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 x 1.3) = 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

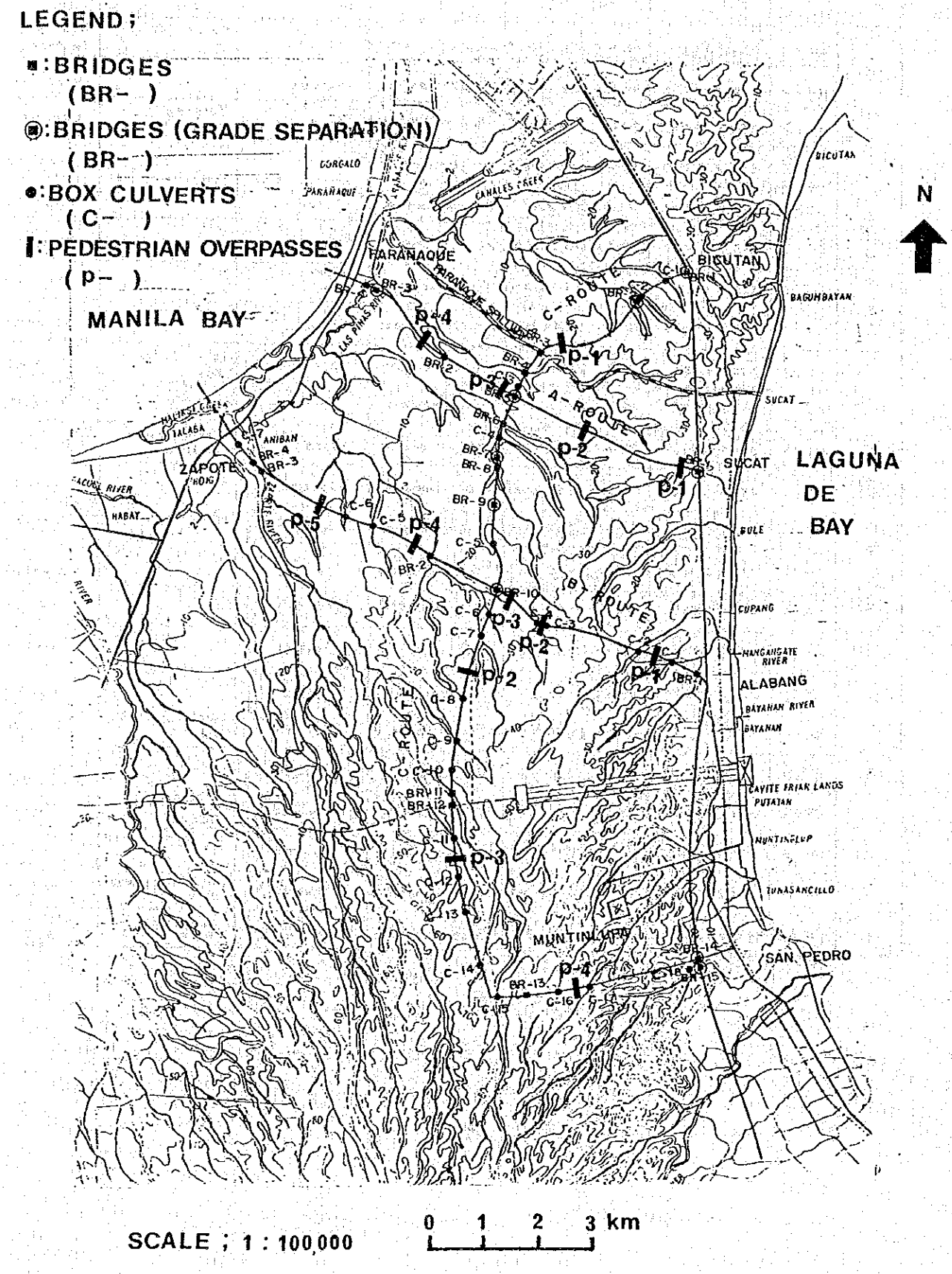
Subbase (t=20 cm) 0.2 x 192.58 ₱/m^3 x 1.3 = 24.1

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

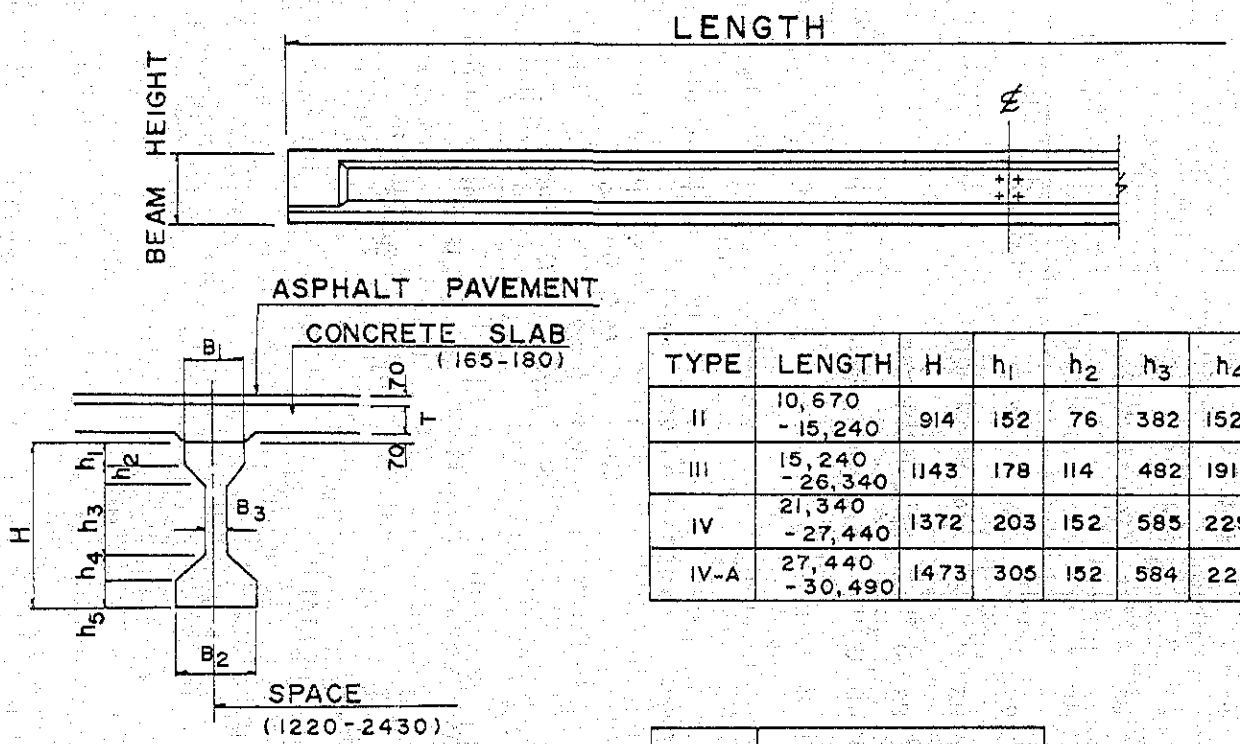


APPENDIX TABLE 8.7-2 LIST OF PROPOSED BRIDGES

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. 3 +175	36.4m (2 x 18.2m)	P.C. Composite	Spread		River Br.
	BR.-3	STA.6 +945	40 m (1 x 40m)	Steel Composite	Pile	Imeldo 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(2x 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 25 m)	P.C. Composite	Spread	South Express Way	Over Br. (Widening)
	BR.-2	STA.1 + 100	18 m (1 x 18 m)	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 22.4 m)	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 (2 x 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	Pedestrion 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

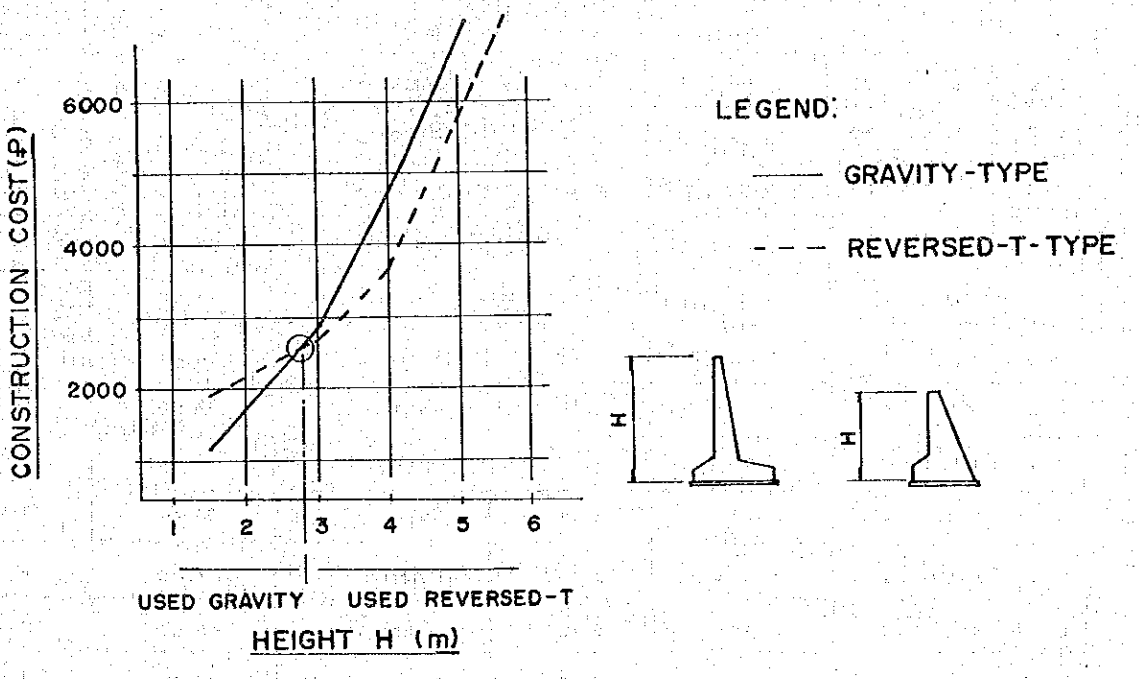
· Bridge Length Main ; 30.02 m

Stairway ; 2 @ 13.31 m

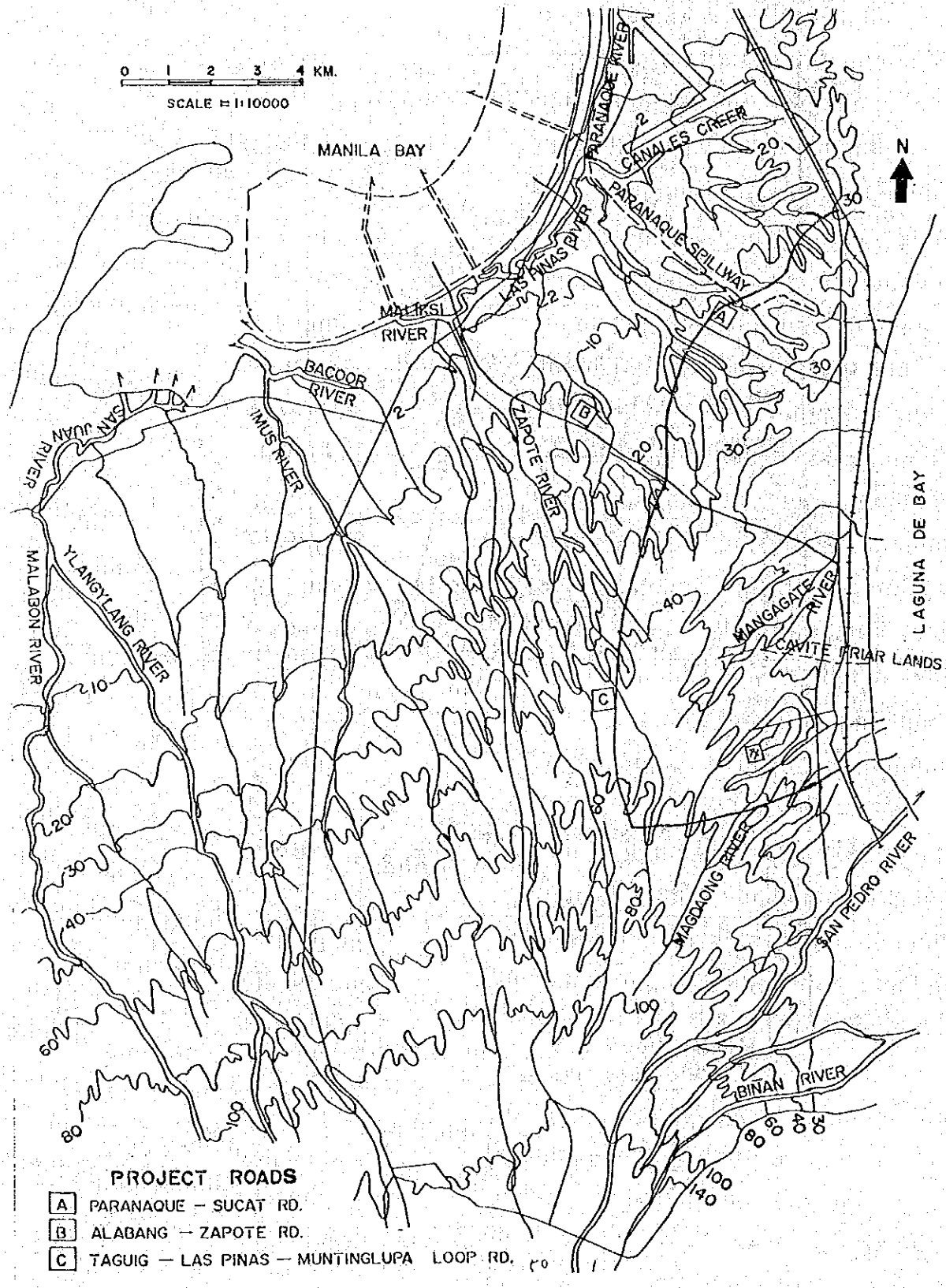
APPENDIX TABLE 8.7-6 LIST OF PROPOSED BOX CULVERTS

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 + 980	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	STA3 + 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	56.30	"
	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)

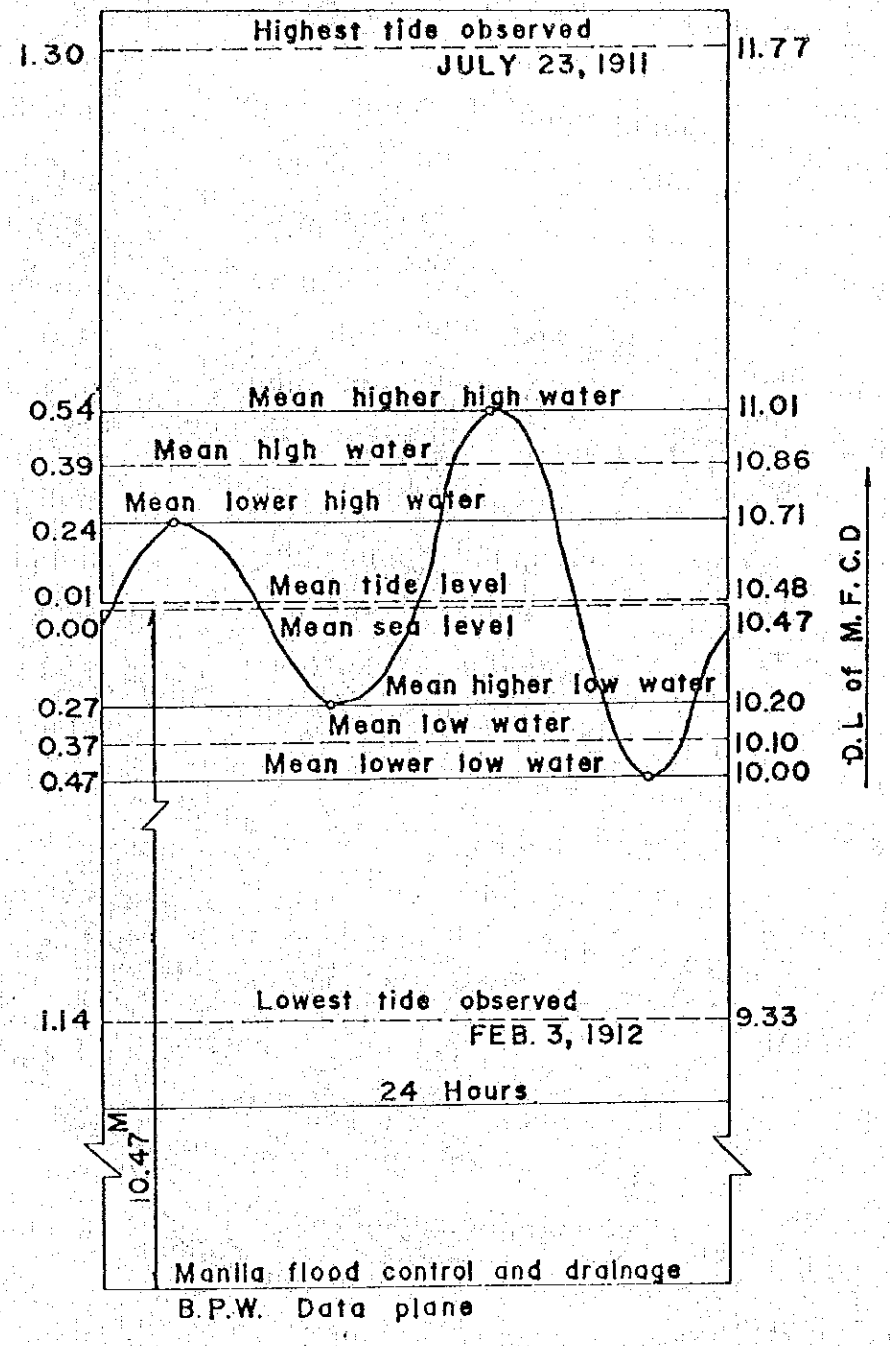
APPENDIX FIG. 8.7–2 RELATIONSHIP OF COST OF RETAINING WALL–TYPE



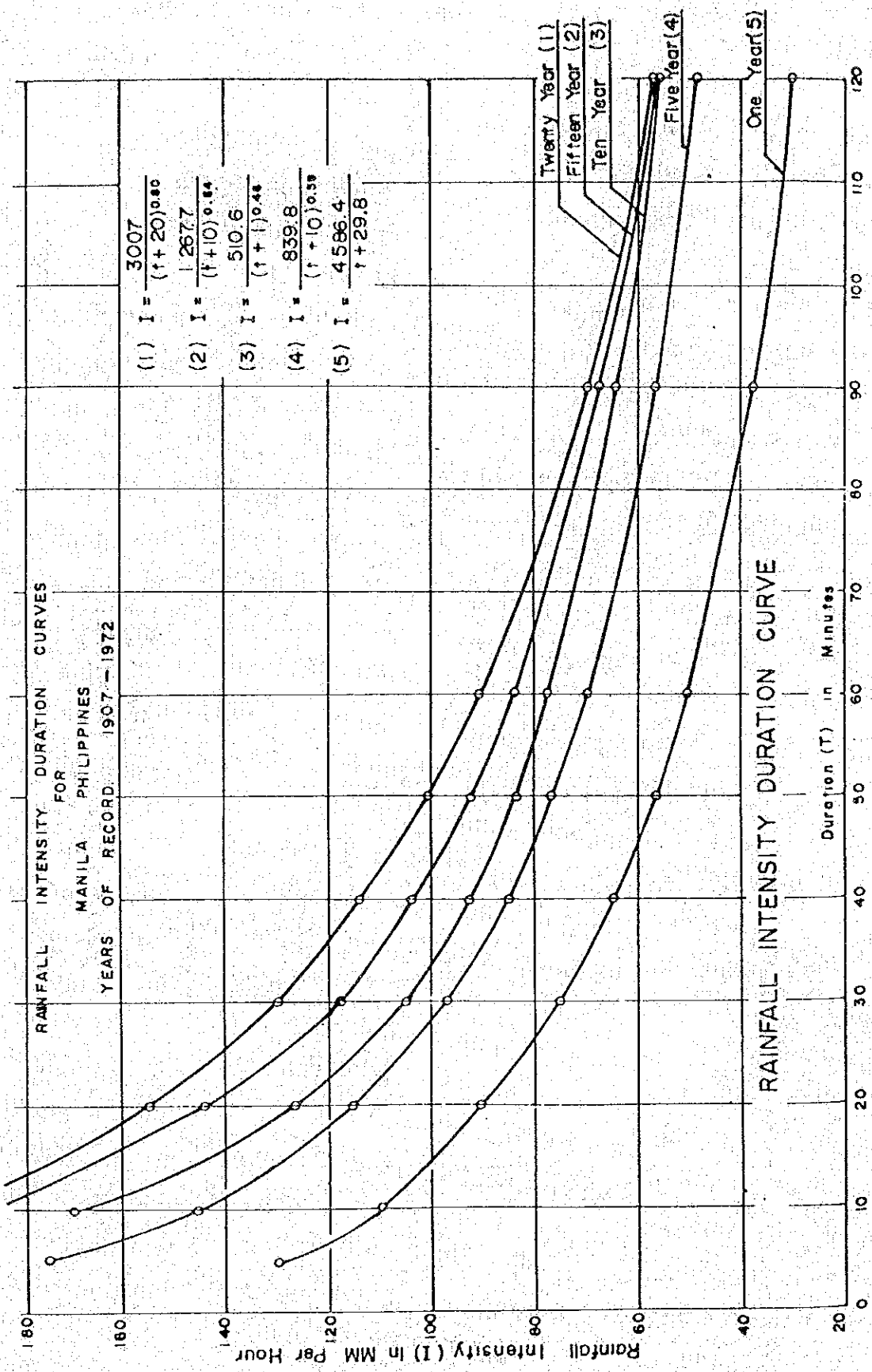
APPENDIX FIG. 8.8-1 RIVERS IN PROJECT AREA



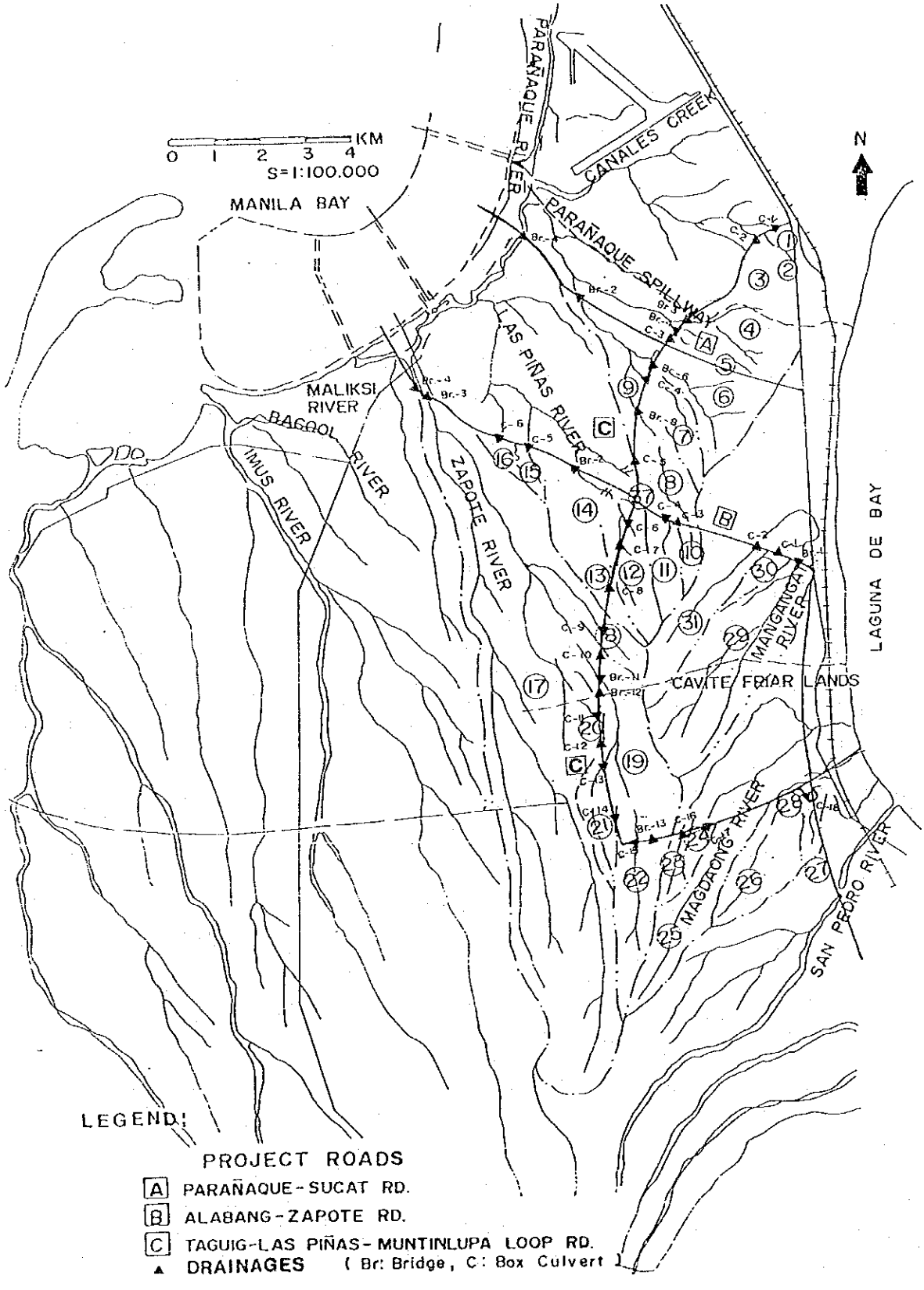
APPENDIX FIG. 8.8–2 MEAN TIDE VALUES OF MANILA BAY



APPENDIX FIG. 8.8–3 RAINFALL INTENSITY DURATION CURVES



APPENDIX FIG. 8.8-4 CATCHMENT AREAS FOR MAIN RIVERS



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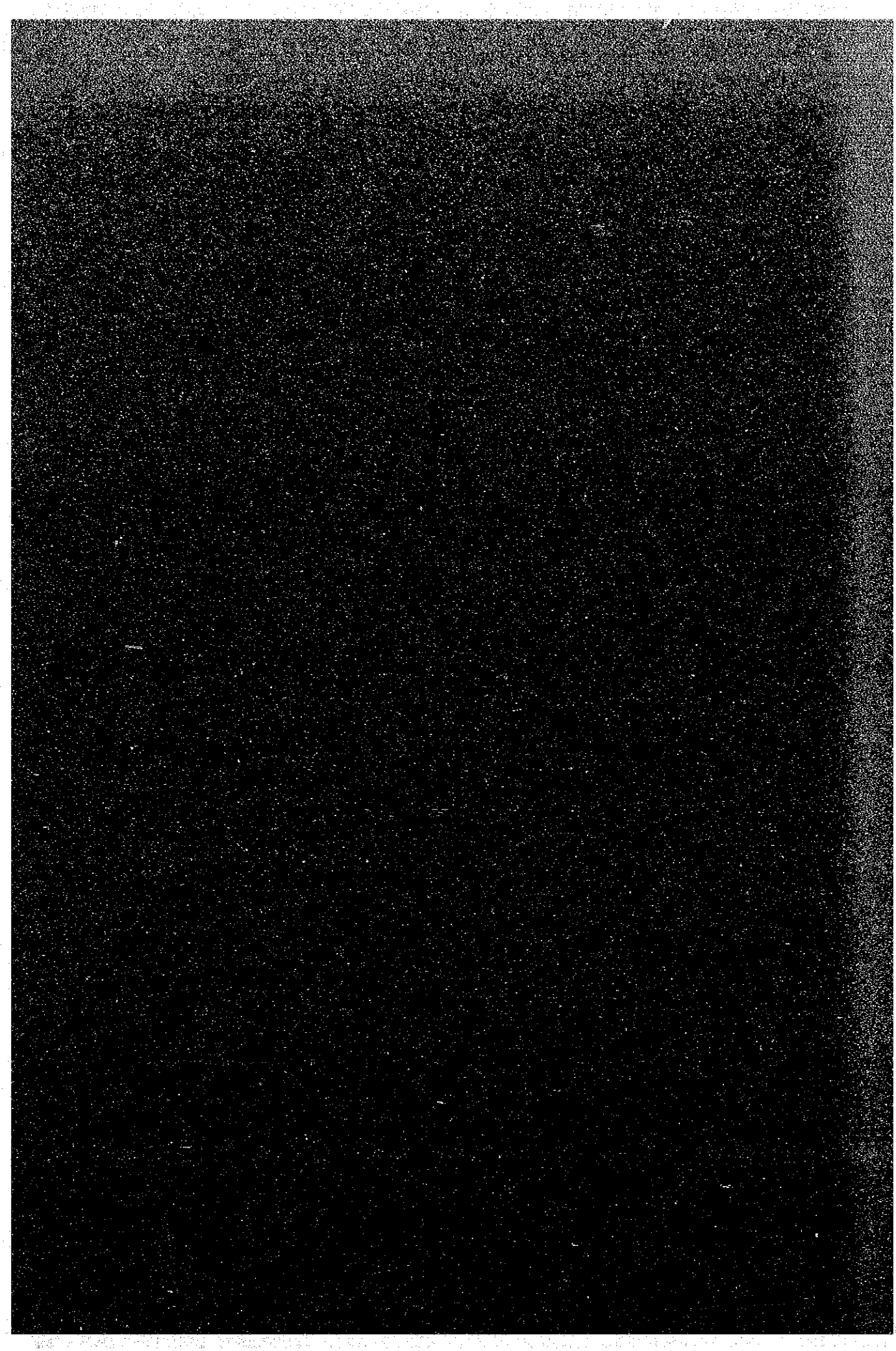


APPENDIX TABLE 10.3-1 EXAMPLES OF UNIT PRICE ANALYSIS

ITEM NO. 107
DESCRIPTION: BORROW

PROJECT: FEASIBILITY STUDY FOR METRO MANILA OUTER MAJOR ROADS (SOUTHERN PACKAGE)

UNIT PRICE: 41.41 ₱/m³

PRICE COMPONENT	₱/UNIT	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	SUB-TOTAL	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	TOTAL
A) Equipment:									
3 Excavator Crowler	₱/h	804.00	240.00	156.00	1200.00				
40 Dump Truck, 10t	"	3000.00	1000.00	1000.00	5000.00				
1 Motograder 125 HP	"	151.80	46.00	32.20	230.00				
1 Crawler Tractor	"	92.40	28.00	19.60	140.00				
1 Vibratory Sheepsfoot Roller 6 ton	"	59.40	18.00	12.60	90.00				
1/2 Pneumatic Roller (Self-propelled up to 15 ton)	"	46.20	14.00	9.80	70.00				
1 water Trucks 8 m³	"	177.00	63.00	60.00	300.00				
1/2 water Pump 3" ø	"	5.02	1.43	1.05	7.50				
Minor Tools (10% Unskilled Laborers)	"	0.77	0.23	0.16	1.16				
Total A	₱/h	4336.59	1410.66	1291.41	7038.66				
B) Labor:									
1 Foreman	₱/h		6.27		6.27				
5 1/2 Heavy Equipment Operator	"		31.19		31.19				
1 1/2 Light Equipment Operator	"		6.57		6.57				
1/2 Skilled Laborers	"		2.50		2.50				
41 Drivers	"		179.58		179.58				
3 Unskilled Laborers	"		11.55		11.55				
Total B	₱/h		237.66		237.66				
Total A + B	₱/h	4336.59	1648.32	1291.41	7276.32				
Total A + B Carried Forward	₱/h	4336.59	1648.32	1291.41	7276.32				

APPENDIX TABLE 10.3–1 EXAMPLES OF UNIT PRICE ANALYSIS (cont'd)

ITEM NO.
DESCRIPTION: BORROW

PROJECT: FEASIBILITY STUDY FOR METRO MANILA OUTER MAJOR ROADS (SOUTHERN PACKAGE)

PRICE COMPONENT	₱/UNIT	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	SUB-TOTAL	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	TOTAL
Total A + B Brought Forward	₱/h	4336.59	1648.32	1291.41	7276.32				
C) Output: 200 m^3/h; 7276.32 ₱/h / 200 m^3/h	₱/m^3					21.68	8.24	6.46	36.41
D) Materials:									
Royalty	₱/m^3						5.00		5.00
Total Cost	₱/m^3					21.68	13.24	6.46	41.41
	%					52	32	16	100

APPENDIX TABLE 10.3–1 EXAMPLES OF UNIT PRICE ANALYSIS (cont'd)

ITEM NO. 108 PROJECT: FEASIBILITY STUDY FOR METRO MANILA OUTER MAJOR ROADS (SOUTHERN PACKAGE) UNIT PRICE: 92.58 ₱/m³

DESCRIPTION: AGGREGATE SUBBASE

PRICE COMPONENT	₱/UNIT	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	SUB-TOTAL	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	TOTAL
A) Equipment:									
3 Motograders 125 HP	₱/h	376.20	114.00	79.80	570.00				
1 Vibratory Smooth Roller	"	72.60	22.00	15.40	110.00				
1/4 Pneumatic Roller (Self-propelled up to 15t)	"	23.10	7.00	4.90	35.00				
2 Water Trucks	"	354.00	126.00	120.00	600.00				
1/2 Water Pump 3" Ø	"	5.02	1.43	1.05	7.50				
Minor Tools (10% Unskilled Laborers)	"	1.27	0.39	0.27	1.93				
Total A	₱/h	832.19	270.82	221.62	1324.43				
B) Labor:									
1 Foreman	₱/h		6.27		6.27				
3 Heavy Equipment Operators	"		17.01		17.01				
1 1/4 Light Equipment Operators	"		5.47		5.47				
2 Drivers	"		8.76		8.76				
1/2 Skilled Laborer	"		2.50		2.50				
5 Unskilled Laborer	"		19.25		19.25				
Total B	₱/h		59.26		59.26				
Total A & B	₱/h	832.19	330.08	221.62	1383.69				
C) Output: 80 m³/h									
1,383.69 ₱/h / 80 m³/h	₱/m³					10.40	4.13	2.77	17.30
Carried Forward	₱/m³					10.40	4.13	2.77	17.30

APPENDIX TABLE 10.3–1 EXAMPLES OF UNIT PRICE ANALYSIS (cont'd)

ITEM NO.
DESCRIPTION: AGGREGATE SUBBASE

PROJECT: FEASIBILITY STUDY FOR METRO MANILA OUTER MAJOR ROADS (SOUTHERN PACKAGE)

PRICE COMPONENT	₱/UNIT	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	SUB-TOTAL	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	TOTAL
Brought Forward	₱/m³					10.40	4.13	2.77	17.30
D) Materials on Site:									
Coarse Aggregate:								—	
1.1 t/m³ x 45.00 ₱/t	₱/m³	25.74	15.84	7.92	49.50				
Fine Aggregate:									
0.5 t/m³ x 22.00 ₱/t	"	5.50	3.96	1.54	11.00				
Soil:									
0.4 t/m³ x 36.98 ₱/m³	"	7.60	4.84	2.31	14.78				
Total D	₱/m³	38.84	24.67	11.77	75.28	38.84	24.67	11.79	75.28
Total Cost	₱/m³					49.24	28.80	14.54	92.58
	%					53	31	16	100

APPENDIX TABLE 10.3–1 EXAMPLES OF UNIT PRICE ANALYSIS (cont'd)

ITEM NO. 316 PROJECT: FEASIBILITY STUDY FOR METRO MANILA OUTER MAJOR ROADS (SOUTHERN PACKAGE)

DESCRIPTION: PORTLAND CEMENT CONCRETE PAVEMENT 25 CM THICK

UNIT PRICE: 152.47 ₱/m^2

PRICE COMPONENT	₱/UNIT	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	SUB-TOTAL	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	TOTAL
Output: 10,000 m^2									
A) Equipment:									
33 Concrete Spreader	₱/h	5346.00	1782.00	1782.00	8910.00				
33 Concrete Finisher	"	5544.00	1848.00	1848.00	9240.00				
Total A	₱/h	10890.00	3630.00	3630.00	18150.00				
B) Labor:									
33 Foreman	₱/h		206.91		206.91				
33 Assistant Foreman	"		187.11		187.11				
66 Equipment Operators	"		374.22		374.22				
165 Skilled Laborers	"		825.00		825.00				
264 Unskilled Laborers	"		1016.40		1016.40				
Total B	₱/h		2609.64		2609.64				
Total A & B	₱/h	10890.00	6239.64	3630.00	20759.64				
Carried Forward	₱/h	10890.00	6239.64	3630.00	20759.64				

APPENDIX TABLE 10.3-1 EXAMPLES OF UNIT PRICE ANALYSIS (cont'd)

ITEM NO. PROJECT: FEASIBILITY STUDY FOR METRO MANILA
DESCRIPTION: PORTLAND CEMENT CONCRETE PAVEMENT 250 MM THICK OUTER MAJOR ROADS (SOUTHERN PACKAGE)

PRICE COMPONENT	₱/UNIT	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	SUB-TOTAL	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	TOTAL
Total A & B Brought Foreward	₱/h	10890.00	6239.64	3630.00	20759.64				
C) Materials:									
Concrete delivered on site 2500 m^3 x 534.68 ₱/m^3	₱	696800.00	433175.00	206725.00	1336700.00				
Formwork 460 m^2 x 90 ₱/m^2	"	20700.00	14490.00	6210.00	41400.00				
Steel Bars and Mesh 10.34 t x 5240.00 ₱/t	"	27632.62	22214.46	4334.52	54181.60				
Incidentals Primer Joint Filler (5% above)	"	37256.63	23493.97	10863.48	71614.08				
Total D		782389.25	493373.43	228133.00	1503895.68				
Total Cost		793279.25	499613.07	231763.00	1524655.32				
D) Output: 10,000 m^2 $\frac{1,524655.32\ ₱}{10,000\ m^2}$	₱/m^2					79.33	49.96	23.18	152.47
	%					52	33	15	100

APPENDIX TABLE 10.3-1 EXAMPLES OF UNIT PRICE ANALYSIS (cont'd)

ITEM NO. 402 PROJECT: FEASIBILITY STUDY FOR METRO MANILA OUTER MAJOR ROADS (SOUTHERN PACKAGE) UNIT PRICE: 572.53 ₱/L.M.

DESCRIPTION: PRESTRESSED CONCRETE PILES (0.40 x 0.40 m) (FURNISHING AND DRIVING)

PRICE COMPONENT	₱/UNIT	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	SUB-TOTAL	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	TOTAL
A) Equipment:									
1 1/2 Crawler Crane, 30T	₱/h	271.35	81.00	52.65	405.00				
1 Pile Driver Delmag 30T	"	195.00	60.00	45.00	300.00				
Ancilary Equipment (5% above)	"	23.32	7.05	4.88	35.25				
Total A	₱/h	489.67	148.05	102.53	740.25				
B) Labor:									
1 Foreman	₱/h		6.27		6.27				
1 1/2 Heavy Equipment Operator	"		8.51		8.51				
1 Light Equipment Operator	"		4.38		4.38				
2 Skilled Laborers	"		10.00		10.00				
8 Unskilled Laborers	"		30.80		30.80				
Total B	₱/h		59.96		59.96				
Total A & B	₱/h	489.67	208.01	102.53	800.21				
C) Output: 8 m/h									
800.21 ₱/h / 8 m/h	₱/m					61.21	26.00	12.82	100.03
Carried Forward	₱/m					61.21	26.00	12.82	100.03

APPENDIX TABLE 10.3-1 EXAMPLES OF UNIT PRICE ANALYSIS (cont'd)

DESCRIPTION: PRESTRESSED CONCRETE PILES (0.40 x 0.40 m) (FURNISHING AND DRIVING)

PROJECT: FEASIBILITY STUDY FOR METRO MANILA OUTER MAJOR ROADS (SOUTHERN PACKAGE)

PRICE COMPONENT	P/UNIT	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	SUB-TOTAL	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	TOTAL
Brought Forward	P/m					61.21	26.00	12.82	100.03
D) Materials:									
Prestressed Concrete Pile delivered at Site	P/m					252.00	148.50	49.50	450.00
Incidentals (Including shoes: 5% above)	"					12.60	7.43	2.47	22.50
Total D						264.60	155.93	51.97	472.50
Total Cost	P/m					325.81	181.93	64.79	572.53
	%					57	32	11	100

APPENDIX TABLE 10.3–1 EXAMPLES OF UNIT PRICE ANALYSIS (cont'd)

ITEM NO. 405-3.1A | PROJECT: FEASIBILITY STUDY FOR METRO MANILA OUTER MAJOR ROADS (SOUTHERN PACKAGE) | UNIT PRICE: 534.68 ₱/m³

DESCRIPTION: CONCRETE (PLAIN) CLASS "A"

PRICE COMPONENT	₱/UNIT	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	SUB-TOTAL	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	TOTAL
A) Equipment:									
1 Concrete Batching Plant 15 m³/h	₱/h	138.00	46.00	46.00	230.00				
1 Water Tank Truck 8m³/h	"	177.00	63.00	60.00	300.00				
2 Truck Mixers 5m³/h	"	198.02	66.66	55.32	320.00				
1 Wheel Loader 1-3/4 yd³	"	113.52	34.40	24.08	172.00				
1 Generator, Diesel 50KVA	"	28.50	9.50	9.50	47.50				
6 Belt Conveyors, Portable	"	57.78	16.39	12.07	86.24				
Ancilary Equipment (15% of the above)	"	106.92	35.39	31.05	173.36				
Total A	₱/h	819.74	271.34	238.02	1329.10				
B) Labor:									
1 Foreman	₱/h		6.27		6.27				
1 Batching Plant Operator	"		5.67		5.67				
3 Drivers	"		13.14		13.14				
1 Heavy Equipment Operator	"		5.67		5.67				
2 Skilled Laborers	"		10.00		10.00				
10 Unskilled Laborers	"		38.50		38.50				
Total B	₱/h		79.25		79.25				
Total A & B	₱/h	819.74	350.59	238.02	1408.35				
C) Output: 13 m³/h									
1408.35 ₱/h / 13 m³/h						63.06	26.97	18.30	108.33
Carried Forward	₱/h					63.06	26.97	18.30	108.33

APPENDIX TABLE 10.3–1 EXAMPLES OF UNIT PRICE ANALYSIS (cont'd)

ITEM NO.
DESCRIPTION: CONCRETE (PLAIN) CLASS "A"

PROJECT: FEASIBILITY STUDY FOR METRO MANILA OUTER MAJOR ROADS (SOUTHERN PACKAGE)

PRICE COMPONENT	₱/UNIT	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	SUB-TOTAL	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	TOTAL
Brought Forward						63.06	26.97	18.30	108.33
D) Materials:									
Cement									
0.363 t/m^3 x 800.00 ₱/t	₱/m^3	145.20	101.64	43.56	290.40				
Coarse Aggregate									
1.24 t/m^3 x 50.00 ₱/t	"	33.48	18.60	9.92	62.00				
Fine Aggregate									
0.655 t/m^3 x 28.00 ₱/t	"	9.17	6.60	2.57	18.34				
Incidentals (15% of the above)	"	27.81	19.46	8.34	55.61				
Total D	₱/m^3	215.66	146.30	64.39	426.35	215.66	146.30	64.39	426.35
Total Cost	₱/m^3					278.72	173.27	82.69	534.68
	%					52	32	16	100

APPENDIX TABLE 10.3-1 EXAMPLES OF UNIT PRICE ANALYSIS (cont'd)

ITEM NO.
DESCRIPTION: LEAN CONCRETE (Material only)

PROJECT: FEASIBILITY STUDY FOR METRO MANILA OUTER MAJOR ROADS (SOUTHERN PACKAGE)

UNIT PRICE: 387.30 ₱/m^3

PRICE COMPONENT	₱/UNIT	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	SUB-TOTAL	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	TOTAL
A) Equipment:									
1 Concrete Mixer	₱/h	20.59	6.81	6.97	34.37				
1 Pick-up	"	42.00	14.00	14.00	70.00				
1 Dump Truck	"	75.00	25.00	25.00	125.00				
Minor Tools (10% for the above)	"	13.76	4.58	4.60	22.94				
Total A	₱/h	151.35	50.39	50.57	252.31				
B Labor:									
1 Foreman	₱/h		6.27		6.27				
2 Drivers	"		8.76		8.76				
3 Skilled Laborer	"		15.00		15.00				
10 Unskilled Laborer	"		38.50		38.50				
Total B	₱/h		68.53		68.53				
Total A & B	₱/h	151.35	118.92	50.57	320.84				
C) Output: 2 m^3/h									
$\frac{320.84\ ₱/h}{2\ m^3/h}$						75.67	59.46	25.29	160.42
Carried Forward						75.67	59.46	25.29	160.42

APPENDIX TABLE 10.3–1 EXAMPLES OF UNIT PRICE ANALYSIS (cont'd)

ITEM NO.
DESCRIPTION: LEAN CONCRETE (Material only)

PROJECT: FEASIBILITY STUDY FOR METRO MANILA OUTER MAJOR ROADS (SOUTHERN PACKAGE)

PRICE COMPONENT	₱/UNIT	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	SUB-TOTAL	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	TOTAL
Brought Foreward						75.67	59.46	25.29	160.42
D) Materials:									
Cement									
0.15 t/m^3 x 800.00 ₱/t	₱/m^3	60.00	42.00	18.00	120.00				
Coarse Aggregate:									
1.35 t/m^3 x 50.00 ₱/t	"	36.45	20.25	10.80	67.50				
Fine Aggregate:									
0.67 t/m^3 x 28.00 ₱/t	"	9.38	6.75	2.63	18.76				
Incidentals (10% of the above)	"	10.58	6.90	3.14	20.62				
Total D	₱/m^3	116.41	75.90	34.57	226.88	116.41	75.90	34.57	226.88
Total Cost	₱/m^3					192.08	135.36	59.86	387.30
	%					50	35	15	100

APPENDIX TABLE 10.3-1 EXAMPLES OF UNIT PRICE ANALYSIS (cont'd)

ITEM NO. 406 — PROJECT: FEASIBILITY STUDY FOR METRO MANILA OUTER MAJOR ROADS (SOUTHERN PACKAGE) — UNIT PRICE: 5.24 ₱/kg.

DESCRIPTION: REINFORCING STEEL

PRICE COMPONENT	₱/UNIT	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	SUB-TOTAL	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	TOTAL
A) Equipment:									
Bending Machine									
15 h/t x 19.90 ₱/h	₱/t	185.07	65.67	47.76	298.50				
Shearing Machine									
8 h/t x 12.60 ₱/h	"	62.50	22.18	16.12	100.80				
Minor Tools (3% of machine)	"	7.42	2.63	1.91	11.96				
Total A	₱/t	254.99	90.48	65.79	411.26				
B) Labor:									
Foreman									
8 h/t x 6.27 ₱/h	₱/t		50.16		50.16				
Assistant Foreman									
16 h/t x 5.67 ₱/h	"		90.72		90.72				
Steelmen 5.06 ₱/h									
40 h/t x 5.06 ₱/h	"		202.40		202.40				
Unskilled Laborer									
100 h/t x 3.85 ₱/h	"		385.00		385.00				
Total B	₱/t		728.28		728.28				
Total A & B	₱/t	254.99	818.76	65.79	1139.54				
Carried Forward	₱/t	254.99	818.76	65.79	1139.54	254.99	818.76	65.79	1139.54

APPENDIX TABLE 10.3–1 EXAMPLES OF UNIT PRICE ANALYSIS (cont'd)

ITEM NO.
DESCRIPTION: REINFORCING STEEL

PROJECT: FEASIBILITY STUDY FOR METRO MANILA OUTER MAJOR ROADS (SOUTHERN PACKAGE)

PRICE COMPONENT	₱/UNIT	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	SUB-TOTAL	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	TOTAL
Total A & B Brought Forward						254.99	818.76	65.79	1139.54
C) Materials:									
Reinforcement Steel on Site	₱/t	2204.00	1254.00	342.00	3800.00				
Wastage (5% of the above)	"	110.20	62.70	17.10	190.00				
Wire and Others (3% of Steel)	"	66.12	37.62	10.26	114.00				
Total C	₱/t	2380.32	1354.32	369.36	4104.00	2380.32	1354.32	369.36	4104.00
Total A & B & C	₱/t					2635.31	2173.08	435.15	5243.54
D) Price per kilogram	₱/kg					2.64	2.17	0.43	5.24
	%					51	41	8	100

APPENDIX TABLE 10.3–1 EXAMPLES OF UNIT PRICE ANALYSIS (cont'd)

ITEM NO. 413 (1) PROJECT: FEASIBILITY STUDY FOR METRO MANILA OUTER MAJOR ROADS (SOUTHERN PACKAGE) UNIT PRICE: 286.44 ₱/m

DESCRIPTION: EXTRA STRENGTH REINFORCED CONCRETE PIPE CULVERT 600 mm ø

PRICE COMPONENT	₱/UNIT	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	SUB-TOTAL	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	TOTAL
A) Equipment:									
1 Explosion Rammer (Frog)	₱/h	15.84	4.43	3.03	23.30				
1 Dump Truck	"	75.00	25.00	25.00	125.00				
Minor Tools (10% Unskilled Laborers)	"	0.88	0.25	0.17	1.30				
Total A	₱/h	91.72	29.68	28.20	149.60				
B) Output: 2 m/h; 149.60 ₱/h / 2 m/h	₱/m					45.86	14.84	14.10	74.80
C) Labor:									
Unskilled Laborer 3.39 h/m	₱/m		13.05		13.05				
Driver 0.50 h/m	"		2.19		2.19				
Skilled Laborer 2.50 h/m	"		12.50		12.50				
Assistant Foreman (10% Unskilled Laborers)	"		1.30		1.30				
Total C	₱/m		29.04		29.04		29.04		29.04
Total B & C	₱/m					45.86	43.88	14.10	103.84
Total B + C Carried Forward	₱/m					45.86	43.88	14.10	103.84

APPENDIX TABLE 10.3-1 EXAMPLES OF UNIT PRICE ANALYSIS (cont'd)

ITEM NO. 413 (1) PROJECT: FEASIBILITY STUDY FOR METRO MANILA OUTER MAJOR ROADS (SOUTHERN PACKAGE)

DESCRIPTION: EXTRA STRENGTH REINFORCED CONCRETE PIPE CULVERT 600 mm Ø

PRICE COMPONENT	₱/UNIT	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	SUB-TOTAL	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	TOTAL
Total B + C Brought Forward	₱/m					45.86	43.88	14.10	103.84
D) Materials:									
Pipes Delivered on Site	₱/m	73.15	68.75	18.10	160.00				
Scraps (10% above)	"	7.31	6.88	1.81	16.00				
Sealing Joints									
0.011 m^3/m x 600.00 ₱/m^3	"	3.03	2.70	0.87	5.60				
Total D	₱/m	83.49	78.33	20.78	182.60	83.49	78.33	20.78	182.60
Total Cost	₱/m					129.35	122.21	34.88	286.44
	%					45	43	12	100

APPENDIX TABLE 10.5-1 ESTIMATED CONSTRUCTION COST FOR PLAN 1 BY STAGE

(UNIT: Pesos in thousand)

STAGE	DESCRIPTION	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	TOTAL
1 Opening 1987	Earthwork	31897	20600	9028	61525
	Pavement Structures	46816	29251	13694	89761
	Bridge & Other Structures	25132	16002	5240	46374
	Drainage Structures	11856	10570	3079	25505
	Miscellaneous	15219	15259	3789	34267
	Construction Cost (Sub T.)	130920	91682	34830	257432
	Detailed Design	10661	7143	2779	20583
	Supervision	9164	6418	3438	19020
	Physical Contingencies	15075	10524	4105	29704
	Total	165820	115767	45152	326739
	R.O.W. Cost	-	273709	-	273709
	Grand Total	165820	389476	45152	600448
2 Opening 1991	Earthwork	20569	11771	5601	37941
	Pavement Structures	33889	21170	9913	64972
	Bridge & Other Structures	17746	8639	3036	29421
	Drainage Structures	6101	5437	1583	13121
	Miscellaneous	9286	9882	2296	21464
	Construction Cost (Sub T.)	87591	56899	22429	166919
	Detailed Design	-	-	-	-
	Supervision	6131	3983	1570	11684
	Physical Contingencies	9372	6088	2400	17860
	Total	103094	66970	26399	196463
	R.O.W. Cost	-	-	-	-
	Grand Total	103094	66970	26399	196463
3 Opening 1995	Earthwork	8483	4457	2191	15131
	Pavement Structures	21735	13578	6358	41671
	Bridges & Other Structures	9341	3885	1450	14676
	Drainage Structures	3519	3136	913	7568
	Miscellaneous	4938	4936	1317	11191
	Construction Cost (Sub T.)	48016	29992	12229	90237
	Detailed Design	-	-	-	-
	Supervision	3361	2100	856	6317
	Physical Contingencies	5138	3209	1309	9656
	Total	56515	35301	14394	106210
	R.O.W. Cost	-	-	-	-
	Grand Total	56515	35301	14394	106210
Total	Earthwork	60949	36828	16820	114598
	Pavement Structures	102440	63999	29965	196404
	Bridge & Other Structures	52219	28526	9726	90471
	Drainage Structures	21476	19143	5575	46194
	Miscellaneous	29443	30077	7402	66922
	Construction Cost (Sub T.)	266527	178573	69488	51458
	Detailed Design	10661	7143	2779	20583
	Supervision	18656	12501	5864	37021
	Physical Contingencies	29585	19821	7814	57220
	Total	325429	218038	85945	629412
	R.O.W. Cost	-	273709	-	273709
	Grand Total	325429	491747	85945	903121

NOTES: The cost of detailed design is 3 - 4% of the construction cost.
The cost of supervision is 3 - 7% of the construction cost.
The cost of physical contingencies is 10% for each item.
The cost of land acquisition includes the cost of 10% physical contingencies.
Prices are as of October 1981.
R.O.W. is assumed to be acquired in the first stage regardless of the staged implementation.

APPENDIX TABLE 10.5-2 ESTIMATED CONSTRUCTION COST FOR PLAN 2 BY STAGE

(UNIT: Pesos in thousand)

STAGE	DESCRIPTION	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	TOTAL
1 Opening 1987	Earthwork	27686	17587	7859	53132
	Pavement Structures	33036	20639	9663	63338
	Bridge & Other Structures	21496	12728	4348	38572
	Drainage Structures	7464	6652	1937	16053
	Miscellaneous	11715	11465	2836	26016
	Construction Cost (Sug T.)	101397	69071	26643	197111
	Detailed Design	10661	7143	2779	20583
	Supervision	7098	4835	1865	13798
	Physical Contingencies	11916	8105	3128	23149
	Total	131072	89154	34415	254641
	R.O.W. Cost	-	273709	-	273709
	Grand Total	131072	362863	34415	528350
2 Opening 1995	Earthwork	25492	15212	6966	47670
	Pavement Structures	50312	31434	14716	96462
	Bridge & Other Structures	21378	11909	3928	37215
	Drainage Structures	10492	9355	2725	22572
	Miscellaneous	13272	14133	3396	30801
	Construction Cost (Sub T.)	120946	82043	31731	234720
	Detailed Design	-	-	-	-
	Supervision	8466	5743	2221	16430
	Physical Contingencies	12941	8779	3395	25115
	Total	142353	96565	37347	276265
	R.O.W. Cost	-	-	-	-
	Grand Total	142353	96565	37347	276265
Total	Earthwork	53178	32799	14825	100802
	Pavement Structures	83348	52073	24379	159800
	Bridge & Other Structures	42874	24637	8276	75787
	Drainage Structures	17956	16007	4662	38625
	Miscellaneous	24987	25598	6232	56817
	Construction Cost (Sub T.)	222343	151114	58374	431831
	Detailed Design	10661	7143	2779	20583
	Supervision	15564	10578	4086	30228
	Physical Contingencies	24857	16884	6523	48264
	Total	273425	185719	71762	530906
	R.O.W. Cost	-	273709	-	273709
	Grand Total	273425	459428	71762	804615

NOTES: The cost of detailed design is 3 - 4% of the construction cost.
The cost of supervision is 3 - 7% of the construction cost.
The cost of physical contingency is 10% for each item.
The cost of land acquisition includes the cost of 10% physical contingencies.
Prices are as of October 1981.
The cost of detailed design covers that for the widening of the southern section of Route C which is assumed to be implemented beyond 1995.
R.O.W. is assumed to be acquired in the first stage regardless of the staged implementation.

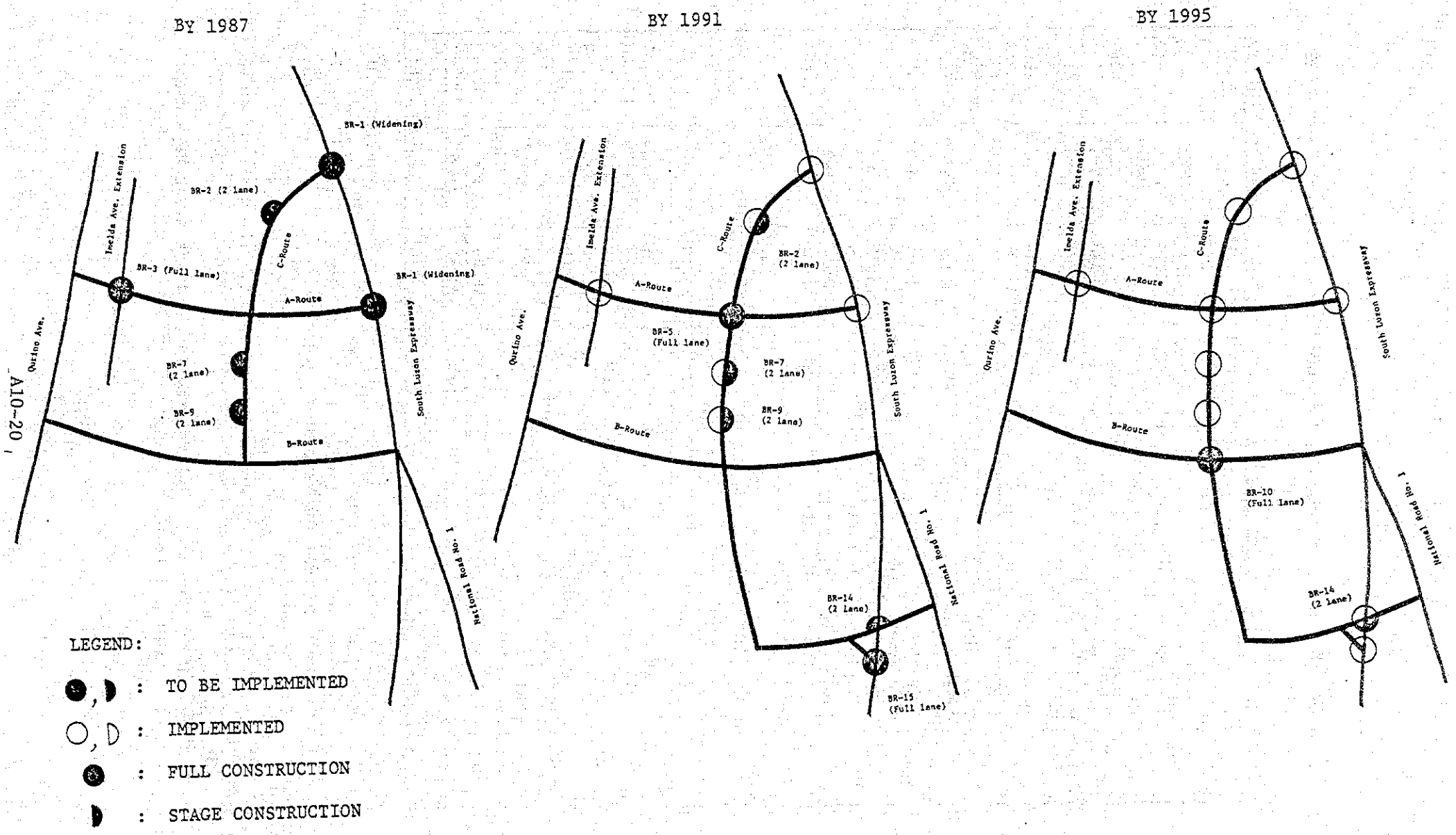
APPENDIX TABLE 10.5-3 ESTIMATED CONSTRUCTION COST FOR PLAN 3 BY STAGE

(UNIT: Pesos in thousand)

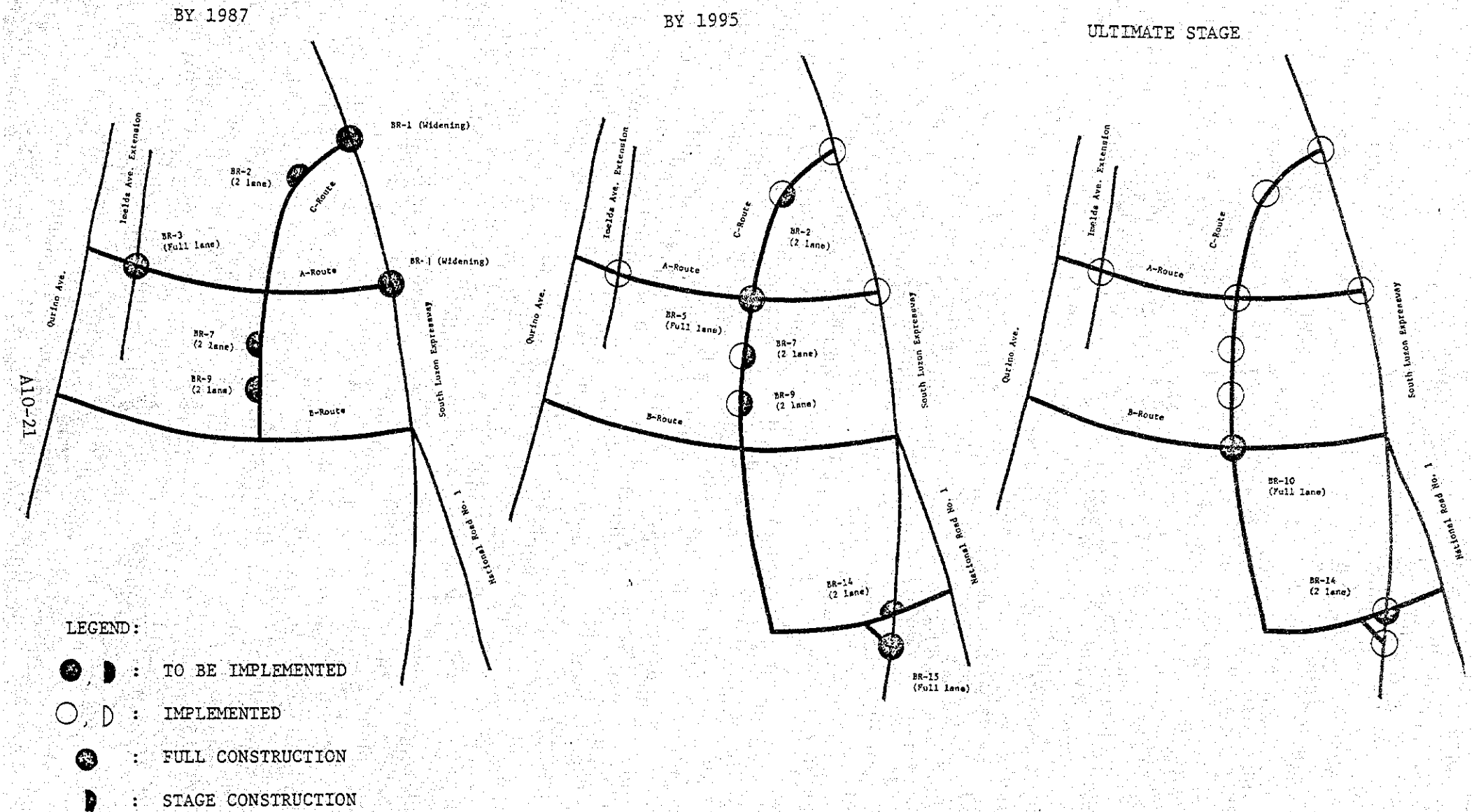
STAGE	DESCRIPTION	FOREIGN CURRENCY	LOCAL CURRENCY	TAXES	TOTAL
1 Opening 1987	Earthwork	40892	26224	11584	78700
	Pavement Structures	58762	36714	17188	112664
	Bridge & Other Structures	33268	20748	6841	60857
	Drainage Structures	14058	12533	3651	30242
	Miscellaneous	18398	18688	4595	41681
	Construction Cost (Sub T.)	165378	114907	43859	324144
	Detailed Design	10661	7143	2779	20583
	Supervision	11577	8044	3070	22691
	Physical Contingencies	18762	13009	4971	36742
	Total	206378	143103	54679	404160
	R.O.W. Cost	-	273709	-	273709
	Grand Total	206378	416812	54679	677869
2 Opening 1995	Earthwork	12285	6575	3241	22101
	Pavement Structures	24585	15359	7191	47135
	Bridge & Other Structures	9606	3889	1435	14930
	Drainage Structures	3898	3474	1011	8383
	Miscellaneous	6589	6910	1637	15136
	Construction Cost (Sub T.)	56963	36207	14515	107685
	Detailed Design	-	-	-	-
	Supervision	3987	2534	1016	7537
	Physical Contingencies	6095	3874	1555	11524
	Total	67045	42615	1708	126746
	R.O.W. Cost	-	-	-	-
	Grand Total	67045	42615	1708	126746
Total	Earthwork	53178	32799	14825	100802
	Pavement Structures	83348	52073	24379	159800
	Bridge & Other Structures	42874	24637	8276	75787
	Drainage Structures	17956	16007	4662	38625
	Miscellaneous	24987	25598	6232	56817
	Construction Cost (Sub T.)	222343	151114	58374	431831
	Detailed Design	10661	7143	2779	20583
	Supervision	15564	10578	4086	30228
	Physical Contingencies	24857	16884	6523	48264
	Total	273425	185719	71762	530906
	R.O.W. Cost	-	273709	-	273709
	Grand Total	273425	459428	71762	804615

NOTES: The cost of detailed design is 3 - 4% of the construction cost.
The cost of supervision is 3 - 7% of the construction cost.
The cost of physical contingency is 10% for each item.
The cost of land acquisition includes the cost of 10% physical contingencies.
Prices are as of October 1981.
The cost of detailed design covers that for the widening of the southern section of Route C which is assumed to be implemented beyond 1995.
R.O.W. is assumed to be acquired in the first stage regardless of the staged implementation.

APPENDIX FIG. 10.5–1 GRADE SEPARATION SCHEDULE BY ALTERNATIVE: PLAN 1



APPENDIX FIG. 10.5-2 GRADE SEPARATION SCHEDULE BY ALTERNATIVE: PLAN 2



APPENDIX FIG. 10.5-3 GRADE SEPARATION SCHEDULE BY ALTERNATIVE: PLAN 3