Chapter 12

Economic Analysis

Chapter 12 Economic Analysis

12.1 Cost Estimates and Implementation Schedule

12.1.1 Project Components

In order to realise the objective of the SMURT-KL Master Plan, the projects and programmes are formulated in the previous chapters as follows:

Long Term Development Plan in Chapter 8;

Traffic Management and Traffic Control System in Chapter 9; and

Development Plan of Model Area in Chapter 10

The projects/programmes proposed are classified into the following four (4) groups:

1) *Arterial Transport Facility Development,* such as rail based projects, highway projects and trunk bus projects, so as to meet the increased traffic demand in the future;

2) *Public Transport-enhancing Projects* to promote use of the public transport mode;

3) *Traffic Control and Management Projects in the CPA including area Pricing;* and

4) *Traffic Information System and others.*

12.1.2 Project Implementation Schedule

A project implementation schedule is proposed as shown in Figure 12.1.1.

The trunk bus system is proposed to implement from the Short-term period to the beginning of the Medium-term period and some of routes are required to widen in the latter period of the Medium-term. Then, one of the routes, the Damansara – Cheras Line is proposed to be converted to the LRT in the last year of Master Plan Period in accordance with the increase of traffic demand.

The implementation schedule the highway projects, including currently committed projects and newly proposed projects, is decided based on the results of the traffic demand forecast, which revealed the future traffic demand, volume capacity ratio and some other traffic characteristics.

With respect other projects, the implementation schedule is set through the consideration on urgency to improve current problems and the schedule in accordance with other related projects.

1. Major Transport Facility Development Projects (1/2)

Project	Project No.	Stage	Implementation Schedule 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
1-1 NEW RAIL PROJECTS			
(1) New LRT Development (Damansara-Cheras)	RT-1	2020	
(2) New LRT Development (Jalan Ipoh/Jalan Kepong))	RT-2	2020	
(3) New LRT Development (Jalan Damansara)	RT-3	2020	
(4) Monorail (South Extension)	RT-4	2020	
1-2 TRUNK BUS SYSTEM			
(1) Trunk Bus System	BS-1	2010	
- Damansara			
- Genting Klang			widening
- Cheras			
- Ampang			
- Kepong			
- Puchong			widening
(2) Bus Priority Lane Reversible Lane	BS-2	2010	widening
Exclusive Bus Lane			
1-3 HIGHWAY PROJECTS			
1) CURRENT PLAN (COMMITTED)			
(1) New Pantai Highway	HW-1	2010	
Subang Jaya - Jalan Templer			
Jalan Templer - JalanBangsar			
(2) KLIA Dedicated Highway	HW-2	2010	
Section 1 Pandan Roundabout - Technology Park			
Section 2 Technology Park - KLIA			
(3) Kajang Traffic Dispersal Ring Road (Balakong-SG.Long-Semenyih-UPM Junction)	HW-3	2010	
(4) Western KL Traffic Dispersal Scheme	HW-4	2010	
(5) Pandan Corridor Extension	HW-5	2010	
(6) KL Elevated Inner Ring Road	HW-6	2010	
Section 1 SG.Besi - KLCC			
Section 2 Jalan Duta - KLCC			

1. Major Transport Facility Development Projects (2/2)

Project	Project No.	Stage	Implementation Schedule 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
(7) KL Transit Route	HW-7	2010	
Package 1 upgrading Jalan Kuching			
Package 2 upgrading Jalan Duta			
Package 3 Damansara Transit Route			
(8) Kuala Lumpur-Rawang Expressway	HW-8	2010	
(9) Wangsa-Keramat Expressway	HW-9	2010	
Kg. Relawan - Wangsa maju			
Kg. Dato Kermat - Kg. Pandan			
(10) Kajang-Seremban Expressway	HW-10		
Kajang - Seremban			
(11) Kajang Bypass	HW-11		
(12) Shah Alam-Rawang Expressway	HW-12		
Sg.Damansara - Tmn. Subang I/C			
Tmn. Subang I/C - Paya Jaras I/C			
Paya Jaras I/C - Kuang System I/C			
(13) KL Outer Ring Road	HW-13		
2) NEWLY PROPOSED			
(1) Under Ground Expressway	HW-14	2020	
(2) Major Road 1 (KL Elevated HWY-Wangsa Keramat)	HW-15	2020	
(3) Major Road 2 (KL Elevated-New Pantai)	HW-16	2010	
(4) Local Road 1 Jalan Genting Kelang - Jalan Damansara	HW-17	2020	
(5) Local Road 2 Jalan Yap Kwan - Jalan Datuk Abu Mali	HW-18	2010	
(6) Local Road 3 Jalan Conlay - Jalan Raya Cholan	HW-19	2000	
(7) Local Road 4 S.G. Besi - Jalan Tenteram	HW-20	2010	
(8) Local Road 5 Jalan Pantai - Jalan Gasing	HW-21	2010	
(9) Local Road 6 KL - Seremban - Jalan Syed	HW-22	2020	
(10) Local Road 7 Jala Ipoh - Jalan Sentul	HW-23	2010	
(11) Local Road 8 Fontage of North-East Expressway	HW-24	2010	
(12) Local Road 9 Jalan Cheras - Jalan 3/29 1A	HW-25	2010	
(13) Connecting Link 1 (to Petaling Jaya)	HW-26	2010	
(14) Connecting Link 2 (Shah Alam Expressway-Federal Highway)	HW-27	2010	

Figure 12.1.1 Proposed Projects and Implementation Schedule 1/2

Table 12.1.1 Proposed Projects and Implementation Schedule 2 / 2

2. Public Transport-Enhancing Projects

Project	Project No.	Stage	Implementation Schedule 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
1) Inter-modal Facility			
(1) Transferring System	PT-1	2010	
- Sultan Ismail, P. Ramlee and Wawasan Stations			
- Bank Negara and Bandaraya Stations			
(2) Rail Station Plaza and Park and Ride Facility	RT-2	2010	
- Ampang Station			
- Masjit Jamek Station			
- 6 Stations (Gombak-Dato Keramat / LRT 2)			
- 5 stations (Setia Jaya-Petaling / KTMB)			
- 5 Stations (Kg. Pasir-Lambah Pantai / PRT)			
- 2 Stations (Rawang Line / KTMB)			
- 2 Stations (Batu Cave Line /KTMB)			
2) Improvement of Access Road to Railway Stations		2010	
(1) Access to Railway Station	RT-3		
- Ampang (LRT 1/Ampang Line)			
- Campaka (LRT 1/Ampang Line)			
- Pandan Indah (LRT 1/Ampang Line)			
- Pandan Jaya (LRT 1/Ampang Line)			
3) Relocation of Inter-state Bus Terminal	RT-4	2020	
- Klang Bus Terminal			
- Pudnaya Bus Terminal			
4) New Railway Station (KTMB)	RT-5	2010	
- Cucpacs			

3 Traffic Control / Management in CPA

Project	Project No.	Stage	Implementation Schedule 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
3-1 TRAFFIC CONTROL/MANAGEMENT			
1) Traffic Signal Control System	CP-1	2000	
- Traffic Signal Light Coordination System & Signal Phase System			
2) Improvement of No-signalised Roundabout & Others	CP-2	2000	
- Improvement of Roundabout (Pudu)			
- Traffic Signalized Intersection			
Jalan Pajang - Jalan Tun Razak			
Jalan Pudu - Jalan Yew			
Jalan Syed Putra			
Jalan Stan Hisyamuddi - Jalan Kinabalu			
Jalan Pudu - Jalan Tun Perak			
- Channelaization System			
3) Improvement of Pedestrian Facilities.	CP-3	2000	
- Signalized Pedestrian Crossing			
- Pedestrian Crossing Bridge			
- Scramble Pedestrian Crossing			
- Pedestrian-friendly Sidewalk			
Jalan Raya Abdullah			
Jalan Ampang			
Jalan Sultan Ismail			
Jalan Ramlee			
Jalan Raja Chulan			
3-2 AREA PRICING			
1) Area Pricing in CPA	CP-4		

4. Transport Information System & others

Project	Project No.	Stage	Implementation Schedule 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
4-1 TRANSPORT INFORMATION SYSTEM			
1) Bus Location System	IS-1	2000	
2) Modernization and Improvement Current System (First Stage)	IS-2	2000	
- Parking Guidance System			
3) Navigation and Route Guidance System (Second Stage)	IS-3	2010	
4) Automated Driving System (Third Stage) & Others		2020	
4-2 PROJECT FOR FREIGHT MOVEMENT			
1) Truck Terminal	ZZ-3	2010	

Figure 12.1.1 Proposed Projects and Implementation Schedule 2/2

12.1.3 Cost Estimates

(1) General Assumption of Cost Estimates

The cost of the Master Plan are estimated and allocated under the following assumptions:

- All costs are estimated at market prices as of in September 1998;
- The import goods are quoted in CIF price and converted into Ringgit Malaysia by using the foreign exchange rate: RM3.80 per US Dollar 1.00;
- Land and compensation costs are estimated based on LAPORANRASARAN HARTA (Property Market Report) 1997; and
- Physical contingency is estimated at 20 % of the construction costs.

(2) Capital Cost of SMURT-KL Master Plan

The total capital costs of the SMURT-KL Master Plan, definitely the incremental costs, are estimated at RM 20.4 billion. Of this total, RM 0.3 billion, RM 12.3 billion and RM7.8 billion are allocated to the Short-Term, Medium-Term and Long-Term Phase, respectively. Table 12.1.1 shows the allocation of the capital costs including the land and compensation. The breakdowns of the individual projects are attached in Appendix 12.

Table 12.1.1 Capital Cost of SMURT-KL Master Plan

Unit: RM million

	Short-Term	Medium-Term	Long-Term	
	1999 | 2000	2001 | 2010	2011 | 2020	Total
I. Construction Cost				
1. Major Transport Facility Development				
1-1 New Rail Projects	0	0	4,715	4,715
1-2 Trunk Bus System	30	15	0	45
1-3 Highway Projects	2	8,396	2,434	10,832
Subtotal	31	8,411	7,149	15,592
2. Public Transport-Enhancing Projects	0	19	5	24
3. Traffic Control / Management in CPA				
3-1 Traffic Control/Management	41	0	0	41
3-2 Area Pricing	5	0	0	5
Subtotal	46	0	0	46
4. Transport Information System & others	33	120	0	153
Total	110	8,550	7,154	15,814
II. Land and Compensation				
1. Major Transport Facility Development				
1-1 New Rail Projects	0	0	53	53
1-2 Trunk Bus System	187	271	0	459
1-3 Highway Projects	6	3,362	559	3,927
Subtotal	194	3,633	612	4,438
2. Public Transport-Enhancing Projects	0	19	15	34
3. Traffic Control / Management in CPA				
3-1 Traffic Control/Management	11	0	0	11
3-2 Area Pricing	0	0	0	0
Subtotal	11	0	0	11
4. Transport Information System & others	0	60	0	60
Total	204	3,712	627	4,543
III. Total Investment Cost				
1. Major Transport Facility Development				
1-1 New Rail Projects	0	0	4,768	4,768
1-2 Trunk Bus System	217	286	0	504
1-3 Highway Projects	8	11,758	2,994	14,760
Subtotal	225	12,044	7,761	20,031
2. Public Transport-Enhancing Projects	0	38	20	58
3. Traffic Control / Management in CPA				
3-1 Traffic Control/Management	51	0	0	51
3-2 Area Pricing	5	0	0	5
Subtotal	56	0	0	56
4. Transport Information System & others	33	180	0	213
Total	315	12,262	7,781	20,358

Note: Land and compensation costs of new rail project: An additional cost is included, while the land, which is converted from trunk bus route, is included in the trunk bus costs.

Source: JICA Study Team

12.1.4 Economic Cost

All costs and benefits for the projects are evaluated at economic prices in the economic analysis. The items, such as tax, duty, vehicle registration fee, road tax, government subsidies etc., are eliminated from the project costs and benefits because they are only transfer payments in national economy.

The Government of Malaysia has prepared the "National Parameters for Project Appraisal in Malaysia" to estimate the economic prices of goods and services in 1986. The conversion factors of this evaluation are estimated based on the National Parameter, while the current Malaysian Customs Tariff schedule are also taken into account.

(1) Capital Cost

An amount of RM 20.4 billion is the incremental capital costs of the SMURT-KL Master Plan, which are expressed in term of market price as shown in Table 12.1.1. The costs are converted into economic costs as shown in Table 12.1.2 by using the following conversion factors. The total economic investment costs are estimated at RM 18.1 billion.

a.	Highway	80 % - 90 %
b.	Railway	85 %
c.	Signalling and other equipment	80 % - 90 %

(2) Operation and Maintenance Costs

Based on the types of the project components, the annual operation and maintenance costs of the proposed projects are estimated at the following rates to the initial investment costs:

a.	Highway	0.5 – 0.8 %
	(Except 1.2 % of Under Ground Expressway)	
b.	Inter-modal Facility & Pedestrian Facility	0.4 – 0.5 %
c.	Area Pricing	10 %
d.	Signalling & Transport Information System	0.8 – 1.0 %

The operation and maintenance costs are calculated based on the assumption above and converted into economic costs by using the conversion factor of 0.90 as shown in Table 12.1.3.

Table 12.1.2 Economic Capital Costs of SMURT-KL Master Plan

Unit: RM million

	Short-Term	Medium-Term	Long-Term	
	1999 | 2000	2001 | 2010	2011 | 2020	Total
I. Construction Cost				
1. Major Transport Facility Development				
1-1 New Rail Projects	0	0	4,008	4,008
1-2 Trunk Bus System	28	14	0	43
1-3 Highway Projects	2	7,252	2,075	9,328
Subtotal	30	7,267	6,082	13,379
2. Public Transport-Enhancing Projects	0	17	4	21
3. Traffic Control / Management in CPA				
3-1 Traffic Control/Management	36	0	0	36
3-2 Area Pricing	4	0	0	4
Subtotal	40	0	0	40
4. Transport Information System & Others	28	107	0	135
Total	98	7,390	6,087	13,575
II. Land and Compensation				
1. Major Transport Facility Development				
1-1 New Rail Projects	0	0	53	53
1-2 Trunk Bus System	187	271	0	459
1-3 Highway Projects	6	3,362	559	3,927
Subtotal	194	3,633	612	4,438
2. Public Transport-Enhancing Projects	0	19	15	34
3. Traffic Control / Management in CPA				
3-1 Traffic Control/Management	11	0	0	11
3-2 Area Pricing	0	0	0	0
Subtotal	11	0	0	11
4. Transport Information System & Others	0	60	0	60
Total	204	3,712	627	4,543
III. Total Investment Cost				
1. Major Transport Facility Development				
1-1 New Rail Projects	0	0	4,060	4,060
1-2 Trunk Bus System	216	286	0	501
1-3 Highway Projects	8	10,614	2,634	13,256
Subtotal	224	10,899	6,694	17,817
2. Public Transport-Enhancing Projects	0	37	19	56
3. Traffic Control / Management in CPA				
3-1 Traffic Control/Management	47	0	0	47
3-2 Area Pricing	4	0	0	4
Subtotal	51	0	0	51
4. Transport Information System & Others	28	167	0	195
Total	303	11,102	6,713	18,119

Source: JICA Study Team

Table 12.1.3 Operation and Maintenance Costs in Economic Prices (1999 – 2020)

Unit: RM million

	Short-Term	Medium-Term	Long-Term	
	1999 | 2000	2001 | 2010	2011 | 2020	Total
1. Major Transport Facility Development				
1-1 New Rail Projects	0.0	0.0	147.3	147.3
1-2 Trunk Bus System	0.3	2.7	3.2	6.3
1-3 Highway Projects	0.0	326.0	723.2	1,049.3
Subtotal	0.3	328.8	873.8	1,202.9
2. Public Transport-Enhancing Projects	0.0	0.4	0.8	1.2
3. Traffic Control / Management in CPA	1.0	6.5	6.5	13.9
4. Transport Information System & Others	0.4	6.8	10.5	17.6
Total	1.7	342.5	891.6	1,235.7

Source: JICA Study Team

(3) Economic Cost during the Master Plan Period

The total incremental costs of the proposed Master Plan in terms of economic prices, which include the investment costs and the operation and maintenance costs, are estimated at about RM 19.4 billion. Out of this total, RM 0.3 billion, RM 11.4 billion and RM 7.7 billion are allocated for the Short, Medium and Long Term Phases, respectively, as shown in Table 12.1.4.

Table 12.1.4 Total Economic Cost of SMURT-KL Master Plan

Unit: RM million

	Short-Term	Medium-Term	Long-Term	
	1999 | 2000	2001 | 2010	2011 | 2020	Total
1. Capital Investment Costs	98	7,390	6,155	13,643
2. Land & Compenzation	204	3,712	627	4,543
Subtotal	303	11,102	6,782	18,187
3. Operation & Maintenance Costs	2	342	892	1,236
Total	304	11,445	7,673	19,423

Note: As the replacement costs of equipment are included in "Capital Investment Cost", the amount of the capital investment costs is higher than that in Table12.1.2.

Source: JICA Study Team

12.2 Economic Analysis

12.2.1 General

Although, the SMURT-KL Master Plan aims to alleviate traffic congestion and to improve the quality of the urban environment in Kuala Lumpur, it requires a great deal of investment costs as estimated in the previous section. The total incremental cost of the Master Plan over the period 1999 to 2020 is estimated to amount to RM 19.4 billion in economic prices including the capital cost, the land and compensation and the operation and maintenance costs as shown in Table 12.1.4. In the meantime, the cumulative GRDP of the Study Area is estimated to be RM 3,100 billion in 1998 prices over the same period. The amount of RM 19.4 billion accounts for more than 0.6 % of the future GRDP of the Study Area.

This chapter examines and ensures the economic viability of the Master Plan from the nation's economic point of view, adopting the Cost-Benefit Analysis. The indices of the net present value (NPV), Benefit-Cost Ratio (B/C Ratio) and the Internal Rate of Return (IRR) are used as parameters to examine the viability of the proposed SMURT-KL Master Plan.

The following manuals and studies, related to the Study Area and/or the transportation sector, have been reviewed and referred:

A Manual for the Urban Transport Plans in Malaysia, Government of Malaysia and Asian Development Bank
Klang Valley Transportation Study, JICA, 1987
Highway Network Development Plan Study in Malaysia, JICA, 1992; and
The Feasibility Study on Kuala Lumpur Outer Ring Road Project, JICA, 1996

(1) General Assumption

The following assumptions are made for the Cost-Benefit Analysis:

a. A. Project Life: 20 years after the target year of the Master Plan, namely from 1999 to 2040.

b. Traffic Volume: The future traffic volume is projected for the Short, Medium and Long Term Phase in the Traffic Demand Forecast in Chapter 7. The growth of the volume after the target year i.e. from 2021 to 2040 is estimated at the same rate as that from 2010 to 2020.

c. Life Period: Life period of facility is estimated as the following years and the replacement cost is also estimated when the life period is completed:

Civil Work:	50 years
Building:	50 years

Rolling Stock:	25 years
Signalling and other equipment:	20 years

d. Residual Value: Residual value is calculated as an inverse cost in the last year of the project period.

e. Discount Rate: A discount rate of 12 % is used.

f. Foreign Exchange Rate: For the purpose of this study, the foreign exchange rate is fixed at the following rate. A shadow exchange rate is not considered.

US Dollar 1.00 equivalent to RM3.80

g. Inflation: Inflation is not taken into account both in benefit and cost estimates.

12.2.2 "With Project" and "Without Project" Assumptions

In the Benefit-Cost Analysis, two scenarios, "With Project" and "Without Project" scenarios are assumed to evaluate the proposed Master Plan. With comparison of two scenarios, it is examined whether or not the benefits of savings in transport costs with project could recover the incremental costs of the proposed projects in the viewpoint of national economy.

The SMURT-KL Master Plan assumes "With Project" and "Without Project" of scenarios as follows.

(1)"With Project":

Figure 12.2.1 shows the "With Project" scenario of the SMURT-KL Master Plan. It includes the projects, which are proposed by the JICA Study, as well as the projects planned and/or committed by Malaysian Government, such as the LRT projects and the privatised expressway projects.

In this scenario, the transport costs are expected to be reduced by the introduction of an efficient transport system, however, a huge burden of investment costs for the new system is required as described above.

(2)***"Without Project"***:

"Without project" Case is assumed as shown in Figure 12.2.2. All projects are eliminated from the project list except for the projects, which have been committed and scheduled to be completed until 2000.

This case is not realistic, however, it is prepared in order to examine the economic viability of the investment plan of the SMURT-KL Master Plan in Cost-Benefit Analysis.

With Project Scenario	Short-term 1999 | 2000	Medium-term 2001 | 2010	Long-term 2011 | 2020
1. Major Transport Facility Development			
New Rail Projects committed	———		
newly proposed			———
Trunk Bus System	———		
Highway Projects committed	———	———	———
newly proposed	———	———	———
2. Public Transport-Enhancing Projects	———	———	———
3. Traffic Control / Management in CPA	———	———	———
4. Transport Information System & Others	———	———	———

Figure 12.2.1 Project Components of "With Project" Scenario

Without Project Scenario	Short-term 1999 | 2000	Medium-term 2001 | 2010	Long-term 2011 | 2020
1. Major Transport Facility Development			
New Rail Projects committed	~~Note 1)~~		
newly proposed			
Trunk Bus System			
Highway Projects committed	~~Note 2)~~		
newly proposed			
2. Public Transport-Enhancing Projects			
3. Traffic Control / Management in CPA			
4. Transport Information System & Others			

Note: 1) Includes Rail projects which are scheduled to complete until 2000, such as LRT Phase 2 of System I, Phase 2 of System II and PRT Section I.
2)Includes the privatised Expressway under construction and/or completed until 2000, such as Ampang Elevated Highway (Phase 1) and Sungai Besi highway, etc.

Figure 12.2.2 Project Components of "Without Project" Scenario

12.2.3 Evaluation Cases

(1) Cases for Cost-Benefit Analysis

As regards the "With Project" scenario, the following five (5) alternative cases are formulated for the Cost-Benefit Analysis.

Major Development Components \ Case	Trunk Bus	Highway Intensive	Base Case	Base Case with Area Pricing	SMURT-KL Master Plan
Trunk Bus System	o		o	o	o
Public Transport-enhancing Project	o	o	o	o	o
Highway Development		o	o	o	o
Area Pricing				o	o
New LRT System					o

Figure 12.2.3 Five Cases and Major Development Components

1) ***Base Case*****:** the Base Case includes the major Arterial Transport Facility Development such as the Trunk Bus System and Highway Projects, except for the New LRT System (Damansara – Cheras Line). Area pricing is not included in this case.

2) ***Trunk Bus*****:** This Case examines the economic viability when solely the trunk bus system is introduced. Namely, it is assumed that all highway projects, except for the committed projects until 2000, will not be implemented in this case.

3) ***Highway Intensive*****:** A number of highway projects have currently been planned, in the meantime the JICA Study newly proposes several highway projects. The total capital cost of those projects amounts for RM13.3 billion (see Table 12.1.2 and 12.2.1) or approximately 72 % of the total investment costs in economic prices. This case evaluates an urban transport system which depends intensively on highway development, while it requires huge investment costs.

4) ***Base Case with Area Pricing*****:** This case proposes the introduction of Area Pricing additionally to the Base Case. It is expected in this case that passengers have to induce to switch their trips from private vehicle to public transportation mode if the costs of public transport are lower. Consequently, the cost burdens of transport operation are expected to reduce in the society.

5) ***SMURT-KL MASTER PLAN (Base Case with Area Pricing and New LRT)*****:** This case includes the complete set of components, including the New LRT Line between

Damansara and Cheras which is converted from the trunk bus system in 2020. This case is ultimately proposed as the SMURT-KL Master Plan in the JICA Study.

(2) Economic Costs of Five Cases for Cost-Benefit Analysis

Although the total capital cost of the Master Plan amount to RM 18,119 million in term of economic prices as shown in Table 12.1.2, some projects are closely related to the change in traffic demand and others are not. In Cost-Benefit Analysis, the projects, which will not affect directly the traffic demand, are deleted from the project costs. Table 12.2.1 comperes the capital costs among five alternative cases.

Table 12.2.1 Capital Costs of Five (5) Cases in Economic Prices

Unit: RM million

	Total Economic Cost 1)	Case of Cost Benefit Analysis				
		Trunk Bus Case	Highway Intensive Case	Base Case	Base Case with Area Pricing	SMURT-KL Master Plan
1. Arterial Transport Facility Development						
1-1 New Rail Projects	4,060	0	0	0	0	4,060
1-2 Trunk Bus System	501	501	0	501	501	501
1-3 Highway Projects	13,256	0	13,256	13,256	13,256	13,256
Subtotal	17,817	501	13,256	13,757	13,757	17,817
2. Public Transport-Enhancing Projects	56	56	56	56	56	56
3. Traffic Control/Management in CPA						
3-1 Traffic Control/Management	47	0	0	0	0	0
3-2 Area Pricing	4	0	0	0	4	4
Subtotal	51	0	0	0	4	4
4. Transport Information System & others						
- Bus Location System	20	20	0	20	20	20
- Others	175	0	0	0	0	0
Subtotal	195	20	0	20	20	20
Total	18,119	577	13,311	13,832	13,837	17,897
	100%	3%	73%	76%	76%	99%

Note: 1) Refer to Table 12.1.2
Source: SMURT-KL

(3) Traffic Demand for Cost-Benefit Analysis

Based on the Traffic Demand Forecast in Chapter 7, the traffic demand is projected for six (6) cases in terms of the Vehicle-km, Vehicle-hour and Passenger-hour for the Cost-Benefit Analysis. Table 12.2.2 shows the cases of the demand forecast referred in the Cost-Benefit Analysis.

Table 12.2.2 Traffic Demand for Cost-Benefit Analysis

	2000	2010	2020
Without Project Scenario	WO00	WO10	WO20
With Project Scenario			
1) Trunk Bus	WOHWY00	WOHWY10	WOHWY20
2) Highway Intensive	WOTBS00	WOTBS10	WOTBS20
3) Base Case	BASE00	BASE10	BASE20
4) Base Case with Area Pricing	APATB00	APATB10	APATB20
5) SMURT-KL Master Plan	APATB00	APATB10	APAFN20

Figure 12.2.4 shows the flowchart to estimate the transport costs, such as vehicle operation costs and passenger travelling costs, and the investment costs of the proposed projects for five Cases with Project Scenario and one Case without Project Scenario.

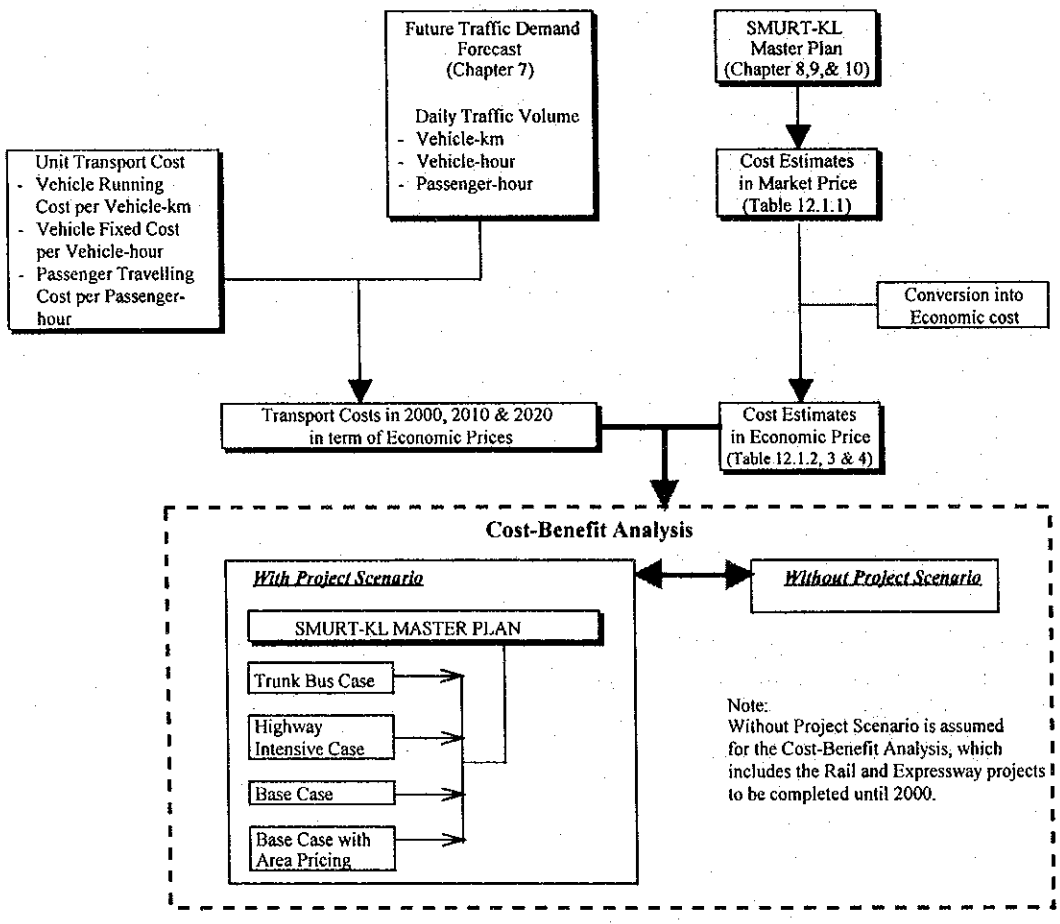


Figure 12.2.4 Flowchart of Cost-Benefit Analysis

12.2.4 Benefits

1) General

The SMURT-KL Master Plan proposes the improvement of urban transportation network system in order to alleviate traffic congestion in the Study Area. The alleviation of congestion usually derives the saving in:

- Transport Operation Cost of Vehicles; and
- Travelling Time of Passengers

These savings reduce the transport costs of the society. Savings in vehicle operation costs and the travelling time costs of passengers are defined principally as benefits for the economic evaluation of the Master Plan.

Traffic safety is also one of the important impacts resulting from improvement of urban transportation. The effect of accident reduction is counted as supplementary benefits, and the magnitude of this impact on the indices of economic evaluation is examined.

Figure 12.2.5 shows the incremental cost and benefit of Master Plan in Cost-Benefit Analysis and the next section explains the procedure to estimate vehicle operation cost, passenger travelling time cost and accident cost for the analysis.

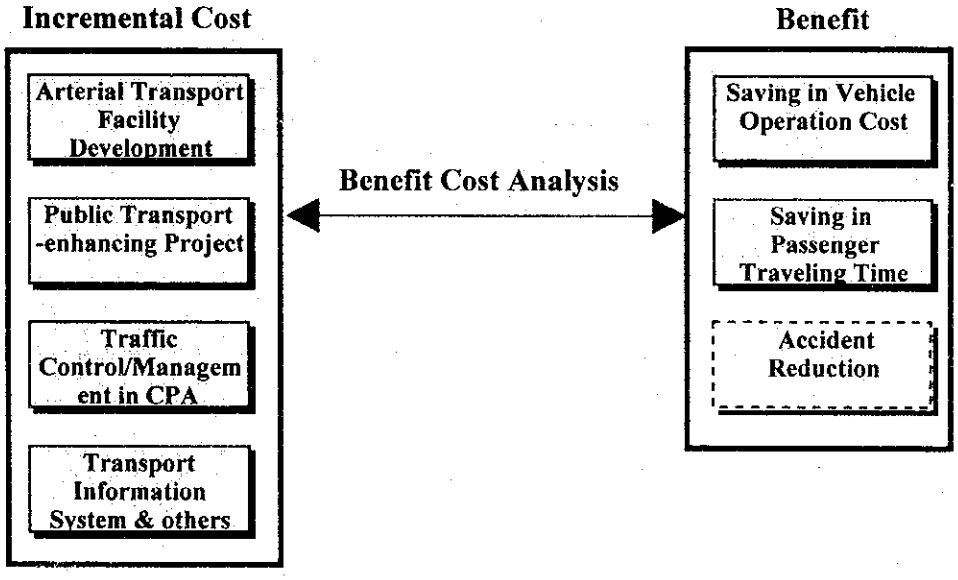


Figure 12.2.5 Comparison between Incremental Cost and Benefit of Master Plan

(2) Vehicle Operation Cost

1) General

Vehicle operation cost is principally divided into vehicle running cost and fixed cost as shown in Figure 12.2.6.

The vehicle running cost consists of fuel cost, lubricant cost, tyre cost and maintenance cost, which vary with the running distance of the vehicle (*vehicle-km*). Fuel costs vary with both, running distance and speed of the vehicle. On the other hand, the fixed costs of vehicle such as interest cost, crew cost and overhead vary with time of vehicle operation (*vehicle-hour*). The vehicle price is a cost item related both to the vehicle running cost and fixed cost.

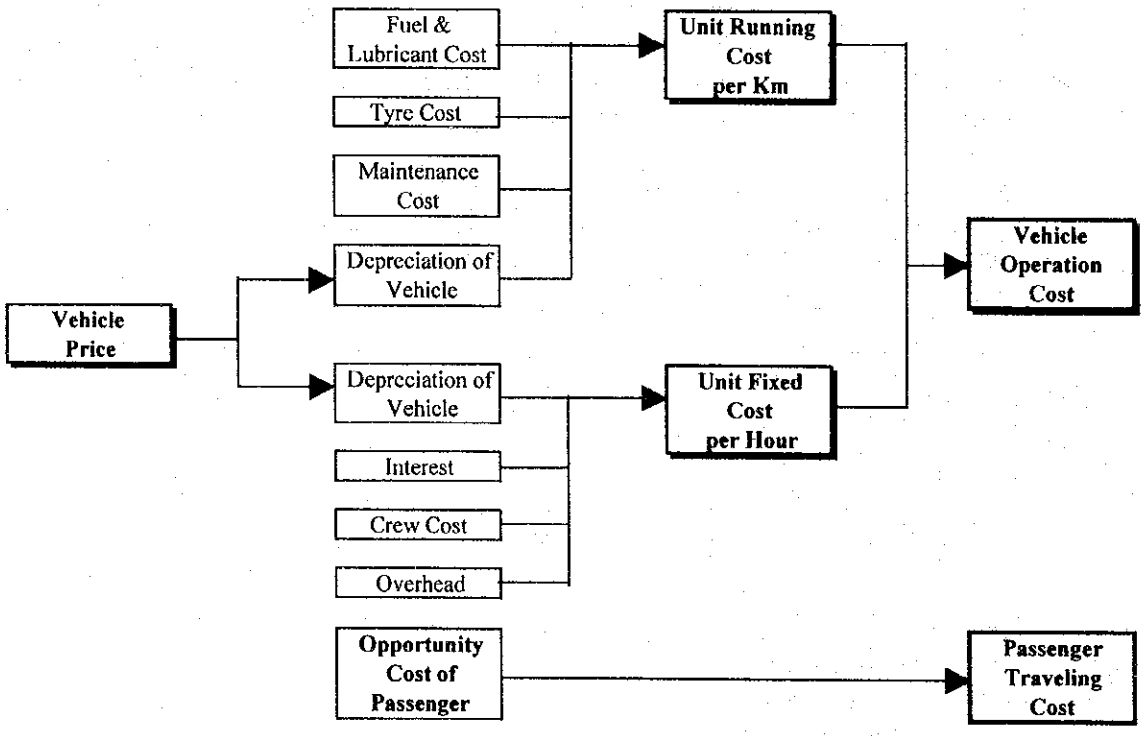


Figure 12.2.6 Vehicle Operation and Passenger Travelling Costs

2) Type of Vehicle

In order to estimate unit vehicle operation cost, vehicles are categorised into the following five types. Then the typical model of five types of vehicle is selected so as to represent the condition of urban transport in Kuala Lumpur as shown in Table 12.2.3.

- Passenger Car
- Small Lorry
- Heavy Lorry
- Bus; and
- Motorcycle

The vehicle prices are estimated at market prices in 1998 and the costs of transfer items, such as import duty, registration fee and road tax are eliminated to convert the market prices to economic prices.

Table 12.2.3 Type of Vehicles and Characteristics

	Passenger Car/Van	Small Lorry	Heavy Lorry	Bus	Motorcycle
Fuel Type	Gasoline/Diesel	Diesel	Diesel	Diesel	Gasoline
Net On Road Price (RM)	48,845	45,964	128,771	488,720	4,997
Costs for Transfer Items (RM)	9,803	4,298	13,386	32,580	90
Costs included in Vehicle Operation Cost	1,956	2,846	9,720	8,760	331
Financial Price (RM)	46,890	43,118	119,051	479,960	4,667
Economic Price (RM)	37,087	38,820	105,665	447,380	4,577
Annual Mileage (km/yr)	20,000	50,000	70,000	70,000	10,000
Annual Usage Hour (hr/yr)	500	1,430	2,000	2,000	500
Average Year-round Speed (km/yr)	40	35	35	35	20

Passenger Car/Van	Weighted Average Price of Proton Wira 1.3S (40%), Proton Wira 1.5 (40%) and Ford Ecovan/ST63 FM-2184 (20%)
Small Lorry	Mitsubishi Canter Guts/FB11B8RDG1 (Load Capacity: 2.5 ton)
Heavy Lorry	Mitsubishi FM617/MHRG1 (EURO 1)
Bus	Weighted Average Price of Optare (20%) and Iveco (80%)
Motorcycle	AN 110F

Source: Malaysian Industrial Development Authority
INTRAKOTA Komsosit SDN. BHD.
Motor Sale companies in Kuala Lumpur
SMURT-KL

The operation cost of the rail systems, such as the LRT and monorail, are also estimated. Firstly, the train operation plan is prepared to meet the traffic volume of the future demand forecast and the operation cost is estimated for the individual lines based on the operation plan.

3) Unit Running Cost of Vehicle per Vehicle-km

The running cost of vehicles (or the distant related cost) consists of the costs for fuel, lubricant, tyre, maintenance parts, maintenance crew and depreciation. Among them the fuel cost varies with running distance and speed of vehicles, while others vary with running distance. The fuel consumption is usually efficient when the vehicle speed is 50 – 60 km per. Accordingly, the increase in vehicle running speed firstly reduces fuel consumption and gradually increases it again when vehicle speed exceeds

60 km per hour. The fuel cost per vehicle-km is estimated based on the fuel consumption curve and fuel price. The unit fuel cost per Vehicle-km is calculated for 10 kilometres range of speed for individual five types of vehicles.

On the other hand, the vehicle costs vary with running distance and time. The depreciation of vehicle is divided into vehicle running cost (distant portion) and fixed cost (time portion).

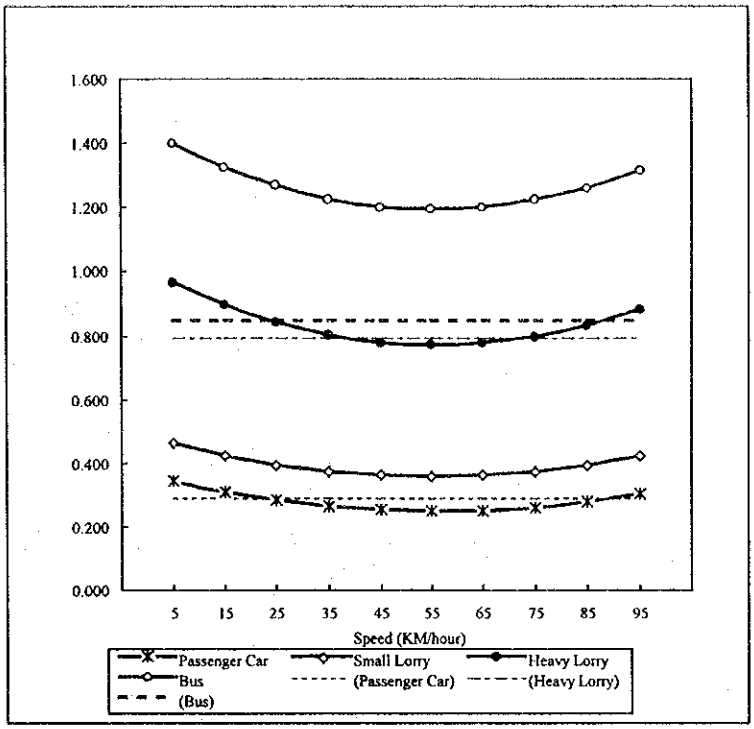
Table 12.2.4 shows the unit running cost of five types of vehicles by running speed and Figure 12.2.7 shows the changes in unit running cost by type of vehicle and speed. The details of estimation are attached to Appendix 12.2.

Table 12.2.4 Unit Running Cost of Vehicle by Speed

Unit:RM/Vehicle-km

Speed (KM/Hour)	Passenger Car	Small Lorry	Heavy Lorry	Bus	Motorcycle
Financial Cost					
5	0.344	0.462	0.965	1.399	0.097
15	0.310	0.425	0.896	1.326	0.087
25	0.284	0.396	0.842	1.269	0.080
35	0.265	0.375	0.803	1.228	0.075
45	0.253	0.362	0.779	1.203	0.072
55	0.248	0.358	0.770	1.194	0.071
65	0.250	0.362	0.776	1.201	0.071
75	0.260	0.375	0.797	1.224	0.074
85	0.277	0.396	0.832	1.263	0.079
95	0.302	0.425	0.883	1.318	0.085
Economic Cost					
5	0.246	0.398	0.846	1.262	0.078
15	0.226	0.370	0.795	1.208	0.072
25	0.210	0.349	0.755	1.166	0.068
35	0.199	0.333	0.726	1.136	0.065
45	0.192	0.324	0.709	1.117	0.064
55	0.189	0.321	0.702	1.111	0.063
65	0.191	0.324	0.706	1.116	0.063
75	0.197	0.333	0.722	1.133	0.065
85	0.207	0.349	0.748	1.161	0.067
95	0.221	0.371	0.785	1.202	0.071

Note: The details of the estimation of each item are shown in Appendix 12.2.
Source: SMURT-KL



Note: The straight-dotted lines show the unit running cost of passenger car, heavy lorry and bus from the bottom in KLORR

Figure 12.2.7 Unit Running Cost of Vehicle per Vehicle-km by Speed

4) Unit Fixed Operation Cost of Vehicle per Vehicle-hour

The fixed operation costs (or time related cost) of vehicle are estimated for the following cost items as shown in Table 12.2.5.

- Depreciation
- Interest Cost: The annual interest cost is estimated at 10 % of the undepreciated value of vehicle cost during the vehicle life period.
- Crew Cost: Crew cost is calculated based on the average number of crew per vehicle for lorry and bus.
- Overhead: Overhead cost includes insurance costs, registration fees, road tax and overhead costs for the vehicle operation.

Table 12.2.5 Unit Fixed Cost of Vehicle per Vehicle-Hour

RM/Vehicle-hour

	Passenger Car	Small Lorry	Heavy Lorry	Bus	Motorcycle
Financial Cost					
Depreciation	3.751	0.769	1.518	6.119	0.533
Interest	5.745	1.848	3.647	14.703	0.584
Crew Cost	0.000	12.629	14.857	7.429	0.000
Overhead	3.560	7.401	10.330	10.330	0.640
Total	13.057	22.646	30.352	38.581	1.757
Economic Cost					
Depreciation	2.967	0.692	1.347	5.704	0.523
Interest	4.544	1.664	3.237	13.705	0.573
Crew Cost	0.000	12.629	14.857	7.429	0.000
Overhead	2.563	5.699	7.438	7.438	0.461
Total	10.074	20.683	26.879	34.275	1.556

Source: SMURT-KL

(3) Passenger Travelling Cost

The improvement of urban transport reduces the travelling time of passengers and induces the benefits. The passenger travelling cost is evaluated in the contest of opportunity costs of passenger, which could produce the economic outputs of the country.

Table 12.2.6 shows the future GRDP and the number of employee in the Study Area estimated in the Planning Framework of Chapter 5.

Table 12.2.6 GRDP and Number of Employee in Study Area

	2000	2010	2020
1. GRDP in the Study Area			
RM million in 1978 prices	41,156	65,833	110,543
RM million in 1998 prices	85,237	136,346	228,942
2. Number of Employee (thousand)	1,752	2,134	2,518
3. GRDP per Employee (RM per year)	48,648	63,883	90,911
4. GRDP per Employee (RM per hour)	23.2	30.4	43.3
Annual Growth Rate		2.8%	3.6%

Note: Average working hours per month is estimated at 175 hours.
Source: SMURT-KL

The GRDP per employee is estimated at RM 48,648 per year or RM 23.2 per hour in 2000 and the future GRDP per employees is estimated to amount to RM 30.4 and RM 43.3 per hour in 2010 and 2020, respectively. In the Cost-Benefit Analysis, the growth of productivity is taken into account to estimate the future opportunity costs of passenger travelling time.

Table 12.2.7 shows the trip purpose of passenger based on the results of the Home Interview Survey in 1997. The share of HBW (Home Based Work) and NHBB (Non-home Based Business) trips is 41 % and 15 %, respectively of total motorised mode trip. In economic analysis, therefore, it is assumed that 56 % of the total saved Passenger-hours could be accounted for as benefits from savings in travelling time.

Table 12.2.7 Trip Purpose of Passenger

Trip Purpose	HBW	HBS	HBO	NHBB	NHBO	Total	Business related
Non-Motorised Transport	14%	34%	27%	3%	23%	100%	16%
Motorised Transport	41%	18%	16%	15%	10%	100%	56%

Source: Home Interview Survey, JICA Study

The occupancy of the passenger in vehicle is estimated to be 1.47, 1.14 and 13.30 persons per vehicle for passenger car, motorcycle and bus, respectively, based on the traffic survey.

(4) Traffic Accident Reduction

Table 12.2.8 shows number of death by traffic accidents in major cities in the world. The death rate of thousand population is 0.04 – 0.06 in Tokyo, London and New York, while it is 0.40 in the Study Area in 1995.

Table 12.2.8 Death by Traffic Accident

	Death by Accident per year	Population (thousand)	Death per 1,000
Study Area	1,521	3,774	0.40
- Kuala Lumpur	396	1,375	0.29
- 4 districts	1,125	2,399	0.47
Tokyo	429	11,799	0.04
London	399	6,756	0.06
New York	465	7,323	0.06

Source: Table 2.1.5 and Table 6.6.1

According to the Japanese statistics, the rate of traffic casualty defers among the traffic modes. Number of death per billion passenger-km is 0.053, 0.818 and 11.698 for rail, bus and private passenger car, respectively, which reveals the safety of public transport system. (See Table in Appendix) The shift from the private vehicle to the public transportation could considerably reduce the traffic casualties of passengers.

12.3 Evaluation

12.3.1 Costs and Benefits

As previously shown in Figure 12.2.4, the costs and benefits of five Cases are estimated as the following measures adopting the "With project" and "Without project" assumptions:

Costs: The total value of economic investment costs and operation and maintenance costs is allocated in accordance with the implementation schedule over the project period (1999-2040). At the same time those costs are discounted at a rate of 12 % and converted to the Present Value of the costs.

Benefits: Firstly, the traffic demand of "With Project Scenario" is compared with "Without Project Scenario" based on the demand forecast in terms of Vehicle-km, Vehicle-hour and Passenger-hour. Secondly, the changes in the traffic volumes are converted into the vehicle operation costs by using the unit cost of vehicles operation estimated as shown in Table 12.2.4 and 12.2.5. The savings in the passenger travelling time are converted into the opportunity costs of the passengers based on the assumptions previously discussed. The savings in transport costs and passenger travelling costs are accounted for as benefits.

The increased (or decreased) costs of the existing LRT operation, such as the purchase costs of additional rolling stocks and electricity expenses, are also taken into account based on the train operation plan.

Subsequently those benefits are discounted at a rate of 12 % and converted into the Present Value of the benefits.

Table 12.3.1 compares the benefits in term of the current price and the present value discounted at 12 %.

Table 12.3.1 Benefits of Five Cases in Current and Discount Prices

Unit: RM million

	Current Price				Present Value (Discount rate: 12%)			
	Vehicle Operation Cost Savings		Passenger Travelling Time Savings	Total	Vehicle Operation Cost Savings		Passenger Travelling Time Savings	Total
	Vehicle Running Cost Savings	Vehicle Fixed Cost Savings			Vehicle Running Cost Savings	Vehicle Fixed Cost Savings		
SMURT-KL Master Plan	231	70,930	283,677	354,838	152	4,043	10,644	14,840
Trunk Bus	-2,349	7,388	27,217	32,256	120	-30	1,576	1,666
Highway Intensive Case	-11,464	61,023	258,548	308,107	-555	3,514	10,469	13,428
Base Case	-7,647	62,971	207,700	263,024	-299	3,463	9,685	12,849
Base Case with Area Pricing	-885	70,306	270,499	339,920	124	4,013	10,288	14,425

Source: SMURT-KL

12.3.2 Evaluation

Table 12.3.2 shows the results of calculation using the indices of the Net Present Value (NPV), B/C Ratio and Internal Rate of Return (IRR). The detailed process of estimation is attached to Appendix 12.

The IRR of SMURT-KL Master Plan proposed by the JICA Study is estimated at 18.8 %, which is sufficiently high to justify the implementation of the project. The major benefits are derived from the cost savings in time related portion such as vehicle fixed costs and passenger travelling costs as shown in Table 12.3.1, which induce as the results of the decrease of vehicle running hours and passenger travelling hours, respectively. The total benefits of the SMURT-KL Master Plan are the highest of the five cases, and, at the same time, the total investment costs are also the highest.

Table 12.3.2 NPV, B/C Ratio and IRR of Five Cases

Case	Net Present Value (Discount Rate:12%) (RM million)	Present Value (Discount Rate: 12%)		Benefit-Cost Ratio (Discount Rate:12%)	Internal Rate of Return %
		Costs (RM million)	Benefits (RM million)		
SMURT-KL Master Plan	7,862	6,978	14,840	2.13	18.8%
Trunk Bus	1,276	390	1,666	4.28	27.5%
Highway Intensive Case	7,376	6,051	13,428	2.22	19.3%
Base Case	6,430	6,419	12,849	2.00	18.7%
Base Case with Area Pricing	7,997	6,428	14,425	2.24	19.0%

Source: SMURT-KL

The development of the new LRT Line from Damansara - Cheras is proposed to be completed in 2020 and the economic investment cost of the new LRT is estimated at RM 4,060 million in 1998 prices, accounting for about 24 % of the total investment cost of the SMURT-KL master Plan as shown in Table 12.2.1. However, an additional burden of RM 4,060 million is discounted into RM 550 million in present value, and the effect on the evaluation indices of economic analysis is not significant

Although the effects on traffic volume through each component of the SMURT-KL Master Plan are interdependently linked and complicated, they can be explained from the results of the evaluation of four cases as follows.

(1) Trunk Bus:

The total cost is estimated at RM390 million at present value and it is recovered by the benefits of RM 1,666, which mostly resulting from the time savings in the passengers travelling as shown in Table 12.3.1 and 12.3.2. The NPV is small compared with other four cases, however, the IRR shows a sufficiently high rate of 27.5 % to justify the project. A trunk bus system is recommended to be

implemented in the early stage of the Master Plan, because a small burden of investment costs is expected to save the transport costs of the society.

1) Highway Intensive Case:

The cost savings in vehicle running costs are negative in this case, since vehicle running costs or distant related costs increase caused by the increase of the highway capacity. The IRR is the highest of all cases except for the Trunk Bus Case.

2) Base Case and Base Case with Area Pricing:

The comparison between two cases, Base Case and Base Case with Area Pricing, examines the effects of Area Pricing. The benefit with Area Pricing Case is higher than that without Area Pricing in every benefit item i.e. savings in vehicle running cost, vehicle fixed cost and passenger travelling cost. The total benefit increases from RM 12,849 million to RM 14,425 million by a rate of 12 % with Area Pricing. The results explain that the restraint of traffic by Area Pricing will reduce the traffic costs of vehicles and passengers in the Study Area.

Figure 12.3.1 shows the flow of the benefits in the present value from 1999 to 2000 in the SMURT-KL Master Plan Case. There is a continuous increase of the benefits of passenger travelling time, as it includes the growth of the unit opportunity cost of passenger. The opportunity cost of passenger is assumed to increase in accordance with the future GRDP growth per employees in the analysis.

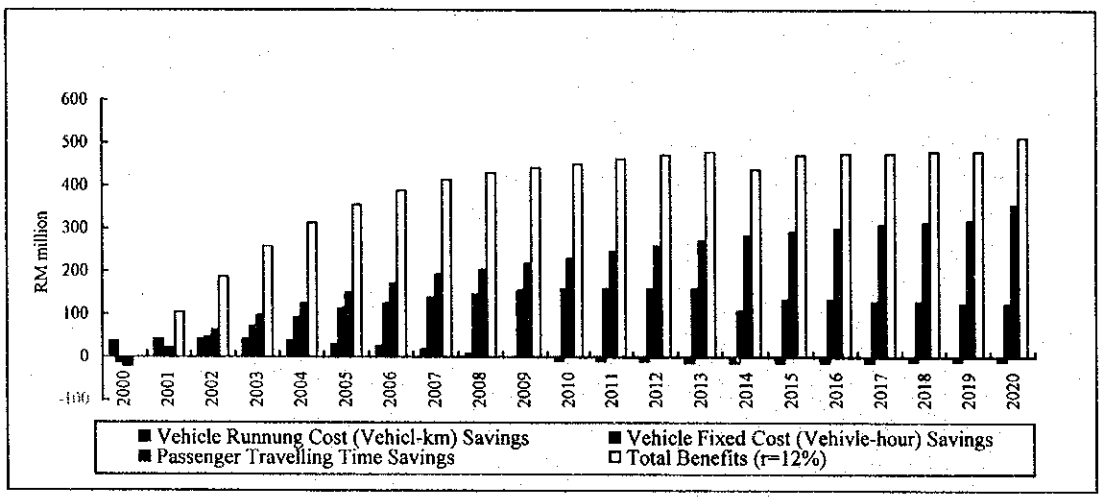


Figure 12.3.1 Benefits of SMURT-KL Master Plan in Present Value (1999 – 2020)

Figure 12.3.2 shows the benefits, the costs, the annual net benefits and the cumulative net benefit in present value. The annual net benefit turns positive in 2008, while the cumulate net benefit is continuously negative until 2016 and turns positive from 2017 onwards.

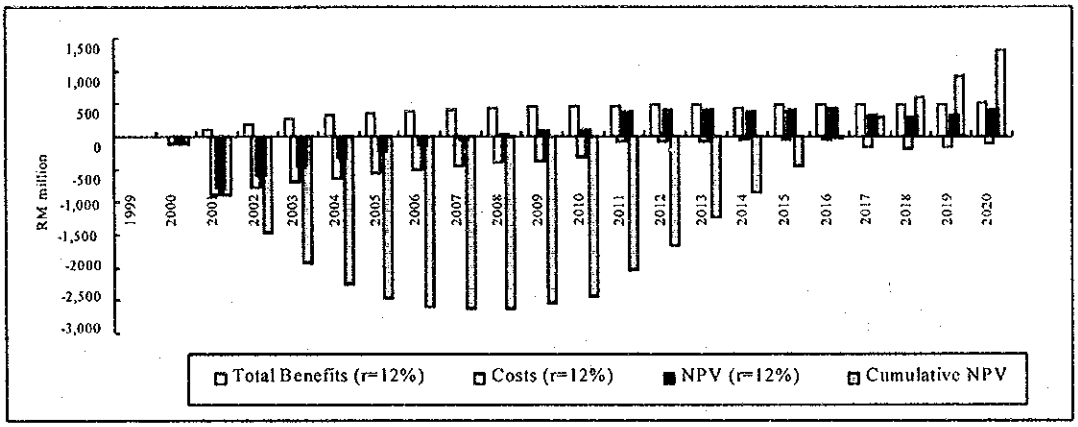


Figure 12.3.2 Benefits, Costs, Annual Net Benefits and Cumulative Net Benefit in Present Value of SMURT-KL Master Plan (1999 – 2020)

12.3.3 Sensitivity Analysis

(1) Sensitivity Analysis

The sensitivity of the SMURT-KL Master Plan is examined for the following cases.

1) Increase of the Investment Costs by 20 %: the IRR decreases from 18.8 % to 16.9 %. However, it remains high enough to show the viability of the Project to be implemented.

2) The share of Business Trip at 36 % in stead of 56 %: Assuming that NHBB trips and a half of HBW trips are taken into account to estimate the opportunity cost of passenger, the benefit decreases by 26 % and the IRR declines to 16.0 %.

3) Traffic Accident Reduction: Assuming that the Study Area could gradually reduce the rate of death caused from traffic accident to 0.08 in 2010 and later to 0.05 in 2020 from 0.40 per thousand population in 1997, the benefits of the saved lives from death are calculated under the following assumptions:

- The average residual year of the person is 30 year; and
- The benefit is the saved GRDP per Capita discounted at a rate of 12 %.

The saved costs account for RM 4,900 million in 1998 prices or RM 1,118 million in present value during the period from 1999 to 2020. The benefit raises the IRR of the SMURT-KL Master Plan from 18.8 % to 20.4 %.

Table 12.3.3 shows the results of the sensitivity analysis.

Table 12.3.3 Results of Sensitivity Analysis

Case	Net Present Value (Discount Rate:12%) (RM million)	Present Value (Discount Rate: 12%)		Benefit-Cost Ratio (Discount Rate:12%)	Internal Rate of Return %
		Costs (RM million)	Benefits (RM million)		
SMURT-KL Master Plan	7,862	6,978	14,840	2.13	18.8%
Investment Cost Increase by 20%	6,466	8,374	14,840	1.77	16.9%
Business related Trip: 36%	4,060	6,978	11,038	1.58	16.0%
With Benefit of Accident Reduction	8,979	6,978	15,957	2.29	20.4%

Source: SMURT-KL

(2) Non-rail Case

A Non-rail Case is assumed as a "without project" scenario and its traffic demand is compared with that of the SMURT-KL Master. It is assumed in the Non-rail Case, that every rail project, including operating lines and planned lines of the LRT and the Monorail, will be suspended in 2000, while other projects except for rail proposed in the SMURT-KL Master Plan will be implemented.

As shown in Table 12.3.4, the IRR of the SMURT-KL Master Plan is estimated at 41.8 %. It reveals that the transport costs of the society are much lower in the SMURT-KL Master Plan than that in the Non-rail Case.

Table 12.3.4 Evaluation of Non-rail Case

	Net Present Value (Discount Rate:12%) (RM million)	Present Value (Discount Rate: 12%)					Benefit-Cost Ratio (Discount Rate:12%)	Internal Rate of Return %
		Costs (RM million)	Benefits (RM million)			Total Benefits (RM million)		
			Vehicle Cost Savings on Road	O & M Costs Savings of Rail	Passenger Travelling Time Savings			
SMURT-KL Master Plan	9,116	2,880	14,182	-4,616	2,430	11,996	4.17	41.8%

Note: The costs for rail projects until 1999 is assumed to be sunk costs except for the costs of rolling stocks. The residual value of rolling stocks is calculated as an inverse cost in 2000.

Chapter 13

Financial Analysis on Public Transport

Chapter 13 Financial Analysis on Public Transport

13.1 Financial Analysis of Rail Based Transport

13.1.1 Rail-Based Transport Lines

(1) Railway Lines and Companies

Figure 13.1.1 shows the total network of the rail-based transport in Kuala Lumpur including the new lines recommended in the Master Plan. Table 13.1.1 explains the contents in detail such as 1) company name, 2) line name, 3) operating sections, and 4) number of stations and length.

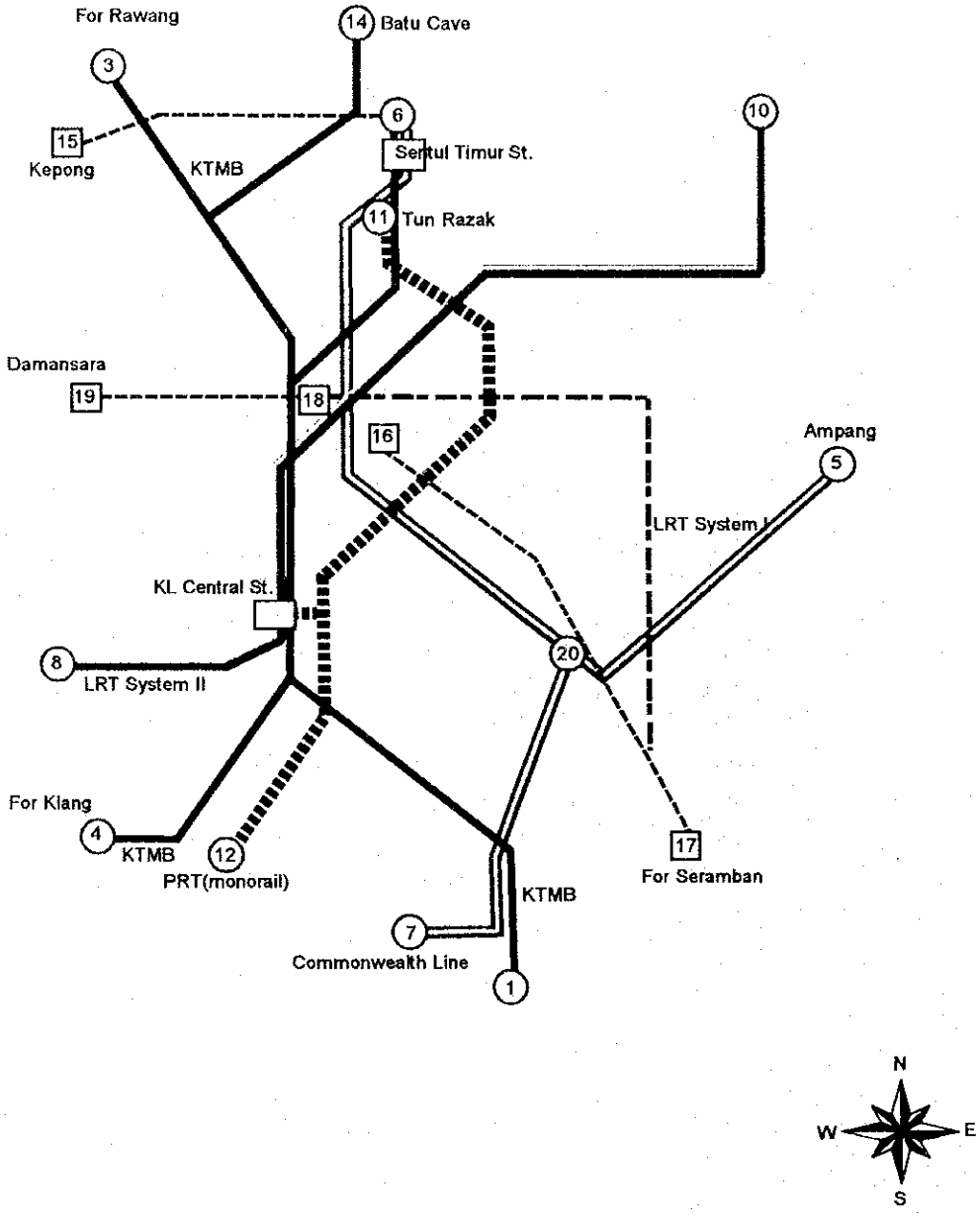
Table 13.1.1 Operation Outline of Rail-Based Transport in KL

Company			Operation Section					Station/Distance	
Name	No.	Line	Origin		-	Destination		Number	Length
KTMB	1	N.S.Line	1	Seremban	-	3	Rawang	20	105
	2	W.Line	2	KL.Central	-	4	Pel.Klang	19	48
STAR	3	Anpang Line	5	Ampang	-	6	Sentul Timur	18	15.2
	4	S.Petaling Line	20	Chan Show Lin	-	7	Sri Petaling	8	11.8
PUTRA	5	Section 1	8	Lenbah Subang	-	9	Pasar Seni	11	14.1
	6	Section 2	9	Pasar Seni	-	10	Gombak	13	14.9
PRT	7	N.Section	11	Tun Razak	-	2	KL.Sentral	13	8
KTM	8	Batu Line	13	Junction	-	14	Batu Cave		7.6
LRT-1	9	Cheras Line	18	Junction	-	17	Cheras		17.3
LRT-2	10	Damansara Line	18	Junction	-	19	Damansara		11.9
Total		Length Approved: 217 km, Planned Length: 36.8 km						111	253.8 km

Source: SMURT-KL based on KTMB, STAR, PUTRA and MRT information

Completed Lines: Out of the total 10 lines of 254 km, 5 lines over 194 km are complete and in operation; 1) North South line of KTMB 105 km, 2) West line of KTMB 48 km, 3) Ampang line 15 km, and 4) Sri Petaling line of STAR 12 km, and 5) Section 1 of PUTRA 14 km.

Lines under Construction: Section 2 of PUTRA 15 km is expected to operate as scheduled in 1999. The North section of PRT 8 km has stopped construction since 1997 and is scheduled to start construction again at the end of 1998, and is expected to be completed by the year 2000. The South section of PRT is not included for the present financial analysis since this line has been cancelled recently.



LEGEND

- KTMB
- STAR
- PUTRA
- Monorail
- Change from Trunk Bus to Rail
- Trunk Bus

Figure 13.1.1

Study Line for Rail- Based Network

SMURT-KL

STUDY ONINTEGRATED URBAN TRANSPORT STRATEGIES FOR ENVIRONMENTAL IMPROVEMENT IN KUALA LUMPUR

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

New Lines: The Batu Line extension of KTMB 8 km is expected to start construction in 1999 and to be completed in 2001. Another two lines, the Cheras line 17 km and the Damansara line 12 km are being recommended by the Master Plan and are assumed to be completed by 2020 after a four-year construction period. These two lines will be recommended after a comparison with the trunk bus lines as an alternative of rail transport.

Managing Companies: All 10 lines are operated by private companies as shown in Table 13.1.2. KTMB manages as the commuter line, STAR and PUTRA the light rail system, and PRT the monorail system. The KTMB has not been completely privatised yet, and its infrastructure belongs to the Rail Asset Corporation, which is a government organisation.

Table 13.1.2 Construction and Management Body of Public Transport

	KTM B(Commuter Train)	
1)	Name of Company:	Keretapi Tanah Melayu Berhad (KTMB)
2)	Agreement Date:	August 14, 1995. Operation and Management only
3)	Amount of Capital:	
4)	Shareholder:	Marak Unggul Sdn Bhd (Renong DRB Bhd)
	STAR (Light Rail)	
1)	Name of Company:	Sistem Transit Aliran Ringan (STAR)
2)	Agreement Date:	December 22, 1991. Build, Operate, and Own
3)	Amount of Capital:	700 Million RM
4)	Shareholder:	55% is Malaysian
		45% is Foreign (T.W.I of Britain, ZEG W.T.S.G of Germany)
	PUTRA (Light Rail)	
1)	Name of Company:	Projek Usahasama Transit Automatic Sdn Bhd (PUTRA)
2)	Agreement Date:	August 7, 1995. Build, Operate, and Own
3)	Amount of Capital:	1,307 Million RM
4)	Shareholder:	Renong Company
	PRT (Monorail Rail)	
1)	Name of Company:	People Mover Rapid Transit (PRT)
2)	Agreement Date:	October 26, 1996. Build, Operate, and Own
3)	Amount of Capital:	120 Million RM
4)	Shareholder:	63% Linercity Sdn Bhd
		37% KL Monorail Concessionaires Sdn Bhd

Note: Figures for PRT are based on in-house estimation.

Source: KTMB, STAR, PUTRA, and PRT.

(2) Data Used for Financial Analysis

Financial analysis of railway transport is closely related to the management situation of the company concerned. Accordingly most data used in this study are based on inference by the Study Team, by comparing rail transport systems of Malaysia with

other similar countries. The situations of other countries were analysed taking into consideration that they may change according to the business management effort.

The purpose of the analysis is to judge the profitability of each line of urban railroad as a public transport in view of the future traffic demand, and to prove its importance. It is not to compare the management situation of each company's line. Therefore average and common figures and data were used, such as construction cost, operation cost, fare revenue, and so forth.

13.1.2 Capital Investment

(1) Capital Investment Cost

Cost per Km: Table 13.1.3 shows the scale of investment of the rail-based transport business. Total investment amounts to RM 15.6 billion in actual price and RM 16.4 billion in present value in 1998, including the two recommended rail lines. The average investment cost per km is between RM 140 and 180 million except for the KTMB.

Conversion of Capital Cost Invested in the Past: All cost invested before 1998 are converted into present value of 1998 price by using the following price index for financial analysis.

1993 = 116.9 1994 = 113.9 1995 = 110.5

1996 = 106.9 1997 =104.0 1998 = 100

Table 13.1.3 Comparison of Capital Investment by Line

Unit: RM Million

Items	KTM			STAR	
	N.S.Line	W.Line	B.Cave	Anp-S.Tim.	Com-C.S.L
1) Length (km)	105.0	48.0	7.6	15.2	11.8
2) Investment Cost	1,147	746	163	2,061	1,761
3) Cost / km	11	16	21	136	149

Items	PUTRA		PRT	LRT-1	LRT-2
	Section 1	Section 2	N.Section	Cheras	Damansa
1) Length (km)	14.1	14.9	8	17.3	11.9
2) Investment Cost	1872	2695	1169	2990	1725
3) Cost / km	133	181	146	173	145

Source: SMURT-KL Estimation based on the data of KTMB, STAR, PUTRA, and MRT.

KTMB: KTMB started rail-based commuter service by using the existing KTMB's tracks. Therefore, the amount of investment was small and contents of investment works were mainly double tracking, grade separation, free passage, station plaza, and improvement of signal and telecommunication equipment. It did not need to

undertake ordinary civil works (refer to Table 13.1.4). KTMB's Electric locomotives were the first electric trains in Malaysia

PUTRA: The investment cost of PUTRA was higher than the average. This is because of the tunnel cost of 4.4 km. The construction cost of tunnel per km was more than the cost of an elevated line. The LRT Cheras line also contains a tunnel about 4-km long.

(2) Investment Cost

Cost Items: The main capital investment items were classified generally into four categories: 1) Civil works, 2) Signal and telecommunication, 3) Rolling stock, and 4) Machinery. Some companies have different classification grouping such as civil works, track works, electric works, depot construction works, professional fee, and project management. The cost estimation by item was made to estimate their maintenance cost and depreciation cost as well. Table 13.1.4 is a summary of those costs for the 10 lines.

Estimation: The cost by item were estimated as follows: 1) Actual cost of civil works was based on the completed lines, and a separate estimation was made for each line with a tunnel; 2) Cost of rolling stock was estimated by the number of trains necessary and by operation speed and travel time; and 3) Cost estimation of new lines under planning was done using the unit cost data of the actual line with a balanced allocation ratio of items.

As a result the components of each item were as follows:

1.	Civil work	40 - 55%	Case of KTMB	3%
2.	Signal and rolling stock	10 - 25%	Case of KTMB	28 - 30%
3.	Rolling stock	6 - 16%	Case of KTMB	26 - 39%
4.	Machinery	10 - 13%	Case of KTMB	20 - 21%
5.	Others	12 - 18%	Case of KTMB	10 - 20 %

Table 13.1.4 Estimation of Detailed Investment Cost by Item

Unit:RM Millioin

Company			1)Civil	2) Signal &	3) Rolling	4) Machin-	5)Others	Total
Name	No.	Line	Work	Telecom.	Stock	ery		
KTMB	1	N.S.Line	34	344	298	241	229	1147
	2	W.Line	22	210	288	149	77	746
	3	B.Cave	5	47	62	33	16	163
STAR	4	Amp.Line	907	475	158	206	315	2061
	5	S.P.Line	775	433	113	176	264	1761
PUTRA	6	Section 1	768	225	308	243	329	1872
	7	Section 2	1497	270	308	296	323	2695
PRT	8	N.Section	526	234	121	117	171	1169
LRT-1	9	Cheras Line	1585	359	227	359	460	2990
LRT-2	10	Damansara Line	776	267	267	173	242	1725

Source: SMURT-KL Estimate

(3) Capital Investment by Year

Steps: Construction usually proceeds with the implementation of civil works and then the installation of signalling, telecommunication, and machinery. Table 13.1.5 shows the investment amount by year. The construction period and cost allocation by year was different for each company, but they needed four or five years for construction period.

Table 13.1.5 Scale of Capital Investment by Year and by Line

Unit. RM Million

Company			Starting.	Investment Term						1998
Name	No.	Line	Year	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	Price
KTNB	1	N.S.Line	1993	126	126	814	80			1,147
	2	W.Line	1993	82	82	530	52			746
	3	B.Cave	1999	18	18	116	11			163
STAR	4	Amp.Line	1993	412	515	515	309		309	2,061
	5	S.P.Line	1994	246	317	687	511			1,761
PUTRA	6	Section 1	1995	374	468	468	562			1,872
	7	Section 2	1995	539	674	674	539	270		2,695
PRT	8	N.Section	1997	234	351	351	234			1,169
LRT-1	9	Cheras Line	2017	598	897	897	598			2,990
LRT-2	10	Damansara Line	2017	345	518	518	345			1,725
Total										16,329

Source: SMURT-KL estimation based on KTMB, STAR, PUTRA, and PRT data.

Cost Adjustment of Ampang Line: The construction period of the STAR Ampang line was adjusted to six years, because the section between Sultan Ismail to Sentul Timur had been added to the Ampang Line. This portion is 3.2 km and scheduled to be completed by the end of 1998 as a part of the Ampang line.

13.1.3 Operation and Maintenance Cost

(1) Rail Service and Number of Trains

Operation Service: The service level of operation is different by service time. During rush hour the service is at 5-minute intervals from 7.00 to 9.00 and from 16.00 to 18.00, and at 15-minute intervals during the off peak hours from 6.00 to 7.00 and from 18.00 to 24.00 at the average speed of 37 km/h. In the case of KTMB, the commuter train serves at 20-minute intervals during rush hour and at 30-minute intervals during the off-peak hours at a speed of 32 - 54 km/h.

Number of Trains Needed: The numbers of trains necessary in the years 2000, 2010, and 2020 was estimated based on the volume of passengers and on the train operation schedule. Table 13.1.6 shows the number of trains needed. The details are in Appendix Table 13.1.1 and Appendix Table 13.1.2.

KTMB will need additional rolling stocks. This is because the operating distance is long, i.e., 105 km for the South-North Line and nearly 50 km for the West Line.

Table 13.1.6 Estimation of Number of Rolling Stocks for Rail Operation

Company			1) No. of Rol. Stocks			2) Necessary No. of Rolling Stocks					
			1998			2000		2010		2020	
Name	No.	Line	Train	1 Unit	Total	Add.	Total	Add.	Total	Add.	Total
KTNB	1	N. S. Line	32	3	96	43	139	56	195	139	334
	2	W. Line	31	3	93	122	215	21	236	233	469
	3	B.Cave	7	3	21	0	20	15	35	18	53
STAR	4	Amp. Line	18	3	54	0	41	0	41	41	82
	5	S. P. Line	13	3	39	0	33	0	33	0	33
PUTRA	6	Section 1	35	2	70	0	48	0	48	2	72
	7	Section 2	35	2	70	0	27	0	53	0	53
PRT	8	N. Section	13	3	39	5	44	0	44	19	63
LRT-1	9	Cheras Line								91	91
LRT-2	10	Damansara L.								67	67

Source: SMURT-KL Estimate

(2) Operating Cost for Rail Service

The operating cost for rail service consists of 1) Personnel cost, 2) Electricity, and 3) Maintenance of infrastructure, signalling, telecommunication, rolling stock, and machinery.

Personnel Cost: The number of employees was estimated based on the assumption that 20 employees/km are required. The number of employees of STAR was 478 and at PUTRA was 482 in 1998. The salary level differs by company, and the figure of 17,820 - 18,034 RM per year was used.

Electricity Cost: The electricity cost was assumed to be 13.04 RM per train-km. This figure was obtained from the annual expense for electricity of a similar LRT divided by the annual train-km. Appendix Table 13.1.3 shows the details of the cost of the 10 lines.

Table 13.1.7 shows the personnel cost and electricity cost with the investment cost of additional trains by increase of passengers. The train cost was estimated by multiplying the unit price of rolling stock by the necessary number of trains. The unit cost of rolling stock differs by company, somewhere between RM 2.5 million to RM 4.4 million.

Table 13.1.7 Estimation of Personnel Cost and Electricity Cost

Unit: RM Million

Company			1) Person nel	2) Electricity				(Add. Investment Cost of Train)			
Name	No.	Line		1998	2000	2010	2020	1998	2000	2010	2020
KTMB	1	N.S.Line	37.9	40.0	90.0	125.9	215.9	297.6	133.3	173.6	430.9
	2	W.Line	15.5	18.0	81.1	88.4	176.8	288.3	378.7	65.1	722.3
	3	B.Cave	2.7	3.2	5.9	10.4	15.6		62.1	46.5	55.8
STAR	4	Amp.Line	4.7	15.0	15.6	15.6	31.3	127.3			127.3
	5	S.P.Line	3.8	11.7	12.1	12.1	12.1	102.4			
PUTRA	6	Section 1	4.3	14.0	19.3	19.3	29.0	308.0			8.8
	7	Section 2	4.4	14.8	10.2	20.4	20.4	308.0			
PRT	8	N.Section	2.9	7.9	11.0	11.0	15.5	120.9			52.3
LRT-1	9	Cheras Line	6.2				35.6				226.6
LRT-2	10	Damansara L	4.3				24.5				267.0

Source: SMURT-KL estimation.

Maintenance Cost: The maintenance cost of infrastructure, signalling, telecommunication, and machinery was assumed to be independent of the number of passengers. It was expressed as a percentage against the investment cost of each item. The maintenance cost of rolling stocks was correlated to the number of passengers. Table 13.1.8 shows the maintenance cost.

Table 13.1.8 Estimation of Annual Maintenance Cost

Unit: RM Million

Company		Infra.	Sig.Tel.	Machi.	Rolling Stock				Total Maintenance Cost			
Name	Line	1998 - 2020			1998	2000	2010	2020	1998	2000	2010	2020
KTMB	N.S.Line	0.7	15.5	3.6	4.5	2.0	2.6	6.5	24.3	26.3	28.9	35.3
	W.Line	0.5	9.4	2.2	4.3		1.0	10.8	16.5	16.5	17.4	28.3
	B.Cave	0.1	2.1	0.5	1.0	0.1	0.7	0.8	3.7	3.8	4.5	5.3
STAR	Amp.Line	19.0	21.4	3.1	2.3			1.8	45.9	45.9	45.9	47.6
	S.P.Line	16.3	19.5	2.6	1.7				40.1	40.1	40.1	40.1
PUTRA	Section 1	16.1	10.1	3.7	4.6			1.6	34.5	34.5	34.5	36.1
	Section 2	31.4	12.1	4.4	4.6		1.7		52.6	52.6	54.4	54.4
PRT	N.Section	11.0	10.5	1.8	1.8			0.9	25.1	25.1	25.1	26.0
LRT-1	Cheras Line	33.3	16.1	5.4				3.4				58.2
LRT-2	Damansara L.	16.3	12.0	2.6				2.5				33.4

Source: SMURT-KL estimation.

The following experimental rates were used for estimation.

1. Infrastructure ——— 2.10 % of investment cost
2. Signal and telecommunication —— 4.5% of investment cost
3. Rolling Stock ——— 1.5 % of investment cost
4. Machinery ——— 1.5 % of investment cost

13.1.4 Passengers and Revenue

(1) Passengers and Fare

Passengers of KTMB: The number of passengers using rail-based transport is very small at present. Table 13.1.9 shows the operation record of KTMB commuter since its operation in August 1995. For the North-South line, passenger was 51.1% and revenue 43.4 % of the forecast. Therefore, the actual number of passenger for the N-S line in 1998 was only 28,580 per day.

$$55{,}920 \times 51.1\% = 28{,}580 \text{ / day}$$

Passenger of STAR: STAR has operated since December 1996 and PUTRA has operated since July 1998 under similar situations. The number of passengers on STAR in 1997 was recorded as 46,850 per day for the Ampang Line. In the year 1998 up till June, it was almost the same level of 46,490 per day. The Demand forecast for 1998 was 170,000 per day at the time of planning.

Table 13.1.9 Operating Record of KTMB Commuter Service

Commuter		1995	1996	1997	1998
No. of Passengers / year	Pass.	2,817,443	11,094,551	16,499,363	10,065,547
Passenger-km / year	Pass./km	57,830,185	251,957,380	290,315,840	
Revenue / year	RM	4,958,626	23,702,630	29,231,120	
Average Passenger / day	Pass.	7,719	30,396	45,204	55,920
Average travel distance	Km	20.5	22.7	17.6	
Average Revenue / passenger	RM	1.8	2.1	1.8	
Average Revenue / km	RM	0.09	0.09	0.10	

Note: Four months in 1995
Number of passenger in 1997 covers 12 months but revenue covers only 6 months.
Source: Keretapi Tanah Melaya Berhad (KTMB)

Fare and Fare System: KTMB sells seasonal tickets such as weekly, monthly, quarterly, six-month, and yearly tickets, and gives a 50% discount for children. The average fare for KTMB is RM 0.09 per person per km. STAR has a student discount system, and a 18-month commuter discounting system. The boarding charge for STAR is RM 1.00 for one ride and the distance-proportional charge is RM 1.00 in the city and RM 0.50 outside the city. PUTRA provides concession tickets with a 50% discount and does not charge children under 6 years old. PUTRA also accepts the Touch'n Go Card, called a 'smart card', which contains electric cash.

(2) Forecast of Passenger and Revenue

Forecast with Area Pricing: The number of passengers and revenue were based on the data of Chapter 7 'Transportation Demand Forecast'. Table 13.1.10 shows the summary of the data which were the forecasts from the year 2000 in the central city area after the Area pricing scheme had be introduced.

Table 13.1.10 Estimation of Passenger and Revenue, Year 2000, 2010, and 2020 (Area Pricing)

Currency Unit: RM Million

Company	Line	2000		2010		2020	
		Passenger	Revenue	Passenger	Revenue	Passenger	Revenue
KTMB	N-S Line	115,817	62.9	168,451	81.8	269,116	138.3
	W. Line	163,487	84.9	232,994	107.2	372,636	193.8
	Batu C.	15,159	8.7	27,601	15.9	37,672	21.7
STAR	Ampang	107,719	58.3	130,882	67.2	202,725	110.9
	S. Petaling	24,154	19.7	36,893	29.4	58,350	48.9
PUTRA	Section 1	63,987	55.2	76,344	61.0	129,847	104.0
	Section 2	42,675	27.9	73,409	48.2	120,688	84.8
PRT	N. Section	60,760	26.8	128,297	59.0	219,571	103.1
LRT-1	Cheras			74,238	60.6	110,024	92.4
LRT-2	Damansara			73,407	49.4	110,581	73.6

13.1.5 Cost and Revenue Comparison

(1) Indicators and Assumptions

Three Indicators: The following three indicators were applied for the financial analysis of the rail-based transport business: 1) Income Statement Indicator, 2) Financial Statement Indicator, and 3) Investment Decision Indicator.

Table 13.1.11 shows the formula and criteria. Out of the three indicators, the investment decisions criteria (FIRR) is the most important.

Assumption for Calculation: The following data and assumptions were used for the analysis of cost revenue comparison.

1) Project life: 30 years from start of operation

2) Depreciation Period: 50 years for infrastructure, 20 years for telecommunication and machinery, and 25 years for rolling stock

3) Salvage Value: Appropriated at the last year of the project life.

4) Loan Condition: There are two types of loans: soft loan and commercial loan. The soft loan is a government loan, conditioned at 6 - 8 % annual interest rate with a 15-year repayment period. The commercial loan is a bank loan, conditioned at 11 % annual interest rate with a 30-year repayment period including a 15-year grace period.

5) Tax allowance: Allowance period of 10 years, and allowance of 60% of investment tax.

Table 13.1.11 Three Evaluation Indicators for Viability of Rail-Based Transport

1) Income Statement Indicator Operating Profit = Revenue - Operating Cost - Depreciation Cost (Shorter the term of deficit is, more profitable is the investment)
2) Financial Statement Indicator Net Cash Flow = Loans + Equity + Operating Profit + Depreciation – Investment – Repayment – Interest payment (The project is feasible and free from revolving fund shortage if deficit turns out black within 8 or 9 years)
3) Investment Decision Indicator Financial Internal Rate of Return : Total Discounted Present Value of Revenue = Total Discounted Present Value of Cost (If the FIRR turns out higher than average interest rate, investment is proved feasible.) (Higher the FIRR is, the more profitable is the project.)

(2) Result of Comparison

Calculation: Table 13.1.12 is a summary of the result of the evaluation of all lines. The net present value is the difference between total discounted present revenue and total discounted present cost by average interest rate.

Income Statement Indicator of Column 1): (Operating Profit = Revenue – Operating Cost – Depreciation) The shorter the term of the deficit is, the more profitable is the investment. As the table shows, almost all of the lines will be in deficit for their project life, which means that revenue cannot cover operating cost and depreciation cost.

Financial Statement Indicator of Column 2): (Net Cash Flow = Operating profit + Loans + Equity + Depreciation – Investment - Repayment – Interest expense) The project is feasible in spite of a shortage of revolving fund, if deficit turns black within 8 or 9 years. As the table shows, most lines will be still in deficit for over 8 years, which means that all of the companies will have a problem of shortage of revolving fund.

Table 13.1.12 Summary of the Results of Financial Calculation (with Area Pricing)

Unit: RM Million

Company		1)Operating Profit		2) Net Cash Flow		3) FIRR	4) Ope.=Reve.
Name	Line	2010	2020	2010	2020	%	Year
KTMB	NS Line	-165	-222	-6,937	-25,573	-	-
	W. Line	-68	-109	-3,942	-13,978	-	17
	B. Cave	-10	-12	-258	-1,032	-	4
STAR	Amp. Line	-56	-35	-5,953	-22,392	-	13
	S. P. Line	-77	-57	-6,217	-23,155	-	26
PUTRA	Section 1	-48	-15	-4,256	-15,459	-	8
	Section 2	-100	-63	-5,572	-21,048	-	20
PRT	N. Section	-13	+24	-2,085	-7,312	-	5
		2030	2040	2030	2040		
LRT-1	Cheras Line	-60	-19	-6,181	-22,484	-	3
LRT-2	Daman. Line	-22	+3	-3,286	-11,848	-	2

Investment Decision Indicator of Column 3): (Financial Internal Rate of Return) If the FIRR turns out higher than the average interest rate, the investment is proved to be feasible. According to the analysis all lines have a lower FIRR than the average interest rate.

Comparison between Revenue and Operating Cost of Column 4): Column 4) shows the number of years required to cover the operating cost (excluding depreciation) by annual revenue after start of operation. In the case of the North-South line of KTMB, profit cannot cover the operating cost at all for the whole project life.

13.1.6 Policies and Viability of Public Transport

(1) Policy for Revenue Increase

Policy 1: Area Pricing: People will use more rail-based transport if travel cost of road transport increases more by, through the charging of an additional fee to enter the central part of the city. This effect was already considered in the previous revenue estimation.

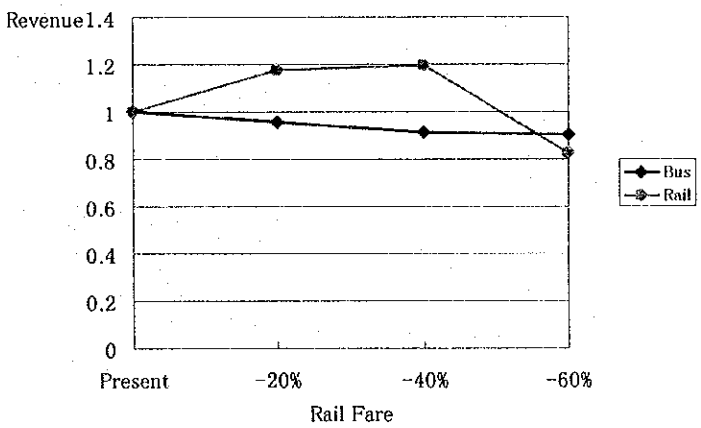
Policy 2: Present Fare Deduction: Based on the traffic interview survey, the following data was obtained about fare elasticity. As shown in Table 13.1.13 and the Figure, by decreasing the present rail fare by 20 %, revenue is expected to increase by 18%.

Policy 3: Allowance to Commuter Pass by Employer: At present, a private car commuter gets an allowance for parking. If workers could get from their employee a 100% allowance of a monthly railway ticket, for example, transport would be a great advantage for them. This is very common in cities where the public transport

network is well-developed. According to the survey explained in Chapter 7, 'Transportation Demand Forecast', users of the railway increases by 1.52 times on the whole through this policy.

Table 13.1.13 Fare Elasticity Between Rail and Bus Ridership

Fare		Present	-20%	-40%	-60%
Share (Sample)	Bus (%)	51.6	29.1	3.4	0.4
	Rail (%)	48.4	70.9	96.6	99.6
Share (Current)	Bus (%)	91.7	87.8	83.4	82.9
	Rail (%)	8.3	12.2	16.6	17.1
Average Travel Time	Bus (Min.)	67.7	67.7	67.7	67.7
	Rail (Min.)	47.7	47.7	47.7	47.7
Average Far	Bus (RM)	1.18	1.18	1.18	1.18
	Rail (RM)	1.77	1.42	1.06	0.71
Ridership Ratio	Bus	1	0.958	0.91	0.904
	Rail	1	1.4649	1.9959	2.0579
Revenue Amount	Bus	1.18	1.130349	1.0736365	1.0670164
	Rail	1.77	2.0801	2.1156	1.4611
Revenue Change	Bus	1	0.95790	0.90980	0.90430
	Rail	1	1.17520	1.19530	0.82550



Policy 4: Acceleration of Integrating Railroad Lines: There are 10 rail lines at present including those in operation and others in planning stages operated by four independent railway companies. Passengers will increase if these railways are managed as one railway network through the use of common ticket for all lines, and by using the same facilities to make transfer easier.

Policy 5: Diversification of Railway Business: The diversification of the railway business is one way to cover the railway deficit through side businesses. Generally speaking, side businesses are more profitable than the transportation business.

Examples of typical diversification are bus service, real-estate, urban development business such as the developing a commercial area, garden city, and high quality

residential town; inviting universities; and building terminal department stores, recreation facilities, hotel, and amusement centre.

Table 13.1.14 shows an example in Japan. The rail revenue share is less than half of the total revenue of the company. However, it takes a long time to establish diversified businesses.

Table 13.1.14 Revenue Sources of Major Private Railway Companies in Japan

Company	Line Length (km)	Passenger-km (million)	Revenues (billion Yen)						
			Railway	%	Bus	%	Other	%	Total
Tokyu	464	14,366	142	59%	35	15%	63	26%	240
Seibu	180	9,489	87	39%			138	61%	226
Keisei	92	3,860	51	59%	27	31%	8	9%	86
Keio	85	6,936	69	59%	21	18%	27	23%	117
Odakyu	122	10,983	96	63%	1	1%	56	37%	153
Tokyu	101	8,759	106	40%			159	60%	265
Keikyu	84	6,275	62	46%	24	18%	47	35%	132
Sotetsu	35	2,823	28	21%	9	7%	95	72%	132

Note: Rail service in Tokyo area in 1994

Source: Yearbooks of individual private railway companies.

(2) Financial Viability of Public Transport

Commuter Pass Applied: All of the Policies mentioned in the above paragraphs will be needed to resolve the road traffic congestion and to utilise the rail transport efficiently. Among the five policies mentioned above, Item 3 is the most important and effective policy. This is the policy where employers pay a certain amount of the cost of the commuter pass in the same way that most companies now pay the parking fee for car commuters.

Policy 1:	Area Pricing----------It is already included in the transport demand forecast and revenue estimation.
Policy 2:	Fare Deduction----An 18 % increase in revenue through 20 % fare reduction will have a big effect but not big enough to cover the large deficit.
Policy 3:	Commuter Pass Allowance by the Employer---The increase in demand by 1.52 times seems to be a way to cover the railway deficit
Policy 4:	Acceleration of Integrating Railroad Lines----The effect will be gradual and occur in small amounts.
Policy 5:	Diversification of Railway Business----This will produce an effect in future.

Result of Calculation: The income statement indicator improved a great amount compared with the case having only the area pricing, while the net cash flow did not improved much. The railway lines which will have less than 10 years of deficit are the following 4 lines while the others will be more than for 10 years.

KTMB	Batu Line --------	Operating Profit:	Deficit period for 3 years
		FIRR:	1.7%
PRT	North Line ----------	Operating Profit:	Deficit period for 7 years
		FIRR:	3.8%
LRT	Cheras Line ---------	Operating Profit:	Deficit period for 6 years
		FIRR:	2.1%
LRT	Damansara Line ---	Operating Profit:	Deficit period for 1 year
		FIRR:	3.8%

However, the investment indicator, (i.e., FIRR), shows that railway investment is not viable.

Balance of Passenger: 'Estimation' of passenger in Table 13.1.15 is the number of passengers estimated after the introduction of the commuter pass allowance. 'Needed' number of passengers in the table is the number of passengers needed to get a viable FIRR, which is the average interest rate of each company. On an average, 1.8 times more passengers are needed to make the FIRR feasible.

Table 13.1.15 Comparative Analysis of Railway Passengers Between Estimated and Actual Number Needed

Unit: Person/day

Company		2000				2010		
Name	Line	Estimation	Needed	Shortage	Ratio	Estimation	Needed	Shortage
KTMB	NS Line	176,042	264,063	-88,021	1.50	256,046	384,068	-128,022
	W. Line	248,500	285,775	-37,275	1.15	354,151	407,274	-53,123
	B. Cave	23,042	29,954	-6,912	1.30	41,954	54,540	-12,586
STAR	Amp. Line	163,793	196,479	-32,686	1.20	198,941	238,729	-39,788
	S. P. Line	36,714	159,706	-122,992	4.35	56,077	243,937	-187,860
PUTRA	Section 1	97,260	170,205	-72,945	1.75	116,043	203,075	-87,032
	Section 2	64,866	204,328	-139,462	3.15	111,582	351,482	-239,900
PRT	N. Section	99,555	102,545	-2,990	1.03	195,011	200,862	-5,851
LRT-1	Cheras Line	117,367	172,881	-55,514	1.47	167,236	246,339	-79,103
LRT-2	Daman. Line	116,265	156,957	-40,692	1.35	168,083	226,912	-58,829

Balance of Revenue: Table 13.1.16 also shows the revenue in the same way as the above analysis. The table shows the level of revenue which will make the railway investment viable. In the case of PUTRA section 1, the estimated revenue is RM 84 million, but RM 145 million will actually be needed in 2000, and RM 255 million in 2010.

Table 13.1.16 Comparative Analysis of Railway Revenue Between Estimated and Actual Amount Needed

Unit: RM Million

Company		2000			2010			2020		
Name	Line	Estimation	Needed	Shortage	Estimation	Needed	Shortage	Estimation	Needed	Shortage
KTMB	NS Line	96	143	-47	124	189	-174	210	315	-105
	W. Line	129	148	-19	163	187	-172	295	338	-43
	B. Cave	13	17	-4	24	32	-17	33	43	-10
STAR	Amp. Line	89	106	-17	102	122	-107	169	202	-33
	S. P. Line	30	131	-101	45	194	-179	74	324	-249
PUTRA	Section 1	84	147	-63	93	162	-147	158	277	-119
	Section 2	42	134	-91	73	231	-216	129	406	-277
PRT	N. Section	44	45	-1	90	92	-77	157	161	-4
LRT-1	Cheras Ln.	96	142	-45	141	207	-192	393	580	-186
LRT-2	Daman. Ln.	78	106	-27	112	151	-136	202	257	-55

Conclusion: As the financial conclusion, revenue will not be able to cover the whole construction cost, but its degree differs by lines. Some projects are nearly viable after applying area pricing, commuter allowance, and discounting passenger policies.

13.1.7 Policies and Strategies in Master Plan

(1) Precondition of Policy

The following preconditions must be considered in solving the deficit problems of the railway business in the Master Plan.

1. Continue the Building, Operating, and Owning (BOO) system by a private company: Implementation of this new system is now underway. It is vital to continue it for a certain number of years.

2. Subsidisation policy leads the company to wrong direction: Government subsidy, generally speaking, decreases commercial business endeavour, degrades the quality of transport service, and leads to inefficient management. It tends to make the management less cost-minded, and it causes a vicious cycle of more deficit and more subsidies.

3. Competitive management as a principle: The competition principle is a prerequisite to public service especially in public transport.

4. Subsidy must be paid back: As a principle, beneficiaries (railway users) must pay the costs. At the same time, the Government may issue a bond to make it possible for railway companies to receive loans under certain conditions.

(2) Policy to Stop Increasing Deficit

Without policy enforcement, the deficit of the private railway company will increase further. The following policies are recommended for implementation along with the existing transport-related policies.

1. Implementation of the area pricing scheme in the central city area.
2. Implementation of the commuter pass allowance through government initiative.
3. 20% reduction of fare by government guidance.
4. Facility improvement for modal interchange through government initiative.
5. Enforcement of co-development with an urban development plan.

(3) Subsidy Policy with Premise

Many Deficit Cases in Other Countries: Many countries have similar deficit problems. The availability and scope of public aid varies from country to country. There are a few companies that can cover their operating cost by revenue. Those companies are usually located in big cities with a huge demand as shown in Table 13.1.17.

Table 13.1.14 showed cases of private companies which manage a railway service without government subsidy in Japan. The success in management of private companies mainly depends upon two factors: 1) large, high-density market, and 2) business diversification.

Table 13.1.17 Key Indicator of Performance of Rail Service

Unit: US$ million

City	Type of System	1) Operating Cost	2) Total Cost	3) Revenue	4) Revenue/ Operating Cost	5) Revenue/ Total Cost
Caracas	Metro	33.34	120.28	42.16	1.26	0.35
Santiago	Metro	15.32	76.89	20.31	1.33	0.26
San Paulo	Metro	67.15	210.54	40.68	0.61	0.19
Tunis	Suburban rail	7.55	11.41	4.05	0.54	0.35
Adelaide	Suburban rail	31.7	51.88	4.29	0.14	0.08
Baltimore	Metro	99.2	147.33	48.1	0.48	0.33
Berlin	Metro	126.44	498.15	104.05	0.82	0.21
Chicago	Metro	101.5	388.79	61.3	0.60	0.16
Hong Kong	Metro	60.96	152.06	132.27	2.17	0.87
London	Metro	440.08	1098.58	440.99	1.00	0.40
Montreal	Metro	92.53	180.38	31.68	0.34	0.18
Nagoya City	Metro	127.09	326.43	158.73	1.25	0.49
New York	Metro	1100	4750.99	955.34	0.87	0.20
Osaka	Metro	414.37	780.32	416.49	1.01	0.53
San Diego	Light rail	5.3	14.86	4.34	0.82	0.29
San Francisco	Metro	128.2	410.66	69.8	0.54	0.17

Note: 1) Operating cost excludes depreciation and interest charge.
2) Total annual cost includes operating cost, depreciation, and interest charges.
3) Operating revenue include fare and advertising revenue, but it excludes subsidies.

Source: A World Bank Policy Study, 1986

Reasons of Subsidy: The following points are some of the reasons why governments provide subsidies to unprofitable railway companies in other countries. All four reasons to subsidise are applicable to the rail-based public transport and have to be considered in future policies.

1. Subsidy to subway only at **initial stage**: Initial investment cost is too large to be covered by a private company using revenue in the early operating stage, especially if the cost is forced to increase to serve the transport demand at peak hours on urban railways.

2. Subsidy to infrastructure cost of Monorail: Monorail constructed on a highway is a kind of elevated highway which contributes to **reducing traffic congestion** on the surface highway.

3. Subsidy to light rail transport in city: Its role is in **reducing social cost** such as air pollution, noise pollution, and saving energy.

4. Subsidy to public transport in city: Even though the financial internal rate of return (FIRR) is low, which means it is not profitable, if the economic internal rate of return (EIRR) is higher than the opportunity cost of capital, public transport will have a favourable **impact on national economy**. Table 13.1.18 shows the relation between EIRR and FIRR.

Table 13.1.18 Example of Results of Economic and Financial Evaluation

1)City	2)System	3)Length (km)	4) Forecasted Traffic Demand (1,000Persons/day)	5)EIRR (%)	6)FIRR (%)
A	Subway	13.5	1,000	8.7	1.1
B	MRT(Elevated)	14.2	200	9.2	4.3
C	Railway (Surface)	30.0	90	16.4	5.7
d	Monorail	17.4	640	12.2	3.8

Note: a, b, c, and d have been used for actual city names, in order to maintain confidentiality.

Source: Japan Railway & Transport Review, 1997.

(4) Continue the Present Government Policies

Continue the Privatisation Policy: Application of the competition principle to public transport should continue as a government principle. Malaysia started investments in public infrastructure by 100% private companies according to the competition principle. It had been successful until the recent economic recession.

Long-Term Government Loan: The government provides 20-30 % of the capital investment as a government loan with a 6-8 % interest rate and a repayment period of 30 years with a 15-year grace period.

Low Lease Rate of Right of Way: The right of way patches are owned by the asset corporation of the government and leased to the private railway company at a low lease rate.

Tax Allowance: 60% investment tax allowance for 10 years.

Founded New Fund Raising Organisation: The government has created a special agency called the 'Infrastructure Development Corporation' (IDC) under the Ministry of Finance and IDC issued RM 10.5 billion long term government bonds.

Finance Government Bond for Outstanding Interest: The amount from the RM 4.5 billion bond is to be allocated to KTMB, STAR and PUTRA as their loan through United Engineers Bhd.(UEM) which is a 100% subsidiary of Renong. The Renong Group secures the bond to UEM with the expected revenue from the North - South Expressway management (A Renong Groups company called Project Lebuhraya Utrara Sulatan (PLUS)). The total amount of RM 4.5 billion will be used for purchasing rolling stocks and for outstanding interest for commercial bank loan.

(5) Policy Alternatives

For the ten railway lines which were found to be barely profitable or unprofitable, the following alternative analysis was undertaken in order to judge the effectiveness of policies to enhance sound management in the future.

1. Comparison between revenue and operating cost (not including depreciation).
2. Comparison of costs in the case that infrastructure cost is deducted from the initial investment cost.

Table 13.1.19 shows the comparison between revenue and operating cost. The revenue is the amount presupposing commuter pass allowance. The results of the analysis were found to be follows.

1) The revenues were considered to be sufficient to cover the costs excluding depreciation except for two lines.

2) The S. Petaling line of STAR was found not to have enough revenue to cover the cost. The reason is that the number of passengers were comparatively small and that the growth rate was low.

3) N-S line of KTMB was another line where revenue was found to be insufficient to cover the cost. This was due to the relatively low revenue and high operation costs derived from its long distance operation.

Table 13.1.19 Balance Between Revenue and Operating Cost by Line

Unit: RM Million

		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
N-S Line	Revenue	96	98	101	104	106	109	112	115	118	122	124
	Ope. Cost	153	153	153	153	153	153	153	153	153	153	192
	Balance	-58	-55	-53	-50	-47	-44	-42	-39	-36	-32	-68
West Line	Revenue	129	132	135	138	142	145	149	152	156	160	163
	Ope. Cost	118	118	118	118	118	118	118	118	118	118	126
	Balance	11	14	17	20	23	27	30	34	37	41	36
Batu Line	Revenue				16	17	18	19	20	21	23	24
	Ope. Cost				12	12	12	12	12	12	12	17
	Balance				4	5	6	7	8	9	11	7
Ampang L.	Revenue	89	90	91	93	94	95	97	98	100	101	102
	Ope. Cost	47	47	47	47	47	47	47	47	47	47	47
	Balance	42	43	44	46	47	48	50	51	53	54	55
S. P. Line	Revenue	30	31	32	34	35	36	38	39	41	43	45
	Ope. Cost	40	40	40	40	40	40	40	40	40	40	40
	Balance	-10	-8	-7	-6	-4	-3	-1	0	2	3	5
Section 1	Revenue	84	85	86	86	87	88	89	90	91	92	93
	Ope. Cost	42	42	42	42	42	42	42	42	42	42	42
	Balance	42	43	44	44	45	46	47	48	49	50	51
Section 2	Revenue	42	45	47	50	53	56	59	62	66	69	73
	Ope. Cost	36	36	36	36	36	36	36	36	36	36	46
	Balance	7	9	12	14	17	20	23	26	30	34	27
PRT	Revenue		44	48	52	56	60	65	71	77	83	90
	Ope. Cost		28	28	28	28	28	28	28	28	28	28
	Balance		16	20	24	28	32	37	43	49	55	62
Chelas	Revenue	140	147	153	160	167	174	182	190	198	207	216
	Ope. Cost	67	67	67	67	67	67	67	67	67	67	88
	Balance	74	80	86	93	100	108	115	123	132	140	129
Damans.	Revenue	112	116	121	126	131	137	142	148	154	160	167
	Ope. Cost	47	47	47	47	47	47	47	47	47	47	61
	Balance	64	69	74	79	84	89	95	100	106	113	105

Note: Figures for Cheras and Damansara lines start from year 2020.

Table 13.1.20 shows the analysis of operating profits by line, if the infrastructure cost were to be deducted from the initial costs.

The infrastructure costs for all 10 lines amounted to 6.895 billion RM. When the cost is deducted, there will be many changes in the analysis.

1 Total investment cost is reduced.

2 Maintenance cost of infrastructure is reduced.

3 Depreciation cost of infrastructure is reduced.

4 Amount of repayment of capital is reduced.

5 Amount of interest expense is reduced.

In the case of KTMB, the infrastructure cost amounts to only 3 % of the total investment costs, because the Government has borne most of the infrastructure costs in the past.

Table 13.1. 20 Summary of the Result of Operating Profit Analysis

Condition: Total Initial Investment Cost – Infrastructure Cost
(Operating Profit = Revenue – Operating Cost – Depreciation) Unit: RM Million

Year	KTMB			STAR		PUTRA		PRT	LRT-1	LRT-2
	N-S Line	W. Line	Batu C.	Ampang	S.Petaling	Section 1	Section 2	N. Section	Cheras	Damans.
2000	-104	-34		3	-44	6	-34		29	32
2001	-102	-31		4	-43	7	-32	-6	35	36
2002	-99	-28		5	-42	8	-29	-3	41	41
2003	-97	-24	-3	7	-40	9	-26	1	48	46
2004	-94	-21	-2	8	-39	10	-24	5	55	51
2005	-91	-18	-1	9	-38	10	-21	10	63	56
2006	-88	-14	0	11	-36	11	-17	15	70	62
2007	-85	-11	2	12	-34	12	-14	20	78	68
2008	-82	-7	3	13	-33	13	-11	26	87	74
2009	-79	-4	4	15	-31	14	-7	32	95	80
2010	-121	-11	-2	16	-29	15	-13	39	79	67
2011	-114	-1	-1	22	-27	20	-9	44	89	74
2012	-107	10	0	27	-25	25	-5	50	99	81
2013	-100	21	1	33	-22	31	0	56	109	89
2014	-92	33	2	39	-19	37	5	62	120	96
2015	-84	45	3	45	-16	43	11	68	131	104
2016	-75	59	3	52	-13	50	16	75	143	112
2017	-66	73	4	59	-10	57	22	82	156	121
2018	-56	88	5	67	-7	64	29	90	169	130
2019	-46	104	6	74	-3	72	35	98	182	139
2020	-149	-7	-1	60	0	70	42	99	160	120

Note: Cheras and Damansara lines start operation in 2020.

The result of the analysis:-

1 The North - South Line of KTMB, the S.Petaling Line of STAR, and the PUTRA Section 2 will suffer from operating deficit for a long time.

2 The Ampang line of STAR and the Section I of PUTRA will show operation profits from the year 2000.

3 As for PRT, LRT-1 and LRT-2, the operating profit will improve remarkably.

4 Although the financial situation will improve through assistance for the infrastructure investment, the net cash flow analysis showed a shortage of funds. The major cause of the shortage was considered to be the high interest rate of loans, particularly the short-term loan, which was adopted to balance the annual fund shortage.

5 There are profitable lines and unprofitable lines by company. As a total, the whole revenue and expenditure situation will be improved.

(6) Policy and Strategy

The rail-based transport system is a key to alleviating traffic conditions and achieving a balanced public transport network in the Kuala Lumpur conurbation area. However, according to the results of the financial analysis, the railway business will reach a dead end if the environmental situation for the business does not change.

Therefore, the issue facing rail-based transport will be how to sustain the business for the future healthy public transport of the area. The following strategies are proposed.

- Reorganise the institutional environment to sustain the business such as commuter allowance, permission for the companies to conduct related businesses, and so on.
- Make the service more convenient to users by improving the transfer facilities, ticketing system, feeder service, have closer connection with urban developments, and so on.
- Give more preferential loans to the business to lessen the financial burden of the government.

With regard to the fund necessary to sustain the rail-based transport modes, further study will be necessary on measures to assist infrastructure investment cost, financial resources, possible new taxes, and so on.

13. 2 Viability Analysis of Bus Transport

(1) Bus Transport Management

Description of Buses Operated by INTRACOTA: Table 13.2.1 shows the outline of the bus transport operated by a bus company, INTRAKOTA, which started its business in 1996. 774 buses in total are operating now in Kuala Lumpur. There are five kinds of buses, but they can be grouped into two categories, small-size buses and large-size buses.

Table 13.2.1 Bus Description of INTRAKOTA

Type of Bus	Small Bus	Large Size Bus				
Kind of Bus	OPTARE	SCANIA	IVECO	MAN	Total	Average
Number of Buses	222	24	293	205	522	
Passenger Capacity	44	77	69	66		71
Number of seat	31	48	43	41		44

Source: INTRAKOTA Consolidated Berhad.

Cost Breakdown of Bus Investment: As shown in Table 13.2.2, the company investment to start the bus transport business was about 290 million RM, of which 90% was used for purchasing the buses. Therefore, it is vitally important for the company to utilise the buses effectively.

Table 13.2.2 Total Asset and the Share of Bus Investment

Unit : RM Million

Items	1966		1997		Total	Percentage
		(Installment)		(Installment		
1 Freehold land			0.75		0.75	0.3%
2 Building			1.41		1.41	0.5%
3 Buses and destination board	14.42	47.29	44.17	151.69	257.57	88.9%
4 Ticketing equipment	4.32		9.69	2.77	16.78	5.8%
5 Office equipment	0.05		0.70		0.75	0.3%
6 Garage equipment			0.05	0.33	0.37	0.1%
7 Computer	0.12		0.71		0.83	0.3%
8 Motor vehicles	0.25	0.73	0.03	0.98	1.98	0.7%
9 Furniture and fitting			0.02		0.02	0.0%
10 Capital work in progress		0.88		8.42	9.30	3.2%
	19.16	48.90	57.50	164.18	289.75	100.0%

Source: "Reports and Accounts for the Year Ended 31 March 1997" by INTRAKOTA

(2) Fixed Bus Operation Costs

Items of Fixed Cost: There are two kinds of cost for bus operation, one is fixed costs and the other is running costs. Table 13.2.3 shows the items of the fixed cost per one hour per bus. Fixed cost consists of 6 items which were separately calculated from actual bus operation.

Table 13.2.3 Unit Fixed Cost of Bus Operation Per Hour

Fixed Cost Items	OPTARE	SCANIR	IVECO	MAN
Capital Costs (Depreciation - Time Relation)	3.173	6.350	6.737	6.233
Long Term Interest Cost	2.539	5.080	5.390	4.987
Insurance Cost	1.172	1.172	1.172	1.172
Overhead Cost	8.479	8.821	8.821	8.821
Crew Costs	11.250	11.250	11.250	11.250
Road Tax	0.645	0.645	0.645	0.645
Fixed Costs, All	27.258	33.318	34.014	33.107
Factor	0.650	0.650	0.650	0.650
Total Fixed Costs / Vehicle-hour	17.718	21.657	22.109	21.520
Total Fixed Costs / Vehicle-km	0.394	0.481	0.491	0.478

Source: Estimated by SMURT-KL Based on Data Obtained from INTRAKOTA

Component of Fixed Cost: The most expensive fixed cost item was the crew cost amounting to over 70%, and the next one was the overhead cost. The estimation of crew cost was based on RM 1,200 monthly average salary for 1,370 bus drivers and their assistants. Their working hour was set at 8 hours a day 24 days a month. The item "Factor" in the table means the percentage of hours in which the of bus was used productively for operation, which was estimated to be 65% for the purpose of calculations.

Fixed Cost: As shown in the table, the fixed cost per hour is RM 17.7 for OPTARE, RM 21.6 for SCANIA, RM 22.1 for IVECO, and RM 21.5 for MAN. The fixed cost per bus-km was obtained by dividing the fixed cost per hour by 45 km/h, the base speed. The difference for each bus mainly comes from the different purchasing prices.

Data: All the data usedng for this calculation is explained in Table 13.2.4, "Input Data for Unit Bus Operating Cost Calculation by Base Speed".

Table 13.2.4 Input Data for Unit Bus Operating Cost Calculation

	Items	OPTARE	SCANIR	IVECO	MAN
1	Vehicle Price (Excl. Tyres) RM	270,800	541,900	574,900	531,900
2	Vehicle Life (Years)	10	10	10	10
3	Vehicle Life Km	604,800	604,800	604,800	604,800
4	Vehicle Annual Km	60,480	60,480	60,480	60,480
5	Vehicle Life Operating Hours	12,800	12,800	12,800	12,800
6	Vehicle Annual Operating Hours	1,280	1,280	1,280	1,280
7	Fuel Price (RM/Liter)	0.55	0.55	0.55	0.55
8	Fuel Consumption (Litre/Km)	0.41	0.36	0.36	0.36
9	Tyre Unit Price (RM /Peace)	1,460	1,460	1,460	1,460
10	Number of Tyres	6	6	6	6
11	Tyre Life-Km	60,000	60,000	60,000	60,000
12	Lubricants Price (RM/Litre)	3.12	3.12	3.12	3.12
13	Lubri. Oil Consumption (Litre/100km)	0.99	0.99	0.99	0.99
14	Maintenance Spares/Year	2,500	2,500	2,500	2,500
15	Maintenance Labor (Hour/1000km)	15.00	15.00	15.00	15.00
16	Maintenance Labor Cost (RM/Hour)	7.80	7.80	7.80	7.80
17	Depreciation Distance-Related (%)	85.00	85.00	85.00	85.00
18	Depreciation Time-Related (%)	15.00	15.00	15.00	15.00
19	Opportunity Cost of Capital (%)	12.00	12.00	12.00	12.00
20	Insurance (per year per bus)	1,500	1,500	1,500	1,500
21	Overhead Cost (Annual/car RM)	10,853	11,290	11,290	11,290
22	Crew Number (Driver)	1.80	1.80	1.80	1.80
23	Crew Unit Cost (RM /Hour)	6.25	6.25	6.25	6.25
24	1 Year Road Tax (RM per bus)	1,486	1,486	1,486	1,486

(3) Running Cost of Bus Operation

Unit Cost: Table 13.2.5 shows the running cost to drive one bus for 1 km. The unit cost used for the calculation was as follows: (a) fuel cost: RM 0.55 per litre; (b) lubricants cost: RM 3.12 per litre; (c) tyre unit cost: RM 1,460; (d) spare parts cost for RM 1,500; (e) labour cost per month: RM 1,500; and (f) depreciated cost based on the purchase cost of a bus.

Table 13.2.5 Bus Running Operating Cost per Km

Items of Running Cost	OPTARE	SCANIR	IVECO	MAN
Fuel Costs	0.223	0.196	0.196	0.196
Lubricant Costs	0.003	0.003	0.003	0.003
Tyre Costs	0.146	0.146	0.146	0.146
Maintenance Spares Costs	0.041	0.041	0.041	0.041
Maintenance Labor Costs	0.117	0.117	0.117	0.117
Depreciation Costs	0.381	0.762	0.808	0.748
Total Running Costs/vehicle-km	0.911	1.265	1.312	1.251

Cost by Speed: Table 13.2.6 shows the bus operation cost by travel speed. Small buses are represented by OPTARE which has a 44-passenger capacity. Large buses are represented by SCANIA, IVECO, and MAN, which have a 66 to 77 passenger capacity. The running cost changes by travel speed, while the fixed cost does not change.

The running cost by speed was estimated by applying the cost estimated at a speed of 45 km/h to the speed-cost curve.

Table 13.2.6 Bus Operating Cost by Travel Speed

(Unit: RM)

Travel Speed	Small Bus			Large Bus		
	Running Cost	Fixed Cost	Total	Running Cost	Fixed Cost	Total
10	1.386	0.394	1.780	1.961	0.486	2.447
15	1.289	0.394	1.683	1.824	0.486	2.310
20	1.201	0.394	1.595	1.700	0.486	2.186
25	1.124	0.394	1.518	1.591	0.486	2.077
30	1.056	0.394	1.450	1.494	0.486	1.980
35	0.998	0.394	1.392	1.412	0.486	1.898
40	0.949	0.394	1.343	1.344	0.486	1.830
45	0.911	0.394	1.305	1.289	0.486	1.775
50	0.881	0.394	1.275	1.248	0.486	1.734
55	0.862	0.394	1.256	1.220	0.486	1.706
60	0.852	0.394	1.246	1.206	0.486	1.692
65	0.852	0.394	1.246	1.206	0.486	1.692
70	0.862	0.394	1.256	1.220	0.486	1.706
75	0.881	0.394	1.275	1.247	0.486	1.733

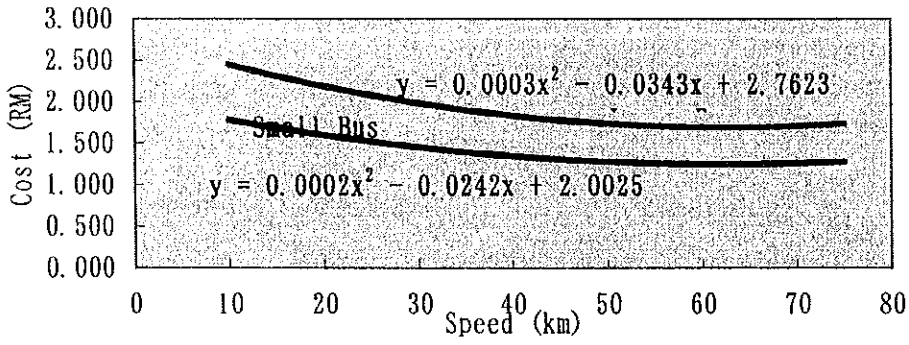


Figure 13.2.1 Running Speed and Bus Operating Cost

(4) Viability of Bus Transport

Viability of Bus Operation: Travel speed and travel distance affect the bus operation cost, which in turn determines the number of passengers required for viability. That is, when the travel speed decreases due to road congestion, the operation cost increases and more passengers will be needed to recover the cost.

When the travel distance increases, the bus operation cost increases as well and more passengers will be needed to recover the cost.

Table 13.2.7 Bus Capacity and Its Revenue

Item	Small Bus		Large Bus				
	OPTARE	Revenue	SCANIA	IVECO	MAN	Average	Revenue
Passenger Capacity	44	39.6	77	69	66	71	63.6
Number of seat	31	27.9	48	43	41	44	39.6

Table 13.2.8 shows the relationship of travel speed, distance, and cost, with the number of passengers required for the viability of small bus and large bus operation. The bus fare is fixed at RM 0.90 for one trip at present.

For example, when a small bus operates over a distance of 5 km at a speed of 10 km/h, the operating cost is RM 8.9 (5km x RM 1.780 = RM 8.9). The fare of a small bus is RM 0.9 for one trip, which means that 10 passengers (RM 8.9 / RM 0.9 = 10 passengers) are required to recover the operating cost of RM 8.9.

In the case of a large bus, if the operating cost is RM 61.2 for the distance of 28 km at a speed of 20 km, for example, the operating cost can be recovered when there are 68 passengers, which is nearly full capacity as shown in Table 13.2.7.

Table 13.2.8 Number of Passenger Required to Cover Bus Operating Cost for One Trip

Cost: RM

Operating Distance	Small Bus					
	Operating Cost	Passenger Required	Operating Cost	Passenger Required	Operating Cost	Passenger Required
Km	10km/h	Number	20km/h	Number	30km/h	Number
5	8.9	10	8.0	9	7.3	8
6	10.7	12	9.6	11	8.7	10
8	14.2	16	12.8	14	11.6	13
10	17.8	20	16.0	18	14.5	16
12	21.4	24	19.1	21	17.4	19
14	24.9	28	22.3	25	20.3	23
16	28.5	32	25.5	28	23.2	26
18	32.0	36	28.7	32	26.1	29
20	35.6	40	31.9	35	29.0	32
22	39.2	44	35.1	39	31.9	35
24			38.3	43	34.8	39
26					37.7	42
28						

Operating Distance	Large Bus					
	Operating Cost	Passenger Required	Operating Cost	Passenger Required	Operating Cost	Passenger Required
Km	10km/h	Number	20km/h	Number	30km/h	Number
5	12.2	14	10.9	12	9.9	11
6	14.7	16	13.1	15	11.9	13
8	19.6	22	17.5	19	15.8	18
10	24.5	27	21.9	24	19.8	22
12	29.4	33	26.2	29	23.8	26
14	34.3	38	30.6	34	27.7	31
16	39.2	44	35.0	39	31.7	35
18	44.0	49	39.3	44	35.6	40
20	48.9	54	43.7	49	39.6	44
22	53.8	60	48.1	53	43.6	48
24	58.7	65	52.5	58	47.5	53
26	63.6	71	56.8	63	51.5	57
28			61.2	68	55.4	62
30					59.4	66
33					65.3	73

Therefore, the following policies should be applied to bus transportation.

1. In the case of a small bus, at a speed of 10 km/h service is feasible within an area 10 km from the railway station if the number of passengers exceeds 20.

2. In the case of a small bus, at a speed of 20 km/h, service is feasible within an area 10 km from the railway station if the number of passengers exceeds 18. Or. at a speed of 20 km/h, bus service is feasible within an areas 10 km from the railway station if there are over 18 passengers.

Viability of Bus Route Operation: The average bus operation distance per day is 180 km, made up of eight round trips, which means 11 km for a one way trip and 23 km for one round trip. The average speed in the city of Kuala Lumpur is about 10 km.

As shown in Table 13.2.9, the bus operating cost for one day at a speed of 10 km/h is RM 320 for a small bus and RM 440 for a large bus. A small bus requires 356 passengers and a large bus requires 489 passengers to recover the operation cost with a one-way fare of RM 0.90.

Table 13.2.9 Number of Passenger Required to Cover Bus Operating Cost for One Day Operation

Cost: RM

		Small Bus			Large Bus		
10 km/h		Half Trip	Round trip	Whole day	Half Trip	Round trip	Whole day
Bus Operating distance	km	11	23	180	11	23	180
Bus Operating Cost	RM	20.0	40.1	320.4	27.5	55.1	440.5
Number of Passenger Required		22	45	356	31	61	489
		Small Bus			Large Bus		
20 km/h		Half Trip	Round trip	Whole day	Half Trip	Round trip	Whole day
Bus Operating distance	km	11	23	180	11	23	180
Bus Operating Cost	RM	17.9	35.9	287.1	24.6	49.2	393.5
Number of Passenger Required		20	40	319	27	55	437
		Small Bus			Large Bus		
30 km/h		Half Trip	Round trip	Whole day	Half Trip	Round trip	Whole day
Bus Operating distance	km	11	23	180	11	23	180
Bus Operating Cost	RM	16.3	32.6	261.0	22.3	44.6	356.4
Number of Passenger Required		18	36	290	25	50	396
		Small Bus			Large Bus		
40 km/h		Half Trip	Round trip	Whole day	Half Trip	Round trip	Whole day
Bus Operating distance	km	11	23	180	11	23	180
Bus Operating Cost	RM	15.1	30.2	241.7	20.6	41.2	329.4
Number of Passenger Required		17	34	269	23	46	366

If travel speed increases from 10 km/h to 20 km/h due to improved traffic conditions, the following effects can be expected for a small bus per day.

a) 12.5% savings in bus operation (RM 320 – RM 287 = RM 40)

b) Operation route may be expanded to an area where there are 10.5% less passengers (3516 - 319 passengers = 37 passengers).

c) Possible operation distance can increase from 180 km to 200 km, about 10%.

(5) Viability in the Context of Trunk Bus System

The number of passengers forecasted is set forth in Table 13.2.10 and many passengers are predicted.

Although there are many preconditions to discuss the viability about trunk bus system, the number of passengers is substantial enough that all trunk bus system can be expected to be lucrative under these circumstances.

Table 13.2.10 Number of Passengers on Trunk Bus

Unit:Passengers

Line	Km.	2000	2010	2020
1 Ampang	10.1	19,100	23,200	34,500
2 Cheras	13.7	28,700	34,500	51,400
3 Damansara	11.9	25,200	25,900	36,500
4 Genting Kelang	9.4	25,800	27,800	39,100
5 Kepong	14.0	15,100	20,100	27,700
6 Puchong	14.2	12,500	15,600	27,500

Source: SMURT-KL

(6) Feeder Bus System

In terms of the feeder bus system, the number of passengers was not forecasted for each feeder bus route. Viability is anticipated to some extent by the number of passengers at rail stations. As many railway passengers cannot be expected in the suburban area due to the low population density, the feeder bus system may not be profitable.

Taking these conditions into consideration, it seems preferable for the feeder bus system to be managed and operated by the same companies or affiliated ones as the railway company so that they can complement each other.