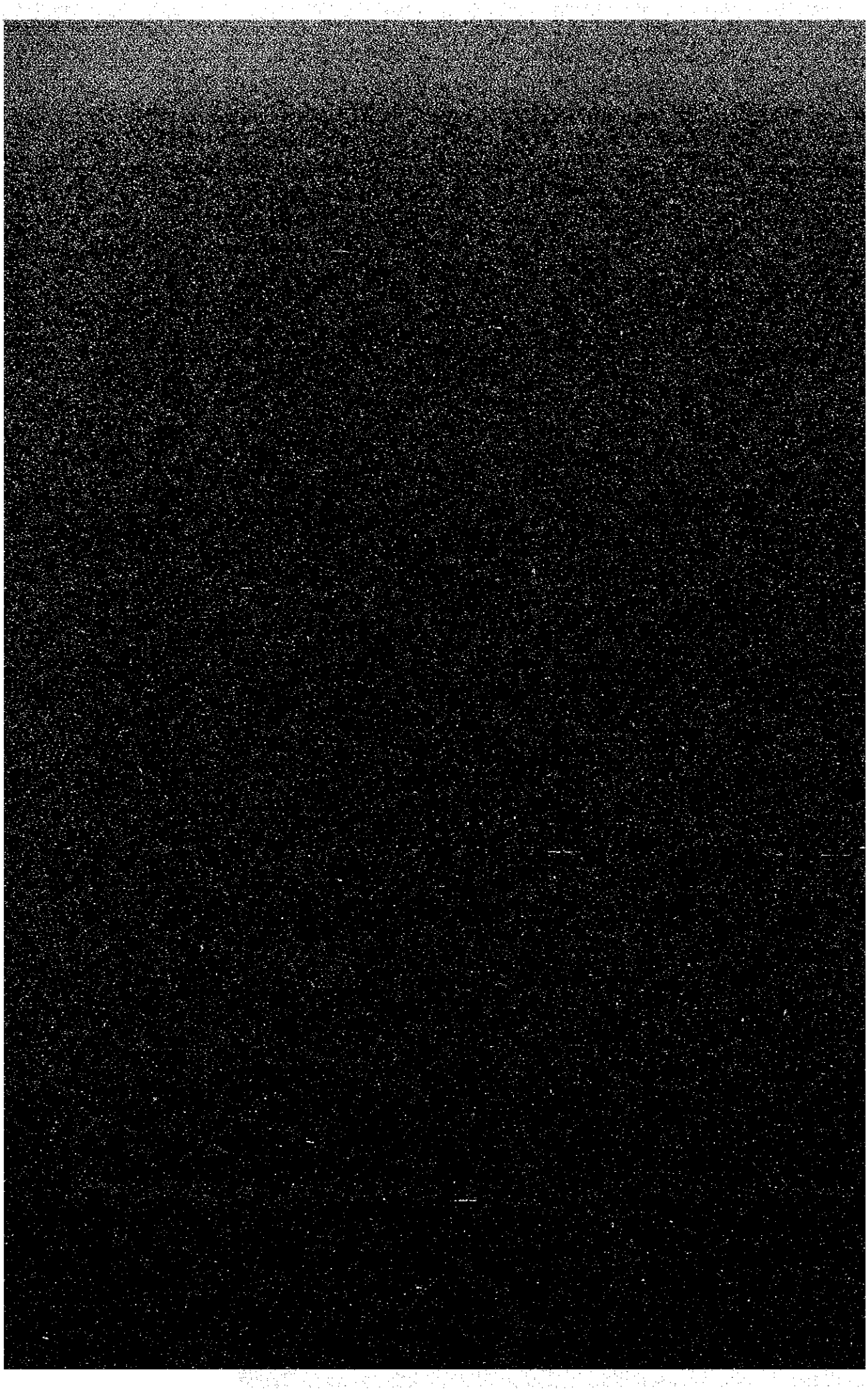
APPENDIXES FOR CHAPTER 8



APPENDIX NOTE 8.2 GEOLOGIC FORMATION OF THE ROADS AND EARTHWORK MATERIALS

8.2.1 Parañaque-Sucat Road (A-Route)

The geologic formation of the route consists of tuffaceous shale, silt stone and sand stone of the Neogen-Territary Quarternary, which is covered with silty clay and silty clayey sand in the hilly region and with sand, silty sand and silty clay in the coastal region. In the stretch between STA. 0+00 and STA. 5+400 the ground surface is covered with silty clayey sand and light brown silty clay mingled with some weathered shale and silt rock fragments, the standard penetration value N thereof being in the range of 11 - 40. The thickness of such a stratum is comparatively thin and is in the range of 1.5 - 3.0 m, which is adjacent to tuffaceous shale and silt stone of basal part. The ground water level in this area is about 3.0 m below the ground surface. Alluvium stratum (Fluviatile beach deposit) distributes in the stretch between STA. 5+400 and STA. 8+600, the thickness thereof increases abruptly from the STA. 7+800 and beyond.

Alluvium deposit here consists of light or dark gray coarse to fine sand with a little fine gravel and olive brownish gray silty clay with some fine sand, the standard penetration value of N thereof betting in the range of 1 - 15 in silty clay and 2 - 24 in the coarse of fine sand with gravel. The thickness of such stratum is in the range of 6.0 - 7.0 m in the stretch of STA. 5+400 to STA. 7+800 and 10.0 m - 11.5 m in the sea bottom in the stretch of STA. 7+800 to STA. 8+600.

The ground water level in this area is 0.5 - 1.5 m from the ground surface on the land side where the ground elevation is 0.7 m above sea level. Beneath such a soft stratum lies tuffaceous siltstone and sand stone as basal part. In such a stratum lies a thin stratum of corallian limestone of about 1.0 m in thickness, the standard penetration value of this thin stratum is in the range of 45/30 - 73/30 on its upper surface.

8.2.2 Zapote-Alabang Road (B-Route)

The geologic formation of this route consists of tuffaceous shale silt stone and sand stone of the Neogen-Teritary Quarternary, which is covered thickly with silty clay in the hilly region and with coarse to fine sand and silty clay in the coastal region of the Bay. Namely, in the stretch between the starting point of the route and STA. 9+00, which is the hilly region, is covered with light dark brown silty clay with a little fine sand, where the standard penetration value N is in the range of 8 - 25. Its thickness is in the range of 3.5 - 6.0 m and is adjacently in contact with tuffaceous shale, silt stone and sand stone of basal part. The ground water level in this route is in the depth of the range of 4.5 - 10.0 m below the ground surface.

In the stretch STA. 9+00 to STA. 11+600 of this route Alluvial

stratum (River Alluvial and Sea Slluvial) distributes, where the stratum thickness abruptly increase from STA. 11+400 and beyond. Such Alluvial stratum consists of light to dark gray coarse to fine sand with fine gravel and brown to olive gray silty clay with some fine sand, the standard penetration value N thereof remains in the range of 1.0 - 12.0 in silty clay and in the range of 4 - 47 in coarse to fine sand. The thickness of such stratum is in the range of 5.0 - 6.0 m in the stretch STA. 11+200 on the land side and in the thickness of about 11.0 m in the stretch STA. 11+200 to STA. 11+600 on the sea side.

Underneath of such soft stratum there lies the distribution of taffaceous shale, silt stone and sand stone as the basal part, the standard penetration value N thereof is in the range of 58/30 - 60/5 on the upper surface of the basal part.

8.2.3 Taguig-Las Piñas-Muntinlupa Loop Road (C-Route)

The geologic formation of this route consists of tuffaceous shale, silt stone and sand stone of Neogen-Tertiary Quarternary Pliocen Pleistocene Period as its basal part and soft stratum covering thereon. Tuffaceous shale, silt stone and sand stone here belong to soft rock, the standard penetration value N thereof remains in the range of 70/30 - 60/3, and its uni-axial compressive strength qu is in the range of 20 - 63 kg/cm^3.

The soft rock stratum covering such a basal part is brownish gray clayey silt and light gray silty clay with some fine sand and also light brown silty clayey sand, its standard penetration value N remains in the range of 8 - 30, and its thickness is in the range of 2.30 - 7.00 m.

In the river beds and vallyes, where usually the thickness of such coverings are thin, the basal part exposes on the ground surface directly and such characteristics are commonly observed on the whole length of the route.

The ground water level along this route is 3.0 - 10.0 m below the ground surface, comparatively deep compared with those on other routes.

Such geologic characteristic of this route gives a merit to structures to be built to enable economizing the type of their foundations resting footings directly on the exposed basal part of the ground without using any piles.

8.2.4 Fill Earthwork Materials

The following three locations were selected to test filling materials for the earthwork. Samples were tested with Compaction Test and CBR Test.

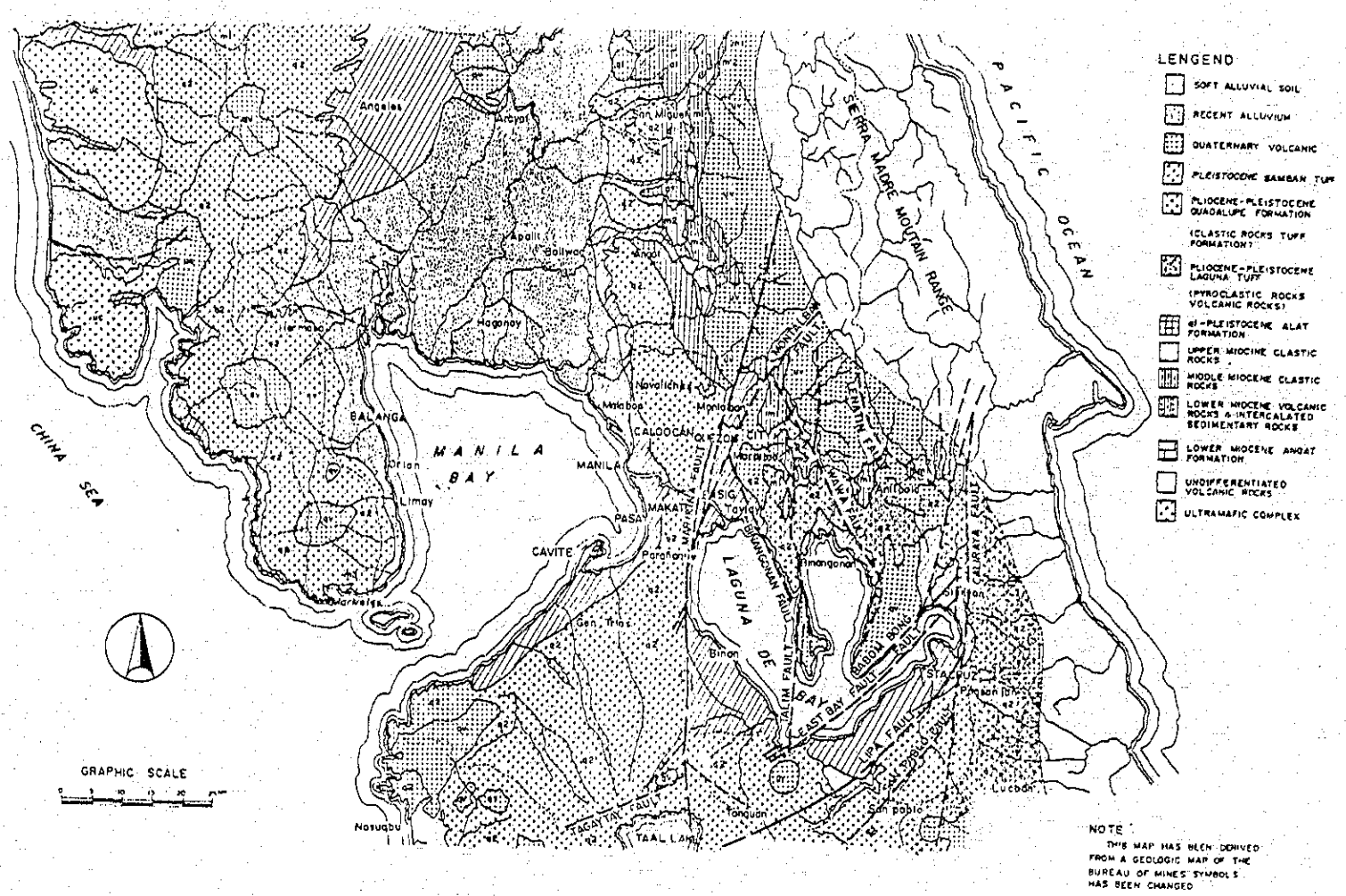
TP-1, 2, 3, sampled at Susana Height, Alabang, Muntinlupa.
TP-4, 5, 6, sampled at South Luzon Expressway, at San Pedro, Laguna.
TP7, 8, 9, sampled at South Luzon Expressway, at Patatan, Muntinlupa.

The results of these tests are presented in Appendix Table 8.2-2. According to Appendix Table the optimum moisture content is in the range of 16.0 - 40.5%, the maximum dry density in the range of 1.301 - 1.710 tons/m^3, the CBR value in the range of 4.6 - 19.7% in the case of 10 blows and if the maximum and minimum ones (TP 6 and 7) are excluded it is in the range of 5.4 - 12.7%, the average being 8.4%.

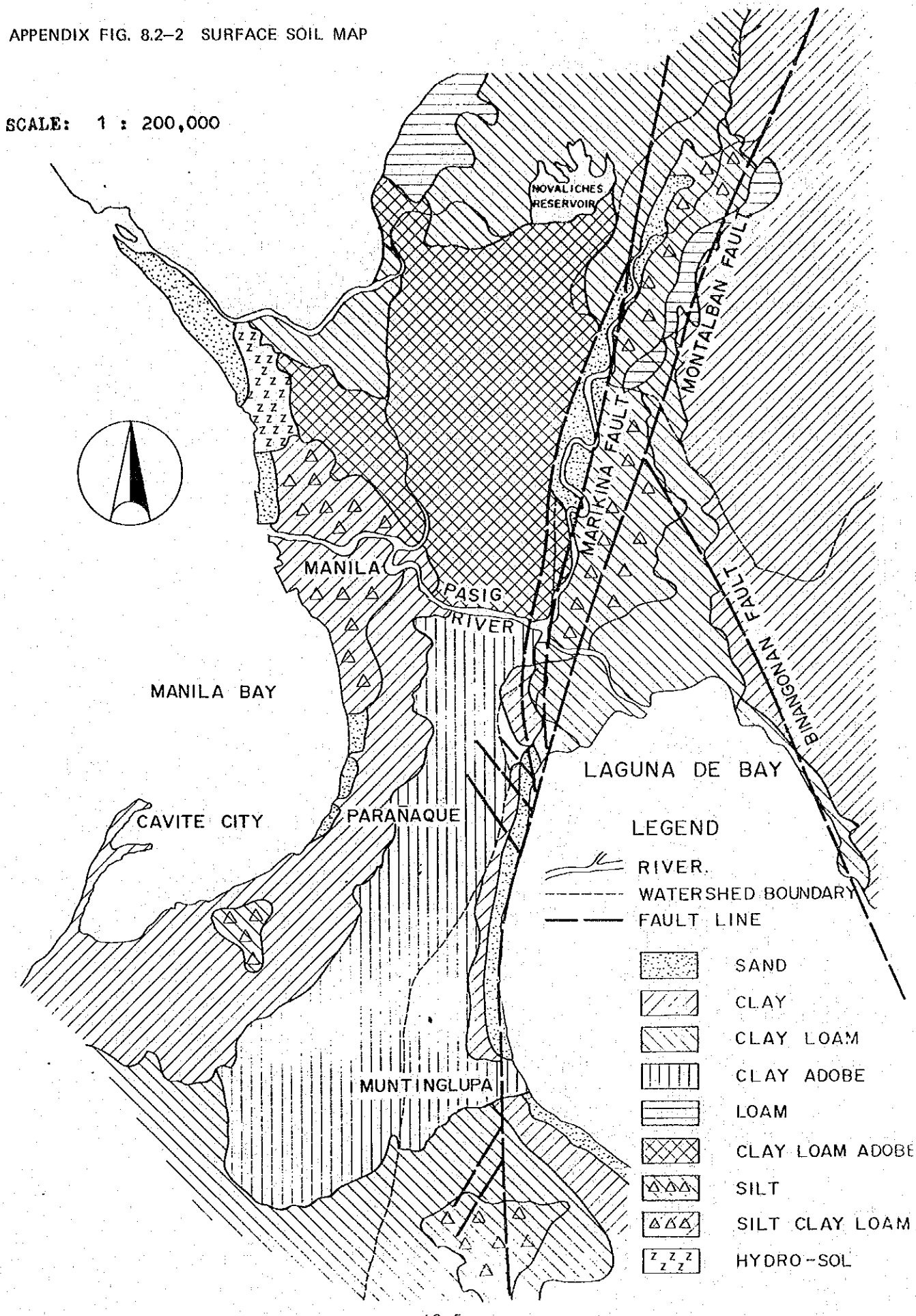
The results of Atterberg Limit Test conducted only for fine particles of soils show the Liquid Limit of 34% and the Plastic Index of 12%.

Based on these test results the filling materials sampled at the aforementioned locations are evaluated to be favorable for filling purpose in the earthwork.

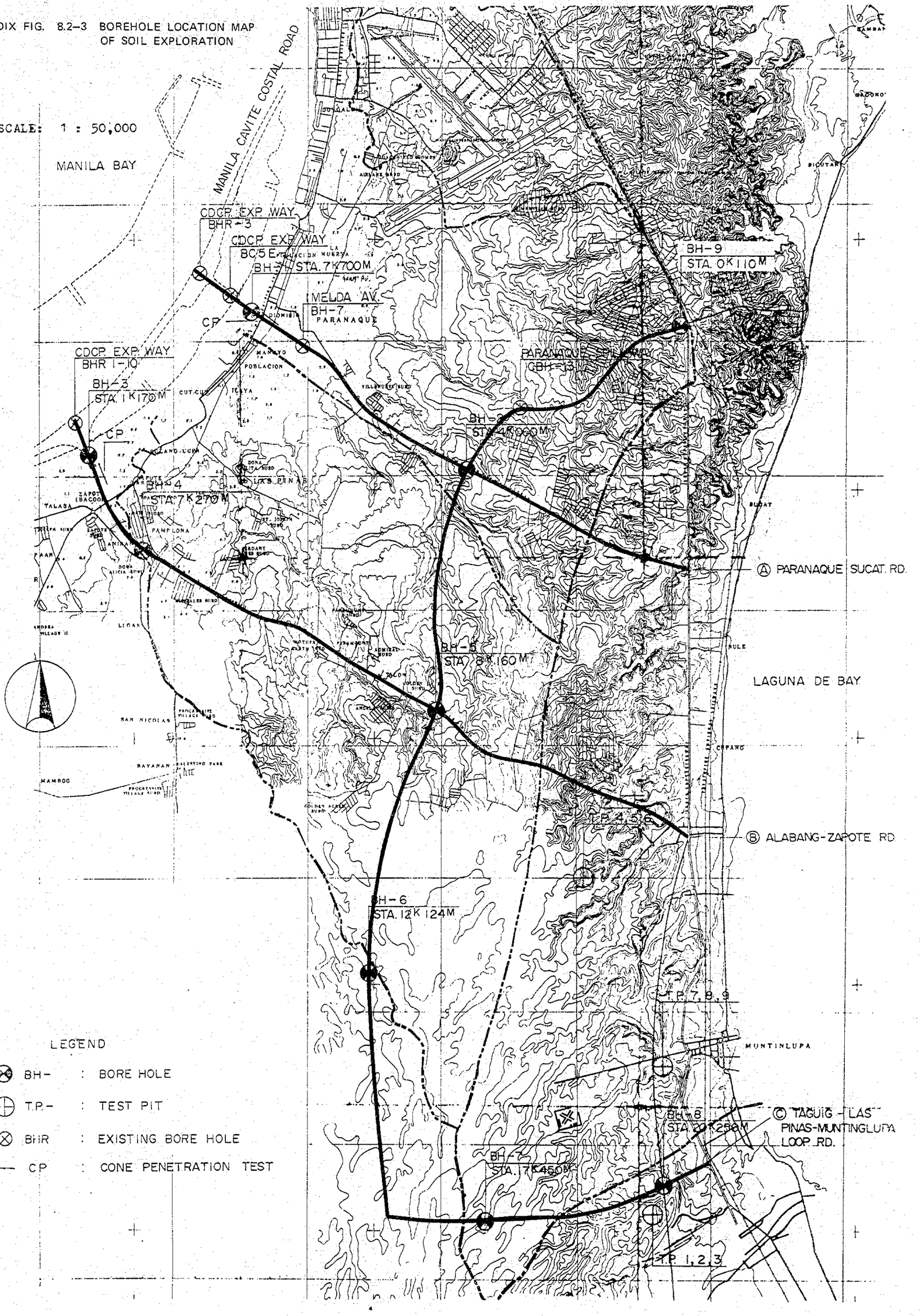
APPENDIX FIG. 8.2–1 GENERAL GEOLOGIC MAP SCALE: 1:1,000,000



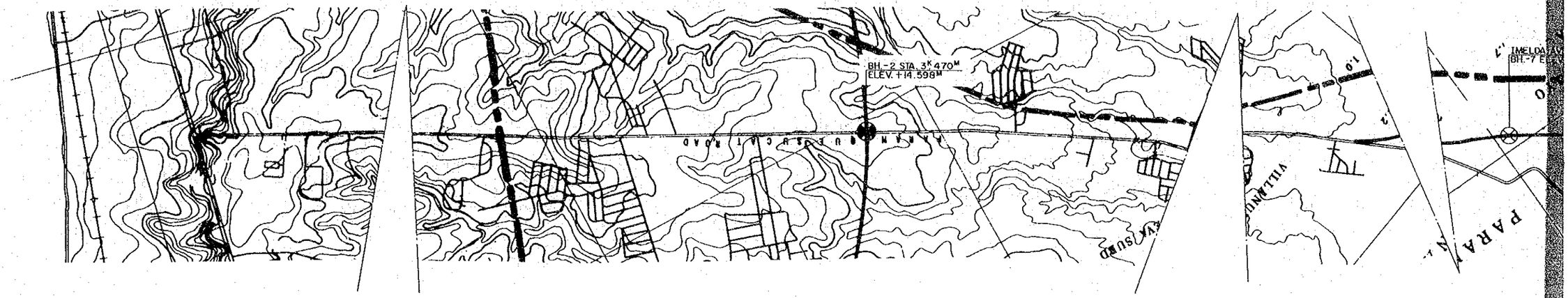
APPENDIX FIG. 8.2–2 SURFACE SOIL MAP



APPENDIX FIG. 8.2–3 BOREHOLE LOCATION MAP OF SOIL EXPLORATION



APPENDIX FIG. 8.2-4 SOIL PROFILE OF A-ROUTE

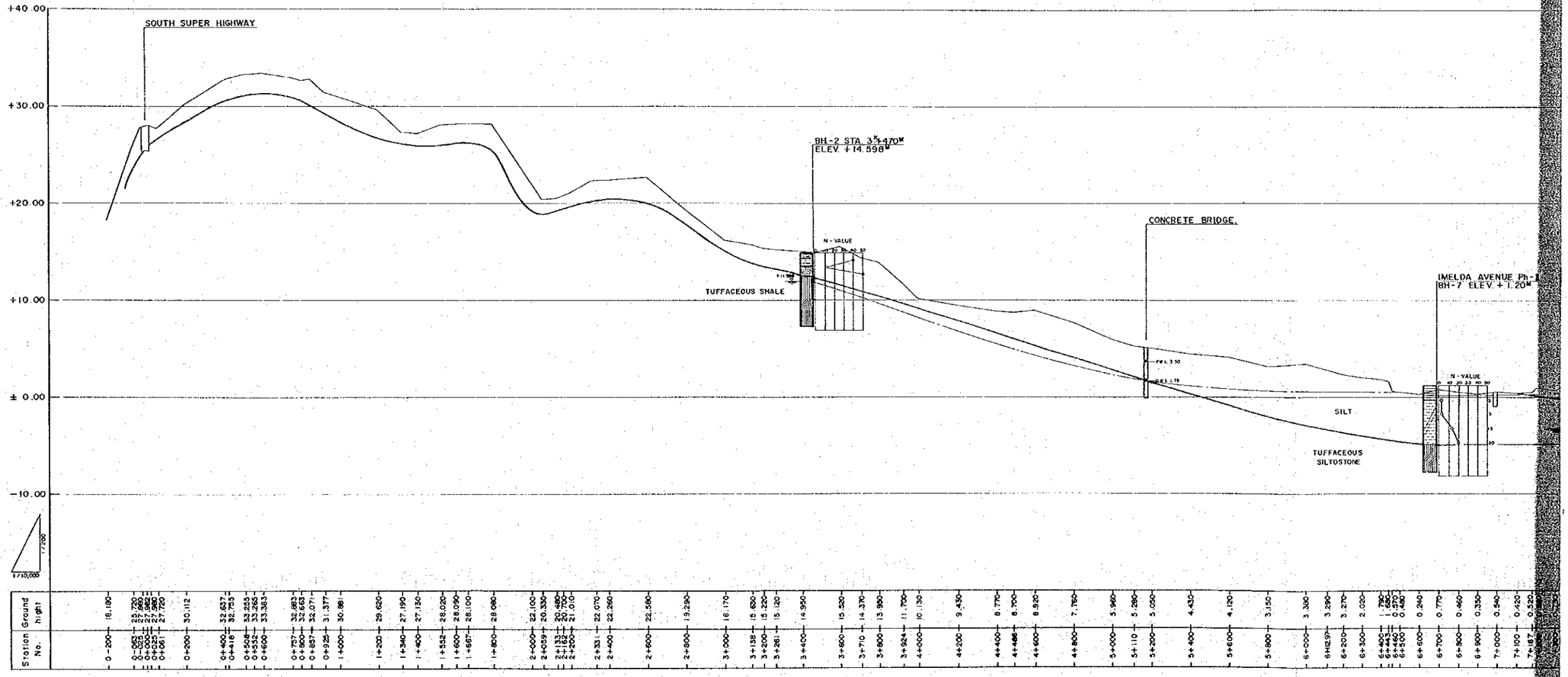


Ⓐ PARANAQUE - SUCAT ROAD

LEGEND.

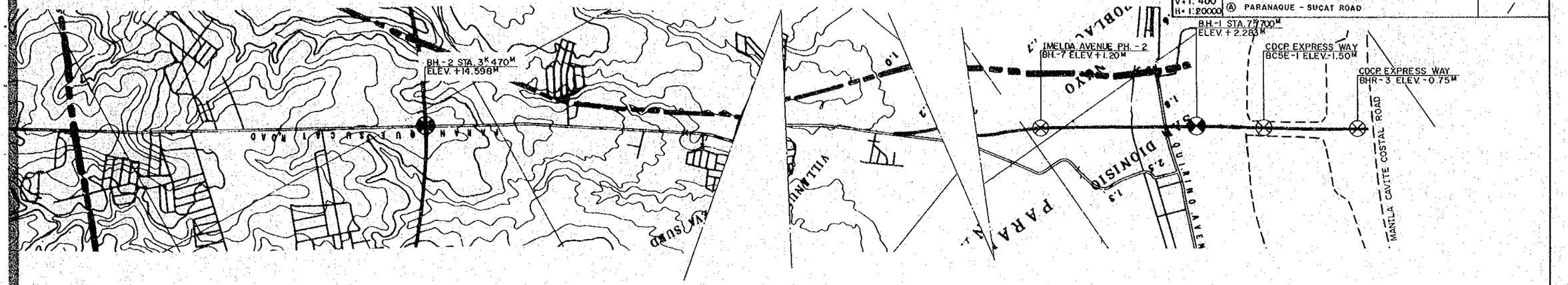
- BH- : BORE HOLE.
- BHR- : EXISTING BORE HOLE.

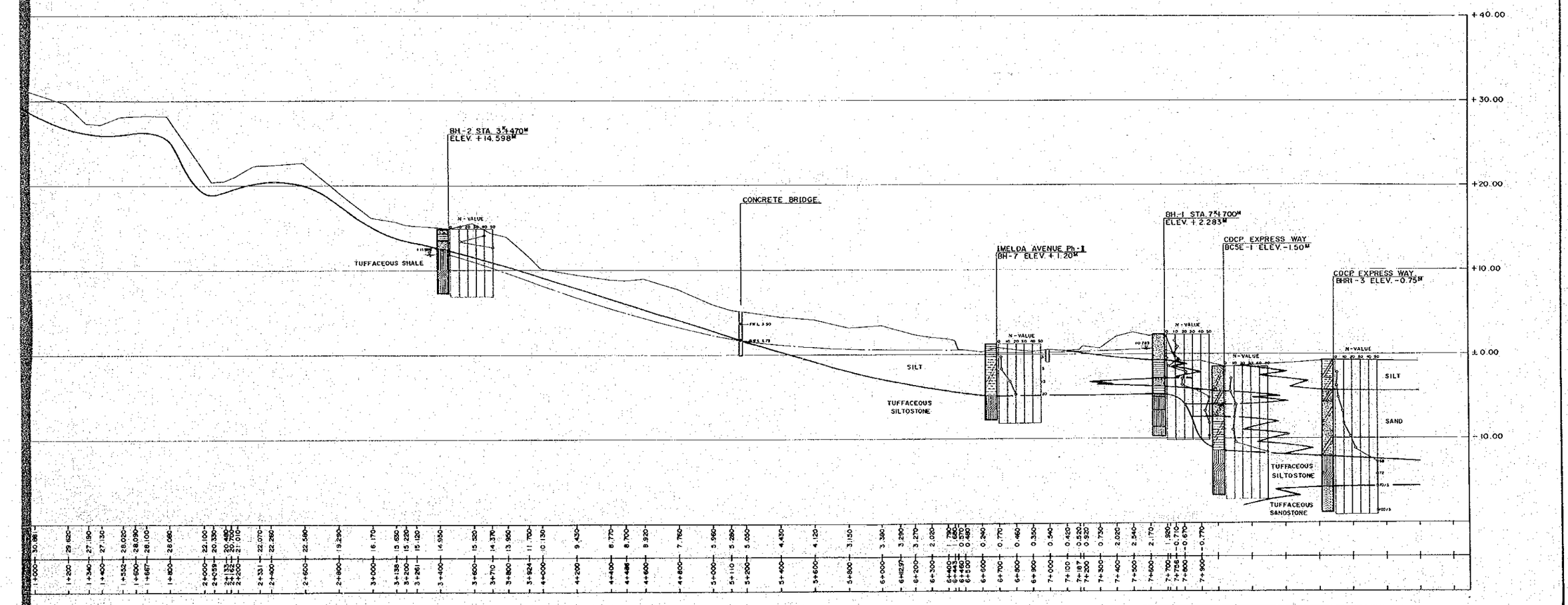
PERIOD		STRATA	DESCRIPTION
QUARTERNARY	RECENT	SAND	SILTY AND CLAYEY COURSE TO FINE SAND WITH TRACES OF FINE GRAVEL, PENETRATION RESISTANCE RANGING FROM 8 TO 18 BLOWS PER 30cm,
		CLAY AND SILT	MOIST SILTY CLAY AND CLAYEY SILT WITH COURSE TO FINE SAND AND TRACE OF FINE GRAVEL, PENETRATION RESISTANCE RANGING FROM 2 TO 22 BLOWS PER 30cm, IN THE RELATIVELY HIGH GROUND ELEVATION AREA, CLAY ADOBE WITH SOME WEATHERED TUFF FRAGMENT, PENETRATION RESISTANCE RANGING FROM 8 TO 40 BLOWS PER 30cm,
TERTIARY ~ QUARTERNARY	PLIOCEN ~ PLEISTOCENE	TUFF (GUADALUPE FORMATION)	COMPOSED PRINCIPALLY OF TUFFACEOUS SEDIMENTRY, TUFFACEOUS SHALE, SILTSTONE AND SANDSTONE,
		TUFFACEOUS SAND STONE	
		TUFFACEOUS SHALE AND SILT STONE	



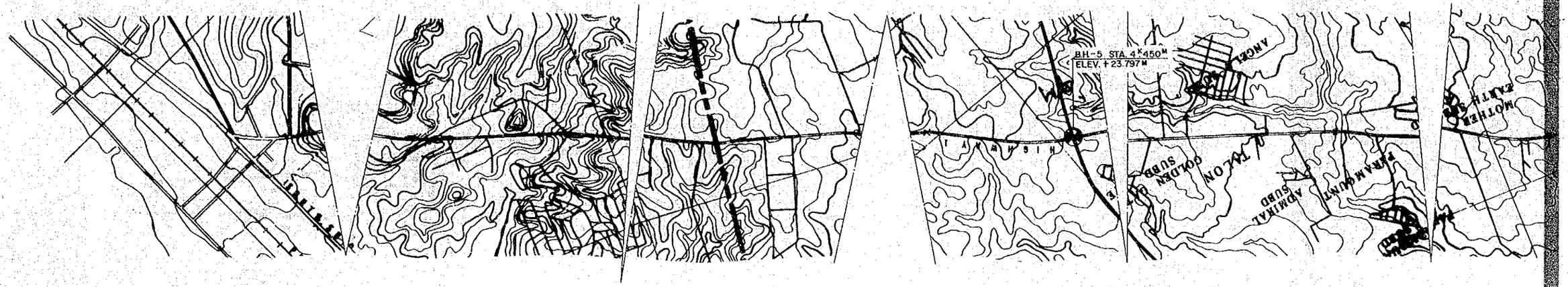
THE METRO MANILA OUTER MAJOR ROADS PROJECT (SOUTHERN PACKAGE)

SCALE V: 1: 400 H: 1: 20000 | Ⓐ PARANAQUE - SUCAT ROAD | DRAWING NO. /





APPENDIX FIG. 8.2 -5 SOIL PROFILE OF B- ROUTE

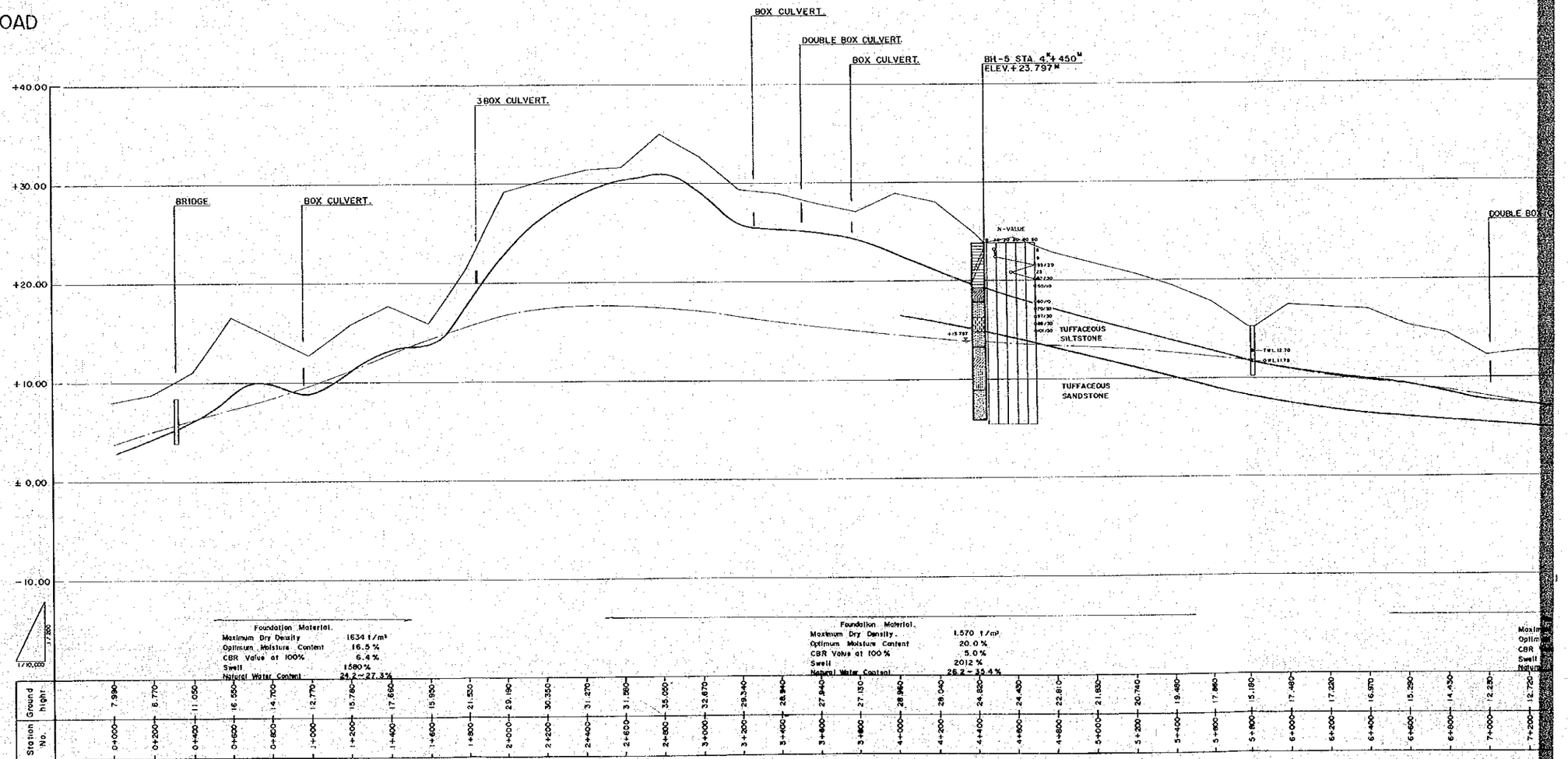


Ⓑ ALABANG - ZAPOTE ROAD

LEGEND

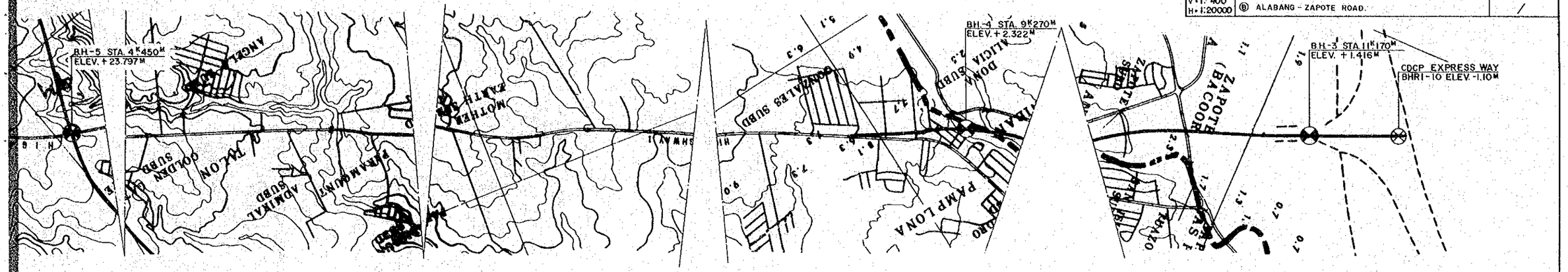
- BH.- : BORE HOLE.
- BHR - : EXISTING BORE HOLE.

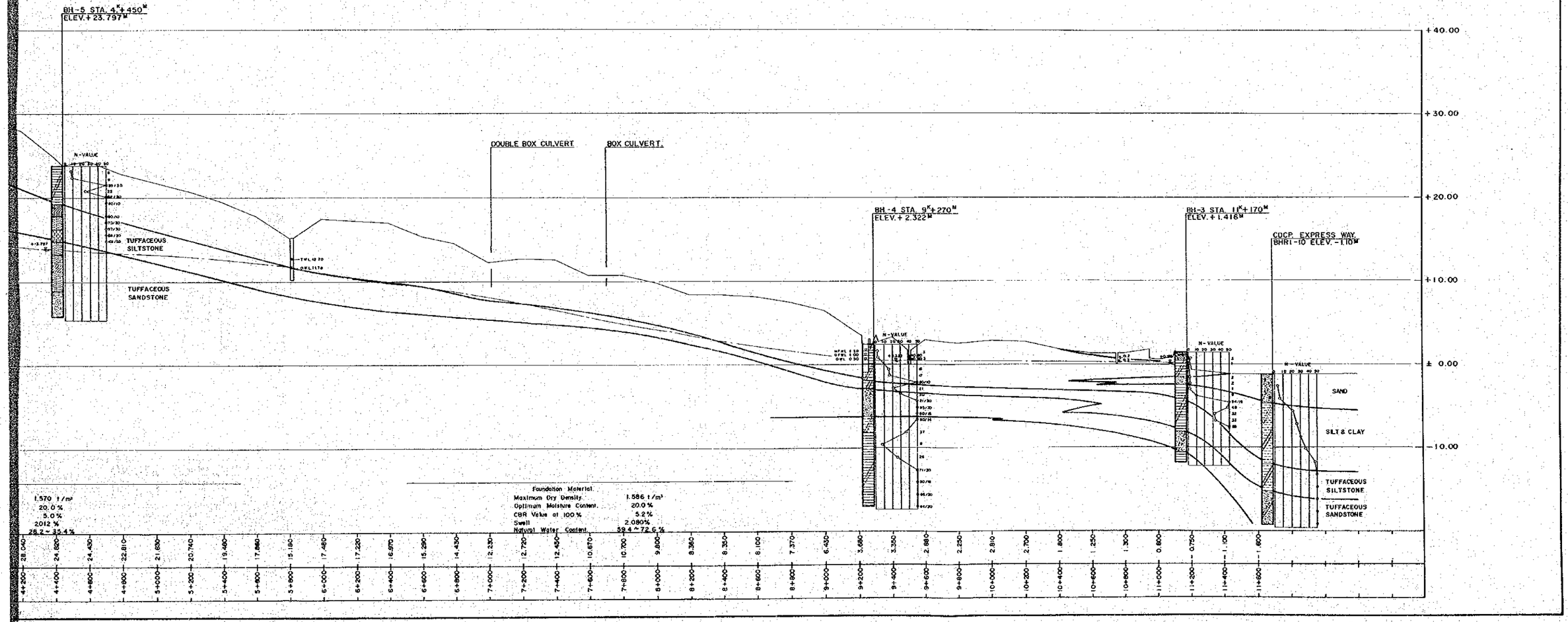
PERIOD		STRATA	DESCRIPTION
QUARTERNARY	RECENT	SAND	SILTY AND CLAYEY COURSE TO FINE SAND WITH TRACES OF FINE GRAVEL, PENETRATION RESISTANCE RANGING FROM 8 TO 18 BLOWS PER 30cm,
		CLAY AND SILT	MOIST SILTY CLAY AND CLAYEY SILT WITH COURSE TO FINE SAND AND TRACE OF FINE GRAVEL, PENETRATION RESISTANCE RANGING FROM 2 TO 22 BLOWS PER 30cm, IN THE RELATIVELY HIGH GROUND ELEVATION AREA, CLAY ADOBE WITH SOME WEATHERED TUFF FRAGMENT, PENETRATION RESISTANCE RANGING FROM 8 TO 40 BLOWS PER 30cm,
TERTIARY ~ QUARTERNARY	PLIOCEN ~ PLEISTOCENE	TUFF (GUADALUPE FORMATION) TUFFACEOUS SAND STONE	COMPOSED PRINCIPALLY OF TUFFACEOUS SEDIMENTRY, TUFFACEOUS SHALE, SILTSTONE AND SANDSTONE,
		TUFFACEOUS SHALE AND SILT STONE	



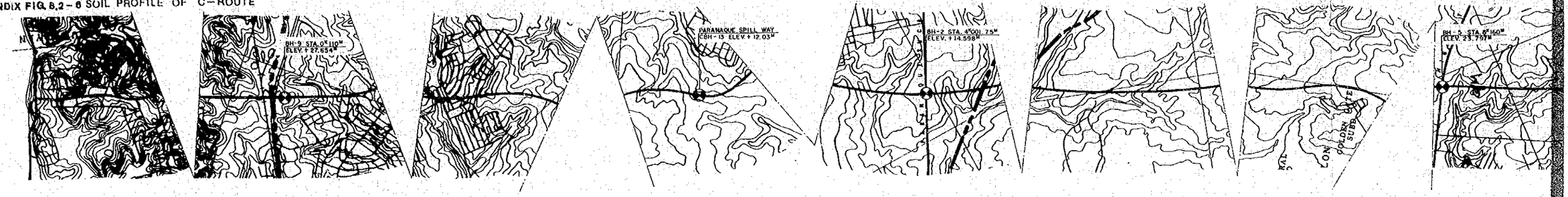
THE METRO MANILA OUTER MAJOR ROADS PROJECT (SOUTHERN PACKAGE)

SCALE		DRAWING NO.
V: 1: 400 H: 1:20000	(B) ALABANG - ZAPOTE ROAD.	/





APPENDIX FIG. 8.2 – 6 SOIL PROFILE OF C – ROUTE



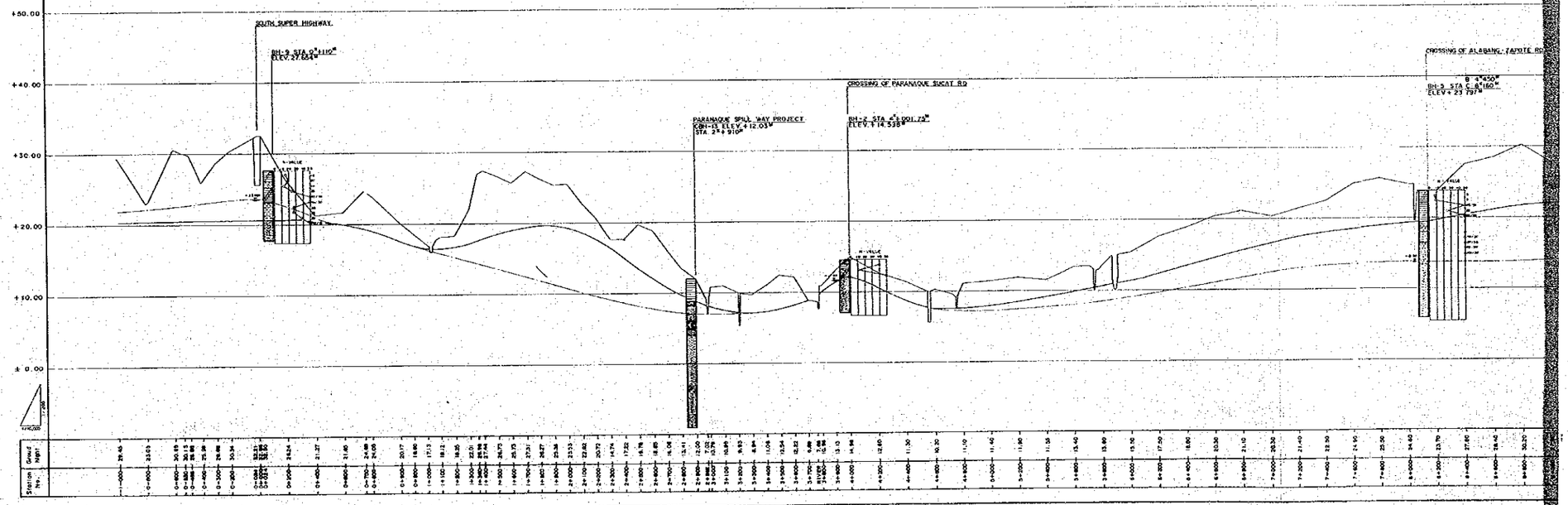
© TAGUIG - LAS PINAS - MUNTINGLUPA LOOP ROAD

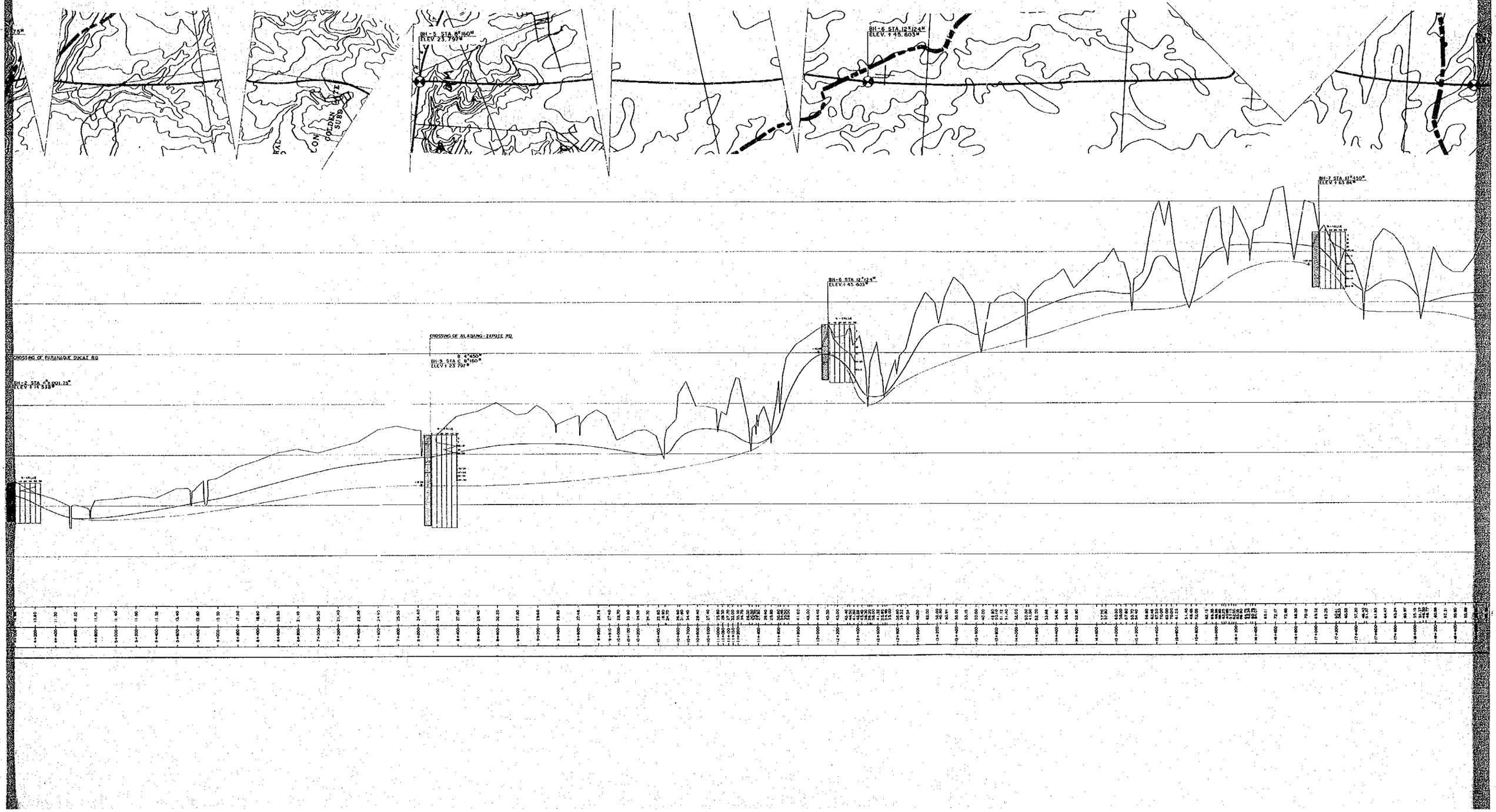
LEGEND.

BH- BORE HOLE.

BHR- : EXISTING BORE HOLE.

PERIOD		STRATA	DESCRIPTION
QUARTERNARY	RECENT	SAND	SILTY AND CLAYEY COURSE TO FINE SAND WITH TRACES OF FINE GRAVEL, PENETRATION RESISTANCE RANGING FROM 8 TO 48 BLOWS PER 30cm.
		CLAY AND SILT	MOIST SILTY CLAY AND CLAYEY SILT WITH COURSE TO FINE SAND AND TRACE OF FINE GRAVEL, PENETRATION RESISTANCE RANGING FROM 2 TO 12 BLOWS PER 30cm, IN THE RELATIVELY HIGH GROUND ELEVATION AREA, CLAY ADOBE WITH SOME WEATHERED TUFF FRAGMENT, PENETRATION RESISTANCE RANGING FROM 8 TO 40 BLOWS PER 30cm.
TERTIARY – QUARTERNARY	MIOCENE – PLEISTOCENE	TUFF (GUADALUPE FORMATION) TUFFACEOUS SANDSTONE TUFFACEOUS SHALE AND SILTY STONE	COMPOSED PRINCIPALLY OF TUFFACEOUS SEDIMENTRY, TUFFACEOUS SHALE, SILTSTONE AND SANDSTONE.




BH-3 STA 8+160M
ELEV 23.797M
BH-6 STA 12+124M
ELEV. + 45.603M
BH-7 STA 17+430M
ELEV + 69.84M
CROSSING OF ALABANG-ZAPOTE RD
BH-5 STA 8+160M
ELEV + 23.797M
CROSSING OF PASANJAN SUCAT RD
BH-2 STA 4+901.72M
ELEV + 14.338M

THE METRO MANILA OUTER MAJOR ROADS PROJECT (SOUTHERN PACKAGE)

SCALE
H:
V:

©TAGUIG-LAS PINAS-MUNTINGLUPA LOOP ROAD

DRAWING NO. 1

BH-6 STA 12°124M
ELEV. +45.603M

BH-7 STA 17°450M
ELEV.+ 63.840M

BH-8 STA 20°250M
ELEV.+ 19.45M

BH-7 STA 17°450M
ELEV.+ 63.84M

BH-6 STA 12°124M
ELEV.+ 45.603M

SUSAN HEIGHTS SUBDIVISON
UNDER CONSTRUCTION

BH-8 STA 20°250M
ELEV.+ 19.45M

SOUTH SUPER HIGHWAY

EXISTING
NATIONAL ROAD No.1

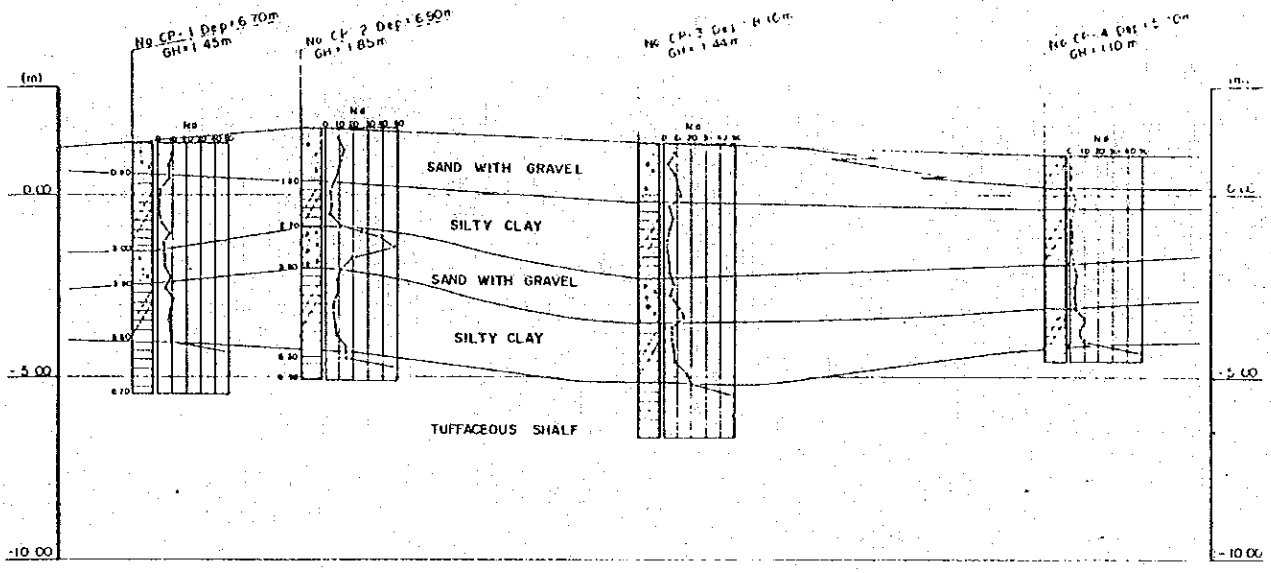
+70.00
+60.00
+50.00
+40.00
+30.00
+20.00
+10.00
± 0.00

APPENDIX FIG. 8.2–7 GEOLOGIC PROFILE OF CONE PENETRATIONS

- LONGOS (BH-3) AREA -

SCALE: V = 1:200

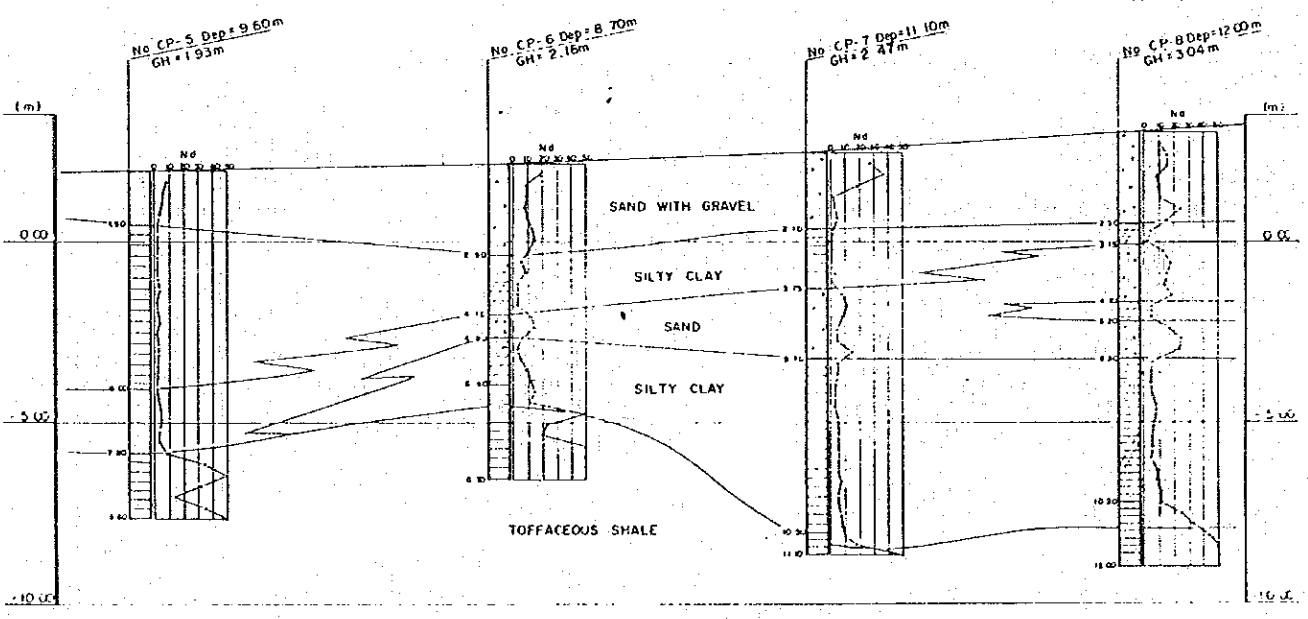
H = 1:800 (Nd = N)



- CES CRAFT BEACH (BH-1) AREA

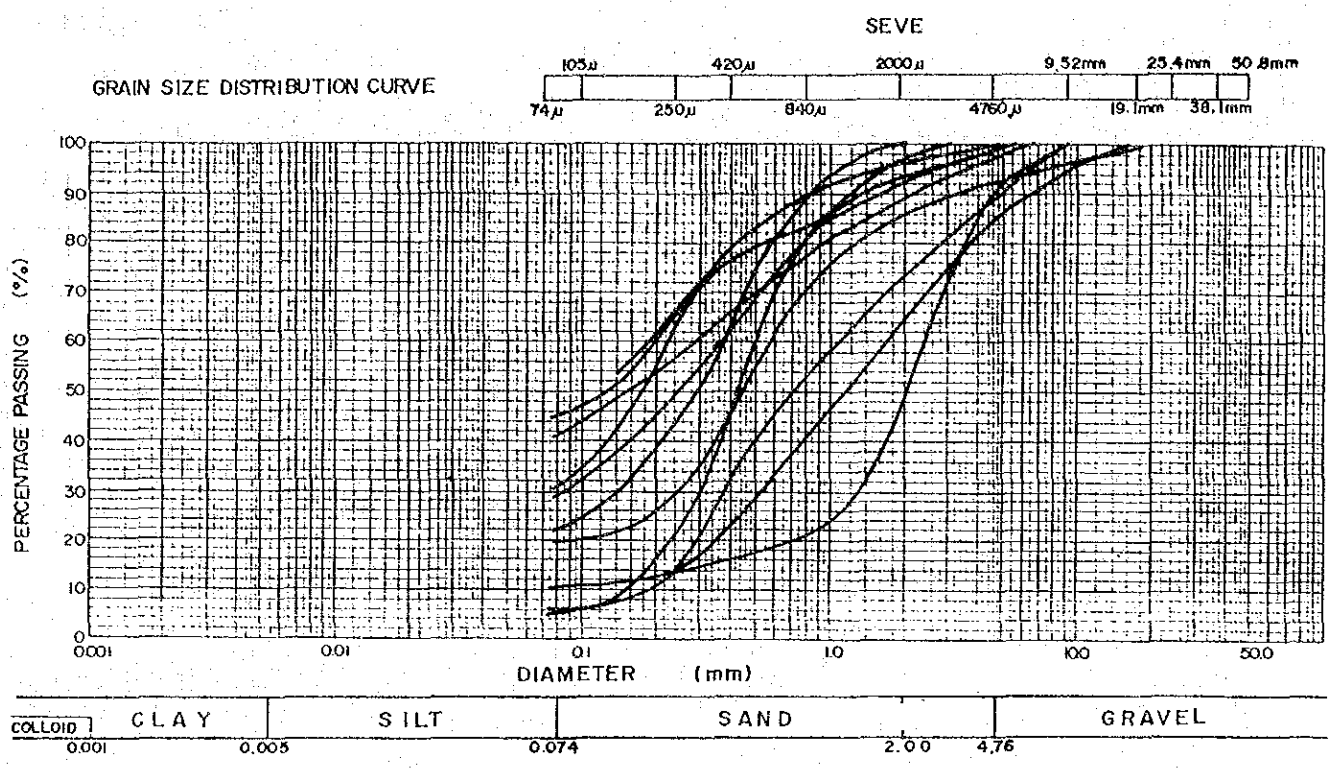
SCAEL: V = 1:200

H = 1:800 (Nd = N)

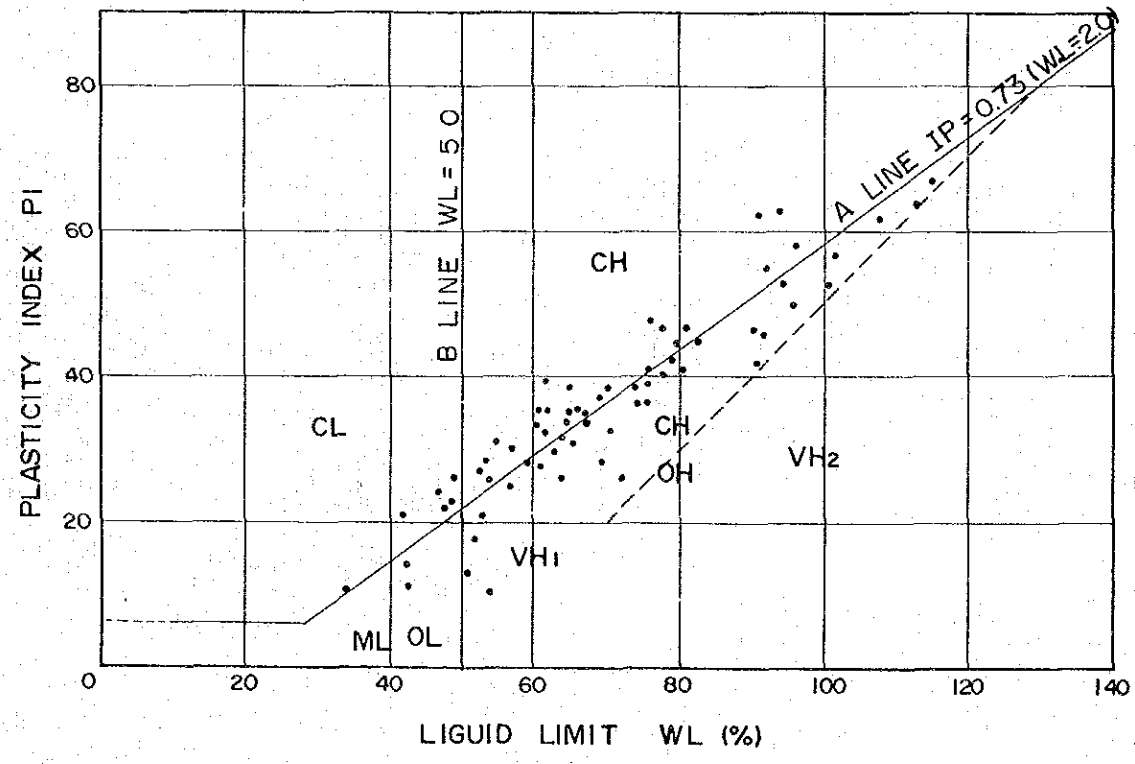


APPENDIX FIG. 8.2-8 SIEVE ANALYSIS AND PLASTICITY CHART OF SUBSURFACE

A. SIEVE ANALYSIS

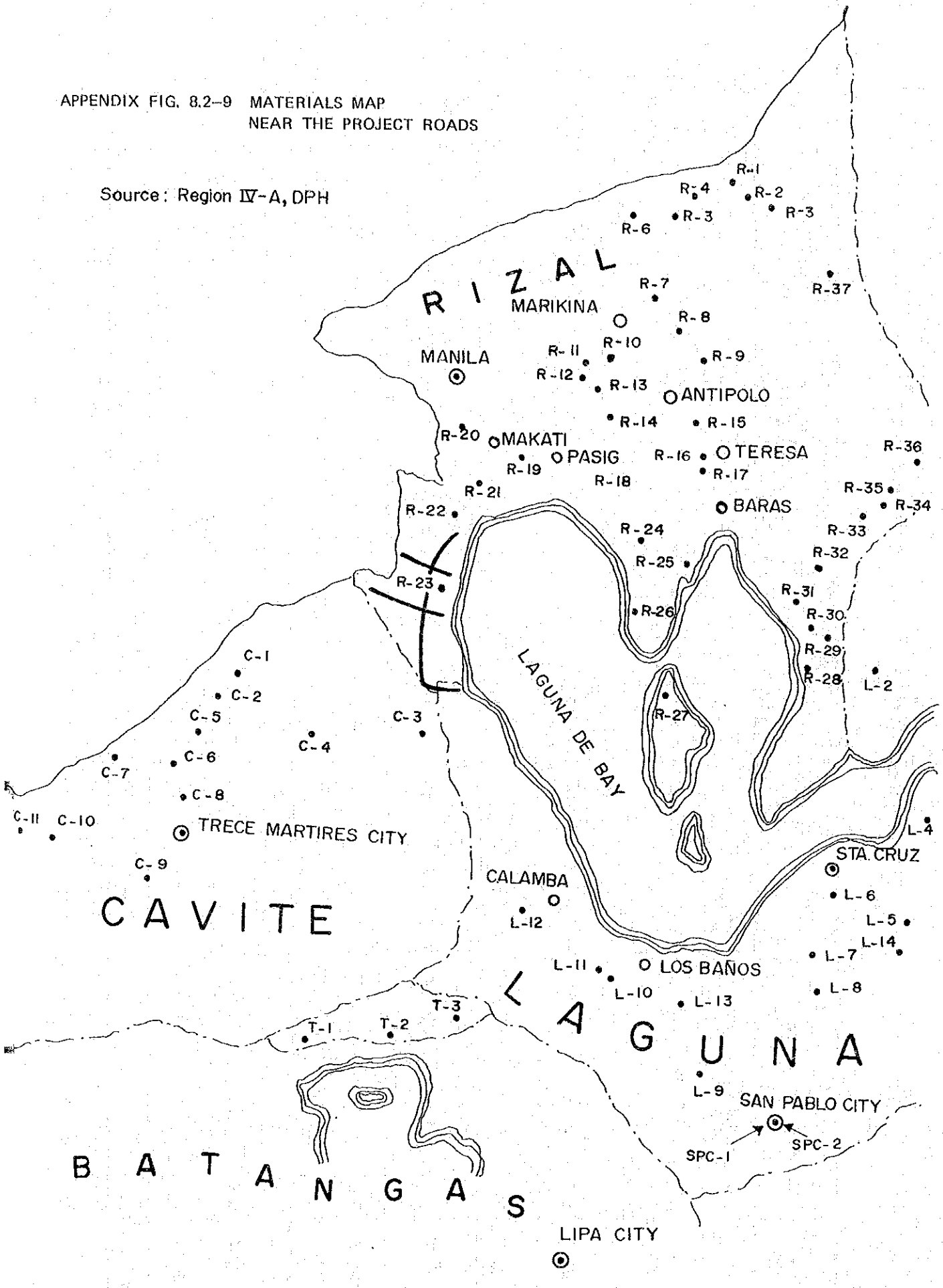


B. PLASTICITY CHART



APPENDIX FIG. 8.2–9 MATERIALS MAP
NEAR THE PROJECT ROADS

Source : Region IV-A, DPH



APPENDIX TABLE 8.2-1 BORING LOGS OF PROJECT ROADS

Bore Hole No.	Station	Ground Elevation (m)	Depth Bore Hole (m)	Thickness of Strata (m)		Standard Penetration Test (N-value)	Number of Soil Samplings		Depth (m) of Ground Water Level from Ground Surface	Remarks
				Soft Strate	Hard Strata		Undisturb Sample	Disturb Samples		
BH-1	A $7^{K}+700^{M}$	+2.283	12.00	6.30	5.70	13	-	13	1.50	
BH-2	B $3^{K}+470^{M}$ C $4^{K}+001.75^{M}$	+14.598	7.55	2.50	5.05	5	-	5	3.00	At the Crossing of A and C Roads
BH-3	B $11^{K}+170^{M}$	+1.416	13.25	5.55	7.70	14	1	14	1.25	Undisturb Sampl 1.50-1.95 in De
BH-4	B $9^{K}+270^{M}$	+2.322	19.50	6.00	13.50	18	-	18	2.00	
BH-5	B $4^{K}+450^{M}$ C $8^{K}+160^{M}$	+23.797	18.00	4.50	13.50	13	-	11	10.00	At the Crossing of B and C Road
BH-6	C $12^{K}+124^{M}$	+45.603	11.00	6.00	5.00	6	-	4	5.50	
BH-7	C $17^{K}+450^{M}$	+63.84	10.75	3.00	7.75	10	-	9	6.50	
BH-8	C $20^{K}+250^{M}$	+19.45	12.00	7.00	5.00	12	-	12	4.50	
BH-9	C $0^{K}+110^{M}$	+27.654	10.00	7.00	3.00	11	-	11	4.00	
Total			114.05	47.85	66.20	Total No. of Strokes 12	1	97		

Note: In the column "Station", A, B and C mean A Route, B Route and C Route respectively.

APPENDIX TABLE 8.2–2 RESULTS OF COMPACTION AND C. B. R. TESTS

TEST PIT NO.	LOCATION	DEPTH (m)	DESCRIPTION	COMPACTION TEST		C.B.R. TEST (%)		
				Optimum Moisture Content (%)	Maximum Dry Density(%)	10 BLOWS	30 BLOWS	65 BLOWS
TP-1	Susana Heights Alabang, Muntinlupa M.M.	0 - 1.5	Creamish brown sandy shale fragments	20.2	1.560	7.7	11.6	17.0
TP-2	"	0 - 1.5	Grayish brown clayey silty sand and gravel mixture	19.7	1.601	7.3	10.0	12.9
TP-3	"	0 - 1.5	Grayish Creamish brown clayey silt with some sand and gravel	19.3	1.628	8.5	10.0	13.9
TP-4	South Luzon Expressway San Pedro, Laguna	0 - 1.5	Rust brown silty clay Sand and gravel mixture	40.5	1.301	7.1	8.3	10.1
TP-5	"	0 - 1.5	Rust brown silty clay, with sand, and gravel	36.6	1.312	5.4	6.3	7.4
TP-6	"	0 - 1.5	Brown silty clay with sand, gravel and shale fragments	28.5	1.444	4.6	5.7	7.1
TP-7	South Luzon Expressway BO. Patatan Muntinlupa, M.M.	0 - 1.5	Brownish gray silty sand with some gravel	19.6	1.650	19.7	27.6	33.1
TP-8	"	0 - 1.5	Brownish gray clayey silty sand with gravel	16.0	1.710	10.1	15.2	16.1
TP-9	"	0 - 1.5	Browish gray clay silty and with gravel	27.5	1.461	12.7	14.0	15.4

APPENDIX TABLE 8.2-3 MATERIAL SOURCES NEAR THE PROJECT ROADS

Source: Regions II & IV-A, DPH

Map Designation Number	Brief of Material Sources
Cavite Province	
C-1	Noveleta Source, Km. 26.60 near Bailey Bridge Materials: Screened Sand Quantity: 10 cu.m./day very limited Spec's. Item No.: Item 305 Type "C", Item 308 Grading "B"
C-2	Bacao Source, Km. 29.20, 80 m. left going to Gen. Trias Transpassing private properties Materials: Sand, Quantity: Unlimited Spec's. Item No. Item 108, Item 308 "B"
C-3	Carmona Source, 800 m. left of Km. 47.75 going to Carmona Materials: Sand, Quantity: Unlimited Spec's. Item No.: Item 108, Item 308 "B"
C-4	Salitran Source, Approx. 500 m. right of Km. 29.00, Salitran-Molino Road.Transpassing private properties. Passable only during dry season Material: Sand, Quantity: Unlimited Spec's. Item No.: Item 108, Item 308 "B"
C-5	Santol Source, End of Santol Feeder Road. Passable only during dry season Materials: Sand, Quantity: Unlimited Spec's. Item No.: Item 108
C-6	Prinsang Matanda Source, Approx. 700 m. left of Km. 42.30 going to Capitol Materials: Sand, Quantity: Unlimited Spec's. Item No.: Item 108, Item 308 "B"
C-7	Naic Source, Km. 47.90 near Santolan Culvert Materials: Sand, Quantity: Limited Approx. 400 cu.m. Spec's. Item No.: Item 108
C-8	Quintana Source, 90 m. left of Km. 45.79 Tanza-Trece Martires National Road Materials: Sand, Quantity: Unlimited Spec's. Item No.: Item 108, Item 308 "B"

C-9 Calumpang Source, 250 m. right of Km. 59.08 going to Indang
Transpassing private properties. Passable only during dry season
Materials: Sand, Quantity: Unlimited
Spec's. Item No.: Item 108

C-10 & C-11 Maragondon Source, Materials: Sand and gravel
Quantity: Unlimited, Item: All items

Laguna Province

L-6 Sta. Cruz River, Item 316 - Fine Aggregate

L-7 Laguna Quarry,
Item 108 - Aggregate sub-base, Item 200 - Aggregate base course
Item 316 - Fine aggregate, Coarse aggregate

L-8 Calumpang River
Item 316 - Fine aggregate, Coarse aggregate, Boulders

L-9 San Pablo-Calauan Boundary Black Cinder

L-10 Los Baños Quarry, Item 200 - Aggregate base course
Item 316 - Fine aggregate, Coarse aggregate

L-11 Banaag Quarry, Item 108 - Aggregate sub-base
Item 200 - Aggregate base course

L-12 Calamba San Cristobal River, Item 316 - Fine Aggregate

L-13 Calauan (Paliparan), Item 108 - Aggregate sub-base

L-14 Dingin Quarry, Item 108 - Aggregate sub-base
Item 200 - Aggregate base course, Item 316 - Fine aggregate, Coarse aggregate

Rizal Province

R-1 San Jose, Montalban, Km. 28+200
Aggregate for Items: 108, 200

R-2 Phil Rock Prods., Inc., Km. 29+000
Aggregate for Items: 108, 200, 308 or 312
Fine aggregate - Coarse aggregate for Items: 310, 316 or 405

R-3 Wawa, Montalban
Aggregate for Items: 108, 200, 308 or 312
Fine aggregate - Coarse aggregate for Items: 310, 316 or 405

R-4 Burgos, Montalban, Km. 26+500
Aggregate for Items: 108, 200

R-5 Rizal Consolidated Investments, Km. 25+850
Aggregate for Items: 108, 200, 308 or 312
Fine aggregate - Coarse aggregate for Items: 310, 316 or 405

R-6 Dulong Bayan, San Mateo, Km. 24
Aggregate for Items: 108, 200

R-7 Philstress, Marikina
Item 405-A Pre-fab. concrete products

R-8 & R-9 Mayamot, Antipolo
Adobe stone spalls, Aggregate for Items: 107, 108

R-10 Pag-asa Steel Corp., Pasig
Item 406 Reinf. steel bars

R-11 Concrete Aggregates Inc., Longos, Q. C.
Fine aggregate - Coarse aggregate for Items: 308, 309, 310, 316 or 405

R-12 Phil. Blooming Mills, Pasig
Item for 406 - Reinf. steel bars

R-13 Asphalttrade & Rizcon, Items: 309, 310 or 413

R-14 Constress, Pasig, Item 405-A Pre-fab. Concrete Products

R-15 Island Cements, Portland Cement

R-16 Filipinas Cement, Portland Cement

R-17 Teresa Quarry, Aggregate for Items: 107, 108, 200

R-18 Elirol, Pasig
Item 406 Reing. steel bars, G.I. sheets

R-19 Puyat Steel, Item 406 Reinf. steel bars

R-20 Phil. Rock Products, Mandaluyong
Fine aggregate - Coarse aggregate for Items: 308, 309, 310 316 or 405

R-21 Supreme Aggregates, Inc., Taguig
Fine aggregate - Coarse aggregate for Item: 316 or 405

R-22 Betonval Ready Cement, Km. 16
Item: 316 or 405

R-23 Pecorp. Muntinlupa
Aggregate for Items : 107, 108, 200

R-24 Concrete Aggregates, Inc., Angono
Aggregate for Items: 108, 200, 308 or 312
Fine aggregate - Coarse aggregate for Items: 310, 316 or 405

R-25 Cardona, Aggregate for Items: 107, 108

R-26 Rizal Cement, Binangonan, Portland Cement

R-27 Navotas, Talim Island, Cardona
For all items involving crush rock and by-products

R-28 Quisao, Pililla, Aggregate for Items: 107, 108

R-29 & R-30 Bugarin, Pililla, Rizal
Aggregate for Items: 108, 200

R-31 Bukal, Tanay, Aggregate for Items: 108, 200

R-32 Genrock, Tanay
Fine aggregates for Items: 310, 316 or 405
Item: 316 or 405, Item: 201 (CTB)

R-33 Midland Cement, Tanay, Portland Cement

R-34 A.P. Sacramento, Tanay, Aggregate for Items: 108, 200

R-35 Supreme Aggregates Asphalt Plant, Tanay
Items: 302, 310

R-36 Rivas, Tanay, Aggregate for Items: 108, 200

R-37 Sta. Inez, Tanay, Aggregate for Items: 107, 108

San Pablo City

SPC-1 Km. 79+800, Materials: Volcanic cinder good for
Items: 107, 108
Distance from National Road - 150 m.
Quantity: Abundant

SPC-2 Km. 95+100, Materials: Item 200, Distance from
National Road - 200 m.
Quantity: Abundant

Tagaytay City

T-1 Proposed rock quarry for Item 316
Distance from Km. 61.71 - 1 Km.
Approx. quantity: 200,000 cu.m.

T-2 Quarry for Item 200, Stationing Km. 62.50
Approx. quantity: 150,000 cu.m. Lab. Report No.
9-157-56: soil classification A-1-a(10)

T-3 Proposed quarry for Item 200, Stationing Km. 63.00
Approx. quantity: 300,000 cu.m.

Bulacan Province

Sta. Maria Gravel Pit, Km. 32.85 right of Bocaue - Sta. Maria Road via Taal (Sta. Clara - Sta. Maria) Aggregate sub-base and Aggregate base course

Pulilan Quarry, Km. 44.8 left of Pulilan-Calumpit Road (Poblacion, Pulilan) 1.2 Km. Sand

Longos Quarry, Km. 43.3 left Pulilan-Calumpit Road + 0.8 Km. Longos, Pulilan. Common borrow and Aggregate base course

Angat River, Km. 38.84 right of CVR + 0.15 Km., Sto. Cristo, Pulilan. Washed sand

Makinabang Gravel Pit, Km. 46.43 right of CVR + 0.64 Km., Makinabang Baliwag. Aggregate sub-base, Aggregate base course Type "A" & "B" to concrete aggregate

Tiaong Gravel Pit, Km. 48.42 right of CVR + 0.15 Km. (Sto. Cristo, Pulilan) Aggregate sub-base, Aggregate base course Type "A" & "B" & G-1, S-1 & 3/4"

San Pedro Gravel Pit, Km. 53.30 left of Plaridel-Bustos Old Road + 1.2 Km. (San Pedro, Bustos) washed sand & washed gravel, Aggregate sub-base & base course, Type "A" & "B"

Sabang Gravel Pit, Km. 53.05 right of CVR + 0.70 Km. (Sabang, Baliwag) aggregate sub-base, Aggregate base course, Type "A" & "B" to Concrete Aggregate.

Tanawan Gravel Pit, Km. 53.6 left of Plaridel - Bustos Road + 2.5 Km. (Tanawan, Bustos) Aggregate sub-base and Aggregate base course, Type "A" & "B"

Caingin Gravel Pit, Km. 54.50 right of Baliwag - San Rafael + 0.90 Km. (Caingin, San Rafael) Aggregate sub-base, Aggregate base course, Type "A" & "B" to concrete aggregate

Luzon Aggregate Inc., Km. 72.15 + 1.6 Km. left of Norzagaray - Bigte Road (Norzagaray) Concrege Aggregate G-1, S-1 & 2/3" Dense graded aggregate

Pulo Gravel Pit, Km. 64.84 right of Baliwag - San Rafael Road + 0.4 Km. (Pulo, San Rafael) Aggregate sub-base and Aggregate base course, Type "A" & "B"

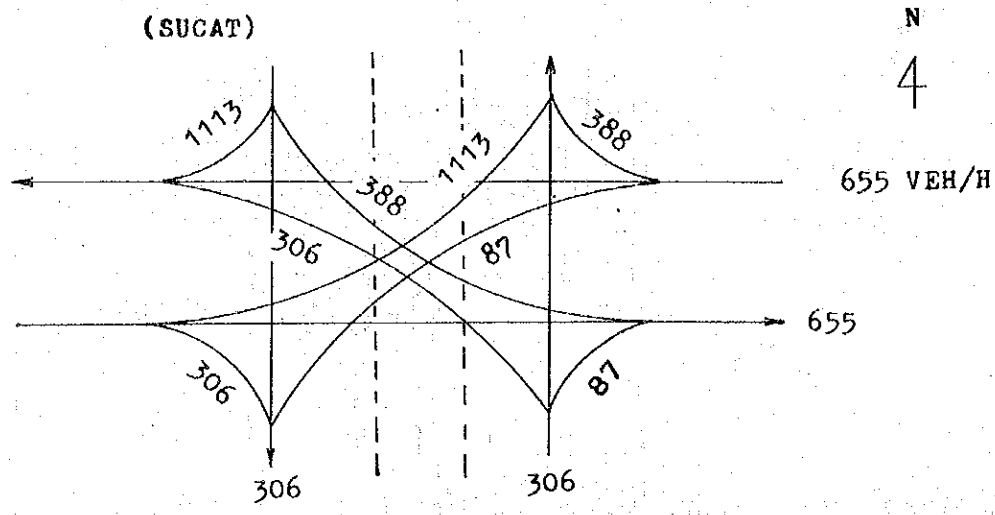
Guiller Aggregate Co. Inc., Km. 55.83 left of Plaridel-Bustos-Norzagaray Road (Bonga Menor, Bustos) Concrete Aggregate G-1, S-1, & 2/3" Dense graded aggregate

Tartaro Gravel Pit, Km. 85.45 right of San Miguel-Sibul Road + 0.80 Km. (Tartaro, San Miguel) Aggregate base course Type "A" & "B" to Concrete Aggregate & Boulders

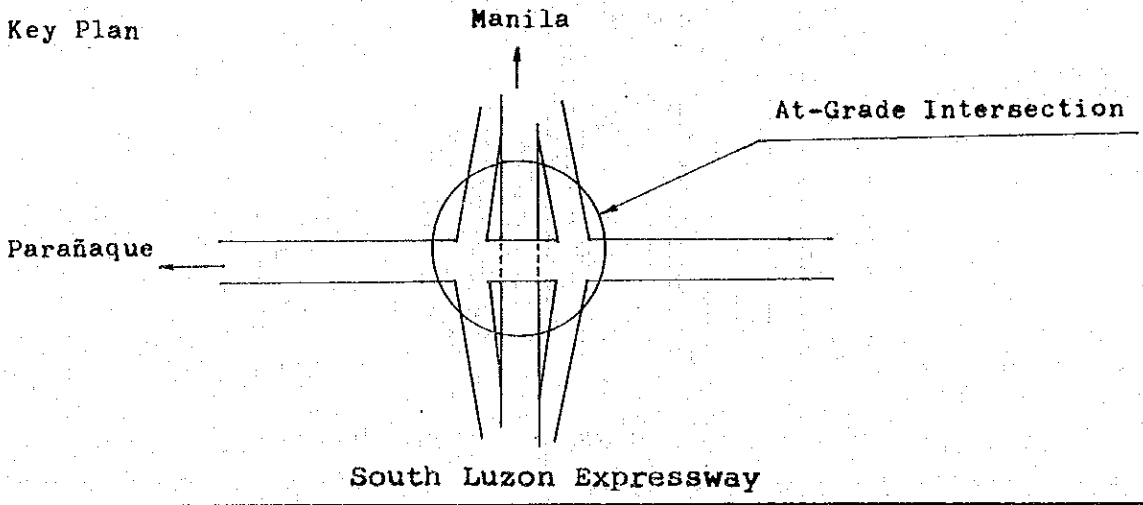
Sta. Ines Gravel Pit, Km. 84.650, 1.20 Km. right of San Miguel-Sibul Road, Aggregate base course to concrete aggregate

Batuhan Gravel Pit, Km. 82.90 right of San Miguel-Sibul Road 2.0 Km. (Labne, San Miguel, Bulacan) Aggregate base course, Type "A" & "B" & Boulders

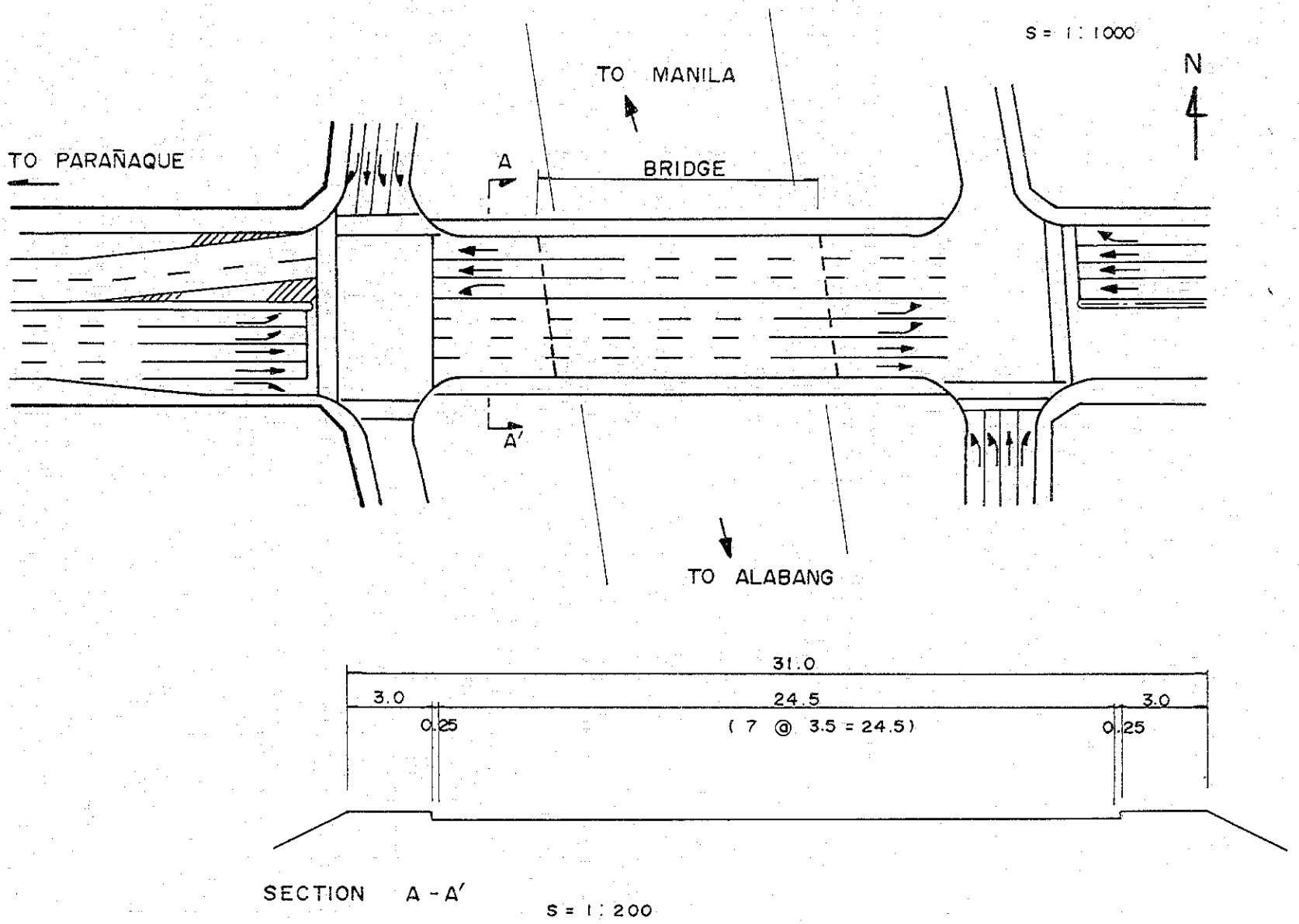
APPENDIX FIG. 8.5-1 CAPACITY ANALYSIS OF INTERSECTION



	TRAFFIC PHASE	TRAFFIC VOLUME V (PCU/H)	POSSIBLE CAPACITY Cp (PCU/H)	INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED	PHASE TIME (SEC)
1		VL = 1336 VT = 786 VR = 367	2 x 2000=4000 2 x 2250=4500	0.334* 0.175	39%	36 + 3
2		VL = 104 VT = 786 VR = 467	1 x 2000=2000 2 x 2250=4500	0.052 0.175*	21%	18 + 3
3		VL = 367 VT = 367 VR = 104	2 x 2000=4000 1 x 2250=2250	0.092 0.163*	20%	17 + 3
4		VL = 467 VT = 367 VR = 1336	2 x 2000=4000 1 x 2250=2250	0.117 0.163*	20%	17 + 3
			T O T A L	0.835	100%	100

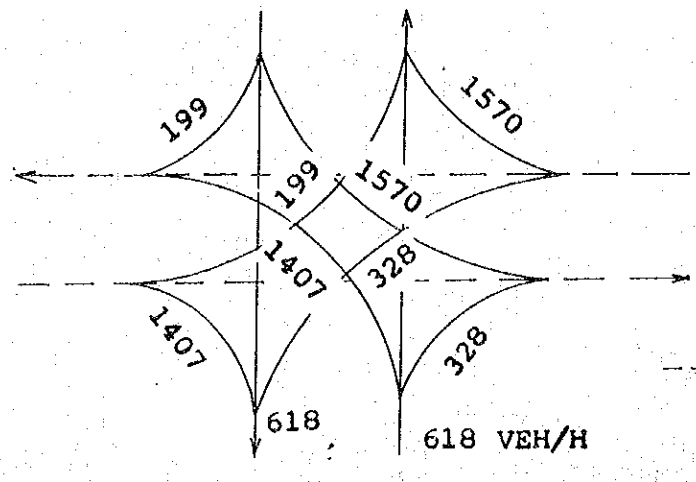


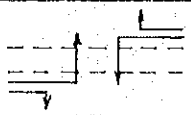
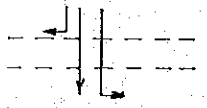
APPENDIX FIG. 8.5–2 SCHEMATIC PLAN OF SUCAT INTERCHANGE



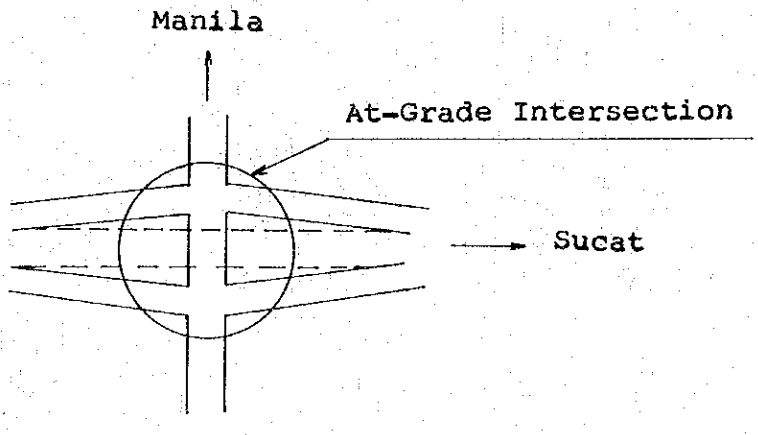
APPENDIX FIG. 8.5-3 CAPACITY ANALYSIS OF INTERSECTION

(A-ROUTE/IMELDA AVE. EXT.)

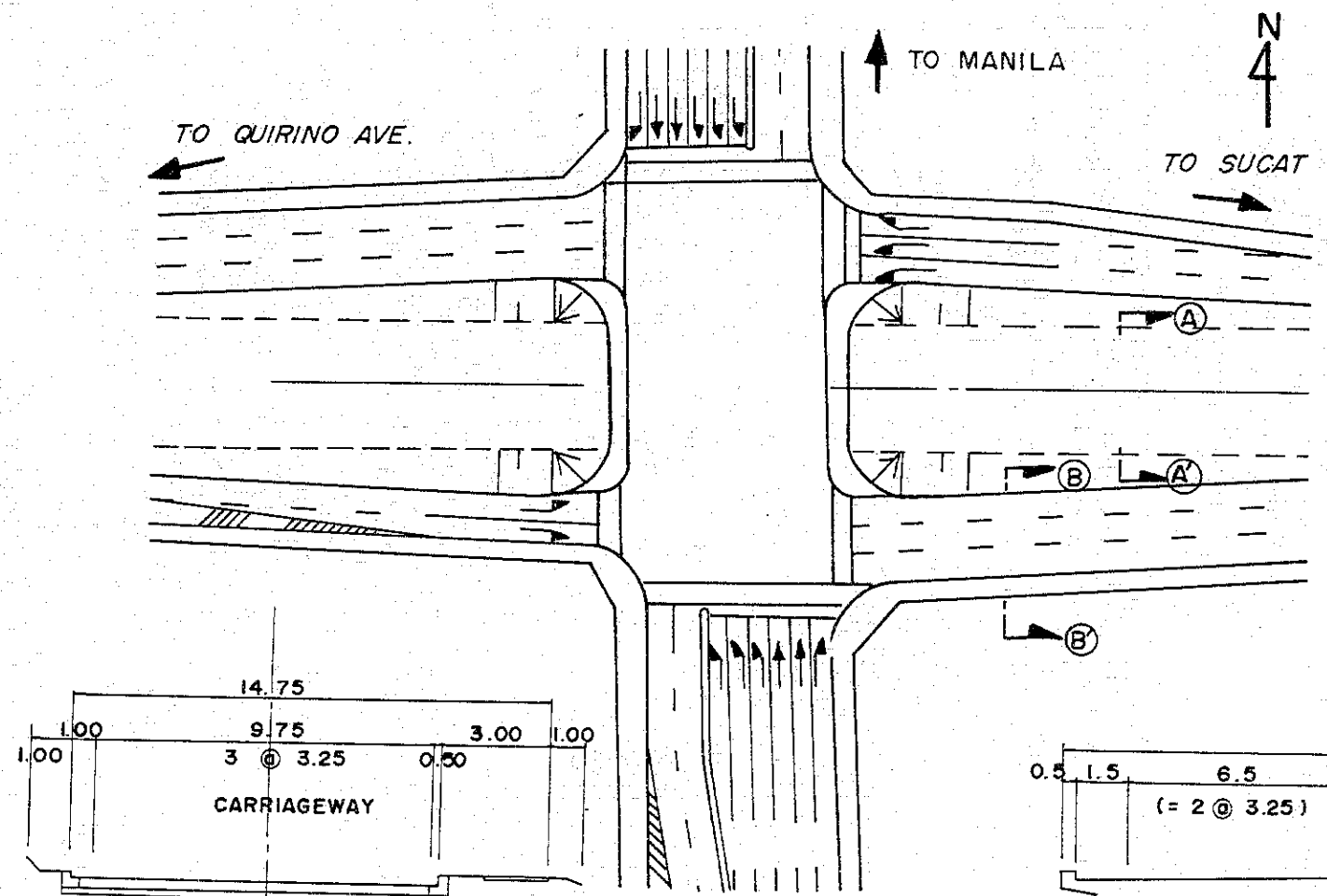


	TRAFFIC PHASE	TRAFFIC VOLUME V (PCU/H)	POSSIBLE CAPACITY Cp (PCU/H)	INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED	PHASE TIME (SEC)
1		VL = 394 VR = 1184 VR = 1688 VL = 239	2 x 2000=4000 1 x 2000=2000	0.099 0.120*	17%	14 + 3
2		VL = 1884 VT = 742 VR = 239	3 x 2000=6000 2 x 2250=4500	0.314* 0.165	44%	41 + 3
3		VL = 1688 VT = 742 VR = 394	3 x 2000=6000 2 x 2250=4500	0.283* 0.165	39%	36 + 3
4		VL = VT = VR =				
			T O T A L	0.717	100%	100

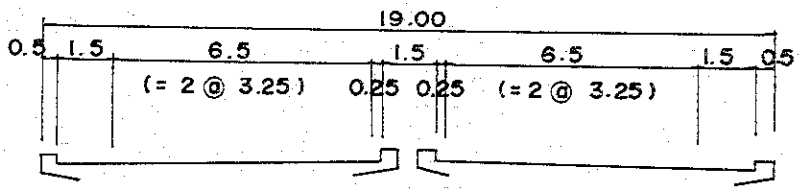
Key Plan



APPENDIX FIG. 8.5–4 SCHEMATIC PLAN OF A – ROUTE / IMELDA AVE. EXT.



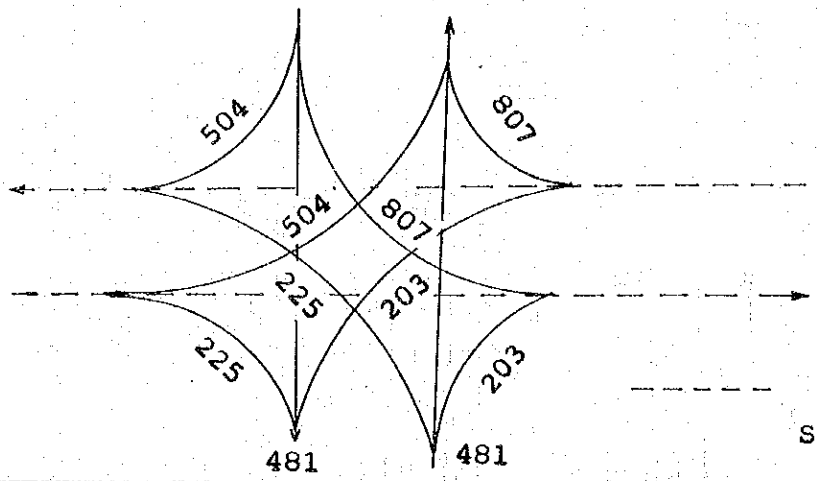
SECTION (B) - (B')
S = 1 : 200

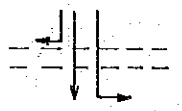
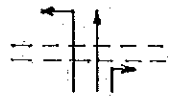


SECTION (A) - (A')
S = 1 : 200

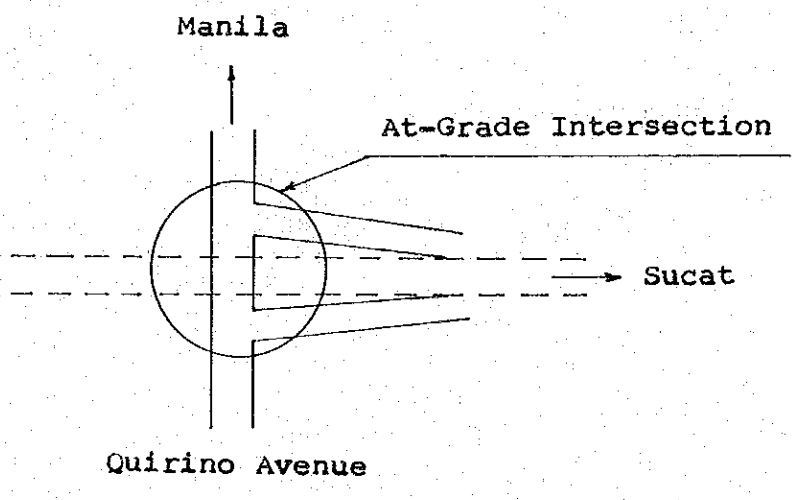
APPENDIX FIG. 8.5-5 CAPACITY ANALYSIS OF INTERSECTION

(A-ROUTE/QUIRINO AVE.)

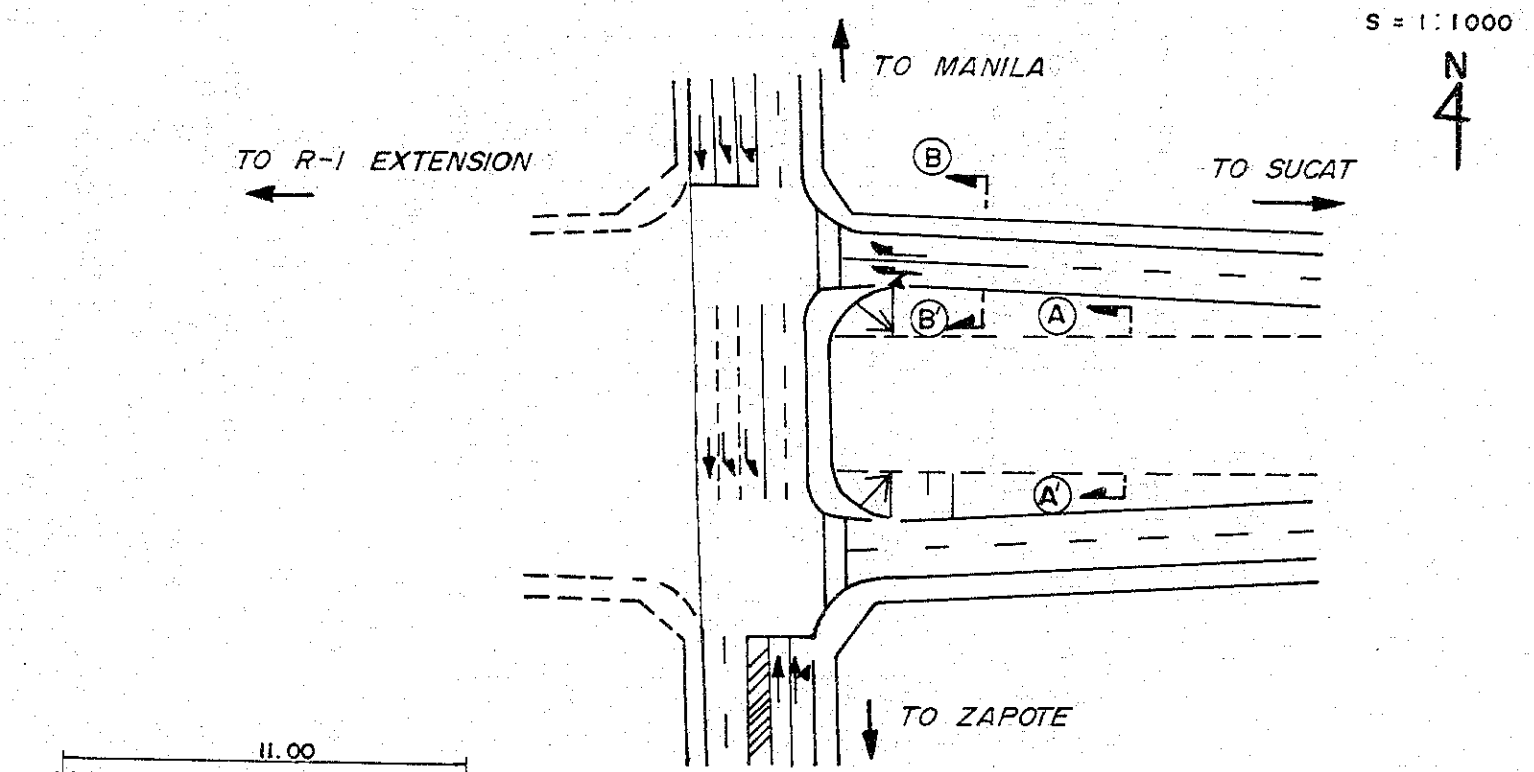


	TRAFFIC PHASE	TRAFFIC VOLUME V (PCU/H)	POSSIBLE CAPACITY Cp (PCU/H)	INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED	PHASE TIME (SEC)
1		VL = 244 VR = 968 VR = 270 VL = 605	1 x 2000=2000 1 x 2000=2000	0.122 0.303*	37%	34 + 3
2		VL = 968 VT = 577 VR = 605	2 x 2000=4000 1 x 2250=2250	0.242 0.256*	31%	28 + 3
3		VL = 270 VT = 577 VR = 244	1 x 2000=4000 1 x 2250=2250	0.068 0.256*	32%	29 + 3
4						
			T O T A L	0.815	100%	100

Key Plan



APPENDIX FIG. 8.5-6 SCHEMATIC PLAN OF A-ROUTE / QUIRINO AVE.



SECTION (B)-(B')

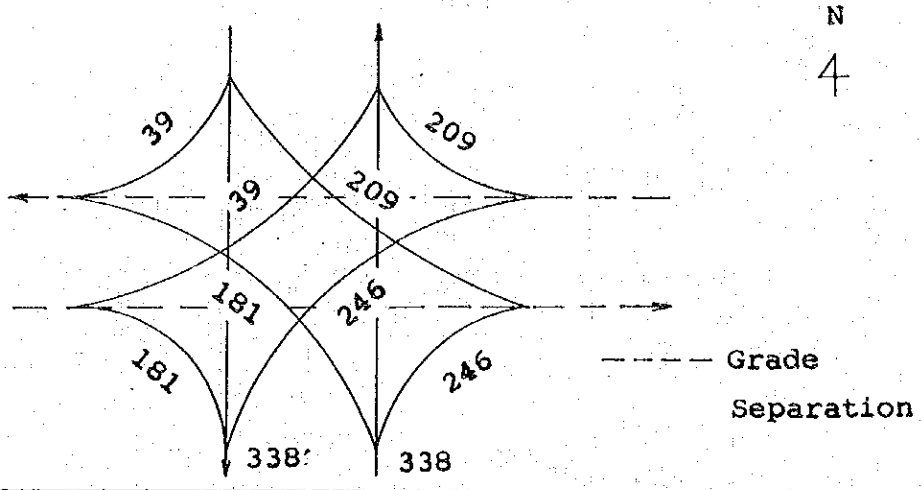
S = 1 : 200

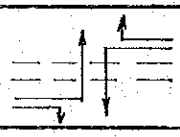
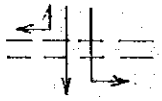
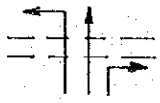
SECTION (A)-(A')

S = 1 : 200

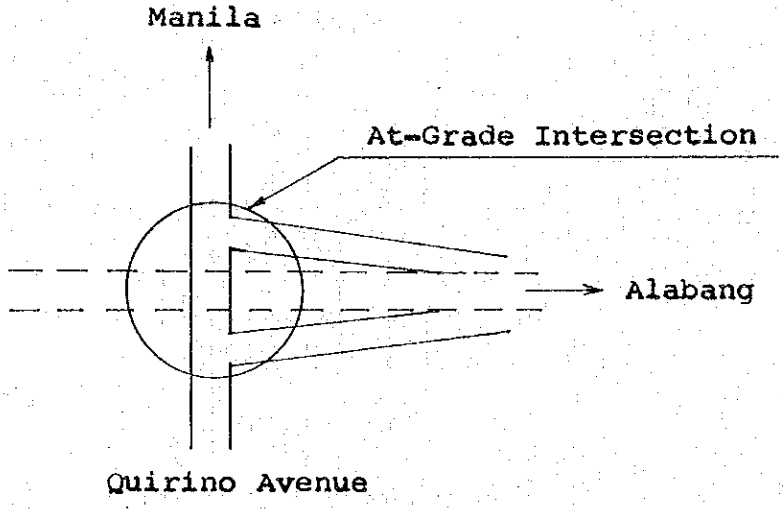
APPENDIX FIG. 8.5-7 CAPACITY ANALYSIS OF INTERSECTION

(B-ROUTE/QUIRINO AVE.)

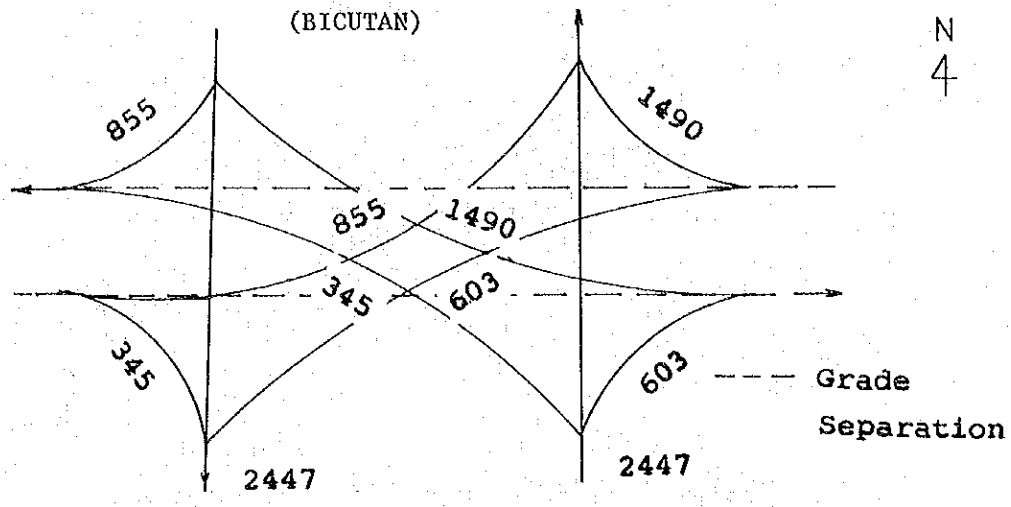


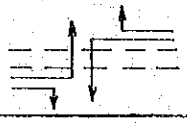
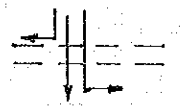
	TRAFFIC PHASE	TRAFFIC VOLUME V (PCU/H)	POSSIBLE CAPACITY Cp (PCU/H)	INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED	PHASE TIME (SEC)
1		VL = 295 VR = 251 VR = 217 VL = 47	1 x 2000=2000 1 x 2000=2000	0.148* 0.024	29%	26 + 3
2		VL = 251 VT = 406 VR = 47	1 x 2000=2000 1 x 2250=2250	0.126 0.180*	35%	32 + 3
3		VL = 217 VT = 406 VR = 295	1 x 2000=2000 1 x 2250=2250	0.109 0.180*	36%	33 + 3
4						
			T O T A L	0.508	100%	100

Key Plan

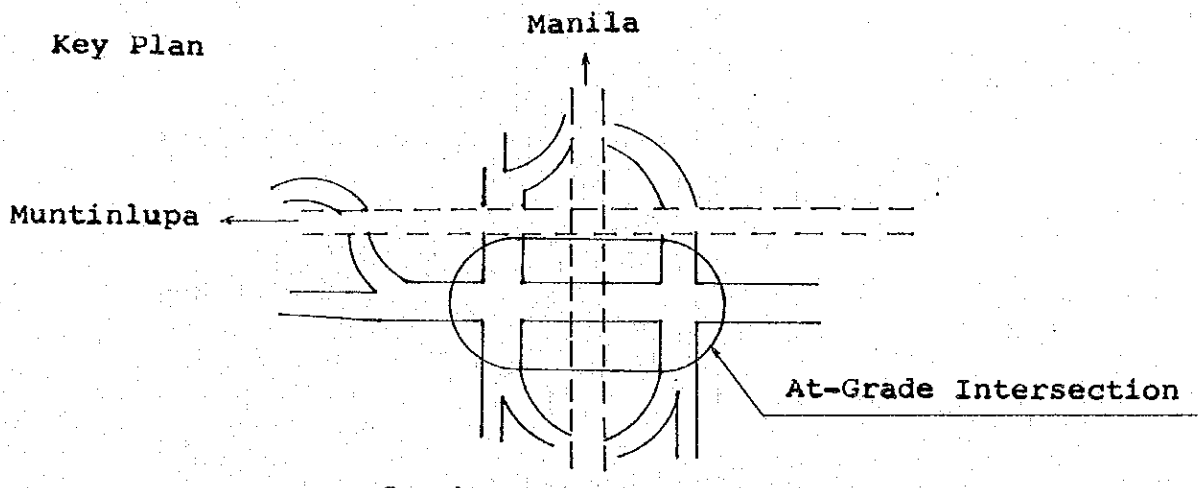


APPENDIX FIG. 8.5-8 CAPACITY ANALYSIS OF INTERSECTION

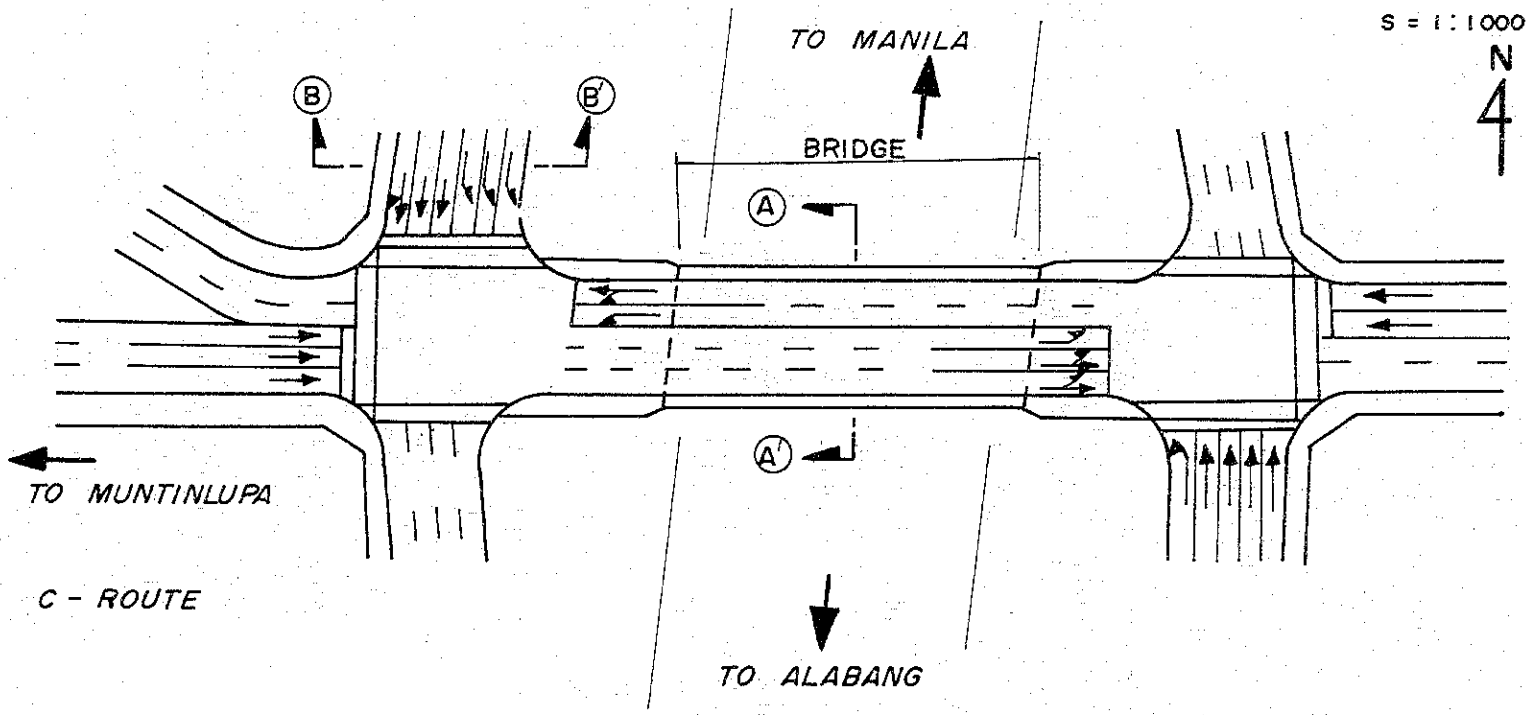


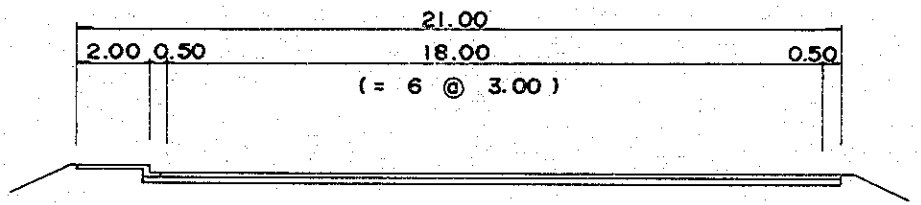
	TRAFFIC PHASE	TRAFFIC VOLUME V (PCU/H)	POSSIBLE CAPACITY Cp (PCU/H)	INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED	PHASE TIME (SEC)
1		VL = 724 VR = 1788 VR = 414 VL = 1026	2 x 2000=4000 3 x 2000=6000	0.181* 0.171	22%	19 + 3
2		VL = 414 VT = 2936 VR = 724	1 x 2000=2000 4 x 2250=9000	0.207 0.326*	39%	36 + 3
3		VL = 1788 VT = 2936 VR = 1026	3 x 2000=6000 4 x 2250=9000	0.298 0.326*	39%	36 + 3
4						
			T O T A L	0.833	100%	100

Key Plan

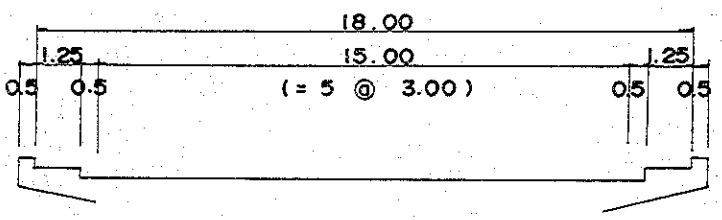


APPENDIX FIG. 8.5–9 SCHEMATIC PLAN OF BICUTAN INTERCHANGE





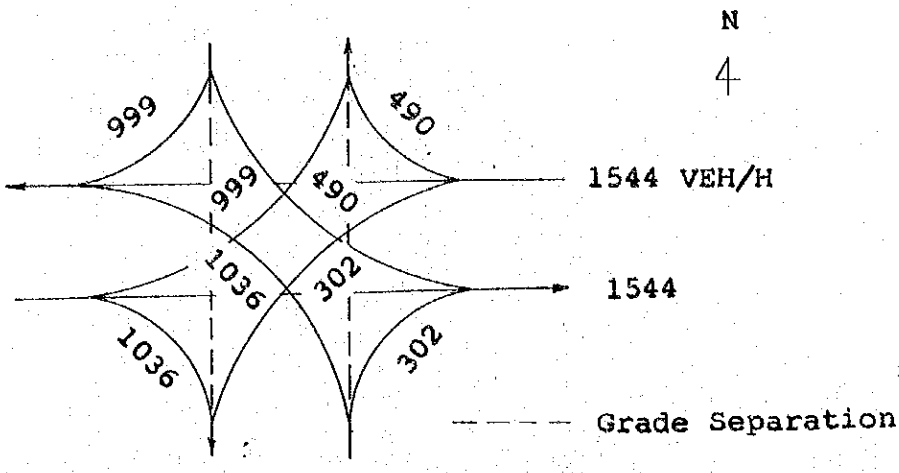
SECTION (B) - (B')
S = 1 : 200

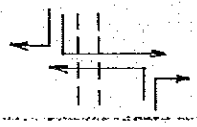
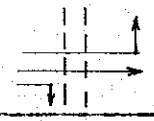


SECTION (A) - (A')
S = 1 : 200

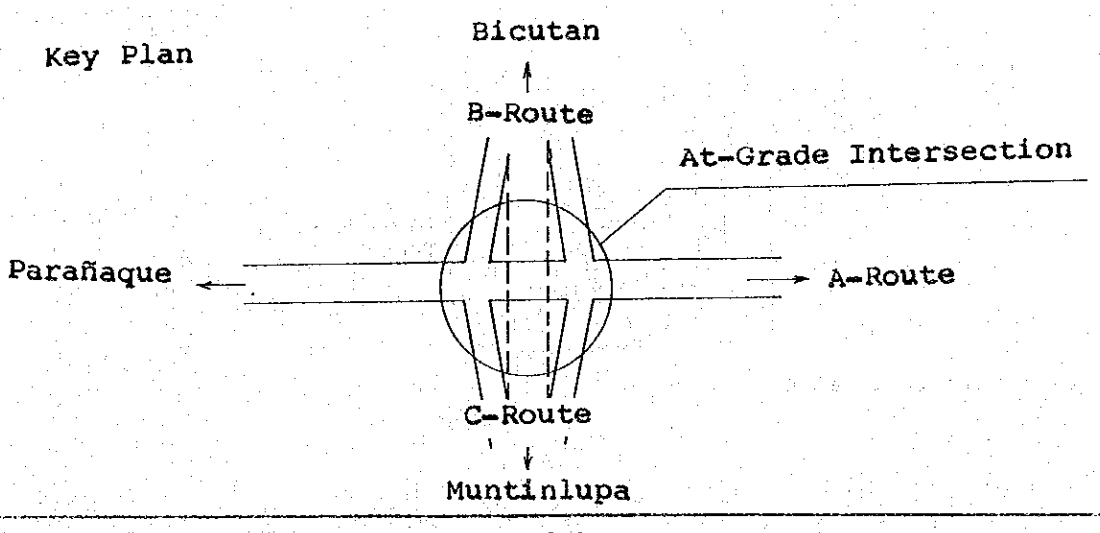
APPENDIX FIG. 8.5-10 CAPACITY ANALYSIS OF INTERSECTION

(A-ROUTE/C-ROUTE)

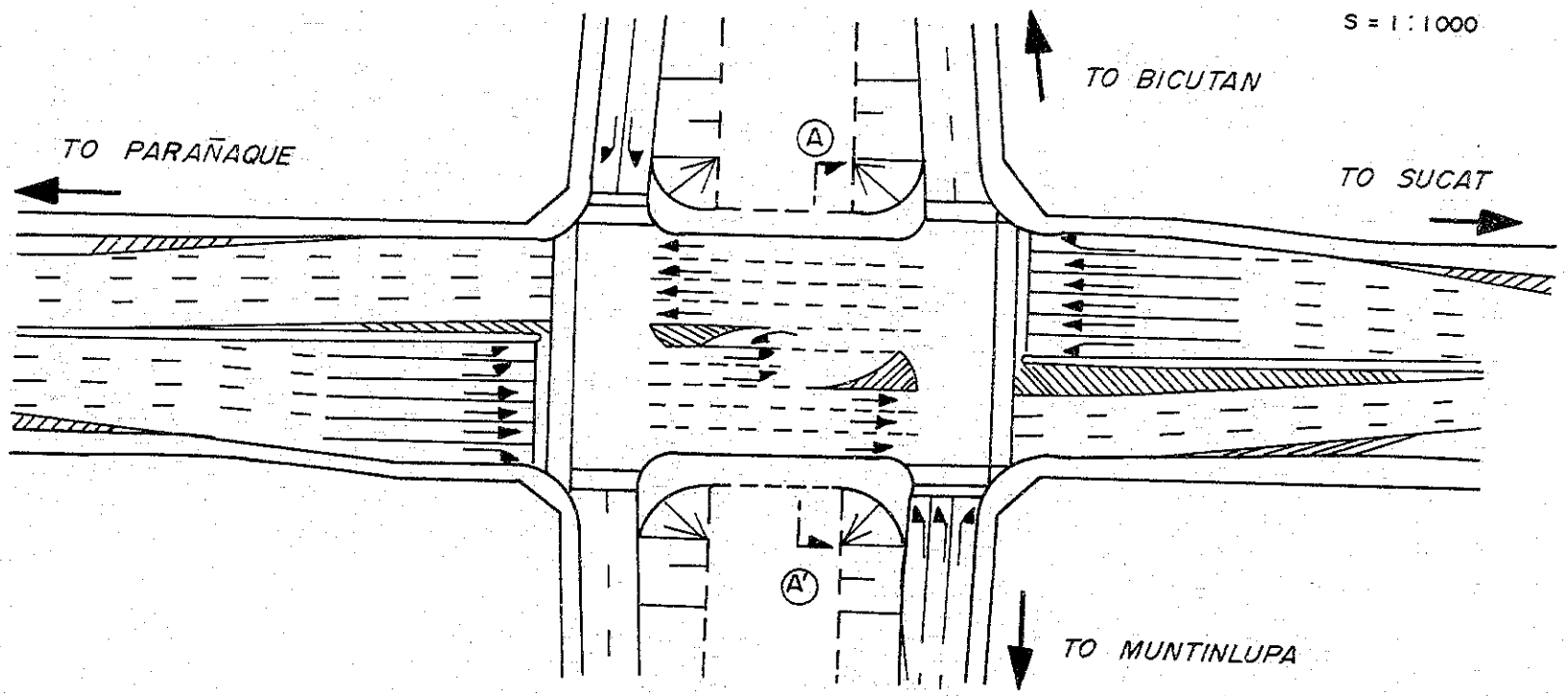


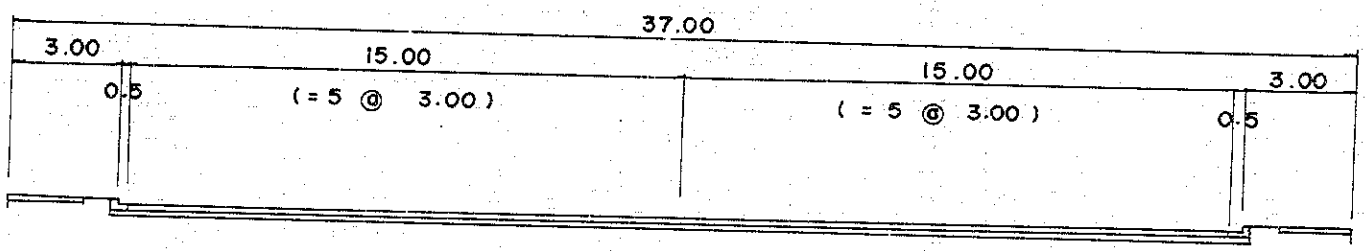
	TRAFFIC PHASE	TRAFFIC VOLUME V (PCU/H)	POSSIBLE CAPACITY Cp (PCU/H)	INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED	PHASE TIME (SEC)
1		VL = 588 VR = 1199 VR = 458 VL = 1243	1 x 2000=2000 2 x 2000=4000	0.294 0.311*	37%	41 + 3
2		VL = 1199 VT = 1853 VR = 1243	2 x 2000=4000 3 x 2250=6,750	0.300* 0.275	36%	40 + 3
3		VL = 458 VT = 1853 VR = 588	1 x 2000=2000 4 x 2250=9000	0.229* 0.206	27%	29 + 3
4			TOTAL	0.84	100%	120

Key Plan



APPENDIX FIG. 8.5–11 SCHEMATIC PLAN OF A–ROUTE / C–ROUTE INTERCHANGE

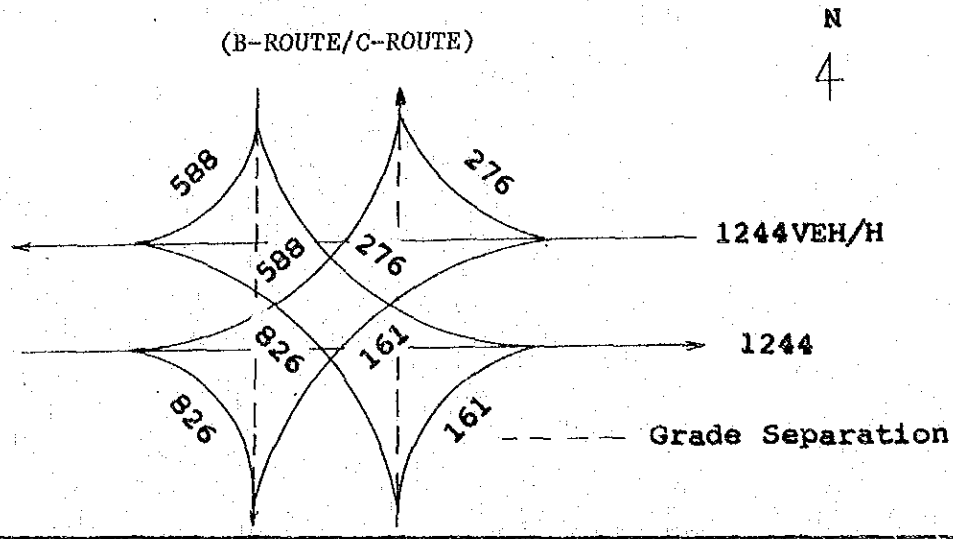


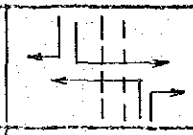
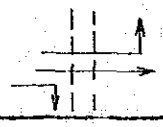


SECTION (A) – (A') S = 1:200

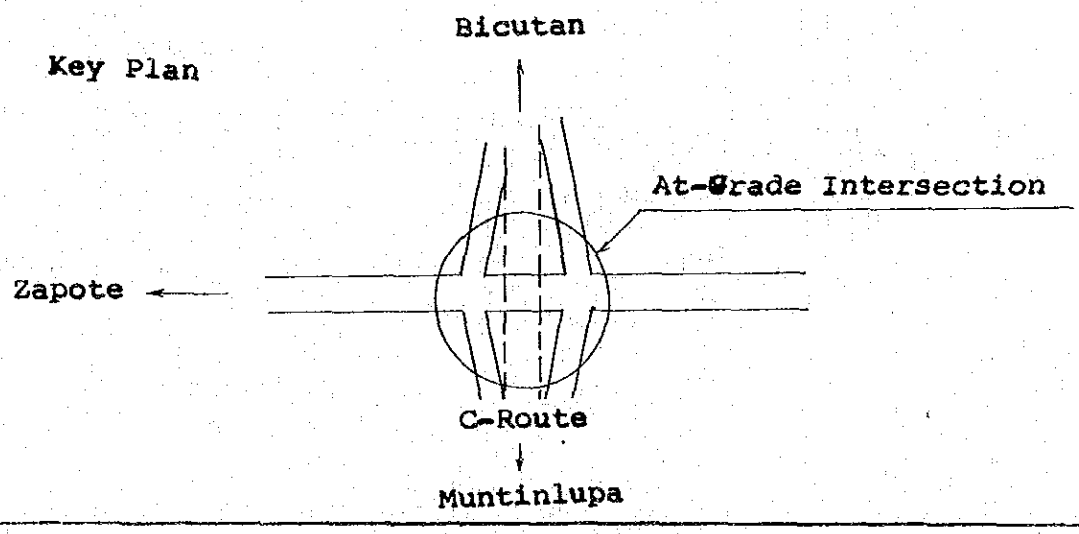
APPENDIX FIG. 8.5-12 CAPACITY ANALYSIS OF INTERSECTION

(B-ROUTE/C-ROUTE)

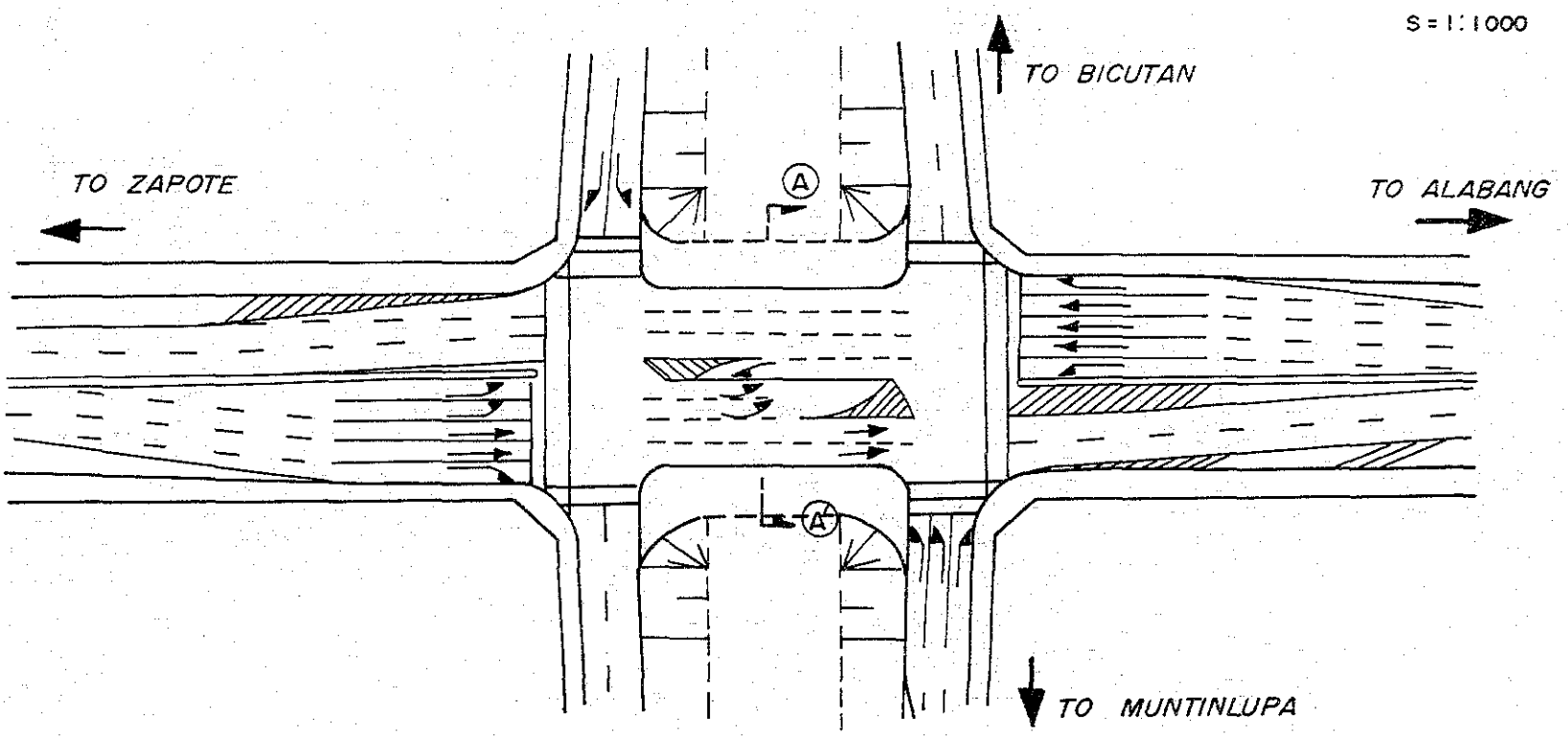


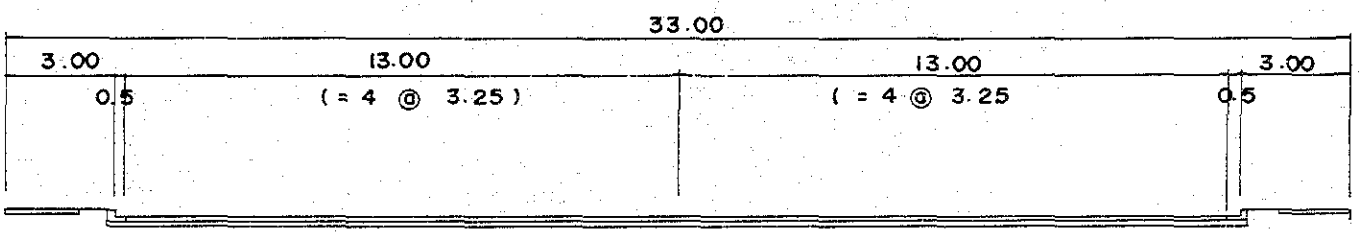
	TRAFFIC PHASE	TRAFFIC VOLUME V (PCU/H)	POSSIBLE CAPACITY Cp (PCU/H)	INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED	PHASE TIME (SEC)
1		VL = 331 VR = 706 VR = 193 VL = 991	1 x 2000=2000 2 x 2000=4000	0.166 0.248*	31%	34 + 3
2		VL = 706 VT = 1493 VR = 991	2 x 2000=4000 2 x 2250=4500	0.177 0.332*	41%	46 + 3
3		VL = 193 VT = 1493 VR = 331	1 x 2000=2000 3 x 2250=6750	0.097 0.221*	28%	31 + 3
4						
			T O T A L	0.801	100%	1 0

Key Plan



APPENDIX FIG. 8.5–13 SCHEMATIC PLAN OF B–ROUTE / C–ROUTE INTERCHANGE

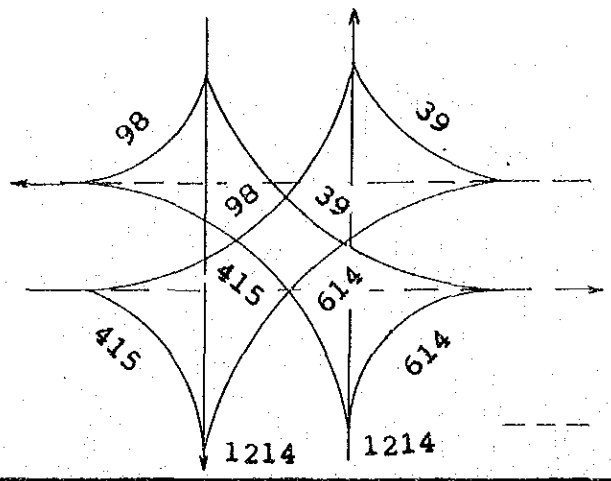


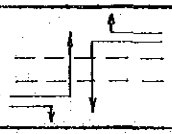
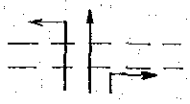


SECTION Ⓐ - Ⓐ' S = 1 : 200

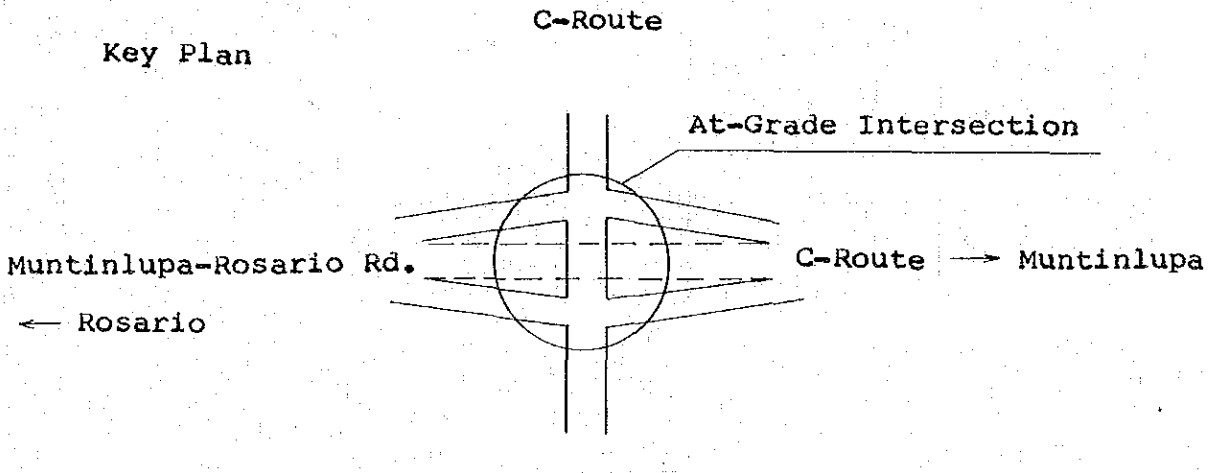
APPENDIX FIG. 8.5-14 CAPACITY ANALYSIS OF INTERSECTION

(C-ROUTE/MUNTINLUPA-ROSARIO ROAD)

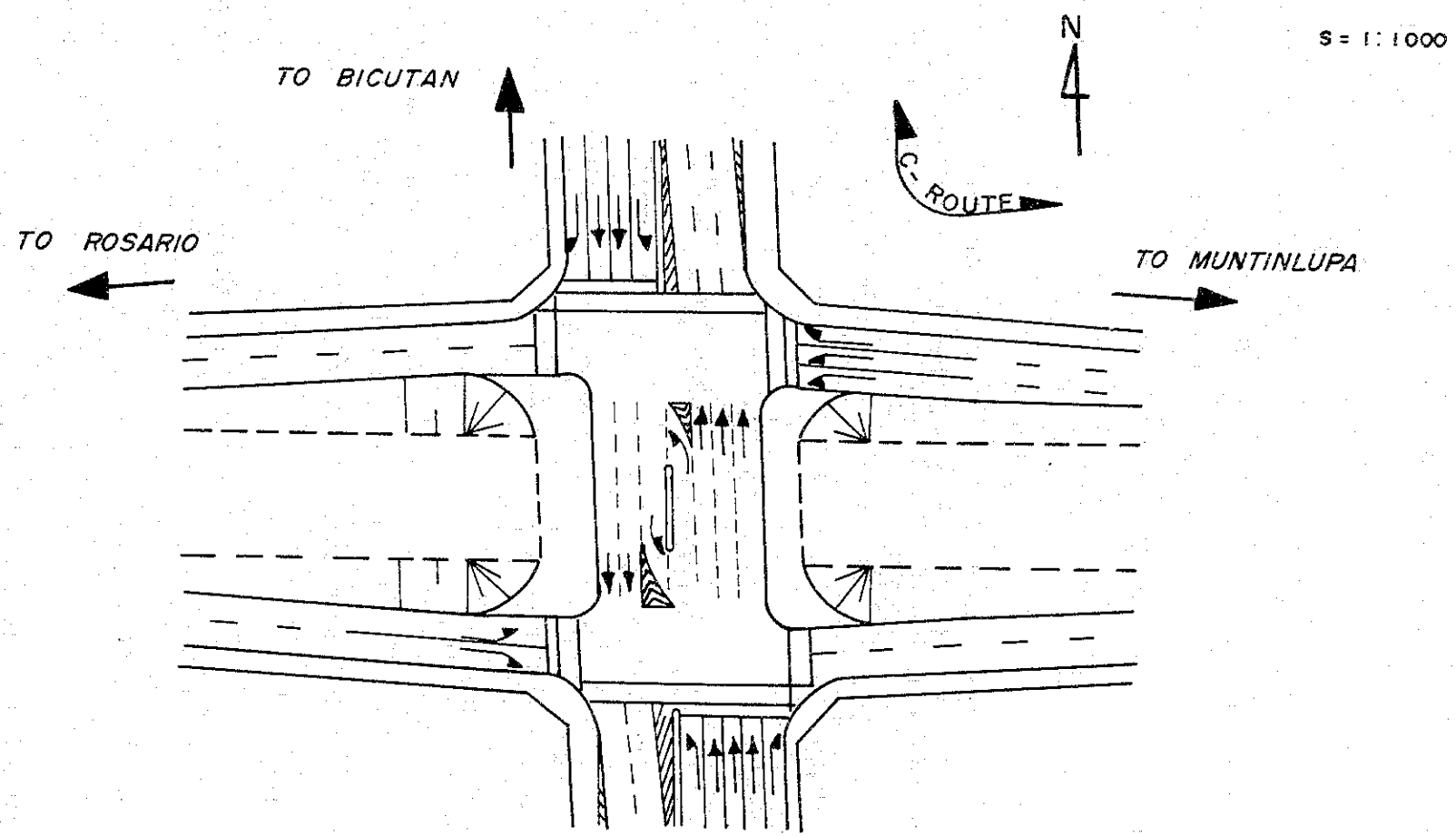


	TRAFFIC PHASE	TRAFFIC VOLUME V (PCU/H)	POSSIBLE CAPACITY Cp (PCU/H)	INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED	PHASE TIME (SEC)
1		VL = 737 VR = 47 VR = 118 VL = 498	2 x 2000=4000 1 x 2000=2000	0.184 0.249*	30%	27 + 3
2		VL = 47 VT = 1457 VR = 118	1 x 2000=2000 2 x 2250=4500	0.024 0.324*	39%	36 + 3
3		VL = 498 VT = 1457 VR = 737	1 x 2000=2000 3 x 2250=6750	0.249* 0.216	31%	28 + 3
4						
			T O T A L	0.822	100%	100

Key Plan

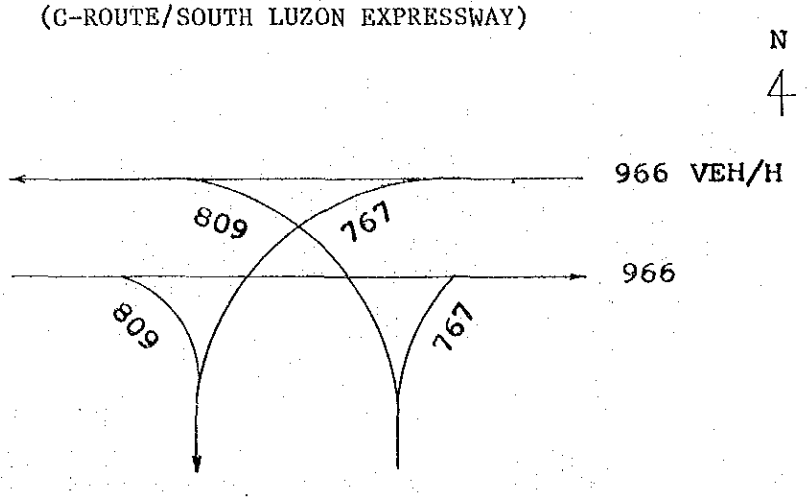


APPENDIX FIG. 8.5–15 SCHEMATIC PLAN OF C–ROUTE/MUNTINLUPA–ROSARIO ROAD



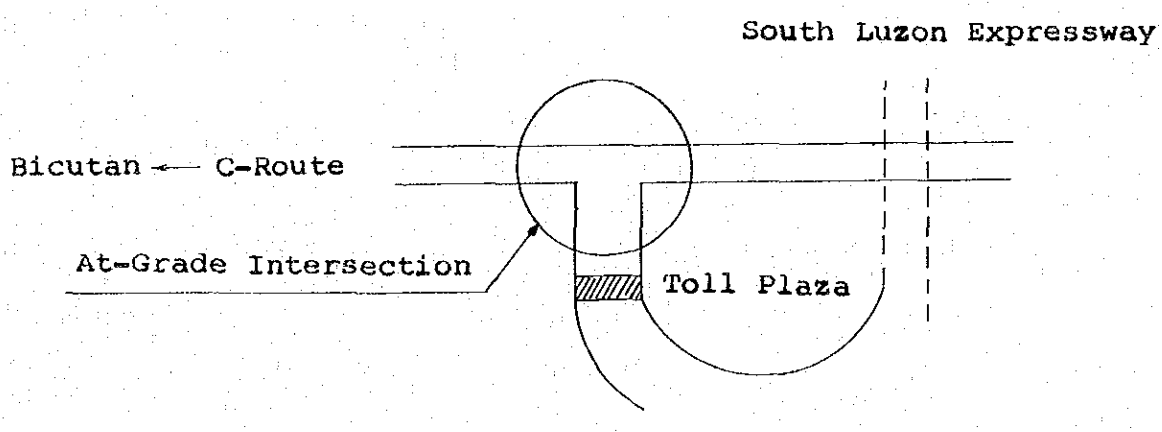
APPENDIX FIG. 8.5-16 CAPACITY ANALYSIS OF INTERSECTION

(C-ROUTE/SOUTH LUZON EXPRESSWAY)



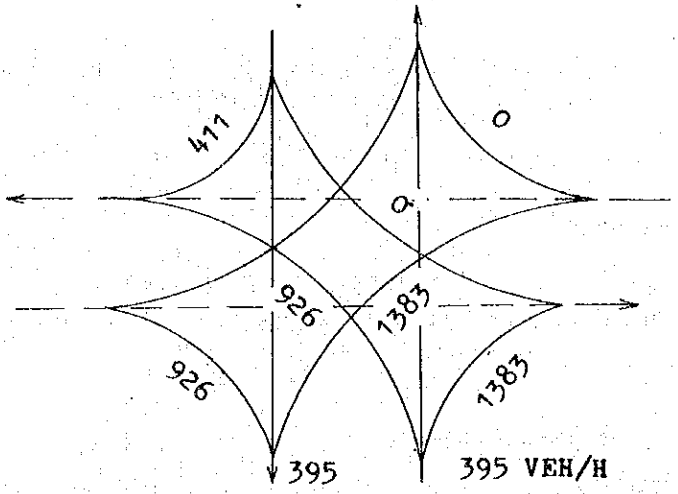
	TRAFFIC PHASE	TRAFFIC VOLUME V (PCU/H)	POSSIBLE CAPACITY Cp (PCU/H)	INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED	PHASE TIME (SEC)
1		V VT = 1159 VR = 1159	2 x 2250=4500 2 x 2250=4500	0.258 0.258	35%	32 + 3
2		V = 920	2 x 2000=4000	0.23	32%	29 + 3
3		V = 971	2 x 2000=4000	0.243	33%	30 + 3
4						
			T O T A L	0.731	100%	100

Key Plan

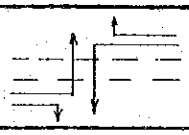
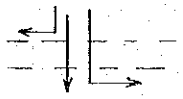


APPENDIX FIG. 8.6-17 CAPACITY ANALYSIS OF INTERSECTION

(C-ROUTE/NATIONAL ROAD NO. 1)

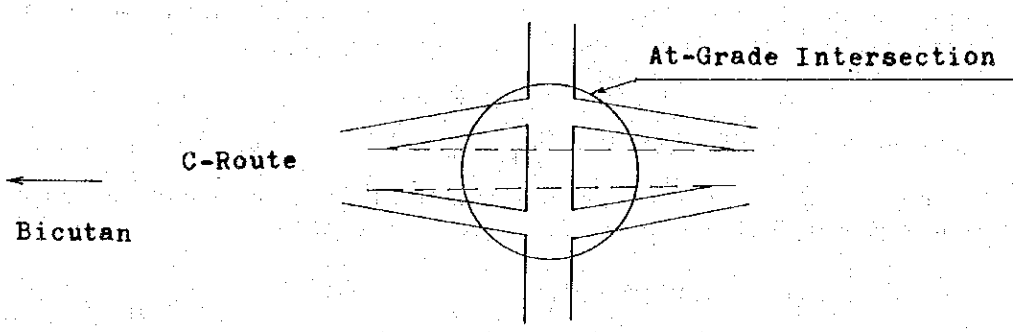


Grade Separation

	TRAFFIC PHASE	TRAFFIC VOLUME V (PCU/H)	POSSIBLE CAPACITY Cp (PCU/H)	INTEGRATED CONGESTION RATIO Y = V/Cp	MODIFIED	PHASE TIME (SEC)
1		VL = 1660 VR = 0 VR = 1111 VL = 493	2 x 2000=4000 1 x 2000=2000	0.415* 0.247	52%	49 + 3
2		VL = 0 VT = 474 VR = 493	2 x 2250=4500	0.105*	13%	10 + 3
3		VL = 1111 VT = 474 VR = 1660	2 x 2000=4000 1 x 2250=2250	0.278* 0.211	35%	32 + 3
4						
			T O T A L	0.798	100%	100

Key Plan

National Road No. 1



APPENDIX NOTE 8.6 DESIGN OF FLEXIBLE PAVEMENT

The design method for the flexible pavement structure for the Roads was based on the "AASHTO INTERIM GUIDE FOR DESIGN OF PAVEMENT STRUCTURES, 1972."

8.6.1 Average Daily Traffic

A 20-year design period from 1987 to 2007 was used for the pavement design. The average daily traffic volume on each section for the selected years are shown in Table 8.6-2.

8.6.2 Equivalent 18-kip Single Axle Loads

The number of equivalent 18-kip single axle load application per day in the design lane was obtained by multiplying the traffic voluem per lane by the 18-kip equivalent factors for all heavy vehicles and the results are listed in Table 8.6-3.

8.6.3 Soil Support Value

The soil support value for this design was obtained by converting the Design CBR, determined by the laboratory test results according to the design method in the AASHTO INTERIM GUIDE:

- Design CBR = 8.4%
- Soil Support Value = 4.6%

8.6.4 Serviceability Index

The terminal serviceability index of 2.5 was recommended for the design of this Project since the road is defined as a major highway.

8.6.5 Regional Factor

A regional factor of 1.5 was adopted considering the adverse conditions in the Project site, such as the strength loss of the roadbed materials which may occur during the rainy season.

8.6.6 Structural Layer Coefficient

Each thickness of the surface course, base course and sub-base course was determined by the following equation:

$$SN = a_1D_1 + a_2D_2 + a_3D_3$$

where: SN = Structural Number

a_1, a_2, a_3 = Coefficients of relative strength of pavement layers

D_1, D_2, D_3 = Actual thickness, in inches, of surface, base and subbase course, respectively.

Using Table C.4-1 in the AASHTO INTERIM GUIDE, the following layer coefficient values were obtained.

Pavement Component	Coefficient
Surface Course:	
Plant Mix (High Stability)	0.44
Base Course:	
Bituminous-Treated (Coarse-Graded)	0.34
Aggregate Base	0.14
Subbase Course: Sandy Gravel	0.11

8.6.7 Pavement Thickness

The required design structural numbers (SN) over the roadbed soil were determined from the Fig. 11-1, of the AASHTO INTERIM GUIDE.

From the above mentioned factors, the weighted structural numbers (SN) for each road section were calculated as follows:

- For A-Route 4.95
- For B-Route 5.10
- For C-Route 4.69

The pavement structures resulted in these calculations are shown as follows:

1) A-Route

	Thickness		Layer Coefficient	SN
A.C. Surface	2.0 (5 cm)	x	0.44	0.88
Bituminous Treated Base	7.1(18 cm)	x	0.34	2.41
Subbase	15.7 (40 cm)	x	0.11	1.73
Total	24.8 inch (63 cm)			5.02

	Thickness	Layer Coefficient		SN
A.C. Surface	2.0 (5 cm)	x 0.44	=	0.88
Aggregate Base	17.4 (45 cm)	x 0.14	=	2.48
Subbase	15.7 (40 cm)	x 0.11	=	1.73
Total:	35.4 inch (90 cm)			5.09

2) B-Route

A.C. Surface	2.0 (t cm)	x 0.44	=	0.88
Bituminous Treated Base	7.9 (20 cm)	x 0.34	=	2.69
Subbase	15.7 (40 cm)	x 0.11	=	1.73
Total:	25.6 inch (65 cm)			5.30

A.C. Surface	2.0 (5 cm)	x 0.44	=	0.88
Aggregate Base	19.7 (50 cm)	x 0.14	=	2.76
Subbase	15.7 (40 cm)	x 0.11	=	1.73
Total:	37.4 inch (95 cm)			5.37

3) C-Route

A.C. Surface	2.0 (5 cm)	x 0.44	=	0.88
Bituminous Treated Base	6.3 (16 cm)	x 0.34	=	2.14
Subbase	15.7 (40 cm)	x 0.11	=	1.73
Total:	24.0 Inch (61 cm)			4.75

A.C. Surface	2.0 (5 cm)	x 0.44	=	0.88
Aggregate Base	15.7 (40 cm)	x 0.14	=	2.20
Subbase	15.7 (40 cm)	x 0.11	=	1.73
Total:	33.4 inch (85 cm)			4.81

8.6.8 Comparison of Construction Cost of Pavement

1) Asphalt Concrete Pavement

a. With Bituminous Treated Base Course:

Surface
(t=5 cm) $0.05\ m^3$ x $2.35\ t/m^3$ x (384.35 ₱/t x 1.3) = $58.0\ ₱/m^2$

Bituminous Treated Base
(t=20) 0.20 x 2.30 x (269.0 x 1.3) = 160.8

Sandy Gravel Subbase
(t=40) 0.40 x (92.58 ₱/m^2 x 1.3) = 48.1

266.9 ₱/m^2

b. With Aggregate Base Course:

Surface
(t=5 cm) $0.05\ m^3$ x $2.35\ t/m^3$ x (384.35 ₱/t x1.3) = $58.0\ ₱/m^2$

Aggregate Base
(t=57) 0.57 x 175.66 ₱/m^3 = 100.1

Sandy Gravel Subbase
(t=40) 0.40 x (92.58 ₱/m^2 x 1.3)= 48.1

206.2

c. With Overlay on Surface Course Every 5 Years:

Surface
(t=5 cm) $0.05\ m^3$ x $2.35\ t/m^3$ x (384.35 ₱/t x 1.3) = $58.0\ ₱/m^2$

Overlay 58.0 ₱/m^2 x 4 times = 232.0

Aggregate Base (t=57 cm) 0.57 x 175.66 ₱/m^3 = 100.1

Sandy Gravel Subbase
(t=40 cm) 0.40 x (92.58 ₱/m^2 x 1.3) = 48.1

438.2 ₱/m^2

2) Cement Concrete Pavement

Surface (t=25 cm) 152.47 ₱/m^2 x 1.3 = 198.2 ₱/m^2

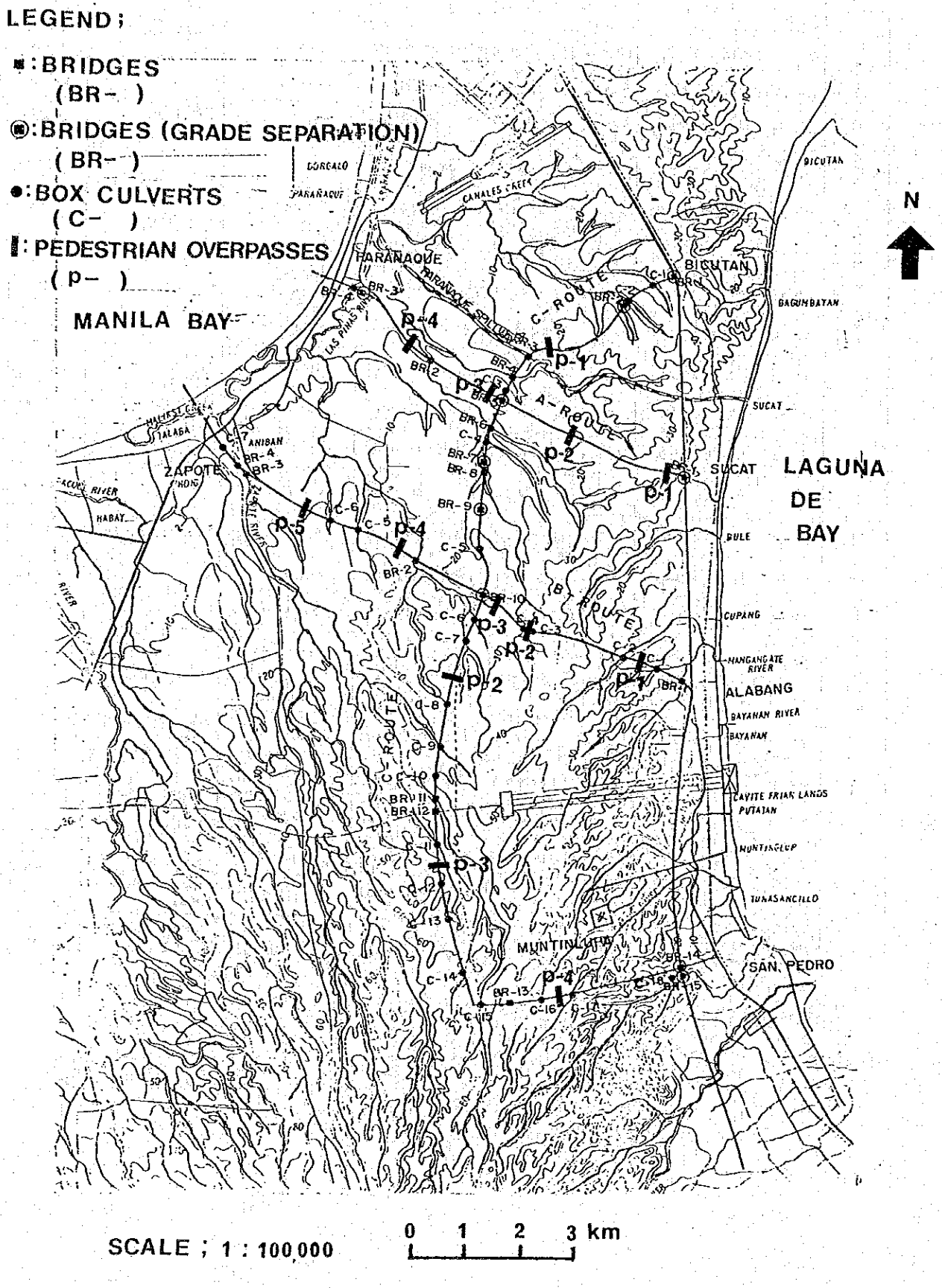
Subbase (t=20 cm) 0.2 x 192.58 ₱/m^3 x 1.3 = 24.1

222.3 ₱/m^2

APPENDIX TABLE 8.7-1 INVENTORY OF EXISTING DRAINAGE STRUCTURES

TYPE OF STRUCTURE AND LOCATION	DESCRIPTION	REMARKS
PARAÑAQUE-SUCAT ROAD		
A. Bridge 0.1 km. from Imelda Avenue	Length : 48.80 m. No. of spans : 4 Width (effective) : 7.40 m. Type : Prestressed/Precast concrete	Substructure (Pile bent pier)
B. Bridge 1.75 km. from Imelda Avenue	Length : 12.00 m. No. of spans : 1 Width (effective) : 7.00 m. Type : Concrete T-Beam	
ALABANG-ZAPOTE ROAD		
C. Bridge 4.5 km. from Zapote	Length : 13.60 m. No. of spans : 1 Width (effective) : 12.00 m. Type : Concrete Arch	
D. Bridge 9.85 km. from Zapote	Length : 9.50 m. No. of spans : 1 Width (effective) : 11.80 m. Type : Concrete Slab	
a. Culvert 2.8 km. from Zapote	Section : Single B x H = 2.00 m. x 1.00 m. Length : 14.50 m.	
b. Culvert 3.4 km. from Zapote	Section : Double B x H = 1.90 m. x 1.70 m. Length : 15.00 m.	
c. Culvert 6.8 km. from Zapote	Section : Double B x H = 2.10 m. x 1.80 m. Length : 15.60 m.	
d. Culvert 7.0 km. from Zapote	Section : Single B x H = 2.10 m. x 2.10 m. Length : 14.30 m.	
e. Culvert 8.1 km. from Zapote	Section : Single B x H = 1.00 m. x 1.00 m. Length : 18.30 m.	
f. Culvert 8.7 km. from Zapote	Section : Triple B x H = 3.05 m. x 2.40 m. Length : 15.30 m.	
g. Culvert 9.3 km. from Zapote	Section : Single B x H = 1.20 m. x 1.20 m.	

APPENDIX FIG. 8.7-1 LOCATION OF PROPOSED STRUCTURES

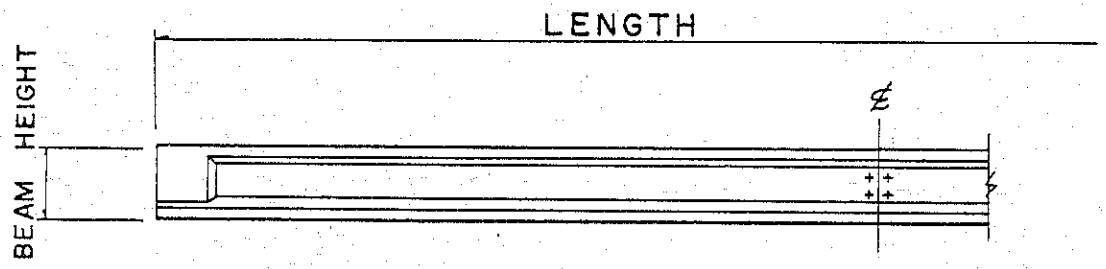


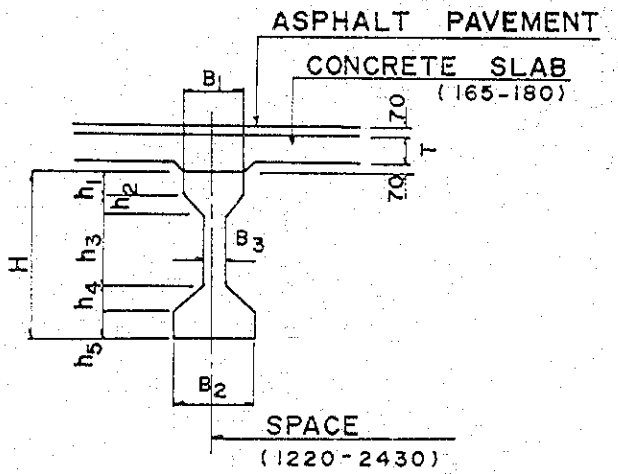
APPENDIX TABLE 8.7-2 LIST OF PROPOSED BRIDGES

Road	Bridge Number	Station	Bridge Length	Super Structure Type	Foundation Type	Crossing Object	Remarks
Parañaque - Sucat Rd. (A)	BR.-1	STA. 0+0	50m (2 x 25m)	Steel Composite	Spread	South Express Way	Over Br. (Widening)
	BR.-2	STA. 5 +175	36.4m (2 x 18.2m)	P.C. Composite	Spread		River Br.
	BR.-3	STA.8 +945	40 m (1 x 40m)	Steel Composite	Pile	Imelda Extension Rd.	Over Br.
	BR.-4	STA.7 + 140	30m (2 x 15 m)	P.C. Composite	Pile		River Br.
Alabang - Zapote Rd. (B)	BR.-1	STA.0 + 322	22.4m(1 x 22.4m)	P.C. Composite	Spread		River Br.
	BR.-2	STA.5 + 820	22.4m(1x 22.4m	P.C. Composite	Spread		River Br.
	BR.-3	STA.9 + 250	51.2m(2 x 25.6m)	P.C. Composite	Spread , Pile		River Br.
	BR.-4	STA.9 + 540	18 m (1 x 18 m)	P.C. Composite	Pile		River Br.
Taguig - Las Piñas - Muntinlupa Loop Rd. (C)	BR.-1	STA.0 + 0	50 m (2 x 25m)	P.C. Composite	Spread	South Express Way	Over Br. (Widening)
	BR.-2	STA.1 + 100	18m (1 x 18m)	P.C. Composite	Spread		Over Br.
	BR.-3	STA.2 + 910	75 m (3 x 25 m)	P.C. Composite	Spread	Parañaque Spillway	River Br.
	BR.-4	STA.3 + 205	22.4m(1x 22.4m)	P.C. Composite	Spread		River Br.
	BR.-5	STA.3 + 965	40 m(1x 40 m)	Steel Composite	Spread	Parañaque - Sucat Rd.(A)	Over Br.
	BR.-6	STA.4 + 560	19.4m(1x19.4m)	P.C. Composite	Spread		River Br.
	BR.-7	STA.5 + 310	22 m (1x22 m)	P.C. Composite	Spread		Over Br.
	BR.-8	STA.5 + 890	22.4m(1x22.4m)	P.C. Composite	Spread		River Br.
	BR.-9	STA.6 + 400	15m (1x15 m)	P.C. Composite	Spread		Over Br.
	BR.-10	STA.7+ 785	40m(1x 40m)	Steel Composite	Spread	Alabang-Zapote Rd. (B)	Over Br.
	BR.-11	STA.11 + 840	22.4m(1x 22.4m)	P.C. Composite	Spread		River Br.
	BR.-12	STA.12+ 250	15m (1x15 m)	P.C. Composite	Spread	Irrigation Canal	River Br.
	BR.-13	STA.16+ 330	17.4m(1x 17.4m)	P.C. Composite	Spread		River Br.
	BR.-14	STA.20+050	70 m(2x 35 m)	Steel Composite	Spread	South Express Way	Over Br.
	BR.-15	STA.20+050	70 m(2 x 35 m)	Steel Composite	Spread	South Express Way	Interchange Br.

APPENDIX TABLE 8.7–3 LIST OF STANDARD AASHTO P.C.–I BEAM SECTIONS

DIMENSION : MILLIMETER





TYPE	LENGTH	H	h_1	h_2	h_3	h_4	h_5	B_1	B_2	B_3	AREA (m^2)
II	10,670 - 15,240	914	152	76	382	152	152	305	153	457	0.2381
III	15,240 - 26,340	1143	178	114	482	191	178	402	178	552	0.3613
IV	21,340 - 27,440	1372	203	152	585	229	203	508	203	660	0.5090
IV-A	27,440 - 30,490	1473	305	152	584	229	203	508	203	660	0.5606

TYPE	APPLIED SPAN(m)
II	15 — 17
III	18 — 22
IV	23 — 27
IV-A	28 — 30

APPENDIX TABLE 8.7-4 LIST OF PROPOSED PEDESTRIAN BRIDGES

Road	Pedestrian Bridge Number	Station	Remarks
Parañaque - Sucat Rd.(A)	PED. OV. BR.- 1	STA. 0 + 150	
	BR.- 2	STA. 2 + 300	
	BR.- 3	STA. 3 + 650	
	BR.- 4	STA. 5 + 810	
Alabang - Zapote Rd. (B)	PED. OV. BR.- 1	STA. 1 + 160	
	BR.- 2	STA. 3 + 360	
	BR.- 3	STA. 4 + 250	
	BR.- 4	STA. 6 + 250	
	BR.- 5	STA. 8 + 270	
Taguig - Las Piñas - Muntinlupa Loop Rd. (C)	PED. OV. BR.- 1	STA. 2 + 370	
	BR.- 2	STA. 9 + 300	
	BR.- 3	STA. 13 + 350	
	BR.- 4	STA. 17 + 540	

Notes:

· Standards Superstructure Type

Main ; P. C. I Beam

Stairway ; R. C. Slab

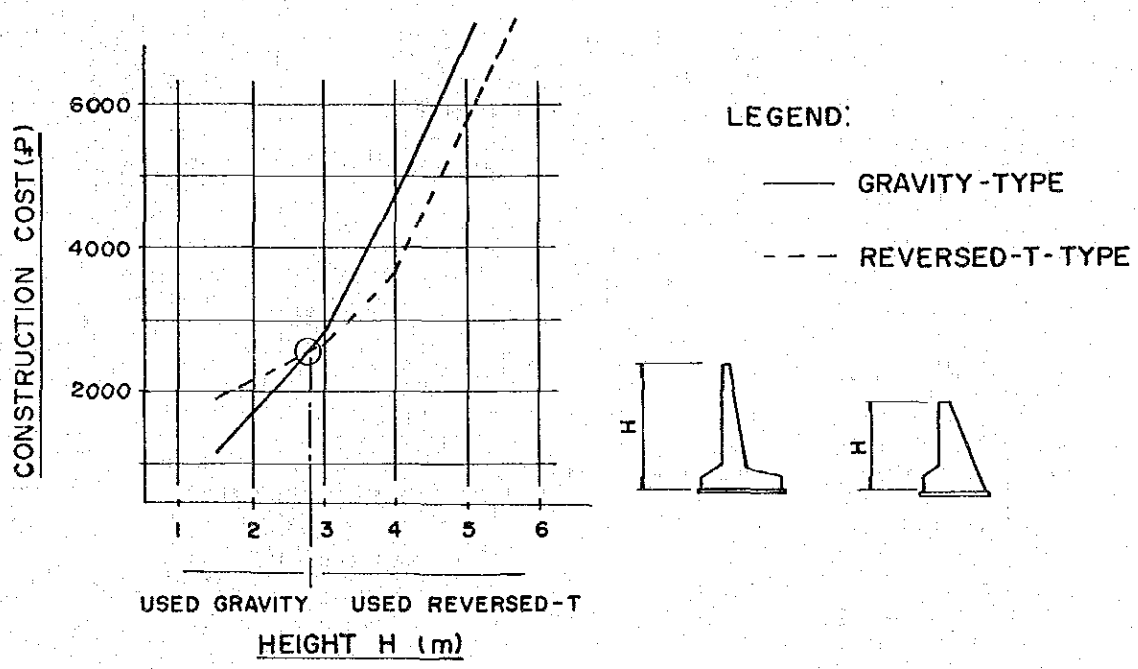
· Bridge Length Main ; 30.02 m

Stairway ; 2 @ 13.31 m

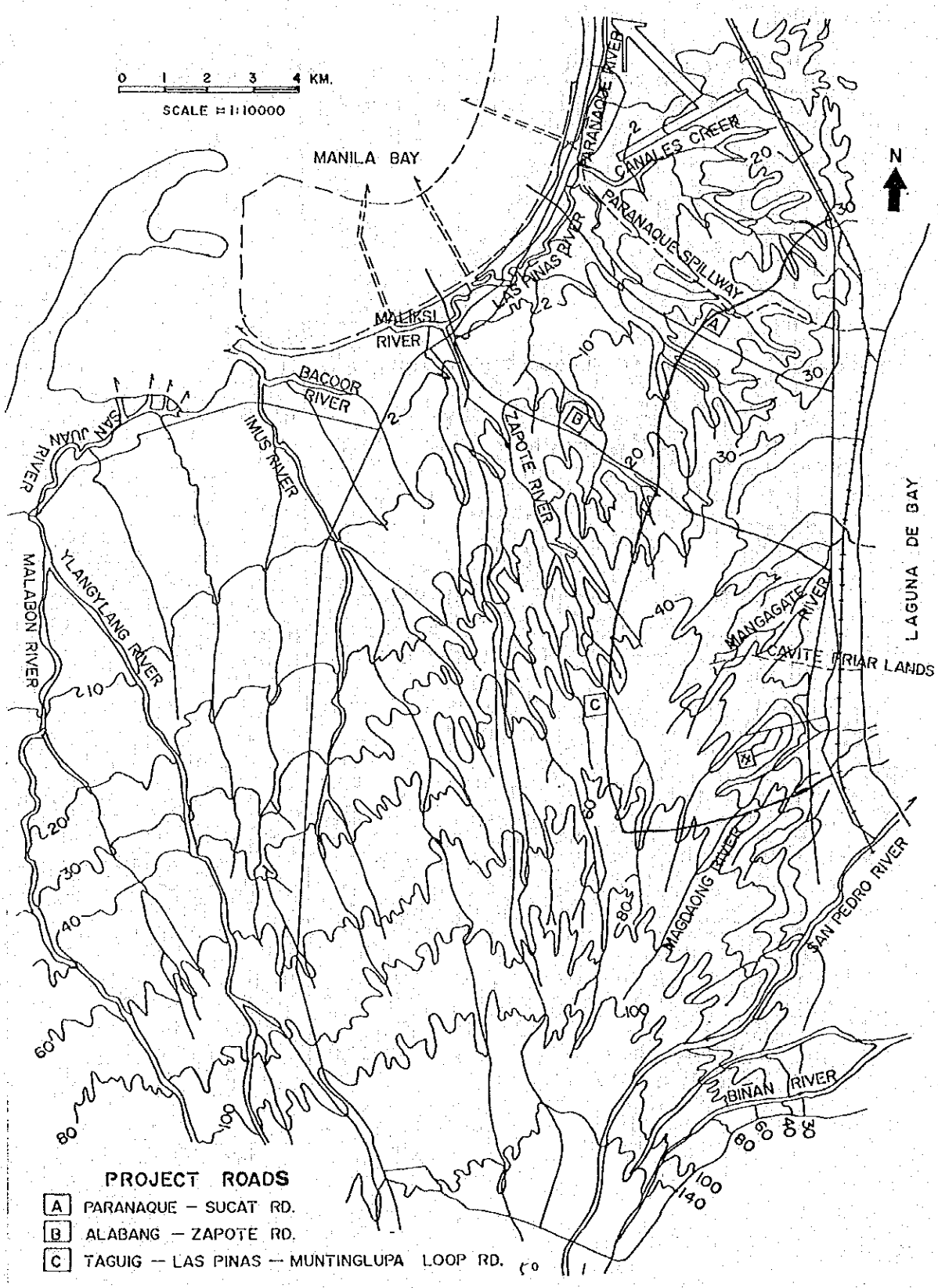
APPENDIX TABLE 8.7-5 LIST OF PROPOSED BOX CULVERTS

Road	Box Number	Station	Width (m)	Height (m)	Opening - Type	Invert Elevation	Remarks
Alabang - Zapote Rd. (B)	C - 1	STA. 0 + 965	3.05	2.44	Mono	9.20	Drainage
	C - 2	STA. 1 + 570	3.05 x 3	3.05	Multi	11.30	"
	C - 3	STA 3 + 320	2.44	2.13	Mono	25.00	"
	C - 4	STA. 3 + 470	3.05 x 2	3.05	Multi	25.70	"
	C - 5	STA. 7 + 025	3.05	3.05	Mono	8.80	"
	C - 6	STA. 7 + 705	2.44	2.44	Mono	8.70	"
	C - 7	STA 9 + 960	6.00	4.00	Mono	2.62	Cross Road
Taguig - Las Pinas - Muntinlupa Loop Rd. (C)	C - 1	STA. 0 + 430	3.05	2.44	Mono	18.90	Drainage
	C - 2	STA. 1 + 030	3.05	2.44	Mono	14.90	"
	C - 3	STA 3 + 765	3.05	3.05	Mono	6.50	"
	C - 4	STA. 4 + 750	3.05 x 2	2.44	Multi	7.50	"
	C - 5	STA. 6 + 980	2.44	2.13	Mono	17.70	"
	C - 6	STA. 8 + 190	3.05	3.05	Mono	21.00	"
	C - 7	STA. 8 + 550	3.05 x 2	3.05	Multi	20.50	"
	C - 8	STA 9 + 790	2.44 x 2	2.13	Multi	23.00	"
	C - 9	STA. 10 + 610	3.05 x 2	2.44	Multi	18.80	"
	C - 10	STA. 11 + 470	2.44	2.13	Mono	20.20	"
	C - 11	STA. 13 + 020	3.05 x 2	2.44	Multi	37.00	"
	C - 12	STA. 13 + 730	2.44	2.13	Mono	40.00	"
	C - 13	STA. 14 + 490	2.44	2.13	Mono	46.00	"
	C - 14	STA. 15 + 170	2.44	2.13	Mono	49.00	"
	C - 15	STA. 16 + 090	2.44 x 2	2.13	Multi	56.50	"
	C - 16	STA. 17 + 240	3.05 x 2	2.44	Multi	46.00	"
	C - 17	STA. 17 + 850	3.05 x 2	2.44	Multi	44.00	"
	C - 18	STA. 20 + 050	3.05 x 2	3.05	Multi	22.30	" (Interchange)

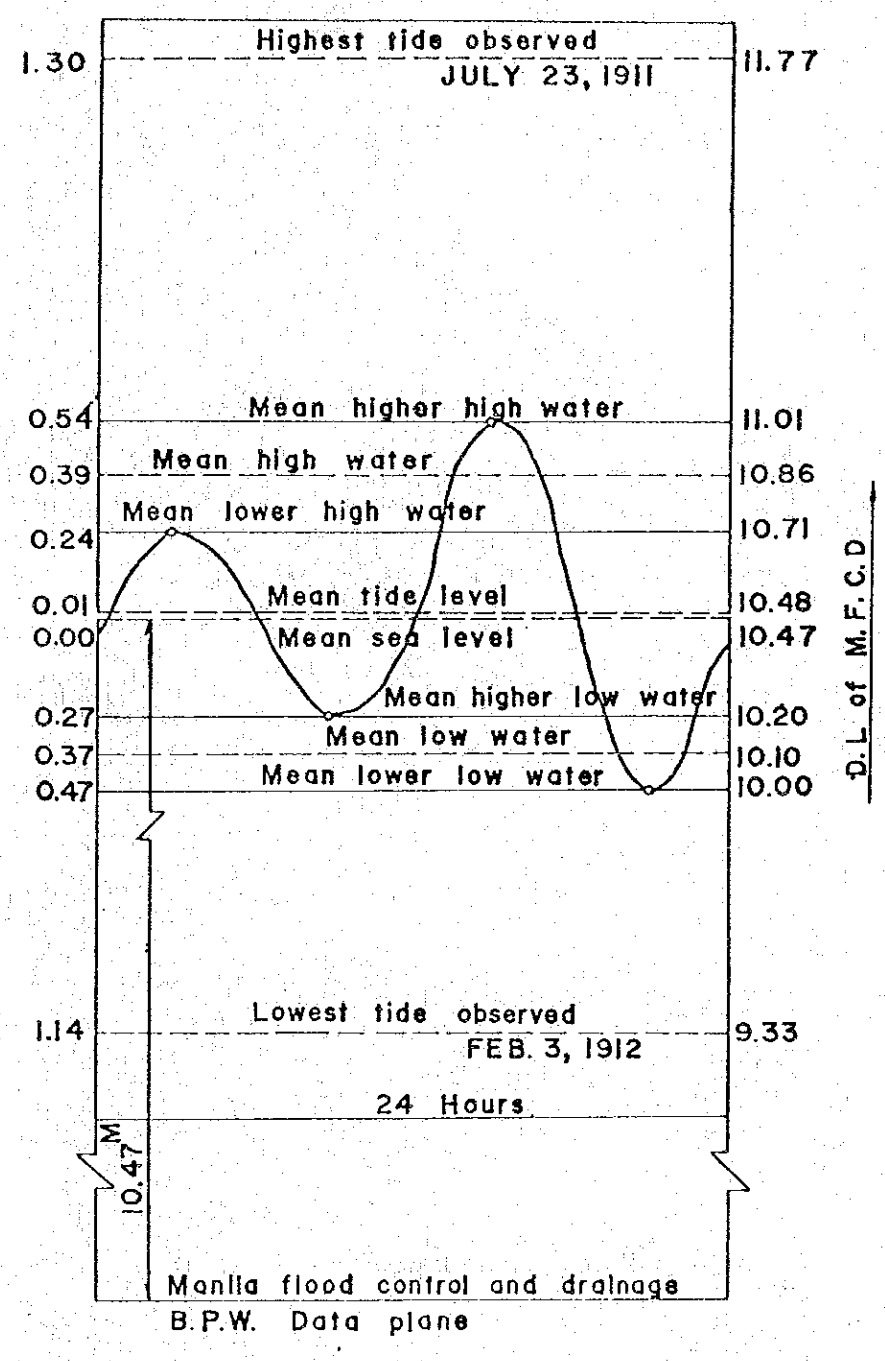
APPENDIX FIG. 8.7-2 RELATIONSHIP OF COST OF RETAINING WALL-TYPE



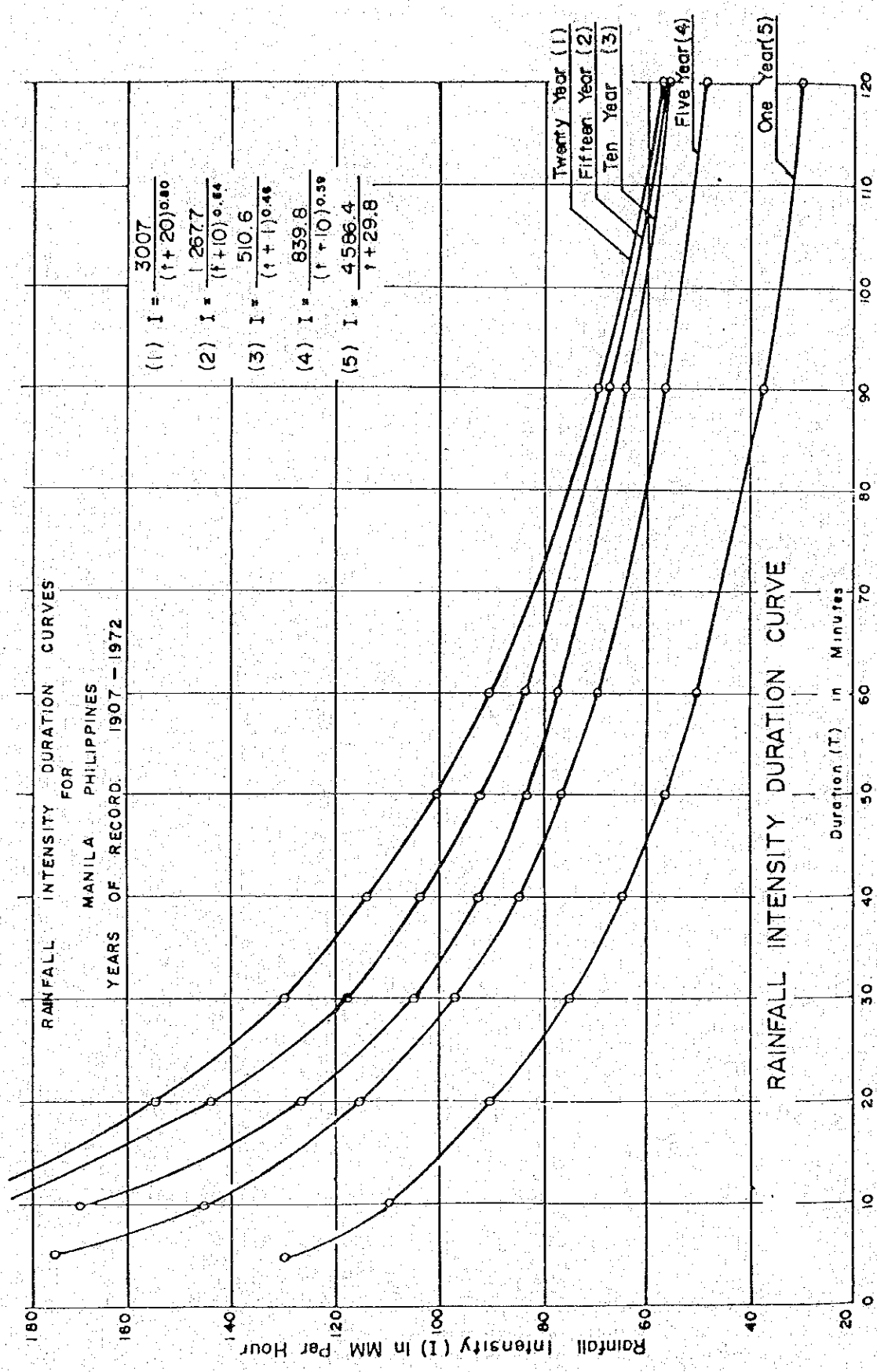
APPENDIX FIG. 8.8-1 RIVERS IN PROJECT AREA



APPENDIX FIG. 8.8–2 MEAN TIDE VALUES OF MANILA BAY



APPENDIX FIG. 8.8–3 RAINFALL INTENSITY DURATION CURVES



APPENDIX FIG. 8.8–4 CATCHMENT AREAS FOR MAIN RIVERS