 = 0.00 M
			15 3.49 M+(90x23175)x1.4 = 6.41 M	15 5.28 M+(120x23175)x1.4 = 9.17 M	0.00 = 0.00 M	0.00 = 0.00 M
			20 3.49 M+(120x23175)x1.4 = 7.38 M	20 5.28 M+(160x23175)x1.4 = 10.47 M	0.00 = 0.00 M	0.00 = 0.00 M
			10 6 L = 60 M	10 8 L = 80 M	0 L = 0 M	0 L = 0 M
			15 L = 90 M	15 L = 120 M	L = 0 M	L = 0 M
			20 L = 120 M	20 L = 160 M	L = 0 M	L = 0 M

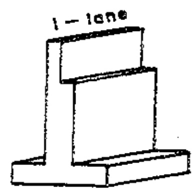
Special Type

SPAN LENGTH	ITEM		4-Lane + 1 Lane Special Type - 2	2 - Lane Special Type - 3	2 - Lane Special Type - 3
					
30 M	Quantities	1) Excavation (m³)	6.0 x 9.0 x 3.0 x 2 = 324.0	3.5 x 7.0 x 3.5 x 2 = 171.5	7.0 x 8.0 x 2.8 x 2 = 313.6
		2) Lean Conc. (m³)	5.2 x 8.2 x 0.1 x 2 = 8.5	2.7 x 6.2 x 0.1 x 2 = 3.3	6.2 x 7.2 x 0.1 x 2 = 8.9
		3) Footing (m³)	5.0 x 8.0 x 2.0 x 2 = 160.0	2.5 x 6.0 x 2.5 x 2 = 75.0	6.0 x 7.0 x 1.7 x 2 = 142.6
		4) Column (m³)	2.5 x 2.2 x 8.0 x 2 + 2.5 x 2.2 x 6.0 x 2 = 154.0	1.5 x 2.0 x 8.0 x 2 = 48.0	2.2 x 2.5 x 15.0 + 2.2 x 2.5 x 9.0 + 2.2 x 2.5 x 7.3 = 172.2
		5) Coping (m³)	1.8 x 2.2 x 25 + 2.0 x 2.2 x 20.0 = 187.0	1.8 x 2.0 x 12.0 = 43.2	1.8 x 2.5 x 19.0 + 1.8 x 2.5 x 10.6 = 133.2
		6) Re-Bar (kg)	160 x 70 + 154 x 200 + 187 x 230 = 85010	75.0 x 70 + 48.0 x 200 + 43.2 x 230 = 24786	142.8 x 70 + 172.2 x 200 + 133.2 x 230 = 75072
(Spread Footing)	Cost	Unit Price			
		1) ₱ 305 /m³	98,820	52,308	95,648
		2) ₱ 2710 /m³	23,111	9,073	24,195
		3) ₱ 4135 /m³	661,600	310,125	590,478
		4) ₱ 4510 /m³	694,540	216,480	776,397
		5) ₱ 4510 /m³	843,370	194,832	600,732
		6) ₱ 28.8 /kg	2,448,288	713,837	2,162,074
	TOTAL		4,769,729 (Say ₱ 4.77 M/pier)	1,496,654 (Say ₱ 1.50 M/pier)	4,249,523 (Say ₱ 4.25 M/pier)
35 M	1.2 x (cost of span 30 M)		₱ 5.72 M/pier	₱ 1.80 M/pier	₱ 5.10 M/pier
40 M	1.4 x (cost of span 30 M)		₱ 6.68 M/pier	₱ 2.10 M/pier	₱ 5.95 M/pier
Cost of Sub Structure (on pile)	30 M	Unit Price of Pile ₱ 2960 /LM	L = 10 | 4.77 M + (400 x 2960) = 5.95 M	L = 10 | 1.50 M + (40 x 23175) = 2.42 M	L = 10 | 4.25 M + (360 x 2960) = 5.32 M
			L = 15 | 4.77 M + (600 x 2960) = 6.55 M	L = 15 | 1.50 M + (60 x 23175) = 2.89 M	L = 15 | 4.25 M + (540 x 2960) = 5.85 M
			L = 20 | 4.77 M + (800 x 2960) = 7.14 M	L = 20 | 1.50 M + (80 x 23175) = 3.35 M	L = 20 | 4.25 M + (720 x 2960) = 6.38 M
	35 M		10 | 5.72 M + (400 x 2960) x 1.2 = 7.14 M	10 | 1.80 M + (40 x 23175) x 1.2 = 2.91 M	10 | 5.10 M + (360 x 2960) x 1.2 = 6.38 M
			15 | 5.72 M + (600 x 2960) x 1.2 = 7.85 M	15 | 1.80 M + (60 x 23175) x 1.2 = 3.46 M	15 | 5.10 M + (540 x 2960) x 1.2 = 7.02 M
			20 | 5.72 M + (800 x 2960) x 1.2 = 8.57 M	20 | 1.80 M + (80 x 23175) x 1.2 = 4.02 M	20 | 5.10 M + (720 x 2960) x 1.2 = 7.66 M
	40 M		10 | 6.68 M + (400 x 2960) x 1.4 = 8.34 M	10 | 2.10 M + (40 x 23175) x 1.4 = 3.39 M	10 | 5.95 M + (360 x 2960) x 1.4 = 7.44 M
			15 | 6.68 M + (600 x 2960) x 1.4 = 9.16 M	15 | 2.10 M + (60 x 23175) x 1.4 = 4.04 M	15 | 5.95 M + (540 x 2960) x 1.4 = 8.19 M
			20 | 6.68 M + (800 x 2960) x 1.4 = 9.99 M	20 | 2.10 M + (80 x 23175) x 1.4 = 4.69 M	20 | 5.95 M + (720 x 2960) x 1.4 = 8.93 M
			10 | 40 | L = 400 M	10 | 4 | L = 40 M	10 | 36 | L = 360 M
			15 | L = 600 M	15 | L = 60 M	15 | L = 540 M
			20 | L = 800 M	20 | L = 80 M	20 | L = 720 M

Abutment







SPAN LENGTH	ITEM		4-Lane (Standard)	4-Lane (Reduced)	2-Lane (Standard)	1-Lane (Ramp)
30 M	Quantities	1) Excavation (m³)	20.7 x 6.0 x 2.6 = 322.9 m³	=	13.7 x 6.0 x 2.6 = 213.7	7.2 x 5.0 x 2.6 = 93.6
		2) Lean Conc. (m³)	19.9 x 5.2 x 0.1 = 10.3	=	12.9 x 5.2 x 0.1 = 6.7	6.4 x 4.2 x 0.1 = 2.7
		3) Footing (m³)	19.7 x 5.0 x 1.5 = 147.8	=	12.7 x 5.0 x 1.5 = 95.3	6.2 x 4.0 x 1.0 = 24.8
		4) Column (m³)	1.5 x 19.7 x 4.0 = 118.2	=	12.7 x 1.5 x 4.0 = 76.2	6.2 x 1.2 x 4.0 = 29.8
		5) Coping (m³)	=	=	=	=
		6) Re-Bar (kg)	147.8 x 70 + 118.2 x 100 = 22166 kg	=	95.3 x 70 + 76.2 x 100 = 14291	24.8 x 70 + 29.8 x 100 = 4716
(Spread Footing)	Cost	Unit Price				
		1) ₱ 305 /m³	98,491	0	65,185	28,548
		2) ₱ 2710 /m³	28,043	0	18,179	7,264
		3) ₱ 4135 /m³	610,946	0	393,859	102,548
		4) ₱ 4510 /m³	533,082	0	343,662	134,218
		5) ₱ 4510 /m³	0	0	0	0
		6) ₱ 28.8 /kg	638,381	0	411,581	135,821
	TOTAL		1,908,943 (Say ₱ 1.91 M/pier)	0 (Say ₱ 0.00 M/pier)	1,232,465 (Say ₱ 1.23 M/pier)	408,419 (Say ₱ 0.41 M/pier)
35 M	1.2 x (cost of span 30 M)		₱ 2.29 M/pier	₱ 0.00 M/pier	₱ 1.48 M/pier	₱ 0.49 M/pier
40 M	1.4 x (cost of span 30 M)		₱ 2.67 M/pier	₱ 0.00 M/pier	₱ 1.73 M/pier	₱ 0.57 M/pier
Cost of Sub Structure (on pile)	30 M	Unit Price of Pile ₱ 2960 /LM — L = 10	1.91 M + (200 x 2960) = 2.50 M	0.00 M + (0 x 2960) = 0.00 M	1.23 M + (120 x 2960) = 1.59 M	0.41 M + (60 x 2960) = 0.59 M
		L = 15	1.91 M + (300 x 2960) = 2.80 M	0.00 M + (0 x 2960) = 0.00 M	1.23 M + (180 x 2960) = 1.77 M	0.41 M + (90 x 2960) = 0.67 M
		L = 20	1.91 M + (400 x 2960) = 3.09 M	0.00 M + (0 x 2960) = 0.00 M	1.23 M + (240 x 2960) = 1.94 M	0.41 M + (120 x 2960) = 0.76 M
	35 M	10	2.29 M + (200 x 2960) x 1.2 = 3.00 M	0.00 M + (0 x 2960) x 1.2 = 0.00 M	1.48 M + (120 x 2960) x 1.2 = 1.91 M	0.49 M + (60 x 2960) x 1.2 = 0.70 M
		15	2.29 M + (300 x 2960) x 1.2 = 3.36 M	0.00 M + (0 x 2960) x 1.2 = 0.00 M	1.48 M + (180 x 2960) x 1.2 = 2.12 M	0.49 M + (90 x 2960) x 1.2 = 0.81 M
		20	2.29 M + (400 x 2960) x 1.2 = 3.71 M	0.00 M + (0 x 2960) x 1.2 = 0.00 M	1.48 M + (240 x 2960) x 1.2 = 2.33 M	0.49 M + (120 x 2960) x 1.2 = 0.92 M
	40 M	10	2.67 M + (200 x 2960) x 1.4 = 3.50 M	0.00 M + (0 x 2960) x 1.4 = 0.00 M	1.73 M + (120 x 2960) x 1.4 = 2.22 M	0.57 M + (60 x 2960) x 1.4 = 0.82 M
		15	2.67 M + (300 x 2960) x 1.4 = 3.92 M	0.00 M + (0 x 2960) x 1.4 = 0.00 M	1.73 M + (180 x 2960) x 1.4 = 2.47 M	0.57 M + (90 x 2960) x 1.4 = 0.94 M
		20	2.67 M + (400 x 2960) x 1.4 = 4.33 M	0.00 M + (0 x 2960) x 1.4 = 0.00 M	1.73 M + (240 x 2960) x 1.4 = 2.72 M	0.57 M + (120 x 2960) x 1.4 = 1.07 M
		10	20 L = 200 M	0 L = 0 M	12 L = 120 M	6 L = 60 M
		15	L = 300 M	L = 0 M	L = 180 M	L = 90 M
		20	L = 400 M	L = 0 M	L = 240 M	L = 120 M

C. BASE COSTS OF EXPRESSWAY MISCELLANEOUS

COST OF EXPRESSWAY MISCELLANEOUS PER KM.

	1 – lane	2 – lane	4 – lane
Pavement Marking	1,000 m^2 ₱ 475,000	800 m^2 ₱ 380,000	1,600 m^2 ₱ 760,000
Road Sign (small)	6 x ₱ 7,800 ₱ 47,000	8 x ₱ 7,800 ₱ 63,000	16 x ₱ 7,800 ₱ 125,000
Road Sign (large)	4 x ₱ 25,000 ₱ 100,000	5 x ₱ 25,000 ₱ 125,000	10 x ₱ 25,000 ₱ 250,000
Overhead Road Sign	2 x ₱ 190,000 ₱ 380,000	2 x ₱ 240,000 ₱ 480,000	2 x ₱ 346,000 ₱ 692,000
Street Lighting	₱ 1,950,000	₱ 2,800,000	₱ 3,500,000
Emergency Telephone and Communication System	₱ 450,000	₱ 450,000	₱ 900,000
Center Median Guard Rail	–	–	₱ 2,870,000
Noise Barrier ₱ 800,000/100 m	₱ 800,000	₱ 1,600,000	₱ 3,200,000
Total	₱ 4,202,000 Say ₱ 4,200,000	₱ 5,898,000 Say ₱ 5,900,000	₱ 12,297,000 Say ₱ 12,300,000

Cost Component of Expresssway Miscellaneous Per Km : 1–Lane

	Cost Per Km	Component (%)			Component Cost		
		F	L	T	Foreign	Local	Tax
Pavement Marking	475,000	43	44	13	204,250	209,000	61,750
Road Sign (Small)	45,000	42	46	12	18,900	20,700	5,400
Road Sign (Large)	100,000	42	46	12	42,000	46,000	12,000
Overhead Road Sign	380,000	55	27	18	209,000	102,600	68,400
Street Lighting	1,950,000	55	27	18	1,072,500	526,500	351,000
Emergency Telephone	450,000	60	22	18	270,000	99,000	81,000
Center Median Guard Rail	–	62	20	18	0	0	0
Noise Barrier	800,000	65	17	18	520,000	136,000	144,000
Total	4,200,000	55.6	27.2	17.2	2,336,650	1,139,800	723,550

Cost Component of Expresssway Miscellaneous Per Km : 2–Lane

	Cost Per Km	Component (%)			Component Cost		
		F	L	T	Foreign	Local	Tax
Pavement Marking	380,000	43	44	13	163,400	167,200	49,400
Road Sign (Small)	65,000	42	46	12	27,300	29,900	7,800
Road Sign (Large)	125,000	42	46	12	52,500	57,500	15,000
Overhead Road Sign	480,000	55	27	18	264,000	129,600	86,400
Street Lighting	2,800,000	55	27	18	1,540,000	756,000	504,000
Emergency Telephone	450,000	60	22	18	270,000	99,000	81,000
Center Median Guard Rail	–	62	20	18	0	0	0
Noise Barrier	1,600,000	65	17	18	1,040,000	272,000	288,000
Total	5,900,000	56.9	25.6	17.5	3,357,200	1,511,200	1,031,600

Cost Component of Expresssway Miscellaneous Per Km : 4–Lane

	Cost Per Km	Component (%)			Component Cost		
		F	L	T	Foreign	Local	Tax
Pavement Marking	760,000	43	44	13	326,800	334,400	98,800
Road Sign (Small)	125,000	42	46	12	52,500	57,500	15,000
Road Sign (Large)	250,000	42	46	12	105,000	115,000	30,000
Overhead Road Sign	695,000	55	27	18	382,250	187,650	125,100
Street Lighting	3,500,000	55	27	18	1,925,000	945,000	630,000
Emergency Telephone	900,000	60	22	18	540,000	198,000	162,000
Center Median Guard Rail	2,870,000	62	20	18	1,779,400	574,000	516,600
Noise Barrier	3,200,000	65	17	18	2,080,000	544,000	576,000
Total	12,300,000	58.5	24.0	17.5	7,190,950	2,955,550	2,153,500