

ภาคผนวก 1  
ข้อกำหนดขอบเขตงาน (TOR)  
ของการศึกษา

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## APPENDIX 1: TERMS OF REFERENCE (TOR)

### Study in Japan

#### **[J-1] Review of financial framework of MRT including PPP**

- (1) To review literature and cases on global experience in financial frameworks of urban railway system and summarize the following items:
  - (a) Type of financial frameworks
  - (b) Roles and responsibilities of stakeholders, i.e., operator and government
  - (c) Legal framework of PPP
  - (d) Risk allocation
  - (e) Service standard and revenue sharing
  - (f) Value for money (VfM) analysis
  - (g) Premise of financial analysis of project and content of financial analysis
- (2) To review literature and cases on operational efficiency and service level of urban railway system and summarize the following items:
  - (a) Customer satisfaction
  - (b) Operational efficiency (No. of service, peak-time operation, etc.)
  - (c) Financial efficiency
- (3) To formulate practical and recommendable project implementation schemes for MRT project by combining alternatives mentioned in (1) and (2) above. The number of schemes will be around 5.

To evaluate project efficiency of each scheme for such items as construction cost, operation cost, ridership, revenue, etc. based on literature.

#### **[J-2] Analysis on the possible financial framework with Japanese ODA Loan**

- (1) To carry out financial analysis of the urban railway projects financed with Japanese ODA loan which are reviewed in [J-1] -(1).

To conduct short-term & long-term financial analysis (financial statements, future cash flow, and FIRR) for each project implementation scheme formulated in [J-1] -(3). At the analysis, weighted average capital cost (WACC) of implementing organization is considered. For standard units of construction cost, operating cost, and ridership demand, the results of evaluation of project efficiency in [J-1] - (3) are reflected.
- (2) To compare and evaluate project implementation schemes formulated in [J-1] - (3)

on the basis of the results of 【J-1】 - (2) and 【J-2】 - (1).

**【J-3】 Other issues on PPP in MRT project**

- (1) To conduct literature study and case studies of urban railway system in Japan and other countries on railway business strategy.

Case studies primarily cover the following items:

- (a) Linkage with urban planning and urban development
  - (b) Establishment of transportation network
  - (c) Approach to non-fare revenue increase
- (2) To analyze entry barriers and risks of private participants in railway network construction by more than one private operator by literature study and interview survey.

The analysis is primarily done from (a) the legal perspective (reciprocal extension contract, responsibility of development planning, etc.) and (b) the financial perspective (revenue sharing, development planning, etc.).

**Field Study in Thailand**

**【T-1】 Collection of data & information on the current MRT projects in Thailand through interview survey and collection of literature, and summary of results**

- (1) To collect supplemental data & information on the financial schemes of the current two MRT projects in Thailand, e.g. SkyTrain Project and Blue Line and analyze the following items:
  - (a) Project profile
  - (b) Type of the financial framework (including detailed information of adopted PPP scheme)
  - (c) Roles and responsibilities of stakeholders
  - (d) Legal framework of PPP in the railway sector in Thailand
  - (e) Risk allocation (e.g. construction risk, operation risk, ridership risk, political risk, country risk, exchange risk etc, force majeure risk)
  - (f) Service standard (i.e. minimum standards of operation such as min. no of service, peak-time operation, etc.) and revenue allocation
  - (g) Application method, premise, and results of VFM analysis
- (2) To analyze current service performance in comparison with original plan and identify problems of service performance according to the results of 【J - 1】 - (2).

- (3) To analyze the financial efficiency of the current MRT projects in Thailand focusing on such items as WACC of fund raising, short-term & long-term financial analysis (financial statements & future cash flow analysis) and FIRR of operating company and to identify problems in comparison with the results of 【J - 2】 - (1).
- (4) To identify the lessons to be learned from the projects from the results of the above (1) to (3) for the implementation of MRT projects in Thailand under both PPP scheme and operation-by-state scheme).

**【T-2】 Collection of data & information on MRT master plan in Thailand and analysis of issues of MRT master plan (added in October, 2009)**

- (1) To review the current situation of city plan centering on MRT projects and identify the situation and issues of collaboration between city plan and transportation plan;
- (2) To review the plans of other modes of transportation such as BRT and feeder bus and analyze the situation and issues of collaboration between MRT plan and plans of other transportation modes;
- (3) To review the contents of URMAPP3 (new MRT master plan) and to analyze issues, especially regarding a policy for network integration and a financial plan;
- (4) To review how URMAPP3 positions other related plans including whether the cabinet meeting has approved or not and to analyze the situation and issues of implementation framework of URMAPP3;
- (5) To analyze the situation and issues of organizational function which integrates related plans;
- (6) To design a framework of ideal integrated MRT master plan and identify a gap between the current situation and ideal framework; and
- (7) To formulate prospective assistance necessary for filling this gap.

**【T-3】 Case studies**

- (1) To carry out financial analysis of future MRT projects in Thailand assuming the use of Japanese ODA loan. The number of subject projects is around 3. Financial analysis is basically done for each project implementation scheme formulated in 【J - 1】 - (3). However, project implementation schemes may be modified according to a discussion between the Study Team and the Thai side.

**【T-4】 Finalization of report and holding of debriefing session**

- (1) To prepare a final report  
A final report shall appropriately reflect the results of discussions between the Study Team and the Thai side.
- (2) To hold a debriefing session in Thailand to report the results of the Study to stakeholders in Thailand and JICA.

**[T-5] Review of tender documents for the Purple Line (added in January, 2010)**

- (1) To review and analyze the contracts and tender documents for MRT system procurement including rolling stock and concession of operation including non-rail business, based on the results of [T-1], and make recommendations for the implementing agency; and
- (2) To draw up a report of review results and recommendations.

## ภาคผนวก 2

# MRT Assessment Standardization

(พิมพ์จากเอกสารของ ADB)

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## APPENDIX 2 Draft Standardization Directive

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### 1. Harmonisation of the 1992 PPSU Act studies

Studies of individual MRT projects within the Five Lines network needed under the 1992 PPSU Act are being separately procured by separate government agencies using different consulting contracts. At the same time, the Sub-Committee for MRT Finance and Operations (the meeting of January 18, 2007) has specified for study a network and concessioning variation which involves combining the Blue Line extension and the Purple Line, which are to be otherwise examined through separate studies. In addition, the Sub-Committee meeting has specified that different types of concessions be studied (Net Cost, Gross Cost and Modified Gross Cost).

To enable comparison of the findings of the separately procured and managed studies and integration into a coherent and meaningful network-level plan, the Ministry requires that the studies observe a standardisation of assumptions, concepts and presentation of findings as set out below. This work is to be undertaken for each Project Option, which will include:

- Individual lines (ie Blue Line, Purple Line or Green Line as defined by the agencies);
- Project Variation(s) as relevant (ie as identified by Sub-Committee for MRT Finance and Operations at the meeting of January 18, 2007); and
- Other combinations of lines as may be determined.

#### 1.1 Ridership and revenue forecasts

Studies shall be based on common and consistent assumptions regarding demography, forecast years, MRT fares and transport networks as shown in Tables 1 and 4. With regard to MRT fares, consideration is to be given to:

- Non-integrated fares, with each MRT boarding requiring payment of a fare that comprises a boarding charge plus a distance-related component; and
- Integrated fares, wherein passengers would not pay the boarding charge for second and subsequent boardings where they transfer directly between lines, eg a passenger transferring from the Purple to the Blue Line would pay a single boarding charge (for the first boarding) plus the distance-related component for their travel on each line.

#### 1.2 Financial Modelling of PPP options

A key objective of the studies is to examine the potential options for private sector participation through investment in fixed Electrical and Mechanical (E&M) equipment and rollingstock for an MRT project, and operations and maintenance (O&M) of the constructed facility. Consideration is also to be given to alternative approaches to the financial structure of concession agreements.

Specifically, consideration is to be given for each Project Option to the following options with regard to private sector involvement:

- Investment and Operations:
  - A concessionaire undertakes only O&M, with the Government financing all infrastructure—this option will be the Public Sector Comparator – PSC; and

- A Public Private Partnership (PPP) in which a private sector concessionaire finances all E&M and rollingstock investment and undertakes O&M, with the Government financing other infrastructure investment.
- For each Investment and Operations option, three concessionaire Payment Options<sup>1</sup>:
  - Net Cost (current method)
  - Gross Cost
  - Modified Gross Cost (with partial demand risk transfer)

Assessments of the technical, economic and financial feasibility of the projects shall assume that in all cases MRT operations and maintenance meet performance-based specifications.

Accordingly, six combinations of Investment and Operations option and Concession Payment option are possible for each Project Option. The analysis shall be based on common approaches and standards, including:

- a common duration for concessions, with evaluations to be undertaken for 25, 30, 35 and 40 year periods
- common factors as described in Table 1
- common factors with regard to depreciation and other accounting conventions
- a common risk analysis framework and basis for allocating and valuing risk in each option

The scope of the analysis for each combination of Project Option, Investment and Operations option, and Concession Payment option shall be in two parts:

#### **Assessment of the financial performance of the Concessionaire**

A financial feasibility analysis for each option that:

- Uses common factors as described in Table 1
- uses pro forma financial statements for the concessionaire (including income statement, cash flow and balance sheet for each year in the concession);

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<sup>1</sup> The three concession options are:

- **Net Cost concession:** This is the form of agreement for the BTS and Blue Line subway. The concessionaire retains fare revenue and pays for O&M and pertinent asset costs. The government will need to make payments to the concessionaire if fare and other revenue is less than the costs incurred by the concessionaire, or the concessionaire will need to make payments to the government if the reverse should occur.
- **Gross Cost concession:** The government pays the concessionaire an amount equal to the costs the concessionaire incurs for the provision of agreed assets and services. Payments are subject to agreed standards being achieved. The government retains all fare revenue.
- **Gross Cost concession (with partial demand risk transfer):** A variant of the Gross Cost concession in which the concessionaire's remuneration incorporates a component that is related to patronage (ie the share of patronage over which the concessionaire has influence) or could be in the form of a bonus payment for achieving patronage targets.

- ensures that private sector concessionaires achieve an acceptable rate of return (either by making payments of excess revenue to the Government or receiving financial payments from the Government) with minimum cost to the Government;
- uses a funding plan based on limited recourse financing (ie the lenders cannot rely on any loan security beyond that provided in the project), indicating a Debt-to-Equity ratio, an interest rate and an internal rate of return on equity (ROE) which reflect the opportunity costs of the lenders and equity sponsors, taking into consideration the project risk of each option;
- presents the total cost of each option to the government; and
- presents summary indicators that show the performance of each option, including the financial internal rate of return (FIRR) on investment and the Enterprise Value (EV) of the project (defined as the Net Present Value of the cash flow available for debt service and other funds providers) and indicators of loan performance risk such as the Debt Service Coverage ratio series.

### **Value for Money (VfM) assessment**

#### Overview

The objective of the Value-for-Money (VfM) analysis is to determine the procurement option that is likely, when account is taken of all risks and uncertainty, result in the lowest cost to the government over the life of the concession. As indicated elsewhere, six procurement options are to be considered covering investment and payment options. The VfM analysis should be prepared for the recommended concession period. The VfM analysis is also to be undertaken in a quantitative manner as far as possible. A qualitative assessment should be made where a quantitative analysis is not possible.

The VfM analysis will be based on forecast cash flows in nominal values. The results of the VfM analysis should be expressed as an expected present value of the cost to the government of ensuring the delivery of the MRT line over the duration of the concession, including the value of risk in each option that is retained by the government.

Costs to be taken into account will include:

- The best estimate of the cost of the project to the government and of forecast patronage demand, as estimated in the current studies.
- The potential for costs and revenue to differ from these best estimates, which will be largely related to optimism bias.

#### Best Estimate of Project Costs and Revenue:

The best estimate of the cost of the project and likely revenue will be prepared under other project activities. Issues to be considered are:

- In the case of a Net Cost concession there could be either a payment from the concessionaire to the government or the reverse depending on the financial viability of the project.
- In the case of a Gross Cost concession, separate account needs to be taken of payments to concessionaires and fare revenue that would be handled outside the concession.

- The cost of civil infrastructure need not be addressed because it is the same for each procurement options.
- Account should be taken of the effects of the three forms of concession on:
  - Funding costs incurred by concessionaires, including the effect on debt-equity ratio and the cost of equity and debt capital
  - The incentive for the concessionaire to maximise patronage on their system

#### Optimism Bias and Other Uncertainty:

International studies of project development in land transport have established sound statistical evidence for a phenomenon now known as 'optimism bias'. This is the tendency for actual costs to be higher and actual passenger demand to be lower than the best estimate at the time the decision is made to proceed with the project. Specific detailed data on the extent of optimism bias in Thailand is not available, though its presence is evident in cost escalation for past public sector projects and the lower than expected demand for the current MRT lines in Bangkok.

Costs and revenue may differ from the best estimate due to:

- Optimism bias. In the current analysis:
  - Parameters for the extent of optimism bias are reported in Table 2.
  - For construction cost, the statistical data for optimism bias is drawn largely from projects constructed by the public sector. Optimism bias in this case is consistent with the public sector approach to decision-making and project management incentives, which is not well suited to achieving project assets that satisfy well-considered use, quality and cost objectives. By contrast, common experience is that the private sector is able to better use skills, knowledge and inventiveness in various disciplines including risk analysis to achieve the ends. The lack of analysis of past expected and actual project costs in Thailand and non-disclosure of private sector costs necessitates some judgement of the appropriate extent of optimism bias to use in the current studies. Data reported in Table 2 are based on international experience (specifically capital costs and patronage) and understandings of general experience.
  - The potential for capital costs to be higher than expected will be less with concessionaire procurement because of better contract management
  - A concessionaire is likely to add a premium into a contract in a net cost concession to protect themselves against exposure to patronage risks that are beyond their control. This will not occur with a gross cost concession because the maximum patronage risk that a concessionaire bears is within their control.
  - In a gross cost concession where no patronage risk is transferred to the concessionaire, the concessionaire will not strive to maximise patronage. In the other concession options, the concessionaire has the incentive to maximise patronage to the extent that it is within their control.
- General uncertainty such as changes in law, taxes, force majeure and government policy. These should be addressed in a qualitative assessment that identifies any key differences between the six procurement options.

### 1.3 Submission of financial models with the study reports

Submission of the study reports should be accompanied by a fully-functioning, fully-auditable copy of the financial model or models used in the study, housed in an electronic file capable of being operated by a standard spreadsheet programme (such as Excel).

### 1.4 Economic Analysis

Key parameters for use in economic evaluations are shown in Table 3.

### 1.5 Studies inception conference

An inception conference for the studies will be organised, with attendees to include OTP, the MRT agencies (namely MRTA and BMA) and their study consultants, to discuss and ensure the required harmonisation as described above.

## 2. Open Technologies and Systems

The studies technical feasibility assessment and project cost estimation shall consider the efficiency and cost effectiveness of open technologies and systems for MRT. In particular the studies shall:

- identify all potential barriers to efficient and safe inter-operability of trains including signalling, rollingstock, ticketing, passenger information, communication and power, processes (managerial, legal and human) and proprietary technologies (in technology systems and sub-systems);
- identify the options to address these impediments, for existing (ie legacy) systems as well as future procurements; and
- for each option prepare an economic or cost-benefit analysis of removing these impediments and estimate an associated phasing schedule for implementation.

## 3. Passenger benefits: integrated MRT network

The traveling public benefits where the planning and management of an MRT network allow through-operation across any concession boundary, under an integrated fare tariff. Where through-operation is restricted due to poor planning or fragmented concessioning, passengers maybe be forced to transfer from one line to another and suffer an inconvenience which should be avoided or reduced if possible. Where fare is not integrated across concessions, passengers suffer a financial rather than a physical inconvenience under forced transfer.

The Net Cost, Gross Cost and Modified Gross Cost concessions being considered impose different demand risk burdens on revenue and, ultimately, the project cash flow available to service private sector debt and pay dividends. As is the case with the two existing Bangkok MRT concessions, where concessionaires bear significant demand risk they are likely to insist on exclusivity of line access to protect their fare revenue and cash flow.

**Studies shall consider how these different demand risk burdens restrict or promote the potential passenger benefit of through-operation and fare integration, taking into account the phased development of the Bangkok MRT network.**

Table 1: Standard Assumptions for Financial Analyses

Item	Quantity	Units	Notes
<b>Price Units</b>			
Base year prices	early 2007		
General rate of inflation		(% p.a.)	applied to all cost items—NESDB to provide
<b>Duration of Analyses</b>			
Concession duration	25, 30, 35, 40	years	(after construction period)
Evaluation period - financial analysis (FIRR)	25, 30, 35 & 40	years	(after construction period)
<b>Discount Rates</b>			
	5.0%	% p.a.	Approximates the risk-free rate. Used to find NPV of cash flows where risk is treated using explicit percentage overrun/underperformance factors (see Table 3).
<b>Annualization factors</b>			
Passenger demand	330	days/year	relative to average demand per working weekday
Supply of services	350	days/year	relative to average supply of services per working weekday
<b>Revenue</b>			
<b>Fare structure</b>			
Boarding charge	10	Baht	2001 prices
Distance charge	1.8	Baht/ km	2001 prices
Fare escalation (nominal)	3.0%	% p.a.	assuming fare increase every year at inflation rate
Non-fare revenue	7.0%	%	as % of fare revenue
<b>Asset Life</b>			
<b>Civil Works</b>			
Tunnels	100		
Structures, incl. stations & depots	50		
Buildings	30	years	

Item	Quantity	Units	Notes
E&M equipment			
Power supply	30	years	
Mechanical, signalling, train control & ICT	15	years	
Rollingstock	30	(years)	
Land acquisition	nil		
Mid-life Refurbishment (in addition to O&M cost)			
Rollingstock			
Refurbishment of rollingstock occurs after	15	years of service	
Cost of refurbishment	33%	of initial price	cost of refurbishment, as a % of the initial cost of a railcar
Exchange rate	35	(Baht/US\$)	
Private Sector Financing			
Debt-to-Equity ratio			
Net cost concession	2.0	times	1.5 for BMCL at present
Gross cost concession	6.0	times	No demand risk. IPPs at 3-4 times.
Modified gross cost concession	5.0	times	Benchmarked on UK LRT projects (some demand risk)
Loans			Average for all loans
Grace period	2	years of service	Principal repayment begins after this period
Terms of loan (including grace period)	15	years	
Interest rate (%)			Average over the loan term
Net cost concession	8.5%		
Gross cost concession	7.5%		
Modified gross cost concession	7.75%		
Return on Equity			

Item	Quantity	Units	Notes
Net cost concession	13.50%		Risk premium (on risk free rate) of 8.5% is similar to BMCL contract  IPP equity returns are 12-13%
Gross cost concession	12.50%		
Modified gross cost concession	12.75%		
<b>Financial Statements</b>			
Corporate tax	30%	of profit before tax	Equal to 2 months waiting time for non-fare revenue collection  Equal to 1 month of outstanding obligations
Accounts receivable	16.67%	of non-fare revenue	
Inventory	0.25%	of gross fixed assets	
Accounts payable and current liabilities	8.33%	of O&M cost	

Table 2: Allowances for Optimism Bias (% difference from the Best Estimate)

	Government procurement			Concessionaire procurement		
	Net Cost concession	Gross Cost concession	Modified Gross Cost concession	Net Cost concession	Gross Cost concession	Modified Gross Cost concession
<b>Costs</b>						
Capital Cost – E&M	+45%	+45%	+45%	+15%	+15%	+15%
O&M Costs	+20%	+10%	+10%	+20%	+10%	+10%
<b>Patronage</b>						
Operating Year 1	-50%	-55%	-50%	-50%	-55%	-50%
Operating Year 3 & after	-30%	-33%	-30%	-30%	-33%	-30%

Source: Based on International studies for implementation of rail projects.



Table 3: Standard Assumptions for Economic Analyses

Item	Quantity	Units	Notes
Price Units	early 2007		
Duration of Analyses	30	years	(after construction period)
Discount Rates	12.0%	% p.a.	Sensitivity test at 8%
Annualization factors			
Passenger demand	330	days/year	relative to average demand per working weekday
Supply of services	350	days/year	relative to average supply of services per working weekday
Revenue			
Fare structure			
Boarding charge	10	Baht	2001 prices
Distance charge	1.8	Baht/km	2001 prices
Real change in fare	0.0%	% p.a.	assuming fare increase every year - assumed equal to inflation
Non-fare revenue	7.0%	%	as % of fare revenue
Asset Life			
Civil Works			
Tunnels	100		
Structures, incl. stations & depots	50		
Buildings	30	years	
E&M equipment			
Power supply	30	years	
Mechanical, signalling, train control & ICT	15	years	
Rollingstock	30	(years)	
Land acquisition	nil		

Item	Quantity	Units	Notes
Mid-life Refurbishment (in addition to O&M cost)			
Rollingstock			
Refurbishment of rollingstock occurs after	15	years of service	
Cost of refurbishment	33%	of initial price	cost of refurbishment, as a % of the initial cost of a railcar
Exchange rate	35	(Baht/US\$)	
Economic values for estimating benefits			
Value of travel time			Use parameters in Tables 4a-4d to calculate these economic values.
Vehicle operating cost			
Environmental cost			

Table 4. Assumptions for passenger demand forecast

Item	Required standard	Notes
Demography	Thailand Official Census 2000.	Source: National Statistical Office
Forecast years	2006 (base), 2011, 2016	
Transport networks	As in OTP's Extended Bangkok Urban Model (eBUM)	Use of eBUM is mandatory
Patronage growth from 2021	2% per annum	In line with population growth

Table 4a. Vehicle kilometres and hours travelled, with the project implemented and without

	Without the project			With the project		
	Vehicle km (million)	Vehicle hours (million)	Speed (kph)	Vehicle km (million)	Vehicle hours (million)	Speed (kph)
Year 2006	194.94	7.94	24.55	194.94	7.94	24.55
Year 2011	226.98	10.07	22.54	224.73	9.84	22.84
Year 2016	268.45	12.47	21.53	263.02	11.80	22.29

Source: OTP

Table 4b. Average vehicle operating cost of representative vehicle

Speed(kph)	Unit: Baht /vehicle km, 2003 constant prices									
	10	20	30	40	50	60	70	80	90	100
Baht/vehicle km	8.86	6.02	5.12	4.68	4.42	4.27	4.20	4.17	4.19	4.25

Source: OTP. Representative vehicle taken to be medium-sized passenger car.

Table 4c. Average value of time

Unit: Baht /person-hour, 2000 constant prices

2006	2011	2021	Notes
71.4	88	126.2	Based on Urban Rail Transport Master Plan data for High Comfort Public Transport Category.

Source: OTP

Table 4d. Average environmental cost per representative vehicle km

Unit: Baht /vehicle-km, 2003 constant prices

	Notes
5.0	Average of the costs for light-duty vehicles using gasoline and diesel in Mccubin & Delucchi, 1999.

Source: OTP



## ภาคผนวก 3

### กระแสเงินสดของการวิเคราะห์ที่ 1



















Appendix 3-12: Cashflow and Income Statement of the PSC Modified-Gross

LRP Unit (Kas 2011 - 2010) - (Income Section)

60% of PSC's  
Commercial Development Revenue (PSC's)  
of PSC's Revenue

Category	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972	1971	1970	1969	1968	1967	1966	1965	1964	1963	1962	1961	1960	1959	1958	1957	1956	1955	1954	1953	1952	1951	1950	1949	1948	1947	1946	1945	1944	1943	1942	1941	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931	1930	1929	1928	1927	1926	1925	1924	1923	1922	1921	1920	1919	1918	1917	1916	1915	1914	1913	1912	1911	1910	1909	1908	1907	1906	1905	1904	1903	1902	1901	1900	1899	1898	1897	1896	1895	1894	1893	1892	1891	1890	1889	1888	1887	1886	1885	1884	1883	1882	1881	1880	1879	1878	1877	1876	1875	1874	1873	1872	1871	1870	1869	1868	1867	1866	1865	1864	1863	1862	1861	1860	1859	1858	1857	1856	1855	1854	1853	1852	1851	1850	1849	1848	1847	1846	1845	1844	1843	1842	1841	1840	1839	1838	1837	1836	1835	1834	1833	1832	1831	1830	1829	1828	1827	1826	1825	1824	1823	1822	1821	1820	1819	1818	1817	1816	1815	1814	1813	1812	1811	1810	1809	1808	1807	1806	1805	1804	1803	1802	1801	1800	1799	1798	1797	1796	1795	1794	1793	1792	1791	1790	1789	1788	1787	1786	1785	1784	1783	1782	1781	1780	1779	1778	1777	1776	1775	1774	1773	1772	1771	1770	1769	1768	1767	1766	1765	1764	1763	1762	1761	1760	1759	1758	1757	1756	1755	1754	1753	1752	1751	1750	1749	1748	1747	1746	1745	1744	1743	1742	1741	1740	1739	1738	1737	1736	1735	1734	1733	1732	1731	1730	1729	1728	1727	1726	1725	1724	1723	1722	1721	1720	1719	1718	1717	1716	1715	1714	1713	1712	1711	1710	1709	1708	1707	1706	1705	1704	1703	1702	1701	1700	1699	1698	1697	1696	1695	1694	1693	1692	1691	1690	1689	1688	1687	1686	1685	1684	1683	1682	1681	1680	1679	1678	1677	1676	1675	1674	1673	1672	1671	1670	1669	1668	1667	1666	1665	1664	1663	1662	1661	1660	1659	1658	1657	1656	1655	1654	1653	1652	1651	1650	1649	1648	1647	1646	1645	1644	1643	1642	1641	1640	1639	1638	1637	1636	1635	1634	1633	1632	1631	1630	1629	1628	1627	1626	1625	1624	1623	1622	1621	1620	1619	1618	1617	1616	1615	1614	1613	1612	1611	1610	1609	1608	1607	1606	1605	1604	1603	1602	1601	1600	1599	1598	1597	1596	1595	1594	1593	1592	1591	1590	1589	1588	1587	1586	1585	1584	1583	1582	1581	1580	1579	1578	1577	1576	1575	1574	1573	1572	1571	1570	1569	1568	1567	1566	1565	1564	1563	1562	1561	1560	1559	1558	1557	1556	1555	1554	1553	1552	1551	1550	1549	1548	1547	1546	1545	1544	1543	1542	1541	1540	1539	1538	1537	1536	1535	1534	1533	1532	1531	1530	1529	1528	1527	1526	1525	1524	1523	1522	1521	1520	1519	1518	1517	1516	1515	1514	1513	1512	1511	1510	1509	1508	1507	1506	1505	1504	1503	1502	1501	1500	1499	1498	1497	1496	1495	1494	1493	1492	1491	1490	1489	1488	1487	1486	1485	1484	1483	1482	1481	1480	1479	1478	1477	1476	1475	1474	1473	1472	1471	1470	1469	1468	1467	1466	1465	1464	1463	1462	1461	1460	1459	1458	1457	1456	1455	1454	1453	1452	1451	1450	1449	1448	1447	1446	1445	1444	1443	1442	1441	1440	1439	1438	1437	1436	1435	1434	1433	1432	1431	1430	1429	1428	1427	1426	1425	1424	1423	1422	1421	1420	1419	1418	1417	1416	1415	1414	1413	1412	1411	1410	1409	1408	1407	1406	1405	1404	1403	1402	1401	1400	1399	1398	1397	1396	1395	1394	1393	1392	1391	1390	1389	1388	1387	1386	1385	1384	1383	1382	1381	1380	1379	1378	1377	1376	1375	1374	1373	1372	1371	1370	1369	1368	1367	1366	1365	1364	1363	1362	1361	1360	1359	1358	1357	1356	1355	1354	1353	1352	1351	1350	1349	1348	1347	1346	1345	1344	1343	1342	1341	1340	1339	1338	1337	1336	1335	1334	1333	1332	1331	1330	1329	1328	1327	1326	1325	1324	1323	1322	1321	1320	1319	1318	1317	1316	1315	1314	1313	1312	1311	1310	1309	1308	1307	1306	1305	1304	1303	1302	1301	1300	1299	1298	1297	1296	1295	1294	1293	1292	1291	1290	1289	1288	1287	1286	1285	1284	1283	1282	1281	1280	1279	1278	1277	1276	1275	1274	1273	1272	1271	1270	1269	1268	1267	1266	1265	1264	1263	1262	1261	1260	1259	1258	1257	1256	1255	1254	1253	1252	1251	1250	1249	1248	1247	1246	1245	1244	1243	1242	1241	1240	1239	1238	1237	1236	1235	1234	1233	1232	1231	1230	1229	1228	1227	1226	1225	1224	1223	1222	1221	1220	1219	1218	1217	1216	1215	1214	1213	1212	1211	1210	1209	1208	1207	1206	1205	1204	1203	1202	1201	1200	1199	1198	1197	1196	1195	1194	1193	1192	1191	1190	1189	1188	1187	1186	1185	1184	1183	1182	1181	1180	1179	1178	1177	1176	1175	1174	1173	1172	1171	1170	1169	1168	1167	1166	1165	1164	1163	1162	1161	1160	1159	1158	1157	1156	1155	1154	1153	1152	1151	1150	1149	1148	1147	1146	1145	1144	1143	1142	1141	1140	1139	1138	1137	1136	1135	1134	1133	1132	1131	1130	1129	1128	1127	1126	1125	1124	1123	1122	1121	1120	1119	1118	1117	1116	1115	1114	1113	1112	1111	1110	1109	1108	1107	1106	1105	1104	1103	1102	1101	1100	1099	1098	1097	1096	1095	1094	1093	1092	1091	1090	1089	1088	1087	1086	1085	1084	1083	1082	1081	1080	1079	1078	1077	1076	1075	1074	1073	1072	1071	1070	1069	1068	1067	1066	1065	1064	1063	1062	1061	1060	1059	1058	1057	1056	1055	1054	1053	1052	1051	1050	1049	1048	1047	1046	1045	1044	1043	1042	1041	1040	1039	1038	1037	1036	1035	1034	1033	1032	1031	1030	1029	1028	1027	1026	1025	1024	1023	1022	1021	1020	1019	1018	1017	1016	1015	1014	1013	1012	1011	1010	1009	1008	1007	1006	1005	1004	1003	1002	1001	1000	999	998	997	996	995	994	993	992	991	990	989	988	987	986	985	984	983	982	981	980	979	978	977	976	975	974	973	972	971	970	969	968	967	966	965	964	963	962	961	960	959	958	957	956	955	954	953	952	951	950	949	948	947	946	945	944	943	942	941	940	939	938	937	936	935	934	933	932	931	930	929	928	927	926	925	924	923	922	921	920	919	918	917	916	915	914	913	912	911	910	909	908	907	906	905	904	903	902	901	900	899	898	897	896	895	894	893	892	891	890	889	888	887	886	885	884	883	882	881	880	879	878	877	876	875	874	873	872	871	870	869	868	867	866	865	864	863	862	861	860	859	858	857	856	855	854	853	852	851	850	849	848	847	846	845	844	843	842	841	840	839	838	837	836	835	834	833	832	831	830	829	828	827	826	825	824	823	822	821	820	819	818	817	816	815	814	813	812	811	810	809	808	807	806	805	804	803	802	801	800	799	798	797	796	795	794	793	792	791	790	789	788	787	786	785	784	783	782	781	780	779	778	777	776	775	774	773
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Appendix 3-14: Cashflow and Income Statement of the PPP Net

2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

WACC of 10.00%  
 WACC of 10.00%  
 WACC of 10.00%

100.00%  
 100.00%  
 100.00%

Account Name	Year													
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
<b>Revenue</b>														
- Fee Revenue	11,125	11,125	11,125	11,125	11,125	11,125	11,125	11,125	11,125	11,125	11,125	11,125	11,125	11,125
- Other Revenue	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Expenses</b>														
- Personnel	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
- Materials	500	500	500	500	500	500	500	500	500	500	500	500	500	500
- Overhead	200	200	200	200	200	200	200	200	200	200	200	200	200	200
- Depreciation	100	100	100	100	100	100	100	100	100	100	100	100	100	100
- Interest	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Taxes	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Net Income</b>	10,125	10,125	10,125	10,125	10,125	10,125	10,125	10,125	10,125	10,125	10,125	10,125	10,125	10,125
- Cash Flow	10,125	10,125	10,125	10,125	10,125	10,125	10,125	10,125	10,125	10,125	10,125	10,125	10,125	10,125
- Depreciation	100	100	100	100	100	100	100	100	100	100	100	100	100	100
- Interest	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Taxes	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Balance Sheet</b>														
- Cash	10,125	20,250	30,375	40,500	50,625	60,750	70,875	81,000	91,125	101,250	111,375	121,500	131,625	141,750
- Accounts Receivable	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Inventory	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Prepaid Expenses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Property, Plant, and Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Accumulated Depreciation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Accounts Payable	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Other Liabilities	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Equity	10,125	20,250	30,375	40,500	50,625	60,750	70,875	81,000	91,125	101,250	111,375	121,500	131,625	141,750

100.00%  
 100.00%  
 100.00%









**ภาคผนวก 4**  
**กรณีศึกษาของระบบขนส่งทางรางในเมือง**  
**ในประเทศอื่นๆ**



## APPENDIX 4 CASE STUDIES OF URBAN RAILWAY SYSTEM IN OTHER COUNTRIES

With the purpose of reviewing i) financial frameworks, and ii) operational efficiency and service level of urban railway systems in Japan and other foreign countries, the following six urban railway systems were studied and analyzed based on available data in Japan and on internet websites:

- a) Urban railway system in Manila, the Philippines;
- b) Urban Railway Systems in Singapore;
- c) Urban Railway Systems in Kula Lumpur, Malaysia;
- d) Delhi Metro in Delhi, India;
- e) Metropolitan Intercity Railway Company (Tsukuba Express) in Japan; and
- f) London Underground in London, the United Kingdom.

### 1. URBAN RAILWAY SYSTEM IN MANILA IN THE PHILIPPINES

#### 1.1 Background

The Metro Manila (National Capital Region), holding 11.5 million people, is one of the most populated urban areas in the Southeast Asia. Manila's population has rapidly grown during the late 1970s and early 80s especially. In those days, "urban transportation" meant "jeepney" to common people in Manila. *Jeepney* was produced by converting surplus army trucks, public & private buses, and some private cars. As motorization grew in this period, the traffic jam in Manila became very serious. During the period from 1976 until 1977, a study on urban transportation in Manila was conducted with the assistance of the World Bank and this study recommended a light railway system. In 1980, the Light Rail Transit Authority (LRTA) was established as a government agency to promote an urban transportation system.

The initial assistance to a light rail transit (LRT) project came from the Belgium government, which granted a soft loan, and a consortium of Belgium companies provided a loan for the project. In 1985, the LRT first line (LRT1: Yellow Line) started full operation.

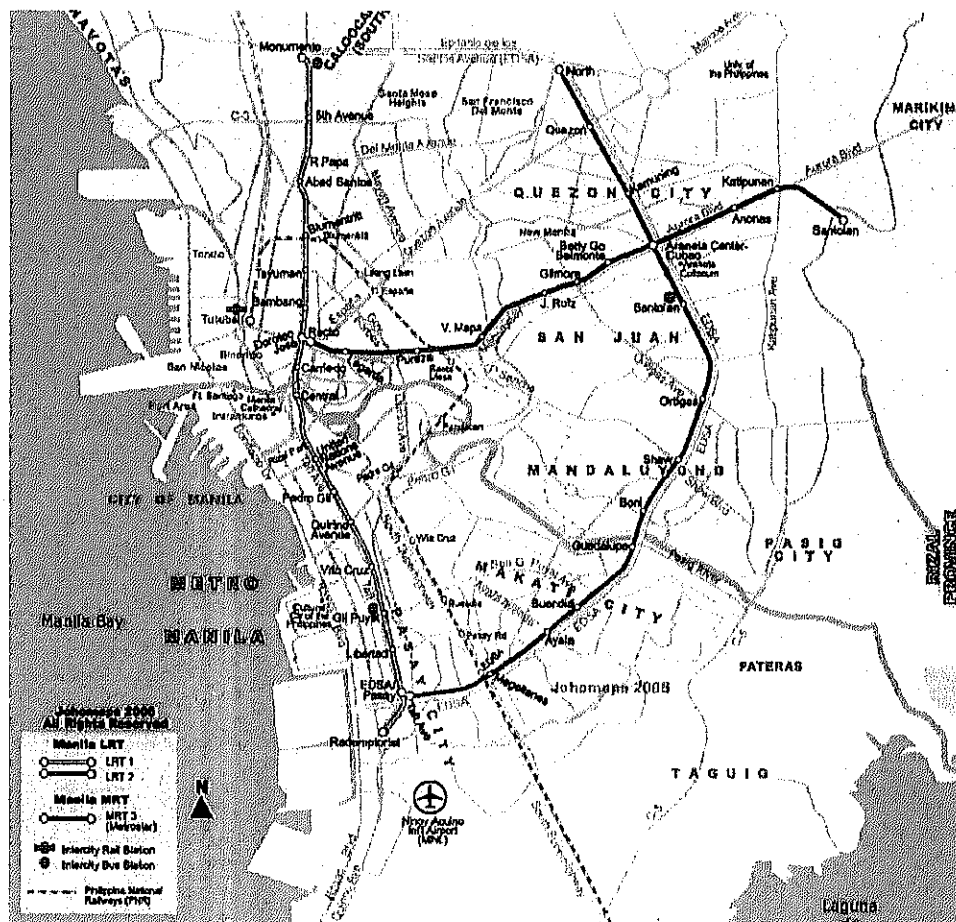
With the economic growth and continuous increase in the population in Metro Manila, the LRT1 faced with the problem of congestion in the 90s, and its transportation capacity needed to be strengthened. Two Japan's ODA loans supported the strengthening of LRT1's capacity in 1994 and 2000. Three other Japan's ODA loans were also provided for the construction of LRT2 (Purple Line).

In the 1990s, along with the trend of private sector participation in public infrastructure, the Philippine government decided to promote the development of Manila Metro Rail Transit System

(MRT). The project of MRT, MRT3 (or Blue Line), was decided to be promoted under PPP scheme. Metro Rail Transit Corporation (MRTC) was awarded the MRT3 project under a Build-Lease-Transfer (BLT) scheme. MRTC started the construction of MRT3 in 1997, partial operation in December 1999 and full operation in July 2000.

### 1.2 Outline of Urban Rail System in Metro Manila

As Figure 1-1 shows, LRT1 goes through Metro Manila from North to South; LRT2 penetrates from East to West; and MRT3 draws semicircle to connect to LRT1 at South and LRT2 at East.



Source: LRTA

Figure 1-1 Map of Urban Rail System in Metro Manila

#### (1) LRT1 (Yellow Line) and LRT2 (Purple Line)

LRT1 (Yellow Line) is the first line of the Manila LRT system, which has a total length of 15 km from Baclaran Terminal in the south to Monumento Terminal in the north with 18 stations, and is fully elevated. The line runs in a north-south direction, linking cities of Quezon, Caloocan (both in the north area), Pasay and Paranaque City (both in the south). Passengers can transfer to LRT2 (Purple Line) at

Doroteo Jose station, while to MRT3 at EDSA station.

LRT2 (Purple Line) is the second line of the Manila LRT system. The line contains eleven stations and runs 13.8 km of mostly elevated track, with exception of Katipunan station which is underground. The line runs in an east-west direction, linking cities of Manila, San Juan, Quezon, Marikina, and Pasig. Passengers can transfer to the LRT1 Line at Recto station, while to MRT3 at Araneta Center-Cubao station.

**Table 1-1 Train Operation Data of LRT1 and LRT2**

Railway Operation Data		
	Line 1	Line 2
<b>Total Route Length</b>	15 Kilometers	13.80 Kilometers
<b>Route</b>	Baclaran Terminal to Monumento Terminal (Taft-Rizal Avenue Corridor)	Santolan Terminal to Recto Terminal (Marcos Highway - Aurora Blvd. - Ramon Magsaysay - Legarda - Recto)
<b>Number of Stations</b>	18	11
<b>Number of Rail Cars</b>	BN/ACEC (1st Generation) - 64 (32 Trains @ 2 Cars)	72 - 18 Trainsets @ 4 Cars per Trainset
	ADTRANZ (2nd Generation) - 28 (7 Trains @ 2 Cars)	
	KINKI SHARYO (3rd generation) - 48 (12 Trains @ 4 Cars)	
<b>Daily Hour of Operation</b>	17	17
<b>Minimum Train Headway</b>	3 Minutes	5 Minutes
<b>Present Maximum Fare per Trip</b>	Php 15.00	Php 15.00

Source: LRTA

LRT was initially operated by an operation company specially established for LRT operation, but later the operation was taken over by LRTA in the wake of the operation company's strike in 2000. Since then, LRTA is the operator of Manila LRT System.

## (2) MRT3 (Blue Line)

The Metro Rail Transit Corporation (MRTC) operates the Manila Metro Rail Transit System, known as the MRT. MRTC is a private consortium established for development and operation of MRT3.

MRT3 serves 13 stations on 17 km of line. It is mostly elevated, with some sections at grade or underground. The line commences at the Taft Avenue and ends at the North Avenue, serving cities that the Epifanio de los Santos Avenue (EDSA) passes through: Makati, Mandaluyong, Pasay, Pasig, Quezon City, and San Juan. Taft Avenue station and Araneta Center-Cubao station interchange with the LRT network. Taft Avenue station connects to EDSA station of the LRT1 and Araneta Center-Cubao station connects to its Naimesak station of LRT2.

### **1.3 Financial Framework of Manila Urban Rail System**

#### **(1) LRT**

The initial system of LRT was financed by a combination of the official and private funds from Belgium. The Belgium government provided an interest-free loan of 300 million pesos with a repayment period of 30 years. A Belgium consortium consisting of private companies of construction, rolling stock, signal/telecommunication, and engineering provided an additional loan of 700 million pesos<sup>1</sup>.

To meet a growing number of passengers of LRT1 line, Japanese ODA loans were provided with the purpose of strengthening its transportation capacity. With Japanese ODA loans, additional rolling stock was procured and railway tracks were improves. A Japanese ODA loan of ¥9.8 billion and that of ¥22.3 billion were provided in 1994 and 2000 respectively.

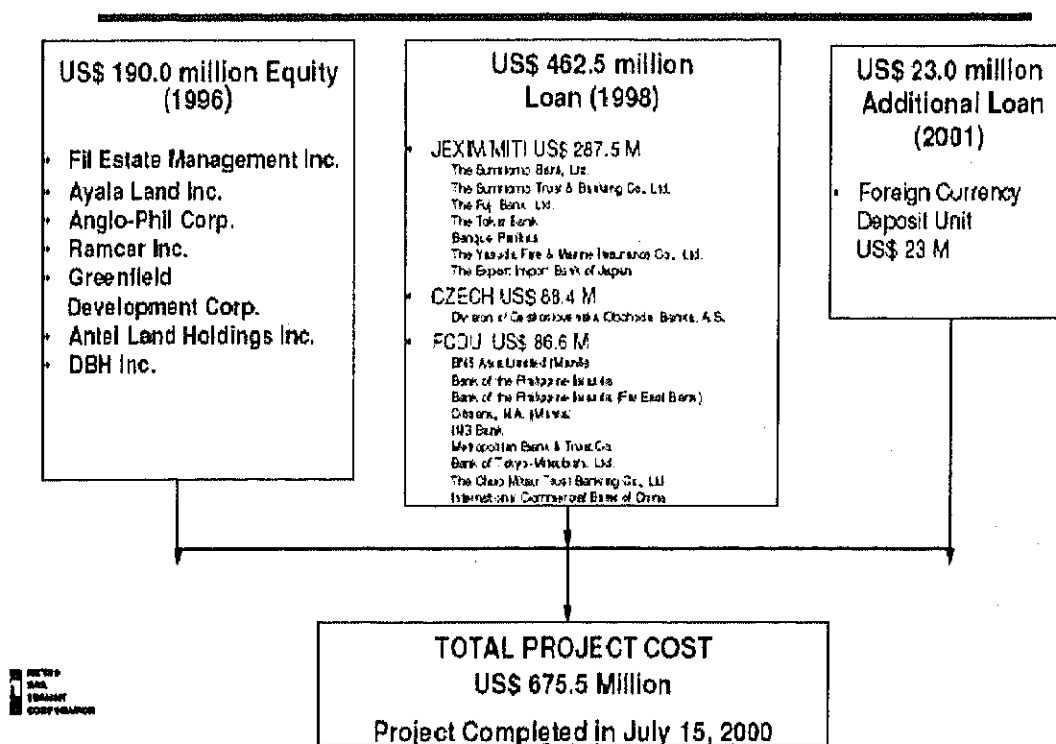
#### **(2) MRT3**

Infrastructure of MRT3 was constructed with Build-Lease-Operation (BLO) scheme. A BLO agreement was signed by MRTC and the Department of Transport and Communications (DOTC). The agreement governs two project phases, i.e., construction phase and revenue service phase. In the agreement, MRT should construct the system by the specified date according to the specifications and drawings approved by DOTC. The completed system should satisfy the specified capacity requirements. MRTC was also obligated to provide all equipment be used in the system, including rail vehicles. At the completion of construction, MRTC was obligated to lease the system to DOTC and provide maintenance service. DOTC was required to make payments of rental fees to MRTC.

MRT3 project was financed by sponsors' equity investment (US\$190 million) and debt financing (US\$485.5 million). Lenders for debt financing consisted of JEXIM (US\$287.5 million with an interest rate of 2.8% per annum), Czech Bank (US\$88.4 million with 7.2% per annum), and a consortium of private banks, Foreign Currency Deposit Unit (FCDU) (US\$109.6 million with LIBOR+1.875%).

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<sup>1</sup> No detail information on financing terms and conditions for Belgium loans is available.



Source: MRTC

Figure 1-2 Financing of MRT3

## 1.4 Performance Summary of LRT and MRT

### (1) Ridership

An average daily ridership of LRT1 is about 300 thousand trips, LRT2, 132 thousand trips, and MRT3, 400 thousand trips. The utilization level of LRT2 has been less than other two lines. A load factor (ridership/carrying capacity) of LRT1 is almost 80% against LRTA's target of 65%, which shows LRT1 is crowded most of the time.

### (2) Efficiency of the Service

LRT1's daily operation hour is 5:00 am to 10:00 pm, i.e., total 17 hours daily, while MRT3 is 5:30 am to 10:30 pm.

Peak hour operation of LRT1 is 20 trains per hour (3 minutes train headway), while LRT2 is 12 trains since LRT2 ridership is relatively less than LRT1. MRT3's peak hour operation is same as LRT1, 20 trains per hour.

### (3) Financial Sustainability

For LRT, fare revenue exceeds its operating cost excluding financial cost, but is not sufficient to serve debt repayment. The ridership of LRT2 is relatively low and it is presumed that the operation of

LRT2 is not financially sustainable at this stage and it is difficult to sustain LRT' service without financial support from the Philippine government.

No detail information on expenditure is available for LRT and MRT3 as well.

**Table 1-2 Performance of Manila Urban Rail System**

	LRT Line 1	LRT Line 2	MRT3
Total route length (km)	15	13.8	16.95
Daily Ridership (no. of trips)	308,288	132,154	393,542
Annual Ridership (in million)	111.08	47.57	142.86
Fare revenue per passenger (peso)	14.06		N.A.
Operating cost per passenger (excluding financial costs)	10.62		N.A.
Operating cost per passenger (including financial costs)	19.85		N.A.
Daily hours of operation	17	17	17
Minimum train headway (minute)	3	5	3
No. of trains operated at peak hour (no. of trains)	20	12	20
Maximum Fare per Trip (peso)	15.00	15.00	15.00

Source: LRT: Annual Report 2006, MRT: Metro Star website (2007)

#### (4) Customer Satisfaction

It was reported that passengers of LRT1 evaluate alleviated congestion after the capacity expansion. However, its load factor level is still high at approximately 80% and trains are densely packed at peak hours.

Accessibility (barrier-free access to stations, escalators), shops and services, safety and security are provided in LRT1, LRT2, and MRT3 as well. Customer satisfaction for these items still needs to be assessed.

## 2. URBAN RAILWAY SYSTEMS IN SINGAPORE

Urban Railway Systems in Singapore has not been developed with PPP but with a unique and efficient PSC, which could be a good reference to Bangkok MRT in making a plan of MRT development with consistency.

### 2.1 Outline of the System

#### (1) Background

##### a. City Planning

Before its independence in 1967, it is told that Singapore had started to make the first City Master Plan in 1958. The basic objective of the Master Plan was to establish strategic land effective use. The concept of the Master Plan was succeeded and materialized in the Concept Plan made in 1967 and its revisions made in 1971 and 1991.



The objectives of the Concept Plan were to solve population centralization, traffic jam and contamination. One of the important solutions recommended in the report was to introduce mass transit system.

**b. Establishment of MRTC and Start of Construction**

**Establishment of MRTC**

Upon the completion of Mass Transit Study which was undertaken based on the concept paper, the Mass Rapid Transit Corporation (MRTC) was established as a statutory body to undertake solely construction works. All of the necessary direct construction expenses and account expenses (mainly personal cost) were provided by the Government. And MRTC was required to be financially independent although its own revenue was quite limited to license fees and so on.

**Start of MRT Construction**

In May 1982, the construction started for the two lines East - West Line (7.0 km) and North - South Line (6.0 km) which would be expected to complete in 1990. The first scheduled construction portion consisted of 45 km of overhead railway, 28 km of subway and 3 km of surface railway. At the offset, the construction of 19.1% of the scheduled portion was started (present network in 2008 is 138 km).

**Start of MRT Operation**

On November 11, 1987, in about 5 years since construction commencement, trial operation of first completed portion was started and the other portions were subsequently followed.

**c. Establishment of SMRT**

In advance of operation, the SMRT Corporation (SMRT) was established in August 1987 as operating company with the license which was granted by the Land Transport Authority (LTA) for a period of 10 years and was later extended to 31 March 1998. The license fee payable is 1.0% of the gross annual fare revenue.

SMRT purchased the MRT System's operating assets from LTA on April 1998 for approximately \$1.2billion. The assets included trains, permanent way of vehicles, power system, control system and other related facilities etc. SMRT received also other two financial supports from LTA, loan of \$480million and a lease relating facilities. At the end of FY2008, the loan has been repaid fully.

Authorized capital and paid-in capital as of established date were 250,000,001 shares and 150,000,001 shares (value of a share is S dollar 1) respectively of which one share (deemed as special stock) was owned by LTA and the rest were held by Tanasek Holding Pte Ltd (100% National owned holding company).

#### d. Start of LRT Operation

In addition to MRT, two Light Rail Transit (LRT) systems were planned and constructed. One is Sengkang LRT having 11km and the other is Punggol having 19km at the beginning. Both are under operation of SMRT since 1997.

SMRT has been granted a similar License of Agreement by LTA to operate the LRT System commencing November 6, 1999 till March 2028. LTA currently owns all the operating assets and infrastructure required to operate the LRT System.

### (2) Organizational Aspect of Urban Railway Systems

#### a. Organizational Framework to Supervise the System

##### Establishment of LTA

The transportation policy of Singapore, covering from construction of road and public transport facilities to traffic control of vehicles, has been implemented under the principles of solidity and well coordination. To implement the above, in September, 1995, the Land Transport Authority (LTA) was newly established as an independent statutory board under the Ministry of Communications by integrating four government entities, i.e., SMRT, Registry of Vehicles, Transport Division of Public works, Land Transport Division of the Ministry of Communication.

##### Role of LTA

LTA is expected to cover a variety of functions relating to the construction and operation of land transportation, namely from construction of MRT and roads to supervision of public transportation, traffic control, registration of vehicles and collection of toll fee.

#### b. Tariff Regulation by PTC

Fare of MRT and LRT is regulated by the Public Transport Council (PTC) and reviewed annually as shown in the table below (Table 2-1).

**Table 2-1 Fare Adjustment**

<ul style="list-style-type: none"> <li>• Fare are regulated by Public Transport Council (PTC) and reviewed annually based on max fare adjustment formula:  <math display="block">0.5 \Delta CPI + 0.5 \Delta WI - 1.5\%</math>           where 1.5% is the productivity index valid for 3 years</li> <li>• Fare adjustment made for Trains and Bus in 2008           <ul style="list-style-type: none"> <li>- Net↑0.6% fare adjustment after increase in fare rebate from 25 cents to 40 cents</li> <li>- Expect to yield additional \$3m in fare revenue for f</li> </ul> </li> </ul>
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Source: SMRT

Fare was eventually lowered to increase ridership. The current ridership and revenues of public transportation services in Singapore are shown in Table2-2. The level of fare box is low in comparing with the neighboring Asian countries as indicated later.

Table 2-2 Current Fare and Revenue of MRT, LRT and Bus Service in Singapore

	MRT			LRT			BUS		
	1Q 09	1Q 08	% Change	1Q 09	1Q 08	% Change	1Q 09	1Q 08	% Change
Ridership ('000)	124,300	112,100	10.9	3.9	3.7	7.5	71.1	67.8	5.0
Avg. Daily Ridership ('000)	1,366	1,232	10.9	43.1	40.2	7.5	781.9	744.7	5.0
Average Fare (cents)	93.0	94.2	(1.2)	55.9	57.6	(2.9)	69.4	69.1	0.4
Revenue (S\$ million)	115.6	106.8	8.2	2.2	2.1	4.3	50.9	48.3	5.3
EBIT (S\$ million)	34.9	32.0	9.1	(0.1)	(0.1)	18.8	(3.3)	0.5	(737.1)

- Notes
1. Higher MRT operating profits due to ridership growth offset by higher electricity costs.
  2. Lower LRT operating loss due to higher average daily ridership.
  3. Lower Bus operating profits due to higher diesel costs.
  4. As of first quarter of Fiscal Year 2009.

Source: SMRT

### (3) SMRT Operation

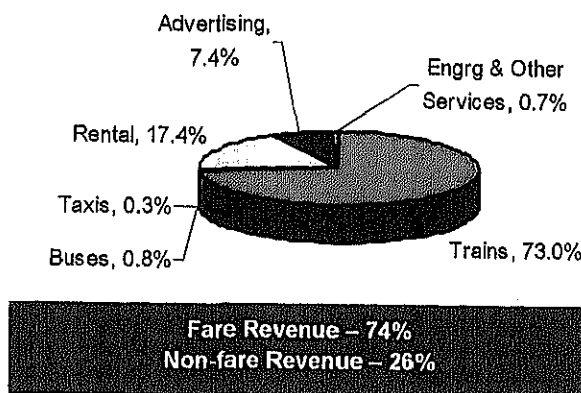
SMRT started its operation of MRT in 1987 and then expanded its railway business to LRT in 1998 and now its railway operation accounts for 73% of its total operation. SMRT has also started other related business like bus, taxi, rental and consulting services. Brief description of SMRT business is shown in Table 2-3 and the share of each business in total sales is shown in Figure 2-1.

Table 2-3 SMRT Operation

Type of Business	Content
MRT	<ul style="list-style-type: none"> <li>• Dominant rail operator in Singapore with 21 years of O&amp;M experience</li> <li>• Operates the North South and East West MRT Lines and will operate Circle line from mid 2009</li> <li>• Average daily ridership of 1.4M (1Q of FY2009)</li> <li>• About 80% market share based on daily ridership</li> </ul>
LRT	<ul style="list-style-type: none"> <li>• Operates first LRT system at Bukit Panjang since 1989</li> <li>• Network comprises 7.8km linking 14 stations</li> <li>• Average daily ridership of 43.1 thousand (1Q of FY2009)</li> </ul>
Buses	<ul style="list-style-type: none"> <li>• Owns about 860 buses running 80 basic bus services between Western and North-Western areas and the rest of Singapore</li> <li>• Average daily ridership of 781.9 thousand (1Q of FY2009)</li> <li>• About 25% market share based on daily ridership</li> </ul>
Rental	<ul style="list-style-type: none"> <li>• Rental of station spaces (about 27,000 square meters)</li> <li>• Total of 27 stations refurbished to-date since FY2005</li> </ul>
Advertising	<ul style="list-style-type: none"> <li>• Provides advertising spaces on trains, buses, taxis as well as in stations</li> <li>• About 18% outdoor media market share</li> </ul>
Taxis	<ul style="list-style-type: none"> <li>• Second largest taxi operator with 12% market share</li> <li>• Manages and leases about 3,000 taxis</li> </ul>
Engineering and Other Services	<ul style="list-style-type: none"> <li>• Pursuing overseas land transport opportunities</li> <li>• First overseas project in Dubai</li> <li>• Leases fiber-optic cables</li> </ul>

Source: SMRT

FY2008 EBIT by Business – Group EBIT of \$178.0m



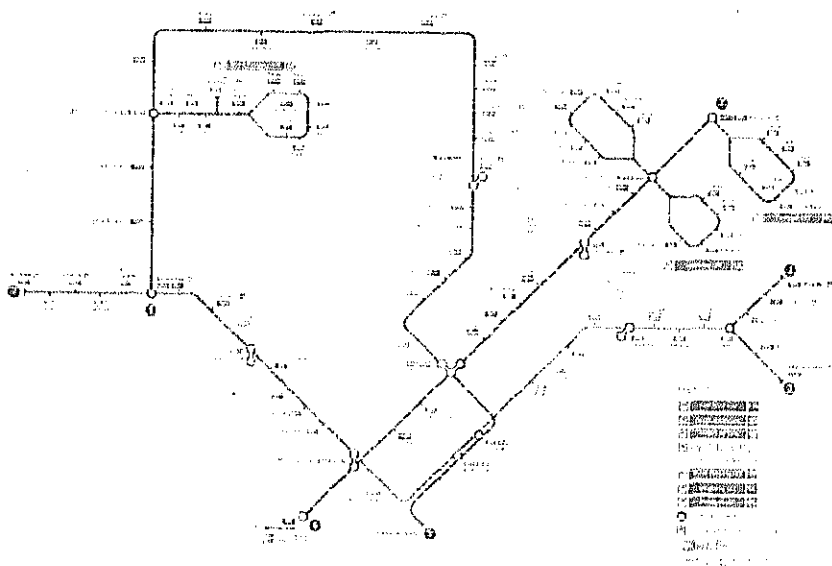
Source: SMRT

Figure 2-1 Core Businesses of SMRT

**(4) Outline of Present Operational System**

**a. MRT and LRT Operation Map**

Since the first operation of MRT in 1987 and LRT in 1998, the network of the two transport systems has been rapidly expanded and its total length of lines as of the end of 2008 is 109.2km for MRT and 28.8km for LRT as in the following figures.

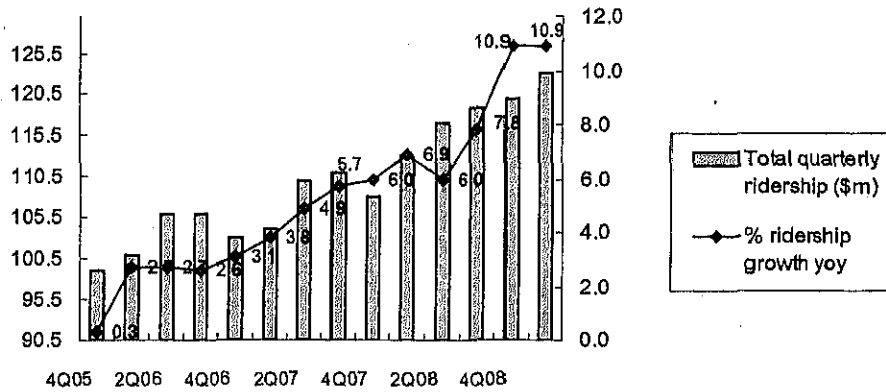


Source: SMRT

Figure 2-2 Current Operational Network of MRT and LRT

**b. Ridership Development**

In accompanying with the expansion of the operational network of MRT and LRT, the revenue from ridership of MRT and LRT has been successfully improved and reached to the highest level in 2008 (see Figure 2-2).



Source: SMRT

**Figure 2-3 Trend of Revenue from Ridership of MRT and LRT**

**(5) Efficiency Level of Operations and Services**

**a. Customers satisfaction**

It is understood that SMRT has gained enough customers' satisfaction from following.

**i) Fare**

Regarding published cash fare for a 10km journey, Singapore is S\$1.30 which is cheapest among the neighboring Asian countries including Bangkok of 1.81.

**ii) Train Arrival (Punctuality)**

In FY2008, SMRT realized a train arrival rate of 97% which is sufficiently higher than the target of 94% set by the government.

**iii) Train Departure (Punctuality)**

In FY2008, SMRT got a train departure rate of 98.5% which is sufficiently higher than the target of 96% set by the government.

**iv) Train Service Availability**

In FY2008, SMRT achieved a train service availability of 99.96% which is sufficiently higher than the target of 98.0% set by the government.

## b. Efficiency of Operations and Services

It is understood the SMRT has gained good efficiency of operations and services from the following indicators.

### i) Punctuality (Timelines of train arrivals)

In FY2008, SMRT got a punctuality score of 99.6 which is the lowest last 5 years.

### ii) Manpower efficiency (passenger-km per staff & contractor hours)

In FY2008, SMRT got a manpower efficiency score of 100 which is the highest last 5 years

### iii) Cost efficiency (Operating cost standardized place-km)

In FY2008, SMRT got a cost efficiency score of 100 which is the highest last 5 years.

### iv) Safety (Fatalities due to accidents per billion passenger journeys (Cumulative))

In FY2008, SMRT got a safety score of 95.8 which is the average of last 5 years.

## 2.2 Financial Framework, Results and Its Efficiency

### (1) Financial Framework

Construction is financed by the Singapore government utilizing MRTC as financial channel as well as technical supervisor. Operation is made by an independent government entity, SMRT, to which the operation license is granted by the government agency, LTA. Fare is regulated by an independent government regulatory body, PTC.

### (2) Financial Performance of SMRT

SMRT is profitable mainly because of its fare revenue which accounts for 74% of total revenue. Non-railway business of MRT is also becoming profitable. SMRT was listed in 2000 and its stock price has been constantly going up.

Table 2-1 Financial Performance of SMRT

	FY2004	FY2005	FY2006	Fy2007	FY2008
Revenue (\$ million)	667.3	673.5	711.7	743.1	802.1
EBITDA (\$ million)	225.5	230.0	247.2	255.0	284.1
Profit after tax (\$ million)	90.2	126.6	103.6	135.8	149.9
EPS (cent)	6.0	8.4	6.9	9.0	9.9
Net DPS (cent)	3.6	5.2	5.6	7.0	7.75
ROE (%)	19.7	24.5	18.2	22.1	22.8
ROTA (%)	5.6	8.6	7.5	9.8	10.6

Note: The average growth rate of profit after tax is 13.5% during FY2004 until FY2008.  
Source: SMRT

### (3) Financial Efficiency of SMRT

As a result of efficient operation as well as good financial operation, overall financial efficiency of SMRT is quite noteworthy as shown in the following table.

**Table 2.2 Financial Efficiency Ratios of SMRT**

	FY2008		FY2007	
	Ratio	Growth (%)	Ratio	Growth (%)
Total Ridership (Million trips)	469.3	7.9	434.9	5.1
Car Kilometers operated (Million km)	78.0	1.2	77.1	2.0
Passenger Trip distance (Million km)	5714.5	8.1	5288.3	4.6
Average Operating Car Occupancy (persons)	73.3	6.8	68.6	2.4

Source: SMRT

### 2.3 Lessons learned from Singapore MRT/LRT

Singapore urban transport system has been constructed and managed by a group of the government and public entities which have been well coordinated. Singapore's system could have been done successfully under the following conditions.

- i) Singapore government is quite strong and stable, because its political system is quite developed and well functioning;
- ii) There are a number of public entities which have high professional capability in their own field in Singapore;
- iii) Land area of Singapore is adequate size so that central government can control all the area and all the process;
- iv) Financial situation of Singapore is quite sound and the government is able to make necessary public investments. Government is also highly rated by rating agencies so that its borrowing capacity is high;
- v) Singapore government is fully aware of benefits of PPP, particularly its financial aspects; and
- vi) PPP environment in Singapore is satisfactory, particularly in terms of legal framework and financial structure.

## 3. URBAN RAILWAY SYSTEMS IN KUALA LUMPUR, MALAYSIA

### 3.1 Outline of the LRT Projects

#### (1) Background of the Project

Kuala Lumpur, the capital city of Malaysia, has an area of 243 km<sup>2</sup> with a population of 1.6 million in 2006. Along with the sharp economic development, vehicle ownership in the city had been

increasing rapidly. With such rapid vehicle increase, the city faced serious air pollution, traffic accident, and traffic congestion. To ease these problems, the Malaysia government decided to implement several urban railway projects.

At the planning stage of these urban railway projects, Malaysia followed a strategy of transforming the country in 30 years to a developed society (so-called "Vision 2020"). The strategy included active utilization of private finance for developing infrastructure in the country; one of the pillars of the strategy was "use the private sector and private finance as the engine of growth through the awarding of long-term concessions." This ambitious agenda was set under the sustained high growth of the Malaysian economy during the Mahathir years, and considerable success in developing expressway infrastructure.

In Malaysia, there were conglomerates with experience in infrastructure projects, a domestic capital market, and generally skilled technocrats. The success with large scale expressway projects contributed to a climate of confidence that LRT concession projects could also be implemented successfully<sup>2</sup>. Given background, the government chose to privatize both the construction and operation of the LRT system.

## **(2) Outline of the Privatized Projects**

Kuala Lumpur's urban railway system consists of 7 lines and was operated by 5 operators (currently 3 operators). Among the 5 operators, except for the Malaysian Railway (Keretapi Tanah Melayu: KTM), all other operators were private. Outline of these privatized projects are summarized as follows;

### **a. Two Light Rail Transit Systems**

Two LRT systems, LRT System I and LRT System II were developed for shorter-distance movements within metropolitan Kuala Lumpur and its immediate suburbs. LRT System I - 27-km driver-operated rail system was constructed in two phases in the mid-1990s. The total investment in the development of LRT System I was RM 3,500 million. LRT System II - 29 km, was built at a total cost of RM 5,200 million.

### **b. Express Rail Link (ERL)**

ERL is a 57 km electrified rail link between Kuala Lumpur and the Kuala Lumpur International Airport (KLIA) in Sepang. It has the longest route length track among the four privatized urban rail transit networks. Construction began in late 1998 and its services commenced in April 2002. Total investment in the project was RM 2,400 million.

### **c. KL Monorail**

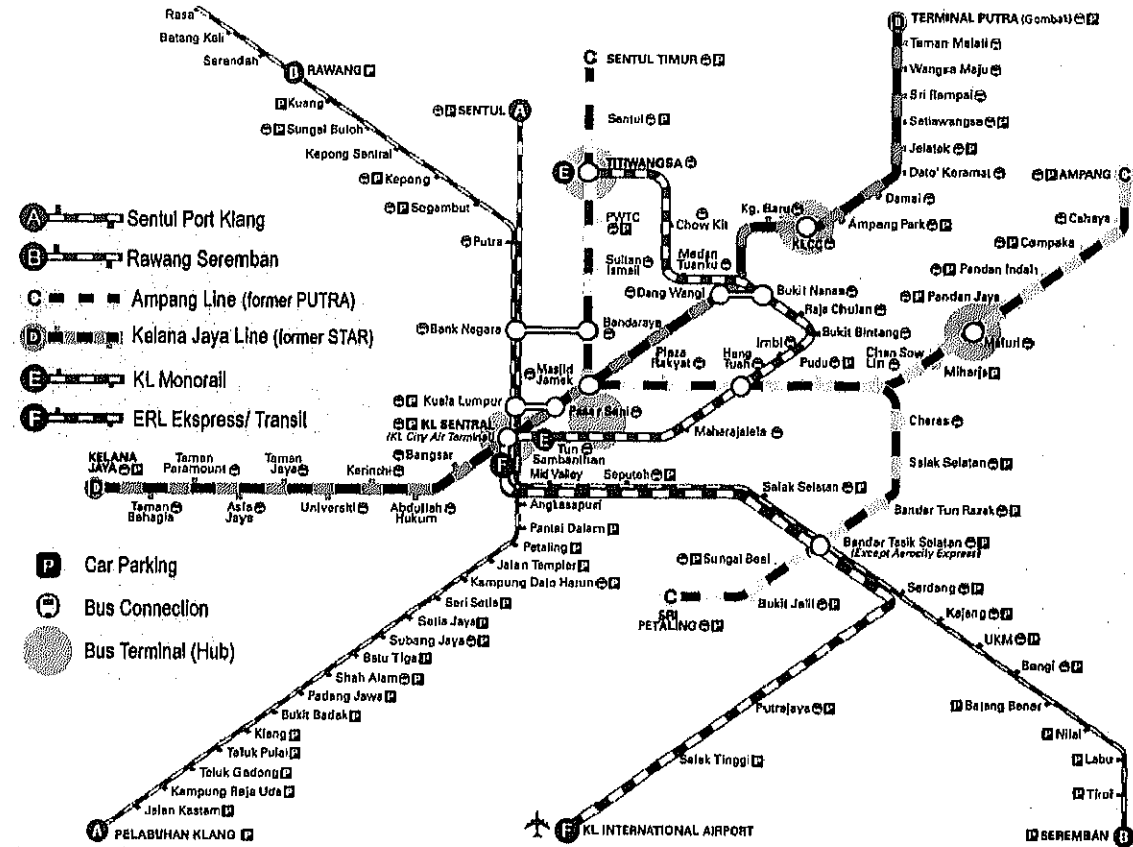
KL monorail is the most recent of Kuala Lumpur's urban rail transit systems which is a straddle beam elevated monorail system with 8.6 km dual guide way. KL Monorail service was

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<sup>2</sup> George Abonyi, Luxmon Attapich, "Building an MRT Industry: Case of Malaysia", April 2007



commenced on August 31, 2003. Although the KL Monorail is a small network relative to the others, because it is an elevated system, the total project cost was RM 1,180 million.



Source: Study Team (revised based on Rapid Kuala Lumpur's KL network map)

Figure 3 -1 Kuala Lumpur Urban Railway Network

Table 3-1 Profile of 4 Privatized Projects

	LRT System I (STAR)		LRT System II (PUTRA)	ERL		KL MONORAIL
	Phase I	Phase II		Ekspress	Transit	
1) Route Network	27km		29km	57km		8.6 km
2) No. of Stations	25		24	2	5	11
3) Stations with Park and Ride Facilities	17		4	4		-
4) Stations with Feeder Bus Service	11		14	-	1	-
5) Service Frequency	(a) Peak Hours	3 min per train	1.5 - 3 min per train	15 min per train	30 min per train	5 min per train
	(b) Off-Peak Hours	7-8 min per train per train	5 - 10 min per train	20 min per train		8 min per train
6) Average Daily Traffic Volume 1	94,480		150,494	6,014		27,000
7) Commencement of Operations	Dec. 1996	Dec. 1998	Sep. 1998 & Jun. 1999	Apr. 2002		Aug. 2003
8) Rolling Stock	17x3 car trains		35x2 car trains	12 x 4 car trains		12 x 2 trains
9) Operating Hours	0600-2350		0600-2400	0500-2400	0533-0100	0600-2400

Source: Ministry of Transport, PPP Resource & Advisory Center, Malaysia, KL Rapid, and other various sources

## 3.2 Financial Framework

### (1) Financial Framework at Inception of the Operation

With the exception of KTM Komuter (Sentul Port Klang and Rawang Seremban) operated by KTM, the other urban railway systems were constructed under implemented under BOT (build - own - operate) scheme. Following table summarize the concession agreements of four privatized projects.

The government financed 10% of equity and 20% of concessional loan to the LRT System I project. On the other hand, in the case of LRT System II and KL Monorail, while about 25% of the project costs were covered by government's concessional loan (repayment obligations were on private concessionaires), there were no government equity injection for these projects.

As shown in the below table, out of 4 projects, concessionaires of two projects were not competitively awarded. According to the PPP Resources & Advisory Center of Malaysia, Malaysian government decided direct negotiation, because i) the transaction costs would be lower under negotiated contracting than if projects were privatized through competitive bidding, and ii) project implementation period can be much faster than under open tender bidding.

**Table 3-2 Concession Models of the Four Privatized Projects**

		LRT System I (STAR/ Ampang line)	LRT System II (PUTRA/ Kelana Jaya Line)	Express Rail Link (KLIA Express/ Transit)	KL MONORAIL
Privatization Method		BOT	BOT	BOT	BOT
Contracting Procedure		Direct Negotiation	Limited Tender	Limited Tender	Direct Negotiation
Concessionaire		Sistem Transit Aliran Ringan Sdn Bhd (STAR) <sup>1</sup>	Projek Usahasama Transit Ringan Automatik (PUTRA) <sup>2</sup>	Express Rail Link Sdn Bhd	KL Monorail Sdn Bhd
Commencement of Operation		Dec. 1996 & Dec. 1998	Sep. 1998 & Jun. 1999	Apr. 2002	Aug. 2003
Concession Period (year)		30 + 30	30 + 30	30 + 30	40
Financing	Govt.	10%	0%	N.A.	0%
	Govt. Loan	20%	25.6%	N.A.	25.4%
	Private Equity	10%	20.4%	N.A.	22.0%
	Commercial Loan	60%	54.0%	N.A.	52.6%
Total Project Cost		RM 3,500 million	RM 5,200 million	RM 2,400 million	RM 1,180 million

Note 1: A Consortium, Kuala Lumpur Train Group, formed by Taylor Woodrow and Adtranz (Formed in 1990) developed LRT System I for STAR. Malaysian companies represented 55 per cent of the stake.

2: Wholly-owned subsidiary of Renong Berhad

Source: Ministry of Transport of Malaysia, PPP Resource & Advisory Center, Malaysia, and KL Rapid

### (2) Bankrupt of Project Operating Entities and Subsequent Nationalization (Current Framework)

The privatization of the LRT system was based on the assumption that urban rail systems are

commercially viable whereas this has rarely been the case. In the case of Malaysia, at inception, the Sistem Transit Aliran Ringan Sdn Bhd (STAR), concessionaire of LRT System I, forecasted a positive net cash flow of RM 80.7 million in the first year of LRT System I operations, increasing to RM 1,793 million in the final year of its 30-year concession period<sup>3</sup>. The commercial outlook for the Projek Usahasama Transit Ringan Automatik (PUTRA) from its LRT System II operations was also assessed as one of high profitability.

Actual ridership volumes on both the LRT networks were much lower than forecasted by the concessionaires. Not only unrealistic ridership forecast made by concessionaires, low ridership was also due to the government's failure to implement policies to promote public transport. As a result, both STAR and PUTRA incurred huge annual deficits on their operations. The financial crisis of 1997/1998 aggravated the situation. The two companies owed a total of RM 5.7 billion of liabilities at November 2001 when the government's Corporate Debt Restructuring Committee (CDRC) restructured the debts of the two LRT companies through the issuance of government-guaranteed bonds by the Syarikat Prasarana Negara Berhad (SPNB: National Infrastructure Company Limited). On September 1, 2002, a government-owned operating company, RapidKL, officially took over LRT operations of Star-LRT and Putra-LRT. And, all the assets and liability were transferred to SPNB.

ERL and KL Monorail were also expected to be self-supporting. However, actually, fare revenues from riders were smaller than expected. Low ridership has weakened the financial viability of the railway operations. In order to salvage the networks, the Government has had to intervene and restructure the KL Monorail operations in May 2007. This has involved a Government takeover of the three LRT operations from the private sector concessionaires. Currently, Rapid KL pays an assets usage charge to SPNB, which is currently at 12 percent of the company's revenue. This charge is to increase in the future.

Not only operation of these three urban railway lines, but also that of bus service within Kuala Lumpur city were nationalized (October 2003), and are now being operated by RapidKL.

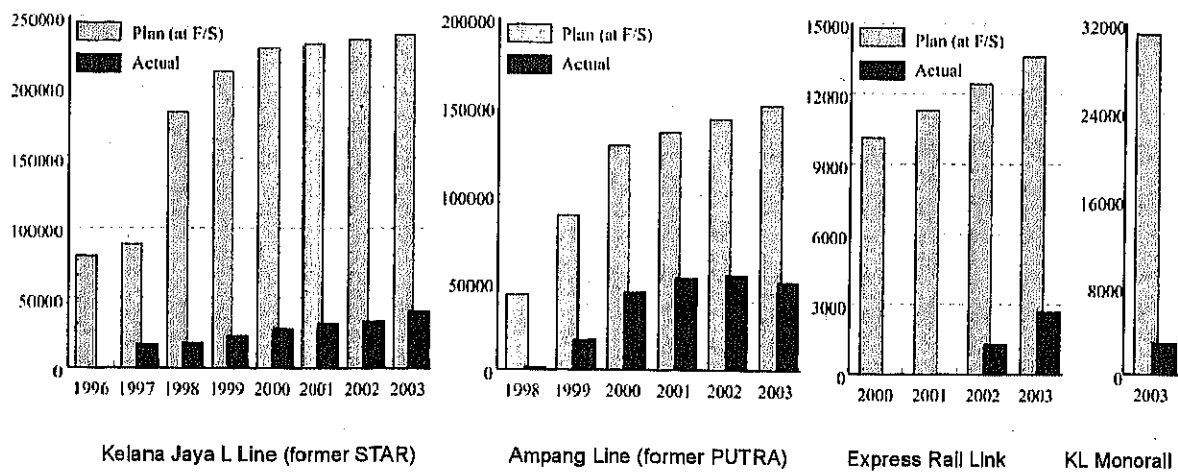
### **3.3 Efficiency Level of Operation and Service**

#### **(1) Operation and Service Performance during Inception Stage**

As mentioned, ridership performance of the privatized LRT projects considerably lower than planned ridership envisaged at the time of feasibility study. The figure below compared the planned and actual ridership performance of privatized four projects.

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<sup>3</sup> Source: PPP Resource and Advisory Center of Malaysia, Concession agreement of LRT system I and LRT system II



Note: Commencement of commercial operations of Kelana Jaya Line, Ampang Line was delayed by one year, and that of ERL was delayed by two years.  
A unit is thousand persons per year.

**Figure 3-2 Ridership Performance of the Four Privatized Projects**

According to the PPP Resources & Advisory Center of Malaysia, one fundamental reason for low ridership figures is i) the small size of the catchments areas of the LRT networks, and ii) population of Kuala Lumpur and its suburban area spreading over a large area, which is insufficient to sustain an urban rail transit system. Cheaper bus services, high motorcycle and car use intensify the competition in the limited transport market. The level of integration among transit operators, both in terms of physical integration and operational integration, such as a common ticketing system across the urban rail transit sector and bus services, was also not implemented. The limited and irregular bus services to the LRT stations, which are priced separately, and insufficient parking bays at the stations also limit the ridership of the LRT networks.

In the case of LRT systems, both STAR and PUTRA, the forecasted ridership, which was based on some aggressive assumptions of competing modes, has turned out to be unrealistic. One assumption was that bus fares in Kuala Lumpur would be raised upon the commencement of rail transit services. An upward revision of bus fares could have improved the competitive position of LRT operations vis-à-vis road-based public transport. However, such bus fare revision was not made at the time.

Also, poor integration between Ampang Line and Kelana Jaya Line, and even poor integration with other rail operators such as KL Monorail and KTM Komuter were considered to badly affect ridership performance.

## (2) Current Operation and Service Performance/ Actions for the Future

After the nationalization, the performance of RapidKL is to be measured according to key performance indicators that are to be set by the Government. The Government penalizes RapidKL financially if the pre-defined targets are not met and rewards it if the targets are

exceeded. This scheme of incentives and penalties is meant to enhance efficiency and service quality of public transport in KL.

Since taking over the LRTs and bus network, RapidKL has taken steps to improve their service.

- i) LRT capacity has been increased. RapidKL and SPNB have issued tenders for the purchase of new LRT rolling stock to increase carrying capacity;
- ii) The common monthly pass for Ampang Line, Kelana Jaya Line, KL Monorail and buses operating within Kuala Lumpur has been introduced;
- iii) Former separate ticket systems by each line has been completely integrated into a common ticketing system magnetic Touch 'n Go card since March 2008, which can be used in all RapidKL buses and rail lines;
- iv) Masjid Jamek LRT station was upgraded to ensure seamless integration between Ampang Line and Kelana Jaya Line (construction was completed in November 2008); and
- v) The connectivity between LRT and bus has been improved. Trunk buses began to link hubs at the edge of the Kuala Lumpur's central business district with suburban transportation hubs. At these suburban hubs, local shuttles will radiate out from rail-based public transport stations and connect to residential areas (see Figure 3-1).

Ridership of Ampang line and Kelana Jaya line were increased up to about 43.8 billion trips per year (120 thousand trips per day) and 69.4 billion trips per year (190 thousand trips per day) respectively in 2006. However, RapidKL was still incurring an operating loss of RM 3 million (US\$0.8 million) per month on total revenue of RM 23 million (US\$6.13 million) and expenses of RM 26 million (US\$6.93 million) in 2006. The government of Malaysia currently provides no subsidy to RapidKL.

## **4. DELHI METRO IN INDIA**

### **4.1 Outline of MRT Project**

#### **(1) Background of Project**

India's population size is the second after China and is expected to exceed China in 2050. Traffic congestion has been a big headache for the government and Mass Transit System has long been awaited. Delhi is the Capital of India. Present population of Delhi is 14 million. City transportation was almost fully road-based until MRT was introduced, with about 38,500 buses (including medium & heavy), 75,000 auto-rickshaws, 16,000 taxis, 2.65 million two wheelers, 1.26 million cars and 135 thousand goods vehicles ply in the City. The existing railway line of 245 km carried only 2% of the

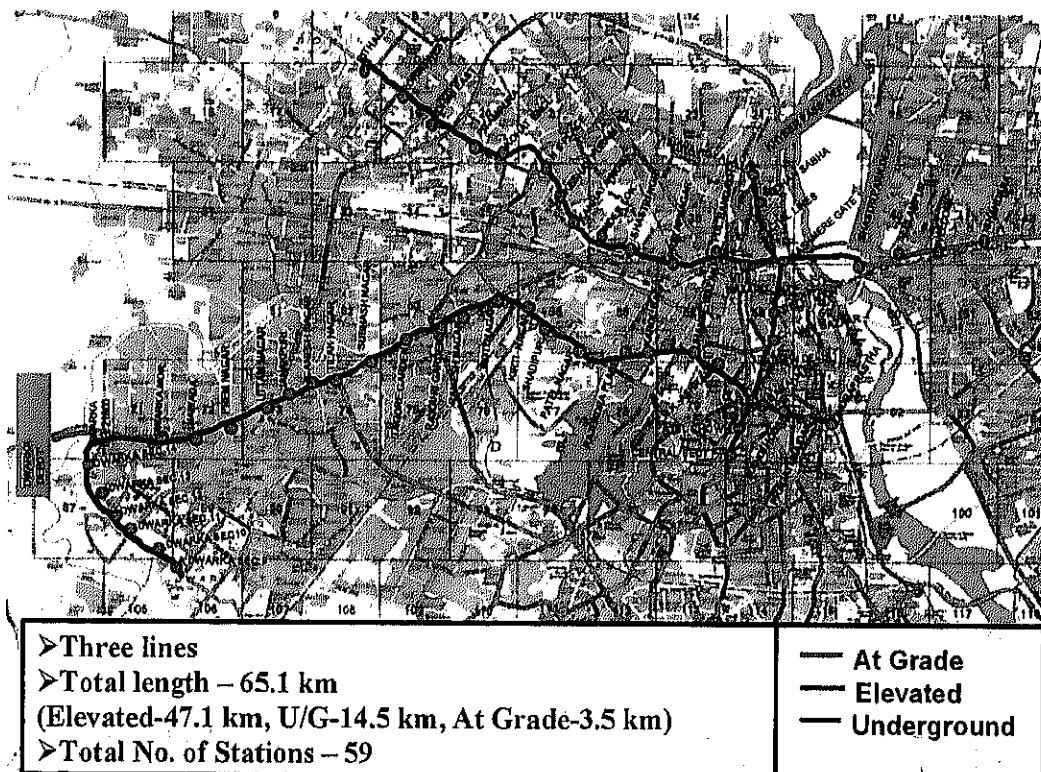
commuter traffic. Consequently, roads were constantly heavily congested, pollution levels were high and road accident rates were also very high. Under this situation, the original plan for mass transit was formed in the early 1990s and the government established a special purpose vehicle, the Delhi Metro Rail Corporation (DMRC), in 1995.

Today, DMRC is well regarded not just within India but also around the world as a highly successful case of mass transit system development in developing country. Much of the success reasons lie in how the project implementing scheme has been designed and prepared.

This case study traces back the history of DMRC and also reviews the recent performance. Notably, it is quite important to draw lessons from the soft elements of DMRC organization itself. This includes areas of governance, human resource management and other various management systems embedded within the organization.

**(2) Outline of MRT Line**

Phase I of Delhi Metro consists of three lines with a length of 65.1 km, of which 14.5 km is underground. Work of Phase I started on October 1, 1998 targeting completion in 10 years. The first phase of Delhi Metro was, however, completed by December 30, 2005 (exactly within 7 years and 3 months). During the construction, no major inconvenience or disruption in the city had been reported, which is quite unusual for a project of this size. Also, it is important to note that construction work was completed within the original estimated cost.



Source: Prepared by Study Team based on DMRC' data.

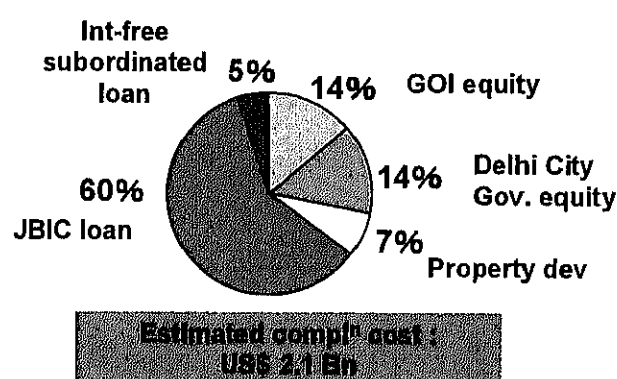
Figure 4-1 Map of Delhi Metro (Phase 1)

## 4.2 Financial Framework

### (1) Fund Raising Method

DMRC is a fully-owned government company - 50% shares held by the Federal Government (Government of India) and 50% shares by the Provincial Government (Government of Delhi). DMRC has full autonomy and there is no interference from the government or city agencies in the working of DMRC. There are 9 part-time and 5 full-time directors in the company.

The flow of funds from the two governments and from JBIC was smooth. Therefore, work never suffered for want of funds. DMRC is now funding 10% of Phase-II from its own resources.



Source: DMRC seminar, DMRC annual report 2007

Figure 4-2 Phase1 –Project Cost & Funding Source

### (2) Role Sharing

The support of the two Governments to the project was very visible, which sent the right message to all related stakeholders. In the project, both central and city government plays a critical role in ensuring a sustainable financial structure. For example, one of the key decisions was the Government's decision to exempt DMRC from payment of taxes & duties. This reduced the cost of the project by 18%.

Also, to assist smooth implementation, the Government of India set up two committees; one under the Cabinet Secretary and another under the Group of Ministers. These committees assisted to speed up decision making and coordination required across multiple ministries.

Lands required for the project were acquired by the City Government under the Land Acquisition Act. For this, periodical meetings were held at the level of Chief Secretary (bureaucratic head of Provincial Government) to review the progress of the land acquisition. At no time, work was held up for want of land. DMRC had a well laid policy for rehabilitation and resettlement of affected persons.

Since DMRC did not have expertise for the planning and building of a metro system, it engaged a

consortium of 5 international consultants to assist as general consultants. By this, DMRC could bring in international standards of specification, quality of work and safety standards. It is important to note that capability building was one of the most important missions of the consultants. This initial investment in capability building has resulted in not only a world class metro system but also in a world class institution. As a professional organization, DMRC is now also assisting other Metros in the country and abroad.

### **(3) Legal Framework of PPP Model**

DMRC got two enabling legislations enacted by the Parliament, i.e., legislation for the construction activities of MRT and legislation for the operation & maintenance of MRT.

Under this legal cover, DMRC was able to: i) acquire any premises; ii) create tunnel under any building or structure; and iii) be exempted from payment of property tax and other taxes.

These legislations were different from the Railway Act prevalent in the country and developed specifically for MRT, since the characteristics of urban mass transit is quite different from inter-city railway.

### **(4) Risk Sharing**

DMRC took all revenue risk from the beginning. This contributed to the autonomy and independence that DMRC enjoys today. However, DMRC management knew that taking such risk was not an easy task. The management made sure that DMRC had a sustainable (defensible) financial structure from the early planning stage. This led to ensuring tax exemptions, stable cost of energy, government indirect support for ridership enhancement and other competitive commercial structures.

Another notable aspect of risk sharing is the way they managed vendors. The procurement package was sub-divided into many packages (probably more than 10 packages). This allowed DMRC to avoid over-dependence on selected vendors. However, this required DMRC to build in-house capabilities for “system integration,” which is quite a task with risks. The human resource pool from the Indian Railway may have contributed to such a bold strategy.

### **(5) Setting of Key Performance Indicators and Revenue Sharing**

The specifics of key performance indicator (KPI) are not clear from publicly available information. However, several points regarding performance should be emphasized as follow:

- Commercial profitability from railway: Sustainable financial operation from core business was thought to be a high priority from beginning;
- Passenger satisfaction: There are clearly planned efforts to make passenger satisfaction a priority. They have made a plan for passenger convenience and safety facilities. This also includes the recent roll-out of Metro feeder bus service; and
- Increase in non-rail revenue ratio: DMRC has taken initiatives to diversify sources of revenue,



including consulting services and real estate business.

**(6) VFM Analysis**

Since DMRC is a fully government owned entity, it is assumed that there was no value for money (VFM) analysis for this project. The Study Team could not find any trace that the Government of India considered PPP concession model as an alternative. This is understandable as India had plenty of railway expertise pool from the long history of Indian Railway.

**(7) Financial Analysis**

Original financial analysis prior to the commencement of Phase I is not clear. However, based on indirect evidence, it is fair to state that DMRC took a conservative view on tariff and ridership forecast. One of the keys to their success is the defensible financial structure, building on a conservative ridership scenario.

**2.4.3 Current Efficiency Level of Operation and Service**

**(1) Customer Satisfaction**

DMRC has put significant efforts to maintain a high level of customer satisfaction. Reports mention a low level of customer complaints with a high level of corporate image. This is owing to their strict standards to maintain punctuality and safety. Although no publicly available customer satisfaction survey has been available, it is fair to say that DMRC has earned the trust of mass public given their generally positive public reputation.

**(2) Efficiency of Operation and Service**

Some notable characteristics of operation and services are:

- About 1,200 train trips a day - with 64 train sets (256 Coaches). Each train consists of 4 coaches. When traffic increases trains can be lengthened to 6 coaches and finally to 8 coaches.
- Average ridership is 550,000 trips a day. Frequency during peak hours is 4 minutes.
- Trains operate from 6 AM to 11 PM. Punctuality measured with a least count of 60 Seconds.
- Fare ranges from Rs. 6.00 (15 cents in the U.S. currency) to Rs. 22.00 (50 cents in the U.S. currency), lowest in the world.
- More than 30% of DMRC's revenue is from non-rail business sources, mainly real estate development, consulting service and advertisements.
- DMRC has introduced bus feeder services to improve the ridership.

Based on such operation and service efficiency, the system has been making operating profit from the first year. Despite heavy investment burden, DMRC has been able to service and pay back the

loans without delay.

### (3) Financial Efficiency

Financial performance of DMRC is impressive. Overall, their profitability is 4%, which is relatively high for mass transit. This is because they have a very high non-rail revenue ratio of 44%. It is believed that non-rail revenue will be an inevitable part of urban railway system success, especially from a financial sustainability point of view.

Gross profitability of non-rail business such as consulting service and real estate is extremely high and contribute to the overall profitability of DMRC.

It is worth noting that non-rail business ratio of other financially successful case, such as Hong Kong MTR and Tokyo Metro, is also relatively high compared to poorly performing cases.

<b>INCOME</b>		
• Traffic Operations	2,833,832,364	
• Consultancy	134,478,705	
• Real Estate	1,534,585,697	
• Others	540,620,275	
<b>TOTAL (a)</b>	<b>5,043,517,041</b>	
<b>EXPENDITURE</b>		
• Traffic Operations	2,003,544,264	
• Consultancy	36,807,579	
• Real Estate	65,064,880	
• Others	2,791,386	
<b>TOTAL (b)</b>	<b>2,108,208,109</b>	
<b>EBITDA (c= a-b)</b>	<b>2,935,308,932</b>	
<b>DEPRECIATION AND INTEREST</b>		
• Depreciation	1,836,449,700	
• Less:- transferred to CWIP	66,200,013	
<b>TOTAL (d)</b>	<b>1,770,249,687</b>	
• Interest & Finance Charges	1,051,076,509	
• Less:- transferred to CWIP	85,843,779	
<b>TOTAL (e)</b>	<b>965,232,730</b>	
<b>PROFIT BEFORE TAX (f=c-d-e)</b>	<b>199,826,515</b>	

•Profit/Revenue=4%

•Non-rail revenue/Revenue=44%

•Gross Profit/Revenue(train)=29%

•Gross Profit/Revenue(non-rail)=95%

Source: DMRC seminar, DMRC annual report2007

Figure 4-3 Financial Highlights of Phase-I (2007) - Profit and Loss Statement

### (4) Key Lessons from Delhi Case

DMRC has shown that a government agency can handle a mammoth project in a crowded city efficiently (causing no inconvenience to the public) and in time, and within budget. Delhi Metro does not receive any government subsidy for operation.

DMRC's success has encouraged metro projects to come up in cities like Bangalore, Hyderabad, Mumbai, Chennai and Kochi. DMRC is the prime consultant to all the cities.

The innovative structure of DMRC, which is 50% owned by the Federal Government and 50% by the City Government, has contributed to the success. No one government has the majority to control the company. DMRC has full freedom and flexibility to decide on technical and financial matters.

The Board of Directors has delegated full powers to the Managing Director. Therefore, decision making process is fast.

The case of DMRC provides quite a counter-intuitive result. In conventional theory, 100% government-owned companies had been believed to be inefficient compared to private. DMRC provides a solid counter argument and proves that government entities can perform well under good governance and management system.

## **5. METROPOLITAN INTERCITY RAILWAY COMPANY (TSUKUBA EXPRESS) IN JAPAN**

### **5.1 Outline of Metropolitan Intercity Railway Company (MIR)**

#### **(1) Background of MIR**

In the northern part of Tokyo metropolitan area, the development of commuter lines has been left behind. The area was deemed to be one of the most undeveloped areas. Therefore, local governments along the line eagerly promoted a new commuter line to this area.

The purpose of the line is as follows;

- To implement a commuter rail network in the northern part of Tokyo metropolitan area;
- To mitigate congestion of the existing commuter railway line;
- To provide good residential area in the northern part of Tokyo metropolitan area; and
- To provide infrastructure for industries along the line and establish business core cities in the area.

In 1985 the construction of the line was proposed to the Ministry of Transport as one of the commuter lines in Tokyo metropolitan area by 2000. The construction of the line was started in 1994 and Metropolitan Intercity Railway Company (MIR) started its service in 2005.

#### **(2) Outline of MIR**

The project has been promoted by MIR who is the newest commuter rail company in Japan. This line connects Akihabara, a center of Tokyo, with Tsukuba city, research and academic city northern part of Tokyo metropolitan area. The route length is 58.3km and most of the line is elevated section except the underground section around the terminals. The number of rolling stock is 180.

## **5.2 Financial Framework**

### **(1) Funding Raising Method**

In Japan, it was obvious that the newly established urban railway company would generate a big debt if the existing financial scheme would be adopted. And the government does not financially support the commuter companies on the operation stage. These have brought about big deficit to them.

To support the expansion of urban transportation, therefore, the Ministry of Transport constituted the law for development of residential area and implementation of commuting railways in the metropolitan area to suppress the land acquisition cost. The Ministry also provided the large amount of capital and the funds with no interest in order to reduce total amount of debt and to suppress total construction cost.

The funds for the line were gathered from the following sources:

- i) interest-free loans from the central and local governments;
- ii) fiscal investment and loan fund from the central government; and
- iii) equity participation by local governments and private companies.

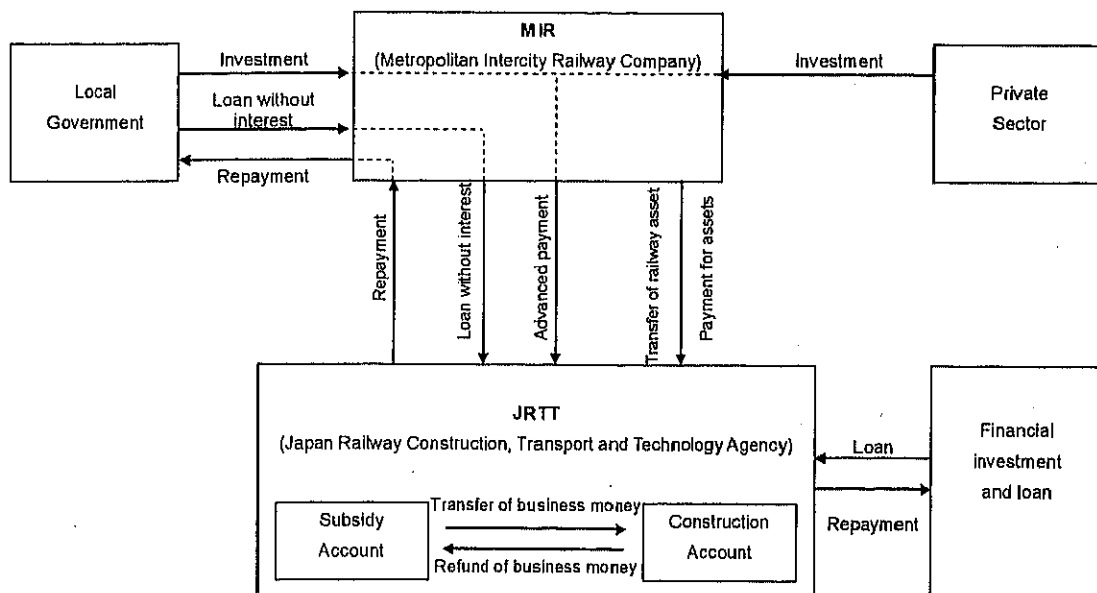
Concrete figures of funds are as follows:

Loans from the central government without interest	411.3 billion yen
Fiscal investment and loan fund from the central government	61.7 billion yen
Loans from the local governments without interest	411.3 billion yen
Equity participation by local governments	144.0 billion yen
<u>Equity participation by private companies</u>	<u>19.0 billion yen</u>
Total	1,047.3 billion yen

**(2) Role Sharing between the Public and Private Sectors**

Financial scheme of the project is not PPP in a strict sense but the joint stock company to implement the project was established jointly by the public and public sectors. It has been eagerly pushed ahead by the local governments along the line and the Ministry of Transport. The private sector invested only 10% of the capital of the company and it did not provided a loan.

As an implementation body, MIR was newly established and as a construction body, the Japan Railway Construction, Transport and Technology Agency (JR TT) was involved. The relationship of the implementation body and construction body is described in the following figure.



Source: Study Team

**Figure 5-1 Institutional Setting of MIR**

#### a. Implementation body

The core staff of MIR was gathered together from the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), JRJT and several private railways in Tokyo.

The capital of MIR is about 185 billion yen, which is the second biggest one as a railway company. This capital is contributed by local governments along the line and related private companies.

#### b. Construction body

The main construction body is JRJT which is a kind of government agency and has a lot of experience on construction works of urban railways and *Shinkansen*. It has carried out all the construction works of the project except procurement of rolling stock for railways.

### (3) Legal Framework of PPP model

As mentioned above, this project is not implemented with PPP scheme and furthermore there is no legal framework of PPP model for railways in Japan.

### (4) Risk Sharing

Basically MIR takes all the risks concerning construction and operation.

### (5) Setting of Key Performance Indicators and Revenue Sharing

In Japan, each railway company is obliged to submit its train time table to MOT. And each railway company is required to get approval on its fare level from MOT. MOT also requires each railway company to make its effort to reduce the congestion ratio at peak time to 150%.

Key performance indicators of the line and figures are expressed in the following table.

Table 5-1 Key performance indicators of MIR

KPI	Figures
Train km per day	16,569km/day
Number of trains at peak time	19 trains per hour on working day
Average traffic volume for all days	193,000 passengers/day
Number of passengers at peak time	Not available.
Average travel distance	22.2km

Source, Railway statistical annual report 2007, Homepage of MIR ([www.mir.co.jp](http://www.mir.co.jp))

All the revenue from the line goes to MIR. There is no concession agreement with others.

### (6) Value for Money Analysis

It is considered that there was no consideration of value for money in this project. In order to lessen land acquisition costs, the government introduced a special arrangement by issuing a law. This is not attained by participation of private sectors.

## (7) Financial Analysis

In Japan, every year each railway company is obliged to report its detailed financial results to MOT to evaluate the proposed new fare level when needed. These figures are publicly opened. Based on these figures of MIR, financial analysis was carried out.

- MIR recorded a deficit after depreciation and tax in 2007. The size of deficit is 9.4% of total revenue. MIR records a deficit even it enjoys favorable treatments such as interest-free loans and lower land acquisition costs. This deficit is considered to be due to the fact that MIR is still at the early stage of operation.
- The ratio of depreciation expense to total expenditure is around 62%. This fact shows that the construction cost of modern a commuter line is huge. The most important factor for the sustainable and sound operation of commuter line is how to share the burden of construction cost and/or how to restrain the construction cost.

**Table 5-2 Profit and Loss of MIR**

Items		Amount (¥ Thousand)
Fare box revenue	A	25,727,316
Non fare box revenue	B	1,046,719
Total revenue	C=A+B	26,774,035
Total operation cost without taxes	D	9,063,957
Taxes	E	2,080,770
Depreciation cost	F	18,156,311
Total expenditure	G	29,301,038
Profit or loss for railway business	H=C-G	-2,527,003

Source: Railway statistical annual report 2007

## 5.3 Current Efficiency Level of Operation and Service

### (1) Customer satisfaction

MIR has not reported the result of customer satisfaction survey to the public. From the following aspects, the customer satisfaction of the line seems to reach a high level.

#### a. availability

MIR does not provide any statistics of train delay. However, no train delay of the line has been reported in newspaper since it opened. Therefore, its availability is deemed to be ensured.

#### b. safety

MIR is equipped with the automatic train protection (ATP). Therefore, any incident due to a signal passing accident danger (SPAD) would hardly happen. As platform doors are installed on the platform, falling-down of passengers from the platform is protected. As just described, the MIR line is highly equipped with safety measures and no serious incident was reported in the

railway statistical annual report 2007. The safety level of this line can be considered sufficiently high.

**c. fare level**

In Japan, the fare level of a newly opened line tends to be high for the recovery of the huge construction cost. However, the minimum fare of this line is 160 yen. This is the same as Tokyo Metro which is the largest metro in Japan. From Table 5-3, it can be seen that the average fare of MIR is smaller than that of lines operated with public & private joint scheme or that of lines operated by the public sector. It seems that the fare level of MIR is acceptable as a commuter line.

**d. amenity**

As MIR is a newly constructed line, a sufficient number of escalators and elevators are installed from the opening. At ticketing gates, the automatic fare collection (AFC) for smart card is installed. Universal signage is introduced for passengers to find station facilities easily. A lot of amenities are available at stations on this line. Thus, passengers may feel comfortableness on the line.

## **(2) Efficiency of Operation and Service**

Table 5-3 shows efficiencies of operation and services by type of operator of commuter railway in Japan. Commuter railways operated by the public sector include the Tokyo Metropolitan Government Bureau of Transportation, Tokyo Metro, Transportation Bureau of City of Yokohama, Transportation Bureau of City of Nagoya and Osaka Municipal Transport Bureau. Those operated jointly by the public and private sectors are MIR, Chiba Urban Monorail, Saitama Railways, Tama Urban Monorail, Tokyo Waterfront Area Rapid Transit and Toyo Rapid Railway. Private operating companies of urban railway are Tokyu, Seibu Railway, TOBU Railway, Keio, Odakyu Electric Railway and Keihin Electric Express Railway.

The comparison with other urban railways shows:

- a) Fare per passenger km of MIR is cheaper than the average of public & private joint operators and also that of public operators. This lower fare level may be owing to suppressed construction cost. MIR's moderate fare has contributed to an increase in passengers, which is higher than estimated.
- b) The number of staff per route km of MIR is smaller than that of all types<sup>4</sup>. This may be brought about through the introduction of various facilities to operate with smaller number of staff. Operation with less staff leads to financial efficiency.

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<sup>4</sup> It should be noted that all lines operated by the public sector are underground railways that need more staff than railways on the ground or elevated.



**Table 5-3 Comparison of Operation and Service Level of Commuter Lines in Japan**

Type of Operating Company	Fare per passenger km (Yen)	Number of staff per route km
MIR	16.36	9.7
Public	22.6	35.9
Public + Private (Joint)	33.0	13.0
Private	11.3	19.9

Source: Railway statistical annual report 2007

**(3) Financial Efficiency**

Table 5-4 shows the financial efficiency and ratio of profit to railway assets by type of operator of commuter railways in Japan. From this table, the following can be pointed out.

- a) Financial efficiency and profit ratio of railways operated jointly by the public and private sectors are the worst among three types. It seems that an unprofitable railway project tend to be undertaken by an operating company jointly established by the public and private sectors.
- b) Financial efficiency and profit ratio of MIR is lower than the average of each type. This is due to a deficit.

Four years has passed since the start of MIR operation in 2005. The number of passengers is still low. However, ridership is expected to increase in the coming years. As most of operating expenses are fixed cost, it is expected that financial performance of MIR will be improved in future.

It should be also noted that the demand forecast of MIR line was carefully carried out to avoid tragedy of over-estimation because many people considered MIR would be a money-losing line at the planning stage. The current number of ridership is bigger than estimated. Thus, the ridership is still at only 234 thousand passengers per working day.

**Table 5-4 Comparison of Financial Efficiency of Commuter Lines in Japan**

Type of Operating Company	Financial Efficiency (%)	Ration of Profit to Railway Assets (%)
MIR	109.4	-0.3
Public	81.3	2.9
Public + Private (Joint)	97.5	0.8
Private	80.4	5.8

Source: Railway statistical annual report 2007

## **6. LONDON UNDERGROUND IN THE UNITED KINGDOM**

### **6.1 Outline of MRT Project**

In the first half of the 2000's, a PPP scheme was introduced to infrastructure maintenance work of the London Underground. In this section, the PPP scheme which the London Underground has introduced is studied and evaluated as a case study in this section.

#### **(1) Background of Project**

The history of London's underground railway dates back to 1825 when the world's first underground railway opened<sup>5</sup>. The London Underground Limited (LUL) has played an important role of urban transportation in London for the long time. London Underground currently serves a large part of Greater London and neighboring areas of Essex, Hertfordshire and Buckinghamshire. London Underground covers 402 km of route with 11 lines and 270 stations.

In the 1990s, the aging of infrastructure and inflexible response to rapidly expanding demand were recognized as key issues of LUL. LUL could not make a persistent budget because the size of government subsidies which LUL received varied from year to year. It was considered that the private sector would be able to raise long-term funds easier than the public sector such as LUL. LUL's weak capacity of investment planning and, as a result, frequent cost overrun and delay also invited enthusiastic discussions on PPP for the underground railway in London. In February 2002 it was announced that the maintenance and renewal of LUL's infrastructure would be undertaken through three private organizations under the public private partnership (PPP)<sup>6</sup>.

LUL is under the Transport for London (TfL). TfL is a functional body which is responsible for transport under the Greater London Authority.

#### **(2) Outline of PPP**

In 1998, LUL was split into four organizations, i.e., an operating company for running trains and stations and three infrastructure companies (Infracos) responsible for renewing and maintaining assets. Four organizations were operated as public organizations to test a new underground railway operation system with PPP. During this shadow operation, the bidding process of PPP was preceded. In the result, three Infracos were transferred to the private sector. Private consortiums became shareholders of the Infracos. LUL signed three 30 year PPP contracts with Tube Lines for Infraco JNP in December 2002, and with Metronet for Infraco SSL and Infraco VCB in April 2003. LUL retained the ultimate ownership and responsibility for the daily operation of trains and stations, and for safety, while the private Infracos were expected to maintain and renew infrastructure including the trains, stations, track and signaling, in a whole life manner.

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<sup>5</sup> Transport of London, "London Underground Factsheet," February 2009.

<sup>6</sup> Martin Kellaway & Helen Shanks, "Metronet, Tube Lines and the London Underground PPP," National Accounts Classification Committee, 24 September 2007

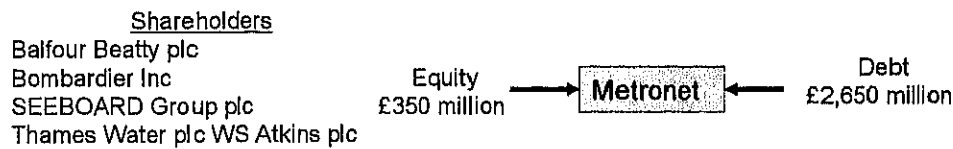
## 6.2 Financial Framework

### (1) Fund Raising Method

#### a. Fund Raising by Private Sector

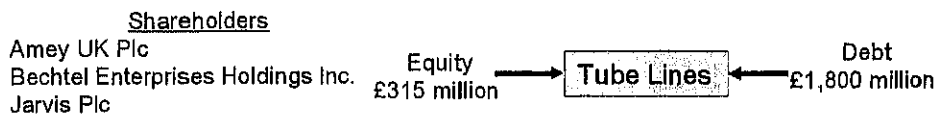
The participants in the Metronet Consortium are affiliates of Balfour Beatty plc, Bombardier Inc, SEEBOARD Group plc (part of the American Electric Power Company Inc. group), Thames Water plc (part of the RWE group) and WS Atkins plc. Metronet arranged a borrowing of £2.65 billion for the first 7-and-half-year period of the 30-year PPP contracts. In addition, Metronet's five shareholders supposed to provide £350 million in equity. Metronet planned to invest nearly £8.7 billion in its two PPP contracts during the first 7-and-half-year period split almost equally between maintenance and renewal.

The shareholders of Tube Lines Limited are affiliates of Amey UK Plc, Bechtel Enterprises Holdings Inc., and Jarvis Plc. The share capital was divided equally among shareholders. Tube Lines Limited raised £315 million in equity and arranged £1.8 billion in borrowing to help fund its planned investment of £4.8 billion during the first 7 and half years. In 2003 Grupo Ferrovial SA of Spain acquired Amey. In 2004 Jarvis sold its shares to Amey. Thus, Grupo Ferrovial SA holds two thirds of the share capital. Tube Lines increased its debt to £2.0 billion and reduced its equity to £180 million at the time of refinancing in May 2004.



Source: The Comptroller and Auditor General, "Department for Transport The failure of Metronet HC 512 Session 2008-2009," National Audit Office, June 5, 2009

Figure 6-1 Fund Raising by Metronet



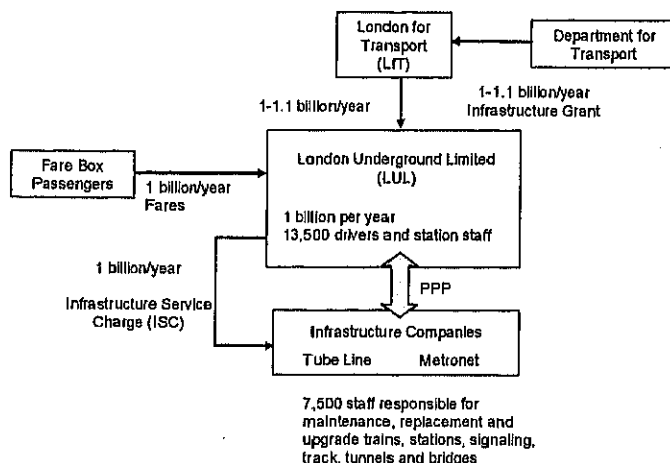
Source: The Comptroller and Auditor General, "Department for Transport The failure of Metronet HC 512 Session 2008-2009," National Audit Office, June 5, 2009

Figure 6-2 Fund Raising by Tube Lines

#### b. Payment of Infrastructure Service Charge to Infracos

Regular payments of an Infrastructure Service Charge (ISC) are made by four-weekly to Infracos by LUL according to a fee structure that is fixed for the first 7 and half years. The amount of payments is adjusted according to defined performance bonuses and abatements. The

adopted performance indicators are the maximum capacity of the system, the day-to-day ability of LUL to make use of this capacity, and the quality and comfort of the system as experienced by passengers.



Source: The Comptroller and Auditor General, "London Underground Are the Public Private Partnerships likely to work successfully?" the House of Commons, 14 June 2004

Figure 6-3 Flow of Service Charge

(2) Role Sharing of the Public and the Private Sector

The role sharing was arranged as follows:

Table 6-1 Role Sharing of Public and Private Sectors

Sector	Organization	Role
Public sector	LUL	<ul style="list-style-type: none"> <li>- retain responsibility for passenger service provision on the Underground, including operation of trains and stations;</li> <li>- be responsible for collecting and retaining all fares and other revenues (including from advertising, car parks etc.);</li> <li>- continue to manage the existing network-wide PFI contracts, and any other PFI contracts let before or after completion of the PPP (other than the NLTS Contract, which will transfer to Infracos JNP);</li> <li>- manage its relationship with the Infracos through the Service Contracts;</li> <li>- continue with marketing and planning of the whole network;</li> <li>- take a leading role in ensuring that the PPP arrangements maintain and improve safety in accordance with its statutory responsibilities; and</li> <li>- participate in changes to Underground standards and operational practices in accordance with a contractual standard setting and change process.</li> </ul>
Private sector	Infracos (JNP, SSL, VCB)	<ul style="list-style-type: none"> <li>- maintain and upgrade the track, tunnels, signals, stations, lifts, escalators and trains under 30 year contracts to LUL. After the contract period the upgraded assets will return to the public sector.</li> </ul>

Source: European Commission, "State aid No N 264/2002 - United Kingdom London Underground Public Private Partnership," 02.10.2002

The underground lines and assets managed by three Infracos are as follows:

Table 6-2 Lines and Assets of Infracos

Name of Infraco/ Consortium	Participants in Consortium	Responsible Line	Assets under Management
Infraco JNP/ Tube Lines	- Jarvis plc - Amey plc - Bechtel	- Jubilee Line - Northern Line - Piccadilly Line	- Over 370km of track - 100 stations - 250 trains - Associated infrastructure
Infraco SSL/ Metronet	- Bombardier Transportation - SEEBOARD Group plc	- Metropolitan Line - District Line - Circle Line - Hammersmith & City Line - East London Line	- Over 690km of track - 150 stations - 350 trains - associated infrastructure
Infraco BCV/ Metronet	- Balfour Beatty plc - Thames Water plc - WS Atkins plc	- Bakerloo Line - Central Line - Victoria Line - Waterloo & City Line	

Source: European Commission, "State aid No N 264/2002 – United Kingdom London Underground Public Private Partnership," 02.10.2002

### (3) Legal Framework of PPP Model

London Underground's rights of direction and control under the Service Contract arise in two main circumstances, safety and inadequate performance<sup>7</sup>.

### (4) Risk Sharing

The risk sharing between LUL and Infracos is as shown in the following table.

Table 6-3 Risk Sharing between LUL and Infracos

	LUL	Infracos
Revenue Risk	A risk of LUL's revenue is under LUL.	Infracos' revenue risk depends on the level of Infracos' performance as measured under the performance regime
Cost Risk	LUL is to cover additional costs to meet its performance requirements	Infracos take risks of changes in the projected costs
Event Risk		Infracos take no risk on unforeseeable events with major potential cost consequences.

Source: European Commission, "State aid No N 264/2002 – United Kingdom London Underground Public Private Partnership," 02.10.2002

### (5) VfM Analysis & Financial Analysis

The government considered four business structures: a public sector unified business; a private sector unified business; separate private sector businesses split vertically by group of lines; and horizontally split businesses (with operations and infrastructure maintenance, renewal and upgrading

<sup>7</sup> European Commission, "State aid No N 264/2002 – United Kingdom London Underground Public Private Partnership," 02.10.2002

carried out by separate businesses). The government chose the third option<sup>8</sup>.

LUL evaluated the net present value of three PPPs with a 6 per cent discount rate. The net present value of all three PPPs over 30 years was evaluated at £15.7 billion (with a value of £9.7 billion at 2002-03 prices over the first 7 and half years)<sup>9</sup>.

Ernest & Young LLP prepared a report which reviewed the value for money of LUL's PPP, "London Underground PPPs: Value for Money Review," dated February 5, 2002. In this report, Ernest & Young LLP reviewed LUL's assessments of the value for money of the PPP and concluded that overall the methodology adopted for assessing the value for money by LUL were robust and appropriate and LUL's recommendation that the PPP proposals delivered value for money was subjective. Ernest & Young LLP adopted five cases for the comparison of PSC and VfM. For each case, the comparison was made on both a cash (NPC) and value (NPV) base. The adopted cases were as shown in the following table.

**Table 6-4 Prime Financial Analysis Comparisons**

Ref	Evaluation Period	PSC Funding Assumptions	Discount Rate	Comments
A	30 years	Traditional	6%	This scenario represents the base case PSC. It assumes that funding will be on an annual basis.
B	30 years	Traditional	3.5% with 30% uplift	This is the main sensitivity for discount rate assumptions. It is a variant that captures the lower cost of public sector capital. To reflect the opportunity cost of Government expenditure there is 30% uplift on costs.
C	30 years	Stable Funding	6%	In order to assess the impact of a stable funding environment, additional cost savings were projected for the PSC. These were reflected in savings on investment and maintenance costs.
D	7 and half years	Underlying costs only	6%	In order to assess the underlying cost of the PPP with the PSC over the first 7 and half years. PPP funding costs are excluded.
E	7 and half years	Traditional	6%	In order to make a like-for-like comparison capturing the impact of funding that will be raised as part of the 30 year bid. This 7 and half year analysis compares the PSC with the PPP for 7 and half years plus the outstanding debt and equity amounts as of year 7½.

Source: Ernst & Young LLP, "London Underground PPPs: Value for Money Review," February 5, 2002"

The results of comparison were as shown in the following table. The report concluded that "overall it is not possible to produce a single comparison that is able to provide indisputable evidence of value for money in either direction and the range of outcomes should be assessed. The results of the financial analysis need to be considered with the wider qualitative factors."

<sup>8</sup> The Committee of Public Accounts, "London Underground Public Private Partnerships - Seventeenth Report of Session 2004-05," The House of Commons, 31 March 2005

<sup>9</sup> The Comptroller and Auditor General, "London Underground Are the Public Private Partnerships likely to work successfully?" the House of Commons, 14 June 2004

Table 6-5 Summary of Comparisons

Comparison	SSL		JNP		BCV		Total	
	NPC	NPV	NPC	NPV	NPC	NPV	NPC	NPV
A	below	below	within	below	within	below	below	below
B	below	below	above	below	within	below	within	below
C	below	below	above	below	above	below	above	below
D	below	below	within	below	above	above	below	below
E	below	below	above	within	above	above	within	below

Note: 'below' - PPP price below 2nd quartile of PSC range

'within' - PPP price within 2nd quartile of PSC range

'above' - PPP price above 2nd quartile of PSC range

Source: Ernst & Young LLP, "London Underground PPPs: Value for Money Review," February 5, 2002.

## (6) Evaluation of LUL's PPP Projects by the Government

The report of Committee of Public Accounts under the House of Commons examined the rationale of LUL's PPP projects in 2005 and made the following conclusions and remarks<sup>10</sup>:

- The PPP approach might have been restricted solely to major upgrade work which LUL was unable to implement effectively. However, the actual PPP covered ongoing maintenance and renewal work;
- The Department for Transport and LUL should have considered wider, non-quantitative factors alongside the PSC, as recent Treasury guidance downplays the role of the PSC. They should not use the PSC as conclusive evidence of the value for money of the PPPs;
- Issuance of a public sector bond should be considered for financing infrastructure projects in which significant risk transfer to the private sector may not be achievable. Bond financing would have been cheaper than the PPP financing costs;
- Disagreement between the main parties responsible for procuring and managing a PPP ideally should be resolved certainly before the terms of a PPP agreed;
- The accuracy of PSC, and value for money, is very sensitive to the costing of risk; and so forth.

## 6.3 Current Efficiency Level of Operation and Service

### (1) Customer Satisfaction

The level of customer satisfaction for the operation of LUL has remained unchanged since the start of PPP. This means that the introduction of PPP for infrastructure renewal and maintenance has not

<sup>10</sup> The Committee of Public Accounts, "London Underground Public Private Partnerships - Seventeenth Report of Session 2004 - 05," the House of Commons, March 2005.

give a significant impact to customer satisfaction of passengers.

**Table 6-6 Customer Satisfaction Scores (%)**

	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08
London Underground	75	76	78	78	76	77
Busses	76	77	78	78	78	79
Docklands Light Railway	92.5	94	94.9	95.4	96.8	97.3

Source: Transport for London, "Annual Reports and Statement of Accounts"

## (2) Efficiency of Operation and Service

The trend of operational performance of London Underground is as shown in the following table. Such indicators as passenger journeys and kilometers operated have shown improvement. It is considered that the operation of LUL has been adequately supported by services of Infracos.

**Table 6-7 Performance Indicators of London Underground**

	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08
Passenger journeys (millions)	942	948	976	971	1,014	1,073
Kilometers operated (millions)	66.0	67.7	69.4	68.8	69.8	70.5
Percentage of schedule operated (per cent)	92.2	93.1	95.3	93.6	94.5	94.8
Excess journey time (weighted) (minutes)	9.7	7.4	7.2	7.5	8.1	7.8

Source: Transport for London, "Annual Reports and Statement of Accounts"

At the introduction of PPP, it was estimated that that the PPP would realize an investment in underground railway infrastructure of over £16 billion over the first 15 years. Sustained investment has been made along with the PPP arrangements. Line upgrades are due to realize a 25% increase in transportation capacity by 2018 and most of the significant capacity increases are due between 2010 and 2017. Therefore, investments to increase the capacity of LUL must be continued to accommodate the increasing passengers. The progress of line upgrading program is as shown in the following table.

**Table 6-8 PPP Line Upgrading Program and Progress**

Line	Eventual Peak Capacity Increase	Contractual Completion Date	Proportion Complete (As of End of 2007/08)
Sub-surface lines	48%	2012-18	13%
Victoria	19%	2013	39%
Bakerloo	38%	2020	0%
Waterloo & City	25%	2007	100%
Jubilee	33%	2009	61%
Northern	20%	2012	34%
Piccadilly	25%	2014	19%

Source: Transport Committee, "Delays possible Maintaining and upgrading the London Underground," March, 2009.

## (3) Financial Efficiency & Financial Sustainability

The income statement of Tube Lines (Infracos JNP) is as shown in the following table. Tube Line has maintained an operating profit, and profit on ordinary activities after interest payment.



Table 6-9 Table Income Statement of Tube Line

	2003/04	2004/05	2005/06
Turnover	597	864	875
Operating costs	-522	-736	-800
Operating profit	75	128	75
Interest receivable and similar income	35	63	87
Interest payable and similar charges	-69	-137	-99
Profit on ordinary activities before taxation	42	54	63
Tax on profit on ordinary activities	-16	-11	-20
Profit on ordinary activities after taxation	26	43	44

Source: Tube Line, "Tube Lines Directors' Report & Accounts."

In July 2007, Metronet BCV and Metronet SSL became unable to meet their spending obligations and were placed under the administration of government. TfL purchased 95% of Metronet's debts from the private sector lenders in February 2008<sup>11</sup>. The Department for Transport (DfT) provides a grant of £1.7 billion of grant available to TfL for this deal. Two Infracos of Metronet were transferred to TfL on May 27, 2008. LUL takes the responsibility of delivering Metronet's work program.

The National Audit Office pointed out in its report<sup>12</sup> that the main cause of Metronet's failure was its poor corporate governance and leadership. According to the report, the five shareholders were Metronet's suppliers and had different interests. At Metronet, many decisions had to be agreed unanimously by five shareholders. The management of Metronet had poor access to cost information of the suppliers and could not monitor costs of works. The executive management of Metronet changed frequently.

The summary of the project implementation schemes of urban railway systems adopted as case studies is shown in Table 7-1.

<sup>11</sup> The Comptroller and Auditor General, "Department for Transport The failure of Metronet HC 512 Session 2008-2009," National Audit Office, June 5, 2009.

<sup>12</sup> The Comptroller and Auditor General, "Department for Transport The failure of Metronet," National Audit Office, June 2009.

Table 7.2 Comparison of Urban Railway Systems in Japan and Other Foreign Countries

Items	Urban Railway System in Korea (Seoul Subway)	Urban Railway System in Kuala Lumpur (RTKL)
0 Type of Financial Framework, i.e. state operation or PPP	Both LRT and MRT are Public, not PPP. Government made overall plan. Government entity MRTIC is in charge of construction and another government corporation SMART (100% of share is owned by government entities) in charge operation.	Kuala Lumpur's urban railway system consists of 7 lines. While 3 lines are operated by Malaysian Railway (KTM), remaining 4 lines were developed and operated by 4 different companies under private participation scheme (BOT). However, after facing the financial difficulty, newly established government-owned operating company (Rapid KL) took over 3 private LRT operations of Star-LRT and Putra-LRT, and KL Monorail.
1 Fund Raising Method	MRT construction was financed by the private sector.	Four private LRT projects were implemented under BOT scheme. Government provided concessional loan for LRT System 1 and KL Monorail projects. Also government provided 10% of grant based equity injection for LRT system 1 project. LRT System 2: Govt. equity: 10%, Govt.'s loan: 20%, commercial loan: 80%, and private sector's equity: 10%. LRT System 3: Govt.'s loan: 25.6%, Commercial Loan: 54.4% and private sector's equity: 20.4%. KL Monorail: Govt.'s loan: 25.4%, Commercial Loan: 52.8% and private sector's equity: 21.8%. Express Rail Link: Unknown
2 Roles and Responsibilities of stakeholders, i.e. the public sector and private sector	The private sector financed and constructed MRT. The railway asset has been leased to the Government and MRT receives the fee. Operation is carried out by the private sector according to the agreement with the Government. Detail is unknown.	Before nationalization: Financing, construction, operation and maintenance were done by private concessionaire. After nationalization: All assets were transferred to SPMB (National Infrastructure Company Limited). Newly established government-owned operating company (Rapid KL) is responsible for operation and maintenance of the railway systems and pays an asset usage charge to SPMB.
3 Legal Framework of PPP	BOT Law officially "in act authorizing the financing, construction, operation and maintenance of infrastructure projects by the private sector and for other purposes" exists. The terms and conditions that an act applies and procedures are explained in BOT Law.	The Railway Act 1991 (Act No. 463) provides a legal framework for the privatization of railway operations in the country.
4 Risk Allocation	It depends on the type of contract. In case of MRT, construction, finance, and operation risk are born by the private sector, while the government takes idleness risk. Since BOT contract is not available, risk allocation of MRT is unknown.	Major risks during construction phase and operation phase are deemed to be shouldered by private concessionaire. Land acquisition risk, political risk and were considered to be taken by public sector.
5 Service Standard and Revenue Sharing	Service standards for LRT and MRT are unknown. Revenue of MRT may be determined in BOT contract, which is not available.	After the nationalization, the performance of RapidKL is to be measured according to key performance indicators (KPI) that are to be set by the Government. The Government penalties RapidKL financially if the pre-defined targets are not met and rewards if the targets are exceeded.
6 Method of VIM Analysis	It may be discussed in the Government but not known.	No information available
7 Premise of Financial Analysis of Project and Content of Financial Analysis	Revenue of idleness of LRT covers its operation and maintenance cost but interest payment and depreciation cannot be covered. No detail of expenditure available. No financial data of MRT.	No data available
8 Customer Satisfaction	LRT passengers are not comfortable by congestion. No detail information about customer satisfaction for both LRT and MRT.	No data available
9 Operational Efficiency	No detail information available.	No data available
10 Financial Efficiency	No detail information available.	No data available
Overall Evaluation	<ul style="list-style-type: none"> <li>Both LRT and MRT have been recognized as convenient means of transport in Metro Manila. Analysis and evaluation are unable, since detail information on operation, finance, and other related matters are not available.</li> <li>Both LRT and MRT are planned, constructed and operated by government with its public entities. This urban transport system itself is highly evaluated for its operational and financial efficiencies. It is observed the success is attributed to the government intention with full financial support.</li> <li>Another salient feature is its implementation system consisted of government to make policy and planning. MRTIC to make efficient construction and SMART to make profit at maximum level as a listed profitable company, which is regarded as the most efficient and well organized.</li> </ul>	<ul style="list-style-type: none"> <li>Actual ridership volumes on privatized LRT systems were much lower than forecasted by the concessionaires. Not only unrealistic ridership forecast made by concessionaires, low ridership was also due to the government's failure to implement policies to promote public transport as well as poor integration between urban railway systems, and even poor integration with other mode of transport (such as bus).</li> <li>As a result STAR, PUTRA, and KL Monorail incurred huge annual deficits on their operations. These three LRT systems were then nationalized. Malaysian government levied heavy burden to salvage the network. LRT systems in Kuala Lumpur are considered to be one of the failure examples of urban railway projects through private participation schemes and state operation schemes. However, out of 4 privatized lines, concessionaires of 3 lines were bankrupted and these lines were eventually rehabilitated. This case is considered to be very informative guide to study about Financial Framework of urban railway systems in Thailand.</li> </ul>

Source: Compiled by Study Team.

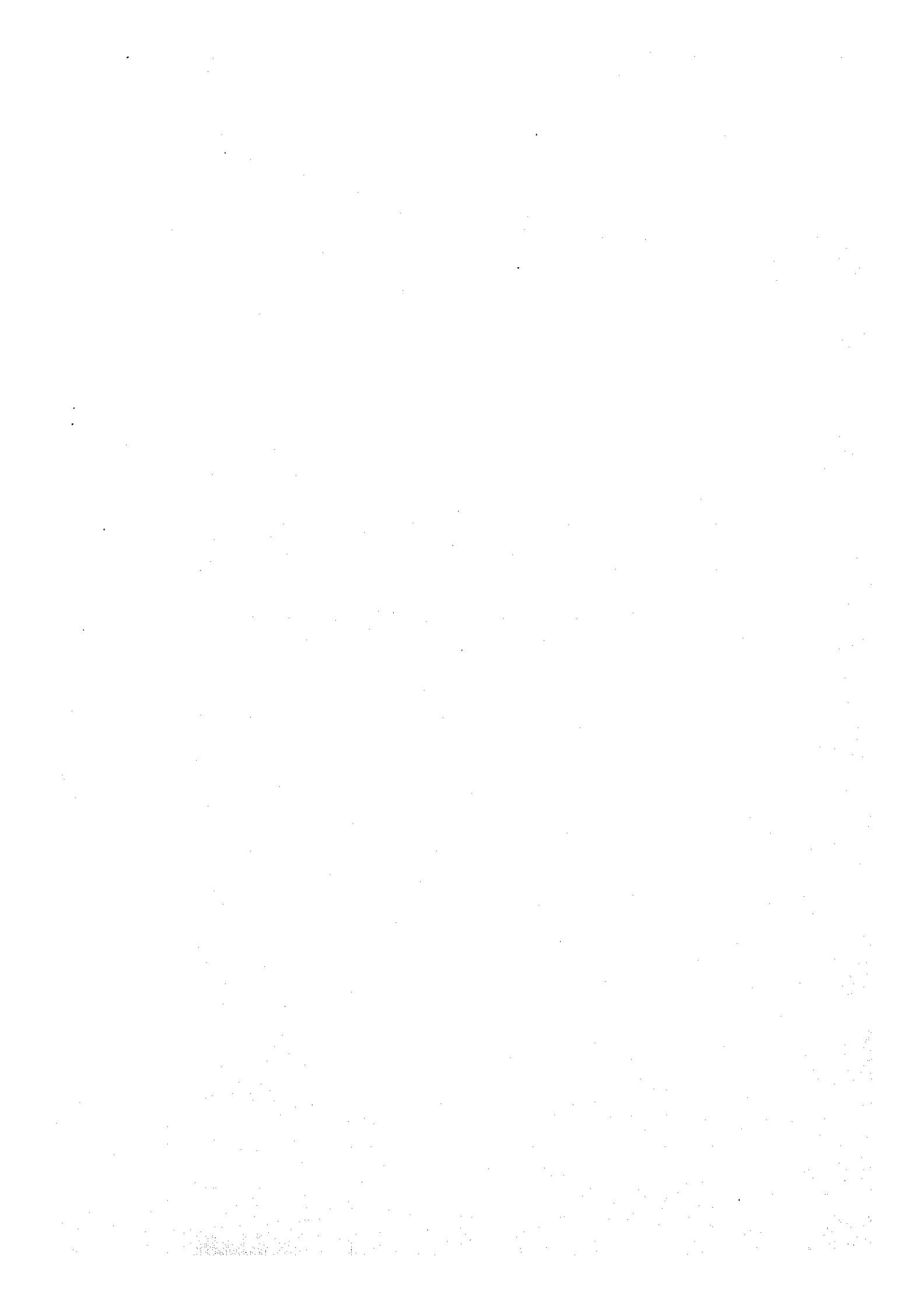
Table 7.2 Comparison of Urban Railway Systems in Japan and Other Foreign Countries (Continued)

Items	Seoul Subway (Korea)	London Underground in London (United Kingdom)
0 Type of Financial Framework, i.e. state operation or PPP	Central government and local government both provided 50% equity each to form DMRC. Therefore, this is a 100% government owned SOE.	London Underground Limited (LUL) operates underground railway in a large part of Greater London and neighboring areas of Essex, Hertfordshire and Buckinghamshire. PPP was introduced for new investments and maintenance of infrastructure due to LUL's low capability of investment planning and costlier land raised by the private sector.
1 Fund Raising Method	Construction cost was 80% funded by Japanese ODA loan. Remainder was funded by equity from central and local government, loan from financial institution, etc.	One private consortium (Tube Lines) established an infrastructure company (TfL) and another private consortium (Metrolink) established two infrastructures for renewing and maintaining assets. Two consortiums procured necessary funds by bank loans and bond issuance in addition to equity participation.
2 Roles and Responsibilities of stakeholders, i.e. the public sector and private sector	DMRC is a 100% government owned SOE and does not fall under any PPP law. Upon establishment of DMRC, laws and regulations enacted two legislations. Legislation for the construction, operation and maintenance of MRT and implementation of MRT. These legislations were enacted from the Railway Act promulgated specifically for MRT, since the characteristics of urban mass transit is quite different from inter-city railway.	Regular payments of an Infrastructure Service Charge (ISC) are made by four-weekly to TfL from LUL. Public sector (LUL) retains responsibility for passenger service provision including operation of trams and stations, for collecting and returning all fares and other revenues, for marketing and planning of the whole network, etc. Private sector (TfL) maintains and upgrades the track, tunnels, signals, stations, lifts, escalators and trains under 30-year contracts to LUL. After the contract period the upgraded assets will return to the public sector.
3 Legal Framework of PPP	Aside from political and unforeseen risks, taken by the government, need business risks were assumed by DMRC. The private sector took operation cost risk and construction cost risk in return government asset was provided in terms of low cost financing and non-financial support such as transportation policies. DMRC and government invested sufficient time and money to secure a desirable financial structure.	According to the Citizens Charter in 1991, the Ministry of Finance published "Approval and Evaluation in Central Government (Green Book)" as a guideline for public projects approval. Since 1992, PFI was promoted for public projects which were not suited for privatization or outsourcing. U.K. did not introduce any comprehensive act regarding PFI. Instead, acts of individual public businesses were modified in order to implement PFI in specific business areas. As for MRT in London, the London Transport Act was modified in 1994 in order to enable PFI.
4 Risk Allocation	Specific service level standards could not be found from publicly available information. Profit sharing is done via dividend payment to both local and central government according to shareholding ratio. However, for the first several years of operation, it seems the shareholders had agreed to retain profit margins to prepare for future investments. Also, we must not forget that financial sustainability of DMRC leads to contribution back to the government in terms of tax payments such as corporate tax.	A risk of LUL's revenue is under LUL's revenue risk depends on the level of TfL's performance as measured under the performance regime. TfL's risks take risks of changes in the projected costs. LUL is to cover additional costs to meet its performance requirements. TfL's risks take no risk on unforeseeable events.
5 Service Standard and Revenue Sharing	We could not find any publicly available information on financial analysis prior to the start of project. However, based on the upfront negotiation of desirable financial structure, it is assumed that tariff and demand forecast assumptions were rather conservative and the gap between forecast and actual should not be significant.	The amount of ISC payments from LUL is adjusted according to defined performance bonuses and deductions. The adopted performance indicators are the maximum capacity of the system, the day-to-day safety of LUL to make use of the capacity, and the quality and comfort of the system as experienced by passengers.
6 Method of VIM Analysis	We could not find any publicly available information on survey results regarding customer satisfaction. However, based on articles and annual reports, DMRC considers customer satisfaction as a high priority objective and plans facilities to enhance customer convenience and safety.	London Underground set out its analysis of the PPP proposals in its Final Assessment Report which covered a wide range of issues including value for money, understanding requirements of its value for money (VfM) and London Underground considered both financial and wider factors. This was consistent with the approach set out by the National Audit Office in its December 2000 report.
7 Premise of Financial Analysis of Project and Context of Financial Analysis	We could not find any publicly available information on financial analysis prior to the start of project. However, based on the upfront negotiation of desirable financial structure, it is assumed that tariff and demand forecast assumptions were rather conservative and the gap between forecast and actual should not be significant.	In the financial analysis, the expected cost of the private sector (PFI) and public sector option (PSO) were compared. The payment streams were presented as net present value costs for purely cash amounts and net present values (NPV) for each bid non-cash amounts. Analysis time frame was 30 year and 7.5 years. Treasury guidance set out a discount rate of 6% per annum. A discount rate of 3.5% was also used to assess sensitivities.
8 Customer Satisfaction	We could not find any publicly available information on survey results regarding customer satisfaction. However, based on articles and annual reports, DMRC considers customer satisfaction as a high priority objective and plans facilities to enhance customer convenience and safety.	The level of customer satisfaction for the operation of LUL has remained unchanged since the start of PPP. This means that the introduction of PPP for infrastructure renewal and maintenance has not given a significant impact to customer satisfaction of passengers.
9 Operational Efficiency	Peak hour headway is managed at 4 minutes. Accuracy of operation is managed within 60 second tolerance level. Operation hours are maintained between 6am to 11pm, 17 hours a day.	In the first year of PPP (April 2003 - March 2004), availability performance measured by lost customer hours was better than the total contractual benchmark. Fault rectification performance in the first year was better than forecasted on the whole.
10 Financial Efficiency	Net profit over total sales 4%. Non-net revenue ratio 40%. Gross railway business profitability 25%. Gross non-railway business profitability 95%. Net profit over total asset 0.13%. Net profit over total equity 0.41%.	Indicators of operational performance of LUL such indicators as passenger journeys and kilometers operated have shown improvement during the period from 2003/4 until 2007/8. Such indicators as percentage of schedule operated and excess journey time do not show clear improvement.
Overall Evaluation	<ol style="list-style-type: none"> <li>Financial framework: Role definition between DMRC and government was capital clear. DMRC was provided all responsibility for all key project performance and risks. On the other hand, government played a role to support DMRC in terms of transport policy and financing cost and ensured a desirable financial structure. As a result, DMRC has been recording profits from year 1.</li> <li>Supplier management: DMRC did not over-rely on selected suppliers. It is bringing to outsourcing to a supplier with system integrator function. However, DMRC took another path in design/procurement packages and managed integration. It is important to note that DMRC built in-house capabilities by upfront usage of international consultants.</li> <li>Stakeholder management: DMRC set up corporate governance system of global standard and distributed all political risks. As a result, they also take proactive measures on line extension planning and new line establishment. In general, India is making efforts to promote PPP for infrastructure development. All the more, it is important to find out the background behind their choice to select 100% government-owned SOE. This is a country with long history of railway infrastructure, and availability of high quality technical local staff could be one of the reasons. However, in order to derive meaningful conclusions for Thailand government, there are limitations to information from publicly available information regarding management philosophy and implementation systems. Therefore, we recommend to undertake field interviews in DhK.</li> </ol>	<p>The case can be a reference when Thailand considers a participation of private sector in upgrading and maintenance of infrastructure in the future.</p> <p>Negative impact on operation of trams and stations is not observed so far result of PPP in upgrading and maintenance of infrastructure.</p> <p>Due to the unavailability of financial information of LUL, it can not be judge whether expected VfM has been achieved. As the report of National Audit Office pointed out, financial analysis needs refinement because there are many uncertain factors to be considered.</p> <p>One consortium has maintained profit every year. The other, Metrolink, fell into financial difficulty and was nationalized. After the nationalization, it was pointed out as a problem that procedures of bankruptcy case had been not clearly regulated. The National Audit Office concluded that the main reason for Metrolink's failure is its poor corporate governance and buy-back. The five shareholders were suppliers to Metrolink and had different interests. Metrolink had poor access to cost information of the suppliers and could not monitor the costs.</p> <p>The Committee of Public Accounts under the House of Commons concluded that LUL's PPP projects had the problems such as 1) the PPP approach should have been applied to major separate work, 2) the PSC should not be used as a conclusive evidence of the VfM, 3) issuance of a public bond should be considered, 4) disagreement between the main parties responsible for procuring and managing a PPP ideally should be resolved earlier before the terms of a PPP agreed, 5) the accuracy of PSC, and VfM, is very sensitive to the costing of risk, and so forth.</p>

Source: Compiled by Study Team.



**ภาคผนวก 5**  
**การเปรียบเทียบตัวชี้วัดทางการเงินและ**  
**การดำเนินงานของระบบขนส่งทางในเมือง**  
**ในประเทศอื่นๆ**



APPENDIX 5: Comparison of Financial and Operational Indicators of Urban Railway in Other Countries

		Manila Lines	Singapore	Japan	Malaysia	Delhi	London
Railway operator		Light Rail Transit Authority	Singapore Mass Rapid Transit Ltd	Metropolitan Intercity Railway Company	PURTA (Current Rapid KL)	Delhi Metro Railway Corporation	London Underground Limited
Investors and concession period		Concession Period	DOTC	MIRC (Local gov. 90%, private 10%)	30 years + 30 years PURTA (PPP, Build-Operate-Transfer) Source of funds: Gov loan 25.6%, Private equity 20.4%, Other debts 54%	DMRC (the central gov. and Delhi city)	30 years London Underground Limited PPP for infrastructure maintenance and asset improvement
Rolling stock		Rolling stock	MRTC (PPP, Build-Operate/Lease-Transfer) Source of fund: Private equity 28%, Other debt 72%	MIRC (Local gov. 90%, private 10%)	PURTA (PPP, Build-Operate-Transfer) Source of funds: Gov loan 25.6%, Private equity 20.4%, Other debts 54%	DMRC (the central gov. and Delhi city)	London Underground Limited PPP for infrastructure maintenance and asset improvement
Equipments		Equipments	Source of fund: Private equity 28%, Other debt 72%	MIRC (Local gov. 90%, private 10%)	PURTA (PPP, Build-Operate-Transfer) Source of funds: Gov loan 25.6%, Private equity 20.4%, Other debts 54%	DMRC (the central gov. and Delhi city)	London Underground Limited PPP for infrastructure maintenance and asset improvement
Infrastructure		Infrastructure	Source of fund: Private equity 28%, Other debt 72%	MIRC (Local gov. 90%, private 10%)	PURTA (PPP, Build-Operate-Transfer) Source of funds: Gov loan 25.6%, Private equity 20.4%, Other debts 54%	DMRC (the central gov. and Delhi city)	London Underground Limited PPP for infrastructure maintenance and asset improvement
Currency		00000000Yen	Million USD	00Million Yen	0000000RS	0000000Rupees	0000000GBP
Civil		A		6,082			
E&M		B		1,350			
Rolling stock		C					
Others		D		649			
Opening cost		E					
Interest		F					
Grand total		G=SUM(A:F)	1,340	675.5	5,200	10,571	1,566
Fiscal year			2004	2003	2008	2008	2007
Currency		000Pesos	000Pesos	000Yen	0000000 SS	0000000Rupees	0000000GBP
Fare revenue		A	1,659,788	1,381,032	436.9	25,727,316	39,287
Non rail business		B	36,957	2,460	365.2	1,046,719	2,813
Property development		C	0				24,500
Subsidy		D	34,669				0
Exchange profit		E					
Other revenue		F		4,394			
Total revenue		G=SUM(A:F)	1,731,414	1,387,886	802.1	26,774,035	5,778
Operation cost		H	1,280,697	1,319,965	129.3	9,063,957	72,378
Power cost			237,900	47.5		1,012,357	22,807
Maintenance cost			258,781				
Track access charge		I	0	1,035,000			
Property development cost		J	0				
Management/administration		L		27,000			
Exchange Loss		M	465,192				
Other cost		N	82,652	186,507	409.6		
Depreciation/amortization		O	352,880	106.1			
Interest		P	1,013,598				
Balance		R=G-Q	-1,463,605	-2,587,667	149.9	-2,527,003	
Route km		KM	15	16.9	89.4	58.3	408
Number of stations			18	13	51	20	60
Minimum fare			15	15.0	1.0	160.0	5.1
No. of passengers per day			US\$0.69	US\$0.93	US\$0.93	US\$1.21	US\$3.33
Average riding distance			308,288	393,542	1,080,000	193,887	550,000
Average load factor			15.6	14.5	14.5	22.2	8.1
No. of trains per day			420	797	797	404	1,200
No. of trains per hour during peak			62.04	39.6	29.3	21	15.5
Availability/punctuality			5:00-23:00	5:00-23:00	20 in average	5:00-1:00 (Next Morning)	6:00-23:00
No. of rolling stock		C=A*B	59.4	94.5	99.96	99.5	100
Staff number per station			560	670	2,830	204	280
Staff number per route km			37.3	39.6	31.7	9.7	45.0

Note:  
 Performance data of LRTA Manila is based on that of the Line 1 only.  
 Regarding MIRC, procurement cost of rolling stock is not disclosed and in construction cost, the procurement cost of rolling stock is not disclosed and in construction cost, the procurement cost of rolling stock is not disclosed.  
 Construction cost of LU is the capital expenditure in 2007.  
 Source:  
 Subway in the world (JARTS) 2005, Jane's urban transit systems 2008-9, The 2005 International Comparison Program (WB)  
 Home page of each railway, Annual report of each railway and Interim report 1 of this study  
 Report of JICA expert Mr. Hirasawa 2006, Home page of LRTA, Home page of Metrostar Express  
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