APPENDIX II

TECHNICAL NOTES/MATERIALS

OD MATRIX

1. OD MATRIX

Table 1
2015 OD Table – Public Mode (32 Zone Base)

('000)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	Total
1	Manila	1061	108	76	59	138	57	100	204	63	48	66	52	17	7	10	9	13	9	14	9	14	21	26	9	1	3	54	9	7	29	40	10	70	2412
2	Pasay/Paranaque	100	517	80	27	33	25	34	46	49	57	46	83	6	0	4	3	5	3	4	0	6	10	13	5	0	1	45	23	6	29	20	14	49	1347
3	Makati/Pateros	87	85	339	48	44	42	46	48	57	75	59	41	3	1	2	4	3	2	5	0	6	10	14	6	1	1	35	6	3	20	27	9	16	1147
4	Mandaluyong/Pasig	65	28	49	217	57	32	32	43	73	30	22	15	5	1	2	2	3	2	4	1	7	15	27	14	3	3	10	2	0	7	7	5	0	783
5	Quezon(EDSA)	143	57	44	53	657	126	136	152	113	23	23	18	12	4	7	9	7	7	10	3	18	25	28	7	2	1	14	2	2	8	17	6	105	1838
6	Quezon(Northeast)	55	21	35	33	132	761	72	32	39	5	9	4	4	3	1	2	2	2	9	3	6	4	9	1	0	1	3	1	0	6	6	2	9	1274
7	Quezon(North)	92	81	46	33	143	99	1002	64	25	8	9	4	13	3	3	5	3	8	26	7	4	5	10	2	0	0	6	1	0	2	7	3	0	1713
8	Kalookan/Malabon	231	41	52	43	170	40	70	1277	29	10	11	7	114	43	11	11	9	12	8	2	4	6	8	2	0	1	7	1	1	9	8	4	48	2290
9	Marikina/Pasig	66	63	59	75	124	46	27	29	747	31	13	6	1	2	1	6	7	2	4	0	26	33	52	7	2	1	7	1	1	5	7	5	8	1465
10	Taguig	61	59	85	37	27	8	9	11	34	415	38	15	0	2	1	1	1	1	1	0	1	3	9	2	0	0	10	2	2	6	18	16	16	891
11	Muntinlupa/Las Pinas	74	48	61	25	27	12	11	11	15	36	754	78	2	3	1	1	1	0	0	0	2	5	5	2	0	0	30	6	2	22	75	29	6	1343
12	Las Pinas/Paranaque	55	88	44	15	17	4	5	8	4	12	70	418	2	1	0	1	0	1	1	0	0	1	2	1	0	0	48	12	3	15	14	6	7	856
13	Marilao/Meycauayan	21	6	3	5	13	7	16	117	1	0	1	4	240	18	27	11	12	11	9	0	0	5	2	1	0	0	0	0	1	0	1	0	2	535
14	Obando/Bulacan	9	1	2	1	6	3	6	40	3	3	3	0	19	60	21	32	10	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	3	228
15	Bocaue/Balagtas	17	2	4	1	8	2	5	16	1	1	1	0	30	22	158	35	28	42	5	8	1	0	0	1	0	0	0	0	0	0	0	1	15	406
16	Malolos/Paombong	13	1	5	2	10	2	7	16	7	0	1	1	12	29	31	327	59	13	12	10	0	0	0	0	0	0	0	1	0	0	0	0	1	560
17	Plaridel/Pulilan	21	4	4	3	7	7	5	13	8	2	1	0	12	9	29	68	216	13	0	0	0	2	0	0	0	0	0	0	0	0	0	1	8	435
18	Sta. Maria/Pandi	12	7	4	3	10	4	13	18	2	1	0	1	12	5	47	14	12	204	19	26	0	0	2	0	0	0	0	0	0	0	0	2	0	417
19	San Jose del Monte	17	6	8	6	11	14	31	11	5	3	0	1	8	0	5	11	0	19	440	33	0	5	0	0	1	0	0	0	0	6	0	0	13	654
20	Norzagaray	12	0	0	0	3	5	8	2	2	0	0	0	0	0	8	4	0	28	36	80	0	0	0	0	0	0	0	0	0	0	2	0	1	191
21	San Mateo/Rodriguez	16	5	8	8	20	11	5	4	31	0	2	0	0	0	1	0	0	0	0	0	117	3	7	2	0	0	0	1	0	1	1	1	0	245
22	Antipolo	21	9	15	17	25	6	6	6	32	4	7	2	4	0	0	0	2	0	4	0	3	403	34	17	16	11	0	0	0	8	4	6	0	664
23	Taytay/Cainta	24	14	20	29	31	10	11	7	51	8	5	2	2	0	0	0	0	3	0	0	7	35	350	37	6	7	3	1	0	0	9	0	1	674
24	Angona/Binangonan	9	4	6	15	6	2	2	2	7	1	2	0	0	0	1	0	0	0	0	0	2	18	40	188	33	11	4	1	0	0	0	2	0	356
25	Cardona/Morong	2	0	1	2	1	1	0	0	2	0	0	0	0	0	0	0	0	0	1	0	1	15	7	24	58	14	0	0	0	0	0	0	0	129
26	Tanay/Pililia	3	1	2	3	1	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	11	7	10	17	114	2	0	0	0	0	0	0	174
27	Bacoor/Imus	72	43	41	14	15	4	7	9	7	9	31	55	0	0	0	0	0	0	0	0	0	0	4	2	0	1	1055	61	31	131	9	4	1	1607
28	Cavite City/Kawit	12	27	5	1	2	3	1	1	2	3	5	17	0	0	0	1	0	0	0	0	1	0	0	1	0	0	60	171	75	36	2	6	1	433
29	G. Trias/Tanza	10	6	3	2	2	0	0	1	1	2	2	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	34	75	301	60	3	0	55	564
30	Dasmarinas/Silang	35	29	27	7	11	9	0	10	4	6	21	15	0	0	0	0	0	0	6	0	1	0	0	2	0	0	108	41	41	1193	82	14	8	1671
31	Carmona/G. Alvarez	42	20	28	7	18	7	8	8	8	18	69	16	1	2	0	0	0	0	0	2	1	6	8	1	1	1	9	1	4	79	800	113	0	1277
32	Cabuyao/Calamba	11	12	10	3	5	5	5	8	4	18	29	7	0	0	0	0	0	2	4	0	1	6	2	3	0	0	4	3	0	16	115	536	0	810
33	Outside Study Area	39	31	7	0	34	3	1	6	1	4	0	1	0	0	9	0	5	7	6	0	0	0	1	0	0	0	2	6	27	8	0	0	12	215
	Total	2506	1424	1175	795	1808	1360	1682	2220	1430	836	1303	869	521	215	378	557	398	398	630	183	230	647	668	345	144	172	1550	428	508	1700	1277	796	454	29604

Table 2
2015 OD Table – Private Mode (32 Zone Base)

('000)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	Total
1	Manila	357	44	65	27	64	25	48	71	38	20	32	28	7	3	4	3	4	2	6	1	6	8	9	3	0	0	28	3	2	7	12	5	8	941
2	Pasay/Paranaque	37	197	56	8	15	11	13	15	13	39	36	46	1	1	1	3	1	1	0	0	2	4	7	4	0	0	25	29	0	11	13	3	1	596
3	Makati/Pateros	63	48	205	25	35	25	39	49	50	49	67	47	15	4	4	1	6	5	12	0	12	14	23	8	1	4	26	7	4	9	25	15	3	900
4	Mandaluyong/Pasig	23	10	23	79	24	13	13	14	29	11	13	10	1	0	1	0	1	1	1	0	2	6	16	4	1	1	3	0	1	2	3	2	1	311
5	Quezon(EDSA)	61	17	36	23	291	55	66	63	59	12	18	10	10	3	3	3	4	4	8	1	11	15	20	2	3	1	8	2	1	7	3	3	6	829
6	Quezon(Northeast)	24	14	26	16	62	289	62	18	27	3	12	3	2	0	0	4	0	1	8	2	1	5	6	1	0	0	1	0	0	2	3	7	0	598
7	Quezon(North)	58	19	46	18	88	86	425	51	20	3	8	2	8	3	2	0	3	10	14	3	2	5	6	7	0	0	0	0	0	4	4	2	1	898
8	Kalookan/Malabon	90	18	44	19	77	29	53	474	16	4	9	2	52	6	15	15	6	5	8	0	1	2	7	8	0	0	7	1	1	3	5	5	6	987
9	Marikina/Pasig	39	15	60	38	73	35	20	15	341	14	13	4	0	0	1	6	1	1	2	0	18	26	49	3	3	3	2	1	0	4	7	9	2	804
10	Taguig	23	56	64	11	14	2	3	4	17	153	39	18	0	0	0	0	0	0	1	0	0	1	0	1	0	0	9	0	0	2	15	8	3	445
11	Muntinlupa/Las Pinas	39	37	96	16	21	7	7	12	18	34	477	99	3	0	2	0	0	0	0	0	1	1	5	2	0	1	32	4	0	17	52	32	2	1017
12	Las Pinas/Paranaque	34	51	62	13	11	8	3	4	6	18	99	254	0	0	1	0	0	1	2	0	1	0	3	0	0	0	31	14	1	8	16	10	2	652
13	Marilao/Meycauavan	11	2	4	2	13	5	10	50	2	1	2	0	201	0	30	11	1	22	8	0	0	0	4	0	0	0	0	0	0	0	2	0	2	384
14	Obando/Bulacan	3	2	2	0	5	0	3	6	0	0	0	0	0	26	3	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62
15	Bocaue/Balagtas	4	1	2	0	3	0	2	12	2	0	1	1	29	3	135	23	7	28	0	0	0	0	0	0	0	0	0	4	0	0	1	0	5	263
16	Malolos/Paombong	3	4	1	0	1	6	0	14	6	0	1	1	4	9	17	95	25	12	0	0	0	0	0	4	0	0	0	0	0	4	0	3	0	211
17	Plaridel/Pulilan	4	8	1	1	2	1	2	3	2	1	1	1	1	1	5	18	37	2	2	0	1	1	1	1	0	0	12	1	1	2	2	1	1	118
18	Sta. Maria/Pandi	4	8	4	2	4	3	6	7	2	1	1	2	21	1	16	10	4	117	32	17	1	3	1	1	0	0	1	1	1	1	1	1	1	276
19	San Jose del Monte	8	0	7	2	13	11	20	11	4	1	0	2	8	0	0	0	0	37	152	49	0	0	0	0	0	0	0	0	0	0	0	0	3	326
20	Norzagaray	1	0	0	0	1	3	3	0	0	0	0	0	0	0	0	0	0	16	51	33	0	2	0	0	0	0	0	0	0	0	0	0	0	112
21	San Mateo/Rodriguez	8	2	8	3	12	0	2	0	23	0	2	1	0	0	0	0	0	0	0	0	89	2	10	0	0	0	1	0	0	0	0	2	0	165
22	Antipolo	8	4	12	9	18	3	5	3	25	3	3	0	0	0	0	0	0	2	5	0	2	179	48	13	10	7	5	0	0	0	0	1	0	366
23	Taytay/Cainta	14	9	22	19	21	9	8	13	48	2	4	1	0	2	0	0	1	0	0	0	5	40	218	29	3	3	4	0	1	0	8	7	0	493
24	Angona/Binangonan	3	4	4	5	4	1	10	2	2	1	5	0	0	0	0	5	0	0	0	0	0	14	37	87	3	2	0	0	0	0	1	0	0	190
25	Cardona/Morong	0	1	1	1	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	8	3	2	14	9	0	0	0	0	0	1	0	49
26	Tanay/Pililia	1	1	2	1	1	0	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	5	0	4	10	58	0	0	0	0	0	0	0	92
27	Bacoor/Imus	38	35	30	4	7	3	0	6	2	6	31	45	0	0	0	0	11	0	0	0	0	0	0	0	0	0	405	29	31	52	12	14	2	763
28	Cavite City/Kawit	4	27	5	1	2	0	0	2	1	0	4	11	0	0	6	0	0	0	0	0	0	0	0	0	0	0	25	79	22	11	2	3	4	208
29	G. Trias/Tanza	6	1	5	0	0	0	0	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	23	67	15	4	1	11	174
30	Dasmarinas/Silang	8	15	11	1	6	5	1	5	2	1	14	18	0	0	0	2	0	0	0	0	0	2	0	0	0	0	30	15	30	315	22	7	5	514
31	Carmona/G. Alvarez	16	14	28	4	4	2	3	6	10	14	47	14	2	0	1	0	2	0	0	0	0	0	9	2	0	0	13	2	0	17	306	45	1	561
32	Cabuyao/Calamba	5	4	14	2	4	6	2	4	6	7	22	9	0	0	0	5	1	0	0	0	2	6	8	3	0	1	14	3	0	7	47	348	0	531
33	Outside Study Area	18	5	5	1	6	0	1	2	2	7	2	6	3	0	5	0	1	1	3	0	0	0	0	0	0	0	2	6	18	2	1	0	4	103
	Total	1013	673	953	352	905	644	832	941	776	406	967	636	370	62	252	215	118	267	315	107	154	350	490	188	51	93	720	225	181	503	568	535	75	14936

APPENDIX II

TECHNICAL NOTES/MATERIALS
TRANSPORTATION INVESTMENT AND FUNDING

2. TRANSPORTATION INVESTMENT AND FUNDING

2.1 Introduction

This note takes into account updated data on National (NG), Local Government (LG) and Government Owned or Controlled Corporation (GOCC) spending published in the General Appropriations Act (GAA) for 1998 and the draft (proposed) Budget of Expenditures and Sources of Funding (BESF) for 1999. These documents present: actual expenditure for 1997; the latest revisions of allocations for 1998, and the proposed public sector allocations for 1999.

In addition to the updated base of observed and programmed spending, the revised forecasts also take into account the potential impact of the recent currency turmoil in the Region, both on the Philippine economy and on Government spending. Since the Regional, and indeed global, economic outlook is still unusually uncertain at present, a range of possible futures are presented.

Data Sources

The main sources of data used for NG, LG and GOCC income and spending have been two annual publications from Department of Budget and Management.

1) Budget of Expenditures and Sources of Financing (BESF), which presents:

   (a) proposed ("Program") expenditure by Department / Agency / Special Purpose Fund for the next year (year t, the year used to identify the BESF) – this data is dis-aggregated by economic function, sub-Department and Region, and also by project where foreign funding is involved;

   (b) "Adjusted Program" expenditure for the current year (t-1, actually the year of publication of each BESF) as at the time of publication - at a lower level of dis-aggregation, with no data at project level;

   (c) "Actual" expenditure in the previous year (t-2), also at the lower level of dis-aggregation;

   (d) details of the macro-economic assumptions underlying the Budget – GNP/GDP growth, inflation, exchange rate, T-bill interest rate; and

   (e) detail of the tax, non-tax and borrowing sources of funding for these programs.

2) General Appropriations Act (GAA) of year t, which presents Program expenditure by Department / Agency / Special Purpose Fund for year t as approved by Congress, the level of detail and dis-aggregation of data increasing in recent volumes.

Copies of these publications for most years since 1992 have been made available to the Study by the Budget Office of DOTC.

The progression from proposed to actual spending for any year ***t*** is thus:

- the proposed Program in BESF ***t***;
- the approved Program in GAA ***t***;
- the Adjusted Program in BESF ***t+1***; and
- the Actual Obligations in BESF ***t+2.***

It should be noted that Actual spending reported in BESF ***t+2***, particularly that relating to items of capital expenditure, is not necessarily the true Actual figure, as the data will have been collated only a few months after the end of the year being reported on and are thus un-audited.

Secondary data sources used include:

- annual accounts of LRTA, PNR, PNCC etc.;
- the Philippines Yearbook 1995;
- the Philippines Statistical Yearbooks for 1996 and 1997;
- additional data, not in BESF, made available by DPWH, DOTC and Department of Finance;
- earlier studies and reports; and
- press releases and news articles about the economy and the land transportation sector.

Estimates have first been made of spending at the national level, where comprehensive data is available for many items. Separate estimates are presented for:

- Public Sector - National Government Direct;
- Public Sector - Government Owned or Controlled Corporations;
- Public Sector - Local Government; and
- Private Sector.

Spending within the Study Area has then been identified where possible, using official data, some unpublished data and reasoned apportionment where no local or Regional figures are available.

Forecasts of potential future funding have then been derived following a methodology.

The detailed estimate of the likely Public Sector investment budget for the Study Area has been revised, taking into account the latest trends in functional and sectoral distribution of the Budget revealed by BEFS99 and the revised economic outlook for South East Asia, the Philippines and the Study Area. Ranges of future scenarios are presented.

The potential for future Private Sector investment is less easy to extrapolate from historic trends. This sector has only been investing any significant amount in infrastructure since 1997. Further, private sector infrastructure investments tend to be "one-off" mega-projects, which may not lead to a continuous stream of expenditure such as that seen from the public sector. BESF99 presents a list of ongoing and potential BOT projects as of 21st July 1998, which may be taken as an indication of private sector interest in land transportation in the medium term.

2.2 National Spending

Public Sector - National Government Direct

Only two Departments have been allocated funds for investment in land transport in any significant amount in the budgets of expenditure for 1998 or 1999:

- Department of Public Works and Highways (DPWH); and
- Department of Transport and Communications (DOTC).

Transportation related appropriations to DOTC are mainly for the shipping and aviation sectors, but also include sums related to the activities of Philippines National Railways (PNR) and the Light Rail Transit Authority (LRTA). These organizations also receive direct allocations, see below.

Table 1 presents total NG spending on investment in infrastructure for the period from 1987 (actual) to 1999 (proposed), at the current prices of each year. Spending is shown in the nominal (current) values of each year. Infrastructure spending is related to: GNP; total NG spending and NG capital spending. Where available, figures are given for both the original proposed Program and the Actual spending for a year. For 1998 the Adjusted Program figure from BESF99 is used in place of Actual.

Table 2 presents investment in land transportation from DPWH and DOTC. It should be noted that there have been changes in the responsibilities of these agencies since 1992.

Comparison with Tables 1 and 2 suggests an immediate reaction to the recent re-valuation of the Peso v/v the major trading currencies. A sharp reduction in investment, discussed further in section 4 below, is evident, both as a percentage of total spending and of GNP, compared to the rising trend identified in previous study before Asian currency crisis in 1997. This retrenchment appears to commence in 1997 - out-turn 1997 Capital and Infrastructure spending is much lower than the Adjusted Program figures presented in BESF98, despite the GNP and total spending estimates in that publication proving to be reasonably accurate.

The rapid devaluation of the Peso in the second half of 1997 may not, however, be the only factor contributing to this downward revision of capital spending. Table 1 also illustrates a feature of almost all NG capital spending – that the amount spent in a year is often significantly different to the amount originally programmed.

Table 1
National Government Direct Spending on Infrastructure

Year	GNP	Total NG Spending		NG Capital Spending				NG Infrastructure Spending				
			% of	Program	Actual	Actual as % of		Program	Actual	Actual as % of		
	(mn Peso)	(mn Peso)	GNP	(mn Peso)	(mn Peso)	GNP	NG Sp.	(mn Peso)	(mn Peso)	GNP	NG Sp.	Cap. Sp.
1987	665,443	155,504	23.37%	n/a	20,261	3.04%	13.03%	n/a	6,900	1.04%	4.44%	34.06%
1988	782,069	167,409	21.41%	23,612	18,238	2.33%	10.89%	9,000	8,610	1.10%	5.14%	47.21%
1989	905,459	173,339	19.14%	35,848	27,364	3.02%	15.79%	14,600	9,800	1.08%	5.65%	35.81%
1990	1,071,433	255,775	23.87%	47,846	38,236	3.57%	14.95%	19,100	18,100	1.69%	7.08%	47.34%
1991	1,254,562	293,161	23.37%	57,516	49,637	3.96%	16.93%	19,109	21,700	1.73%	7.40%	43.72%
1992	1,374,838	286,603	20.85%	57,797	37,621	2.74%	13.13%	24,123	25,591	1.86%	8.93%	68.02%
1993	1,500,287	313,752	20.91%	57,306	44,981	3.00%	14.34%	28,804	20,438	1.36%	6.51%	45.44%
1994	1,736,382	327,768	18.88%	47,165	66,616	3.84%	20.32%	24,289	34,763	2.00%	10.61%	52.18%
1995	1,958,932	372,081	18.99%	64,095	67,245	3.43%	18.07%	28,464	42,607	2.18%	11.45%	63.36%
1996	2,261,300	416,139	18.40%	82,046	65,236	2.88%	15.68%	37,434	42,824	1.89%	10.29%	65.64%
1997	2,526,900	491,793	19.46%	78,995	81,102	3.21%	16.49%	50,396	50,101	1.98%	10.19%	61.78%
1998	2,822,300	528,263	18.72%	75,510	67,635	2.40%	12.80%	47,454	43,077	1.53%	8.15%	63.69%
1999	3,185,900	579,481	18.19%	58,919	n/a	1.85%	10.17%	45,355	n/a	1.42%	7.83%	76.98%

n/a not available
Source: Annual BESF, Tables A1, B1, B4 and B5, and Consultant's calculations

Table 2
Investment in Land Transportation Infrastructure and Vehicles from
DPWH and DOTC Budget Allocation

Year	DPWH Infrastructure Spending				DOTC Infrastructure Spending				Land Transportation Spending				
	total		Roads and Bridges		total		Land Transportation						
	Program (mn Peso)	Actual (mn Peso)	Program (mn Peso)	Actual (mn Peso)	Program (mn Peso)	Actual (mn Peso)	Program (mn Peso)	Actual (mn Peso)	Program (mn Peso)	Actual[1] (mn Peso)	Actual[2] as % of GNP	NG Sp.	Inf. Sp.
1987	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	4,300	0.65%	2.77%	62.32%
1988	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5,500	5,012	0.64%	2.99%	58.21%
1989	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	8,100	5,500	0.61%	3.17%	56.12%
1990	11,872	n/a	n/a	n/a	1,598	n/a	n/a	n/a	9,730	8,500	0.79%	3.32%	46.96%
1991	11,236	n/a	n/a	n/a	2,885	n/a	n/a	n/a	7,500	8,000	0.64%	2.73%	36.87%
1992	17,349	17,605	10,114	13,002	3,553	4,450	593	535	10,707	13,537	0.98%	4.72%	52.90%
1993	20,145	13,843	13,284	10,513	3,995	3,142	234	10	13,518	10,523	0.70%	3.35%	51.49%
1994	14,887	23,197	11,666	14,328	3,842	5,580	69	23	11,735	14,351	0.83%	4.38%	41.28%
1995	15,986	30,442	12,099	13,608	4,355	4,480	65	75	12,164	13,683	0.70%	3.68%	32.11%
1996	25,763	31,998	15,616	21,930	4,225	2,120	52	55	15,668	21,985	0.97%	5.28%	51.34%
1997	31,100	36,800	20,293	21,805	8,716	6,636	2,283	2,144	22,576	23,949	0.95%	4.87%	47.80%
1998	38,340	27,452	26,756	19,754	7,603	5,873	1,783	1,456	28,539	21,210	0.75%	4.02%	49.24%
1999	29,323	n/a	24,552	n/a	6,455	n/a	888	n/a	25,440	n/a	0.80%	4.39%	56.09%

n/a data not available
Source: Annual BESF, Table B5, and Consultant's calculations
1 Adjusted Program for 1998
2 Program for 1999

As all values are in current prices, the Program figure involves an assumption on the rate of inflation for the next two years, which may overstate or understate the out-turn rate, and thus out-turn spending. Further, there may be changes from the plan in the nature and extent of the works undertaken. A number of reasons may been advanced to explain this[1]:

[1] A discussion of DPWH's poor performance in 1996/7 is presented in the commentary on the 1998 BESF. Of 2,375 projects programmed for DPWH for 1996, only 1,598 were completed within the year, and 393 had not been started at all. Performance varied between regions, and was particularly poor in NCR, where no start was made on 1/3 of the programmed projects. Right-of-way acquisition problems were cited as a major issue here. BESF98 also notes that as at 31/3/97 work had only started on 38 out of a programmed 2,047 DPWH projects for 1997.

- Actual may fall short of Program because of delays in commencing a project, possibly because of land acquisition difficulties, or because the promised funds, often linked to Overseas Development Aid, were not available.

- Actual may exceed Program because of catching up on previous years' under-spend, or because there has been a change in priorities between the planning year and the implementation year (e.g. following the eruption of Mount Pinatubo).

Both Departments also receive annual allocations for "Maintenance and Other Operating Expenses" (MOOE). Less data is available on these sums than on capital spending. However, it is known that DOTC's MOOE allocation is all for telecommunications, ports, airports and the Department's own equipment, while it is possible to identify Program (approved budget) appropriations to DPWH, for maintenance of national highways and bridges and for maintenance equipment, from the GAAs. These are shown in Table 3.

Table 3
Annual Appropriation to DPWH for Highway Maintenance

Year	Sum in GAA (m Peso)	
	Road Maintenance	Capital (equipment)
1993	1,661	58
1994	1,767	60
1995	3,237	75
1996	3,399	153
1997	3,586	200
1998	3,696	n/a
1999	3,907	n/a

n/a value not separately indicated
Source: annual GAA (1999 estimated from BESF99 Table B3)

Actual maintenance spending on roads cannot be identified without detailed analysis of DPWH records. However, there is much less variation between Program and Actual spending for non-capital items, and Table 3 may be taken as a reasonable approximation of out-turn spending on maintenance for the national highway network. A significant increase in the maintenance effort from 1995 onwards is noticeable, this is part of long-term policy to put maintenance of Government assets on a properly funded basis.

Public Sector - Government Owned or Controlled Corporations

Only two GOCCs make investments in land transportation: PNR and LRTA. Table 4 presents estimates of the capital and maintenance expenditure of each organization Comparison with the earlier estimation before the Asian currency crisi in 1997 reveals the extent to which investments, programmed in mid 1997, have either failed to take place, or have been transferred to the DOTC budget allocation. This is particularly true for LRTA, where detailed changes of alignment and right-of-way acquisition problems have delayed investment in LRT2.

Table 4
Estimated LRTA and PNR Investment and Maintenance Spending
on Infrastructure, Vehicle, etc.

Year	LRTA			PNR			Total	
	Capital		Maint.	Capital		Maint.	Capital	Maint.
	Equip't. (mil. P)	Inf. (mil. P)	(mil. P)	Equip't. (mil. P)	Inf. (mil. P)	(mil. P)	% Inf. Sp.	% NG Sp.
1987	21	0	63	0	0	25	21	88
1988	20	0	83	0	0	30	20	113
189	1	0	98	0	0	33	1	131
19901	15	0	117	0	0	35	15	152
1991	30	0	150	0	0	40	30	190
1992	2	0	192	0	263	32	265	224
1993	4	0	159	93	130	32	227	191
1994	4	0	134	39	231	48	274	182
1995	25	15	150	55	552	44	647	194
1996	100	29	160	62	512	75	703	235
1997	220	981	176	58	564	102	1,823	278
1998	479	1,255	190	0	204	100	1,938	290
1999	258	4,033	210	0	75	90	4,366	300

Source: Annual BESF Table E12-14 and Consultant's estimates

Public Sector - Local Government Units

No detailed information from LGUs has been made available to the Study team. However, many social and economic functions were decentralized from NG agencies to LGUs in the early 1990s, without a similar change in the scope of the LGUs to raise revenues to pay for these activities. Consequently some 2/3 of LGU annual income, at a Nationwide level, needs to be allocated from NG sources in the annual budget. BESF presents data not only on the sums allocated in the budget, but also on total LGU income and spending. The data is dis-aggregated by level of government (Province, City, Municipality) and by type of expenditure, and is summarized in Table 5.

It can be seen that there is very little infrastructure spending by LGUs out of NG allocations. The whole of programmed infrastructure spending for 1998 and 1999 is via the Municipal Development Fund (MDF), a Foreign-Assisted Project (FAP). Similar expenditure was programmed for 1997 but does not, according to figures in BESF99, appear to have been incurred[2]. No data is available on road maintenance spending by LGUs.

[2] It is possible that DPWH have been used as the executing agency for this work, and that the Program and Adjusted Program expenditure is detailed under LGUs, but the Actual expenditure appears in the DPWH returns.

Table 5
Estimated Capital and Infrastructure Spending by LGUs

Year	NG Appropriation (m Peso)	Capital (m Peso)	Infrastructure (m Peso)
1987	7,354	2,264	858
1988	7,430	815	0
1989	10,540	5,820	1,999
1990	13,951	6,034	2,029
1991	16,437	7,259	1,660
1992	22,047	5,415	0
1993	39,121	9,078	0
1994	50,149	9,962	0
1995	57,324	13,410	190
1996	62,321	13,484	0
1997	74,878	14,397	0
1998	77,462	16,398	1,226
1999	103,849	22,848	1,490

Source: Annual BESF, Tables F

Private Sector - Infrastructure

Private sector spending on infrastructure was minimal until work commenced on Skyway and EDSA MRT in 1996.

Citra Metro Manila Tollways Corporation (CMMTC), a joint venture (JV) between the existing South Luzon Expressway (SLE) concessionaire Philippines National Construction Company (PNCC) and Indonesian toll road operator P.T. Citra, is undertaking Stage 1 of the “Skyway” project. Construction is well advanced, but has fallen behind the original schedule, in part due to delays in commencing construction of the entry / exit ramps at the northern (Makati) end of the Stage 1 project. A detailed expenditure schedule for this project has not been made available, An estimate based on the loan and equity draw-down schedule envisaged in 1996 was given in Table 6.

While partial opening is still scheduled for 1999, the delay to construction means that, as with many public sector infrastructure projects, actual spending will not match program spending. Construction over-runs usually result in cost over-runs, but the equity draw-down schedule is $-denominated. Savings on the $ cost of local construction inputs since September 1997 will thus off-set the impact of the delay on project costs.

Table 6
Estimated Investment Schedule for Skyway Stage 1

Year	US$ (m)	Peso* (m)
1995	30	771
1996	126	3,304
1997	118	3,477
1998	150	6,150
1999	90	3,870

* $ denominated spending, exchange rates from BESF 1998 and 1999, Table A1
Source: CMMTC presentations, Consultant's estimates

Private sector investment, by Metro Rail Transit Corporation (MRTC), also commenced in October 1996 on the EDSA "light rail" Line (MRT3). Again, no detailed implementation schedule is available. There have also been delays on this project, notably in land clearance at the depot site and at the southern end of the line, between Buendia and Taft, where the timing of construction is dependent on the commencement or completion of other transportation projects.

An estimated expenditure profile, prepared on the same basis as Table 6, is presented in Table 7.

Table 7
Estimated Investment Schedule for EDSA MRT3

Year	US$ (m)	Peso* (m)
1996	45	1,180
1997	170	5,010
1998	225	9,225
1999	190	8,170

* $ denominated spending, exchange rates from BESF 1998 and 1999, Table A1
Source: MRTC presentations, Consultant's estimates

Work has subsequently commenced on three other JV/BOT transport infrastructure projects:

- the Cavite expressway, which is being implemented as a JV between Public Estates Authority (PEA) and Renong Bhd., owner of Malaysian toll road operator PLUS – the section parallel to Coastal Road has been completed, and opened recently, but work on the link road to the C5/SLE intersection has been delayed by funding difficulties;

- the Southern Tagalog Toll Expressway (STATE), linking Batangas to the existing SLE, which has been let by DPWH as a Build-Transfer-Operate (BTO) franchise to the Strategic Alliance Development Corporation (Stradec), an Indonesian company which is also an equity partner in CMMTC – this road lies wholly outside the MMUTIS Study Area; and

- Pabahay sa Riles, a JV between PNR and New San Jose Builders, with the participation of National Housing Authority (NHA) and Housing and Urban Development Co-ordinating Council (HUDCC), to develop low cost housing along the PNR right of way between Caloocan and EDSA/SSH, with an elevated toll road above the railway. Construction of the housing has recently been suspended following a legal challenge. Construction of the toll road element was never likely to start until the housing element was complete and, as it closely parallels Skyway Stage 2 phase 2 and Stage 3, may now never be built.

Updated estimates have made of expenditure on Cavite expressway and STATE, and are included in Table 8, along with the estimates of expenditure on Skyway and MRT3 already presented. This Table also includes estimates of maintenance expenditure by PNCC on its existing tollway concessions.

Table 8
Private Sector Spending on Land Transport Infrastructure (peso m)

Year	Investment					Maintenance PNCC (SLE, NLE)
	CMMTC	MRTC	Renong	Stradec	Total	
	(Skyway)	(MRT 3)	(Cavite Expressway)	(STATE)		
1987						117
1988						128
1989						140
1990						158
1991						184
1992						199
1993						213
1994						234
1995	771				771	250
1996	3,304	1,180			4,484	272
1997	3,477	5,010	1,473		9,960	289
1998	6,150	9,225	5,125	615	21,115	317
1999	3,870	8,170	3,010	860	15,910	345

Source: Tables 6, 7, PNCC Annual Reports, Consultant's estimates

The Table reveals a low level of expenditure by the private sector up to 1995, but thereafter indicates the scale of future investment that may flow from the private sector if concessions continue to be let. Anticipated private sector expenditure in 1998 and 1999 on just four projects is greater than NG expenditure nationwide in any year up to 1995.

Private Sector - Vehicles

The analysis has been restricted to vehicles registered for commercial operation, i.e. as public transport or for hire, and thus excludes vehicles used for private purposes (including the carriage of the owner's goods). It is thus an analysis of investment by the transportation industry.

Data is available from LTO and the Philippine Statistical Yearbook on the number of vehicles registered each year. Net growth in registration of commercial vehicles has been taken as a conservative estimate of the number of new (or imported second-hand) vehicles. Data dis-aggregated by vehicle type (bus, jeepney, taxi, truck, etc.) is only available for years up to 1996. For 1997 the commercial fleet has been assumed to grow at a rate derived from the medium growth forecasts used in the recent Philippine Transport Strategy Study (PTSS): 5% for buses; 4% for jeepneys; 10% for taxis; and 5% for trucks (this is half the PTSS rate - the hire fleet is expected to grow more slowly than the private fleet). The growth rate has been halved again for 1998 and 1999, to allow for the impact of devaluation and economic downturn on purchase of new vehicles[3].
Investment has been calculated as the change in fleet size each year factored by a typical (new) vehicle cost, adjusted for inflation between the expenditure year and the cost estimate year[4]. A similar basis is used for maintenance (parts, tires and labour), but the expenditure is calculated on the basis of the whole fleet. The results are shown in Table 9.

Total Expenditure

Table 10 presents updated total expenditure on land transportation since 1989, summing Tables 2, 3, 4, 5, 8 and 9. Highway maintenance for years before 1992 is estimated. The whole of budgeted LGU infrastructure spending from NG sources has been included, in lieu of information on roads spending funded by local sources and LGU road maintenance expenditure.

This shows that public sector investment in new infrastructure and vehicles has consistently been higher than private sector investment throughout the period under review, usually by 50-100%. The continuance of this differential into the recent years of private sector spending on BOT schemes suggests that private sector spending is additional to, rather than a substitute for, public sector investment. The difference has narrowed sharply in the last year as the private and public sectors have adopted different approaches to the economic downturn. While the private sector has generally proceeded as fast as right-of-way difficulties will allow, in order to complete the project and start to earn a return on the investment, the public sector (where "income" largely comes from general taxation) has cut back and postponed expenditure.

Maintenance expenditure by the private sector, on the other hand, has generally been higher than that of the public sector. This reflects both: the input required for the private sector's high-maintenance vehicles compared to the public sector's low-maintenance infrastructure; and the greater importance attached to maintenance by operators who have a commercial interest in the condition of their assets.

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[3] Press reports of vehicle sales for the first 9 months of 1998 indicate a 50% drop from sales for the same period in 1997, split 60% for cars and 40% for "commercial" vehicles (which include utility vehicles purchased for private use).

[4] The change in the number of vehicles registered for commercial use will not be the number of new (and imported second-hand) vehicles purchased in the year. Vehicles will also move between the commercial and private fleets, and older vehicles will be de-registered (in some years, the number of vehicles can decline). It is thus likely to be an under-estimate, but the use of the cost of a new vehicle for all additions compensates for this. Overall, the calculation is expected to give a reasonable estimate of the investment sum.

Table 9
Estimated Spending on Commercial Vehicles

Year	Bus			Jeepney			Taxi			Truck			Total	
	Fleet	Invn't. (mil P)	Maint. (mill P)	Fleet	Invn't. (mil P)	Maint. (mill P)	Fleet	Invn't. (mil P)	Maint. (mill P)	Fleet	Invn't. (mil P)	Maint. (mill P)	Invt. (mil P)	Maint. (mil P)
1988	11,420	n/a	978	55.895	N/a	909	7,092	N/a	146	5,435	N/a	202	N/a	2,235
1989	13,077	1,788	1,227	62,773	1,065	1,119	9,755	525	220	6,109	474	249	3,852	2,816
1990	14,667	1,871	1,500	71,365	1,450	1,387	13,676	842	336	6,515	311	290	4,475	3,513
1991	16,884	2,945	1,951	87,285	3,035	1,916	16,360	651	454	7,534	883	379	7,514	4,699
1992	20,493	5,589	2,760	96,471	2,041	2,468	19,484	883	630	7,484	(50)	438	8,463	6,296
1993	20,303	(318)	2,950	119,208	5,451	3,291	24,047	1,392	869	9,232	1,905	584	8,431	7,664
1994	23,095	4,986	3,586	131,939	3,262	3,892	26,195	700	976	10,312	1,258	697	10,205	9,151
1995	23,983	1,744	4,096	135,229	927	4,388	35,977	3,508	1,475	10,832	666	805	6,845	10,763
1996	25,002	2,151	4,588	144,193	2,714	5,028	51,299	5,905	2,259	11,531	962	921	11,732	12,796
1997	26,502	3,450	5,300	151,403	2,379	5,753	56,429	2,155	2,709	12,108	865	1,053	8,849	14,816
1998	27,297	1,941	5,794	155,188	1,326	6,258	59,250	1,258	3,018	12,410	482	1,146	5,005	16,216
1999	28,116	2,189	6,534	159,067	1,488	7,024	32,213	1,446	3,470	12,720	541	1,286	5,663	18,314

Table 10
Total Spending on Lanbd Transportation Infrastructure and Vehicles

Year	NG		GOCC		LGU		Sub-total Public		Private		Total	
	Invn't. (mil P)	Maint. (mill P)	Invn't. (mil P)	Maint. (mill P)	Invn't. (mil P)	Maint. (mill P)	Invn't. (mil P)	Maint. (mill P)	Invn't. (mil P	Maint. (mill P)	Invt. (mil P)	Maint. (mil P)
1989	5,500	1,110	1	131	199	n/a	7,500	12,41	3,852	2,955	11,352	4,196
1990	8,500	1,210	15	152	2,029	n/a	10,544	13,62	4,475	3,671	15,019	5,033
1991	8,000	1,367	30	190	1,660	n/a	9,690	15,57	7,514	4,882	17,204	6,439
1992	13,537	1,593	265	224	0	n/a	13,802	18,17	8,463	6,494	22,265	8,311
1993	10,523	1,719	227	191	0	n/a	10,750	19,10	8,431	7,875	19,181	9,785
1994	14,351	1,827	274	182	0	n/a	14,625	20,09	10,205	9,384	24,830	11,393
1995	13,683	3,312	647	194	190	n/a	14,520	35,06	7,616	11,013	22,136	14,519
1996	21,985	3,552	703	235	0	n/a	22,688	37,87	16,216	13,068	38,904	16,855
1997	23,949	3,576	1,823	278	0	n/a	25,772	38,54	18,809	15,105	44,580	18,959
1998	28,539	3,696	1,938	290	1,226	n/a	31,703	39,86	26,120	16,532	57,823	20,518
1999	25,440	3,907	4,366	300	1,490	n/a	31,296	43,07	21,573	18314	52,869	22,521

2.2 Spending in the Study Area

For some types of spending, the amounts actually incurred in the Study Area are known, e.g. from DPWH local office records or because the spending agency is only active in the Greater Capital Region (GCR). Other items have been apportioned on a rational basis.

Public Sector - NG Direct

DOTC investment spending in the Study Area can be identified from the detailed listing of Program expenditure in GAA and actual expenditure (on FAPs) in BESF. While there are inconsistencies in the figures shown for projects year by year, and even between tables in the same volume, a detailed analysis of recent DBM publications yields the following a best estimate of Study Area spending:

1992	TEAM 346m;	
1993	TEAM 19m;	
1994	LRT3 9m;	
1995	none;	
1996	LRT3 36m;	
	LRT2 right of way 71m	total 107m;
1997	LRT1 re-hab. 185m,	
	LRT1 capacity exp'n 211m,	
	LRT2 right of way 1,140m,	
	LRT3 64m,	
	PNR commuter line south 400m,	
	PNR rolling stock re-hab 29m (50% of 59m),	total 2,029m;
1998	LRT1 re-hab. 335m,	
	LRT1 AFC equipment 9m,	
	LRT2 right of way 176m,	
	LRT3 71m,	
	PNR commuter line south 1055m,	
	PNR rolling stock re-hab 40m (50% of 79m),	total 1,686m.
1999	LRT1 re-hab. 8m,	
	LRT2 right of way 751m,	
	PNR rolling stock re-hab 50m (50% of 100m),	total 859m.

The situation is less clear for DPWH. Spending is distributed between some 30 offices, most of which deal with other sectors in addition to land transportation[5]. Regular, locally funded, work is dealt with by Regional offices, but larger projects, and those where foreign assistance is involved (FAPs), are implemented by a number of Project Management Offices (PMOs) and Agencies, at least 7 of which could have an interest in roads and bridges in the Study Area[6].

The three Regional Offices which deal with the Study Area, advised MMUTIS of actual spending on road and bridge construction and maintenance for 1992 to 1997, but no breakdown is yet available for 1998, or for the PMOs. An estimate of PMO spending can be made from data on FAPs in BESF and GAA.

Table 11 summarizes known DPWH expenditure and spending plans in the Study Area, together with the DOTC spending identified above. It is likely to be an under-estimate, as many DPWH FAPs have no geographical limits and may involve spending in the Study Area that has not been included in the Table. Given this, the Table indicates that in most years at least 15% of these Department's land

[5] DPWH also has responsibilities for: ports and lighthouses; flood control; water supply; urban infrastructure; schools and other national buildings; and "other public works projects".

[6] The: Urban Roads Project Office (URPO) - the main office for national roads in NCR; MMINUTE-PMO; IBRD-PMO; BOT-PMO; Jumbo Bridge Reconstruction PMO; Traffic Engineering Centre (TEC)-PMO; and the Toll Regulatory Board (TRB). There are also ADB- and Philippines-Japan Highway Loan (PJHL-) PMOs, but it is understood that all recent FAPs implemented by these offices have been located outside the Study Area.

transportation spending was incurred in the Study Area, possibly more than 30% in some years.

Public Sector - GOCCs

All LRTA expenditure is in the Study Area. For PNR, 100% of spending on projects located in the Study Area (e.g. Commuter Line South) has been taken into account, plus 50% of all other spending. This estimate is carried forward to Table 13.

Public Sector - LGUs

None of the MDF spending that gives rise to the infrastructure spending by LGUs shown in Table 4.5 is in the Study Area. However, the LGU Budget appropriation has been apportioned on a per-capita basis to proxy infrastructure spending by LGUs in the Study Areas funded from non- NG budget sources, as many Cities and Municipalities in NCR have substantial own-income from which to fund infrastructure spending. The percentage of the National population in the Study Area is derived from the revised (Interim Report) MMUTIS Socio-economic framework, with Study Area population rising from 19.93% of National population in 1992 to an estimated 21.82% in 1999. The estimated spending in the Study Area is carried forward to Table 13.

Private Sector

Of the private sector infrastructure investments presented in Table 8, only Stradec's spending (on STATE) is outside the Study Area. Private sector maintenance expenditure has been conservatively assumed to be 50% of PNCC's spending, the balance being on sections of SLE and NLE that lie outside the Study Area.

The estimate of expenditure on commercial vehicles in the Study Area given in Table 12 has been prepared.[7]. As in Table 9, the growth rate has been halved for 1998 and 1999.

[7] Philippine Statistical yearbook 1997 confirms the high number of new vehicles registered in NCR. In 1996 84% of new cars; 51% of new utility vehicles; and 64% of new trucks were registered in NCR, but only 21% of new motorcycle/tricycles.

Table 11
DPWH and DOTC Spending on land Transportation in the Study Area

Year	DPWH Regional Spending: NCR Build (m Peso)	NCR Maint. (m Peso)	Bulacan Build (m Peso)	Bulacan Maint. (m Peso)	Cavite Build (m Peso)	Cavite Maint. (m Peso)	Laguna Build (m Peso)	Laguna Maint. (m Peso)	Rizal Build (m Peso)	Rizal Maint. (m Peso)	DPWH FAPs Build (m Peso)	DOTC Build (m Peso)	Total Build (m Peso)	Total % Nat.	Total Maint. (m Peso)
1992	398	58	n/a	11	17	10	14	13	15	13	1,881	346	2,671	19.73%	105
1993	422	109	n/a	18	0	17	27	19	4	7	1,495	19	1,967	18.69%	170
1994	612	119	n/a	27	28	23	64	22	4	16	1,488	9	2,205	15.36%	207
1995	973	155	n/a	53	94	47	51	46	7	38	640	0	1,765	12.90%	339
1996	1,272	152	n/a	35	66	41	17	59	16	40	875	107	2,353	10.70%	327
1997	2,530	163	n/a	34	41	35	38	32	9	32	1,593	2,029	6,240	26.06%	296
1998	1,186	150	20	36	159	36	163	36	130	36	1,406	1,687	4,751	22.40%	294
1999	1,660	169	25	37	160	36	170	38	130	38	785	859	3,789	14.89%	318

n/a not available
Source: DPWH, BESF (Consultant's estimates for 1999 Regional Spending)

Table 12
Estimated Spending on Commercial Vehicles in the Study Area

Year	Bus Fleet	Bus Investment (mn Peso)	Bus Maint. (mn Peso)	Jeepney Fleet	Jeepney Investment (mn Peso)	Jeepney Maint. (mn Peso)	Taxi Fleet	Taxi Investment (mn Peso)	Taxi Maint. (mn Peso)	Truck Fleet	Truck Investment (mn Peso)	Truck Maint. (mn Peso)	Total Investment (mn Peso)	Total Maint. (mn Peso)
1988	3,116	n/a	267	23,169	n/a	377	4,821	n/a	99	2,022	n/a	75	n/a	818
1989	3,608	531	339	25,828	412	461	6,780	386	153	2,361	239	96	1,567	1,048
1990	4,329	848	443	27,659	309	538	8,150	294	200	2,532	131	113	1,583	1,293
1991	5,408	1,434	625	34,410	1,287	755	12,424	1,037	344	2,911	328	146	4,086	1,871
1992	6,154	1,155	829	36,090	373	923	14,043	458	454	2,884	(27)	169	1,959	2,375
1993	6,129	(42)	891	48,561	2,990	1,341	18,329	1,308	639	3,323	478	210	4,735	3,081
1994	7,467	2,389	1,159	53,494	1,264	1,578	19,020	225	709	3,434	129	232	4,008	3,678
1995	7,915	880	1,351	56,169	754	1,822	20,922	682	857	3,606	220	268	2,535	4,299
1996	8,390	1,002	1,540	58,977	850	2,056	23,014	806	1,014	3,786	248	302	2,907	4,912
1997	8,893	1,158	1,779	61,926	973	2,353	25,316	967	1,215	3,975	284	346	3,381	5,693
1998	9,160	651	1,944	63,474	542	2,560	26,581	564	1,354	4,075	158	376	1,916	6,234
1999	9,435	734	2,193	65,061	609	2,873	27,910	649	1,557	4,177	178	422	2,169	7,045

n/a not applicable

Total

Table 13 sums these Study Area expenditure estimates. It presents each sector's spending both in absolute terms and as a percentage of the equivalent national spending from Table 10. As noted in the commentary on Table 11, 15-30% of direct NG land transportation investment has been in the Study Area in recent years. However, the proportion of NG maintenance spending is much lower, reflecting the relatively short length of National highway in the Study Area and the allocation of maintenance funds on a strict "equivalent km" basis.

The activity of the land transportation GOCCs are concentrated in the Study area. At least half, and usually over 80%, of this sector's transportation spending is in the Study Area. LGU spending has been apportioned on a per-capita basis, with around 21% estimated to be in the Study Area.

Since DPWH investment in the Study Area is, as noted above, almost certainly underestimated, it is probable that at least 20% of relevant public sector investment has been in the Study Area in most years, rising to over 30% with the commencement of work on LRT2.. This ratio is comparable with the proportion of the national population that is in the Study Area.

Public sector maintenance spending, on the other hand, is at a lower than per-capita rate. It is notable that annual rail maintenance spending by the GOCCs, with only 75 route km, is close to DPWH maintenance expenditure on over 1000km of national highway. There is a suggestion in this data that there is insufficient maintenance of highways in the Study Area.

Conversely the Study Area's share of private sector spending, either on investment or maintenance is greater than its share of population, reflecting the concentration of:

- economic activity;
- wealth;
- the commercial vehicle fleet; and
- private investment in infrastructure,

in Metro-Manila. The Study Area currently accounts for 3/4 of the private sector's investment, and about 1/3 of its maintenance spending.

In contrast to the national position, where the public sector makes the greater investment input, private sector infrastructure investment in the Study Area has been at least equal to the public sector's and, since the commencement of BOT activity, has exceeded it by a factor of 2-3 each year. For maintenance spending the differential is even more marked, with a factor of 7–12, reflecting the higher maintenance needs of vehicles (mostly in the private sector) compared to infrastructure (mostly in the public sector).

Table 13
Spending on Land Transportation Infrastructure and Vehicle in the Study Area

Year	NG		GOCC		LGU		Sub-total Public		Private		Total	
	Inv. (m peso)	Maint. (m peso)	Inv. (m peso)	Maint. (m peso)	Inv. (m peso)	Maint. (m peso)	Inv. (m peso)	Maint. (m peso)	Inv. (m peso)	Maint. (m peso)	Inv. (m peso)	Maint. (m peso)
1992	2,671	105	265	208	0	n/a	2,936	313	1,959	2,375	4,895	2,688
%N	*19.73%*	*6.59%*	*100.0%*	*92.86%*			*21.27%*	*17.23%*	*23.15%*	*36.57%*	*21.99%*	*32.34%*
1993	1,967	170	116	175	0	n/a	2,083	345	4,735	3,081	6,817	3,426
%N	*18.69%*	*9.89%*	*50.9%*	*91.62%*			*19.37%*	*18.06%*	*56.15%*	*39.12%*	*35.54%*	*35.01%*
1994	2,205	207	184	158	0	n/a	2,389	365	4,008	3,678	6,397	4,043
%N	*15.36%*	*11.33%*	*67.2%*	*86.81%*			*16.34%*	*18.17%*	*39.27%*	*39.20%*	*25.76%*	*35.49%*
1995	1,765	339	445	172	40	n/a	2,249	511	3,306	4,299	5,556	4,810
%N	*12.90%*	*10.24%*	*68.7%*	*88.66%*	*20.94%*		*15.49%*	*14.58%*	*43.42%*	*39.04%*	*25.10%*	*33.13%*
1996	2,353	327	512	198	0	n/a	2,865	525	7,391	4,912	10,256	5,436
%N	*10.70%*	*9.21%*	*72.78%*	*84.04%*			*12.63%*	*13.85%*	*45.58%*	*37.59%*	*26.36%*	*32.25%*
1997	6,240	296	1,703	227	238	n/a	8,181	523	13,341	5,693	21,523	6,216
%N	*26.06%*	*8.28%*	*93.42%*	*81.65%*	*21.53%*		*31.74%*	*13.57%*	*70.93%*	*37.69%*	*48.28%*	*32.79%*
1998	4,751	294	1,836	240	266	n/a	6,853	534	22,526	6,234	29,379	6,768
%N	*16.65%*	*7.95%*	*94.74%*	*82.76%*	*21.68%*		*21.62%*	*13.40%*	*86.24%*	*37.71%*	*50.81%*	*32.99%*
1999	3,789	318	4,329	255	325	n/a	8,443	573	17,219	7,045	25,662	7,618
%N	*14.89%*	*8.14%*	*99.14%*	*85.00%*	*21.82%*		*26.98%*	*13.62%*	*79.82%*	*38.47%*	*48.54%*	*33.82%*

n/a not available

During the period of MMUTIS, 1997 spending has moved from Adjusted to Actual, and 1998 spending from Program to Adjusted, the public sector contribution has fallen sharply (by some 50%), while the private sector contribution held steady for 1997 and has increased for 1998 (despite a 50% reduction in spending on new vehicles between the two estimates).

It was noted that, at the level of national expenditure, there is no evidence of the increased private expenditure substituting for public investment. The suggestion above that substitution is happening in the Study area implies that the focus of public sector expenditure is being shifted to the provinces.

Closer examination of the figures indicates that this may only be temporary. Much of the reduction in anticipated public expenditure in 1997 and 1998 can be attributed to delays in the construction of LRT2. While there have been some delays on the private projects, the consortia are still progressing them as fast as possible, in order to complete them and start the income stream. Coupled with the impact of the Peso depreciation on the imported technology for these projects, this has pushed the private spending estimate up since 1997.

Other public sector projects may be awaiting completion of the LRT and Tollway projects to free up specialist labour, machinery and construction sites. The low level of public sector investment in the Study Area may thus be a temporary phenomenon, brought about by a combination of the private sector commanding so many resources and critical locations and the impact of the economic slowdown on public funds available for investment at this time.

2.3 Projection of Future Public Sector Investment Budget

Analysis of Past trends

Table 14 presents: GDP (nominal); The GDP deflator to 1985 values; GDP in real (1985) Peso; National Government (NG) annual revenue (in 1985 Peso); and NG annual expenditure (in 1985 Peso), both total and by broad class of spending, for years from 1987 to 1999.

The GDP deflator has been derived from nominal and real GDP data in PSY. An official GDP deflator is not yet available for 1997-1999, a value has been derived using the annual CPI rates of inflation reported in BESF99.

Expenditure is shown dis-aggregated into 6 classes[8]

1) Interest;
2) "Transfers" (grants, subsidies, contributions, SS payments etc.);
3) Personal Services;
4) Maintenance and Other Operating Expenditure (MOOE), net of interest and transfers;
5) Infrastructure Investment; and
6) Capital Outlays (net of infrastructure investment).

[8] Prior to 1994, the aggregate figure for NG spending included a 7th item, loan amortization. This now appears in the NG Capital Account, and "spending" is concerned solely with the Current Account. For consistency, loan amortization has been deducted from aggregate NG spending in earlier years.

The distribution of spending between these classes, and trends over time in spending patterns, are more easily seen in graphical form.
Figure 1 presents real (1985 Peso) NG spending in each year as a stacked-column chart, with each class of spending represented by a different level in the column.

In Figure 2 the elements of the columns represent each class of expenditure as a percentage of total spending.

Finally, in Figure 3 the shares of expenditure are presented as percentages of GDP.

Comparison of the NG revenue and Total spending columns in Table 14 show the extent to which annual NG spending exceeds revenue. Part of the shortfall is met from other Public Sector sources of income, but the bulk of it has been covered by borrowing, either planned or emergency. Deficit financing of the annual budget was the norm up to the early 1990s. Since then a more prudent fiscal approach has been adopted, with net repayments of Government debt in 1996 and 1997.

A consequence of deficit financing is an increasing interest charge on the accumulated debt. Interest reached 32% of total NG spending in 1990, placing a severe constraint on the level of other NG spending - on economic, social, and public services - that was possible without increases in income (taxation) or yet more borrowing.

Table 14 and Figure 1 show annual interest expenditure declining in real terms from 1990 until the on-set of the South East Asian currency crisis. Figures 2 and 3 show that the decline, as a share of annual spending and GDP, was even greater, interest falling from 31% of NG spending in 1992 to only 16% by 1997, and from 7% of GDP in 1990 to 3% by 1997. The latest projection is for a rise to 20% of NG spending (4% of GDP) in 1998 and 1999.

Figure 2 shows that the reduction in the proportion of NG spending on interest was largely taken up by increases in spending on:

- Transfers, in particular to LGUs in connection with the de-centralisation of a number of Government responsibilities; and
- Personal Services, with the implementation since 1995 of the Salary Standardisation Law (SSL) – the actual number of Government employees is programmed to decline.

Thus, while NG spending on interest halved, in real terms, between 1990 and 1997, spending on the classes of most relevance to MMUTIS - capital projects and in particular Infrastructure Investment – did not rise. Table 14 shows that investment spending was 29bn (1985) Peso in 1990, and was still 29bn in 1997. Program spending in 1999 is 18bn, only 62% of the level in 1990.

Table 14
National Income, Government Income, and Government Spending by Type

(million peso)

Year	GDP (nominal)	GDP deflator (to 1985 value)	GDP (1985 value)	NG Revenue (1985 value)	National Government Spending: Total (1985 value)	% GDP	Interest (1985 value)	Transfer Payments (1985 value)	Personal Services (1985 value)	MOOE (1985 value)	Infrastruct. Investment (1985 value)	Other Capital (1985 value)
1987	682,764	1.11	616,923	93,261	110,880	17.97%	33,824	6,114	28,496	17,235	6,235	18,977
1988	799,182	1.21	658,581	93,005	116,979	17.76%	37,795	8,439	35,926	15,745	7,095	11,979
1989	925,444	1.32	699,448	115,191	118,003	16.87%	30,017	9,282	39,306	17,516	7,407	14,476
1990	1,077,237	1.49	720,690	121,027	147,547	20.47%	47,576	12,347	43,010	17,590	12,109	14,914
1991	1,248,011	1.74	716,522	126,761	142,119	19.83%	43,015	11,659	39,751	15,900	12,459	19,335
1992	1,351,559	1.88	718,941	129,108	136,666	19.01%	42,327	15,497	41,254	16,406	13,613	7,569
1993	1,474,457	2.01	734,156	129,660	137,881	18.78%	38,503	21,584	38,313	15,736	10,176	13,568
1994	1,692,932	2.21	766,368	152,175	148,376	19.36%	35,837	25,303	41,907	15,677	15,737	13,915
1995	1,906,328	2.37	802,866	151,708	156,705	19.52%	30,682	32,214	47,654	17,834	17,944	10,377
1996	2,171,900	2.59	838,912	158,539	160,737	19.16%	29,561	32,665	53,432	19,881	16,541	8,657
1997	2,423,600	2.75	882,536	171,818	179,079	20.29%	28,393	35,517	65,156	20,480	18,244	11,289
1998	2,693,200	3.01	895,774	155,021	175,703	19.61%	35,817	31,034	68,094	18,263	14,328	8,168
1999	3,023,400	3.26	927,126	168,810	177,698	19.17%	37,018	36,815	67,183	18,614	13,908	4,159

Source: PSY 96, 97, BESF99, Consultants calculations

Figure 1
Government Expenditure by Type
Real –1985-prices

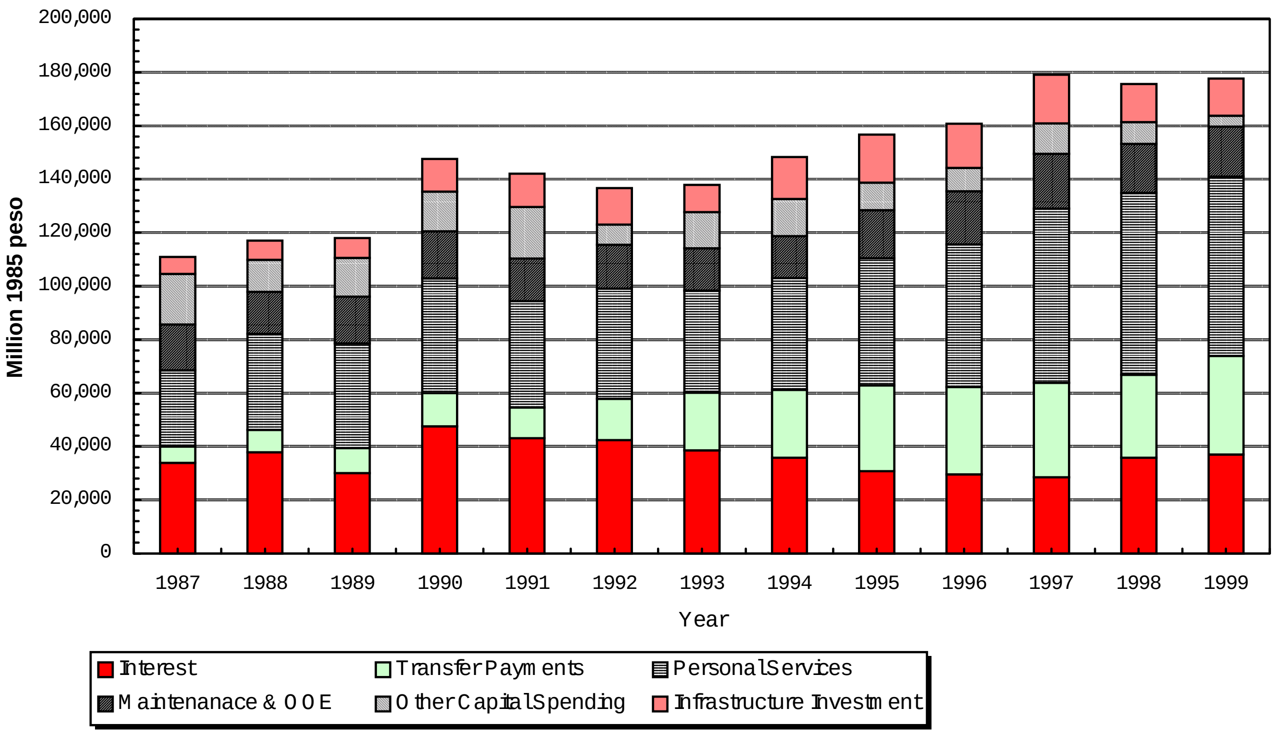


Figure 2
Shares of government Expenditure

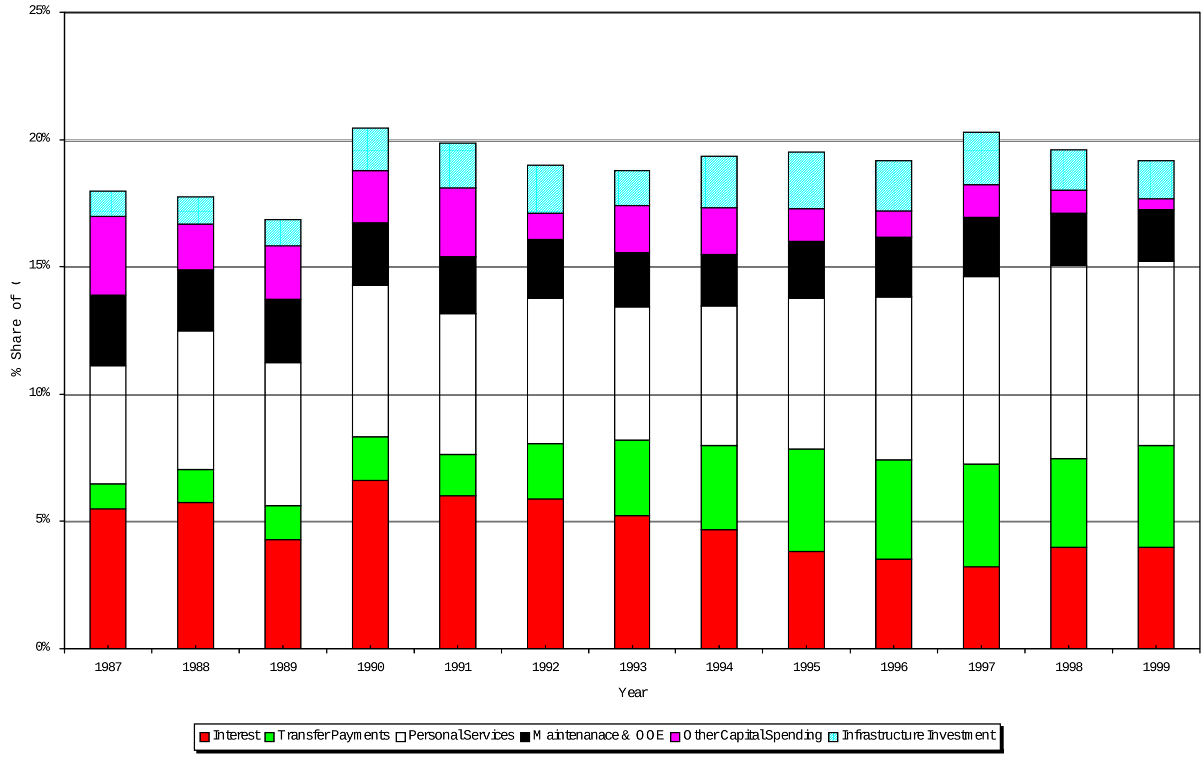
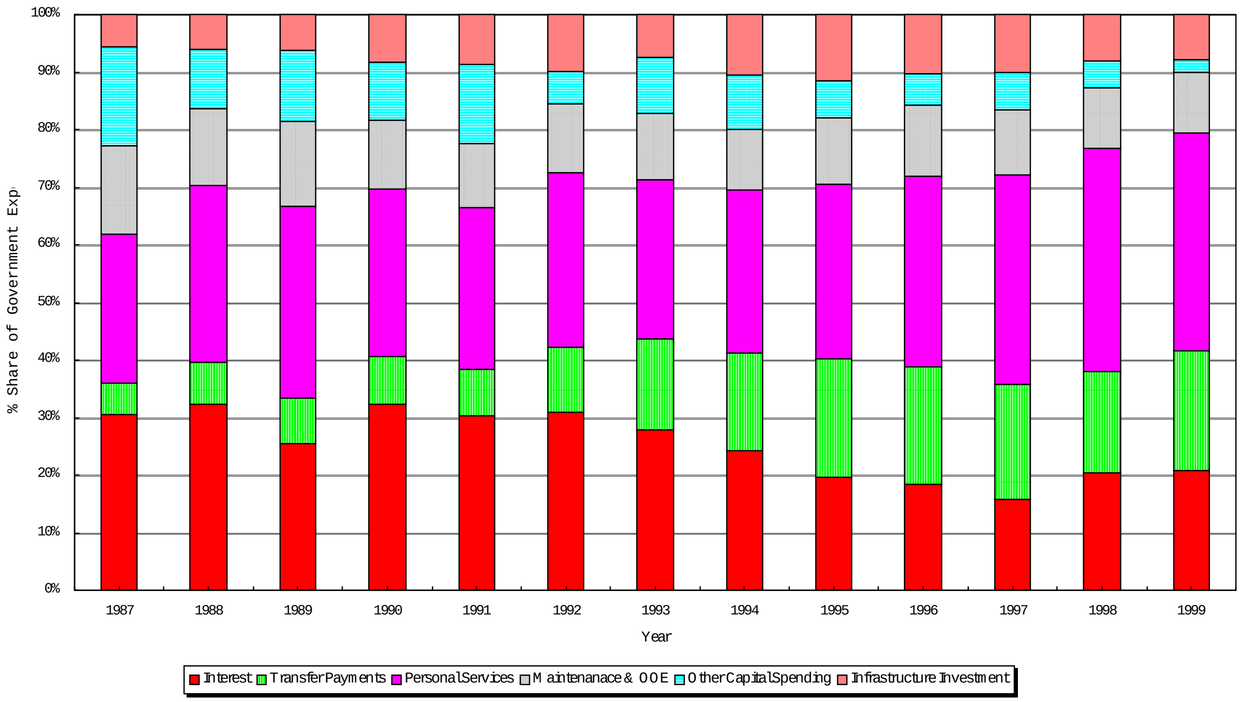


Figure 3
Government Expenditure as % of GDP



GNP and NG spending have both been increasing in real terms during this period. NG capital spending has thus declined as a proportion of spending and economic activity. Figure 2 shows that the share of Infrastructure and Other Capital Spending in NG spending has declined from 22% in 1990 to 10% in 1999 Program expenditure. In terms of GDP (Figure 3), the decline is from 4.4% in 1991 to 1.9% in 1999.

This reduction in NG investment has coincided with the most sustained period of growth in the Philippine economy for several decades, and highlights that most investment expenditure is now undertaken by the Private Sector and, to a lesser extent, GOCCs. Privatisation and BOT initiatives have transferred investment responsibility for whole areas of the economy from the Public to the Private sector.

The transfer of investment responsibility has been greatest in sectors where the Private Sector can charge directly for the product or services of their investment, e.g. power generation. Investments for which the benefit is greater collectively than for individuals using the new facility (i.e. there are externalities or public goods) have tended to remain with the Public Sector. These include most infrastructure investments (roads, flood defense, irrigation etc.). It can be seen from Table 14 that NG Infrastructure Investment has not declined as much as total capital spending, rising from 24% of capital spending in 1987 to 77% in the 1999 Program, and increasing in real terms up to 1997.

The proportion of this investment that has been in Land Transportation, shown in Table 2, has varied between 30% and 60%, but is usually around 50%. Land Transportation investment has tended to fluctuate less as a percentage of wider aggregates, lying between 3.3%.and 5.3% of NG spending and 0.75% and 1.0% of GDP in all years since 1992.

As noted in Section 2 above, there are two avenues for Public Sector investment in rail: either direct, by the respective GOCC (LRTA or PNR); or via a budget allocation to DOTC. Table 15 compares total Public Sector Land Transportation investment (PSLTI, from Table 10) with GDP and total Public Sector spending. Monetary values in this Table are in nominal Peso.

The lack of growth in NG direct activity in the early 1990s, as activities were transferred to GOCCs and LGUs, is striking, as is the stability of total Public Sector activity as a percentage of GDP, at around 27-30%. At the aggregate Public Sector level, PSLTI generally accounts for between 3% and 4% of Public Sector economic activity, tending to 4% in recent years as LRTA embarks on LRT2. During this period PSLTI has also always exceeded 1% of GDP, peaking at 1.18% for the 1998 Adjusted Program budget.

Projection of Future Spending Patterns

The past trends and spending patterns identified above may be used as a basis for future projections, subject to:

- an understanding of the causal relationships underlying the past trends;
- consideration of the medium term future for the Philippine economy; and

- possible changes in the emphasis of NG economic policy.

Table 15 presented projections of future spending based on the data available to DBM in July 1997, using the future relationships shown below:

Table 15
1997 Assumptions Underlying the National Land Transport Budget

Scenario	Growth		
	Low	Medium	High
GNP % Growth Rate per annum	4.0	5.5[a]	7.0[b]
Annual Budget as % of GNP	19.0	21.0	23.0
Infrastructure Spending as % of Budget	10.0	12.0	14.0
Land Transport Spending as % of Infrastructure	45.0	42.5	40.0

a declining to 4.0% between 2006 and 2010
b declining to 4.0% between 2006 and 2015

The marked difference between data presented in BESF98 (June 1997) and BESF99 (July 1998) noted above indicates that not only do the projections now need to be re-based, but also the assumptions need to be reviewed, particularly for the short to medium term future. The current uncertainty regarding the economic growth prospects for the Philippines may also lead to revisions of previously well established expenditure relationships within the economy.

Forecasts of the future should always be treated with caution. Even if all the relationships between parameters are fully understood, there will always be uncertainty regarding future values of key input parameters.

At the present time there is probably greater uncertainty about future prospects, particularly in the short term, for the Regional and Global economy than there has been at any time in the last 50 years. The consensus view on even the short term future can change from day to day with each new item of economic or financial data.

Over the longer run, expert opinion is divided between a number of alternative outcomes. These differ not only on the prospects for economic growth at the National and Regional level, but also in their assessment of the root causes of the present slowdown and thus the measures to be adopted to minimize the impact of the so-called "South East Asian Crisis". Pessimists' doubt that it is possible to avoid a second wave of slowdowns followed by a slide into Global deflation on a scale not seen since the 1930s. Optimists advocate interest rate cuts in most developed nations accompanied by coordinated budgets throughout the Region to give fiscal and monetary stimulus to local economies.

Table 16
Public Sector Land Transportation Investment vs. National and Public Sector Economic Activity

Year	GDP	NG		GOCC		LGU		Total Public Sector		PS as % of	LT Investment as % of	
		Activity	LT Inv.	Activity	LT Inv.	Activity	LT Inv.	Activity	LT Inv.	GDP	GDP	Total Pub.Sect.
1992	1,351,559	256,803	13,537	89,568	265	22,047	0	368,418	13,802	27.26%	1.02%	3.75%
1993	1,474,457	258,216	10,523	149,409	227	39,175	0	446,800	10,750	30.30%	0.73%	2.41%
1994	1,692,932	259,176	14,351	156,339	274	64,006	0	479,521	14,625	28.32%	0.86%	3.05%
1995	1,906,328	324,650	13,683	187,553	647	74,132	190	586,335	14,520	30.76%	0.76%	2.48%
1996	2,171,900	336,439	21,985	155,657	703	81,513	0	573,609	22,688	26.41%	1.04%	3.96%
1997	2,423,600	401,037	23,949	161,657	1,823	104,953	0	667,647	25,772	27.55%	1.06%	3.86%
1998	2,693,200	444,182	28,539	239,351	1,938	114,681	1,226	798,214	31,703	29.64%	1.18%	3.97%
1999	3,023,400	469,316	25,440	251,068	4,366	126,064	1,490	846,448	31,296	28.00%	1.04%	3.70%

Source: Table 4.10, BESF Table A4

Three macroeconomic scenarios have been considered for the Philippines.

- Low Growth – Double Shock. The second shock is expected to occur early in 1999. It has the effect of preventing an early return of the Philippines economy to a long-term growth path. There is no growth in 1999, and only 1-2% p.a. until 2003. When sustained growth does resume, it is at the relatively low rate of 4% per annum.

- Medium Growth – Single Shock, Low Growth Path. Demand stimulation and confidence building measures currently being pursued in Japan and USA are partially successful. Global recession is avoided and the Philippine economy, as one of the healthier in South East Asia, returns to moderate growth by 2001. There is a brief "catching-up" period (5-5.5% growth p.a.) from 2002 to 2005, after which growth stabilises at the same rate as in the Low scenario (4% p.a.).

- High Growth – Single Shock, High Growth path. Demand stimulation and confidence building measures currently being pursued in Japan and USA are successful, outstanding Regional political and economic issues are resolved in ways that are positive for Regional growth[9]. Recession ends in ASEAN as a whole. The Philippine economy, being basically sound, rapidly returns to pre-"crisis" growth rates (5-6%p.a.), slowing with maturity to 4% by 2015.

It is to be noted that the current Low scenario is more optimistic than the "Global Deflationary Spiral" scenario, while the High scenario is more pessimistic than the Medium forecast in Table 17.

Figure 4 compares the current Low and High forecasts with the GDP equivalent of the Medium GNP forecast presented in 1997. Figure 5 shows a similar comparison, using per-capita GDP as the measure.

[9] E.g., reforms in Indonesia are sufficient for full IMF support payments to be released; exchange restrictions on Malaysian Ringgit are lifted; return of investor confidence lifts asset values and prevents collapse of Thai banks; China (and consequently Hong Kong) does not devalue.

Table 14 shows that the ratio of NG expenditure to GDP has fluctuated within a narrow range - 18.8% to 20.3% of GDP - in recent years. While this appears to be a very stable relationship, having been maintained throughout the economic slowdown of the early 1990s as well as the rapid expansion in the mid of 1990s, it is known that Government would like to increase this proportion.

The previous administration sought to pursue a policy of balanced budgets while increasing expenditure to around 22% of GDP via increases in NG income. This involved a revision of the tax base through the Comprehensive Tax Reform Package, and an improvement of the effectiveness of the tax collecting agencies[10]. In addition to these measures, the new administration is also understood to be considering increased deficit financing of the annual budget, i.e. NG expenditure is programmed to exceed NG income, with the difference covered by increased NG borrowing.

Table 17
Growth Rate Assumptions for National Economy

year	Economic Growth Scenario								
	Low			Medium			High		
	a[1]	b[1]	**c[2]**	a[1]	b[1]	**c[2]**	a[1]	b[1]	**c[2]**
1997	7.0%[3]	5.7%[4]	**5.2%[5]**	7.0%[3]	5.7%[4]	**5.2%[5]**	7.0%[3]	5.7%[4]	**5.2%[5]**
1998	7.5%[3]	2.0%[4]	**1.5%[5]**	7.5%[3]	2.5%[4]	**1.5%[5]**	7.5%[3]	3.0%[4]	**1.5%[5]**
1999	4.00%	1.00%	**0.00%**	5.50%	1.00%	**1.00%**	7.00%	2.00%	**2.00%**
2000	4.00%	1.00%	**0.00%**	5.50%	2.00%	**2.00%**	7.00%	3.00%	**4.00%**
2001	4.00%	1.00%	**1.00%**	5.50%	3.50%	**3.50%**	7.00%	5.00%	**5.00%**
2002	4.00%	2.00%	**2.00%**	5.50%	5.00%	**5.00%**	7.00%	7.00%	**5.50%**
2003	4.00%	4.00%	**3.00%**	5.50%	5.50%	**5.50%**	7.00%	7.00%	**6.00%**
2004	4.00%	4.00%	**4.00%**	5.50%	5.50%	**5.50%**	7.00%	7.00%	**5.50%**
2005	4.00%	4.00%	**4.00%**	5.50%	5.50%	**5.00%**	7.00%	7.00%	**5.00%**
2006	4.00%	4.00%	**4.00%**	5.20%	5.20%	**4.50%**	6.70%	6.70%	**4.90%**
2007	4.00%	4.00%	**4.00%**	5.01%	5.01%	**4.00%**	6.40%	6.40%	**4.80%**
2008	4.00%	4.00%	**4.00%**	4.83%	4.83%	**4.00%**	6.10%	6.10%	**4.70%**
2009	4.00%	4.00%	**4.00%**	4.64%	4.64%	**4.00%**	5.80%	5.80%	**4.60%**
2010	4.00%	4.00%	**4.00%**	4.00%	4.00%	**4.00%**	5.50%	5.50%	**4.50%**
2011	4.00%	4.00%	**4.00%**	4.00%	4.00%	**4.00%**	5.20%	5.20%	**4.40%**
2012	4.00%	4.00%	**4.00%**	4.00%	4.00%	**4.00%**	4.90%	4.90%	**4.30%**
2013	4.00%	4.00%	**4.00%**	4.00%	4.00%	**4.00%**	4.60%	4.60%	**4.20%**
2014	4.00%	4.00%	**4.00%**	4.00%	4.00%	**4.00%**	4.30%	4.30%	**4.10%**
2015	4.00%	4.00%	**4.00%**	4.00%	4.00%	**4.00%**	4.00%	4.00%	**4.00%**
2016	4.00%	4.00%	**4.00%**	4.00%	4.00%	**4.00%**	4.00%	4.00%	**4.00%**
2017	4.00%	4.00%	**4.00%**	4.00%	4.00%	**4.00%**	4.00%	4.00%	**4.00%**
2018	4.00%	4.00%	**4.00%**	4.00%	4.00%	**4.00%**	4.00%	4.00%	**4.00%**
2019	4.00%	4.00%	**4.00%**	4.00%	4.00%	**4.00%**	4.00%	4.00%	**4.00%**
2020	4.00%	4.00%	**4.00%**	4.00%	4.00%	**4.00%**	4.00%	4.00%	**4.00%**

a Forecast made in October 1997
b Forecast made in March 1998
c Forecast made in October 1998
1 GNP growth rate
2 GDP growth rate
3 BESF98
4 Philippine Daily Inquirer, 2nd March 1998
5 BESF98

[10] It is estimated that a further P63bn – 2.3% of GDP and 12% of actual NG revenue - would be received if the existing taxes and duties were paid on all appropriate income, profits, and transactions. It is unlikely that so large a sum could be transferred from the private sector to the public sector without some slowing of (private sector) economic activity, but gives an indication of the short-term potential to improve public sector finances without a major legislative overhaul.

Figure 4
GDP Estimates

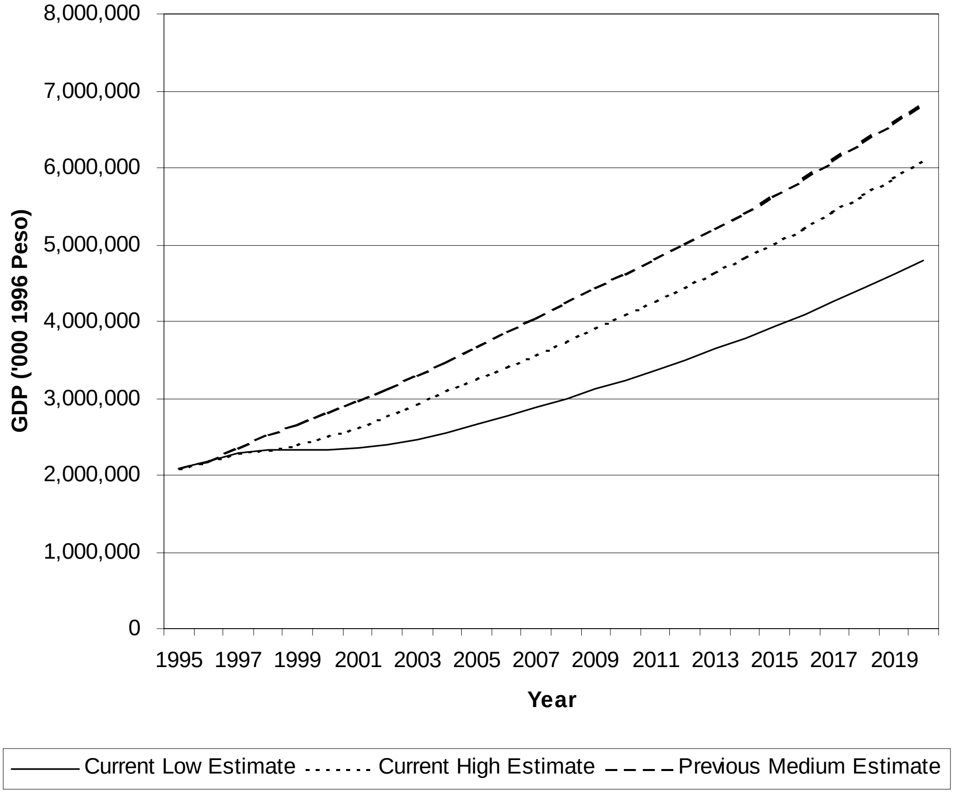
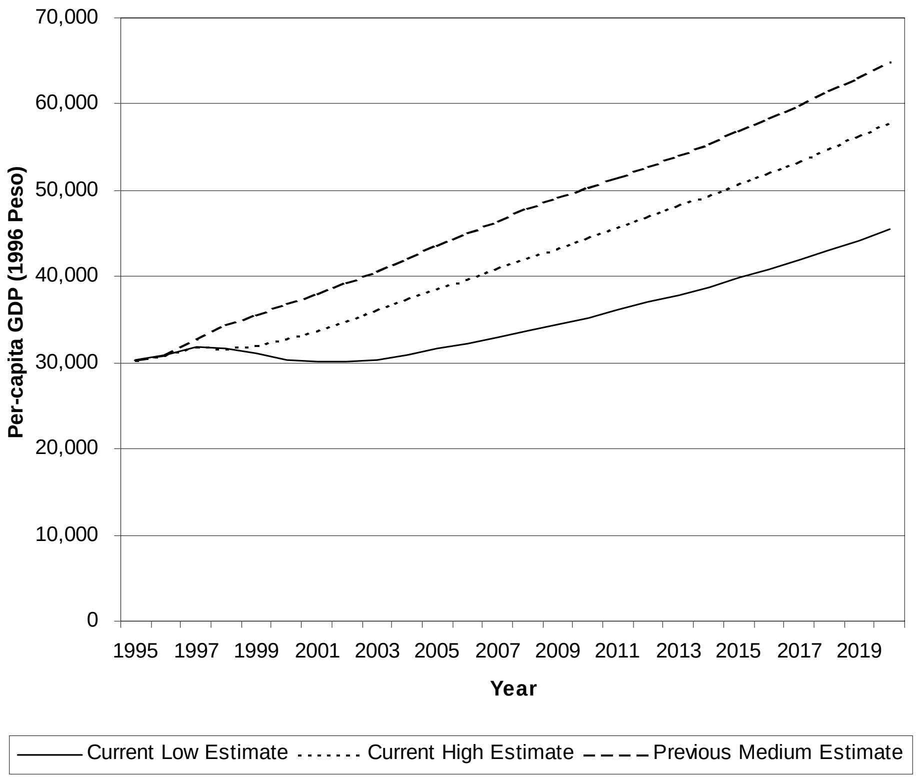


Figure 5
Per-capita GDP Estimates



Development agencies, and in particular the IMF, do not favour deficit financing. Excessive borrowing to fund budget deficits has, in the past, led a number of governments and nations into extreme debt problems. When a deficit is accrued:

- to fund over-ambitious expenditure plans;
- because of the lack of effective institutions for revenue collection; or
- because of a lack of political will to impose taxes on influential sectors of society,

the IMF view is valid. This is particularly true if the deficit is intended to fund the current spending program.

An alternative viewpoint is that, provided:

- a deficit is solely to fund Public Sector investment spending, preferably on projects that will generate future revenue for the Government from which the debt can be repaid;

- the accumulated NG debt is, over the long term, an acceptable, constant or falling, proportion of GDP; and

- the annual interest charge on that debt is, over the long term, an acceptable, constant or falling, proportion of NG current spending,

then an annual budget deficit, leading to an ever-increasing nominal NG debt, is acceptable. Under these conditions accumulated debt could be increased at the same rate as nominal GDP, perhaps faster if debt as a proportion of GDP were relatively low and real interest rates were falling[11].

The detailed position of the new administration on the rationale for, and extent of, future borrowing to fund increased NG spending is not known. Given this additional uncertainty on the future direction of fiscal policy, upper and lower bounds have been placed on the level of NG borrowing to fund the budget, giving two, limiting, budgetary scenarios for each macro-economic scenario. These are:

- Balanced Budget – apart from the net borrowing implicit in BESF99, government debt remains at the same nominal level throughout the forecast period, i.e. it continues to reduce in real terms; and

- Deficit Financing – once the immediate economic slowdown incorporated in the macro-economic growth assumptions of Table 4.17 is over, the budget is expanded via borrowing sufficient to hold debt, as a percentage of GDP, at the current level of around 27.5%[12].

[11] Despite the prudent fiscal stance adopted throughout the Ramos administration, and extended to BESF99 ("the most modest, belt-tightening, budget ever approved by the House", House Speaker Manuel Villar Jr. quoted in the Philippine Star, 24th October 1998), Public Sector debt only decreased in 1994 and 1997. It was over P200m higher at the end of the Ramos administration than at its commencement. As a percentage of GDP, however, it has fallen from 45% in 1993 to only 27% in the 1999 Program.

[12] As this is a relatively low ratio of debt to GDP, the Deficit Financing sub-scenarios may still be regarded as fiscally prudent.

As cumulative debt influences the annual interest charge, forecasting the size of the budget involves projecting the likely division of the resultant NG spending between interest, current and capital items, also generating forecasts of Infrastructure Investment spending.

Table 4.18 summarizes the resulting annual levels of:

- NG Expenditure as a percentage of GDP; and
- NG Infrastructure Spending as a percentage of NG Spending.

It can be seen from the Table that over the long run deficit financing would allow the annual budget to be expanded by around 2.3% of GDP in all growth scenarios (all scenarios have the same rate of GDP growth in later years). It can also be seen that, by 2014, the added burden of the interest charge on the higher level of government debt implicit in deficit financing is such that a higher percentage of the budget is available for Infrastructure Investment in the balanced budget sub-scenarios than in the deficit financing cases.

However, because the budget is larger in the deficit financing sub-scenarios, the actual allocation, in 1996 Peso, is larger in all years in the study period except 2020 in the Low growth scenario.

Figure 6 illustrates the differential growth of the Infrastructure budget in each sub-scenario. It shows the early boost to spending that deficit financing can bring, but also that the benefit is eroded over time as increasing interest liabilities until (e.g. by 2019 in the Low growth scenario), there is no difference in the sums available[13].

The impact of the double shock in the Low growth scenario can be seen. The Medium growth balanced budget scenario represents a return to pre-crisis spending patterns, and the High growth balanced budget scenario is similar to the spending pattern that would have been possible with an efficient tax collection system in the absence of the recent economic crisis.

Finally, the earlier estimate of Land Transport spending as a percentage of (NG) Infrastructure spending excludes spending by the GOCCs, LRTA and PNR, funded from their own income. Aggregate Public Sector Land Transportation Infrastructure (PSLTI) spending, expressed as a percentage of NG Infrastructure spending, has varied in recent years between 34% and 76%, and for the 1993-1998 period averaged 50%. It is particularly high at present (74% 1998 Adjusted, 69% 1999 Program) due to LRTA investment in LRT2.

The average of 50% has been adopted as a reasonable measure of the level of PSLTI investment over the longer-run. It has been assumed that the level of investment will be inversely related to economic growth, i.e. it will be lower in high growth periods as more funds are made available for other infrastructure projects. Future rates have been adopted of 52.5% in the Low growth scenarios, 50% in the Medium growth scenarios and 47.5% in the High growth scenarios.

[13] There is, in fact, as dis-benefit, as interest will still need to be paid on the debt even if the policy is ended.

The resulting estimates of the total (nationwide) funds available for PSLTI investment in each year of the Study Period is shown in: Table 19 (Low growth); Table 20 (Medium growth); and Table 21 (High growth). All estimates are in real terms, expressed in 1996 Peso.

PSLTI Funds for the Study Area

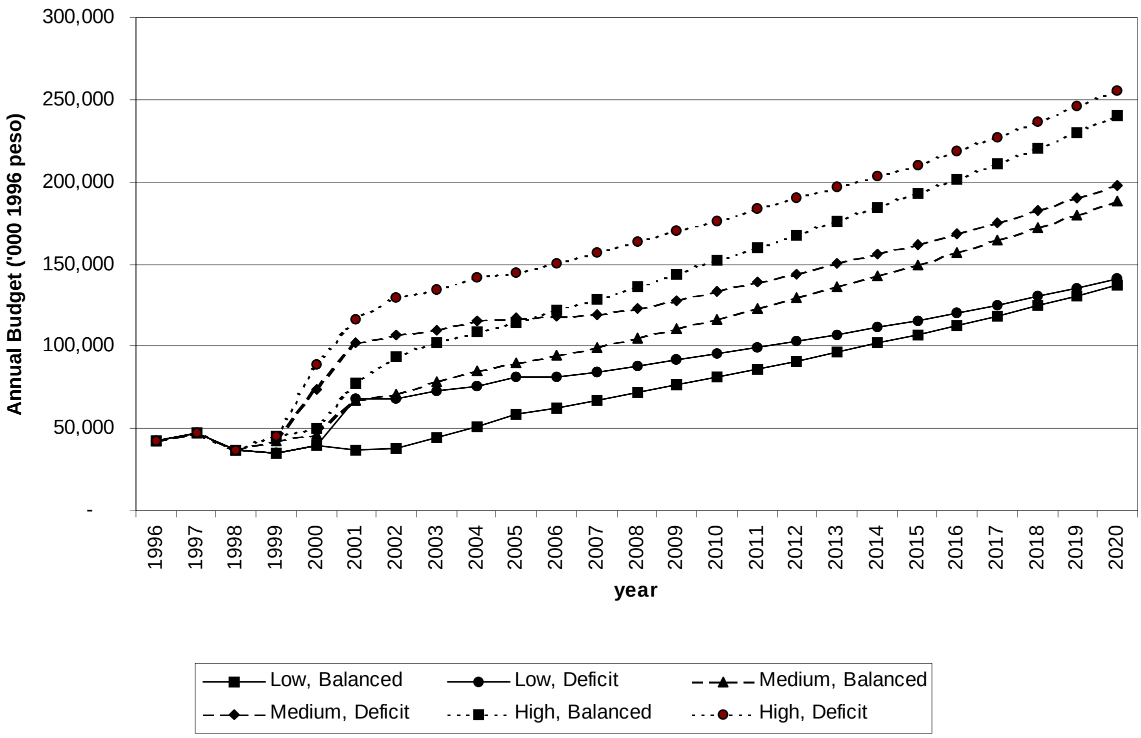
Table 13 shows the estimated proportion of PSLTI spending that has been in the Study Area, which varied between 12.6% and 31.7% in recent years, with the higher percentages attributable to LRTA spending on LRT2 from 1997 onwards. The wide range, with marked fluctuation from year to year, highlights a problem in estimating a spending trend for a relatively small area – transportation infrastructure projects usually involve spending a large amount of money over a short period. The annual amount spent in the Study Area is thus dependent on the individual projects being undertaken in each year.

Table 18
Budget and Infrastructure Investment Relative to National Macroeconomy

year	Government Expenditure as % of GDP						NG Infrastructure Spending as % of NG Spending					
	Low		Medium		High		Low		Medium		High	
	1	2	1	2	1	2	1	2	1	2	1	2
1997	20.3%	20.3%	20.3%	20.3%	20.3%	20.3%	10.2%	10.2%	10.2%	10.2%	10.2%	10.2%
1998	19.6%	19.6%	19.6%	19.6%	19.6%	19.6%	8.2%	8.2%	8.2%	8.2%	8.2%	8.2%
1999	19.6%	19.6%	19.5%	19.5%	19.5%	19.5%	7.8%	7.8%	9.2%	9.2%	9.8%	9.8%
2000	20.5%	20.5%	19.9%	22.1%	19.4%	22.4%	8.3%	8.3%	9.8%	14.0%	10.6%	16.2%
2001	20.0%	22.5%	21.0%	23.9%	21.0%	24.0%	7.9%	12.9%	12.9%	17.3%	14.4%	18.7%
2002	20.0%	22.7%	21.0%	24.0%	22.0%	24.9%	8.0%	12.6%	13.0%	17.2%	15.6%	19.2%
2003	20.0%	22.7%	21.0%	23.7%	22.0%	24.6%	9.1%	13.1%	13.6%	16.9%	16.1%	18.9%
2004	20.0%	22.5%	21.0%	23.7%	22.0%	24.7%	10.1%	13.1%	14.0%	16.9%	16.2%	18.8%
2005	20.0%	22.5%	21.0%	23.6%	22.0%	24.6%	10.9%	13.6%	14.1%	16.4%	16.3%	18.4%
2006	20.0%	22.3%	21.0%	23.4%	22.0%	24.5%	11.3%	13.2%	14.2%	16.0%	16.5%	18.3%
2007	20.0%	22.3%	21.0%	23.3%	22.0%	24.5%	11.7%	13.2%	14.4%	15.5%	16.7%	18.2%
2008	20.0%	22.3%	21.0%	23.3%	22.0%	24.5%	12.0%	13.2%	14.6%	15.4%	16.9%	18.1%
2009	20.0%	22.3%	21.0%	23.3%	22.0%	24.5%	12.3%	13.2%	14.8%	15.4%	17.0%	18.0%
2010	20.0%	22.3%	21.0%	23.3%	22.0%	24.4%	12.6%	13.2%	15.0%	15.4%	17.2%	18.0%
2011	20.0%	22.3%	21.0%	23.3%	22.0%	24.4%	12.8%	13.2%	15.2%	15.4%	17.3%	17.9%
2012	20.0%	22.3%	21.0%	23.3%	22.0%	24.4%	13.0%	13.2%	15.4%	15.4%	17.4%	17.8%
2013	20.0%	22.3%	21.0%	23.3%	22.0%	24.4%	13.2%	13.2%	15.5%	15.4%	17.5%	17.7%
2014	20.0%	22.3%	21.0%	23.3%	22.0%	24.3%	13.4%	13.2%	15.7%	15.4%	17.6%	17.6%
2015	20.0%	22.3%	21.0%	23.3%	22.0%	24.3%	13.6%	13.2%	15.8%	15.4%	17.7%	17.5%
2016	20.0%	22.3%	21.0%	23.3%	22.0%	24.3%	13.8%	13.2%	15.9%	15.4%	17.8%	17.5%
2017	20.0%	22.3%	21.0%	23.3%	22.0%	24.3%	13.9%	13.2%	16.1%	15.4%	17.9%	17.5%
2018	20.0%	22.3%	21.0%	23.3%	22.0%	24.3%	14.0%	13.2%	16.2%	15.4%	18.0%	17.5%
2019	20.0%	22.3%	21.0%	23.3%	22.0%	24.3%	14.2%	13.2%	16.3%	15.4%	18.1%	17.5%
2020	20.0%	22.3%	21.0%	23.3%	22.0%	24.3%	14.3%	13.2%	16.3%	15.4%	18.2%	17.5%

1 Balanced Budget
2 Deficit Financing

Figure 6
National Infrastructure Budget in Each Scenario



It would be possible to assume that spending continues at an average of past levels of spending. Over the period 1992-1998, the Study Area's share of known/budgeted spending has been:

- NG direct (DPWH, DOTC) – 17.3%;
- Total Public Sector – 20.6%; and
- Total Public Sector, excluding LRTA's "commercial" spending on LRT2 as a project which may be transferred to the private sector in the near future via the privatization of LRTA – 18.9%.

However, for reasons similar to those contributing to the recent fluctuations in annual spending in the Study Area, average future spending could be significantly higher or lower than that of the recent past.

Among reasons for future expenditure to be higher are:

1) Spending follows recent trends, but the percentages presented above area an under-estimate due to the lack of full data on the spending of DPWH PMOs, Municipalities and Cities from the historic analysis;

2) An increase in the proportion of spending on locally funded transportation projects in the Study Area because of the severe and high-profile traffic problems in Manila;
3) A similar bias towards Metro-Manila in the investment priorities of the Development Agencies funding FAPs; and
4) The availability of low interest foreign loans tied to the use of a particular equipment supplier – the higher technology projects which may attract this (MRT, LRT, elevated tollways etc.) will be concentrated in the Study Area.

Table 19
Transport Investment Budget Relative to National Macroeconomy

Low Growth - Double Shock | all values in '000,000 constant 1996 Peso

year	GDP		Government Expenditure as % of GDP				NG Infrastructure Spending as % of NG Spending				PSLTI Spending as % of NG Infrastrucutre Spending			
	growth pa		Balanced Budget		Deficit Financing		Balanced Budget		Deficit Financing		Balanced Budget		Deficit Financing	
1995	4.76%	2,078,578	19.5%	405,500	19.5%	405,500	11.5%	46,434	11.5%	46,434	34.1%	15,832	34.1%	15,832
1996	4.49%	2,171,900	19.2%	416,139	19.2%	416,139	10.3%	42,824	10.3%	42,824	53.0%	22,688	53.0%	22,688
1997	5.20%	2,284,839	20.3%	463,426	20.3%	463,426	10.2%	47,211	10.2%	47,211	51.5%	24,296	51.5%	24,296
1998	1.50%	2,319,111	19.6%	454,605	19.6%	454,605	8.2%	37,071	8.2%	37,071	73.6%	27,299	73.6%	27,299
1999	0.00%	2,319,111	19.6%	453,628	19.6%	453,628	7.8%	35,446	7.8%	35,446	52.5%	18,609	52.5%	18,609
2000	0.00%	2,319,111	20.5%	474,273	20.5%	474,273	8.3%	39,330	8.3%	39,330		20,648		20,648
2001	1.00%	2,342,302	20.0%	468,460	22.5%	526,416	7.9%	37,139	12.9%	67,855		19,498		35,624
2002	2.00%	2,389,149	20.0%	477,830	22.7%	541,796	8.0%	38,014	12.6%	68,125		19,957		35,766
2003	3.00%	2,460,823	20.0%	492,165	22.7%	559,300	9.1%	44,706	13.1%	73,043		23,471		38,348
2004	4.00%	2,559,256	20.0%	511,851	22.5%	576,465	10.1%	51,574	13.1%	75,615		27,077		39,698
2005	4.00%	2,661,626	20.0%	532,325	22.5%	600,085	10.9%	58,273	13.6%	81,893		30,594		42,994
2006	4.00%	2,768,091	20.0%	553,618	22.3%	617,751	11.3%	62,728	13.2%	81,461		32,932		42,767
2007	4.00%	2,878,815	20.0%	575,763	22.3%	642,461	11.7%	67,260	13.2%	84,719		35,311		44,478
2008	4.00%	2,993,967	20.0%	598,793	22.3%	668,159	12.0%	71,876	13.2%	88,108		37,735		46,257
2009	4.00%	3,113,726	20.0%	622,745	22.3%	694,886	12.3%	76,586	13.2%	91,633		40,207		48,107
2010	4.00%	3,238,275	20.0%	647,655	22.3%	722,681	12.6%	81,396	13.2%	95,298		42,733		50,031
2011	4.00%	3,367,806	20.0%	673,561	22.3%	751,588	12.8%	86,316	13.2%	99,110		45,316		52,033
2012	4.00%	3,502,518	20.0%	700,504	22.3%	781,652	13.0%	91,353	13.2%	103,074		47,960		54,114
2013	4.00%	3,642,619	20.0%	728,524	22.3%	812,918	13.2%	96,517	13.2%	107,197		50,671		56,278
2014	4.00%	3,788,324	20.0%	757,665	22.3%	845,435	13.4%	101,815	13.2%	111,485		53,453		58,530
2015	4.00%	3,939,857	20.0%	787,971	22.3%	879,252	13.6%	107,256	13.2%	115,944		56,309		60,871
2016	4.00%	4,097,451	20.0%	819,490	22.3%	914,422	13.8%	112,850	13.2%	120,582		59,246		63,306
2017	4.00%	4,261,349	20.0%	852,270	22.3%	950,999	13.9%	118,606	13.2%	125,405		62,268		65,838
2018	4.00%	4,431,803	20.0%	886,361	22.3%	989,039	14.0%	124,532	13.2%	130,422		65,380		68,471
2019	4.00%	4,609,075	20.0%	921,815	22.3%	1,028,600	14.2%	130,640	13.2%	135,639		68,586		71,210
2020	4.00%	4,793,438	20.0%	958,688	22.3%	1,069,744	14.3%	136,938	13.2%	141,064		71,893		74,059

Table 20
Transport Investment Budget Relative to National Macroeconomy

Medium Growth - Single Shock, Slow Growth Path — all values in '000,000 constant 1996 Peso

year	GDP		Government Expenditure as % of GDP				NG Infrastructure Spending as % of NG Spending				PSLTI Spending as % of NG Infrastrucutre Spending			
	growth pa		Balanced Budget		Deficit Financing		Balanced Budget		Deficit Financing		Balanced Budget		Deficit Financing	
1995	4.76%	2,078,578	19.5%	405,500	19.5%	405,500	11.5%	46,434	11.5%	46,434	34.1%	15,832	34.1%	15,832
1996	4.49%	2,171,900	19.2%	416,139	19.2%	416,139	10.3%	42,824	10.3%	42,824	53.0%	22,688	53.0%	22,688
1997	5.20%	2,284,839	20.3%	463,426	20.3%	463,426	10.2%	47,211	10.2%	47,211	51.5%	24,296	51.5%	24,296
1998	1.50%	2,319,111	19.6%	454,605	19.6%	454,605	8.2%	37,071	8.2%	37,071	73.6%	27,299	73.6%	27,299
1999	1.00%	2,342,302	19.5%	457,789	19.5%	457,789	9.2%	42,154	9.2%	42,154	50.0%	21,077	50.0%	21,077
2000	2.00%	2,389,149	19.9%	475,911	22.1%	527,720	9.8%	46,566	14.0%	74,025		23,283		37,013
2001	3.50%	2,472,769	21.0%	519,281	23.9%	590,242	12.9%	67,078	17.3%	102,166		33,539		51,083
2002	5.00%	2,596,407	21.0%	545,246	24.0%	623,569	13.0%	70,941	17.2%	107,434		35,470		53,717
2003	5.50%	2,739,210	21.0%	575,234	23.7%	648,505	13.6%	78,480	16.9%	109,664		39,240		54,832
2004	5.50%	2,889,866	21.0%	606,872	23.7%	684,173	14.0%	84,946	16.9%	115,696		42,473		57,848
2005	5.00%	3,034,359	21.0%	637,215	23.6%	714,795	14.1%	90,012	16.4%	117,537		45,006		58,768
2006	4.50%	3,170,906	21.0%	665,890	23.4%	743,176	14.2%	94,852	16.0%	118,665		47,426		59,332
2007	4.00%	3,297,742	21.0%	692,526	23.3%	768,930	14.4%	99,396	15.5%	119,042		49,698		59,521
2008	4.00%	3,429,651	21.0%	720,227	23.3%	799,687	14.6%	104,956	15.4%	123,372		52,478		61,686
2009	4.00%	3,566,838	21.0%	749,036	23.3%	831,674	14.8%	110,867	15.4%	128,307		55,433		64,153
2010	4.00%	3,709,511	21.0%	778,997	23.3%	864,941	15.0%	116,932	15.4%	133,439		58,466		66,719
2011	4.00%	3,857,891	21.0%	810,157	23.3%	899,539	15.2%	123,162	15.4%	138,777		61,581		69,388
2012	4.00%	4,012,207	21.0%	842,563	23.3%	935,520	15.4%	129,567	15.4%	144,328		64,784		72,164
2013	4.00%	4,172,695	21.0%	876,266	23.3%	972,941	15.5%	136,159	15.4%	150,101		68,079		75,050
2014	4.00%	4,339,603	21.0%	911,317	23.3%	1,011,859	15.7%	142,946	15.4%	156,105		71,473		78,052
2015	4.00%	4,513,187	21.0%	947,769	23.3%	1,052,333	15.8%	149,942	15.4%	162,349		74,971		81,174
2016	4.00%	4,693,715	21.0%	985,680	23.3%	1,094,426	15.9%	157,156	15.4%	168,843		78,578		84,421
2017	4.00%	4,881,463	21.0%	1,025,107	23.3%	1,138,204	16.1%	164,601	15.4%	175,597		82,301		87,798
2018	4.00%	5,076,722	21.0%	1,066,112	23.3%	1,183,732	16.2%	172,289	15.4%	182,620		86,145		91,310
2019	4.00%	5,279,791	21.0%	1,108,756	23.3%	1,231,081	16.3%	180,232	15.4%	189,925		90,116		94,963
2020	4.00%	5,490,983	21.0%	1,153,106	23.3%	1,280,324	16.3%	188,442	15.4%	197,522		94,221		98,761

Table 21
Transport Investment Budget Relative to National Macroeconomy

High Growth - Single Shock, Fast Growth Path — all values in '000,000 constant 1996 Peso

year	GDP		Government Expenditure as % of GDP				NG Infrastructure Spending as % of NG Spending				PSLTI Spending as % of NG Infrastrucutre Spending			
	growth pa		Balanced Budget		Deficit Financing		Balanced Budget		Deficit Financing		Balanced Budget		Deficit Financing	
1995	4.76%	2,078,578	19.5%	405,500	19.5%	405,500	11.5%	46,434	11.5%	46,434	34.1%	15,832	34.1%	15,832
1996	4.49%	2,171,900	19.2%	416,139	19.2%	416,139	10.3%	42,824	10.3%	42,824	53.0%	22,688	53.0%	22,688
1997	5.20%	2,284,839	20.3%	463,426	20.3%	463,426	10.2%	47,211	10.2%	47,211	51.5%	24,296	51.5%	24,296
1998	1.50%	2,319,111	19.6%	454,605	19.6%	454,605	8.2%	37,071	8.2%	37,071	73.6%	27,299	73.6%	27,299
1999	2.00%	2,365,494	19.5%	462,028	19.5%	462,028	9.8%	45,360	9.8%	45,360	47.5%	21,546	47.5%	21,546
2000	4.00%	2,460,113	19.4%	477,647	22.4%	550,204	10.6%	50,642	16.2%	89,098		24,055		42,322
2001	5.00%	2,583,119	21.0%	542,455	24.0%	619,722	14.4%	77,898	18.7%	116,111		37,001		55,153
2002	5.50%	2,725,191	22.0%	599,542	24.9%	678,588	15.6%	93,433	19.2%	130,123		44,381		61,809
2003	6.00%	2,888,702	22.0%	635,514	24.6%	709,304	16.1%	102,280	18.9%	134,057		48,583		63,677
2004	5.50%	3,047,581	22.0%	670,468	24.7%	751,988	16.2%	108,524	18.8%	141,614		51,549		67,267
2005	5.00%	3,199,960	22.0%	703,991	24.6%	785,804	16.3%	114,573	18.4%	144,552		54,422		68,662
2006	4.90%	3,356,758	22.0%	738,487	24.5%	823,510	16.5%	121,758	18.3%	150,761		57,835		71,612
2007	4.80%	3,517,882	22.0%	773,934	24.5%	862,201	16.7%	129,102	18.2%	157,080		61,324		74,613
2008	4.70%	3,683,222	22.0%	810,309	24.5%	901,845	16.9%	136,601	18.1%	163,500		64,886		77,663
2009	4.60%	3,852,651	22.0%	847,583	24.5%	942,409	17.0%	144,250	18.0%	170,012		68,519		80,756
2010	4.50%	4,026,020	22.0%	885,724	24.4%	983,852	17.2%	152,044	18.0%	176,607		72,221		83,888
2011	4.40%	4,203,165	22.0%	924,696	24.4%	1,026,133	17.3%	159,975	17.9%	183,272		75,988		87,054
2012	4.30%	4,383,901	22.0%	964,458	24.4%	1,069,202	17.4%	168,037	17.8%	189,998		79,818		90,249
2013	4.20%	4,568,025	22.0%	1,004,965	24.4%	1,113,008	17.5%	176,222	17.7%	196,773		83,706		93,467
2014	4.10%	4,755,314	22.0%	1,046,169	24.3%	1,157,493	17.6%	184,522	17.6%	203,583		87,648		96,702
2015	4.00%	4,945,526	22.0%	1,088,016	24.3%	1,202,596	17.7%	192,926	17.5%	210,417		91,640		99,948
2016	4.00%	5,143,347	22.0%	1,131,536	24.3%	1,250,700	17.8%	201,765	17.5%	218,833		95,838		103,946
2017	4.00%	5,349,081	22.0%	1,176,798	24.3%	1,300,728	17.9%	210,904	17.5%	227,587		100,179		108,104
2018	4.00%	5,563,045	22.0%	1,223,870	24.3%	1,352,757	18.0%	220,358	17.5%	236,690		104,670		112,428
2019	4.00%	5,785,566	22.0%	1,272,825	24.3%	1,406,867	18.1%	230,142	17.5%	246,158		109,317		116,925
2020	4.00%	6,016,989	22.0%	1,323,738	24.3%	1,463,142	18.2%	240,271	17.5%	256,004		114,129		121,602

Conversely, reasons for future Public Sector spending to be at a lower relative level than in recent years include:

1) The continuing transfer of responsibility for certain types of project to the private sector (privatization of LRTA, PNR, BOT toll ways rather than DPWH highways etc.);

2) A lower priority being accorded to the Land Transportation sector than the 47-53% of infrastructure spending assumed; and

3) A bias in NG/FAP investment priorities towards the Regions, either because of the increasing substitution of private investment for public investment within the Study Area, or as part of a policy shift to promote decentralization[14].

A range of alternative is advanced as measures with which to apportion National PSLTI to the Study Area on an empirical basis:

- NCR population / national population;
- Study Area population / national population;
- NCR GRDP / GDP; and
- Study Area GRDP / GDP.

Estimates based on these measures produced a very wide range of forecasts. For each economic/ fiscal sub-scenario a best estimate of the funds available was made: the average of estimates based on NCR GRDP and the Study Area population. On this basis some 27% to 29% of PSLTI spending will be in the Study Area, rising over time as the Study Area grows faster than the country as a whole.

This compares with the "observed" rate of 21% over the 1992-1998 period (peaking at 31% in 1997). Given the likely underestimation of DPWH spending in the historic data, and proposals for a number of high cost projects to be undertaken by agencies currently in the public sector (LRT1/6 extension, LRT2 extension, NorthRail, etc.), this appears a reasonable estimate.

Table 22 summarizes potential Public Sector (NG, LGU, GOCC) investment spending possible in each scenario, subdivided into administrative periods. More detail of the derivation of these sums, together with estimates of potential spending in US$ terms[15], is given in Table 23 (Low growth), 24 (Medium growth), and 25 (High growth), which extend the analysis of Tables 19, 20 and 21.

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[14] A successful decentralization policy would also result in less people, economic activity, and traffic in the Study Area than has been assumed in the MMUTIS Socio-economic framework and in estimates of future transport demand.

[15] Conversion is at P40 = $1, rather lower than the present rate of 42-44, as the Peso appears "over-sold" at present in comparison to other regional currencies and the long-run rate will rise as confidence returns to the economy.

Table 22
Best-estimate Budget Envelope by Growth Scenario

(m 1996 Peso)

Scenario		1999-2004	2005-2010	2011-2020
Low Growth	Balanced Budget	35,674	61,369	165,929
	Deficit Financing	52,064	76,760	178,343
Medium Growth	Balanced Budget	53,824	86,240	220,499
	Deficit Financing	76,037	103,459	237,829
High Growth	Balanced Budget	62,676	106,006	269,222
	Deficit Financing	86,035	127,792	294,154

These appear to be substantial sums, particularly when compared to historic levels of expenditure. However, the cost of some of the projects currently in progress or in the pipeline for the Study Area, particularly elevated roads and mass transits, is also high. The (private sector) budgets for Skyway and MRT3 are equivalent to nearly 1.5bn Peso per km., while the multi-articulated LRV favoured in Manila cost around P40m each.

Future Private Sector Infrastructure Investment

The future level of infrastructure investment by the Private Sector is more difficult to forecast. Private investment is not made in response to pressing socio-economic need or the availability of funds, but to make a profitable return on the investment.

All Private Sector investment in transportation infrastructure in the Philippines currently involves the issue of a license or franchise by the Government or one of its agents. The future level of spending will be influenced by the number of franchises let, and the terms on which they are offered as well as by the level of market demand for the resulting transportation services.

Two public-private joint ventures and a Build-Lease-Transfer (BLT) franchise are under construction in the Study Area. Most major expressway and L/MRT proposals for the Study Area are now being packaged as BOT franchises with varying degrees of private sector involvement. Table 8 reports actual and planned expenditure on these schemes of between 10bn and 21bn Peso for 1997 to 1999, more than public sector expenditure in those years.

If expenditure on LRT2, being undertaken by the Public Sector but on a commercial basis, is also taken into account, expenditure on the four schemes currently under construction which will ultimately be paid for by their users (via fares or tolls) greatly exceeds the residual expenditure on "pure" Public Sector projects, funded from general taxation. Table 26 illustrates this development.6

Table 23
Study Area Public Sector Transport Investment Budget

year	PSLTI Spending as % of NG Infrastrucutre Spending				NCR Share of		Study Area share of		Median	PSLTI Spending for Study Area			
	Balanced Budget		Deficit Financing		population	GDP	population	GDP	Share	Balanced Budget		Deficit Financing	
										1996 Peso	$	1996 Peso	$
1995	34.1%	15,832	34.1%	15,832	13.8%	32.5%	20.9%	44.9%	26.7%				
1996	53.0%	22,688	53.0%	22,688	13.7%	32.8%	21.4%	45.8%	27.1%				
1997	51.5%	24,296	51.5%	24,296	13.9%	33.0%	21.5%	46.2%	27.3%	6,625		6,625	
1998	73.6%	27,299	73.6%	27,299	14.1%	33.0%	21.7%	48.2%	27.3%	7,464		7,464	
1999	52.5%	18,609	52.5%	18,609	14.2%	33.0%	21.8%	50.9%	27.4%	5,101	127.5	5,101	127.5
2000		20,648		20,648	14.4%	33.0%	22.0%	53.6%	27.5%	5,674	141.9	5,674	141.9
2001		19,498		35,624	14.2%	33.0%	22.1%	55.7%	27.5%	5,370	134.3	9,811	245.3
2002		19,957		35,766	14.1%	33.0%	22.2%	57.2%	27.6%	5,508	137.7	9,871	246.8
2003		23,471		38,348	14.0%	33.0%	22.3%	58.0%	27.7%	6,491	162.3	10,605	265.1
2004		27,077		39,698	13.8%	33.0%	22.4%	58.2%	27.7%	7,503	187.6	11,000	275.0
									sub-total	35,647	891.2	52,064	1,301.6
2005		30,594		42,994	13.7%	33.0%	22.5%	58.3%	27.8%	8,493	212.3	11,936	298.4
2006		32,932		42,767	13.6%	33.0%	22.7%	59.0%	27.8%	9,167	229.2	11,905	297.6
2007		35,311		44,478	13.4%	33.0%	22.8%	59.5%	27.9%	9,856	246.4	12,414	310.4
2008		37,735		46,257	13.3%	33.0%	23.0%	59.9%	28.0%	10,559	264.0	12,943	323.6
2009		40,207		48,107	13.2%	33.0%	23.1%	60.2%	28.1%	11,278	282.0	13,494	337.4
2010		42,733		50,031	13.1%	33.0%	23.2%	60.3%	28.1%	12,015	300.4	14,067	351.7
									sub-total	61,369	1,534.2	76,760	1,919.0
2011		45,316		52,033	13.0%	33.0%	23.4%	60.4%	28.2%	12,776	319.4	14,669	366.7
2012		47,960		54,114	12.9%	33.0%	23.5%	60.4%	28.3%	13,557	338.9	15,296	382.4
2013		50,671		56,278	12.9%	33.0%	23.7%	60.3%	28.3%	14,359	359.0	15,948	398.7
2014		53,453		58,530	12.8%	33.0%	23.8%	60.1%	28.4%	15,185	379.6	16,627	415.7
2015		56,309		60,871	12.7%	33.0%	24.0%	59.8%	28.5%	16,034	400.9	17,333	433.3
2016		59,246		63,306	12.6%	33.0%	24.1%	59.5%	28.6%	16,919	423.0	18,078	452.0
2017		62,268		65,838	12.6%	33.0%	24.3%	59.1%	28.6%	17,831	445.8	18,853	471.3
2018		65,380		68,471	12.5%	33.0%	24.4%	58.6%	28.7%	18,773	469.3	19,661	491.5
2019		68,586		71,210	12.5%	33.0%	24.6%	58.1%	28.8%	19,745	493.6	20,501	512.5
2020		71,893		74,059	12.4%	33.0%	24.7%	57.5%	28.9%	20,750	518.8	21,375	534.4
									sub-total	165,929	4,148.2	178,343	4,458.6
									Total	262,946	6,573.6	307,166	7,679.1

Table 24
Study Area Public Sector Transport Investment Budget

year	PSLTI Spending as % of NG Infrastrucutre Spending				NCR Share of		Study Area share of		Median	PSLTI Spending for Study Area			
	Balanced Budget		Deficit Financing		population	GDP	population	GDP	Share	Balanced Budget		Deficit Financing	
										1996 Peso	$	1996 Peso	$
1995	34.1%	15,832	34.1%	15,832	13.8%	32.5%	20.9%	44.9%	26.7%				
1996	53.0%	22,688	53.0%	22,688	13.7%	32.8%	21.4%	46.1%	27.1%				
1997	51.5%	24,296	51.5%	24,296	13.9%	33.0%	21.5%	46.8%	27.3%	6,625		6,625	
1998	73.6%	27,299	73.6%	27,299	14.1%	33.0%	21.7%	49.0%	27.3%	7,464		7,464	
1999	50.0%	21,077	50.0%	21,077	14.2%	33.0%	21.8%	51.4%	27.4%	5,778	144.4	5,778	144.4
2000		23,283		37,013	14.4%	33.0%	22.0%	53.3%	27.5%	6,398	160.0	10,171	254.3
2001		33,539		51,083	14.2%	33.0%	22.1%	54.2%	27.5%	9,237	230.9	14,069	351.7
2002		35,470		53,717	14.1%	33.0%	22.2%	54.3%	27.6%	9,790	244.7	14,826	370.6
2003		39,240		54,832	14.0%	33.0%	22.3%	53.9%	27.7%	10,852	271.3	15,164	379.1
2004		42,473		57,848	13.8%	33.0%	22.4%	53.5%	27.7%	11,769	294.2	16,029	400.7
									sub-total	53,824	1,345.6	76,037	1,900.9
2005		45,006		58,768	13.7%	33.0%	22.5%	53.2%	27.8%	12,494	312.4	16,315	407.9
2006		47,426		59,332	13.6%	33.0%	22.7%	53.9%	27.8%	13,202	330.1	16,517	412.9
2007		49,698		59,521	13.4%	33.0%	22.8%	54.7%	27.9%	13,871	346.8	16,613	415.3
2008		52,478		61,686	13.3%	33.0%	23.0%	55.4%	28.0%	14,684	367.1	17,261	431.5
2009		55,433		64,153	13.2%	33.0%	23.1%	55.9%	28.1%	15,549	388.7	17,995	449.9
2010		58,466		66,719	13.1%	33.0%	23.2%	56.4%	28.1%	16,439	411.0	18,759	469.0
									sub-total	86,240	2,156.0	103,459	2,586.5
2011		61,581		69,388	13.0%	33.0%	23.4%	56.7%	28.2%	17,361	434.0	19,562	489.1
2012		64,784		72,164	12.9%	33.0%	23.5%	56.9%	28.3%	18,312	457.8	20,398	510.0
2013		68,079		75,050	12.9%	33.0%	23.7%	57.0%	28.3%	19,293	482.3	21,268	531.7
2014		71,473		78,052	12.8%	33.0%	23.8%	57.0%	28.4%	20,304	507.6	22,173	554.3
2015		74,971		81,174	12.7%	33.0%	24.0%	56.9%	28.5%	21,348	533.7	23,115	577.9
2016		78,578		84,421	12.6%	33.0%	24.1%	56.8%	28.6%	22,439	561.0	24,108	602.7
2017		82,301		87,798	12.6%	33.0%	24.3%	56.5%	28.6%	23,568	589.2	25,142	628.6
2018		86,145		91,310	12.5%	33.0%	24.4%	56.2%	28.7%	24,735	618.4	26,218	655.5
2019		90,116		94,963	12.5%	33.0%	24.6%	55.9%	28.8%	25,944	648.6	27,339	683.5
2020		94,221		98,761	12.4%	33.0%	24.7%	55.5%	28.9%	27,195	679.9	28,505	712.6
									sub-total	220,499	5,512.5	237,829	5,945.7
									Total	360,563	9,014.1	417,326	10,433.2

Table 25
Study Area Public Sector Transport Investment Budget

High Growth - Single Shock, Fast Growth Path

year	PSLTI Spending as % of NG Infrastrucutre Spending				NCR Share of		Study Area share of		Median	PSLTI Spending for Study Area			
	Balanced Budget		Deficit Financing		population	GDP	population	GDP	Share	Balanced Budget		Deficit Financing	
										1996 Peso	$	1996 Peso	$
1995	34.1%	15,832	34.1%	15,832	13.8%	32.5%	20.9%	44.9%	26.7%				
1996	53.0%	22,688	53.0%	22,688	13.7%	32.8%	21.4%	47.1%	27.1%				
1997	51.5%	24,296	51.5%	24,296	13.9%	33.0%	21.5%	48.8%	27.3%	6,625		6,625	
1998	73.6%	27,299	73.6%	27,299	14.1%	33.0%	21.7%	51.9%	27.3%	7,464		7,464	
1999	47.5%	21,546	47.5%	21,546	14.2%	33.0%	21.8%	54.0%	27.4%	5,906	147.7	5,906	147.7
2000		24,055		42,322	14.4%	33.0%	22.0%	55.5%	27.5%	6,611	165.3	11,630	290.8
2001		37,001		55,153	14.2%	33.0%	22.1%	56.3%	27.5%	10,191	254.8	15,190	379.7
2002		44,381		61,809	14.1%	33.0%	22.2%	56.7%	27.6%	12,249	306.2	17,059	426.5
2003		48,583		63,677	14.0%	33.0%	22.3%	56.5%	27.7%	13,436	335.9	17,610	440.3
2004		51,549		67,267	13.8%	33.0%	22.4%	56.5%	27.7%	14,284	357.1	18,639	466.0
									sub-total	62,676	1,566.9	86,035	2,150.9
2005		54,422		68,662	13.7%	33.0%	22.5%	56.6%	27.8%	15,108	377.7	19,061	476.5
2006		57,835		71,612	13.6%	33.0%	22.7%	57.2%	27.8%	16,100	402.5	19,935	498.4
2007		61,324		74,613	13.4%	33.0%	22.8%	57.7%	27.9%	17,116	427.9	20,825	520.6
2008		64,886		77,663	13.3%	33.0%	23.0%	58.1%	28.0%	18,156	453.9	21,731	543.3
2009		68,519		80,756	13.2%	33.0%	23.1%	58.4%	28.1%	19,220	480.5	22,652	566.3
2010		72,221		83,888	13.1%	33.0%	23.2%	58.6%	28.1%	20,306	507.7	23,587	589.7
									sub-total	106,006	2,650.1	127,792	3,194.8
2011		75,988		87,054	13.0%	33.0%	23.4%	58.7%	28.2%	21,423	535.6	24,543	613.6
2012		79,818		90,249	12.9%	33.0%	23.5%	58.8%	28.3%	22,562	564.0	25,510	637.8
2013		83,706		93,467	12.9%	33.0%	23.7%	58.8%	28.3%	23,721	593.0	26,487	662.2
2014		87,648		96,702	12.8%	33.0%	23.8%	58.8%	28.4%	24,899	622.5	27,471	686.8
2015		91,640		99,948	12.7%	33.0%	24.0%	58.7%	28.5%	26,095	652.4	28,461	711.5
2016		95,838		103,946	12.6%	33.0%	24.1%	58.6%	28.6%	27,368	684.2	29,684	742.1
2017		100,179		108,104	12.6%	33.0%	24.3%	58.4%	28.6%	28,688	717.2	30,957	773.9
2018		104,670		112,428	12.5%	33.0%	24.4%	58.1%	28.7%	30,055	751.4	32,282	807.1
2019		109,317		116,925	12.5%	33.0%	24.6%	57.8%	28.8%	31,472	786.8	33,662	841.5
2020		114,129		121,602	12.4%	33.0%	24.7%	57.4%	28.9%	32,941	823.5	35,098	877.4
									sub-total	269,222	6,730.6	294,154	7,353.9
									Total	437,904	10,947.6	507,981	12,699.5

Table 26
Expenditure on Projects to be Paid for by Users or Taxpayers

(million current Peso)

Year	Private/ JV	LRT2	Total "User Pays"	Pure Public	Pure Public as % of Total Exp.
1996	4,484		4,484	2,865	39%
1997	9,960	1,200	11,160	6,981	38%
1998	21,115	1,500	22,650	5,353	19%
1999	15,910	4,000	19,910	4,443	18%

It is likely that this pattern will continue for a number of years. BESF now contains a list of projects that are the subject of:

- Negotiations with the Private Sector as a BOT franchise (or one of the many variants on identified in the Amended BOT Law, RA 7718);
- An unsolicited bid from the Private Sector; or
- Proposed for bidding.

BESF99 identifies a number of transport related projects which will be wholly or partly within the Study Area on which construction has yet to start or a successful bid has yet to be selected. Table 27 lists these projects, indicating their: status; expected construction period; implied average annual spending (on the transport element within the Study Area).

Table 4.27
Official List of Pending Transportation BOT Projects in Study Area

Project	Status	Construction Period	Average Spend per Year (Pbn)
Pabahay Sa Riles	PNR – JV	1996-2000	1.83*
Manila-Subic Expressway	Unsolicited bid, FPIDC/PNCC - JV	1998-2002	1.97
R4/R5 (Pasig) Expressway	Unsolicited Bid, Stradec/Marubeni/ Kumagai Gumi/PNCC – BOT	1999-2002	7.85
LRT4	Unsolicited Bid, Bouyges/Systra/ Ayala – BTO	1999-2001	13.76
MCX Commuter Rail South	Ayala – BT / BOO	1999-2001	7.17
C3 South Section	Unsolicited Bid, Mancon/ CBDC – BOT	1999-2001	1.38
Northrail	BCDA – JV	2000-2002	9.17
	Total Annual Average		41.3*

* As it is considered unlikely that the transport part of Pabahay sa Riles will be built, it is not included in the total annual average.

Were all these schemes to proceed according to their proposed schedule, the average annual spending would be 35.5bn. (1996) Peso. This is double the combined level of expenditure planned for LRT2, MRT3, Skyway and Cavite Expressway in 1999, and six times higher than the average Public Sector budget possible for the current (1999-2004) Medium Term Development Plan period under the Low growth – Balance Budget scenario developed above and presented in Table 23.

Further schemes with BOT potential are identified in the MMUTIS Master-Plan presented in the Interim Report:

- Skyway stages II and III
- R10/C3 (north) Expressway
- R7 Expressway
- C5 Expressway (alternatively, C6 Expressway unsolicited bid from PNCC)
- MRT3 north extension
- MRT3 south extension
- LRT4 extension
- LRT6 (LRT1 south extension)

None of these schemes will have a zero cost to the Public Sector, and there is a danger that, in the Low growth scenario, the public element of the construction cost of BOT projects could consume the entire PSLTI budget for the Study Area.

APPENDIX II

TECHNICAL NOTES/MATERIALS

LONG TERM FINANCIAL VIABILITY IN THE MANILA BUS AND JEEPNEY INDUSTRY

3. LONG TERM FINANCIAL VIABILITY IN THE MANILA BUS AND JEEPNEY INDUSTRY

3.1 Introduction

A detailed analysis has been undertaken of the cost and revenue streams for typical bus and jeepney operations in Manila. This combined:

- load factor data from the MMUTIS bus and jeepney surveys;
- average vehicle speed data from the MMUTIS bus and jeepney surveys;
- average (passenger) trip length data from the MMUTIS bus and jeepney surveys;
- LTFRB tariff schedules; and
- output from the MMUTIS vehicle operating cost model.

Estimates of average revenue and cost per km run were made. These were also compared, to estimate the financial viability of the services, both collectively and on individual routes.

The analysis indicated that, with the current tariff schedules and typical Manila traffic conditions, there are limited circumstances in which revenue on ordinary (non-air-conditioned) bus services can cover both day-to-day operating expenses and justify replacement of the vehicle when it is life-expired. Long-run financial viability may also be a problem for a number of jeepney routes, typically those covering a long distance and with long average passenger trip lengths.

These problems are partly attributable to the traditional tariff structure applied to the heavily regulated ordinary services in the Philippines, and partly to operating conditions in most of the NCR. As noted elsewhere in MMUTIS reports, traffic conditions are unlikely to improve substantially in the next 20 years, and may worsen if transport demand management measures are not successful and there is insufficient funding to implement the recommended investment program.

3.2 Revenue and Cost Streams

The current tariff structure for Jeepney services is shown in Figure 1 (that for ordinary buses is almost identical). It comprises a boarding charge of P2.5 that covers trips of up to 4km, and a marginal charge of P0.475 per km thereafter. The longer the trip, the lower the average fare per passenger km. Revenue only arises with distance travelled, there is no time charge like that included in taxi fares.

While revenue arises solely from passenger km, cost has large fixed and time related elements. In distance terms, the lower the average operating speed, the higher the effective cost per vehicle km. In time terms, the lower the average operating speed, the lower the possible revenue per vehicle km

Figures 2 (Jeepney), 3 (New Ordinary Bus) and 4 (Re-conditioned Ordinary Bus) compare cost (heavy line) with potential revenue (light line) per hour run, at different average speeds and load factors. Cost is the full cost of owning and operating the vehicle (including depreciation and return on capital invested) over the vehicle's useful lifetime, divided by an estimate of the lifetime hours run for each average speed. Revenue is based on marginal rate per km in the LTFRB schedule.

On these cost and revenue assumptions Jeepney operation is not profitable at average speeds below 9km/hr, even with a 100% load. Break-even can be achieved at 20km/hr with a 75% load factor.

New Bus operation is viable at speeds as low as 7km/hr with a full load, but requires average speed above 17km/hr if load factor is only 75%, and is never profitable with only a 50% load factor.

If bus services are operated using imported second-hand vehicles re-conditioned in the Philippines, maintenance costs are higher, but depreciation and return on capital required are lower. Such services are profitable at average speeds as low as 5km/hr provided all places are taken for the entire journey, and 8km/hr with a 75% load factor, but are still not viable at a 50% load factor at any speed likely to be encountered on "City" operations.

Tariffs for air-conditioned services (including recently legalised air-conditioned paratransit services using Tamaraw FX vans) are less regulated. Operators are effectively free to charge what the market will bear. Such services appear to be extremely profitable, with new vehicles and routes being introduced[1].

3.3 Achieving Financial Viability

Despite the apparent lack of profitability indicated above, there is no shortage of ordinary bus and jeepney services in Manila. Its operators consider each sub-mode profitable, but the mechanisms for achieving profitability differ. Both mechanisms benefit some passengers, as well as the operators, but bring dis-benefits to other passengers and to the urban population as a whole.

Jeepney

Jeepney operations are financially viable because the typical Manila route is achieving an average fare per passenger km significantly higher than the LTFRB marginal tariff used to calculate revenue in Figure 2. As Figure 1 shows, the boarding charge is now more than four times the marginal tariff, and average fare per km will be higher than the marginal rate used in Figure 2 for all trips[2]. Even a 10km trip involves an average fare of P0.52km. Further, the average trip length observed in the MMUTIS jeepney survey is only 3.53km. The minimum fare must still be paid, so the average fare is at least P0.7/km[3].

[1] At the time of the MMUTIS surveys there were 229 AC routes in the Study Area, and only 144 Ordinary. The respective levels of daily activity were (Ordinary in parentheses): Vehicle trips 19,576 (13,368); Vehicle km 654,481 (471,701); Person trips 1,835,681 (1,369,767); Passenger km 25,207,877 (17,192,547). It is understood that AC has increased its share of the market in the following 15 months.

[2] The situation is similar regarding bus fares, but the marginal tariff is P0.49/km.

[3] It is probably higher. An average trip length of 6km implies revenue of around P3.5 per passenger, but if it arose due to a 50:50 mix of 1km (revenue P2.5) and 11km (revenue P6.0) passengers, the actual average revenue is P4.25.

At these average fares the break-even speed will be higher, or the required load factor lower, than indicated in Figure 2. Figures 5, 6 and 7 show the impact of average trip lengths of 10, 4 and 2.5km respectively on the financial viability of jeepney operation.

For the 10km trip, 7.5km/hr is adequate with a full load, while a 75% load is profitable at 15.5km/hr. With trip length of 4km (above the city-wide average) a full load breaks even at only 5km/hr (a speed at which it may be faster, if less convenient, for the passengers to walk) and a 75% load at 9km/hr.

For trips shorter than 4km, the increase in average fare is exponential, as shown in Figure 1. At 2.5km (=P1/km) a 75% load is profitable at only 4km/hr (the practical lower limit for commercial operations) and a 50% load profitable if average speed exceeds 8km/hr.

At the time of the MMUTIS survey (before the December 1996 tariff revision) the boarding charge was P1.5 and the marginal tariff P0.415. The boarding charge was less than 4x the marginal tariff, fare/km was at a minimum at 4km and lower than the LTFRB marginal rate for all longer trips. Immediately prior to the December 1996 tariff revision, only 20% of surveyed routes were potentially financially viable, almost all of these were shorter than 4km, guaranteeing a high fare per passenger km.

The overall pattern of jeepney operations in Manila reflects the greater financial viability of catering to short trips implicit in the tariff structure. Of 569 routes fully surveyed, 148 were less than 4km long. On a further 245 routes the average trip length observed was less than 4km. The hop-on hop-off convenience of the jeepney does make it attractive for short trips, but it would seem that Jeepney financial viability is being achieved by failing to cater to potential longer distance passengers as non-viable (usually longer) routes are abandoned. While the number of jeepneys in operation within Manila is estimated to have risen by 118% between 1983 and 1996, the number of routes fell by 38% over the same period.

Table 1 summarises surveyed passenger activity on jeepneys, in total and dis-aggregated by length of trip.

Table 1
Analysis of Passenger Trips by Jeepney

Measure	All Routes	Routes less than 4km long	Routes > 4km, but average trip < 4km	Other Routes
share of routes	100%	26%	43%	31%
share of vehicle trips	100%	31%	44%	25%
share of vehicle km	100%	10%	45%	45%
share of passenger trips	100%	22%	53%	25%
share of passenger km	100%	9%	42%	49%
average trip length	3.53km	1.40km	2.79km	6.91km
load factor	62%	54%	58%	69%
average speed	10.80km/hr	7.95km/hr	9.12km/hr	14.67km/hr
average fare – 11/96	P0.51/pkm	P1.07/pkm	P0.54/pkm	P0.39/pkm
average fare – 12/96	P0.67/pkm	P1.43/pkm	P0.72/pkm	P0.49/pkm
increase	31.4%	33.6%	33.3%	25.6%
average fare – 10/97	P0.81/pkm	P1.78/pkm	P0.90/pkm	P0.56/pkm
increase	20.8%	25%	25%	14.3%

It can be seen that 75% of vehicle trips and 75% of passenger trips (but only 55% of vehicle km and 51% passenger km) were on routes where average trip length was below 4km. It can also be seen that the routes with long average trip lengths and low revenue per passenger km operate with much higher load factors and at much higher speeds than the “short-trip” routes. This is in line with the theoretical conditions for viability indicated in Figures 2, 5, 6 and 7.

Following the recent tariff increases, jeepney operation in the Study Area is calculated to be in overall financial surplus, as might be expected after the average fare has risen 59% in 11 months. However, it can also be seen that the impact of these particular tariff increases was greatest (66%) for those routes which already had the potential for financial viability in November 1996, and least (43%) for those routes in the greatest difficulty.

Short route operation, even in Manila traffic conditions, can now be extremely profitable, some respondents to the MMUTIS jeepney operators survey reporting net income (profit) of over P1,000 per day. On most routes this excess profit is dissipated by operating far more vehicles than the route actually needs, even at times of peak demand or traffic congestion. It is not uncommon for vehicles to queue for 30 minutes or more at terminals to reach the loading point, making less than one round trip (revenue potential P80-100) per hour even on short services.

Although road based public transport in Manila is wholly provided by profit-making private sector services, fares are extremely low compared to other countries (even those where transport services are provided by a heavily subsidised public sector organisation). Nevertheless, short-trip jeepney passengers would seem to be paying higher fares than necessary to maintain an excessive number of vehicles on some routes, the surplus vehicles also causing congestion at terminals when not in use.

While there will be some travellers who benefit from the concentration of vehicles on fewer (high frequency) routes, many will be disadvantaged by the lack of a direct route, having to change vehicles[4] and pay a minimum of P5 for a trip that could be made on a single vehicle for P3 or 4. In addition to the inconvenience to many passengers, other road users are disadvantaged. More short trips mean more boarding and alighting movements, with stationary vehicles blocking the road, particularly at intersections.

Some of the seemingly surplus vehicles on short routes could usefully be switched to new routes that could cater for a journey in one vehicle trip rather than two or more. This would involve the authorities in franchising new routes, and in re-franchising vehicles, but the availability of a route franchise from LTO only constitutes a permit to operate, it imposes no compulsion to do so.

There therefore has to be a rationalisation of the tariff structure, as well as the route network, to improve the effectiveness of jeepney services in meeting future transport needs.

Ordinary Bus

While there are a few short routes at high average fare per passenger km for ordinary bus, the average trip length in the MMUTIS database is 12.5km, and bus operators experience fares close to the LTFRB marginal rate shown in Figures 3 and 4. With no revenue enhancement possible, the survival mechanism involves cutting costs.

One option is to use re-conditioned buses, as shown in Figure 3. An alternative is to lower the depreciation element of costs by retaining the bus in service longer – a number of the “Love-buses” introduced in the early 1980s are still in operation. Either option results in a

[4] Even with fewer routes, the number of Jeepney terminals rose 14% between 1983 and 1996.

low quality of service for passengers, and a poor environment for other road users, with frequent breakdowns and air pollution from poorly maintained engines.

Dis-aggregation of the MMUTIS database into City and Provincial routes indicates that the two types of operation experience widely differing operating conditions, even within the Study Area.

- Provincial services have an average passenger trip length of 28km (often 100% of passengers ride all the way between the Study Area boundary and the City terminal) and a high average speed of 20km/hr. As Figure 3 shows, operation of a new bus can be viable with high load factors at these speeds.

- City services have a lower average passenger trip length of 8km, yielding an average fare of around P0.62/km. However, average speed is only 12km/hr, and an average load factor above 60% is needed to make even re-conditioned bus operation viable.

City operations can continue in business for a while, even if these conditions are not achieved, provided daily revenue exceeds daily costs. Excluding depreciation and return on capital from the calculation of cost (i.e. writing off the investment in the vehicle and forgoing a full return on the capital) reduces the cost to be covered by about 15%. Under these conditions, operation of an existing vehicle can be viable at lower speeds and load factors than those required for full financial viability. The direct and full cost of Reconditioned Bus are shown in Figure 8.

Such levels of income would not, however, generate sufficient profit to warrant replacing the vehicle when it is life-expired, even with another re-conditioned bus, and operators either replace old ordinary buses with air-conditioned vehicles or leave the bus industry. Consequently, ordinary bus operations on City routes are declining rapidly. While the total number of buses on City operations has more than doubled since 1983, the number of ordinary buses has declined, operating only 63 routes by the time of the MMUTIS survey, compared to 150 in 1983.

Overall, bus services are operating at higher service levels than ever in Manila, but are now provided predominantly by air-conditioned buses. These charge a minimum fare of P7[5] for the first 6km and P1-1.5 per km for longer trips, fares that may be beyond the means of poorer travellers.

3.4 Restoring Viability

For both ordinary bus and jeepney, the industry as a whole is profitable, but there is no mechanism for subsidy[6], and no incentive to operate intrinsically unprofitable routes or sub-modes – a franchise can be offered or issued, but it does not have to be used. If mass transit is to continue to be available to the poorer members of Manila's population, urgent reform is of the tariff structure and franchise regulations is needed, and travellers may be required to pay more for some journeys.

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5 This would purchase a 13km trip on an ordinary bus.

6 There is limited opportunity for cross-subsidy within a route or group of routes. One bus company may own most or all of the vehicles operating and it is not necessary for all vehicles to operate profitably. For jeepneys, most of which are operated by individuals, this is more difficult. All operators need to be at least breaking even all the time. A form of revenue sharing is in use, route co-operatives controlling the number of vehicles in service at any time. As noted, on some routes this results in excess revenue being divide between more vehicles than are strictly needed to run the service.

Ordinary bus operations, catering for longer trips even on City routes, need either a radical improvement in operating conditions[7] or an increase in revenue for longer trips. Likewise, the extreme taper in the jeepney tariff schedule, which makes short routes extremely profitable and long routes unprofitable, seems to be operating against the public interest.

It is notable that the bus and jeepney tariffs set by LTFRB are almost identical in structure and in the tariff for trips of different lengths, for all parts of the Philippines. There is no rational reason for this - operating conditions in the Study Area are very different to those experienced almost everywhere else in the Country, and within Manila there is little remaining on-street competition between bus and jeepney.

A national tariff level which permits financial viability for a wide range of services while preventing excess profits in the provinces (where demand levels may be lower, but operating speeds are much higher) would not seem to be appropriate for the metropolis. Short feeder routes in the GCR experience huge demand and can generate revenue well in excess of cost, even in congested urban conditions. Longer urban routes, whether run by ordinary bus or jeepney, do not appear to be viable in the long run under the present tariff structure.

Revision of the tariff structure for ordinary services is needed. The rate for short trips, where travellers appear to be paying higher fares than necessary on urban routes with high levels of demand over long periods of the day, should fall. Conversely, fares for longer trips need to rise so that operators serving these markets can afford to stay in business.

This suggests a need to reduce the taper on the current tariff structure. A boarding charge of P2.0, covering only the first 3km, with a marginal rate of P0.6 thereafter, is compared with the current schedule in Figure 9.

This results in cheaper short trips (below 4km), with travel increasingly more expensive the longer the trip. Higher fares may not seem to be in the interests of poorer travellers, but without these fares longer distance ordinary services will disappear and journeys will involve a number of (more expensive) short trips by jeepney or upgrading to air-conditioned bus.

It would also reduce the income of jeepney operators (both drivers and owners) on short routes. Income levels could be maintained, however, if these routes were run with fewer vehicles. Redundant vehicles could be re-franchised on longer routes, which would now be more financially attractive.

Improving the financial viability of ordinary bus and jeepney services will require action from the regulatory authorities, both in revising the tariff schedules and in helping the industry to re-organise to bring improved services to the travelling public while preserving the income of operators.

Manila is one of very few large cities in the world (if not the only one) in which public transport is not regulated by a body with particular responsibility for the metropolis, usually a branch of the city administration. It may be appropriate for these changes to be overseen by a new regulatory body with specific responsibility for NCR or GCR. MMDA is still relatively new and limited in its powers and capabilities, nevertheless, it would seem to be the appropriate body to administer Metro Manila’s public transport if the regulator is to be more locally accountable and be able to concentrate on optimising the interests of local travellers and operators.

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[7] MRT3 may bring this, for buses operating along EDSA. The main cause of delay to buses on EDSA is other buses, blocking intersections and boarding/alighting areas. MRT3 will attract up to 50% of public transport demand in this corridor, leading to a reduction in the number of buses and an improvement in traffic conditions for those still running. As MRT3 will be air-conditioned and charge at least P1.5 per km, it is likely that most of the mode transfer will be from a/c buses, leaving poorer travelers on ordinary buses operating in de-congested conditions.

The financial viability of services in the MMUTIS database was tested using the revised tariff schedule shown in Figure 9. Short jeepney routes remained viable, and long routes and ordinary bus services became viable, but most long jeepney services serving a number of different local markets and experiencing average trip lengths below 4km became less viable. Further, detailed, research into the cost and revenue structure of the Manila jeepney industry may be needed before change is introduced.

There is no reason why all routes should have the same fare schedule. In Hong Kong the regulatory authorities set a different schedule for each route, usually a flat fare with a lower charge for short trips that is only applied towards the end of the vehicle's journey. A new regulator more closely attuned to the metropolitan transport market could define some routes as short, local, feeder services (e.g. to the increasing number of LRT stations), and specify a flat fare for all trips. Other, longer, routes which also serve cross-city trips would operate under different regulations and have a graduated fare structure with a lower taper.

Given a tariff system and route structure to give industry wide long-run financial viability, the regulator will also need to impose quality standards more rigorously than at present. There is currently no clear mechanism to prevent unscrupulous operators taking the new, higher, fares but continuing to operate old vehicles, making excess profits until the vehicles become a commercial liability, then leaving the industry.

Safety and exhaust emissions standards are among those that can be used to ensure that vehicles are well maintained and renewed at the appropriate time. If necessary, schemes to make imported re-conditioned vehicles available on lease to ordinary bus operators could be revived.

3.5 Further Quality Improvements

A revised tariff and route structure could enable basic services to remain financially viable and continue to serve poorer travellers in all parts of the Study Area. Economic growth brings increasing personal income levels and aspirations for a higher quality of service. At present air-conditioned mass transit services are only found in a few areas and main corridors. For much of the city there is no intermediate level of transport service between jeepney and car/taxi, with the latter making much poorer use of scarce road-space.

Paratransit services operated by air-conditioned Tamaraw FX mini-vans are becoming increasingly common but: are considerably more expensive to use than jeepney (around P3/km); and do not serve all areas.

While such services may give people an alternative to using a car for higher quality transportation, the FX itself makes relatively poor use of the roads. In addition to carrying fewer people than a jeepney, maintaining the air-conditioned passenger environment means that the vehicle has doors, which are normally closed, but need to be opened for passengers to board or alight. Although the FX has more doors than a jeepney, opening and closing the doors takes time and FXs can be stationary (blocking other traffic) for longer than a jeepney at boarding points.

Further, the doors are hinged, opening outwards into the path of other road users. The FX in use as paratransits are un-modified from those sold for personal use, and have doors on the off-side of the vehicle in the passenger compartment as well as for the driver. Passengers can therefore board and alight on the off-side of the vehicle in heavy traffic (even in the middle of the road), causing further disruption to other road users.

The FX, as currently used, is thus not an ideal solution to the problem of providing intermediate transport services throughout the metropolitan area. There is a need for air-conditioned services operated by vehicles that:

- have a greater capacity (lower operating cost per passenger, more efficient use of roadspace);

- only allow passengers to board or alight on the near-side of the vehicle (safety, more efficient use of roadspace); and

- have sliding or folding doors (more efficient use of roadspace, shorter dwell-time at stops).

Such vehicles, based on the Ford Transit van, are in common use in South Asian and South American cities. The base vehicle is cheap, capacity is similar to a jeepney (15-18), and a large sliding door on the near-side of the vehicle permits short dwell-times at stops. They are, however, usually two person operated, with the second man controlling the door and collecting fares, which might make their use in Manila uneconomically expensive.

FX services originally started as a result of regulatory inaction – failure to franchise new jeepney routes in areas of urban expansion. If air-conditioned paratransit services that make more efficient use of roadspace than the FX are to appear in Manila, positive regulatory involvement will be needed. This would require interaction with operators' organisations to agree on the need for, and specification of, a new type of service, and also moves to curb the inappropriate use of the FX[8].

Again, this is unlikely to happen while the regulatory authority has national responsibilities and priorities – the need for an efficient quality paratransit as an alternative to increasing car ownership and use is much greater in the Study Area than elsewhere in the country. The organisation and regulation of such vehicles needs to be controlled by a body with specific responsibility for Metro-Manila.

8 Restricting the use of the off-side door by passengers to emergency situations only, limits on fares to be charged, etc.

APPENDIX II

TECHNICAL NOTES/MATERIALS
INFLUENCE OF COLOR CODING

4. INFLUENCE OF COLOR CODING

In the MMUTIS Person Trip Survey, some ancillary interviews have been conducted to quantify the influence of Color Coding. Tables 1, 2 and 3 show the changes of trip pattern due to Color Coding, the alternative travel mode when car cannot be used, and public transportation modes used in the absence of cars, respectively.

Table 1
Changes in Trip Pattern Due to Color Coding

Answer	To Work		Other Purposes	
	No.	%	No.	%
No change	1,877	45.4	556	18.1
Stay Home	1,055	25.5	442	14.4
Change Time of Travel	363	8.8	1,258	40.9
Change usual Car	794	19.2	755	24.5
Others	48	1.2	68	2.2
TOTAL	4,137	100.0	3,079	100.0

Table 2
Alternative Mode When Car Cannot be Used

Answer	To Work		Other Purposes	
	No.	%	No.	%
No other family vehicle	406	30.4	256	27.3
Share a ride	175	13.1	83	8.8
Use Public Transport	442	33.1	380	40.5
Use Taxi	288	21.5	204	21.7
Use other modes	26	1.9	15	1.6
TOTAL	1,337	100.0	938	100.0

Table 3
Public Transportation Modes Used in the Absence of Car

Answer	To Work		Other Purposes	
	No.	%	No.	%
Pedicab	2	0.6	0	0.0
Tricycle	17	4.8	7	2.5
Jeepney	215	61.3	144	51.8
Minibus	16	4.6	12	4.3
Standard Bus	91	25.9	101	36.3
LRT	10	2.8	14	5.0
PNR	0	0.0	0	0.0
TOTAL	351	100.0	278	100.0

Tables 1, 2 and 3 above can be converted into all-purpose weighted average as shown in Tables 4, 5 and 6.

Table 4
Changes in Trip Pattern Due to Color Coding
(Weighted Average)

Answer	%
No Change	26.5
Stay Home Mostly	17.8
Change Time of Travel	30.9
Change Usual Car	22.9
Others	1.9

Table 5
Alternative Travel Mode When Car Cannot be Used
(Weighted Average)

Answer	%
Use Another Family Vehicle	28.2
Share a Ride	10.2
Use Public Transport	38.2
Use Taxi	21.7
Use Other Modes	1.7

Table 6
Public Transportation Mode Used in the Absence of Cars
(Weighted Average)

Answer	%
Pedicab	0.2
Tricycle	3.2
Jeepney	54.7
Minibus	4.4
Standard Bus	33.1
LRT	4.4
PNR	0.0

Based on the above tables, the major impacts of Color Coding can be summarized as follows:

1) 22.9% of car users are forced to change their mode of travel on a restricted day.
2) 38.4% of this 22.9%, or 8.8% of restricted car users, share a ride. Car traffic volume decreases by this percentage.
3) 38.2% of this 22.9% or 8.7% of restricted car users, shift to public transportation. Car traffic volume decreases by this percentage and public transportation traffic increases accordingly. Out of this 8.7%, 54.7% or 4.8% of restricted car users shift to jeepney, and 33.1% or 2.9% of restricted car users, shift to standard bus.
4) 21.7% of this 22.9%, or 5.0% of restricted car users, shift to taxi. Car traffic volume decrease by this percentage and the modal share of taxis increases accordingly.

Namely, 21.5% of restricted car users, which is assumed to be 1/5 of total car users, give up to use their cars. In other words, the effect of Color Coding is to reduce car traffic by about 4.3% (21.5% x 1/5).

APPENDIX II

TECHNICAL NOTES/MATERIALS

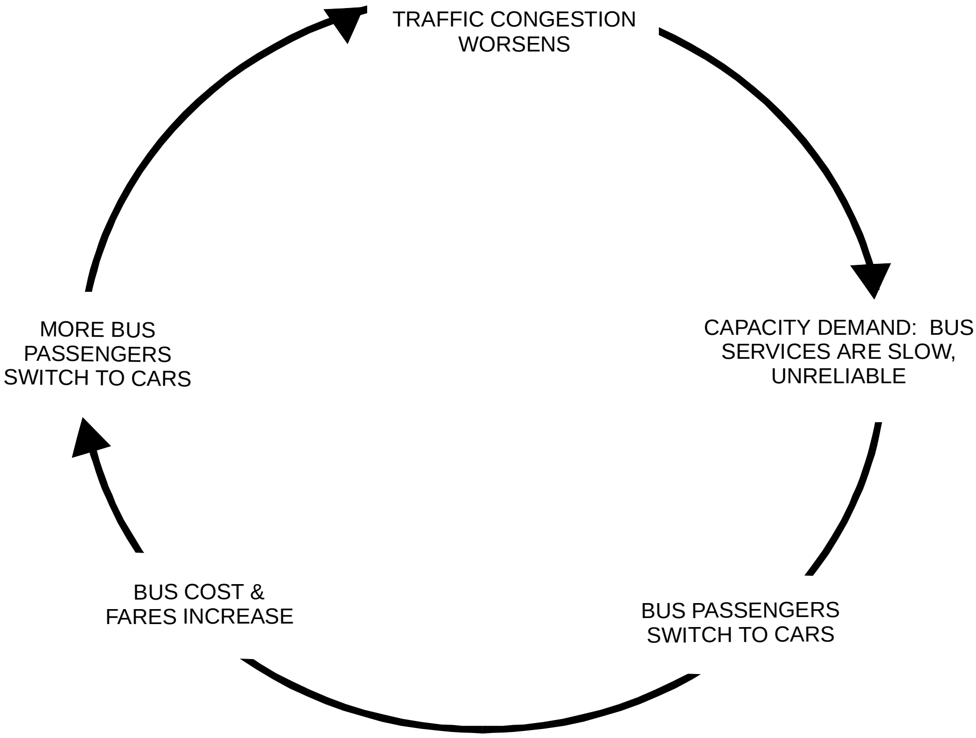
POSSIBLE TDM MEASURES

5. POSSIBLE TDM MEASURES

5.1 General

Many large cities in the world suffer from traffic congestion. As the “vicious circle” in Figure 1 indicates, traffic congestion is a difficult problem to solve. The vicious circle shows that with traffic congestion bus and other road-based mass transit become slow and unreliable, providing users with an incentive to switch to private vehicles in order to obtain higher levels of service. This results in the fares for mass transit becoming higher to make up for lost revenue, which lowers the level of service of public transport even more and produces a greater shift in ridership to modes of private transportation.

Figure 1
Vicious Circle of Traffic Congestion



Conventionally, the method for reducing road traffic congestion has been to increase network capacity by constructing new roads. However, the provision of infrastructure has failed to pace with the ever-increasing road traffic demand. In other words, it has been shown throughout the world that it is difficult, if not impossible, to solve traffic congestion from the supply side alone. Therefore, more attention has been given to managing traffic demand via the application of transport demand management (TDM) techniques.

The major objectives of TDM techniques are to use road space more efficiently and to promote modal balance in order to alleviate traffic congestion and thereby reduce travel time (i.e. improve the level of service of roads). There is another reason that makes TDM measures more attractive. That is the possibility to obtain revenue which can be invested into transportation infrastructure to provide better service for road users.

The TDM measures can be roughly classified by objective as follows:

1) Less car ownership (e.g. heavier tax on vehicle purchase)
2) Less car use (e.g. heavier tax on fuel)
3) Lower peak traffic (e.g. staggered working hours)
4) Less traffic congestion in specific areas/roads (e.g. area licensing, road pricing)

The following discusses the impact of possible TDM measures in the MMUTIS Study Area:

5.2 Heavier Tax on Vehicle Purchase

1) Objective

Car ownership rate (more precisely, car owning household ratio) if forecast by MMUTIS to rise from 18.5% at present to 25.0% in 2015. The vehicle tax policy aims to lessen this rate by means of heavier taxation, discouraging people from buying car.

2) Assumption and Methodology

The assumptions adopted in estimating the car ownership rate are as follows:

(a) Car Price 400,000 pesos (460,000 pesos inclusive of 15% value-added tax)

(b) Value-added Tax: Raising current 15% by 10% pitch

Table 1
Current Value-added Tax

Engine Displacement (cc)		Tax Rate (%)
Gasoline	Diesel	
Up to 1600	Up to 1800	15
1601 - 2000	1801 - 2300	35
2001 - 2700	2301 - 3000	50
2701 or above	3001 or above	100

(c) Others

- Interest Rate 15%
- Car Life 10 years
- Decrease in disposable monthly income (ΔI)

10%	664 Pesos
20	1,328
30	1,993
40	2,657
50	3,321
60	3,985

The formulas to calculate car ownership rate are:

- Current car ownership rate

$$\Sigma\,\Sigma\,(n \bullet N(I) \bullet F_n(I) / \Sigma\,N(I)$$

- Car ownership rate after imposing heavier tax

$$\Sigma\,\Sigma\,(n \bullet N(I) \bullet F_n(I - \Delta I) / \Sigma\,N(I)$$

where,

C	Price of a car:
r_o	Current tax rate:
$r\ (r > r_o)$	Raised tax rate:
$(r - r_o)\,C$	Raised amount of tax:
n years	Car life:
i	Interest rate:
$\Delta I = (r - r_o)\,C \bullet i\,(1 + i)^n / \{(1 + I)^n - 1\}$	Decrease in monthly disposable income
$F_n(I)$	Probability of a household with a monthly income of I pesos to own n units of cars:
$N(I)$	Number of households with a monthly income of I pesos:

3) Estimated Results

The results are shown in Table 2 and 3.

Table 2
Future Car Ownership

	1996	2005	2015	2015/1996
Population (000)	14,997	18,967	23,713	1.58
No. of Household	3,155	4,210	5,264	1.67
Car Ownership Rate (%)				
MMUTIS	18.5	20.7	25.0	1.35
10 % up (25 %)	-	20.3	24.3	1.31
20 % up (35 %)	-	19.9	23.5	1.27
30 % up (45 %)	-	19.3	22.3	1.21
40 % up (55 %)	-	18.8	21.3	1.15
50 % up (65 %)	-	18.3	20.1	1.09
60 % up (75 %)	-	17.7	18.9	1.02
No. of Cars (000)				
MMUTIS	730	1,324	2,074	2.84
10 % up (25 %)	-	1,301	2,016	2.76
20 % up (35 %)	-	1,276	1,949	2.67
30 % up (45 %)	-	1,239	1,854	2.54
40 % up (55 %)	-	1,206	1,765	2.42
50 % up (65 %)	-	1,169	1,670	2.29
60 % up (75 %)	-	1,137	1,566	2.15

Note: All vehicles are assumed to be the lowest class.

Table 3
Demand and Additional Revenue of Passenger Car and
Utility Vehicle during 1999 – 2015

Surtax	Demand for Vehicles (1000)	Additional Revenue	
		(million P)	(million $)
MMUTIS	2,770	-	-
10 % up (25 %)	2,700	108,027	2,701
20 % up (35 %)	2,623	209,858	5,246
30 % up (45 %)	2,512	301,365	7,534
40 % up (55 %)	2,408	385,301	9,633
50 % up (65 %)	2,296	459,258	11,481
60 % up (75 %)	2,176	522,201	13,055

4) Conclusion

As was revealed by the impact analysis above, the effectiveness of heavier taxation on vehicle purchase is remarkable in order to reduce the traffic volume if the tax rate is raised drastically. The potential revenue from this tax is large as well.

However, the following issues must be discussed and consensus be reached before implementation:

(a) In order to avoid the negative impact on business activities as well as prices of goods, tax rate should be adjusted as much as possible according to the purposes of use (e.g. heavier tax for passenger cars of private use).

(b) The analysis above was made only for the MMUTIS Study Area. However, if the tax is raised only for the Study Area, all new vehicles will be registered in other provinces. Thus, tax must be raised in the whole country if it is raised. The problem here is that the tax may adversely influence the regional economy where car restriction is not needed. Presumably, some measures to mitigate the negative impact should be taken into account in other provinces (e.g. tax refund on some documents on activity base).

5.3 Heavier Tax on Fuel

1) Objective

Policy of heavier taxation on fuel for transportation aims at discouraging people's car use and urging them to use public transport, as well as raising funds to develop or upgrade public transport facilities.

2) Assumptions and Methodology

(a) Current Fuel Tax

Table 4
Current Fuel Tax (as of Aug. 1998)

Fuel Type	(a) Market Price	(b) Excise Tax*	(c) Tax Rate (%)**
Regular Gasoline	11.69 P	4.80 P	41.1
Leaded Premium	12.03 P	5.35 P	44.5
Unleaded Premium	-	4.35 P	-
Diesel	8.36 P	1.63 P	19.5

Note: * National Internal Revenue Code, 1997
** (c) = (b) / (a)

(b) Cases to be Tested

Table 5
Cases Tested

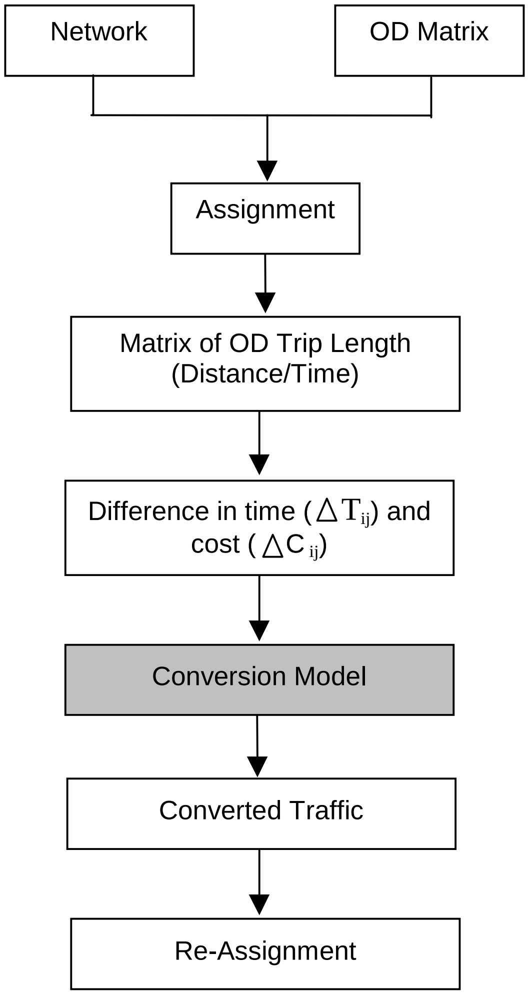
	New Objective Tax (% of retail price)	New Retail Price	
Case A	50 %	Regular	17.54
		Premium	18.05
Case B	100 %	Regular	23.38
		Premium	24.06

(c) Others

- No additional tax is levied on diesel.
- Increase of bus and jeepney fare is disregarded.
- Average fuel consumption rate of a car is 8km/l. (e.g. travel cost will rise by 0.75 pesos/km/person in Case B (12 pesos/8km/2 passengers)
- Regular gasoline: Premium gasoline = 30:70

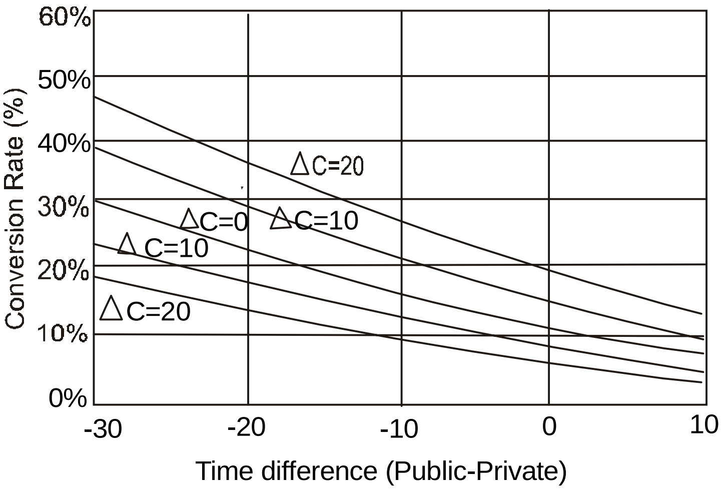
The methodology for the impact analysis is shown below:

Figure 2
Impact Analysis Methodology



The Conversion Model derived from the MMUTIS SP Survey is as follows:

Figure 3
Demand Conversion
from Private Mode to Public Mode



$$p_{ij} = 1.0/(1.0 = \mathrm{Exp}\,(\mathrm{c}\Delta \mathrm{T}_{\mathrm{ij}} \div \beta \Delta \mathrm{C}_{\mathrm{ij}} + \gamma))$$

$$c = 0.04082 \quad \beta = 0.03292 \quad \gamma = 2.35$$

3) Estimated Results

The estimated results are shown in Table 6 and Table 7.

Table 6
Modal Shift

Item	Case A	Case B
Average Conversion Rate (%)	3.2	5.5
Conversion from Car to Public (1) Passenger (000/day) (2) PCU (000/day) (3) PCU-km (000/day)	 212 105 1170	 365 181 2060
Modal Share* (Private : Public)	26.1 : 73.9	25.5 : 74.5

Note: * Original Share without Policy is 27.0 : 73.0

Table 7
Possible Revenues

Year/period	Case A	Case B
2000	13.3	26.1
2015	37.8	75.2
2000 - 2015	383.2	759.8

Note: Fuel consumption by company cars (26% of total) is added.

4) Conclusion

The shift of transport mode from private to public due to the increase in fuel tax seems to be quite moderate; only 5.5% car users will give up the use of their cars even fuel price doubles. However, the revenue potential is as large as the taxation on purchase of vehicles.

It is recommended to raise fuel prices (particularly of gasoline) little by little (e.g. by 10% every two years) mainly to collect funds to improve transport infrastructure. The price of fuel is considered still low in the Philippines as compared to other countries. The Case A and Case B above are corresponding to the tax rate of 63% and 72%, respectively.

Table 8
Percentage of Fuel Tax in Retail Price in
Selected Countries, 1997

Country	%
France	78.9
Finland	75.3
Germany	74.6
Italy	72.1
Spain	65.5
Canada	48.0
Mexico	13.0
UK	77.0
Norway	74.7
Sweden	72.7
Greece	69.9
Japan	56.0
USA	31.1
Philippines	44.5

4. Staggered Working Hours

1) Objective

Judging from the hourly variation of traffic in the MMUTIS Study Area, there are three peaks in a day. The highest peak is observed in 6 to 7 in the morning (by starting time of trip) due to the concentration of "To Work" and "To School" trips. The objective of Staggered Working Hours is to lower this morning peak by allowing commuters to reach their office in a broader range of time. This measure is adopted in many large cities of the world, and it requires only a negligible cost (e.g. lighting cost of office due to longer office hours).

2) Assumptions and Methodology

The assumptions adopted in the impact analysis are:

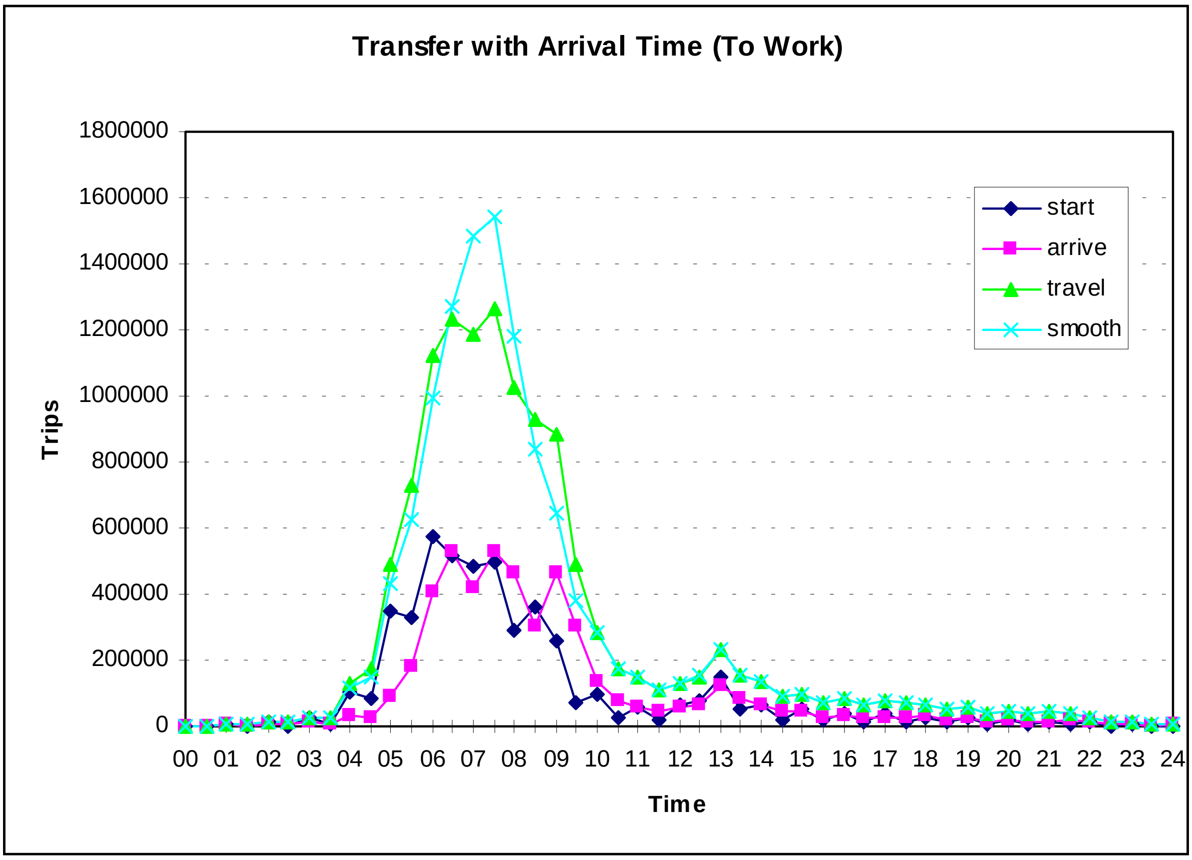
(a) Only "To Work" trips are analyzed.

(b) Arrival of "To Work" trips at office is allowed flexibly than at present. More precisely, a percentage (22%) of offices that have working hours starting between 7 and 8 a.m. shift it one hour earlier, and a percentage (26%) of offices that start between 8 and 9 a.m., one hour later. This will equalize the arrival of workers at office from 6 to 8 a.m. and 8 to 10 a.m.

3) Estimated Results

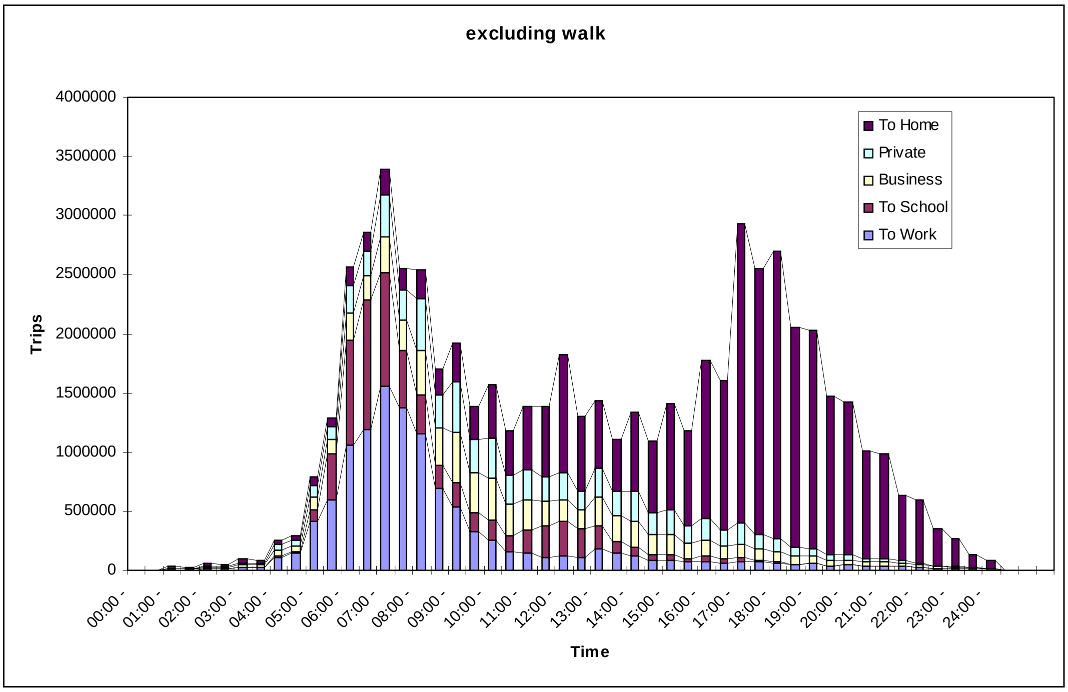
Considering the distribution of starting time, arrival time and travel duration of commuting trips, the Staggered Working Hours mentioned above has an effect of curtailing the peak commuting traffic by about 18% (7:30 – 8:00) as shown below.

Figure 4
Effect of Staggered Working Hours



However, compared to the hourly distribution of all trips, the effect is calculated at about 7%.

Figure 5
Distribution of Moving Trips by Purpose



4) Conclusion

The effect of Staggered Working Hours is considered noticeable. Although it alone cannot solve the problem of traffic congestion, it is worth implementing the scheme coupled with other TDM measures. Government should take actions (e.g. discussion with business circles) to promote the scheme, since its effect is comparable to the current Color Coding.

5. Pricing Techniques

1) General

Pricing measures such as road pricing and area licensing has been successfully implemented in some cities in the world such as Singapore, Oslo and Tronheim. At the same time, however, the proposal for pricing has been rejected in some cities like Hong Kong and London and most of other cities are wait-and-see attitude.

The problem inherent to pricing is the difficulty to reach a social consensus particularly in relation to the revenue created by pricing. Political decision is usually made by car owners, and they don't like to be taken of money and are afraid of objections raised by car-owning society. Finance officers of the government want to incorporate the revenue from pricing into the general budget while the proponents of pricing always intend to earmark the revenue for transportation infrastructure.

Although it is not yet certain whether pricing mechanism works effectively Manila and whether the proposal could be accepted politically and socially, some hypothetical cases have been studied:

2) Case Studies

In this study, the following cases have been studied:

(a) Road Pricing on EDSA (North Ave. – Taft Ave.)

It was assumed that all the private vehicles entering EDSA pay ₱ 40 (US$) per entry. The traffic crossing EDSA is not charged. By conducting traffic assignment, the following results were obtained:

- The effect of alleviating traffic congestion on EDSA is significant (about 5% less). However, some of parallel roads become more congested due to detouring traffic.
- The revenue will be about US$ 70 million/year in 2015.

(b) Cordon Pricing Makati CBD

This intends to charge vehicles crossing the boundary of Makati CBD to alleviate traffic congestion of the area. Charge level was assumed to be ₱ 40 per entry. By applying the same demand shift model presented earlier, traffic assignment was conducted.

- The effect of reducing traffic congestion is significant in and around Makati (5 to 10 % typically). Although some distortion of traffic distribution is seen due to detouring traffic, its extent is moderate compared to road pricing.
- The revenue is estimated at about US $ 61 million/year in 2015.

(c) Cordon Pricing EDSA

In the similar manner as above, traffic assignment was conducted after applying the demand shift model.

- The effect is wider and deeper as compared to the Makati Cordon Pricing Scheme. Although there is no specific road that will be improved remarkably, most of the roads in Metro Manila shows an alleviation of traffic congestion (typically 3-10 %).
- The revenue will be about US $ 174 million/year in 2015.

(d) Parking Pricing Makati CBD

In a similar manner to Cordon Pricing Schemes, the demand shift model was applied assuming the parking event. However, unlike cordon pricing, it was assumed that parking pricing is effective only for those who pay the charge from their own pocket. In the case of Makati, this percentage is 10.3%

according to the 1996 MMUTIS Person-Trip Survey. For those who are offered parking spaces by their companies, parking pricing is not effective because the charge can be offset with their tax liabilities.

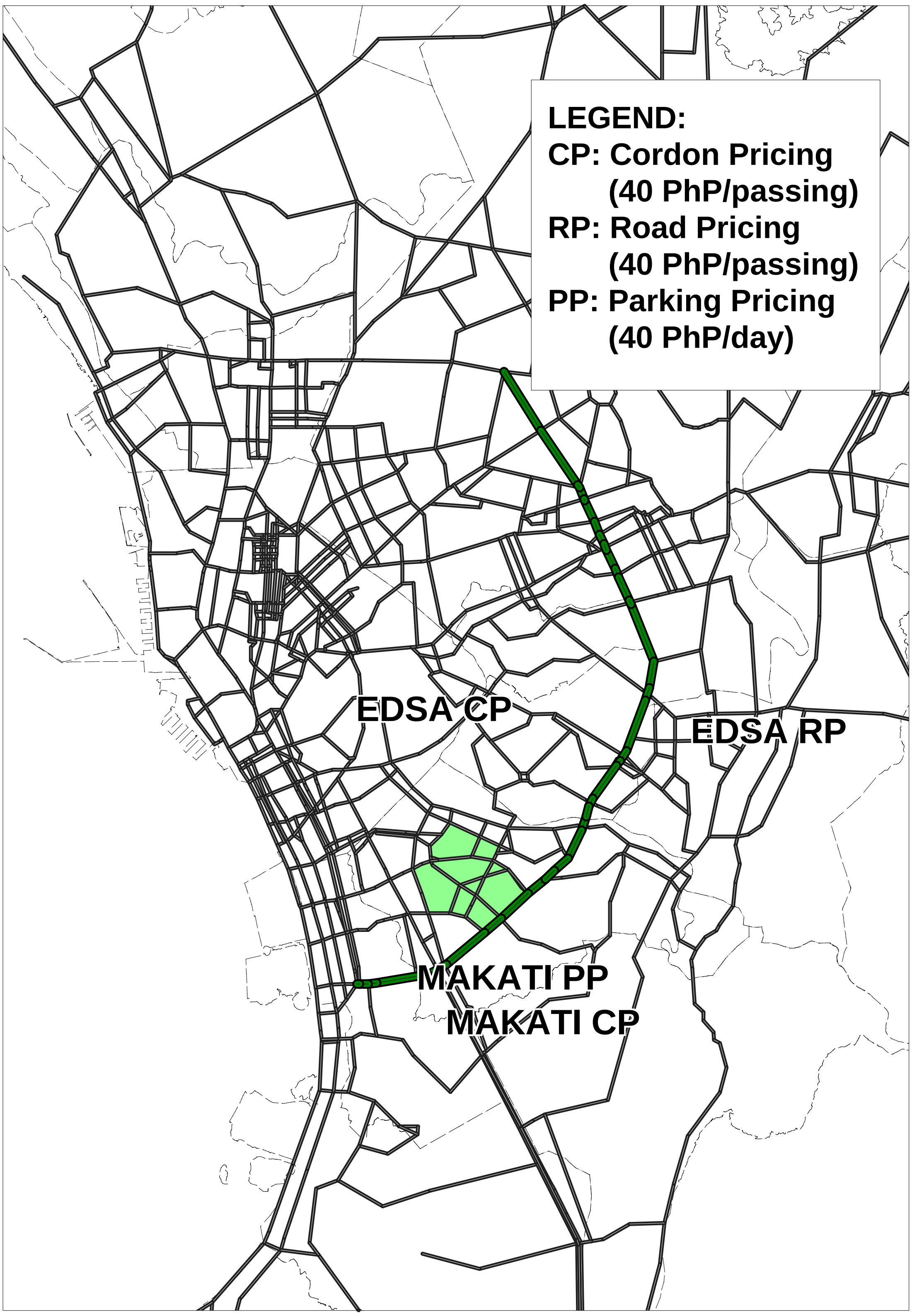
- The effect of traffic calming is minimal. The advantage of parking pricing is that the distribution of traffic is not distorted in the absence of detour traffic.
- The potential revenue will be about US$ 15 million/year in 2015.

Table 9
Impact of Pricing Measures

		Master Plan	EDSA RP	Makati CP	EDSA CP	Makati PP
Traffic (veh-km/day)	Total Area	114036	112896 (-1.0)	112806 (-1.1)	110326 (-3.3)	113366.1 (-0.6)
	Area outside EDSA	17621	17460 (-0.9)	17117 (-2.9)	16352 (-7.2)	17400.7 (-1.2)
Average Speed (km/h)	Total Area	6.44	6.47 (-0.5)	6.52 (1.3)	6.61 (2.6)	6.48 (0.6)
	Area within EDSA	6.99	6.94 (-0.7)	7.36 (5.2)	7.58 (8.4)	7.27 (4.0)
	Area outside EDSA	6.35	6.39 (0.7)	6.39 (0.7)	6.46 (1.9)	6.35 (0.0)
VCR	Total Area	0.98	0.97 (-1.0)	0.97 (-1.0)	0.94 (-4.1)	0.97 (-1.0)
	Area within EDSA	0.93	0.93 (0.0)	0.90 (-3.2)	0.86 (-7.5)	0.91 (-2.2)
	Area outside EDSA	0.99	0.98 (-1.0)	0.98 (-1.0)	0.96 (-3.0)	0.99 (0.0)
Public Transport Use (Pas-km/day)	Road	195070	202284 (3.7)	195938 (0.4)	199542 (2.3)	195105 0
	Railway	134989	130240 (-3.5)	135562 (0.4)	135977 (1.5)	133506 (-1.1)
Revenue (P million/year		0	10.8	9.4	26.8	2.2
Revenue (US$ million/year)		0	70.2	61.1	174.2	14.6

Note: Figure in parenthesis indicate the percentage of change
No. of operating days per year was assumed at 260

Figure 6
Pricing Schemes Tested



APPENDIX II

TECHNICAL NOTES/MATERIALS
DELAY AT INTERSECTION

6. DELAY AT INTERSECTION

Traffic flow is interrupted by crossing traffic at intersection, signalized or not, where conflicting movements must share the time and space. Thus the most of the delay along a route occurs at intersection. Delay at intersection is reviewed and models have been developed for different types of intersection. The models are intended for estimating the effectiveness of signal and other measures to be applied at intersections in terms of time saving. Thus mathematical strictness is not of the first priority. On the contrary, simplification has been introduced to the extent that does not invalidate the comparison. The following types of intersection are considered:

- Non-Signalized intersection
- Signalized intersection
- Intersections with coordinated signals
- Grade separated (fly-over) intersection

6.1 Non-signalized intersection

At a non-signalized intersection, a vehicle has to wait until a gap of sufficient duration occurs in the traffic flow of conflicting movements before it can pass through the intersection. When traffic is light, most of gaps are large enough to cross safely. As traffic volume increases, average gap duration decreases so that vehicles in the crossing direction have to wait longer. When traffic volume exceeds certain level, large gap seldom takes place and vehicles have to wait too long. At this level of traffic volume and higher, traffic signal is required to stop the traffic flow to allow the crossing movement to proceed.

A case, in which vehicles trying to cross a single lane of traffic flow is considered here. When a vehicle arrives at intersection, there are two possibilities. Case 1 is the case in which the remaining time of current gap is large enough and the vehicle can cross the road without waiting. In Case 2, the current gap is not large enough or the vehicle arrived toward the end of the gap so that the vehicle has to wait for a gap equal to or larger than the minimum gap duration. If the probability of Case 1 and Case 2 is denoted by P_1 and P_2, respectively, and waiting time for both cases by W_1(which is actually zero) and W_2, then expected waiting time or delay of non-signalized intersection $E[D_{non}]$ is obtained by:

$$E[D_{non}] = P_1W_1 + P_2W_2 = P_2W_2 = (1 - P_1)W_2$$

1) Case 1: Proceed without stop

P_1 is the probability of the case that the remaining duration of the gap at the time of arrival of crossing vehicle is equal to or larger than the minimum gap length g_m. Let a function $p(x)$ denote the probability density function of a gap being x. Then, as the arrival of a vehicle of crossing street and gap on the main street are independent events, P_1 is expressed as:

$$P_1 = \int_{g_m}^{\infty} \frac{t - g_m}{t} p(t \geq g_m) dt$$

Assuming a traffic flow of random arrival, which is expressed by Poisson Distribution, the probability density of gap follows a negative exponential distribution. In a traffic flow of random arrival with the volume of v vehicles per unit time, the probability $p(v,t)$ that a gap length is t is expressed by the following equation:

$$p(v,t) = \frac{1}{v} e^{(-t/v)}$$

The cumulative distribution function P_{gm} that a gap is equal to or larger than g_m is, then, expressed as:

$$P_{gm} = p(t \geq g_m) = \int_{g_m}^{\infty} \frac{1}{v} e^{(-t/v)} dt$$

Substituting this into the first equation, the probability P_1 is calculated as follows:

$$\begin{aligned} P_1 &= \int_{g_m}^{\infty} \frac{t-g_m}{t} \frac{1}{v} e^{-t/v} dt \\ &= \frac{1}{v} \int_{g_m}^{\infty} e^{-t/v} dt - \frac{g_m}{v} \int_{gm}^{\infty} \frac{1}{t} e^{-t/v} dt \\ &= e^{-g_m/v} - \frac{g_m}{v} \int_{gm}^{\infty} \frac{1}{t} e^{-t/v} dt \end{aligned}$$

2) Case 2: Stop and wait for a suitable gap

In this case, the remaining time of the gap that a vehicle of crossing movement encounters upon arrival at intersection is not large enough and the vehicle must wait a gap equal to or larger than the minimum gap g_m. The probability of Case2, P_2, is obtained by:

$$P_2 = 1 - P_1$$

On the other hand, the length of gap in the main traffic flow follows a negative exponential distribution as assumed. Then, the probability P_3 of a gap equal to or larger than g_m in the gap sequence is expressed as:

$$P_3 = 1 - F[x = g_m] = 1 - e^{-g_m/v}$$

where $F[x]$ is the cumulative distribution function. The mean number N_g of gaps until a gap of sufficient length arrives is the reciprocal number of P_3 and obtained by:

$$E[N_g] = \frac{1}{P_3} = \frac{1}{1 - e^{-g_m/v}}$$

As the mean duration of gaps is 1/v, the mean waiting time W_2 that N_g gaps arrive is calculated as:

$$W_2 = E[N_g]\frac{1}{v} = \frac{1}{v(1-e^{-gm/v})}$$

The mean waiting time at an isolated intersection is obtained by substituting equations (1.5) and (1.6) into (1.1) .

3) Mutli-lane road

The case discussed above assumes that there is only one lane of traffic stream to cross. In the actual road network, however, two or more lanes are common. Waiting time to cross multi-lane traffic is calculated by substituting traffic volume v with the total of traffic flow v_1, v_2, v_3, ····, regardless of the direction of flow if arrival of vehicles in each lane is random and flow in each lane is independent each other.

4) Waiting queue

The waiting time shown above is the case that no queue is created while waiting for a gap of suitable size, or the case of the first car in the queue. Normally, a queue is formed on the crossing street unless the flow rate of both main and crossing movements is extremely small. If a queue is formed, time for a queue to discharge must be considered in the calculation of delay experienced by the vehicles in the queue.

The distribution of waiting time to find a gap of sufficient size shown above does not follow any analytical function so that behavior of waiting queue cannot be expressed analytically. If we ignore the probability of a vehicle crossing traffic flow without waiting, however, the waiting time is expressed by a negative exponential function. This simplification is equivalent to setting start of a gap at the time of arrival of a vehicle on the crossing road. In a traffic flow of moderate volume, error caused by the assumption does not affect the magnitude of the delay.

A single server first-in, first-out (FIFO) queuing model with Poisson arrivals and negative exponentially distributing waiting times can then be applied to the case of vehicles waiting for a gaps of suitable size. The state of the system is described by the random variable X representing the number of vehicles in the system at any given time, including those that are crossing the road. When the mean arrival rate (v_c vehicles per unit time) is less than the mean service rate ($1/w$ vehicles per unit time, where w is the mean waiting time), X is distributed according to the following function:

$$f(x) = P[X = x] = v_c^2 w^2 (1 - v_c w)$$

The expected number of vehicles in the waiting queue N_q can be expressed by the:

$$E[N_q] = \frac{v_c^{2} w^{2}}{(1 - v_c w)}$$

where w is the expected waiting time as obtained in the preceding sections. The expected time W_q each vehicle spends in the queue is calculated by dividing the equation above with v_c, the arrival rate.

$$E[W_q] = \frac{v_c w^{2}}{(1 - v_c w)}$$

6.2 Isolated signalized intersection

At an isolated signalized intersection, delay is caused cyclically by the signal provided that the total volume is less than the capacity of the intersection. This condition means that the queue created during red signal is discharged during the green and no queue is existing at the end of a green. If total volume exceeds intersection capacity, left-over is generated every signal cycle and queue keeps developing indefinitely.

The delay caused by the signal is directly related to the duration of red signal. Assuming random arrival, the chance of a vehicle meeting the red signal or queue discharging time that follows red signal is equal to the ratio of these periods against signal cycle. The mean delay $E[D_{iso}]$ caused by the signal is the half of these periods and expressed by:

$$E[D_{iso}] = \frac{1}{2}\left(r + \frac{r v_a}{(v_s - v_a)} \right) = \frac{r v_s}{2(v_s - v_a)}$$

where r is the length of red signal, v_a is the arrival flow rate and v_s is the saturation flow rate. The saturation rate is the rate with which vehicles are discharged from the waiting queue after the start of green. The first term in the equation above represents the mean delay by red signal and the second term is the delay during discharging time of waiting queue.

It is pointed out that the mean delay is proportional to the length of red signal, and not to the ratio of red signal against cycle time. This means that even the split of a signal, which is the ratio of green signal length against cycle length, is kept same, the delay becomes longer proportionally to the length of red signal if cycle length is extended.

It is also pointed out that as the arrival flow increases and approaches the capacity, the mean delay increases rapidly in inverse proportion to the difference of capacity and arrival rate. In fact, the difference is the dominant factor that determines the magnitude of delay in the signal operation. If arrival rate is at around 90 % of the

capacity, the intersection is at critical level of operation and queue may develop any time.
In the dense road network, where distance between two signals is short, say less than 700 meter, vehicle arrival at an intersection is no longer a random process. A group of vehicles, usually called a platoon, is formed by the signal operation at the upstream intersection. A platoon discharged from the upstream intersection gradually disperses as it approaches the downstream intersection. But the arrival pattern is different from random arrival. The delay experienced by each vehicle in this case depends much on the offset between two signals in addition to the volume and length of red signal at the downstream intersection.

If the arrival of platoon is random relative to the signal timing, however, the magnitude of average delay over many signal cycles can still be estimated using the formula above.

6.3 Intersection with coordinated signal

In a dense road network where the distance between two signals is relatively short, the coordination between signals is important. Because arrival pattern is no longer a random process and timing of arrival relative to the green time determines the magnitude of delay at the intersection. A platoon is formed as the result of signal operation at upstream intersection. If a platoon arrives at a right moment, vehicles can pass through the intersection without stopping. On the contrary, if the arrival of a platoon is at the end of a green, most of the vehicles have to wait until next green signal. It is necessary, therefore, to set a relationship between two signal in such a way that platoon arrives at the beginning of a green. If signals operate with a certain relationship each other, it is said that signals are coordinated.

In order to establish a relationship of timing between two or more signals, they must be operated with a common cycle time. Otherwise, relationship or time difference between two signals varies every cycle and platoon arrives at the different timing. Time difference of the start of green between two signals is called offset and expressed either in second or percentage against the cycle time length. In a coordinated signal system, not only the optimization of the signal timing at each intersection but also the optimization of the relationship between signals must be considered. The optimum cycle length at one intersection may not be the optimum cycle for other intersections.

It is pointed out that along two-way street, optimum offset for one direction is not necessarily good for the flow in the opposite direction. In fact, compromise is often required to satisfy the contradictory requirements of the two directions. Depending on the flow characteristics, a priority is given to one direction, or equal priority is given to both directions. The difficulty of meeting the requirements depends on the distance between two signals and the travel speed of the platoons. If offset is set at the multiple of the travel time between two intersections, equal priority offset can be established, and both directions receives the same through band that passes through multiple intersections (green wave).

If signals are not coordinated and each signal is operated with its own cycle, average delay at each intersection over many cycles can be same as the delay at an isolated intersection shown above. If these signals are coordinated part of vehicles forming a platoon can proceed several intersection without stopping incurring no delay. The percentage of these lucky vehicles is, however, dependent on the geographic and traffic conditions and varies widely from location to location. It is also possible that priority is given to one direction and signal offsets are calculated in such a way that the offset equals multiple of travel time. In this case, the vehicles on the opposite flow may or may not have through band. In reality, however, the turning vehicle that leaves the coordinated signal system or enters into it, vehicles dropped out of through band, dispersion of platoon, different feature of each vehicle, etc. disturb the flow. For this reason, generalized mathematical expression of delay in a coordinated signal system is not possible.

For the purpose of predicting the effects of coordinated signal system against non-coordinated system, however, the magnitude of delay reduction by the signal coordination can be obtained with a simplified model. If priority is not given to either of the two opposing flows, offset of each signal must be either 0 % (simultaneous start of green), or 50 % (half cycle difference). Assuming that split is same at both intersections (and within the range usually used), the width of through band varies between the optimum case (same as split) to zero. In average, through band *b* would be expressed by the following equation:

$$b = \frac{1}{2}s + (2s - 1) = \frac{5}{2}s - 1 \qquad (s \geq 0.5)$$

$$= s^2 \qquad (s \leq 0.5)$$

$$\approx \frac{s}{2}$$

Through band with *b* is always equal to or smaller than split *s,* and the approximation is valid only around $s=0.5$. If the traffic volume is v_a and saturation flow rate is v_s, the ratio of the two v_a/v_s must be equal or smaller than s for a stable condition, in which no queue is developed. The probability P_4 of a vehicle of taking on through band is the ratio of *b* and *s*, and expressed by:

$$P_4 = \frac{b}{s} = \frac{1}{2}$$

The above equation shows that in average half of vehicles are on the through band. These vehicles on the through band incur no delay at intersection. On the other hand, vehicle is dropped out of through band with the probability of $1\text{-}P_4$. The average delay for these vehicles $E[D_{co}]$ is expected to be same as the delay in the case of isolated intersection.

$$E[D_{co}] = \left(1 - \frac{1}{2}\right) E[D_{iso}] = \frac{(1-s)v_s}{4(v_s - v_a)}$$

In conclusion, coordination of signals can reduce the delay caused by signal operation by half.

6.4 Grade separated intersection

If a fly-over is constructed at an intersection, one of the conflicting movements is separated physically from other movements and vehicles of grade-separated movement can proceed through intersection without stopping. The delay caused by signal is eliminated for this movement. The benefits or saving in time brought about by fly-over can, thus, be the elimination of delay for the separated movement plus the reduction of delay at at-grade intersection due to the shorter red time. It is noted that, in most of the cases, there are still conflicting movements such as turning movements and signal is still needed at at-grade intersection. But the number of phases usually can be reduced and each movement receives longer green time, which results in the reduction of delay.

APPENDIX II

TECHNICAL NOTES/MATERIALS

COMMENTS ON MANUAL CONTROL OF SIGNAL

7. COMMENTS ON MANUAL CONTROL OF SIGNAL

Manual control of traffic signal by traffic enforcer is a common practice in Metro Manila. Traffic enforcers claim that signal is not efficient and not capable of handling heavy traffic so that they have to turn to manual control. On the other hand, road users complain about long signal cycle they experience under manual control and blame traffic enforcers as cause of congestion. This paper looks into the mechanism of manual control and presents advantages and limits of manual control.

7.1 Control Criteria

Purpose of traffic signal is to control right-of-way of conflicting movements and to prevent collision at intersection. At the same time, adverse effect of signal such as stop and delay must be minimized. The task is relatively easy when traffic is light. Each approach to an intersection can receive sufficient duration of green time and no congestion occurs. But it becomes gradually difficult as traffic volume increases. If total traffic volume exceeds the capacity of intersection, which is defined mainly by the geometric features of intersection, congestion is unavoidable and queue develops with time. Signal has to cope with different traffic condition and the criteria for "good" control varies for different levels of traffic demand.

7.2 "Minimum number of stops" criterion

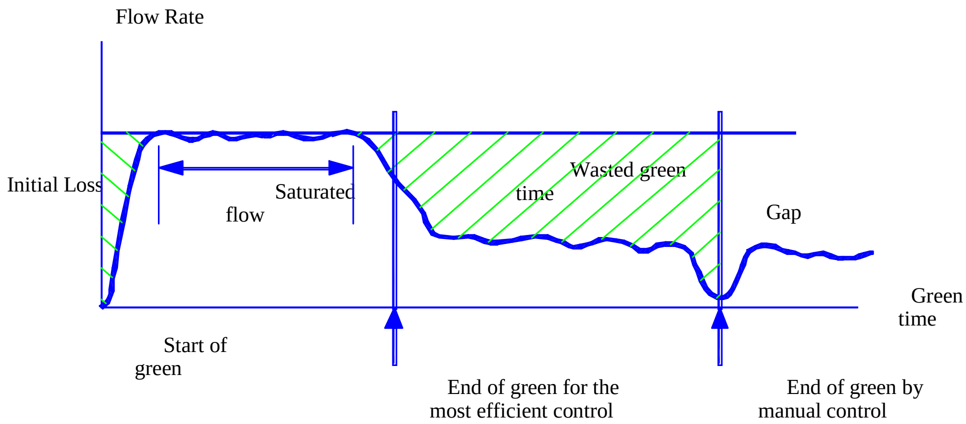
Under the light traffic in which arriving traffic demand is much less than the intersection capacity, "good" signal control means less number of stops. This is to minimize the number of stops that vehicles make before going through an intersection. Such criterion can be achieved by maintaining green signal as long as there are approaching vehicles and terminating as soon as a gap is detected in the approaching flow. This method of signal operation can be called "number of stops" criterion. The criterion works as gap is frequent under light traffic. Ideally, no vehicle has to stop at intersection under the extremely light traffic because chance of two vehicles of conflicting flows arriving at the same time is very small. Manual control is best suited to this situation and could perform better than automatic control. Because no vehicle detector is as effective and flexible as human eyes in detecting gap in the approaching traffic stream and switch over the signal indication according to gap. On the contrary, vehicle detector cannot detect a gap until gap comes into its detection zone.

As the traffic volume increases, less number of gaps is found in a traffic flow. Changing signal indication in synchronization with a gap in the flow will no longer work properly. As a result, signal cycle becomes longer under "number of stops" criterion. In addition, efficiency decrease as part of green time is wasted. Figure 1 illustrates the typical manual control operation of signal under such situation.

7.3 Manual control practiced by traffic enforcers

When signals turns green, vehicles in the waiting queue are discharged at the maximum flow rate called saturation rate. The saturation rate is maintained until all vehicles in the waiting queue and some vehicles that joined the queue during discharge have passed the stop line. After that, the flow rate lowers to the arriving flow rate. The flow is maintained until green indication is terminated.

Figure 1
Discharging Flow at Green



Manual control practiced by traffic enforcers maintains green signal until a gap comes in the approaching flow as shown in the figure. If arriving flow maintains certain level and a gap is not found, green signal is extended unreasonably. During this period, signal operation is not efficient. Because the arrival flow rate, which is also the departing flow rate, is much lower than the saturated flow rate. As a result, less number of vehicles pass the intersection than the number that would be possible if the saturation rate is maintained.

Figure 2
Green times vs. Flow Rate
(EDSA – Shaw Westbound Approach)

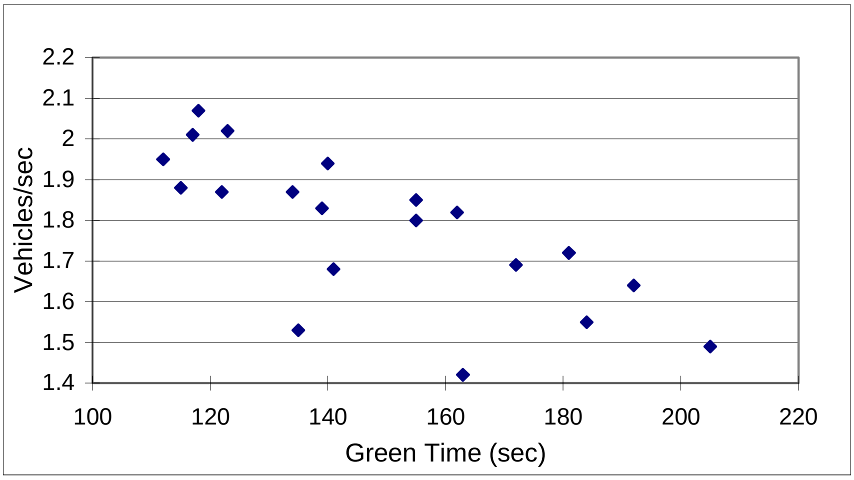


Figure 2 shows the results of a survey conducted at EDSA – Shaw intersection for westbound traffic in July 1994 before a fly-over was constructed. During the survey, the signal was operated manually. The number of vehicles that passed through the intersection for each green time was counted. The total number of vehicles was then divided by the green time length and the number of vehicles per unit green time was obtained. The relationship in the figure clearly shows that the flow rate decreases as the duration of green time increases. It also reveals that the green time is unreasonably long in the rage of 100 to more than 200 second. This implies that the signal cycle, which was not recorded, would be more than five (5) minutes considering that the signal is operated with four (4) phases.

Traffic enforcer claims that they can control traffic efficiently. As a matter of fact, however, they are controlled by the flow as their action is dictated by gaps in traffic flow.

7.4 Maximum flow criterion

Under near-saturated situation, “good” signal control means to maximize the number of vehicles that pass through intersection during a green time to prevent the left over at the end of a green from occurring. In this way, creation of queue can be avoided. This can be achieved by allotting green to an approach for the duration that is enough for waiting queue to discharge as shown in the figure. Saturation flow is maintained during the green and no green time is wasted except initial delay in acceleration.

This criterion of maximum number of vehicles is not compatible with the criterion of minimum number of stops. In maximum vehicles criterion, only vehicles in the queue are discharged during a green time. All arriving vehicles must stop at the intersection and pass through the intersection during the next green. Thus, there is more number of stops under maximum vehicle criterion. In addition, from the viewpoint of fuel efficiency, maximum vehicle criterion is not the best choice as rate of fuel consumption is higher during acceleration. Although more fuel will be consumed if a queue is created as a result of inefficient signal operation. It is said from the experience that the twice of the minimum cycle length is the optimum signal cycle length.

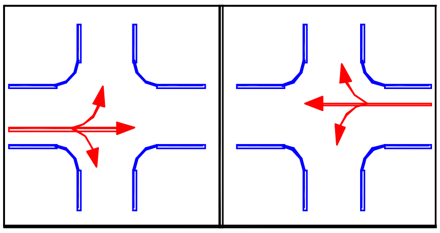
7.5 Signal phasing during manual control

It is often observed that, during manual control, traffic enforcers give a green signal approach by approach as shown in Figure 3 (A) Separate Approach. Vehicles from one approach are discharged in all directions simultaneously followed by a green signal for the opposing approach. The reason for adopting the phase sequence seems not because of the efficiency but because of the fact that separate approach phase sequence is easy to apply while separate control of through and left turn movements is difficult under manual control. For four-leg intersection, this sequence requires four signal phases, if all movements are approved.

Another phasing sequence for two opposing approaches is shown in (B) Simultaneous Through in Figure 3. Through traffic from two opposing approaches is given green simultaneously followed by left turn movement. In this case, left turn arrow signal is required to control left turning traffic separately from through and right turning traffic. Efficiency of the two phasing sequences depends on the volume for through and turning traffic. If through traffic is the majority for both approaches, clearly "simultaneous through" phase sequence is better than "separate approach" phase sequence. One of the reasons that congestion occurs during manual control can be attributed to the inappropriate phase sequence adopted by traffic enforcers.

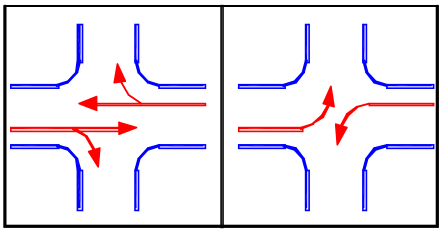
More complicated phase sequence shown in (C) Early and Late Left below is applied at some intersections (for example, EDSA – Quezon Ave. and Commonwealth – Don Antonio). Green signal is given to all movements from one approach followed by simultaneous through from the two approaches. Finally, all movements from the opposing approach receive green signal. This phase sequence is effective when the volumes of two opposing left turn movements are not balanced. Because duration of two left turn phases can be independently adjusted to the left turn volume. Wasting of green time can be minimized by the phase sequence. This sequence can hardly be realized by manual control. Even if it is applied by manual control, controlling green duration to the appropriate duration would not be possible manually.

Figure 3
Signal Phase Sequence



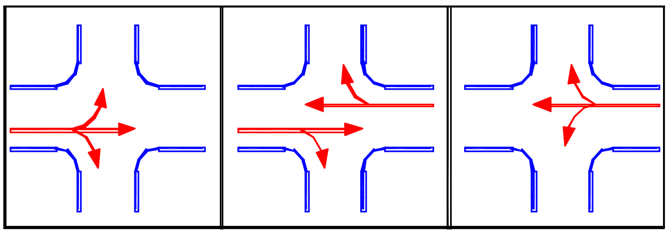
Phase 1 Phase 2

(a) Separate Approach



Phase 1 Phase 2

(b) Simultaneous



Phase 1 Phase 2 Phase 3

(c) Early and Late Left

7.6 Cycle time versus delay

Manual signal control often results in a longer signal cycle. Long cycle time causes twice as long total delay as short cycle time under the same traffic volume and signal split. Figure 4 and 5 illustrates the case of long and short signal cycles. The area of the triangles in the figure represents the total delay experienced by vehicles in the waiting queue. The area is the long cycle time is twice the area of the short cycle time. This means each vehicle in the queue of long cycle time has to wait twice longer than the vehicles of short cycle length.

Figure 4
Short Signal Cycles

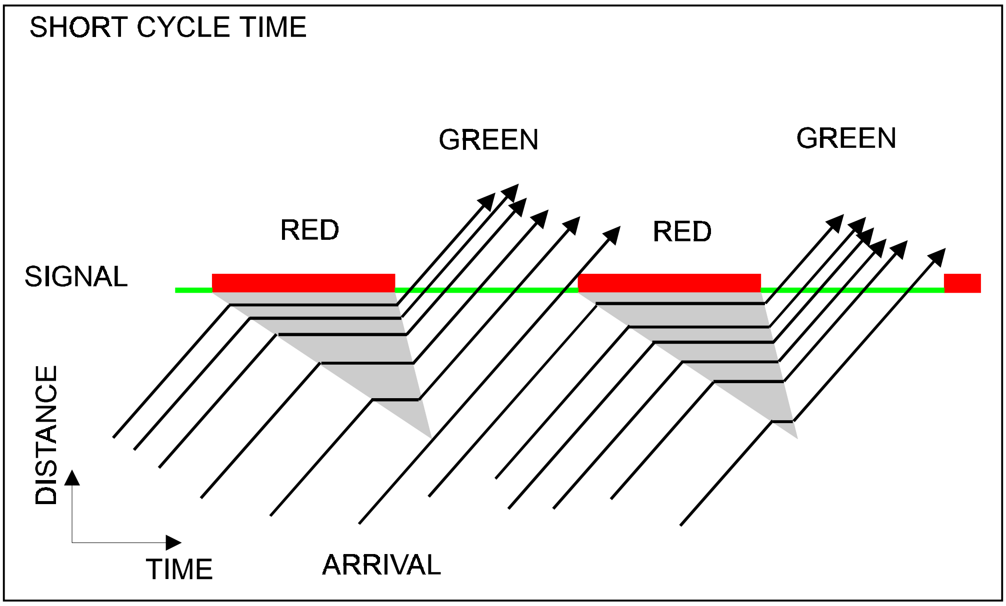
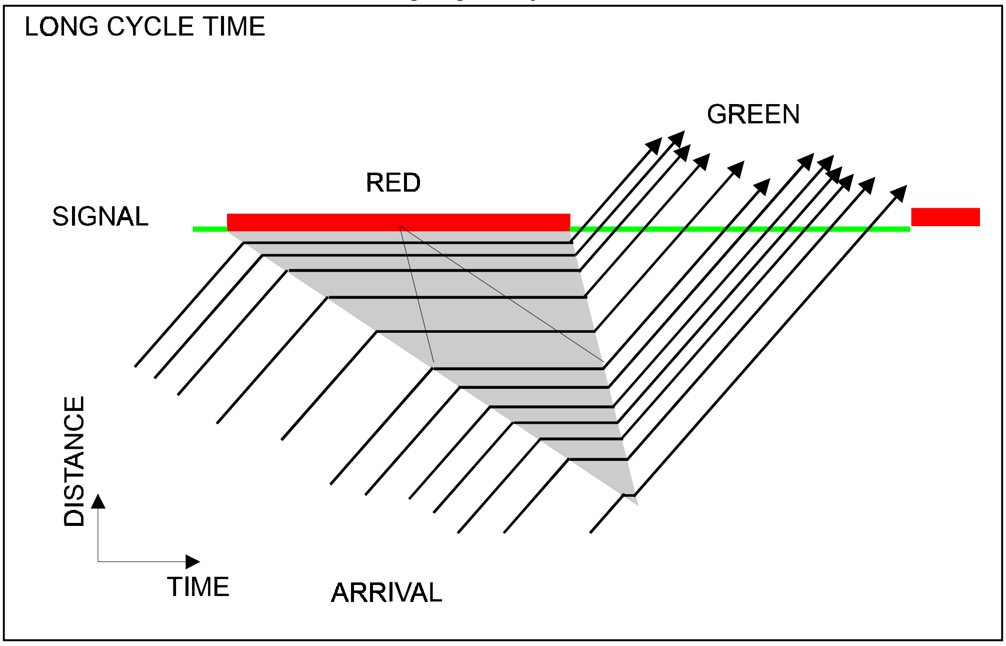


Figure 5
Long Signal Cycle



APPENDIX II

TECHNICAL NOTES/MATERIALS

PARKING FEE BASED ON LAND PRICE

8. PARKING FEE BASED ON LAND PRICE

An attempt has been made to calculate the value of land occupied by parked vehicle based on the land price. It is assumed that land value is amortized in indefinite years. This is equivalent to paying interest only. Then, the following equation can hold good:

$$L = P + P\left(\frac{1}{1+r}\right) + P\left(\frac{1}{1+r}\right)^2 + \cdots$$

$$= P\frac{1}{1-\left(\frac{1}{1+r}\right)}$$

$$= P\frac{1+r}{r}$$

where L: Land price per square meter in Peso,
P: Value of land per square meter per year, and
r: Interest rate.

Inversely, the parking cost per square meter is expressed as follows:

$$P = L\frac{r}{1+r}$$

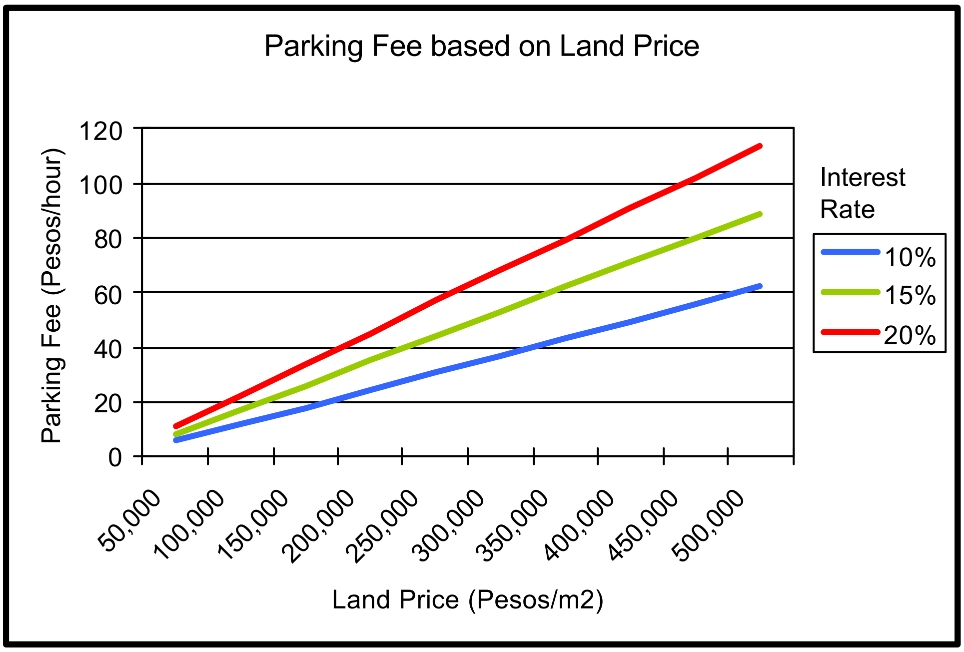
In the case of Makati, land price at the prime area is about Peso 500,000/m^2. Assuming that the land price is Pesos 500,000/ m^2 and annual interest of 18 %, value of land is calculated at Peso 76,271/ m^2 as shown below.

$$P = 500{,}000 \times \frac{0.18}{1.18} = 76{,}271$$

Assuming that a parking lot takes up an area of 12 m^2, its value is calculated at Peso 915,252 per year. If this value is to be covered by parking charge, hourly parking fee should be Peso 104.5 (Peso 915,252 / (365 days x 24 hours)).

The current on-street parking charge in Makati is Peso 40 for the first two hours and Peso 30 for the next one hour. On-street parking is not allowed for more than three hours. The fees are much lower than the value of the land area occupied by the parked vehicle derived from the land price. The differential is considered as subsidy to the users of parking lot. Even the average land price is assumed as 1/3 of the price quoted above, the hourly parking charge should be Peso 35/hour.

The figure below shows the parking cost per hour calculated using the formula above for various land price and interest rate.



Parking Fee based on Land Price
Parking Fee (Pesos/hour)
120
100
80
60
40
20
0
50,000
100,000
150,000
200,000
250,000
300,000
350,000
400,000
450,000
500,000
Land Price (Pesos/m2)
Interest Rate
10%
15%
20%

APPENDIX II

TECHNICAL NOTES/MATERIALS

ANALYSIS OF LRT LINE – 1 CORRIDOR

9. ANALYSIS OF LRT LINE 1 CORRIDOR

9.1 Overview of the Area

LRT line 1 runs a total of 15km from Monumento in the north and Baclaran in the south as shown in Figure 1. The railway track was built on an elevated structure located at the center of road except sections between Central Station and Carriedo Station, where the line crosses Pasig River. The roads where LRT Line 1 passes are, from the north - Rizal Ave. Extension, Rizal Avenue, Arroceros, Taft Avenue and Mexico Road. These roads are primary radial roads in Metro Manila’s road network except Arroceros, which is a short stretch of road located behind Manila City Hall and Mehan Garden. LRT Line 1 Corridor refers to the catchment area of these roads. In terms of local government, the corridor passes through Caloocan, City of Manila and Pasay City.

9.2 Land Use

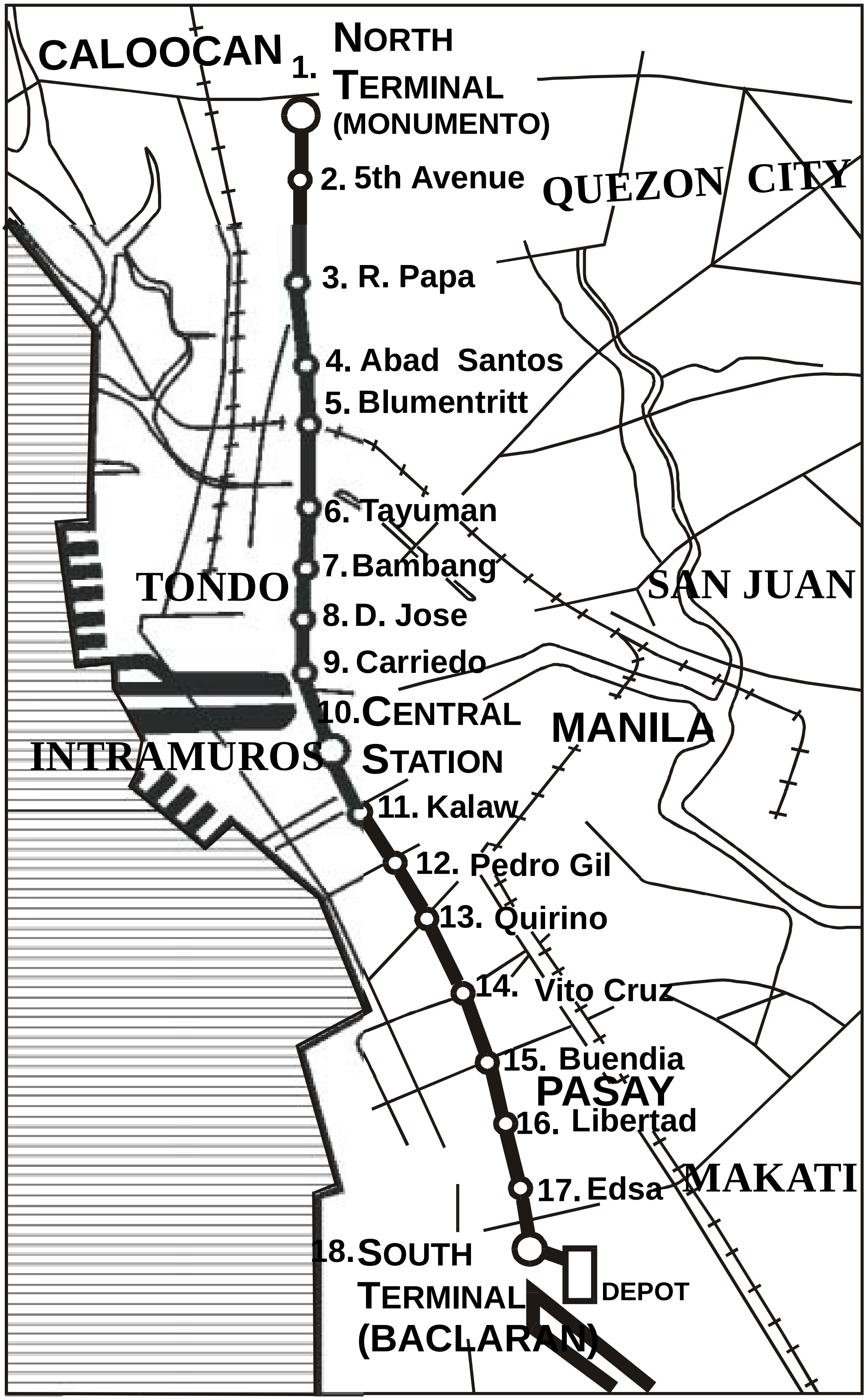
LRT Line 1 and the roads under it pass through the area that is generally old developed and densely populated. Majority is two- or three-story buildings and houses. The building becomes taller at the commercial area. No high rise building is seen along the entire route. Land fronting the route is mostly used for commercial and business. A number of government offices are located south of Pasig River near the intersection with UN Avenue. Several large hospitals are located along the route. So do the college and universities. North Cemetery and Chinese Cemetery occupy a large portion of the land in the northern part of the route. Commercial activities are intense at several locations along the route.

9.2.1 Northern Half (Monumento to Carriedo)

Monumento is one of the busy commercial centers along the route with shopping mall, retail shops, restaurants, movie theatres, banks, etc. along Rizal Avenue Extension and around the Monumento, which is the intersection of Rizal Avenue Extension and EDSA. Bus and Jeepney terminals, both on-street and off-street, are located in the area. It is also a gateway to the northern part of Metro Manila such as Valenzuela and Navotas. Since Monumento is the end station, it also serves as the transfer point from LRT to another mode of transport. Office and business establishments are found behind the commercial area.

The commercial activities are intense between Monumento intersection and LRT Monumento station that it is more significant than in the area in the south of Monumento station. Rizal Avenue Extension is flanked dominantly by commercial and business use until R. Papa Station, where a large cemetery occupies on the east side of Rizal Avenue Extension and in the west side, residential area spreads behind commercial establishments that face the route.

Figure 1
LRT Line 1 Alignment



The same pattern continues until Tayuman Station except around Blumentritt Station. A public market stands at the north-east corner of Blumentritt railroad crossing. Along Blumentritt, which extends from Blumentritt intersection in north-east direction, many shops exits. In front of these shops is on-street market, where vegetables, fruits, fishes and grocery are sold.

Department of Health, Dr. Jose R. Reyes of Memorial Medical Center and San Lazaro Hospital occupy a large block located at south-west corner of Tayuman Station.

Commercial and residential area is found between Bambang and D. Jose Station. Central Market, a large market of traditional type, is located some 300 meter east of the route on Fugoso. South of the market is Manila City Jail, where there is a plan of converting the jail to a commercial complex.
The south area of D. Jose stations and north of Pasig River is the busiest and most crowded commercial district in Metro Manila. Small retail shops, restaurants, movie theatres, small hotels, etc are densely located in the area. Two famous churches, Quiapo church some 250 meter on the east side and Sta. Cruz Church Parish Church less than 100 meter on the west side, are also the attraction of many people.

9.2.2 Southern Half (Central to Baclaran)

Government offices, educational institutions, hospital and open space occupy the majority portion of the area on both sides of LRT Line 1 from Central Station to UN Avenue Station. A large block accommodating WHO Office, National Bureau of Investigation, and other government offices occupies the south-west corner of Taft – UN Avenue intersection. Another large block is located south of the block mentioned above. It accommodates a hospital, a hotel and a shopping complex. Tourism related business is active in the area between these blocks and Roxas Blvd. Area between these large blocks and President Quirino is mostly a mixed area of commercial and residential use with two universities in the area.

Between President Quirino and Gil Puyat, commercial activities are not prominent except north of the intersection of Taft Ave. and Vito Cruz. Another university is located adjacent to the small food complex at the north-west corner of the intersection. Back of the university is a sport complex with stadium, baseball field, tennis courts and caesium. A shopping mall and a hotel are found further west of the sport complex. A number of bus terminals exist near the intersection of Taft Ave. and Gil Puyat. The number of commercial outlets has been increasing along Gil Puyat.

The section between Gil Puyat and EDSA is mostly residential area except two locations. Cartimar Market is located on the west side of the section. Another market occupies the south-west corner of the intersection of Taft Avenue and Libertad. Commercial activities are intense along both streets, where street vendors selling goods on sidewalk and carriageway are common in the area. Residential area spreads behind the commercial and business establishments.

Mexico Road is a road between EDSA and Quirino Highway, where commercial use is dominant particularly towards Quirino Avenue with the residential area behind.

Baclaran station, which is the south end terminal of LRT line 1 is located in the section. Street vendors are extremely abundant in the area, particularly along Redemptorist where the famous Baclaran Church is located.

9.3 Road Geometry

9.3.1 Northern Half (Monumento to Carriedo)

Well-planned grid road network, which consists of straight streets in north-south and east-west direction, is formed at three areas along the entire route. A grid road network exists toward the north end of the route between 1st Avenue and 12th Avenue, where roads run in the north-south and east-west direction with Rizal Avenue Extension at the middle of the network. The spacing between roads is narrower for roads in north-south direction. Rizal Avenue Extension bends in south-west direction, and grid network is bounded with Chinese Cemetery located on the east of the road.

5th Avenue, which will be a section of C-3, has wide right of way of more than eight lanes at the intersection with Rizal Avenue. But the road becomes narrower to two lanes one block west of Rizal Avenue.

Another grid road network exits between Aurora Avenue and C. M. Recto. The rectangular blocks in the network are also longer in north-south direction. The grid network is interrupted by PNR line running east-west direction along Antipolo, which consists of a one-way pair with PNR line at the center. Most of the streets in north-south direction are divided by railroad. Only Rizal Avenue and Tomas Mapua located some 120 meter west of Rizal Avenue cross the PNR line. The network is disturbed by Blumentritt, which extends from Rizal Ave. – Antipolo intersection toward Aurora Avenue in north-east direction. The grid network terminates at San Lazaro Race Truck located east of Rizal Avenue south of PNR line. On the west side of Rizal Avenue, J. R. M. Hospital and San Lazaro Hospital, which are located in the same compound, occupy a large area and grid network is terminated there.

Between C. M. Recto and Pasig River, Rizal Avenue passes through one of the densest commercial districts in the Metro Manila. Narrow and irregularly connected roads exists on both sides of Rizal Avenue, where many retail shops, restaurants, movie theatres are located. Quiapo Church few hundred meters on the east side of the route attracts many worshippers.

9.3.2 Southern Half (Central to Baclaran)

On the south half of the route, a grid road network is formed between UN Avenue and President Quirino. The grid network extends to the west until Roxas Blvd. which runs along shore line. Two large compounds disturb the network. One compound accommodates WHO office, National Bureau of Investigation and other government agencies. The second compound located south of the first accommodates Philippine General Hospital.

On the southern side of President Quirino, a couple of roads run in the north-south direction parallel to Taft Avenue between President Quirino and EDSA. But the pattern is not regular except Tramo on the east side and F. B. Harisson on the west side. Road density is lower than the area on the north side of President Quirino. A sport complex and a shopping mall located on the west side of the section contributes to the low road density.

Taft Avenue ends at EDSA. From the intersection of Taft and EDSA, Mexico Road runs in the south-west direction down to the intersection of Quirino Ave. and Redemptorist. The south end terminal of LRT is located at the mid-block of Mexico Road.

Rizal Avenue and Taft Avenue are only the route that connects straight the peripheral areas in Metro Manila with its centre. Rizal Avenue Extension is connected with McArthur Highway, which extends through Valenzuela toward Malinta. On the south end, Mexico Avenue is connected with Quirino Avenue, which runs parallel to the coastline toward Zapote in Las Pinas.

9.4 Road Condition

Throughout the roads along which LRT Line 1 runs, columns supporting LRT structure stands on the median. Median island of about 2.5 meter wide is constructed continuously along these streets to protect the columns and guide traffic flow. It prevents vehicles from making left turn or U-turn except at opening. Median is open at intersections, some of which is signalized and others are not, to allow vehicle to cross or make turns. In addition, median opening is provided at mid-block points. Some of openings have a hump to force crossing vehicles to slow down. Existence of median, on the other hand, makes it easy for pedestrians to cross the street as median serves as refugee. In order to prevent uncontrolled crossing, pedestrian barrier made of steel fence is installed all along the median for the entire route.

Pavement markings on the roads under LRT Line 1 are faded away and not conspicuous enough to regulate traffic flow. Reflective studs were installed recently at section of northern half. It exhibits better reflectively than thermo-plastic marking materials with beads in the night. But marking is better in guiding traffic. Reflective studs must be used in conjunction with lane line.

Lighting facility is provided under the LRT structure at each span. According to Light Rail Transit Authority (LRTA), the lighting facility is installed by LRTA but its operation including the cost of electricity is the responsibility of local government. According to the same source, the control of lighting system is done manually. A survey conducted during night revealed that lighting is working only at one section between Carriedo station and Philippine Rabbit Transport Terminal located north of C. M. Recto. Lighting at all other sections are not lit during night.

9.4.1 Northern Half (Monumento to Carriedo)

Rizal Avenue Extension is a six-lane divided road except a section between a gate to Chinese Cemetery and the intersection with J. A. Santos Ave., where the street becomes four-lane road. LRT columns line along median and narrow sidewalk exists on both sides. Cement concrete pavement is generally good but dilapidated pavement is spotted at several locations along the route. Sidewalk improvement project is on-going along Rizal Avenue Extension between EDSA and the small bridge north of R. Papa station. The project replaces the existing sidewalk pavement with new surface using bricks. The project also includes installation of street lighting, replacement of damaged drainage cover, rehabilitation of drainage intake.

Rizal Avenue is a four-lane divided road with LRT columns at median. Cement concrete pavement is generally good. Replacement of dilapidated portion of pavement is undertaken as part of signal replacement project. Pavement marking is poor and almost invisible

Along Rizal Avenue, sidewalk is provided under the building. Additionally narrow sidewalk is provided outside of building at some sections. The right of way lies at the edge of carriageway which is not straight. Sidewalk under the building is generally wide and provides pedestrians protection from direct sun and rain. But its design is not consistent. Height of sidewalk is not at the same level making improvement of sidewalk difficult. Sidewalk is often used as parking log or space for business activities.

Some of the crossing streets have poor pavement. Only center portion has good cement concrete pavement. Outer lane is paved with asphalt concrete which is already dilapidated. Most of these streets have no sidewalk.

9.4.2 Southern Half (Central to Baclaran)

P. Burgos in front of Manila City Hall is wide. It has seven lanes in northbound direction and five lanes in southbound direction. Pavement markings are at poor condition. Arroceros located at the back of Manila City Hall is a four-lane road with good pavement but it is under-utilized. The road is used as parking lots on the west side as well as under LRT structure.

Taft Avenue between Ayala Blvd. and President Quirino is an eight-lane divided road. Sidewalks are wide particularly between Ayala Blvd. and UN Avenue is 10 meter wide and planted with tree, and may be the best sidewalk in Metro Manila. The right of way becomes gradually narrower at south of President Quirino but four lanes in each direction are maintained. Sidewalk becomes narrower at one section north of De La Salle University while no sidewalk is provided on the west side.

Taft Avenue is a six-lane divided road between Vito Cruz and EDSA. But width of right of way varies so does the lane width. The width of sidewalk also varies from 6 meters to 1 meter. No sidewalk is provided on the west side near Taft – Libertad intersection. Pavement is at acceptable condition but pavement markings are virtually not existing along Taft Avenue.

Mexico Road is a four-lane divided road with narrow sidewalk. Pavement is good but no pavement markings are provided.

9.5 LRT Ridership

LRT Line 1 has 18 stations for the total length of 15 km. The average number of boarding and alighting passengers at each station on weekdays is shown in Table 1. The daily average number of passengers on weekdays is 435,000. The number of passenger in southbound direction is about 11% higher than that in northbound direction.

At the north end, Monumento Station has the largest number of passengers of 155,490 a day followed by Baclaran at south end of 119,351. Gil Puyat, which is located above the intersection of Taft Ave. and Gil Puyat Ave., is the third. Carriedo located in the busy commercial area of Quiapo has the fourth largest number of passengers. EDSA station, which is next to the southern end of Baclaran and located near the intersection of Taft Ave. and EDSA is the fifth.

Two southern end stations of Baclaran and EDSA, if combined, have more passengers than the north end terminal of Monumento. The share of these three end stations, Monumento, EDSA and Baclaran is 39 %. This indicates that LRT is used more by the passengers whose origin or destination is further north of south than the end terminals or by the passengers who travel within the catchment area of LRT Line 1. This fact suggests the possibility of extending LRT line further north and south.

The concentration of passengers at specific stations is causing a problem of insufficient space at these stations. At Monumento and Baclaran, the number of passengers to be accommodated in one train is restricted for the two reasons; (1) if all passengers are allowed to enter the station, platform will be too crowed with waiting passengers creating a dangerous situation; (2) if train is loaded full at the first station, passengers at the next station cannot board the train. Once platform is filled with waiting passengers for the next train, entrance gate is closed and passengers are asked to wait on the corridor, stairs and sidewalk of the station.

Table 1
The Number of LRT Passengers on Weekdays
(December 1997)

	Station	South Bound			North Bound			Total
		Alighting	Boarding	Total SB	Alighting	Boarding	Total NB	
1	Monumento	0	69,459	69,459	86,031	0	86,031	155,490
2	5th Ave.	283	20,971	21,254	11,486	3,346	14,832	36,086
3	R. Papa	586	6,955	7,541	5,337	2,224	7,561	15,102
4	A. Santos	333	7,674	8,007	4,822	5,565	10,387	18,394
5	Blumentritt	1,129	19,109	20,238	15,730	1,739	17,469	37,707
6	Tayuman	2,091	12,200	14,291	10,550	3,267	13,817	28,108
7	Bambang	993	3,999	4,992	3,360	1,237	4,597	9,589
8	D. Jose	5,548	13,354	18,902	13,202	5,537	18,739	37,641
9	Carriedo	14,172	20,852	35,024	21,603	12,848	34,451	69,475
10	Central	4,332	6,494	10,826	8,783	4,150	12,933	23,759
11	UN Ave.	11,278	9,516	20,794	9,915	10,235	20,150	40,944
12	P. Gil	8,682	7,734	16,416	8,065	12,996	21,061	37,477
13	Quirino	5,820	1,976	7,796	2,430	5,309	7,739	15,535
14	V. Cruz	6,869	3,047	9,916	2,710	8,789	11,499	21,415
15	G. Puyat	49,291	14,773	64,064	1,846	31,685	33,531	97,595
16	Libertad	14,215	8,939	23,154	631	16,077	16,708	39,862
17	EDSA	30,096	1,656	31,752	0	35,149	35,149	66,901
18	Baclaran	73,009	0	73,009	0	46,342	46,342	119,351
	Total	228,727	228,708	457,435	206,501	206,495	412,996	870,431

9.6 Traffic volume

A 14-hour traffic volume count in respective intersections along the route was conducted by Traffic Engineering Center (TEC), DPWH, is shown in Table 2. The counted volume is converted to PCU with the conversion ratio of 1.0, 1.4 and 2.2 for passenger car, jeepney and bus and trucks, respectively. The conversion ratios are same as those used by TEC. The volume in the table is the higher volume between the volume on approach and volume on exit. The data were collected on different days but the level of traffic volume at each location seems to be the same, as if no event that has an impact on the traffic pattern occurred during the period of the survey.

The traffic volume along LRT Line 1 corridor varies considerably. The highest volume is observed at the intersection of Taft Avenue and UN Avenue, where more than 53,000 vehicles travel in north-south direction. The lowest volume found is at Taft – Libertad intersection, where traffic volume in north-south direction is less than 8,000 for 14 hours.

The percentage of public transport (bus and jeepney) and that of jeepney only are also shown in the table. The percentage is high throughout the corridor, particularly in Monumento, where public transport occupies about half of the traffic. At northern half of the corridor, jeepney occupies higher share in the public transport than in the southern half. At Monumento, virtually all public transport are jeepneys.

Table 2
Traffic Volume along LRT Line 1 Corridor

Location	Total in PCU		Total	% of Public		% of Jeepney		Date
	SB	NB	Volume	SB	NB	SB	NB	Surveyed
McArthur Highway	19,847	15,307	35,154	34.5%	33.4%	26.4%	21.8%	12/11/96
Monumento	17,176	10,995	28,171	50.3%	58.6%	47.9%	58.2%	12/12/96
5th Avenue	14,312	15,471	29,783					6/24/96
J. A. Santos	12,457	12,409	24,866	29.5%	25.4%	29.4%	25.3%	10/5/95
Aurora	6,082	6,598	12,680					7/20/96
Tayuman	12,627	6,175	18,803					9/11/98
C. M. Recto	12,581	14,734	27,315					10/30/97
UN Avenue	23,169	29,961	53,130	49.5%	42.6%	36.1%	32.4%	6/17/97
Pres. Quirino	19,714	24,132	43,846	45.7%	33.4%	37.3%	22.3%	2/25/97
Vito Cruz	16,722	12,346	29,068					11/25/97
Gil Puyat	9,315	17,664	26,979					4/30/97
Libertad	5,144	2,704	7,848					5/5/98
EDSA	7,660	9,088	16,748					10/22/96

9.7 Traffic Condition

Traffic conditions and other findings related to vehicle and pedestrian movements are presented on Figures 2 to Fig. 16. The observation of the site was conducted during September 1998.

9.7.1 Northern Half (Monumento to Carriedo)

Like other locations in Metro Manila where public transport has higher share in the composition, the roads along LRT Line 1 suffer from inefficient and slow movement of vehicles. In the case of these roads, the problem is compounded with the additional bottleneck created at LRT stations, where boarding and alighting passengers transfer from one mode of transport to another. Traffic condition along the route is briefly summarised below.

A big volume of pedestrian flow exists between Monument station and Monument intersection. They walk form LRT station to bus or jeepney stops/terminals located around the intersection where sidewalks are narrow. In addition, parked vehicles, street vendors and other obstructions occupy large portion of it. Passengers are pushed out onto the carriageway and the outmost lane has become a pedestrian pass. In fact, local government unit managing the area places a rope barrier between the outmost and the middle lane to delineate the boundary. The middle lane is used for loading and unloading of passengers. Only the innermost lane was left to keep the traffic moving . As a result, movement is very slow at this section. The situation is aggravated by large number of crossing pedestrians in front of LRT station and Ever Gotesco Grand Central Shopping Mall. The situation becomes more critical when a LRT train arrives and discharges large number of passengers. At the entrance side of the station on the west side of the street, passenger control is implemented and passengers who will ride the train after next are standing on the stairs and the space in front of the station.

Figure 2
Current Conditions along LRT Corridor (Monumento Area)

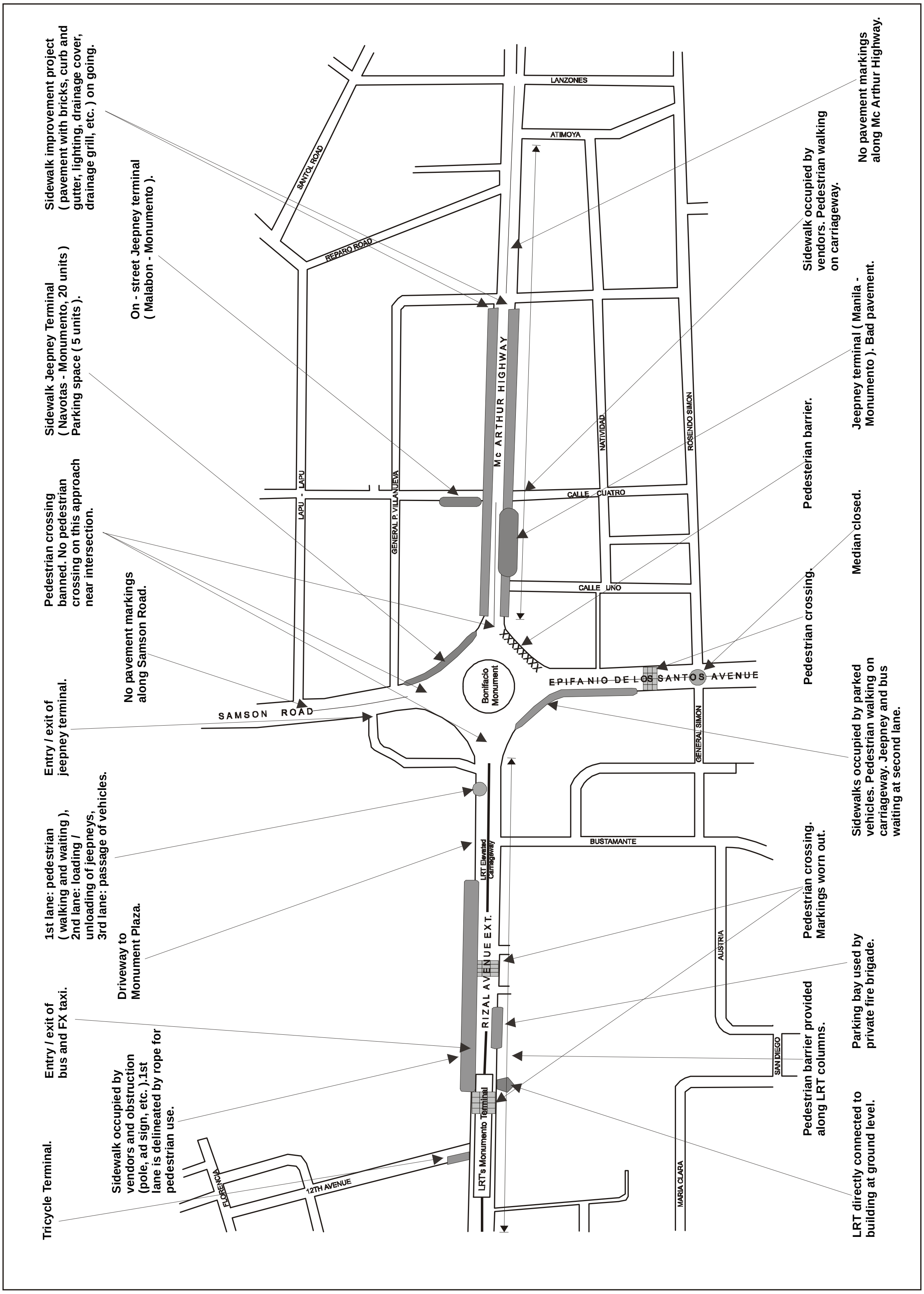


Figure 3
Current Conditions along LRT Corridor (Caloocan Area)

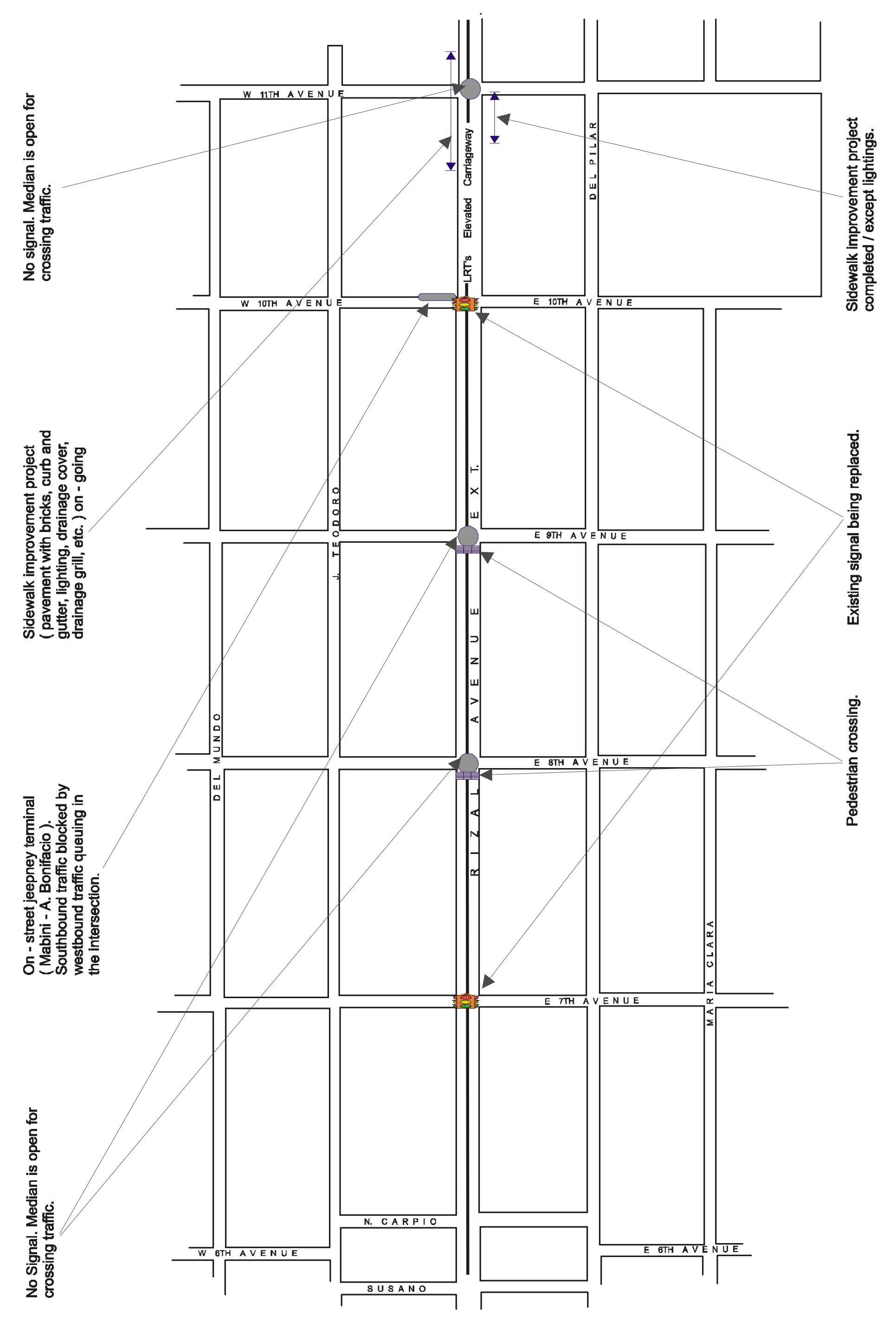


Figure 4
Current Condition along LRT Corridor (5th Avenue Area)

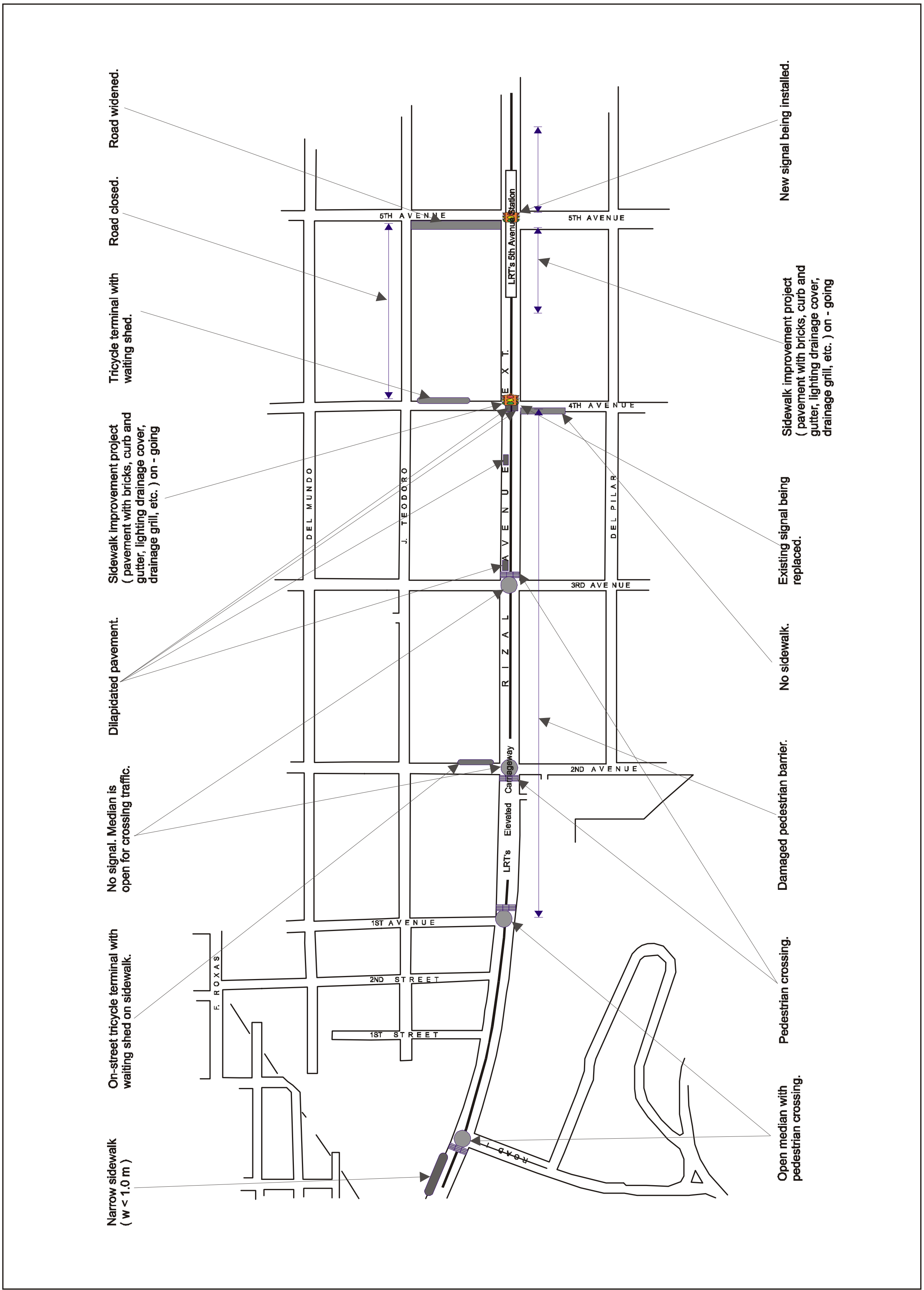


Figure 5
Current Condition along LRT Corridor (J. Abad Santos and R. Papa Area)

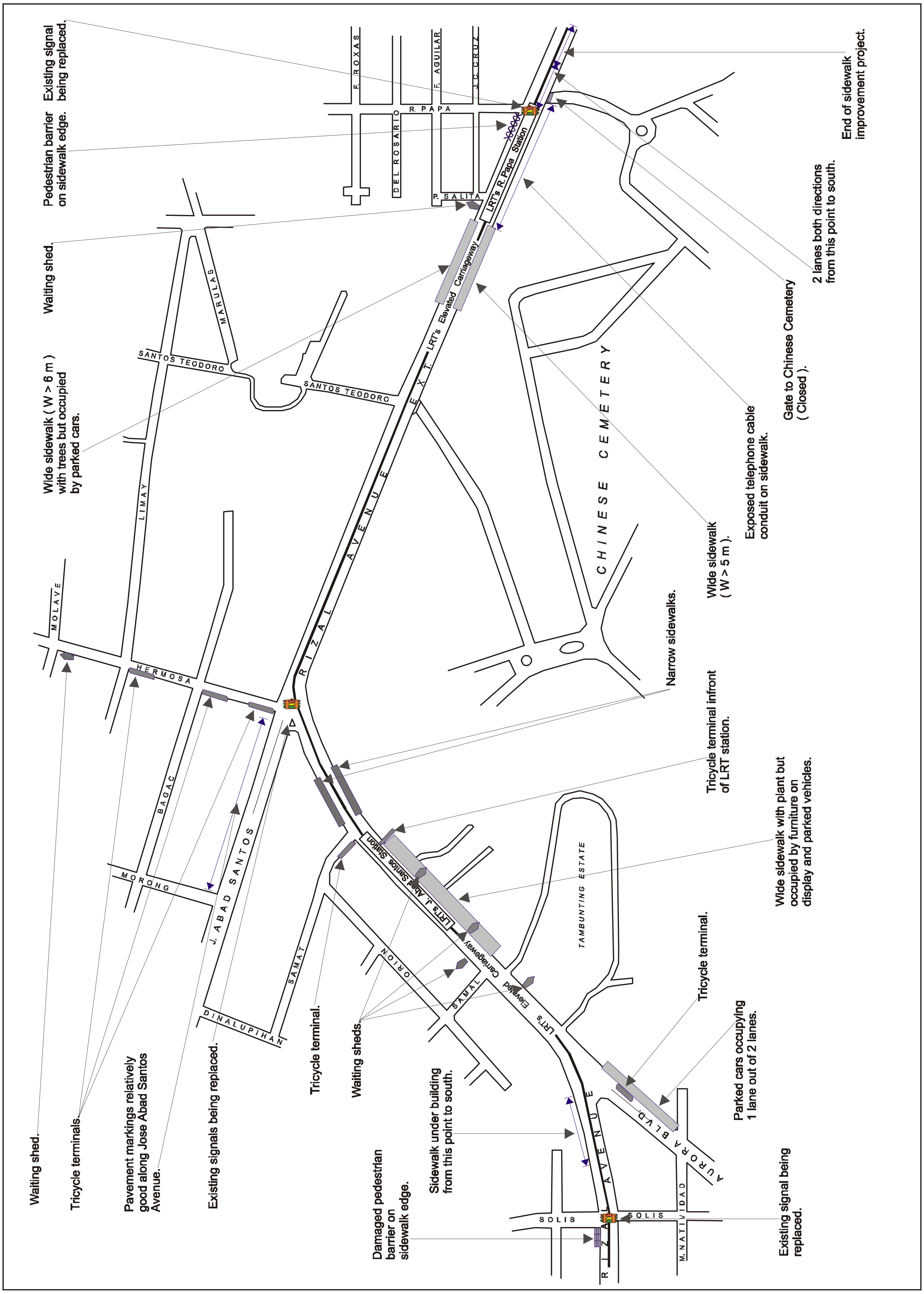


Figure 6
Current Conditions along LRT Corridor (Blumentritt Area)

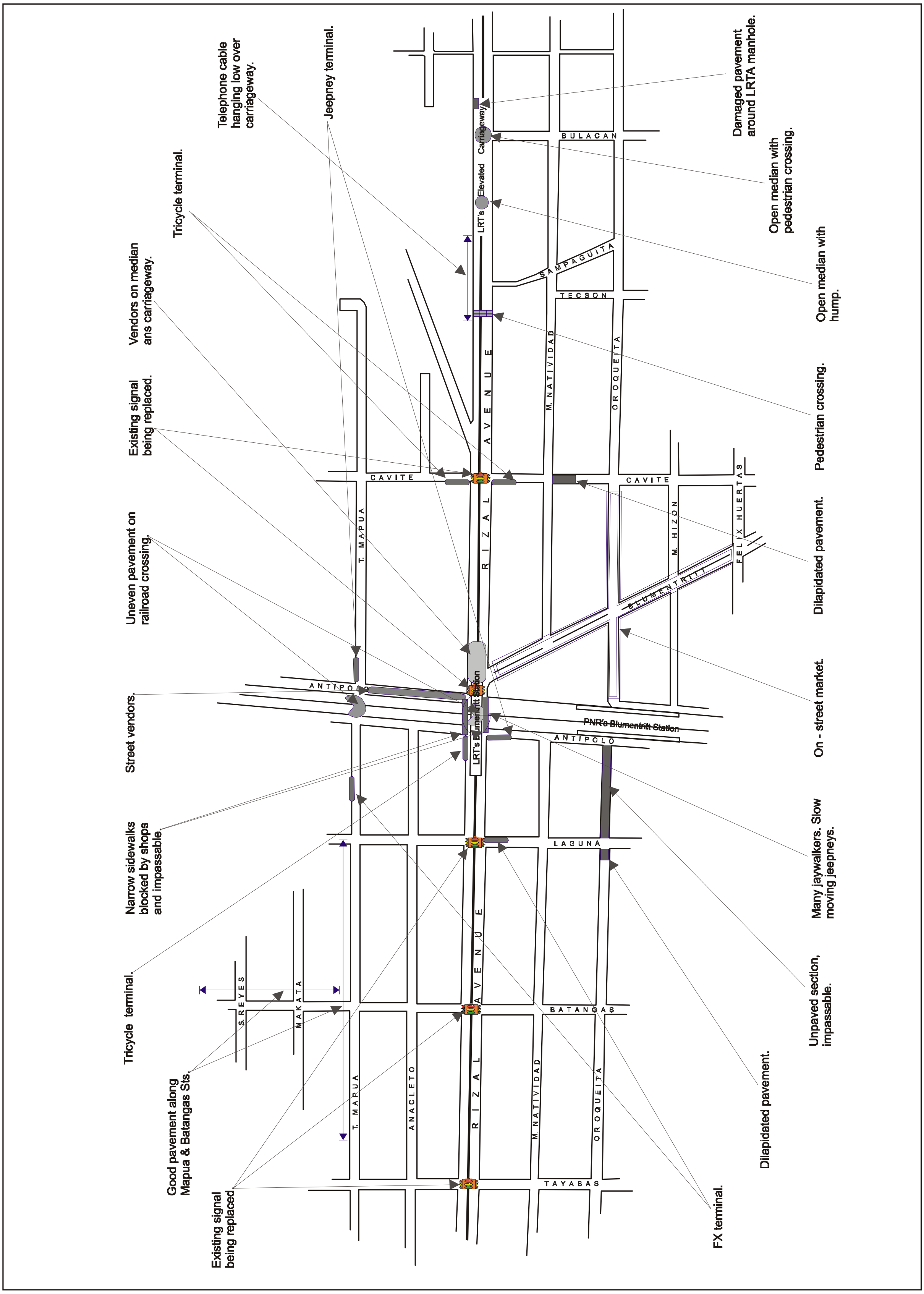


Figure 7
Current Condition along LRT Corridor (Bambang and Tayuman Area)

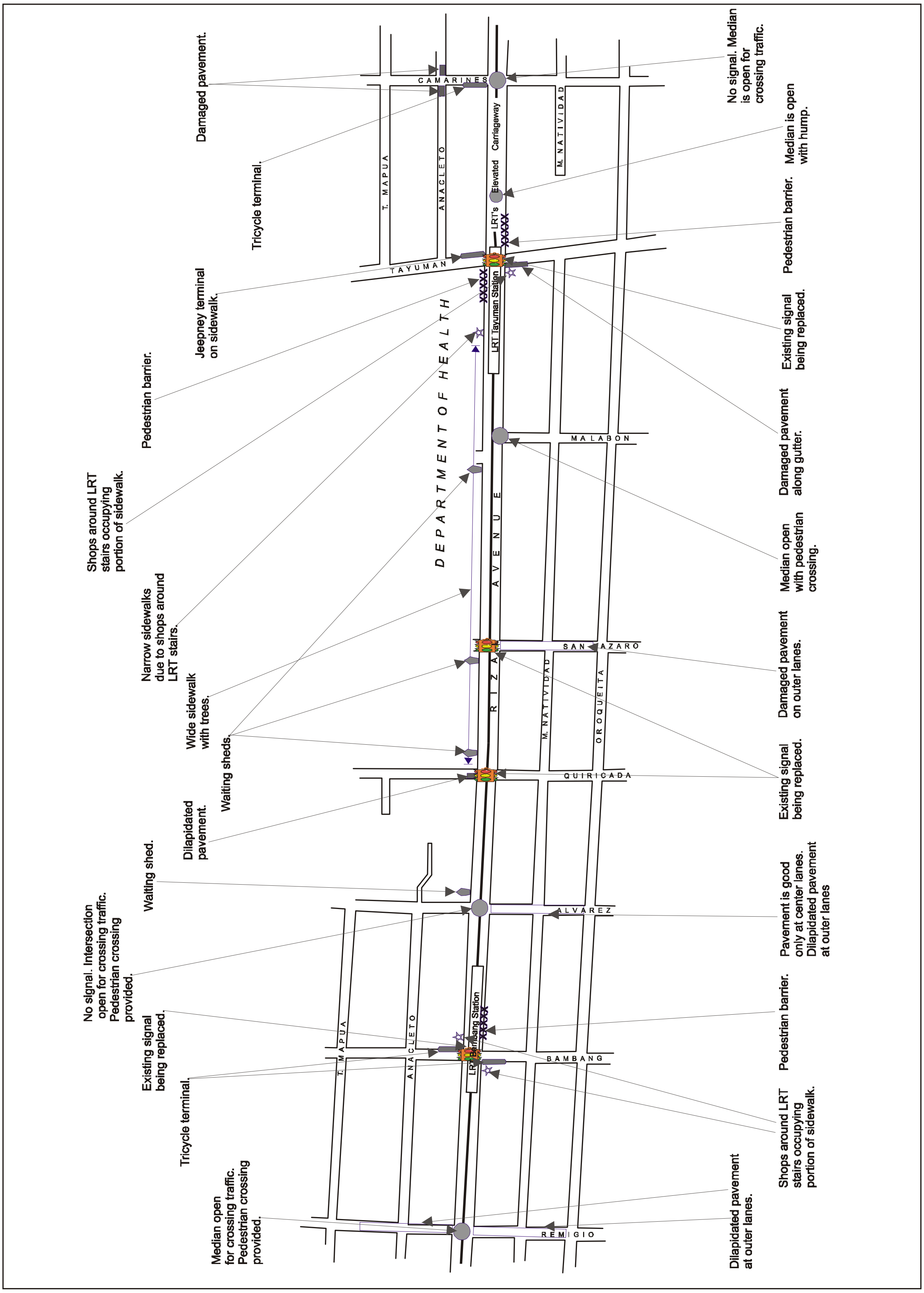


Figure 8
Current Condition along LRT Corridor (Doroteo Jose Area)

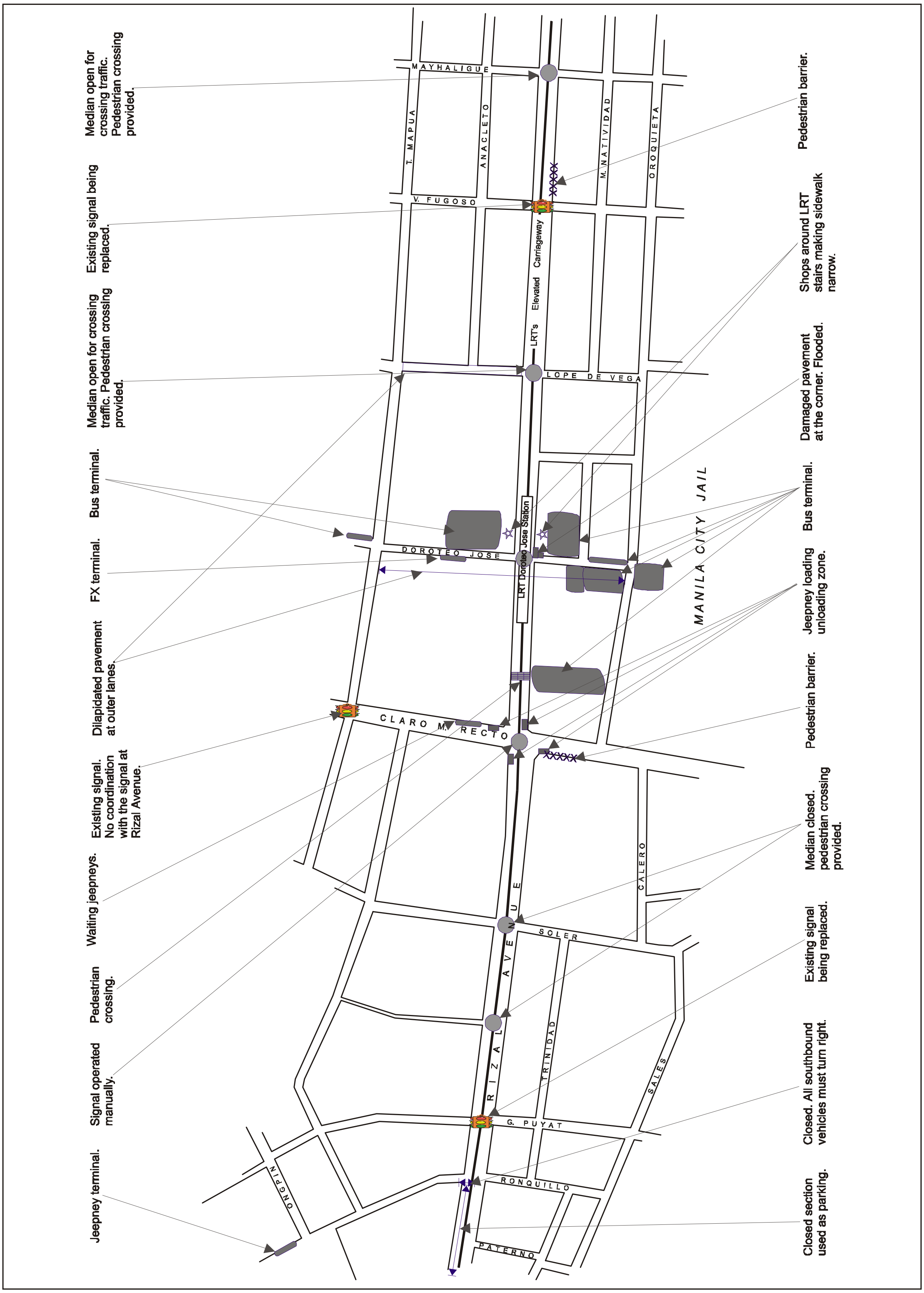


Figure 9
Current Condition along LRT Corridor (Arroceros and Carriedo Area)

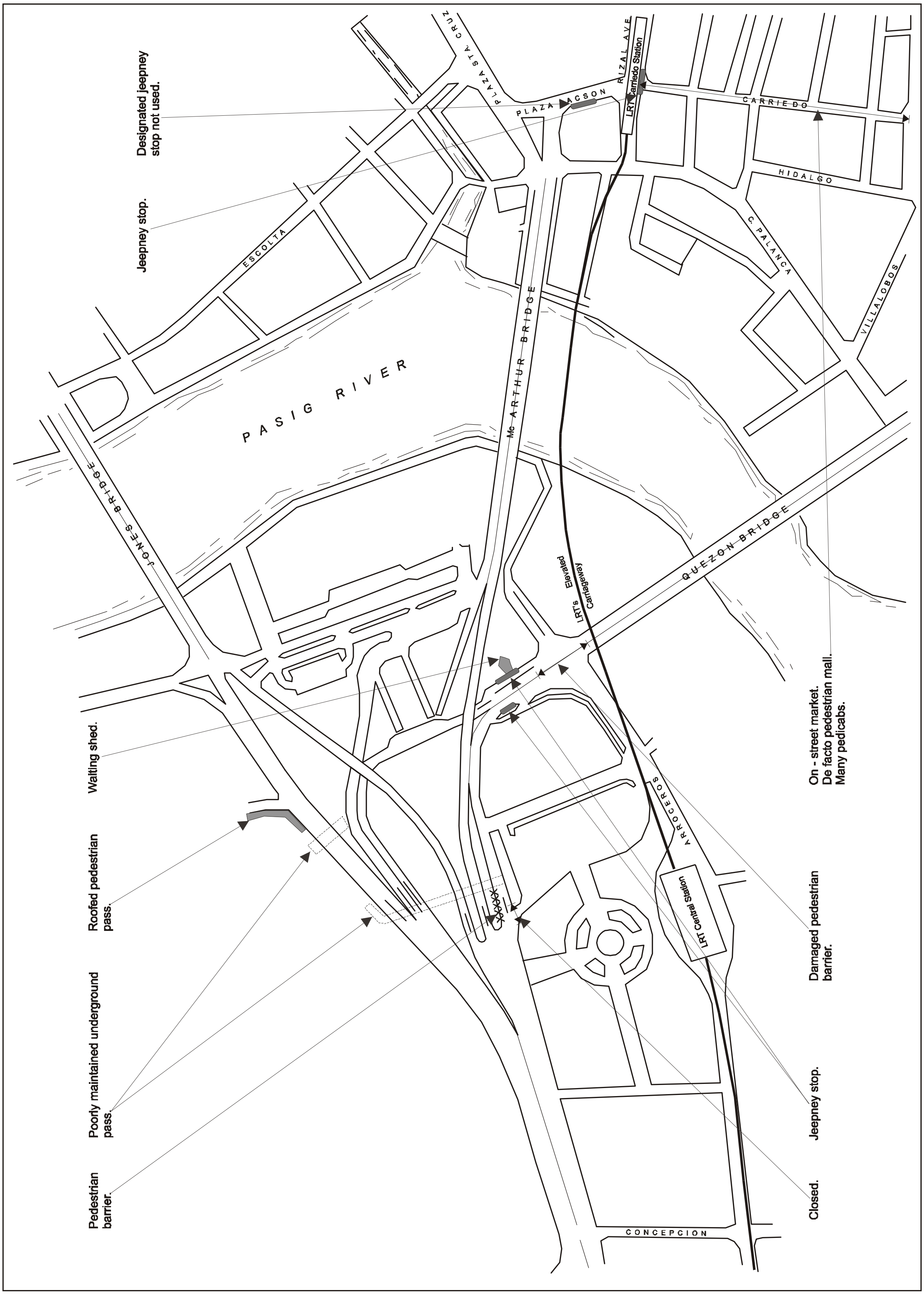


Figure 10
Current Condition along LRT Corridor (UN Ave. Area)

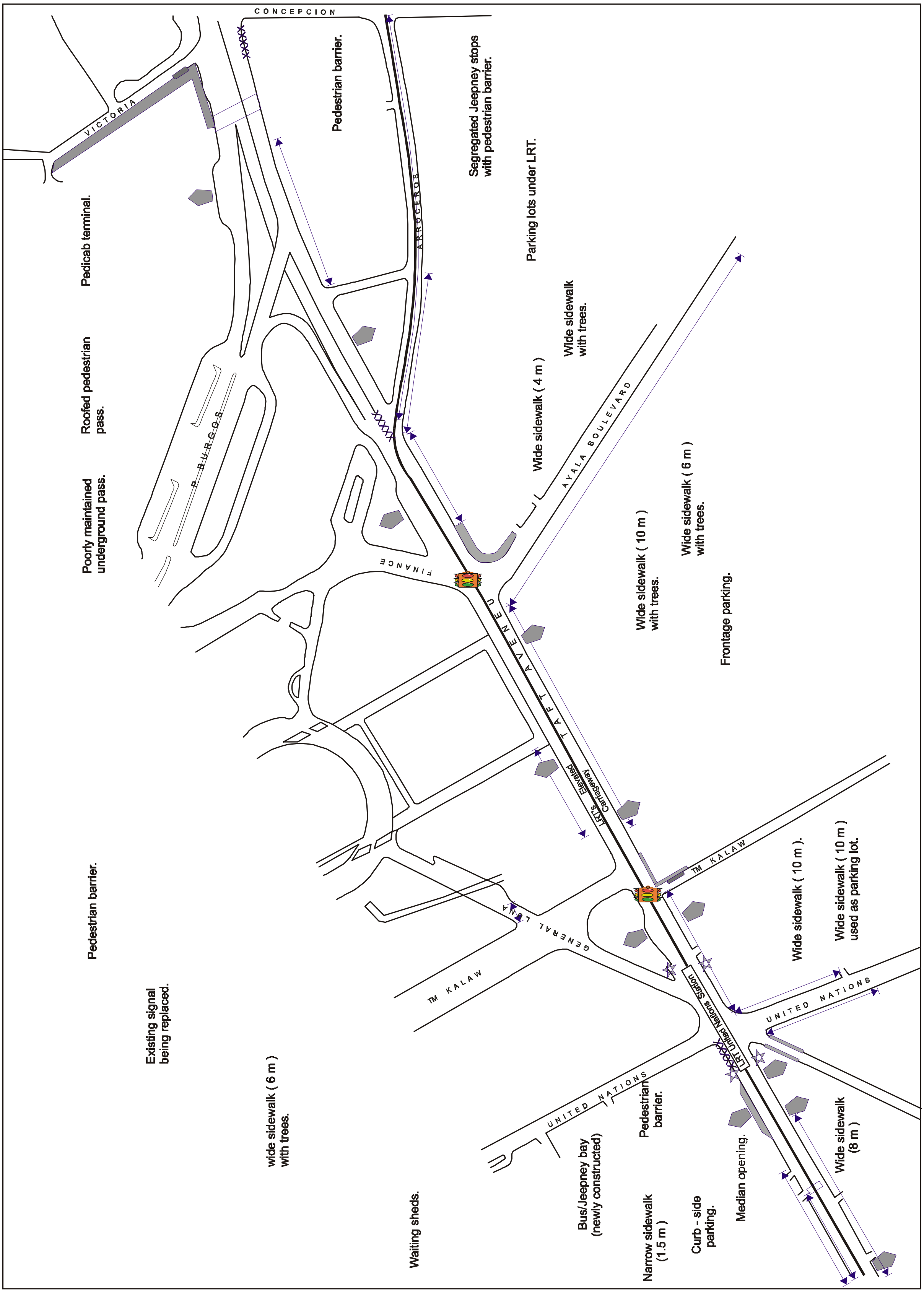


Figure 11
Current Condition along LRT Corridor (Pedro Gil Area)

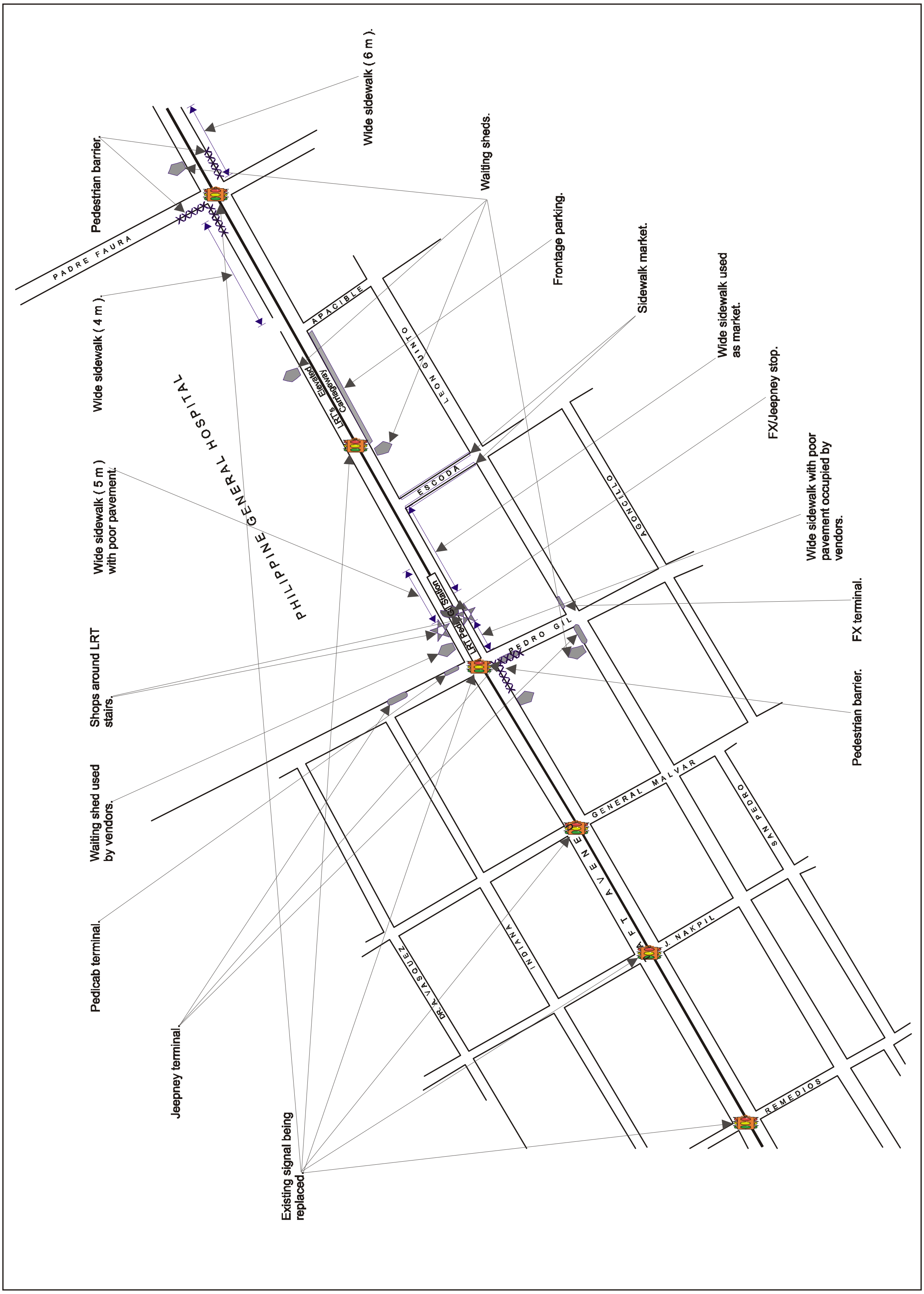


Figure 12
Current Condition along LRT Corridor (Vito Cruz and Quirino Ave. Area)

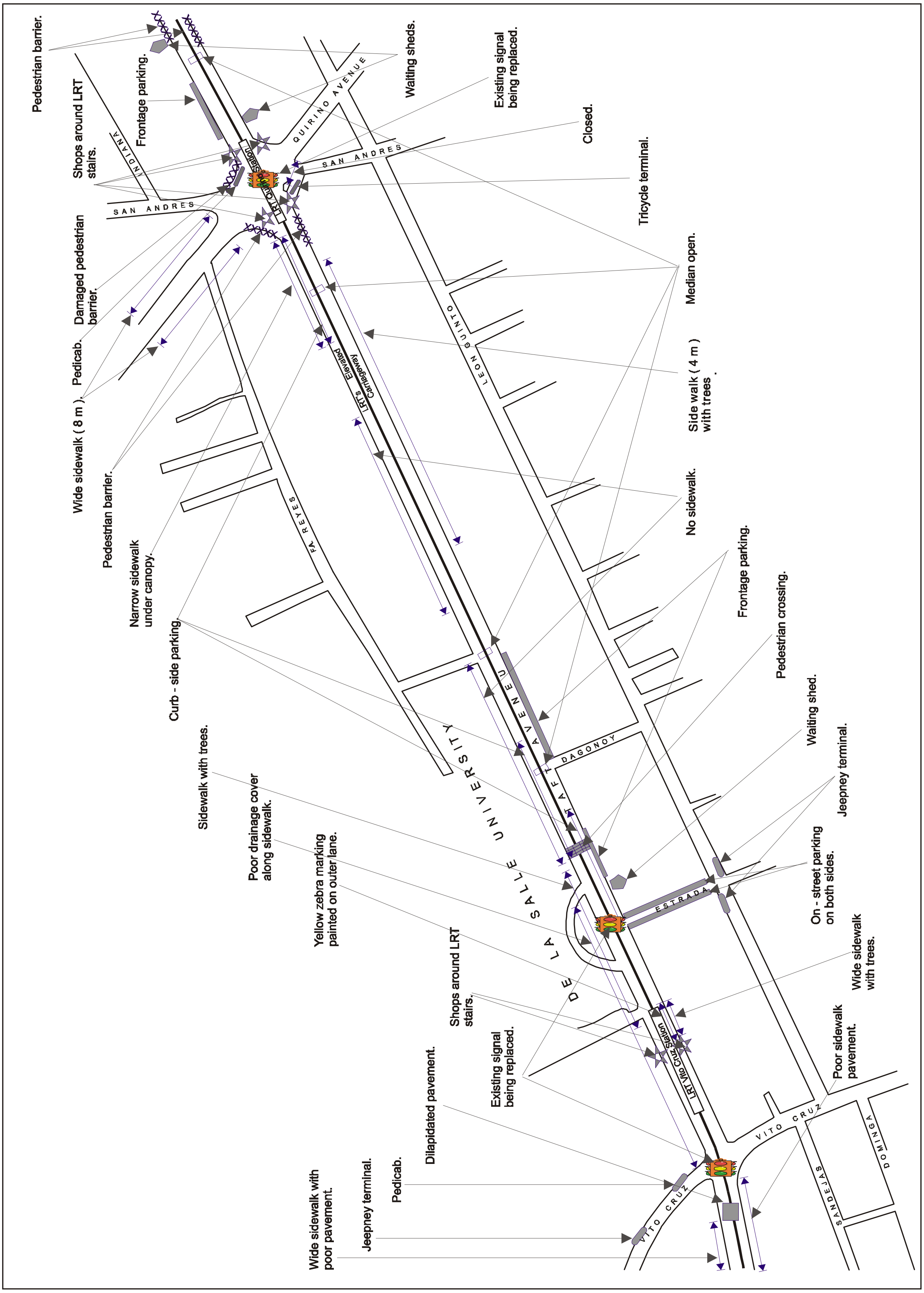


Figure 13
Current Condition along LRT Corridor (Gil Puyat Area)

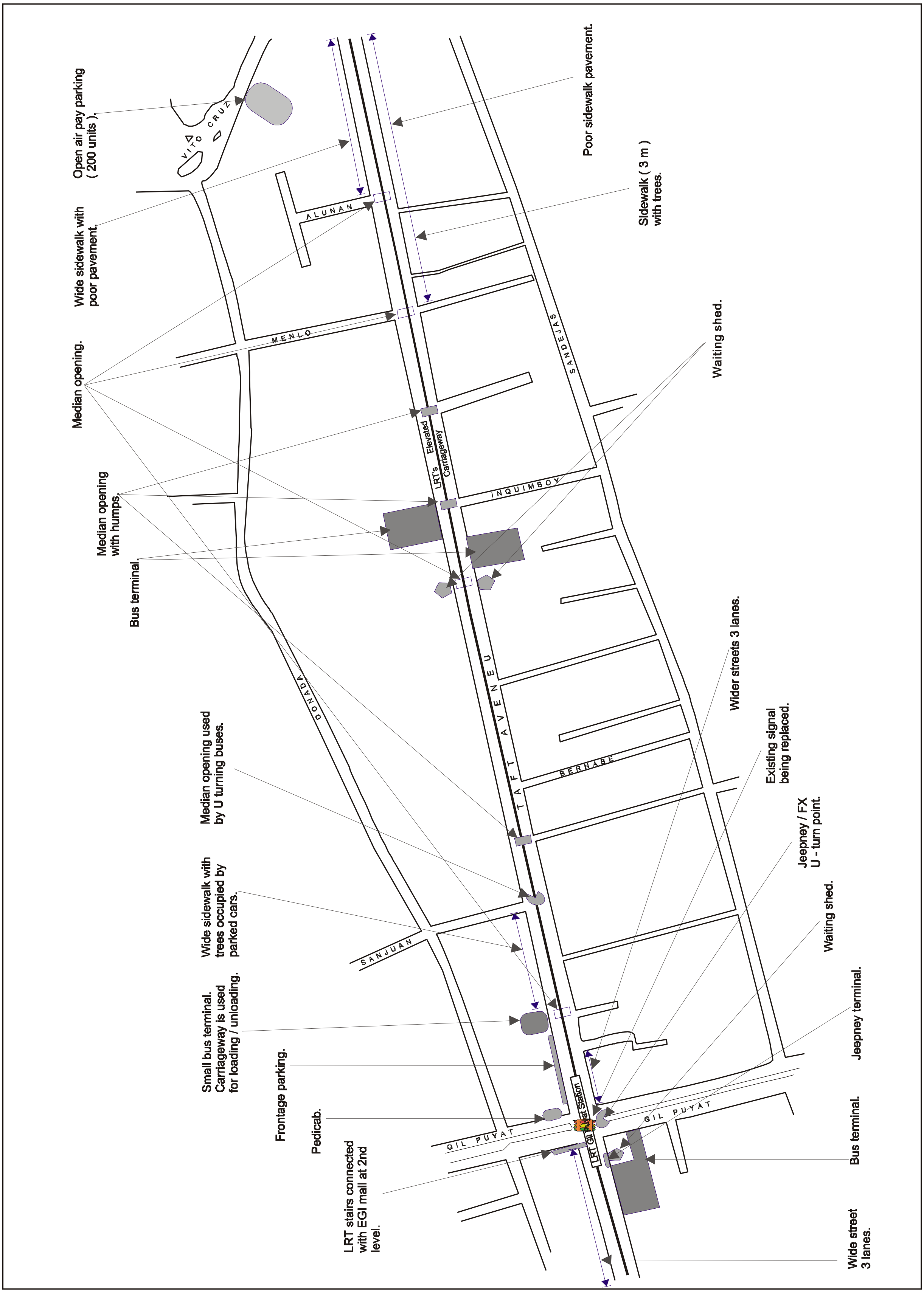


Figure 14
Current Condition along LRT Corridor (Libertad Area)

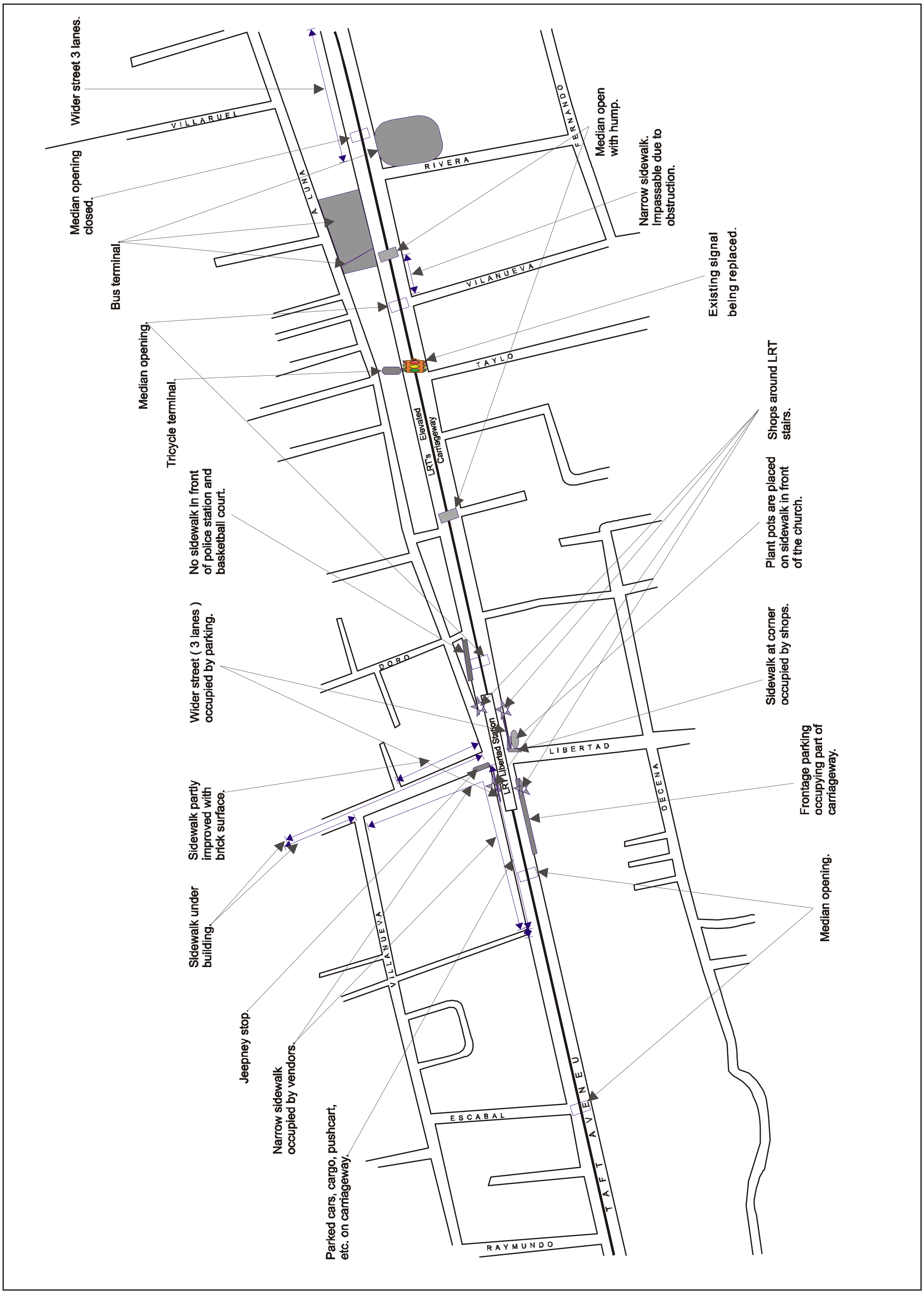


Figure 15
Current Condition along LRT Corridor (EDSA and Baclaran Area)

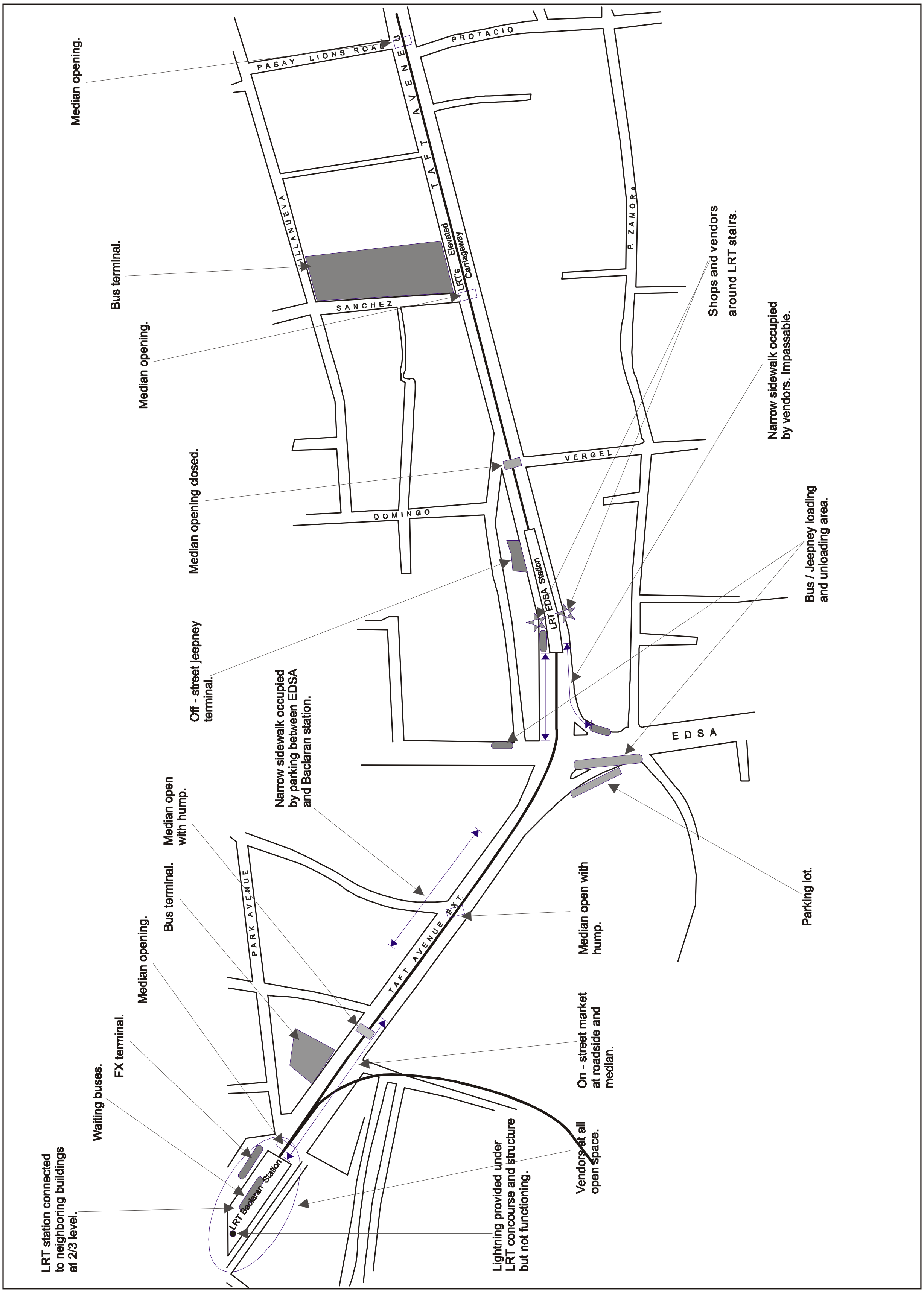
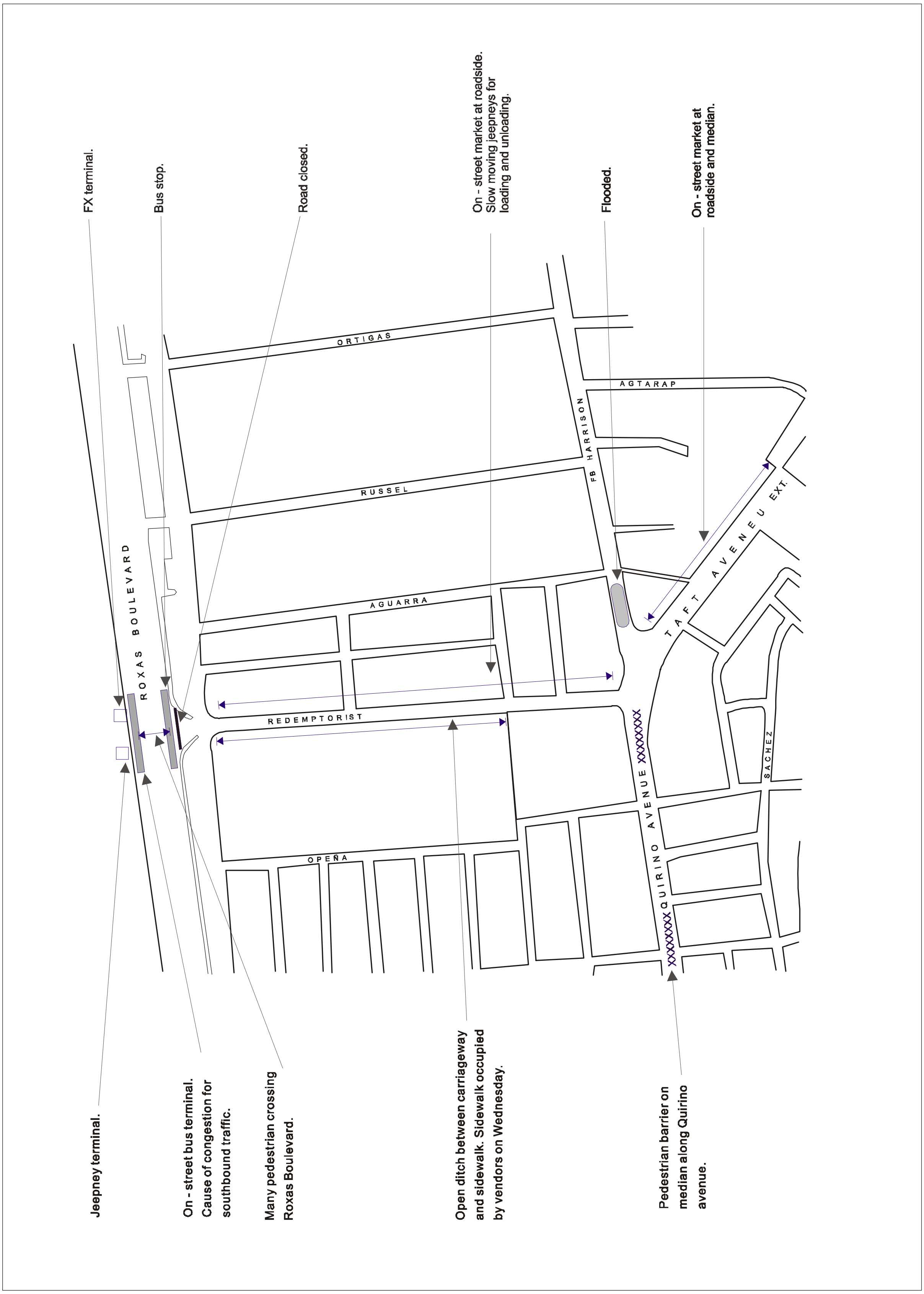


Figure 16
Current Condition Along Roxas Boulevard Area



Traffic condition becomes easier at south side of Monumento station. Occasionally, traffic flow is disturbed by the crossing vehicles that are stocked inside the intersection due to the clogging at the exit side, and by the left turning vehicle. Another disturbance is the jeepney that stops at any location or tries to swerve to the inner lane to overtake the jeepney in front of it. Traffic volume on 5th Avenue is still light.

Traffic volume on the roads which run in parallel to Rizal Extension is light in spite of their good pavement. This may be attributed to the poor connectivity with other roads. Exception is Serrano (5th Street), which is a one-way street and carries heavy southbound traffic.

Traffic flow is squeezed and queue is observed at the north of R. Papa station, where Rizal Avenue Extension becomes from three-lane road per direction to two-lane road.

The intersection of Rizal Avenue and J. A. Santos is one of the large intersections in the northern half of the route. The traffic condition is, however, not critical, due probably to the wide width of J. A. Santos and relatively light traffic.

At Blumentritt, movement is extremely slow mainly due to irregular shape of the intersection and to the manner jeepneys behave. A big food market exists in the area where shoppers flock, that loading and unloading take more time than other locations. In addition, Blumentritt is the end route for the jeepneys coming through Antipolo and going back through Blumentritt. After unloading passengers before the intersection, they pick up passengers while moving slowly blocking other vehicles behind them.

The condition of railroad crossing is not ideal but is not causing much delay. The problem at railroad crossing is the narrow sidewalk with poor pavement. The width is only 1 meter and the space is used by vendors. Pedestrians have no choice but to walk on the carriageway.

No apparent bottleneck exists between Blumentritt and D. Jose. Traffic flow is sometimes disturbed by the left-turning or crossing traffic. Heavy pedestrian movement is observed at D. Jose station between the station and a number of bus terminals nearby.

The intersection of Rizal Avenue and C. M. Recto located at the center of busy commercial district is a bottleneck. Both roads carry heavy volume of traffic, large portion of which is jeepneys. The number of pedestrians is also large. To minimise the number of signal phases, left turn is prohibited from all approaches. Nonetheless, queue is often formed. Congestion is caused by jeepneys, which stop at exit side after crossing the street for loading and unloading blocking the vehicles behind them.

Traffic flow between C. M. Recto and Carriedo station is slow but steady as southbound and northbound vehicles are separated by median and no crossing movement of vehicles is allowed in this section. A jeepney stop is provided in front of Plaza Fair. But it is not used. Instead, Jeepneys tend to stop at end of Carriedo street, where more passengers are expected and the location is protected against direct sun and rain by LRT structure.

9.7.2 Southern Half (Central to Baclaran)

On the south side of Pasig River, traffic volume is extremely low along Arroceros. Only vehicles in and out of Manila City Hall use this street. On the other side of City Hall, P. Burgos carries very heavy traffic. As the location is a focal point in the road network, jeepney terminal here is one of the large transfer points in the Metro Manila transport network. Lane change is frequent at P. Burgos in front of City Hall in both directions. Because road is wide and northbound flow is divided into three directions leading to three bridges, while southbound flow is divided into two. Three pedestrian underpasses crossing P. Burgos segregate the vehicular and pedestrian movements and no conflict exists.

Traffic flow is smooth along Taft Avenue between Ayala Blvd. and President Quirino although the traffic volume is highest along the entire route. The smooth flow is due to the wide street, wide sidewalk and no left turn regulation. A bus bay is recently constructed at the south-west corner of Taft – UN Ave. intersection with roofed waiting shed. Queue is often observed at Taft Avenue – Vito Cruz intersection. Relatively narrow road, illegal curb-side parking, jaywalkers, dilapidated pavement and irregular shape of the intersection are cause of the congestion in addition to the heavy traffic on Vito Cruz.

Traffic flow is generally smooth between President Quirino and Gil Puyat as no bottleneck nor traffic generating facility exists at this section. But queue is created at all directions at the intersection of Taft Avenue and Gil Puyat where many passengers transfer between LRT and other modes of public transport. The reasons are high traffic volume, loading and unloading of jeepney and buses, uncontrolled pedestrians, and four-phase operation of signal. In fact, Gil Puyat station is the third crowded station along LRT Line 1. It is also a U-turn point for jeepneys plying Gil Puyat. The situation worsens when a provincial bus enters into or comes out of the bus terminal nearby.

Another bottleneck exists at the intersection of Taft Avenue – Libertad, where a large market occupies the south-west corner of intersection. Vehicle movement is slow on all four approaches due to obstructions. In the early morning, Taft Ave. south of the intersection is flooded with street vendors occupying carriageway. Only one lane is left for passing traffic. Taft Ave. is widened about 2 meters at exit side in both directions about 50 meters presumably to accommodate jeepney for loading and unloading. But parked vehicles occupy the space. On the east side of the street, frontage parking is provided for the customer visiting Masagana Citimall. The space is narrow and parked vehicles take up portion of carriageway.

Taft Avenue becomes narrower at the end with EDSA. Particularly, smooth flow is interrupted by loading and unloading jeepneys in front of EDSA station. Sometime jeepney is waiting there for additional passengers. The sidewalk there is very narrow taken up by vendors and other obstruction. People walk on the carriageway toward EDSA where they take bus or jeepney to their destination.

Very small number of vehicle uses Mexico Avenue beyond Cuneta Street. Because the road is fully filled with street vendors. They occupy not only the curb side of the street but also median. In addition, there are a large number of pedestrians who walk between LRT station and jeepney terminal along Redemptorist, or bus stop along Roxas Blvd. Space for vehicles is barely left and the road is virtually impassable for vehicles. Loading and unloading approach separated from the main line is provided at Baclaran station but the location is occupied by vendors and waiting FX's.

9.8 Traffic Management Problems

There are several traffic management problems common to all sections of the route as well as problem specific to a location. The problems common throughout the route are presented below. The fundamental course of these problems is the interaction between vehicles and pedestrians. Pedestrian facilities are generally poor and they are exposed to the vehicular traffic. Unless pedestrian facilities are improved, no improvement can be achieved for vehicles.

1) Narrow sidewalk

Sidewalk condition varies from location to location and generally narrow. Wide sidewalk exists only at the section at the mid point of the route, where road network was designed and built at early times. Taft Avenue has exceptionally wide sidewalk of about 10 meter wide between Ayala Blvd. and Padre Faura. The sidewalk becomes narrower at the section south of President Quirino. No sidewalk is provided on the west side just north of De La Salle University, where many students are found. Lack of space on sidewalk is a serious problem at LRT station with large number of passengers like Monumento, Gil Puyat, EDSA and Baclaran.

2) Sidewalk vendor

The problem of narrow sidewalk is aggravated by sidewalk vendors, which are a common phenomenon on a busy sidewalk in Metro Manila. Often they taken up sidewalk and pedestrians are forced to walk on the carriageway.

3) Illegal parking

Sidewalk is often used as parking lot and workshop by the commercial establishments facing the street. The sidewalk parking is common along Rizal Avenue and Rizal Avenue Extension. They occupy a public space for private use. Such activity is tantamount to receiving subsidy from the public.

Illegal curb-side parking causes a serious congestion along Taft Avenue north of Vito Cruz. Sometime, vehicles park in double taking up two lanes on the four-lane road. Yellow zebra marking is applied to the pavement on the east side of Taft north of Vito Cruz. The measure is effective not because of the marking but because of the obstruction placed there.