

APPENDIX 8.2-4 PREDICTION OF POLLUTION CAUSED BY TRAFFIC

1. Type of Pollution Predicted

- a. Noise
- b. Air Pollution
- c. Vibration

2. Roads and Cross-section Design for Prediction

- a. C-6
- b. C-5
- c. Mindanao Avenue
- d. Visayas Avenue

Please refer to Section 8.4 for cross-section design.

3. Formula for Prediction

For Noise

$$L_{50} = L_w - 8 - 20 \log_{10} \lambda \\ + 10 \log_{10} \left(\pi \cdot \frac{\lambda}{d} \tanh 2\pi \cdot \frac{\lambda}{d} \right) + \mathcal{L}d + \mathcal{L}i$$

Where, L_{50} : Average noise level, (dB(A))

L_w : Average power level of a vehicle, (dB(A))

λ : Distance between source and receiver, (m)

d : Average headway, (m) ; $D = 1,000v/N$

v : Average running speed, (km/h)

N : Traffic volume, (Veh/h)

$\mathcal{L}d$: Attenuation due to acoustic shielding, (dB(A))

$\mathcal{L}i$: Adjustment to account for the road type and the height of receiver, (dB(A))

For Air Pollution

Plume Model in case of wind with velocity of more than one (1) meter/second.

$$C(x,y,z) = \frac{Q}{2\pi U S_y S_z} \exp\left(-\frac{y^2}{2S_y^2}\right) \left[\exp\left\{-\frac{(H+z)^2}{2S_z^2}\right\} + \exp\left\{-\frac{(H-z)^2}{2S_z^2}\right\} \right]$$

Where, $C(x,y,z)$: Density at point (x, y, z) , (ppm)

x : Leeward distance from the emission source, (m)

y : Horizontal distance from X line, (m)

z : Vertical distance from X line, (m)

Q : Emission intensity, (cc/s)

U : Wind velocity, (m/s)

H : Height of the emission source, (m)

S_y : Horizontal diffusion width, (m)

S_z : Vertical diffusion width, (m)

Puff Model in case of wind in calm

$$C(x,y,z,T) = \int_0^T \frac{Q}{(2\pi)^{3/2} \cdot S_y^2(t) \cdot S_x(t)} \cdot \exp\left\{-\frac{x^2 + y^2}{2S_y^2(t)}\right\} \left[\exp\left\{-\frac{(H+z)^2}{2S_z^2(t)}\right\} + \exp\left\{-\frac{(H-z)^2}{2S_z^2(t)}\right\} \right]$$

Where, $C(x,y,z,T)$: Density at point (x, y, z) T hours after emission, (ppm)

Q : Emission intensity, (cc/s)

S_y : Horizontal diffusion width T hours after emission, (m)

S_z : Vertical diffusion width T hours after emission, (m)

H : Height of the emission source, (m)

For Vibration

$$L_{10} = a \log_{10} (\log_{10} Q) + b + C_1 + C_2 + C_3$$

where, L_{10} : Upper vibration level of 80 percent range, (dB)

a, b : Coefficients determined by the number of lanes and average running speed

Q : Equivalent traffic volume, (Veh/500 sec. lane) obtained by the following equation:

$$Q = (v_1 + 12v_2) \times \frac{500}{3,600} \times \frac{1}{M}$$

v_1 : Hourly traffic volume of small vehicle, (Veh/hr)

v_2 : Hourly traffic volume of large vehicle, (Veh/hr)

M : Number of lanes

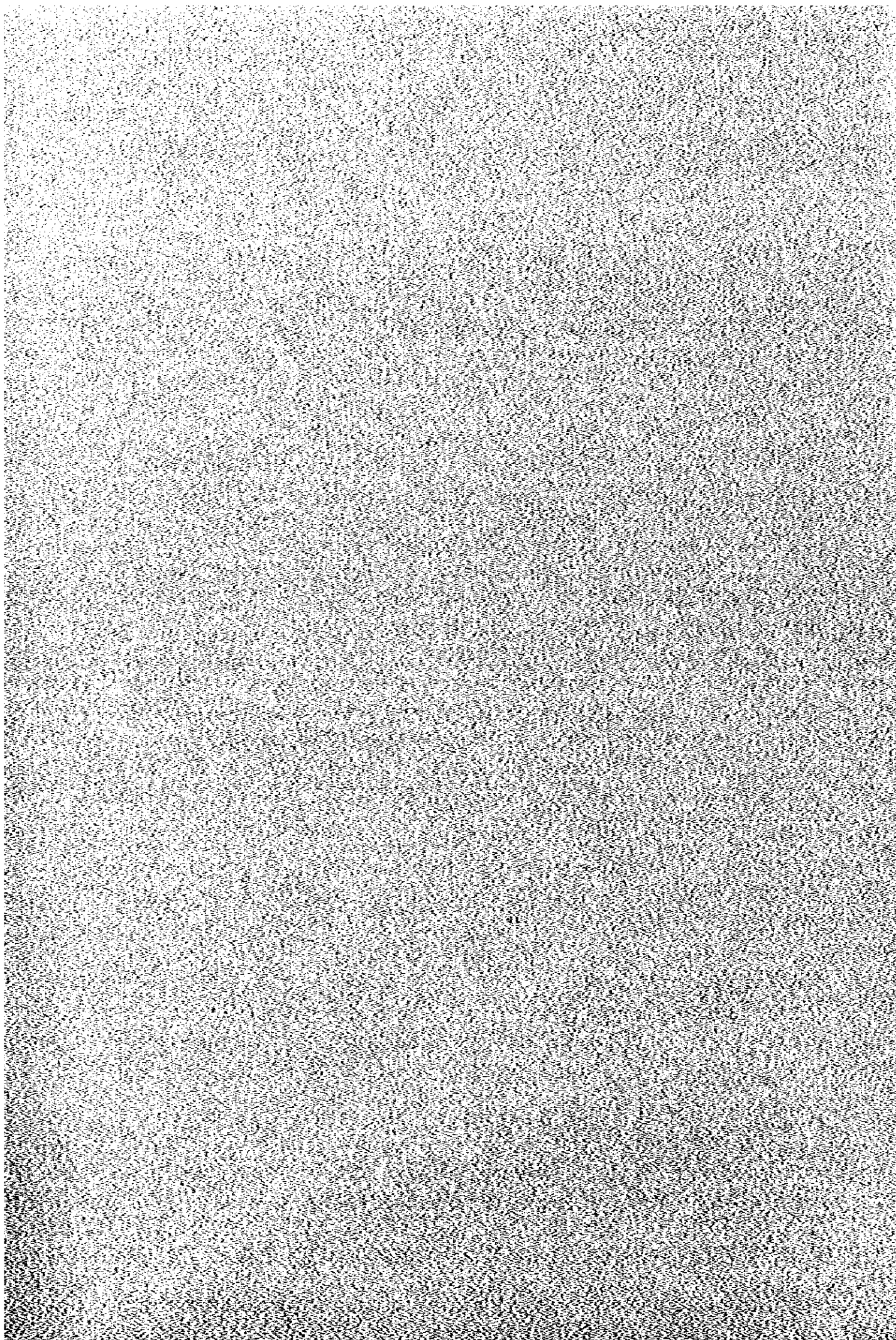
C_1 : Adjustment value to account for prominent ground frequency, (dB)

C_2 : Adjustment value to account for the flatness of pavement surface, (dB)

C_3 : Attenuation by distance, (dB)

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APPENDIX 9.1-1 UNIT COST ANALYSIS

DESCRIPTION		Quantity/ No. of Units/ No.	Unit / No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost
					Foreign	Local	Tax	
1) Equipment		No of Units	No of Hours	Hourly Rate				
	Crawler Tractor, 200 HP	1	9	410.00	2,472.30	811.80	405.90	3,690.00
	Wheel Loader, 2 cu. yd.	1	12	220.00	1,742.40	580.80	316.8	2,640.00
	Dump Truck, 12 t	3	12	230.00	5,947.60	1,573.20	1,159.20	8,280.00
	Vibratory Roller, 18 t	1	8	240.00	1,267.20	422.40	230.40	1,920.00
	Rubber Tire Roller, 20 t	1	8	190.00	988.00	364.80	167.2	1,520.00
	Water Tank Truck, 1600L	1	8	170.00	911.20	285.60	163.20	1,360.00
	Motor Grader, 145 HP	1	6	270.00	1,069.20	356.40	194.40	1,620.00
	Sub-Total				13,997.90	4,395.00	2,637.10	21,030.00
2) Labor		No	No of Days	Daily Rate				
	Foreman	1	2	73.36		146.72		146.12
	Skilled Laborer	4	2	50.00		400.00		400.00
	Unskilled Laborer	8	2	38.32		613.12		613.12
	Sub-Total					1,159.84		1,159.84
Direct Cost					13,997.90	5,554.84	2,637.10	22,189.84
Unit Cost Per Cu. M.					14.00	5.55	2.64	22.19
					(63%)	(25%)	(12%)	Say 22.00

APPENDIX 9.1-1 UNIT COST ANALYSIS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE) DATE:
 ITEM NO: 105 (2) NAME OF ITEM: Roadway/Drainage Excavation QUANTITY: 1000 Cu. M UNIT PRICE: 46.00
 (Rock Excavation)

DESCRIPTION	Quantity/ No. of Units/ No.	Unit/ No. of Hour No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost
				Foreign	Local	Tax	
1) Equipment							
Crawler Tractor, 200 HP	1	24	410.00	6,592.80	2,164.80	1,082.40	9,840.00
Wheel Loader, 2 cu. yd.	1	12	220.00	1,742.40	580.80	316.80	2,640.00
Dump Truck, 12 t	4	12	230.00	7,396.80	2,097.60	1,545.60	11,040.00
Motor Grader, 145 HP	1	15	270.00	2,673.00	891.00	486.00	4,050.00
Rubber Tire Roller, 20 t	1	24	190.00	2,964.00	1,094.40	501.60	4,560.00
Jackhammer	4	24	13.00	287.04	886.08	74.88	1,248.00
Air Compressor, 3-5 m ³ /min.	2	24	85.00	2,284.80	1,020	775.20	4,080.00
Vibratory Plate Compactor 2.5t	4	24	15.00	460.80	892.80	86.40	1,440.00
Ripper Attachment (10% of Tractor)				659.28	216.48	108.24	984.00
Water Tank Truck, 160 HP	1	24	170.00	2,733.60	856.8	489.60	4,080.00
Sub-Total				27,794.52	10,700.76	5,466.72	43,962.00
2) Labor	No	No of Days	Daily Rate				
Foreman	1	3	73.36		220.08		220.08
Skilled Laborer	4	3	50.00		600.00		600.00
Unskilled Laborer	10	3	38.32		1,149.6		1,149.60
Sub-Total					1,969.68		1,969.68
Direct Cost				27,794.52	12,670.44	5,466.72	45,931.68
Unit Cost Per Cu. M.				27.79	12.67	5.47	45.93
				(60%)	(28%)	(12%)	Save 46.00

APPENDIX 9.1-1 UNIT COST ANALYSIS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE) DATE:									
ITEM NO: 107 (1) NAME OF ITEM: BORROW (Common Materials) QUANTITY: 1000 CU. UNIT PRICE: 43.00									
DESCRIPTION	Quantity/ No. of Units/ No.	Unit/ No. of Hour	Unit Rate/ Hourly Rate	COMPONENTS			Tax	Financial Cost	
				Foreign	Local				
1) Materials	Quantity	Unit	Unit Rate						
Royalty	1,000	Cu.M.	3.00				3,000.00	3,000.00	
Sub-Total									
2) Equipment	No of Units	No of Hour	Hourly Rate						
Crawler Tractor, 90 HP	1	12	180.00	1,404.00	518.40		237.60	2,160.00	
Dump Truck, 12 t	7	16	230.00	17,259.20	4,894.40		3,606.40	25,760.00	
Crawler Loader, 1.1/2 cu. yd	2	16	180.00	3,686.40	1,382.40		691.20	5,760.00	
Motor Grader, 145 HP	1	6	270.00	1,069.20	356.40		194.40	1,620.00	
Rubber Tire Roller, 20 t	1	10	190.00	1,235.00	456.00		209.00	1,900.00	
Water Tank Truck, 160HP 6000L	1	10	170.00	1,139.00	357.00		204.00	1,700.00	
Water Pump	1	10	18.00	73.80	84.60		21.60	180.00	
Sub-Total									
3) Labor	No	No of Days	Daily Rate						
Foreman	1	2	73.36		146.72			146.72	
Unskilled Laborer	5	2	38.32		383.20			383.20	
Sub-Total									
Direct Cost									
				25,866.60	8,579.12		8,164.20	42,609.92	
Unit Cost Per Cu. M.				25.87	8.58		8.16	42.61	
				(61%)	(20%)		(19%)	Say 43.00	

APPENDIX 9.1-1 UNIT COST ANALYSIS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE)		DATE:					
ITEM NO: 108	NAME OF ITEM: Aggregate Sub-Base	QUANTITY: 1000 Cu. MUNIT PRICE: 110.00					
DESCRIPTION	Quantity / No. of Units / No.	Unit / No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost
				Foreign	Local	Tax	
1) Materials							
Aggregate for Granular sub-base 1,250 Cu.M.			71.00	56,900.00	16,862.50	15,087.50	88,750.00
Sub-Total				56,900.00	16,862.50	15,087.50	88,750.00
2) Equipment							
	No of Units	No of Hours	Hourly Rate				
Motor Grader, 145 HP	1	26	270.00	4,638.20	1,544.40	842.40	7,020.00
Water Tank Truck, 160HP, 6000L	1	26	170.00	2,961.40	928.20	530.40	4,420.00
Water Pump, 7.5 HP	1	26	18.00	191.88	219.96	56.16	468.00
Rubber Tire Roller, 20 t	1	26	190.00	3,211.00	1,185.60	543.40	4,940.00
Tandem Roller, 8-10 t, 60HP	1	26	130.00	2,197.00	811.20	371.80	3,380.00
Sub-Total				13,194.48	4,689.36	2,344.16	20,228.00
3) Laborer							
	No	No of Days	Daily Rate				
Foreman	1	3	73.36		220.08		220.08
Unskilled Laborer	5	3	38.32		574.80		574.80
Sub-Total					794.88		794.88
Direct Cost				69,994.48	22,345.74	17,431.66	109,772.88
Unit Cost Per Cu. M.				69.99	22.35	17.43	109.77
				(64%)	(20%)	(16%)	Say 110.00

APPENDIX 9.1-1 UNIT COST ANALYSIS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE) DATE:
 ITEM NO: 200 NAME OF ITEM: Aggregate Base Course QUANTITY: 1000 Cu.M UNIT PRICE: 145.00

DESCRIPTION	Quantity/ No. of Units/ No.	Unit / No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost
				Foreign	Local	Tax	
1) Materials							
Aggregate for Base Course	1,250	Cu.M.	110.00	86,625.00	28,875.00	22,000.00	137,500.00
Sub-Total				86,625.00	28,875.00	22,000.00	137,500.00
2) Equipment							
Motor Grader, 145 HP	1	7	270.00	1,247.40	415.80	226.80	1,890.00
Water Tank Truck, 160HP, 6000L	1	10	170.00	1,139.00	357.00	204.00	1,700.00
Water Pump, 7.5 HP	1	10	18.00	73.80	84.60	21.60	180.00
Rubber Tire Roller, 20 t	1	10	190.00	1,235.00	456.00	209.00	1,900.00
Tandem Roller, 8-10 t	1	10	130.00	845.00	312.00	143.00	1,300.00
Sub-Total				4,540.20	1,625.40	804.40	6,970.00
3) Labor							
Foreman	1	2	73.36		146.72		146.72
Unskilled Laborer	5	2	38.32		383.20		383.20
Sub-Total					529.92		529.92
Direct Cost				91,165.20	31,030.32	22,804.40	144,999.92
Unit Cost Per Cu.M.				91.17	31.03	22.80	145.00
				(63%)	(21%)	(16%)	SAY 145.00

APPENDIX 9.1-1 UNIT COST ANALYSIS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE) DATE:
 ITEM NO: 315 NAME OF ITEM: Portland Cement Concrete Pavement QUANTITY: 1000 sq. m. UNIT PRICE: 186.00
 (0.25 m thick)

DESCRIPTION	Quantity/ No. of Units/ No.	Unit/ No. of Hour	Unit Rate/ Hourly Rate	COMPONENTS			Financial Cost
				Foreign	Local	Tax	
1) Materials							
Concrete Class "A"	250	Cu.M.	557.00	76,587.50	41,775.00	20,887.50	139,250.00
Reinforcing Steel	1,300	Kg.	6.40	5,824.00	998.40	1,497.60	8,320.00
Curing Compound	1,000	Sq.M.	1.20	108.00	1,032.00	60.00	1,200.00
Filler	1,500	Lit.	9.00	8,910.00	2,160.00	2,430.00	13,500.00
Sub-Total				91,429.50	45,965.40	24,875.10	162,270.00
2) Equipment							
Concrete Finisher, 100 HP	1	No of Units	Hourly Rate				
	1	22	340.00	5,011.60	1,645.60	822.80	7,480.00
Concrete Vibrator, 3.5 HP	3	22	10.00	217.80	396.00	46.20	660.00
Concrete Saw, 3 t, 30 HP	1	3	25.00	37.50	28.50	9.00	75.00
Steel Forms	58	30	0.50	156.60	522.00	191.40	870.00
Truck Mixer, 8 cu. Yd.	2	22	280.00	8,131.20	2,587.20	1,601.60	12,320.00
Sub-Total				13,554.70	5,179.30	2,671.00	21,405.00
3) Labor							
	No	No of Days	Daily Rate				
Foreman	1	3.5	73.36		256.76		256.76
Skilled Laborer	6	3.5	50.00		1,050.00		1,050.00
Unskilled Laborer	10	3.5	38.32		1,341.20		1,341.20
Sub-Total					2,647.96		2,647.96
Direct Cost				104,984.20	53,792.66	27,546.10	186,322.96
Unit Cost Per Sq. M.				104.98	53.79	27.55	186.32
				(56%)	(29%)	(15%)	Say 186.00

APPENDIX 9-1-1 UNIT COST ANALYSIS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE) DATE: QUANTITY: 1000 Cu. MUNIT PRICE: 921.00
 ITEM NO: 405 (1) NAME OF ITEM: Class "A" Concrete

DESCRIPTION	Quantity / No. of Units / No.	Unit / No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost
				Foreign	Local	Tax	
1) Materials							
Concrete Class "A"	1,000	Cu.M.	557.00	306,350.00	167,100.00	83,550.00	557,000.00
Form Lumber	15,000	Bd.Ft.	3.90	17,550.00	32,175.00	8,775.00	58,500.00
Nails	1,080	Kg.	7.50	5,184.00	2,430.00	486.00	8,100.00
Plywood	900	Sq.M.	61.00	41,724.00	3,294.00	9,882.00	54,900.00
Miscellaneous (2% of above)				7,416.16	4,099.98	2,053.86	13,570.00
Sub-Total				378,224.16	209,098.98	104,746.96	692,070.00
2) Equipment							
Truck Mixer, 3 cu. yd.	2	No of Units / Hour	Hourly Rate				
Crawler Crane, 30 t	1	160	280.00	59,136.00	18,816.00	11,648.00	89,600.00
Concrete Bucket, 1 cu. yd.	1	160	370.00	39,664.00	11,840.00	7,696.00	59,200.00
Concrete Vibrator, 3.5 HP	4	160	19.00	1,337.60	1,428.80	273.60	3,040.00
Minor Tools (10% of Labor)				2,112.00	3,840.00	448.00	6,400.00
Sub-Total				102,249.60	42,393.55	20,065.60	164,708.75
3) Labor							
Foreman	1	No of Days	Daily Rate				
Carpenter	8	50	73.36	4,401.60			4,401.60
Unskilled Labor	8	60	46.88	22,502.40			22,502.40
Unskilled Labor	23	60	38.32	18,393.60			18,393.60
Sub-Total				19,389.92			19,389.92
Sub-Total				64,687.52			64,687.52

APPENDIX 9.1-1 UNIT COST ANALYSIS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE) DATE: _____
 ITEM NO: 405 (6) NAME OF ITEM: Lean Concrete QUANTITY: 1000 Cu.M UNIT PRICE: 577.00

DESCRIPTION	Quantity/ No. of Units/ No.	Unit/ No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost
				Foreign	Local	Tax	
1) Materials							
Lean Concrete	1,000	Cu.M.	501.00	280,560.00	145,290.00	75,150.00	501,000.00
Form Lumber	4,500	Bd.Ft.	3.90	5,265.00	9,652.50	2,632.50	17,550.00
Nails	135	KG.	7.50	648.00	303.75	60.75	1,012.50
Miscellaneous (2% of above)				5,729.46	3,104.93	1,556.86	10,391.25
Sub-Total				292,202.46	158,351.18	79,400.11	529,953.75
2) Equipment							
Truck Mixer, 8 cu. yd.	2	No of Units	Hourly Rate				
Concrete Vibrator, 3.5 HP	2	36	280.00	13,305.60	4,233.60	2,620.80	20,160.00
Minor Tools (5% of Labor)		36	10.00	237.60	432.00	50.40	720.00
Sub-Total				13,543.20	5,896.97	2,671.20	22,111.27
3) Labor							
Foreman	1	No of Days	Daily Rate				
Carpenter	8	18	73.36	1,320.48	1,320.48		1,320.48
Unskilled Laborer	24	18	38.32	6,750.72	6,750.72		6,750.72
Sub-Total				13,543.20	16,821.92		16,821.92
Direct Cost				305,745.66	188,973.49	82,071.31	576,690.46
Unit Cost Per Kg.				305.74	188.87	82.07	576.09
				(53%)	(33%)	(14%)	Say 577.00

APPENDIX 9.1-1 UNIT COST ANALYSIS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE)		DATE:					
ITEM NO: 406		QUANTITY: 10,000 Kg/UNIT PRICE: 8.80					
DESCRIPTION	Quantity / No. of Units/ No.	Unit / No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost
				Foreign	Local	Tax	
1) Materials							
Reinforcing Steel	10,000	Kg.	6.40	44,800.00	7,680.00	11,520.00	64,000.00
Wastage (3% of Reinforcing Steel)	300	Kg.	6.40	1,944.00	230.40	345.60	1,920.00
Tie Wire	430	Kg.	12.10	3,329.92	1,092.63	780.45	5,203.00
Sub-Total				49,473.92	9,003.03	12,646.05	71,123.00
2) Equipment							
Wheel Crane, 3.5	1	No of Units	Hourly Rate				
	1	10	115.00	759.00	253.00	138.00	1,150.00
Bar Shear, 10 HP, 40 mm	5	20	24.00	1,200.00	984.00	216.00	2,400.00
Bar Bender, 7.5 HP, 40 mm	5	36	26.00	2,527.20	1,731.60	421.20	4,680.00
Minor Tools (10% of Labor)					803.86		803.86
Sub-Total				4,486.20	3,772.46	775.20	9,033.86
3) Labor							
Foreman	1	No of Days	Daily Rate				
	1	6	73.36		440.16		440.16
Skilled Laborer	10	6	50.00		3,000.00		3,000.00
Unskilled Laborer	20	6	38.32		4,598.40		4,598.40
Sub-Total					8,038.56		8,038.56
Direct Cost				58,960.12	20,814.05	13,421.25	88,195.42
Unit Cost Per Kg.				5.40	2.08	1.34	8.82
				(61%)	(24%)	(15%)	Say 8.80

APPENDIX 2.1-1 UNIT COST ANALYSIS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE) DATE:

ITEM NO: 413 (3) NAME OF ITEM: ROPC 0.76 m. dia. QUANTITY: 100 Li.M. UNIT PRICE: 476.00

DESCRIPTION	Quantity/ No. of Units/ No.	Unit/ No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost
				Foreign	Local	Tax	
1) Materials							
ROPC 0.76 m. dia.	100	Li.M.	358.00	19,690.00	11,098.00	5,012.00	35,800.00
Portland Cement	18	Bags	33.00	297.00	207.90	89.10	594.00
Sand	1.5	Cu.M.	84.00	78.12	27.72	20.16	126.00
Hauling of Cement	18	Bags	3.00	33.48	12.96	7.56	54.00
Sub-Total				20,098.60	11,346.58	5,128.82	36,574.00
2) Equipment	No of Units	No of Hours	Hourly Rate				
Wheel Crane, 3.5 t	1	32	115.00	2,428.80	809.60	441.60	3,680.00
Stakebody Truck	1	14	185.00	1,605.80	621.60	362.60	2,590.00
Minor Tools (10% of Labor)				4,034.60	1,865.79	804.20	6,704.59
Sub-Total							
3) Labor	No	No of Days	Daily Rate				
Foreman	1	4	73.36		293.44		293.44
Skilled Laborer	4	8	50.00		1,600.00		1,600.00
Unskilled Laborer	8	8	38.32		2,452.48		2,452.48
Sub-Total					4,345.92		4,345.92
Direct Cost				24,133.20	17,558.29	5,933.02	47,624.51
Unit Cost Per Li.M.				241.33	175.58	59.33	476.24
				(51%)	(37%)	(12%)	Sav 476.00

APPENDIX 9.1-1 UNIT COST ANALYSIS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE) DATE:
 ITEM NO: 413 (5) NAME OF ITEM: RCPC 1.07 m. dia. QUANTITY: 100 LI.M. UNIT PRICE: 782.00

DESCRIPTION	Quantity/ No. of Units/ No.	Unit/ No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost
				Foreign	Local	Tax	
1) Materials							
RCPC 1.07 m dia.	100	LI.M.	618.00	33,990.00	18,540.00	9,270.00	61,800.00
Portland Cement	30	Bags	33.00	495.00	346.50	148.50	990.00
Sand	2.5	Cu.M.	84.00	130.20	46.20	33.60	210.00
Hawking of Cement	30	Bags	3.00	55.80	21.60	12.60	90.00
Sub-Total				34,671.00	18,954.30	9,464.70	63,090.00
2) Equipment							
Wheel Crane, 3.5 t	1	No of Hours	HOURLY Rate				
Stakebody Truck	1	36	115.00	2,732.40	910.80	496.80	4,140.00
Minor Tools (10% of Labor)		22	185.00	2,523.40	976.80	569.80	4,070.00
Sub-Total					627.22		627.22
3) Labor							
Foreman	No	No of Days	Daily Rate	5,255.80	2,514.82	1,066.6	8,837.22
Skilled Laborer	1	6	73.36		440.16		440.16
Unskilled Laborer	4	10	50.00		2,000.00		2,000.00
Sub-Total	10	10	38.32		3,832.00		3,832.00
Sub-Total					6,272.16		6,272.16
Direct Cost				39,926.30	27,741.28	10,531.30	78,199.38
				399.27	277.41	105.31	781.99
				(51%)	(35%)	(14%)	SAY 782.00

APPENDIX 9.1-1 UNIT COST ANALYSIS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE) DATE:									
ITEM NO: 502 (4) NAME OF ITEM: Combination Concrete Curb and Gutter QUANTITY: 100 LI. N. UNIT PRICE: 112.00									
DESCRIPTION	Quantity/ No. of Units/ No.	Unit/ No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Tax	Financial Cost	
				Foreign	Local				
1) Materials	Quantity Unit	Unit	Unit Rate						
Concrete Class "A"	13	Cu.M.	557.00	3,982.55	2,172.30	1,086.15		7,241.00	
Portland Cement	4	Bags	33.00	66.00	46.20	19.80		132.00	
Form Lumber	460	Sd.Ft.	3.90	538.20	986.70	269.10		1,774.00	
Nails	9	Kg.	7.50	43.20	20.25	4.05		67.50	
Hauling of Cement	4	Bags	3.00	7.44	2.88	1.68		12.00	
Sub-Total				4,637.39	3,228.33	1,380.78		9,246.50	
2) Equipment	No of Units	No of Hours	Hourly Rate						
Truck Mixer, 8 cu. yd	1	3	280.00	554.40	176.40	109.20		840.00	
Minor Tools (10% of Labor)				554.40	281.46	109.20		945.06	
Sub-Total									
3) Labor	No	No of Days	Daily Rate						
Form Setting: Foreman	1	1	73.36		73.36			73.36	
Carpenter	2	2	46.88		187.52			187.52	
Unskilled Laborer	6	2	38.32		459.84			459.84	
Concrete: Skilled Laborer	2	1	50.00		100.00			100.00	
Concrete: Unskilled Laborer	6	1	38.32		229.92			229.92	
Sub-Total					1,050.64			1,050.64	
Direct Cost				5,191.79	4,560.43	1,489.98		1,242.20	
Unit Cost Per Li.N.				51.92	45.60	14.90		112.42	
				(46%)	(47%)	(13%)		Say 112.00	

APPENDIX 9.1-1 UNIT COST ANALYSIS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE) DATE:									
ITEM NO: 371 NAME OF ITEM: Pavement Markings QUANTITY: 1000 Sq. UNIT PRICE: 54.00									
DESCRIPTION	Quantity/ No. of Units/ No.	Unit/ No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost		
				Foreign	Local	Tax			
1) Materials									
Paints	165	Gal.	250.00	20,625.00	14,437.50	6,187.50	41,250.00		
Wastage (2% of Paints)	3.3	Gal.	250.00	412.50	288.75	123.75	825.00		
Incidentals (10% of above)				2,103.75	1,472.63	631.12	4,207.50		
Sub-Total				23,141.25	16,198.88	6,942.37	46,282.50		
2) Equipment									
Minor Tools (10% of Labor)					659.84		659.84		
Sub-Total					659.84		659.84		
3) Labor									
	No	No of Days	Daily Rate						
Skilled Laborer	1	40	50.00		2,000.00		2,000.00		
Unskilled Laborer	3	40	38.32		4,598.40		4,598.40		
Sub-Total					6,598.40		6,598.40		
Direct Cost				23,141.25	23,457.12	6,942.37	53,540.74		
Unit Cost Per Sq.M.				23.14	23.46	6.94	53.54		
				(43%)	(44%)	(13%)	54.00		

APPENDIX 9-1-2 UNIT COST ANALYSIS FOR PROCESSED MATERIALS

DESCRIPTION		Quantity / No. of Units / No.	Unit / No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost
					Foreign	Local	Tax	
1) Materials		Quantity	Unit	Unit Rate				
	Royalty	432	Cu.M.	3.00			1,296.00	1,296.00
	Sub-total						1,296.00	1,296.00
2) Equipment		No. of Units	No. of Hours	Hourly Rate				
	Hydr. Excavator, 3/4 cu. yd.	1	9	240.00	1,425.60	496.80	237.60	2,160.00
	Dump Truck, 12 t.	2	9	230.00	2,773.80	756.60	579.60	4,140.00
	Wheel Loader, 2 cu. yd.	1	7	220.00	1,016.40	338.80	184.80	1,540.00
	Screening Plant, 150 tph	1	7	310.00	1,256.60	565.90	325.50	2,170.00
	Wheel Loader, 2 cu. yd.	1	14	220.00	2,032.80	677.60	369.60	3,080.00
	Dump Truck, 12 t.	6	14	230.00	12,944.40	3,670.80	2,704.80	19,320.00
	Miscellaneous (5% of above)				1,072.58	327.83	220.10	1,620.50
	Sub-total				22,524.18	6,884.33	4,622.00	34,030.50
3) Labor		No.	No. of days	Daily Rate				
	Foreman	1	2	73.36		146.72		146.72
	Laborer	10	2	38.32		766.40		766.40
	Sub-total					913.12		913.12
	Direct Cost				22,524.18	7,797.45	5,918.00	36,239.62
	Unit Cost per Cu. M.				52.14	18.05	13.70	83.88
					(62%)	(22%)	(16%)	SAY 84.00

APPENDIX 9.1-2 UNIT COST ANALYSIS FOR PROCESSED MATERIALS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE) DATE: _____
 ITEM NO: Ref. 2 NAME OF ITEM: Coarse aggregate for cement concrete QUANTITY: 432 Cu.M. UNIT PRICE: ₱95.00

DESCRIPTION	Quantity/ No. of Units/ No.	Unit / No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost
				Foreign	Local	Tax	
1) Materials							
Royalty	432	Cu.M.	3.00			1,296.00	1,296.00
Sub-total						1,296.00	1,296.00
2) Equipment							
	No. of Units	No. of Hours	Hourly Rate				
Hydr. Excavator, 3/4 cu. yd.	1	13	240.00	2,059.20	717.60	343.20	3,120.00
Dump Truck, 12 t.	2	13	230.00	4,006.20	1,136.20	837.20	5,980.00
Wheel Loader, 2 cu. yd.	1	10	220.00	1,452.00	484.00	264.00	2,200.00
Screening Plant, 150 tph	1	10	310.00	1,798.00	837.00	465.00	3,100.00
Wheel Loader, 2 cu. yd.	1	14	220.00	2,022.80	677.60	368.60	3,080.00
Dump Truck, 12 t.	6	14	230.00	12,944.40	3,670.80	2,704.80	19,320.00
Miscellaneous (5% of above)				1,214.65	376.16	249.19	1,840.00
Sub-total				25,507.75	7,899.36		38,640.00
3) Labor							
	No.	No. of Days	Daily Rate				
Foreman	1	2	73.36		146.72		146.72
Laborer	10	2	38.32		766.40		766.40
Sub-total					913.12		913.12
Direct Cost				25,507.65	8,812.48	6,528.99	40,849.12
Unit Cost Per Cu. M.				59.05	20.40	15.11	94.56
				(62%)	(22%)	(16%)	95.00
							say

APPENDIX 9.1-2 UNIT COST ANALYSIS FOR PROCESSED MATERIALS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE) DATE:

ITEM NO: Ref. 3 NAME OF ITEM: Aggregate for Granular sub-base course QUANTITY: 364 Cu. M. UNIT PRICE: 71.00

DESCRIPTION	Quantity / No. of Units / No.	Unit / No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost
				Foreign	Local	Tax	
1) Materials							
Royalty	364	Cu.M.	3.00				1,092.00
Sub-Total							1,092.00
2) Equipment							
Crawler Loader, 2 cu.yd.	1	No of Units	Hourly Rate	1,716.00	572.00	312.00	2,600.00
Dump Truck, 12 t	9	10.0	230.00	13,869.00	3,933.00	2,898.00	20,700.00
Miscellaneous (10% of above)				779.25	225.25	160.50	1,165.00
Sub-Total				16,364.25	4,730.25	3,370.50	24,465.00
3) Labor							
Asst. Foreman	1	No of Days	Daily Rate		67.52		67.52
Skilled Laborer	1	1	50.00		50.00		50.00
Laborer	3	1	38.32		114.96		114.96
Sub-Total					232.48		232.48
Direct Cost				16,364.25	4,962.73	4,462.50	25,789.48
Unit Cost Per Cu. M.				44.96	13.63	12.26	70.85
				(64%)	(19%)	(17%)	Say 71.00

APPENDIX 9.1-2 UNIT COST ANALYSIS OF PROCESSED ANALYSIS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE) DATE:
 ITEM NO. Ref. 4 NAME OF ITEM: (Crushed Rock Aggregate) QUANTITY: 740 Cu.M. UNIT PRICE: 110.00
 Aggregate for Base-Course

DESCRIPTION	Quantity/ No. of Units/ No.	Unit / No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost
				Foreign	Local	Tax	
1) Materials							
Royalty	740	Cu.M.	3.00				2,220.00
Sub-Total							2,220.00
2) Equipment							
Crushing Plant, 80-135 tpb	1	No of Units	720.00	6,681.60	2,995.20	1,843.20	11,520.00
Wheel Loader, 2 cu. yd.	1	No of Hours	220.00	2,323.20	774.40	422.40	3,520.00
Hydr. Excavator, 3/4 cu. yd.	1	No of Hours	260.00	2,745.60	915.20	499.20	4,160.00
Dump Truck, 12 t	2	No of Hours	230.00	4,931.20	1,378.40	1,030.40	7,360.00
Wheel Loader, 2 cu. yd.	1	No of Hours	220.00	2,323.20	774.40	422.40	3,520.00
Dump Truck, 12 t	12	No of Hours	230.00	29,587.20	8,390.40	6,182.40	44,160.00
Miscellaneous (5% of above)				2,429.60	762.40	520.00	3,712.00
Sub-Total				51,021.60	16,010.40	10,920.00	77,952.00
3) Labor							
Foreman	1	No of Days	73.36		146.72		146.72
Laborer	10	No of Days	38.32		766.40		766.40
Sub-Total					913.12		913.12
Direct Cost				51,021.60	16,923.52	13,140.00	81,085.12
Unit Cost Per Cu. M.				68.95	22.87	17.74	109.57
				(63%)	(21%)	(16%)	Say 110.00

APPENDIX 9-1-2 UNIT COST ANALYSIS FOR PROCESSED MATERIALS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE) DATE:

ITEM NO: Ref. 5 NAME OF ITEM: Concrete Class " A " QUANTITY: 1000 Cu. Yd. UNIT PRICE: 557.00

DESCRIPTION	Quantity/ No. of Units/ No.	Unit/ No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost
				Foreign	Local	Tax	
1) Materials							
Portland Cement	9,500	Bags	33.00	156,750.00	109,725.00	47,025.00	313,500.00
Sand	540	Cu.M.	94.00	28,123.20	9,979.20	7,257.60	45,360.00
Gravel	822	Cu.M.	95.00	48,415.80	17,179.80	12,494.40	78,090.00
Hauling of Cement	9,500	Bags	3.00	17,670.00	6,840.00	3,990.00	28,500.00
Sub-Total				250,959.00	143,724.00	70,767.00	465,450.00
2) Equipment							
Batching Plant, 107HP, 94 ^{cu} /hr	1	25	620.00	9,145.00	3,565.00	2,790.00	15,500.00
Crawler Loader, 2 cu. yd.	1	35	260.00	6,006.00	2,002.00	1,092.00	9,100.00
Water Tank Truck, 160HP 6000L	1	35	170.00	3,986.50	1,249.50	714.00	5,950.00
Truck Mixer 8 cu. yd.	6	35	280.00	38,808.00	12,348.00	7,644.00	58,800.00
Sub-Total				57,945.50	19,164.50	12,240.00	89,350.00
3) Labor							
Foremen	1	4	73.36		293.44		293.44
Laborer	12	4	38.32		1,839.36		1,839.36
Sub-Total					2,132.80		2,132.80
Direct Cost				308,904.50	165,021.30	83,007.00	556,932.8
Unit Cost Per Cu. M.				308.90	165.02	83.01	556.93
				(55%)	(30%)	(15%)	Say 557.00

APPENDIX 9.1-2 UNIT COST ANALYSIS FOR PROCESSED MATERIALS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE) DATE:		QUANTITY: 1000 Cu. M UNIT PRICE: 533.00					
ITEM NO: Ref. 6		NAME OF ITEM: Concrete Class "B"					
DESCRIPTION	Quantity/ No. of Units/ No.	Unit/ No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost
				Foreign	Local	Tax	
1) Materials							
Portland Cement	8,850	Bags	33.00	146,025.00	102,217.50	43,807.50	292,050.00
Sand	450	Cu.M.	84.00	22,940.00	8,140.00	5,920.00	37,000.00
Gravel	900	Cu.M.	95.00	53,010.00	18,810.00	13,680.00	85,500.00
Hauling of Cement	8,850	Bags	3.00	16,461.00	6,392.00	3,717.00	26,550.00
Sub-Total				238,436.00	135,539.50	67,124.50	441,100.00
2) Equipment							
Batching Plant, 107HP, 94 m ³ /hr	1	No of Units	Hourly Rate				
		No of Hours					
	1	25	620.00	9,145.00	3,565.00	2,790.00	15,500.00
Crawler Loader, 2 cu. yd.	1	35	620.00	6,006.00	2,002.00	1,092.00	9,100.00
Water Tank Truck, 160HP, 6000 Lit	1	35	620.00	3,986.50	1,249.50	714.00	5,950.00
Truck Mixer, 8 cu. yd.	6	35	620.00	38,808.00	12,348.00	7,644.00	58,800.00
Sub-Total				57,945.50	19,164.50	12,240.00	89,350.00
3) Labor							
	No	No of Days	Daily Rate				
Foreman	1	4	73.36		293.44		293.44
Laborer	12	4	38.32		1,839.36		1,839.36
Sub-Total					2,132.80		2,132.80
Direct Cost							
				296,381.50	156,836.80	79,361.50	532,582.80
Unit Cost Per Cu. M.				296.38	156.84	79.36	532.58
				(56%)	(29%)	(15%)	Say 533.00

APPENDIX 9.1-2 UNIT COST ANALYSIS FOR PROCESSED MATERIALS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE) DATE: QUANTITY: 1000 Cu.M UNIT PRICE: 635.00
 ITEM NO: Ref. 7 NAME OF ITEM: Concrete Class "D"

DESCRIPTION	Quantity / No. of Units / No.	Unit / No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost
				Foreign	Local	Tax	
1) Materials							
Portland Cement	11,900	BAGS	23.00	196,350.00	137,445.00	58,905.00	392,700.00
Sand	530	Cu.M.	84.00	27,602.40	9,794.40	7,123.20	44,520.00
Gravel	744	Cu.M.	95.00	43,821.60	15,549.60	11,308.80	70,680.00
Hauling of Cement	11,900	BAGS.	3.00	22,134.00	8,568.00	4,998.00	35,700.00
Sub-Total				289,906.00	171,357.00	82,335.00	543,600.00
2) Equipment							
Batching Plant, 107HP 94m ³ /hr	1	No of Units	No of hourly Rate				
	1	25	670.00	9,145.00	3,565.00	2,790.00	15,500.00
Crawler Loader, 2 cu. yd.	1	35	260.00	6,006.00	2,002.00	1,092.00	9,100.00
Water Tank Truck, 160HP, 6000 li	1	35	170.00	3,986.50	1,249.50	714.00	5,950.00
Truck Mixer, 8 cu. yd.	6	35	280.00	38,808.00	12,348.00	7,644.00	58,800.00
Sub-Total				57,945.50	19,164.50	12,240.00	89,350.00
3) Labor							
	No	No of Days	Daily Rate				
Foreman	1	4	73.36		293.44		293.44
Laborer	12	4	38.32		1,839.36		1,839.36
Sub-Total					2,132.80		2,132.80
Direct Cost				347,853.50	192,654.30	94,575.00	635,082.80
Unit Cost Per Cu. M.				347.85	192.65	94.58	635.08
				(55%)	(30%)	(15%)	Say 635.00

APPENDIX 9.1-2 UNIT COST ANALYSIS FOR PROCESSED MATERIALS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO-MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE) DATE: _____
 ITEM NO. Ref. 8 NAME OF ITEM: Lean Concrete QUANTITY: 1,000 CU.MET PRICE: 501.00

DESCRIPTION	Quantity/ No. of Units/ No.	Unit/ No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost
				Foreign	Local	Tax	
1) Materials							
Portland Cement	7,500	Bags	33.00	123,750.00	86,625.00	37,125.00	247,500.00
Sand	510	Cu.M.	84.00	26,560.80	9,424.80	6,854.40	42,840.00
Gravel	1,020	Cu.M.	95.00	60,078.00	21,318.00	15,504.00	96,900.00
Hauling of Cement	7,500	Bags	3.00	13,950.00	5,400.00	3,150.00	22,500.00
Sub-Total				224,338.80	122,767.80	62,633.40	409,740.00
2) Equipment							
Batching Plant, 107HP, 94 ^{m3} /hr	1	No of Units	Hourly Rate				
	1	25	620.00	9,145.00	3,564.00	2,790.00	15,500.00
Crawler Loader, 2 cu. yd.	1	35	260.00	6,006.00	2,002.00	1,092.00	9,100.00
Water Tank Truck, 160HP, 6000Li	1	35	170.00	3,986.50	1,249.50	714.00	5,900.00
Truck Mixer, 8 cu. yd.	6	35	280.00	38,808.00	12,348.00	7,644.00	58,800.00
Sub-Total				57,945.50	19,164.50	12,240.00	89,350.00
3) Labor							
	No	No of Days	Daily Rate				
Foreman	1	4	73.36		293.44		293.44
Labor	12	4	38.32		1,839.36		1,839.36
Sub-Total					2,132.80		2,132.80
Direct Cost				282,284.30	144,065.10	74,873.40	501,222.80
Unit Cost Per Cu. M.				282.28	144.07	74.87	501.22
				(56%)	(29%)	(15%)	Say 501.00

APPENDIX 9.1-2 UNIT COST ANALYSIS FOR PROCESSED MATERIALS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE) DATE:

ITEM NO: Ref. 10 NAME OF ITEM: RCPC 0.76 m. dia. QUANTITY: 100 LI. X. UNIT PRICE: 358.00

DESCRIPTION	Quantity / No. of Units/ No.	Unit / No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost
				Foreign	Local	Tax	
1) Materials							
Class "C" Concrete	26.0	Cu.M.	575.00	8,222.50	4,485.00	2,242.50	14,950.00
Reinforcing Steel	2,008	kg.	6.40	8,995.84	1,542.14	2,313.22	12,951.20
Tie Wire	60	kg.	12.10	464.64	152.46	108.90	726.00
Sub-Total				17,682.98	6,179.60	4,664.62	28,527.20
2) Equipment							
Concrete Vibrator, 3.5 HP	1	No of Units	Hourly Rate				
Bar Shear, 10 HP 40 mm	1	20	10.00	66.00	120.00	14.00	200.00
Steel Forms	35	13	24.00	156.00	127.92	28.08	312.00
Truck Mixer, 8 cu yd., 250 HP	1	72	0.50	226.80	756.00	299.20	1,260.00
wheel Crane, 3.5 t	1	3.5	280.00	146.80	205.80	127.40	980.00
Sub-Total		10	115.00	759.00	253.00	138.00	1,150.00
				1,854.60	1,462.72	584.68	3,902.00
3) Labor							
Foreman	1	No of Days	hourly Rate				
Skilled Laborer	2	6	73.36		440.16		440.16
Laborer	10	6	50.00		600.00		600.00
Sub-Total		6	38.32		2,299.20		2,299.20
					3,339.36		3,339.36
Direct Cost							
				19,537.58	10,981.68	5,249.30	35,768.56
Unit Cost Per Li. M.							
				195.38	109.82	52.49	357.69
				(55%)	(31%)	(14%)	Say 358.00

APPENDIX 9.1-2 UNIT COST ANALYSIS FOR PROCESSED MATERIALS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE) DATE:									
ITEM NO: Ref. 11 NAME OF ITEM: RCPC 1.07 M. dia. QUANTITY: 100 I.M. UNIT PRICE: 618.00									
DESCRIPTION	Quantity/ No. of Units/ No.	Unit/ No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost		
				Foreign	Local	Tax			
1) Materials									
Class "C" Concrete	43.3	Cu.M.	575.00	13,693.63	7,469.25	3,734.62	24,897.50		
Reinforcing Steel	3,740	KG.	6.40	16,755.20	2,872.32	4,308.48	23,936.00		
Tie Wire	110	KG.	12.10	851.84	279.51	199.65	1,331.00		
Sub-total				31,300.67	10,621.08	8,242.75	50,164.50		
2) Equipment									
Concrete Vibrator, 3.5 HP	1		10.00	118.80	216.00	25.20	360.00		
Bar Shear, 10 HP, 40 mm	1		24.00	432.00	354.24	77.76	864.00		
Steel Forms	35		0.50	283.50	945.00	346.50	1,575.00		
Truck Mixer, 6 cu.yd., 250 HP	1		280.00	924.00	294.00	182.00	1,400.00		
Wheel Crane, 3.5 t.	1		115.00	1,214.40	404.80	220.80	1,840.00		
Sub-total				2,972.70	2,214.04	652.26	6,039.00		
3) Labor									
Foreman	1	No. of Days	Daily Rate		733.60		733.60		
Skilled Laborer	2	10	50.00		1,000.00		1,000.00		
Laborer	10	10	38.32		3,832.00		3,832.00		
Sub-total					5,565.60		5,565.60		
Direct Cost				34,273.37	18,400.72	9,095.01	61,769.10		
Unit Cost Per I. M.				342.73	184.01	90.95	617.69		
				(55%)	(30%)	(15%)	618.00		

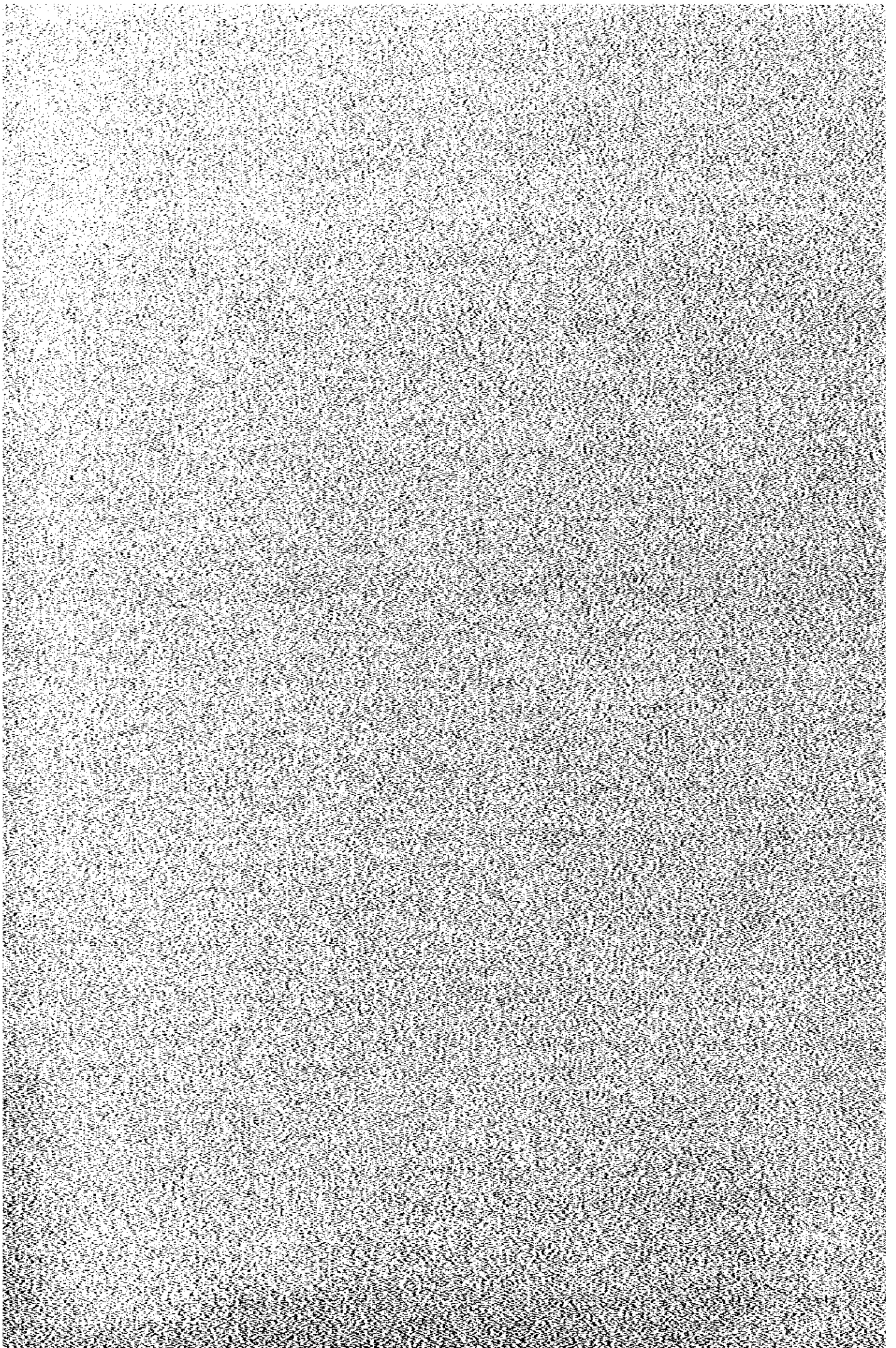
APPENDIX 9.1-2 UNIT COST ANALYSIS FOR PROCESSED MATERIALS

NAME OF PROJECT: FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE) DATE: _____
 ITEM NO: Ref. 12 NAME OF ITEM: Extra Strength RCPC 1.07 M. dia. QUANTITY: 100 I.M. UNIT PRICE: 659.00

DESCRIPTION	Quantity/ No. of Units/ No.	Unit / No. of Hour	Unit Rate / Hourly Rate	COMPONENTS			Financial Cost
				Foreign	Local	Tax	
1) Materials							
Class "C" Concrete	43.3	CU.M.	575.00	13,693.63	7,469.25	3,734.62	24,897.50
Reinforcing Steel	4,600	KG.	6.40	19,642.00	3,367.20	5,050.80	28,060.00
Tie Wire	170	KG.	12.10	851.84	279.51	199.65	1,331.00
Sub-total				34,187.47	11,115.96	8,985.07	54,288.50
2) Equipment	No. of Units						
Concrete Vibrator, 3.5 HP	1	36	10.00	118.80	216.00	25.20	360.00
Bar Shear, 10 HP, 40 mm	1	36	24.00	432.00	394.24	77.76	864.00
Steel Forms	35	90	0.50	283.50	945.00	346.50	1,575.00
Truck Mixer, 8 cu.yd., 250 HP	1	5	280.00	924.00	294.00	182.00	1,400.00
Wheel Crane, 3.5 t.	1	16	115.00	1,214.40	404.80	220.80	1,840.00
Sub-total				2,972.70	2,214.04	852.26	6,039.00
3) Labor	No.	No. of Days	Daily Rate				
Foreman	1	10	73.36		733.60		733.60
Skilled Laborer	2	10	50.00		1,000.00		1,000.00
Laborer	10	10	38.32		3,832.00		3,832.00
Sub-total					5,565.60		5,565.60
Direct Cost				37,160.17	18,895.60	9,837.33	65,893.10
Unit Cost Per I. M.				371.60	188.96	96.37	658.93
				(56%)	(29%)	(15%)	Say 659.00

APPENDIX FOR CHAPTER 10

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APPENDIX 10.1-1 BASIC TRAFFIC COSTS

1. VEHICLE OPERATING COSTS (VOC)

a. Representative Vehicles

Vehicles Type	Weighted Retail Price (Pesos May 1982)	
	Including Tax	Excluding Tax
Light Car, Premium Gasoline	69,070	52,490
Jeepney, MacArthur Diesel	59,520	50,590
Large Bus Diesel	332,990	291,970
Medium Truck Diesel	203,260	174,640

b. Basic Running Costs

Defined as part of vehicle operating costs which vary directly with number of kilometers operated, this cost component consist of the following elements.

- i) Fuel cost was estimated by multiplying fuel consumption (liter/kilometer) for each representative vehicle by fuel price (pesos/liter).

PRICE OF FUEL AND OIL

	(Pesos/liter May 1982)				
	FUEL			ENGINE OIL*	
	Diesel	Regular Gasoline	Premium Gasoline	Cars, Vans & Jeepneys	Buses & Trucks
Price excluding tax	2.51	3.25	3.370	8.55	9.95
Custom duty	0.30	0.30	0.30	0.30	0.30
Specific Tax and Special Funds	0.26	1.31	1.39	0.80	0.80
Energy Tax	0.035	0.190	0.190	0.190	0.190
Development Tax	-	-	-	0.463	0.463
Price including tax	3.11	5.05	5.250	10.30	11.70

* Esso Motor Oil 10^v for cars and jeepneys and Model HD 90 for buses and trucks.

- ii) Oil cost was estimated by multiplying oil consumption by oil price.

FUEL AND OIL CONSUMPTION

VEHICLE TYPE	FUEL CONSUMPTION		OIL CONSUMPTION (Liters/1,000 kms.)
	Fuel Type	Liters/km	
Light Car	Premium Gasoline	0.10	0.7
Jeepney	Diesel	0.09	1.0
Large Bus	Diesel	0.24	3.0
Medium Truck	Diesel	0.26	3.0

- iii) Tire cost was estimated by dividing a set of tire price excluding the spare tire by tire life expressed in terms of kilometer.

For recapping, the following assumptions would be taken, namely,

Recapping normally takes place at 85% of the original life and is assumed to extend the tire life by 50%. The recapping price would be 30% of the original price. On the average, one recapping per original tire for commercial vehicle is assumed.

WEIGHTED RETAIL PRICE AND LIFE OF TIRES

Vehicle Type	No. of Tires	Tire Size	Tire Set Price (₱)		Tire Life (1,000 kms)	
			Including Tax	excluding Tax	NEW	RECAPPED
			(May 1982)			
Car	4	5.60-13,4PR	1,320	1,160	35	-
Jeepney	4	6.00-16,6PR	2,154	1,896	40	54
Bus	6	10.00-20,14PR	15,028	13,225	60	81
Truck	6	8.25-20,14PR	11,796	10,380	50	61.50

iv) Maintenance and repair cost is divided into:

- (1) Labor component is calculated as the required number of labor hours per times hourly labor rate divided by annual operating distance vehicle per annum and
- (2) Spare part component is estimated on the percentage of the adjusted vehicle retail price (vehicle price less tire set costs) divided by annual operating distance

REQUIREMENT FOR MAINTENANCE AND REPAIR

Vehicle Type	Spare Parts Requirements %	No. of Labor Hours Required Per Year	Unit Cost of Labor (₱/hr.)	
			Including Tax	Excluding Tax
Car	2.5	60	15.45	15.00
Jeepney	10.0	200		
Bus	8.0	300		
Truck	7.0	250		

- v) Distance-related depreciation costs are calculated as the distance-related share in percent of the representative vehicle retail price, reduced by the cost of the tire set in use, divided by the life time kilometerage. The split of ratio of depreciation cost into distance and time-related cost are shown below.

OPERATING CHARACTERISTICS

Vehicle Type	Vehicle Life		Annual Operation (1000 kms)	Split Ratio of Depreciation Cost	
	Year	1000 Kms.		Distance Related (%)	Time Related (%)
Car	10	150	15	50	50
Jeepney	7	420	60	85	15
Bus	8	640	80	85	15
Truck	12	540	45	65	35

Source: MP&H Highway Planning Manual, Vol. 4, 1982

The total basic running costs per kilometer is summarized in the following table.

RUNNING COST				
(Pesos/Vehicle/km. May 1982)				
COST ITEM	Light Car	MacArthur Jeepney	Large Bus Diesel	Medium Truck Diesel
Cost Including Tax				
Fuel	0.5250	0.2799	0.7464	0.8086
Lubricant Oil	0.0072	0.0103	0.0351	0.0351
Tire	0.0377	0.0519	0.2412	0.2272
Maintenance:				
Spare Parts	0.1129	0.0956	0.3180	0.2978
Labor	0.0618	0.0515	0.0579	0.0858
Depreciation (Distance)	0.2258	0.1161	0.4223	0.2305
T O T A L	0.9704	0.6053	1.8209	1.6850
Cost Excluding Tax				
Fuel	0.3370	0.2259	0.6024	0.6526
Lubricant Oil	0.0060	0.0086	0.0299	0.0299
Tire	0.0331	0.0456	0.2123	0.1999
Maintenance:				
Spare Parts	0.0856	0.0812	0.2787	0.2555
Labor	0.0600	0.0500	0.0563	0.0833
Depreciation (Distance)	0.1711	0.0985	0.3702	0.1977
T O T A L	0.6928	0.5098	1.5498	1.4189

c. Basic Fixed Costs

Defined as the part of vehicle operating costs which vary directly with operating time (running + waiting time).

- i) Average annual operating hours were assumed as follows:

ANNUAL OPERATING HOURS

Vehicle Type	Operating Hours	
	Per Day	Per Year
Car (Light)	6.5	2,000
Jeepney	10.0	3,000
Bus (Large)	10.0	3,000
Truck (Medium)	9.0	2,700

Source: HPWH Manual Vol. 4

- ii) Time-related depreciation costs are calculated as the time-dependent share in percent of the vehicle retail price, reduced by the tire set costs, and divided by the product of vehicle life in years and annual operating hours.

The time-related depreciation costs per vehicle hour are calculated on the basis of the straight line depreciation method and no salvage value is assumed.

- iii) Opportunity Cost of Capital

The average capital employed over a vehicle's lifetime is assumed to be half the initial purchasing costs in the absence of any salvage value. The calculation of the opportunity cost is assumed at 15% of one-half of the retail price including cost of tire set, divided by the annual operating hours.

- iv) Crew cost per hour including salary, allowance, social benefits and commission and the crew sizes are as follows:

CREW COST

(Peso/hour May 1982)

Vehicle Type	Driver	Conductor	Helper
Car			
Jeepney	3.50		
Buses	3.50	2.00	
Trucks	3.50		2 x @ P2.00

- v) Overhead cost such as licenses and motor vehicle fee.
- vi) Insurance cost per vehicle-hour is calculated as the annual premium over the annual operating hours.
- vii) Basic fixed cost reduction factor has been assumed that only 30% of mini,^{1/} bantam and light cars (including taxis) are considered to be in commercial use.

The fleet reduction factors are supposed to express the degree at which time saving due to road improvement can lead to productivity and gain in the form of fleet reduction. Fleet reduction factors will vary with the type of vehicle, type of operation and area.

Fleet reduction can only be caused by road improvements which, when taken aggregately would imply faster round trips and thus, less time spent in carrying out the vehicle work in terms of ton-kilometers or passenger-kilometers.

It is assumed that the utilization of saved time will probably be higher for vehicles characterized by traditionally short and frequent trips, such as jeepneys and commercial cars. The calculation of total fixed cost per hour using the reduction factors for commercial use and fleet use are as follows:

Basic fixed cost = total fixed cost x commercial use reduction factor x fleet reduction factor

The conclusive summary of basic fixed costs are shown in the following tables.

^{1/} Based on the nationwide O-D survey NESH Manual Vol. 4

SUMMARY OF FIXED COST

(Pesos/Vehicle/Hour, May 1982)

Cost Item	Light Car	Jeepney	Large Bus	Medium Truck
Cost Including Tax				
Depreciation (Time)	1.69	0.41	1.99	2.07
Capital Cost, at 15% p.a.	2.59	1.49	8.32	5.65
Crew Cost	-	3.50	5.50	7.50
Overhead and Motor Vehicle Fee	0.28	3.09	8.24	8.58
Insurance	1.24	1.91	2.66	1.52
T O T A L	5.80	10.40	26.71	25.32
Reduction Commercial Factor Use Fleet	0.30	1.00	1.00	1.00
	1.00	0.90	0.70	0.60
Basic Fixed Cost	1.74	9.36	18.70	15.19
Cost Excluding Tax				
Depreciation (Time)	1.28	0.35	1.74	1.77
Capital Cost, at 15% p.a.	1.97	1.26	7.30	4.85
Crew Cost	-	3.50	5.50	7.50
Overhead and Motor Vehicle	-	3.00	8.00	8.00
Insurance	1.20	1.85	2.58	1.48
T O T A L	4.45	9.96	25.12	23.60
Reduction Commercial Factor Use Fleet	0.30	1.00	1.00	1.00
	1.00	0.90	0.70	0.60
Basic Fixed Cost	1.34	8.96	17.58	14.16

2. PASSENGER TIME COSTS

Defined as the value of passengers' time, including the time value for drivers of private cars.

Time saved is allocated a monetary value for those "at work" at the wage level while one half of that is applied "to/from work" while time saved on other trip is not allocated with any monetary value at all.

The following table gives the time values, used per person-hour and per vehicle.

	At Work	To/From Work May 1982 Prices
Car		
Driver, Owner	14.50	7.25
Driver Otherwise and Passenger	5.50	2.75
Jeepney Passenger	2.50	1.25
Bus Passenger	3.00	1.50

Source: NIPWH Manual, Vol. 4

Based on MMDIP Study, the average passenger occupancy was 2.3 for cars and taxis, 9.0 for jeepneys, 29.0 for buses and 2.4 for trucks.

The Study Team adopted the Metro Manila Outer Major Roads Project, Southern Package assumption that owner drivers are 70% and employed drivers are 30%. Using the average passenger occupancy rate and the percent distribution by trip purposes the passengers time value per hour per vehicle was calculated as follows:

Cars:

Driver owner - driver hired (70%/30%)

Time Value = ₱11.80 per person-hour (In Work)

= ₱5.90 per person-hour (To/From Work)

Total time Costs per Vehicle-hour

Cars:

At Work : ₱11.80 x 1 x 0.194
 + ₱5.50 x 1.3 x 0.194 = 23.68

To/From : ₱5.90 x 1 x 0.326
 + ₱2.75 x 1.3 x 0.326 = 3.09

Composite time value/car-hour = 26.77

Jeepneys:

At Work : ₱2.50 x 9 x 0.066 = 11.48

To/From Work : ₱1.50 x 9 x 0.368 = 4.14

Composite time value/jeepney-hour = 15.62

Buses:

At Work : 33.00 x 29 x 0.066	=	25.74
To/From Work : 24.50 x 29 x 0.368	=	16.00
Composite time value/bus-hour		21.75

Based on the assumption that since the full employment of resources and labor has not yet been realized despite the continuing growth of the Philippine economy, only 50% of the calculated passenger time value would be adopted since the savings of time in transportation are not always or wholly transferred to other productive activities.

NUMBER OF PASSENGER AND TRIP PURPOSE DISTRIBUTION

	Light Car ^{1/}	Jeepney	Large Bus
Average Number of Passenger per Vehicle by Trip Purpose			
In Work	2.3	0	0
To/From Work	2.3	0	0
Total	2.3	9 ^{2/}	29 ^{2/}
Trip Purpose Distribution (%)			
In Work	19.4	6.6	6.6
To/From Work	32.6	36.8	36.8

Note: ^{1/} Including a driver, as owner-driver for 70% and 30% other than owner.

^{2/} Average number of passengers at work or To/From Work

TRIP PURPOSE RESEARCH IN QUEZON CITY

Person O-D Trip Purpose	Person Trip Per Day (%)			
	Private Car		Public Transport	
In Work	214,068	(19.4)	201,198	(6.6)
To/From Work	358,996	(32.6)	1,116,562	(36.8)
To School	137,536	(12.5)	628,259	(20.8)
To Home	224,141	(20.3)	776,571	(25.6)
Private	168,028	(15.2)	308,204	(10.3)
T O T A L	1,102,769	(100.0)	3,030,794	(100.0)

Source: MEUTIP, Vol. D-18, June 1981

APPENDIX 10.1-2 THE "d1" METHOD (APPLICATION OF BASIC TRAFFIC COSTS ON THE ROAD NETWORKS WITH AND WITHOUT THE PROJECT)

The MPMH has developed an applicable set of "d1" values for the estimation of actual traffic costs on road segments considering road elements and traffic conditions at present and in various improvement levels. The "d1" system, which only affects the actual running cost calculation, simulates the extra running costs incurred by vehicles operating on roads which deviate from the ideal condition. Such extra costs are transformed into imaginary road length called "d1", which actually expresses the extra running costs as a percent over the basic running cost.

d1 Value for Roadside Friction Level and Traffic Volume Capacity Ratio

VCR	None	Light	Medium	Heavy
<u>Light Vehicles</u>				
0.05	-	-	0.01	0.01
0.10	0.01	0.01	0.03	0.03
0.25	0.03	0.05	0.08	0.11
0.50	0.10	0.14	0.20	0.26
0.75	0.21	0.26	0.34	0.45
1.00	0.35	0.40	0.50	0.65
1.30	0.56	0.59	0.70	0.91
<u>Heavy Vehicles</u>				
0.05	-	0.01	0.01	0.02
0.10	0.01	0.02	0.03	0.04
0.25	0.04	0.06	0.10	0.12
0.50	0.13	0.18	0.24	0.30
0.75	0.27	0.32	0.41	0.52
1.00	0.45	0.50	0.60	0.75
1.30	0.72	0.74	0.84	1.05

Roadside Friction Level

- None** : No buildings or other structures along the road segment.
- Light** : Scattered buildings along the road on both sides or on one side only. 100-200 meters between buildings. Pedestrians observed occasionally.
- Medium** : Continuous residential houses along one or both roadsides. Pedestrians observed frequently.
- Heavy** : Continuous roadside development within a commercial district with plaza, church, stores and shops, etc. Pedestrians tend to disrupt traffic flows by crossing the street at unpredictable points. Travel speed is usually not more than 30 kph even at low traffic volumes.

APPENDIX 10.3-1 Primary Commercial Energy Demand,^{1/}
 1980-1983 and 1987
 (million barrels of oil equivalent,
 MMEOE)

Item	Actual		Targets			Average Annual growth rates 1983-87(%)
	1980	1981	1982	1983	1987	
Hydro	5.87	6.24	7.78	9.29	15.50	13.7
Geothermal	3.46	4.62	5.91	6.68	16.53	25.4
Coal	1.04	1.00	6.25	11.63	22.44	17.9
Oil	77.26	72.60	72.08	70.33	63.23	(2.6)
Nuclear	-	-	-	-	6.06	-
Nonconventional	0.02	0.37	1.11	1.61	5.33	34.9
Total	87.65	84.83	93.13	99.54	129.09	6.7
Oil dependence (%)	88.1	85.6	77.4	70.7	49.0	
Oil import dependence (%)	83.8	83.8	72.0	65.2	44.1	

^{1/} Excludes the energy requirements of the aluminum smelter and integrated steel mill plants.

Source: Ministry of Energy

APPENDIX 10.3-2 PETROLEUM PRODUCT CONSUMPTION

(thousand barrels)

	Total Consumption	Premium Gasoline	Diesel
1975	72,125	5.124	13.277
1976	73,900	5.530	14.027
1977	80,124	6.102	14.836
1978	82,981	6.832	15.582
1979	85,540	6.652	16.952
1980	79,959	5.866	17.428
1981	75,221	5.700	17.787
1982	75,200	5.941	18.585

Source: Annual Report 1981 MOE

APPENDIX 10.3-3 CO-RELATION OF TRADE AND IMPORTED
PETROLEUM

	Imported Mineral Fuels ¹⁾ Lubricate & Related Matters	Petroleum Product ²⁾ Importations	Import ³⁾ Total	Trade ³⁾ Balance
1975	769.9	82.8	3,459.2	- 1,164.7
1976	890.7	97.2	3,534.4	- 1,059.8
1977	993.2	134.3	3,914.8	- 763.9
1978	1,030.2	110.4	4,732.2	- 1,307.3
1979	1,385.2	326.1	6,141.7	- 1,540.5
1980	2,248.4	208.1	7,726.9	- 1,939.1
1981	n.a.	410.4	7,952.0	- 2,230.0
1982	n.a.		8,600.0	- 2,250.0
1987			16,257.0	- 1,957.0

1) FOB, US \$ million. Source: 1981 Philippine Statistical Yearbook. NEDA

2) CIF, US\$ million. Source: Annual Report 1981. Ministry of Energy

3) FOB, US\$ Million. Source: 1981 Philippine Statistical Yearbook. NEDA. The figures after 1981 are obtained from the Five-Year Development Plan.

APPENDIX 10.3-4 FOREIGN PORTION OF FUEL SAVINGS

(Million, 1982 Market Price)

	PLAN 1-A	PLAN 1-B	PLAN 2-A	PLAN 2-B
FIRST STAGE: (1991)				
Total benefit	608.2	608.2	622.7	622.7
Running cost	239.2	239.2	247.0	247.0
Fuel saving	146.2	146.2	150.3	150.3
Foreign portion	88.4	88.4	90.9	90.9
COMPLETION: (1997)				
Total benefit	869.4	869.4	902.4	902.4
Running cost	309.8	309.8	332.9	332.9
Fuel saving	198.5	198.5	213.0	213.0
Foreign portion	120.2	120.2	128.9	128.9

Source: Table 10.1-1

APPENDIX 10.3-5 SAVING vs. CONSUMPTION

(In thousand barrel)

Saving	Plan 1-A		1-B		2-A		2-B	
	(P)	(D)	(P)	(D)	(P)	(D)	(P)	(D)
1st Stage ^{1/}	132.6	71.9	132.6	71.9	140.6	69.6	140.6	69.6
Completion ^{1/}	175.7	105.0	175.7	105.0	186.4	116.3	186.4	116.3
Fuel Consumption ^{2/}	5,941.0	18,585.0	-----					

(P) Premium gasoline

(D) Diesel

^{1/} Refer to Table 10.1-1

^{2/} Petroleum products consumption, refer to Appendix 10.3-2

APPENDIX 10.3-6 FOREIGN PORTION OF SAVING VS. TRADE DEFICIT

(P million)

Foreign Saving	Plan 1-A		1-B		2-A		2-B	
	(P)	(D)	(P)	(D)	(P)	(D)	(P)	(D)
1st Stage	66.41	22.04	66.41	22.04	70.38	20.49	70.38	20.49
Completion	87.97	32.19	87.97	32.19	93.30	35.64	93.30	35.64
Trade deficit ^{1/}	-----		19,125.00		-----			

U.S. \$1 : \$8.50

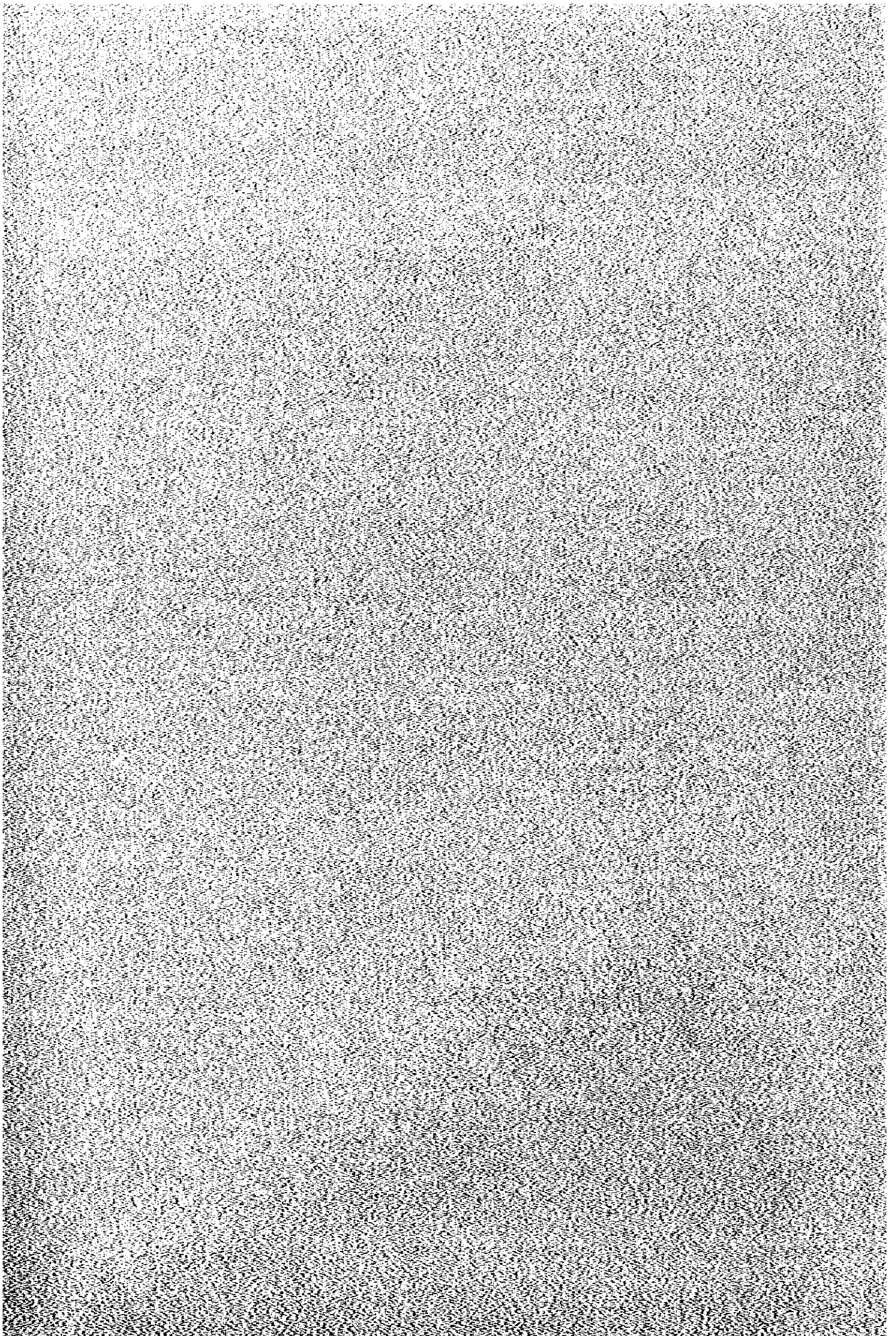
^{1/} Refer to Appendix Table 10.3-3

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APPENDIX A

FEASIBILITY STUDY
FOR
THE METRO MANILA OUTER MAJOR
ROADS PROJECT
(NORTHERN PACKAGE)
STUDY METHODOLOGY

July, 1982

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7. Economic Evaluation - - - - -	27
8. Financial Analysis - - - - -	31
9. Project Implementation Program - - - - -	32

1. Data Collection/Current Status Analysis

WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED																																	
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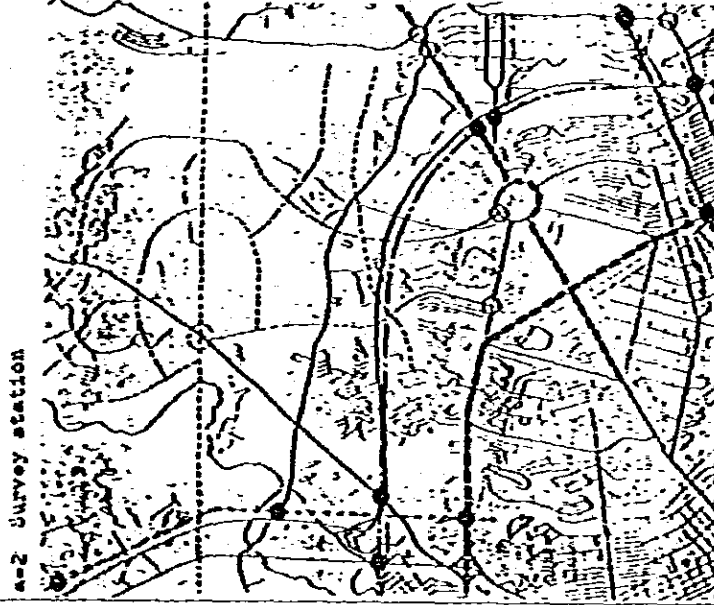
WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
(2) Analysis of Present Status	<p>b-1 Population</p> <ul style="list-style-type: none"> • Population density in 202 zones • Historical trend (jurisdiction level) <p>b-2 Employment</p> <ul style="list-style-type: none"> • Component of workers by industry (primary, secondary, tertiary) and trend of employment <p>b-3 Production</p> <ul style="list-style-type: none"> • Analysis of GNP, GRDP by industry <p>b-4 Number of vehicles</p> <ul style="list-style-type: none"> • Analysis of number of vehicles by type • Analysis of car-ownership (factor = GNP/annum, family size, income level, etc.) <p>b-5 Income</p> <ul style="list-style-type: none"> • Average income level <p>b-6 Investment</p> <ul style="list-style-type: none"> • Road investment (local and foreign) • Component of road investment to the total infrastructure investment 	<ul style="list-style-type: none"> • Distribution of high and low density by zones • Trend of population growth • Trend of employment structure • Production growth • Trend of component by vehicle type • Tendency of car ownership • Car-ownership estimation model • Trend of family income • Yearly amount and component of road investment 	

WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED												
2) Land Use	(1) Data Collection	<ul style="list-style-type: none"> Existing land use 													
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	<ul style="list-style-type: none"> MHC land use map 	MHC													
	<ul style="list-style-type: none"> Slum distribution map 														
	(2) Analysis of the Present Condition	<ul style="list-style-type: none"> Problems of existing land use pattern Urbanization pattern 													
3) Relevant Development Plan	(1) Data Collection	<p>Relevant reports and data regarding infrastructure development plans and future framework plan</p> <hr/> <p style="text-align: center;">Project</p> <hr/> <ol style="list-style-type: none"> 1. Urban Transport Study for the Metropolitan Manila Area (UTSMAA) 2. Metro Manila Transport Cum Land Use and Development Plan (METROPLAN) 3. Radial Road 10 (N-10) and Its Related Roads Project 4. Circumferential Road 3 (C-3) Project 5. Metro Manila Eastern Major Roads Project 													

WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
	<p style="text-align: center;">Project</p> <ol style="list-style-type: none"> 6. BDA (C-4) Upgrading Project 7. Existing and planned circumferential and radial roads 8. Manila-Bataan Coastal Road and its Related Roads (C-5 and C-6) Project 9. Metro Manila Expressway 10. Feasibility Study for the Metro Manila Outer Major Roads Project, Southern Package 11. Metro Manila Urban Transport Improvement Project (MUTIP) 12. Metro Manila Urban Development Projects 13. Lungeod Silangan 14. National Housing Authority (NHA) Resettlement Projects 15. Government Center (Batasang Pambansa) 16. Bulacan Provincial Development Plans 17. Development plan of MMC 		
(2) Current Status	<ul style="list-style-type: none"> - Medium and long term plan for establishment of future framework - Subdivision development plan by private sector - Progress of relevant projects - Required investment of relevant programs 	<ul style="list-style-type: none"> - Implementation Schedule of relevant projects - Project cost and required investment of relevant projects 	

WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED												
4) Transport facilities	<p>(1) Data Collection</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Data</th> <th>Source</th> <th>Relevant Authority</th> </tr> </thead> <tbody> <tr> <td>Road data</td> <td> <ul style="list-style-type: none"> Road inventory (Metro Manila) Road surface condition (Metro Manila) </td> <td>by this Project</td> <td>MPWR MWH</td> </tr> <tr> <td>Other data</td> <td> <ul style="list-style-type: none"> Bus, jeepney routes Service frequencies Number of passengers Data on sea transport Railway transport data Travel speed data Traffic accident records </td> <td>MULTIP</td> <td>MOTC MOTC YPA PNR MOTC CRPO</td> </tr> </tbody> </table>	Item	Data	Source	Relevant Authority	Road data	<ul style="list-style-type: none"> Road inventory (Metro Manila) Road surface condition (Metro Manila) 	by this Project	MPWR MWH	Other data	<ul style="list-style-type: none"> Bus, jeepney routes Service frequencies Number of passengers Data on sea transport Railway transport data Travel speed data Traffic accident records 	MULTIP	MOTC MOTC YPA PNR MOTC CRPO		
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(2) Current Status	<p>b-1 Road facilities</p> <ul style="list-style-type: none"> Current service level of road network Critical sections of road transport on trunk roads in Metro Manila <p>b-2 Public transport</p> <ul style="list-style-type: none"> Public transport system in Metro Manila <p>b-3 Other facilities</p> <ul style="list-style-type: none"> Trend analysis of sea, aero and railway transport 	<ul style="list-style-type: none"> Road density by jurisdiction Inventory of trunk roads in Metro Manila (No. of lanes, ROW, surface condition, etc.) Travel speed on trunk roads Bus and jeepney routes Service frequencies by route Yearly number of passengers and tonnage of cargo by mode Sub-mode of each mode (e.g., truck trips from ports) 													

WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED															
5) Traffic Data (1) Data Collection	<table border="1"> <thead> <tr> <th>Item</th> <th>Source</th> <th>Relevant Authority</th> </tr> </thead> <tbody> <tr> <td>• OD data (202 zones, 1980)</td> <td>MMUTIP</td> <td>MUNC</td> </tr> <tr> <td>• Roadside traffic count (yearly data by station)</td> <td></td> <td>MPWH</td> </tr> <tr> <td>• Other traffic data (traffic count at intersections, vehicle type composition, hourly variation of traffic)</td> <td></td> <td>MPWH</td> </tr> <tr> <td>• Commodity flow data</td> <td>NTUS NTPP</td> <td>NEDA</td> </tr> </tbody> </table>	Item	Source	Relevant Authority	• OD data (202 zones, 1980)	MMUTIP	MUNC	• Roadside traffic count (yearly data by station)		MPWH	• Other traffic data (traffic count at intersections, vehicle type composition, hourly variation of traffic)		MPWH	• Commodity flow data	NTUS NTPP	NEDA	<ul style="list-style-type: none"> • Screenline survey • Traffic count by vehicle type (12 hours) • Intersection traffic count • Straight, right and left turning traffic (12 hours) • Travel speed survey • Hourly traffic count and travel speed 	
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	<p>4-1 Supplementary traffic surveys</p> <p>Screenline survey - - - - 10 points</p> <p>Intersection traffic count - - - - - 5 points</p> <p>Travel time survey - - - - 2 routes</p>																	

WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
	<p>a-2 Survey station</p>  <p>— Screenline No. 1 ● Roadside traffic count - - - - Screenline No. 2 ○ Intersection traffic count ···· Screenline No. 3</p> <p>b-1 Present traffic condition of trunk roads</p> <p>b-2 Current status</p> <ul style="list-style-type: none"> • Characteristics of trunk roads • Classification of trunk roads 	<p>• Major features of trunk roads (component of vehicle type, traffic volume, capacity/volume ratio, etc.)</p>	

WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
	<p>b-2 Trip generation/attraction</p> <ul style="list-style-type: none"> • Zonal characteristics of trip generation/attraction (number of trip generation/attraction by zone, zonal characteristics of per capita generation/attraction) • Other characteristics <p>b-3 Trip distribution</p> <ul style="list-style-type: none"> • Interrelation between trip volume and trip length • Interzonal connection, trip movement pattern <p>b-4 Modal split</p> <p>Characteristics of modal split behavior (Items)</p> <ul style="list-style-type: none"> • Zone • Trip length • Car-ownership <p>b-5 Commodity flow</p> <ul style="list-style-type: none"> • Loading factor analysis • Commodity flow pattern 	<ul style="list-style-type: none"> • Number of trip generation/attraction per unit (person, economic indicator, vehicle, area,) • Hourly variation of trip generation • Number of trips by trip length • Trip desire line • Share of mode of travel by zone • Number of trips by trip length (by mode) • Mode share and car-ownership by zone • Average loading capacity by trade type, average tonnage, and load factor • Desire line of commodity interzonal commodity volume 	

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2. Land Use Framework		MAJOR DATA TO BE USED
WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT
1) Study Approach	<p>(1) Rapid urbanization within the project area.</p> <p>(2) Roads have direct influence in the future land use. Project roads must, therefore, be planned in conformity with the future land use plan.</p> <p>(3) Existing land use plan prepared by the MMC</p> <ul style="list-style-type: none"> • Area covered - - - Metro Manila • Year prepared - - - 1975 • Scale of land use Plan - - - - - 1:10,000 <p>(4) The said land use plan is now being reviewed by MMC</p>	
(2) Study Approach	<p>(1) Results of MMC review of the existing land use plan will basically be followed. However, when this land use plan will not be available during the course of the study, the existing land use plan will be used as a basis of this study.</p> <p>(2) As the land use plan will be one of the basic inputs for selection of highway location and forecast of future traffic demand, it will be formulated in accordance with the following approaches:</p> <ul style="list-style-type: none"> • The land use of the area within the direct influence zone of the project roads will be studied and forecasted in a more detailed manner than the rest of Metro Manila • Modification and/or adjustment of the land use plan within the direct influence area will be done when it becomes necessary during the course of the study. 	

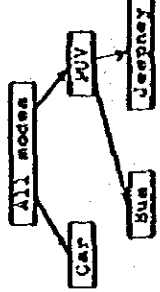
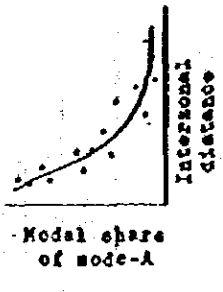
WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
(3) Planning Activities	<p>• Zonal breakdown of future framework to traffic zones will be done based on the formulated land use plan.</p> <pre> graph TD A[Collection and Compilation of Data] --> B[Review of Existing Land Use Plan] A --> C[Study of Planning Conditions] B --> D[Future Framework] C --> D C --> E[Land Use Alternatives in the Direct Influence Zone] E --> F[Formulation of Land Use Plan] E --> G[Breakdown of Framework to Traffic Zones] F --> G H[Current Population & Economy] --> D I[Review of Southern Package Project] --> D </pre> <p>Collection and Compilation of Data</p> <ul style="list-style-type: none"> • Current land use • Location of large scale open space • Current road network <p>Review of Existing Land Use Plan</p> <ul style="list-style-type: none"> • Scope of planning • Planning policy • Planning procedure <p>Study of Planning Conditions</p> <ul style="list-style-type: none"> • Land use • Road network <p>Future Framework</p> <ul style="list-style-type: none"> • Review of Southern Package Project <p>Land Use Alternatives in the Direct Influence Zone</p> <ul style="list-style-type: none"> • Land use pattern • Distribution of land use and facilities <p>Formulation of Land Use Plan</p> <ul style="list-style-type: none"> • Selection of optimum plan • Formulation of implementation program <p>Breakdown of Framework to Traffic Zones</p> <ul style="list-style-type: none"> • Zonal area • Zonal population • Zonal capability to absorb further urbanisation <p>Current Population & Economy</p>		

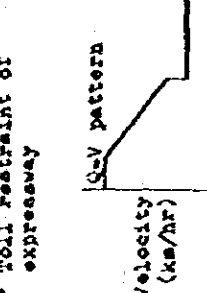
WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
2) Data Collection and Analysis	<p>(1) Land Use and Relevant Data Collection</p> <p>(2) Demographic and Economic Data Collection</p>	<ul style="list-style-type: none"> • Data arrangement to figures and tables • Data arrangement to figures and tables 	
3) Planning Procedure	<p>(1) Planning Criteria</p>	<p><u>Metro Manila</u></p> <ul style="list-style-type: none"> • Land use pattern • Road network • Future population distribution plan 	
	<p>1. Collection/arrangement of existing land use data and future land use plans</p> <ul style="list-style-type: none"> • MHS • MMC • Provincial Development Office of Bulacan • Existing land use data • Aerial photo mosaic pictures • Zoning maps by MHS • Land use plan by MMC <p>1. Demographic data by jurisdiction or on the traffic zone level</p> <p>2. Number of workers by jurisdiction or on the traffic zone level</p> <p>3. Number of establishments, number of vehicles, GNP, family income, etc.</p>	<ul style="list-style-type: none"> • Relevant development project reports • Southern Package reports • Others 	
	<p>(3) Other Data Collection</p>	<p>1. The following criteria will be considered for future land use planning:</p> <ul style="list-style-type: none"> • Criteria in Metro Manila • Land use planning patterns • Relationship with the future road network • Past trend of land use development • Future population distribution 	

WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
	<ul style="list-style-type: none"> • Criteria in the direct influence area • Component of land use • Relationship with the future road network • Current slum area distribution • Public facilities distribution 	<p><u>Direct influence area</u></p> <ul style="list-style-type: none"> • Existing land use map • Road network • Slum area distribution map • Major facilities location map 	
(2) Study of Other Land Use Plans	<ol style="list-style-type: none"> 1. Land use plan by MHS (or MMC) will be studied from the following view points: <ul style="list-style-type: none"> • Contents • Procedure • Purpose • Regulation, system 2. Study on relevant development projects Scale and progress of relevant projects will be studied. 	<ul style="list-style-type: none"> • Land use pattern • Population distribution concept • Major facilities distribution concept 	
(3) Future Land Use Plan	<ol style="list-style-type: none"> 1. Formulation of alternatives and future land use plan Alternative land use plan will be formulated based on the MHU (or MMC) plan in the direct influence area. The selection of the optimum land use plan will be made through an evaluation taking into consideration the following points: <ul style="list-style-type: none"> • Adjustability of the MMC (or MHS) land use plan • Compatibility with future road network • Compatibility with major facilities (Government Center, subdivision plan, industrial development, etc.) 	<ul style="list-style-type: none"> • Alternatives of future land use • Evaluation table of alternatives • Future land use plan (1990, 2000) • Future population distribution plan 	<ul style="list-style-type: none"> • There will be a close coordination between the Study Group and the MMC (or MHU) in the formulation of the future land use plan.

WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
(4) Future Framework Plan and Zonal Forecast	<p>1. The following items will be taken into consideration in the formulation of the future framework plan</p> <ul style="list-style-type: none"> * Target years will be 1990 and 2000 * Southern Package results will be basically used in the preparation of the framework plan of the Northern Package * The findings in the Southern Package will be compared with the latest available statistical data and NEDA Reports <p>2. Zonal Forecast</p> <p>Using the future framework data as the control total, estimated future population will be distributed to traffic zones, in conformity with the land use plan.</p>	<ul style="list-style-type: none"> * Future framework (population, economic indicators) * Future zonal population 	

3- Future Traffic Volume Forecast	WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
1) Trip Forecast Models	(1) Generation/Attraction Model	<p>Future traffic volume will be forecasted through the 4-step method using trip inter-change model.</p> <p>m-1 Total trip generation model</p> <ul style="list-style-type: none"> • Trip generation model will be formulated to forecast the total generated trips to be used as the control total. • The model first estimates the per capita trip rate for various population groups then will be forecasted by multiplying the trip rate by the future population. • Industry and car-ownership will be considered in the classification of the different population groups. These trip generation rates will be based from the UTSMA or MMETROPLAN data. • Problems to be studied: increase of trip generation rates in line with development of economy and mobility. <p>m-2 Generation/Attraction Model</p> <ul style="list-style-type: none"> • Model will be formulated to forecast trip generation/attraction by traffic zone • Regression analysis will be undertaken with population as the main variable, i.e., night or day population, workers by industry, population by car-ownership, etc. 	<p>Forecast models for each step</p> <ul style="list-style-type: none"> • Forecast trip generation rate (per capita trip rate) $Q = \sum P_j Q_j$ <p>Q : Total generated trips</p> <p>P_j : Future population by population group</p> <p>Q_j : Per capita trip rate by population group</p> <p>Model - 1</p> $Y_i = K + \sum A_j P_{ij}$ <p>Model - 2</p> $Y_i = k + \sum a_j P_{ij}$ <p>Y_i = Generated trips by zone</p> <p>P_{ij} = population by zone</p> <p>K, A_j = constant</p>	<ul style="list-style-type: none"> • 202 zone OD table (MOTC, 1980) • Demographic and economic indicators in 202 zones • Night or day population, workers by industry, student, number of vehicle, car ownership • UTSMA • MMETROPLAN • Southern Package Reports • Forecast results of future trip volume by Southern Package (1981, 1990, 2000)

WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
<p>(2) Distribution Models</p>	<ul style="list-style-type: none"> • Estimate of interzonal and intrazonal trips • Gravity models with distance as variable - X_{ij} in case the result of the gravity model does not tally with the present O-D, Fratar Method will be adopted. • Problem of the Gravity Model is the introduction of adjustment factor to prevent the over-estimation of longer trips. 	<ul style="list-style-type: none"> • Calibration of gravity models $X_{ij} = \frac{KA_i B_j}{r_{ij}^2}$ X_{ij} = interzonal and intrazonal trips A_i = trip generation by zone B_j = trip attraction by zone r_{ij} = distance between zones • Order of binary choice 	
<p>(3) Modal Split Models</p>	<ul style="list-style-type: none"> • Modal split of interzonal trips will be forecasted. • Split ratio curve model by binary choice method with interzonal distance as variable. • Related problems to be studied: Inter-relationship between modal split forecast and public transport policy (for example, introduction of bus system, LMT Plan,) 	<ul style="list-style-type: none"> • Split ratio curve model of each step of binary choice  	

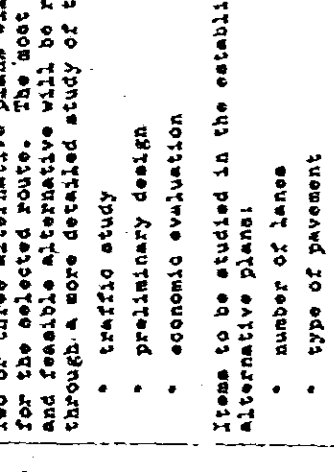
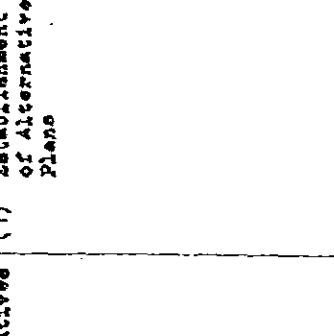
WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
(4) Trip Assignment Model	<ul style="list-style-type: none"> Traffic assignment based on the road network Minimum path search method with capacity restraint Problems to be studied: assignment method for the expressway (toll way) 	<ul style="list-style-type: none"> Quantity and velocity relationship by road classification Toll restraint of expressway  <p>Velocity (km/hr)</p> <p>Q : Traffic volume (PCU/day)</p>	
2) Future Trip Volume Forecast	<ul style="list-style-type: none"> Except for future truck trips, future OD trips by mode will be estimated through 4-step method based on future population. 	<ul style="list-style-type: none"> Future OD trips by mode (trips by resident) Base year - 1980 Target year - 1990, 2000 	<ul style="list-style-type: none"> Commodity flow survey by National Transport System Study (NTSS)
(1) Resident Trips (2) Non-Resident Trips	<ul style="list-style-type: none"> Truck trips will be studied by simple forecast models, and truck trips generated in and attracted to the development area will also be estimated. Future trips by non-residents will be estimated by simple growth rate method <p>NOTE: Non-resident are person who lives outside the Study Area</p>	<ul style="list-style-type: none"> Future OD trips by mode (Trips by non-resident) Average occupancy by mode (for diversion analysis from person trip to Passenger Car Unit (PCU) trip 	<ul style="list-style-type: none"> Present/future population and economic indicators in the Study Area.

4. Candidate routes and Alternative Plans	WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
1) General	(1) Basic Procedure	<p>1. Establishment of candidate routes and alternative plans will be basically done through the following steps:</p> <pre> graph TD A[Reconnaissance Survey] --> D[Study of trunk road network and present condition of the project area] B[Aero Photo Mosaic] --> D C[Study of Existing Reports/Data] --> D D --> E[Traffic Analysis] D --> F[Criteria in the establishment of candidate routes] E --> F F --> G[Candidate routes] G --> H{Evaluation} H --> I[Optimum route] I --> J[Factors to be considered in the preparation of alternative plans] J --> K[Alternative plans] K --> L[Preliminary design] L --> M[Traffic assignment] M --> N[Project evaluation] N --> O[Implementation plan] </pre>		

Figure 3.7 Planning Process

WORK ITEM	DESCRIPTION OF ITEM	MAJOR OUTPUT	MAJOR DATA TO BE USED
	<p>2. Two or three alternative plans will be studied on the selected optimum route.</p> <p>3. The preliminary design and estimation of traffic volume based on traffic assignment will be undertaken for each of the alternative plans. The most feasible plan will mainly be based on the result of the economic evaluation.</p>		
<p>2) Optimum Route (1) Study of Trunk Road Network</p>	<p>1. A trunk road network study will be undertaken including their function and classification based on previous reports taking into consideration the following factors:</p> <ul style="list-style-type: none"> • Relationship between land use plan and road network • Conformity of transport demand pattern and road network • Balance between transport demand pattern and capacity of road network • Trunk road density in the Study Area. • Trunk road density by traffic zone • Functional classification of trunk roads 	<ul style="list-style-type: none"> • Desire line, traffic assignment on spider network • Road density by traffic zone • Function of Projects Roads 	<ul style="list-style-type: none"> • Metro Manila as study area
<p>(2) Candidate Routes</p>	<p>1. General</p> <p>Two to three candidate routes will be studied for each project roads in view of the limitations of corridor width since the general alignment are established, start and end are fixed, presence of existing sub-divisions, etc.</p>		

WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
	<p>2. Establishment of Candidate Routes Factors to consider in the establishment of candidate routes are as follows:</p> <ul style="list-style-type: none"> • Relationship to future land use plan • acts as an input in the realization of the desired land use plan • complement on-going and planned development projects • Geographical/geological aspect • location and angle of river crossing • route that will economically satisfy design standard • Relationship with other major trunk roads • intervals of trunk roads • route length • Intersections • spacing of grade separations • angle and number of legs • interval of major intersections • Geometric Standards • horizontal and vertical alignment • optimum earthwork • Land Acquisition • location of subdivision and permanent structures • alum distribution • least land acquisition cost 	<ul style="list-style-type: none"> • Candidate routes on land use map • Candidate routes on geographical/geological map • Preliminary interchange plan • Preliminary horizontal and vertical alignment plan • Map which indicates the difficulty of land acquisition • Control point location map • Candidate routes map (1/3,000 scale) 	<ul style="list-style-type: none"> • Map (1 10,000, 1/25,000) • Aero photo mosaic picture • Land use plan • Road network

WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
	<ul style="list-style-type: none"> • Continuity • Social/environmental impacts • protection of social, biological and natural/wildlife • community cohesiveness • length of candidate routes in relation with land use 		
(2) Optimum Route.	<p>1. Selection of optimum route</p> <p>The factors to be used in the selection of optimum route are basically the same as those used to establish the candidate routes.</p> <p>Candidate routes will be mainly evaluated by qualitative factors and supported by quantitative ones.</p>	<ul style="list-style-type: none"> • Comparative evaluation of candidate routes • Optimum route map 	
3) Alternatives	<p>(1) Establishment of Alternative Plans</p> <p>Two or three alternative plans will be studied for the selected route. The most economical and feasible alternative will be recommended through a more detailed study of the following:</p> <ul style="list-style-type: none"> • traffic study • preliminary design • economic evaluation <p>Items to be studied in the establishment of alternative plans:</p> <ul style="list-style-type: none"> • number of lanes • type of pavement • type of intersection • stage construction • relationship to other major road network in the area especially the proposed expressway along C-6. 	<p>Alternative Plans</p> <p>Stage 1</p>  <p>Stage 2</p> 	

5. Preliminary Design/Project Cost		MAJOR DATA TO BE USED
WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT
<p>Topographic and Geological Surveys</p> <p>Route Survey</p>	<p>Centerline Survey</p> <ul style="list-style-type: none"> Survey of centerline at an average of 1-km. interval, at intersections and along the length of horizontal curves. <p>Profile leveling</p> <ul style="list-style-type: none"> Every 100-meter interval Bench marks every 2-km. distance Every change of topographic features <p>Cross-section leveling</p> <ul style="list-style-type: none"> 70-100-meter strip at 100-meter interval Cross-section and profile leveling of rivers and streams 	<ul style="list-style-type: none"> Coordinates of each station Profile horizontal scale of 1:2,500 Vertical scale of 1:250 Section scale of 1:200 General view
<p>Geological Survey</p>	<ul style="list-style-type: none"> Mechanical borings at location of major structures Test pit/auger boring for field density and CBX tests Auger boring at the mid-point of test pit locations 	<ul style="list-style-type: none"> Boring location will be indicated on the profile
<p>Preliminary Design</p> <p>Design Standard</p>	<ul style="list-style-type: none"> Geometric and Structural Design Standard The design standards used by the Southern Package Study will be reviewed 	<ul style="list-style-type: none"> Geometric design standard Design speed, lane width, shoulder width, gradient crossfall, minimum radius Structural standard Load design method

WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
Preliminary Design	<ul style="list-style-type: none"> • Route Design 	Plan	Photo mosaic scale of 1:2,500
	<ul style="list-style-type: none"> • Plan design Plan design will be done on mosaic pictures • Profile design Control points Structures (bridges, box culverts) Intersection (construction limits) • Cross-section design will be drawn based on the established Design Standard 	Profile	
Intersection Design	<ul style="list-style-type: none"> • Scheme design The type of interchange selection. It will be studied by road type, its location and vicinity condition 	Cross-section	
Pavement Design	<p>The design standards used by the Southern Package will be followed.</p>	Plan	C.B.R. test
Ancillary Facilities Design	<p>Drainage plan, design of buffer zones, center medians and sidewalks and examination of environmental measures and safety facilities.</p>	Cross-section	
Hydrological Design	<p>Field investigation Mainfall survey Run-off estimation</p>	Plan	Coefficient of run-off, cross-section and profile of river Mainfall intensity Rainfall data Map scale of 1:25,000
Structural Design	<p>Bridges Study of bridge length (river crossings and interchanges)</p>	Cross-section	Clearance, high water level River run-off

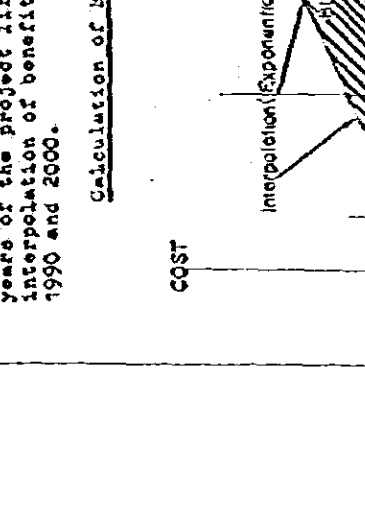
WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
Structural Design	Study and design of structure type (span, superstructure, substructure foundations and box culverts)	General view, preliminary materials	MPWH's standard
Construction Work Plan	Study of work method, work schedule, contractor, etc., in the Philippines	Work schedule and construction period	
Cost Estimate	Detailed Engineering Cost - - - - - Ratio to Construction Cost		
Project Cost Estimation	Construction Cost - - - - - It will be estimated based on the unit price analysis.		
	Land Acquisition Cost - - - - - It will be estimated based on the tax declaration obtained from the Offices of the Municipal Assessors.		
	Construction Supervision Cost - - - - - Ratio to Construction Cost		
	Maintenance Cost - - - - - It will be estimated based on the data of the Bureau of Maintenance of the MPWH.		

6. Impact Study on Social/Natural Environment		MAJOR DATA TO BE USED
WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT
1) General	<ul style="list-style-type: none"> • Except for a series of reports, Environmental Impact Statement (EIS) will be submitted to the National Environmental Protection Council. Study items of the EIS are as follows: <ul style="list-style-type: none"> a. Natural environment <ul style="list-style-type: none"> • Water • Vegetation • Atmosphere • Wildlife • Noise • Vibration b. Socio-economic environment <ul style="list-style-type: none"> • Population • Industry • Land use • Transport • Aesthetical environment • EIS will be made in accordance with the Guideline of National Environmental Protection Council. 	<ul style="list-style-type: none"> • EIS Report
2) NPEC Guideline	<ul style="list-style-type: none"> • Purpose and profile of the project • Historical summary and current status of environment • Basic information for future environmental condition will include the following: <ul style="list-style-type: none"> • Population • Land use • Relevant development plans • Traffic volume • Road network 	<ul style="list-style-type: none"> • NPEC Guideline • Land reconnaissance • Existing land use data • Present traffic volume • Future population estimate • Future land use • Future road network and estimated traffic volume

WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
(4) Environmental Impact	<ul style="list-style-type: none"> • Predicted influence of the project • Forecast model and evaluation method <p>Quantitative items:</p> <ul style="list-style-type: none"> • Noise • Air pollution • Vibration • Water pollution <ul style="list-style-type: none"> • Environmental impact items <p><u>Natural environment</u></p> <ul style="list-style-type: none"> • Water • Atmosphere • Noise • Vibration <p><u>Socio-economic environment</u></p> <ul style="list-style-type: none"> • Land use • Transport • Economy 	<ul style="list-style-type: none"> • Noise pollution • Air pollution • Vibration • Water pollution 	<p>Forecast models used in Japan</p> <ul style="list-style-type: none"> • Japan Acoustic Institute Model (Noise) • Pleam Model } air pollution • Paff Model } • Civil Engineering Institute Model (vibration) • NEPC Models
(5) Countermeasure	<ul style="list-style-type: none"> • Recommended countermeasures of mitigating the adverse impact • Unavoidable influence even with the countermeasure • Study of land acquisition problems for smooth implementation of the project 	<ul style="list-style-type: none"> • Accessibility improvement • Increase of potential area • Recommendation on buffer zone 	<ul style="list-style-type: none"> • Slum distribution map • Existing subdivisions in the DIZ
Other			

7. Economic Evaluation	WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
1) Work Flow		<pre> graph TD A[Construction cost] --> C[Cost analysis] B[Estimation of future traffic volume] --> D[Benefit analysis] C --> E[Economic analysis - NPV - B/C - IRR] D --> E E --> F[Economic evaluation] E --> G[Sensitivity analysis] F --> H[Other project impact (environment and transport system)] H --> I[The most feasible plan (project plan)] </pre>		
2) Cost Analysis		<ul style="list-style-type: none"> Economic cost will be used in the economic evaluation. The project cost, as estimated will be divided into local component, foreign component and taxes to be converted into economic cost with transfer cost and shadow price be deducted from the project cost. The percentage of local, foreign and taxes will be estimated based on the Southern Package Study and other feasibility studies conducted by the MPH. 	<ul style="list-style-type: none"> Local component and foreign component and taxes for each unit cost item Economic project cost 	<ul style="list-style-type: none"> Reports of Southern Package Study Other feasibility studies conducted by the MPH.

WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
<p>3) Benefit Estimation</p>	<p>(1) Benefit to be quantified</p>		
	<ul style="list-style-type: none"> The quantifiable benefits that would be accruing from the construction of the project roads are the savings in vehicle running cost, vehicle fixed cost, and passenger time cost by vehicle type. 	<ul style="list-style-type: none"> Yearly benefits by type Target year: 1990, 2000 	<ul style="list-style-type: none"> Unit costs of vehicle running cost, vehicle fixed cost, passenger time cost of MPVK
	<ul style="list-style-type: none"> Other benefits, such as developmental impact due to increase potential of the area will not be included in the economic analysis. 		
	<p><u>Estimated benefit</u></p> <p>Roads</p> <p>Intersections</p>		
	<p>Vehicle Running Cost</p> <p>Vehicle Fixed Cost</p> <p>Passenger Time Cost</p>		
	<p><u>Vehicle type</u></p> <p>1. Cars/Vans</p> <p>2. Jeeps</p> <p>3. Buses</p> <p>4. Trucks</p>		
	<ul style="list-style-type: none"> Vehicle operating costs and time cost vary by road alignment, profile and cross section characteristics, pavement and roadside conditions. The dl Method has been the standard practice of MPVK in conducting road feasibility studies. 		
	<ul style="list-style-type: none"> The vehicle operating cost and time cost will be modified in line with variations of road conditions 		
	<p>Vehicle Operating cost: pavement, alignment, roadside friction, volume/capacity ratio</p>		
	<p>Time cost: design speed, sight distance, volume/capacity ratio</p>	<ul style="list-style-type: none"> Modified link value 	<ul style="list-style-type: none"> dl factors of MPVK

WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUTS	MAJOR DATA TO BE USED
<p>3) Benefit Qualification</p> <p>(1) Period of Project Benefits</p>	<p>Vehicle operating cost and time cost for the entire road network within the direct influence zone with and without the Project Roads will be calculated and the difference between the two cases could be attributed as savings due to the completion of the Project Roads.</p> <p>Benefits will be calculated for years 1990 and 2000, the target years in the O-D forecast study. The calculation of benefits in the opening and final years of the project life will be by interpolation of benefits for years 1990 and 2000.</p> <p><u>Calculation of Benefit</u></p> 	<ul style="list-style-type: none"> Project benefits in 1990, 2000 initial year, final year 	<ul style="list-style-type: none"> Road network, estimated O-D in 1990 and 2000 Modified link value by "d1" Method
<p>4) Economic Analysis</p>	<ul style="list-style-type: none"> Items for economic evaluation Factors in the economic analysis <ul style="list-style-type: none"> Discount rate : 15% Project life : 20 years 	<ul style="list-style-type: none"> NPV, B/C, IRR by alternative plans 	

WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
5) Sensitivity Analysis	<ul style="list-style-type: none"> • A sensitivity test will be done on the following items in order to verify the stability of the results of the cost-benefit analysis: <ul style="list-style-type: none"> • Time benefit • Construction cost (+20%) • Future traffic volume forecast (-20%) • Construction time schedule 	<ul style="list-style-type: none"> • NW, B/C, IRR of each item in the sensitivity analysis by alternative plan 	
6) Project Evaluation	<ul style="list-style-type: none"> • The best alternative will be selected based mainly on the result of the economic analysis with special consideration on social, living and environmental impacts and from the view point of total transport system. 	<ul style="list-style-type: none"> • Final plan of the Project 	

8. Financial Analysis			
WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	MAJOR DATA TO BE USED
Amount of Possible Investment	<p>Correlation analysis between economic indicators and the national budget/MPMK road construction budget</p> <p>Analysis of amount of investment per year for projects in the past as well as on-going projects</p>	<ul style="list-style-type: none"> Summary of the future amount for road construction budget The amount of road construction budget allocated to Metro Manila Summary of the investment per year for this Project Foreign financial assistance becomes necessary or not 	<ul style="list-style-type: none"> Data of road construction budget Project implementation program Capital Investment Folio
Possibility of Financial Assistance	<ul style="list-style-type: none"> Analysis of condition for credit of international financing institutions 		

9. Project Implementation Program			MAJOR DATA TO BE USED
WORK ITEM	DESCRIPTION OF ITEMS	MAJOR OUTPUT	
Construction Schedule	<ul style="list-style-type: none"> Regional Development Program and the Project Implementation Schedule Project packaging and implementation program of each package Assessment of average workable days per month 	<ul style="list-style-type: none"> Project implementation schedule 	
Implementing Office	<ul style="list-style-type: none"> Organization of MWH and function of each bureau or office 	<ul style="list-style-type: none"> Organization and authority 	
Fund Procurement Plan	<ul style="list-style-type: none"> Procurement Plan by foreign and local funds Annual Cash Flow 	<ul style="list-style-type: none"> Fund Procurement Plan 	
Loan Redemption Plan	<ul style="list-style-type: none"> Loan redemption plan 	<ul style="list-style-type: none"> Loan redemption plan 	
Road Maintenance System	<ul style="list-style-type: none"> Study on maintenance activities, methods, organization and budget 	<ul style="list-style-type: none"> Recommendation on road maintenance 	
Problems Anticipated During Implementation of the Project	<ul style="list-style-type: none"> Problems anticipated (land and property acquisition, public hearing, coordination with other agencies such as PLDT, MWS, MERRALCO, Manila Gas, etc.) 	<ul style="list-style-type: none"> Recommendations on countermeasures to solve/lessen problems for smooth implementation of the project 	

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