Chapter 1

Introduction

1. Introduction

The terms-of-reference (TOR) for "The Study on Integrated Transport Master Plan for Jabotabek (Phase I)" call for a review of the Mass Rapid Transit (MRT) project. The history of the MRT concept goes back to the early 80s when rapid expansion of overwhelmingly private vehicle transport in combination with inadequate public bus and rail transport started to result in serious traffic congestion in particular on the major road corridors of Jakarta's Central Business District (CBD), but also in general in other areas.

The MRT is a "Greenfield" project and the present Final Report (F/R) presents the results of a review from a technical, economic, and financial point of view of key MRT project features.

The F/R is structured broadly along the following lines. Chapter 2 presents a review of the MRT project history, the broad MRT project profile, its current implementation status and the assessment approach adopted in this report. Chapter 3 identifies a problem hierarchy and the major obstacles that impede on MRT realization. It highlights major economic, financial and institutional factors that must be taken into full account in the interpretation of the economic and financial viability results. Chapter 4 reviews and evaluates MRT engineering aspects. Chapter 5 introduces and discusses the demand profile to be expected in the MRT corridor. Chapter 6 reviews MRT environmental related issues. Chapter 7 highlights key aspects of the project's economic viability. Chapter 8 discusses major elements of MRT financial viability. Chapter 9 discusses further possible development directions for the MRT.

Essential documents, statistical data and computation tables that are important to support the line of argumentation presented in this F/R are attached to this document in various annexure.

Chapter 2

Project History and Implementation Status

2. Project History and Implementation Status

2.1 General Project Background

The Indonesian economy grew over the 27 years period 1970 to 1997 at a compound growth rate of 6.6 percent. Gross Domestic Product (GDP) had reached in 1997 before the monetary crisis a level of Rupiah 624 trillion (roughly equivalent to US dollar 260 billion at a pre-crisis average exchange rate). Per Capita GDP increased from US dollar 400 in the seventies to a pre-crisis level of US dollar 1,285 in 1997. The rapid expansion of the economy was accompanied by two not unusual phenomena. A rapid urbanization process with urban population growth averaging 4.6 percent p.a. as against a total population growth rate of about 1.7 percent p.a., and a strong and persistent motorization process with about 30 percent of the total national vehicle fleet operating in the Jakarta Metropolitan area and its surroundings.

The rapid expansion of overwhelming private vehicle transport in combination with insufficient public bus and rail transport has resulted in serious traffic congestion on the Central Business District's (CBD) major roads and in urban areas in general as well as increasingly grave air pollution related problems.

The Government of Indonesia (GOI) recognizes since the early eighties the need for developing and implementing a more comprehensive and integrated long-term multi-modal plan, considered vital for providing direction toward a future long-term transport development for DKI Jakarta and the Jabotabek region as a whole. Such integrated multi-modal plan was to comprise the following major elements:

1. An integrated railway master program, comprising a Mass Rapid Transit system (MRT), heavy rail transport (HRT) and double-double tracking on selected routes;
2. An integrated road master program, comprising arterial road network development in the Jakarta integration area, and the Development of the Jakarta-West Java tollway system[1]
3. An integrated policy and strategy for urban areas addressing the regulatory frameworks, institutional development and co-ordination issues, the integration of urban transport sector planning and policy, urban road infrastructure development, urban traffic management, issues relating to urban public transport services, mass transit system development, road traffic safety and urban environmental control; and
4. The Jabotabek structure plan, the land use plans, and the respective local structure plans.

In general, the fundamental network configuration of a MRT system should be undertaken from a very long-term planning perspective, say 30 to 40[2] years, in order to reflect adequately the average lifecycle of such facilities. Likewise, the MRT network should be established taking into account the following general planning factors:

[1] Please consult with Volume I for further details on this subject matter.
[2]) This does not necessarily imply that realistic transport demand projections can be made for such a long-term period.

1. The route should go through the CBD of the city under consideration
2. The route should be constructed along the main-stream roads, in order to enable diversion from road transport
3. The route should, to the extent ever possible, enable to transfer to other transport modes at many places conveniently located
4. The route should provide a connection between the CBD and the residential areas on the outskirts of the city with minimized commuter time features, and
5. If possible, the route should be connected in the outskirts of the city with other conventional railway lines, in order to increase its efficiency and enhance user convenience.

2.2 Evolution of MRT Planning and Status of Realization

The proposed MRT is a “greenfield” project that has resulted from an almost 20 years long process of general transport/public transport planning for the Jabotabek area comprising some 25 general and special subject studies as listed in Table 2.2.1.

Three out of the many studies so far undertaken appear to be the most relevant in addressing issues of a mass transportation corridor in DKI Jakarta and Jabotabek. They are:

1. The ITSI study of 1990
2. The Consolidated Network Plan of 1993,and
3. The Revised Basic Design Study, 1999.

The 1990 ITSI Study

The objective of the 1990 ITSI feasibility study “Integrated Transport System Improvement by Railway and Feeder Service in Jabotabek Area”, which was sponsored by Japan Internal Cooperation Agency (JICA), was to recommend priority projects to be implemented by the year 2005 for achieving an optimal transportation system in the Jabotabek area. The F/S studied projects relevant in the fields of (a) feeder service improvement, (b) station facilities improvement, and (c) grade separation of the Eastern Line. Pre- F/S level investigations were carried out for a total of 21 stations.

The study relied on the development of the existing sub-urban rail corridor as proposed in the 1981 Jabotabek Railway Master Improvement Plan proposing two new mass transit routes on the whole network, namely:

1. On the North-South Line from Kota to Blok M, and
2. On the East-West Line from Pondok Gede to Kebon Jeruk and Ciledug.

Table 2.2.1 Studies Relevant to Integrated Transport/Public Transport Sector and MRT Planning 1981 to 1999

Year	Title	Acronym	Sponsor
1981	Urban Suburban Railway Transportation in JABOTABEK(M/P)	USRTJ	JICA - MoC
1982	Traffic Managment and Road Network Development	TRMND	IBRD - MoC
1985	DKI Jakarta Structural Plan	RUTR	DKI Jkta. - MoC
1986	Jakarta Urban Transport Programme	JUTP	IBRD
1987	The F/S on Urban Arterial Road System Development Study in Jakarta Metropolitan Area	ARSDS1	JICA - MPW
1990	The Study on Integrated Transportation System Improvement by Railway and Feeder Service in JABOTABEK Area	ITSI	JICA - MoC
1991	Traffic Management and Parking Policy Implementation	TMPPI	IBRD - MoC
1992	Traffic Impact Studies for Mixed Development in Sudirman CBD, Taman Anggrek, Pondok Indah Mall, Cempaka Putih, Kota Kasablanka, and so on	TISM	PT. Pamintori CiptaPrivate
1992	Feasibility Study on Area Traffic Control system Project	FS-ATCS	MoC
1992	Transport Network Planning and Regulation	TNPR	IBRD - MoC
1992	Jakarta Mass Transit System Study	JMTSS	GTZ - BPPT
1992	DKI Jakarta Strategic Planning	RENSTRA	DKI Jakarta
1993	Consolidated Network Plan	CNP	IBRD - MoC
1993	Jakarta Mass Transit System Development and Conceptual Design, Cost and Implementation for Underground System	JDCD	US Aid - BPPT
1993	Jabotabek Metropolitan Development Plan Review	JMDPR	IBRD - MPW
1993	The F/S on Urban Arterial Road System Development Study in Jakarta Metropolitan Area	ARSDS2	JICA - MPW
1996	Basic Design Study	BD	DKI Jkt. - IJEG
1996	Technical Assistance Project for Jakarta Urban Transport Short-Term Implementation Program	JUTSI	IBRD
1996	Jakarta Immediate action Programme	JIAP	IBRD
1997	Jabotabek Public Transport Review	JPTR	IBRD - MoC
1997	Technical Assistance Service for the Jakarta Primary Road Improvement Identification Project	JPRIIP	IBRD - MPW
1998	Structural Plan 2010, DKI Jakarta	SP2010	DKI Jakarta
1998	Preliminary Study for Railway Double Double Tracking on Bekasi Line Corridor	PSRDDT	JTCA - MoC
1998	DKI Jakarta Strategic Planning	RENSTRA	DKI Jakarta
1999	Revised Basic Design Study	BD/Rev.	JTCA - MoC

Source: JICA Study Team compilation.

<u>1993 Consolidated Network Plan</u>

The 1993 Consolidated Network Plan, which was prepared by an Inter-Departmental Working Group in February 1993, was geared at combining and integrating the results of three mass transit studies (i.e. ITSI, TNPR, and JMTSS), all three of which recommended a combination of regional and suburban rail services on the existing Bogor and Bekasi lines, including joint use of the Central and Tanjung Priok sections. The consolidated plan combines the principal system/network configuration alternatives introduced and discussed over the past decade by the ITSI study (JICA-MOC, 1990), the TNPR study (IBRD-MOC, 1992) and the JMTSS study (GTZ-BPPT, 1992).

The 1993 consolidated network proposal comprised new LRT alignments, rail alignments converted to LRT use and suburban and regional rail. The total length of the consolidated network was to be 225 km (Table 2.2.2 refers).

Table 2.2.2 Total Length Consolidated Mass Transit System

Parameter	Length
New LRT Alignments	80 km
Rail Alignments converted to LRT	65 km
Suburban & regional rail	80 km
Total	**225 km**

Source : JICA Study Team compilation.

The 1993 consolidated network proposed that the complete mass transit system be realized by the year 2015. Implementation was suggested in phases. Phase 1 was to realize two lines, i.e. one from Blok M to Kota (Merdeka - Harmoni underground), and the second line was to include two spurs from the Tangerang - Bekasi Line together with the first connecting to Soekarno Hata Airport.

<u>1999 Revised Basic Design</u>

The 1999 revised basic design study reviewed the basic design study undertaken between 1995 to 1997 by the DKI Jakarta and the private sector Indonesian-Japanese-European Group (IJEG). The 1999 revised basic design paid particular attention to the effects of the 1997 economic crisis on the MRT's project outlay features in technical, economic and financial terms. The study recommended implementation of the MRT on the same route corridor, namely from Fatmawati to Kota.

The revised basic design recommended to split implementation into two principal phases as follows:

1. Phase I at a stretch from Fatmawati to Monas. This Phase I was to be sub-divided into three sub-phases, nemely (a) Phase I-1 Fatmawati to Senayan; (b) Phase I-2 Senayan to Dukuh Atas; and (c) Phase I-3 Dukuh Atas to Monas; and

2. Phase II from Monas to Kota.

2.3 Status of MRT Project

The Government of Indonesia (GOI) and the local government of DKI Jakarta attaches high priority to the implementation of the MRT project. The GOI has in a missive dated 26 May 2000 of the Office of the President included the above subject project as a priority project for Special Yen Loan (SYL) consideration and funding.

2.4 Assessment Approach

A selective appraisal approach was adopted for the MRT project proposal, in view of the many differences in basic project definition among the relevant review documents. The project definition reflected in this document is based on the system configuration as outlined in the 1999 revised basic design study.

As has been observed above, the concept for the MRT goes back to the early 80s. The selective approach adopted for reviewing the MRT project request attempts to take all relevant dynamic changes in the overall enabling environment for MRT realization into account by employing a comprehensive checklist [3]. However, primary data source for the assessment exercise had to be the following document:

Japan Transport Cooperation Association,, Revised Basic Design Study For Jakarta MRT System, February 1999.

The nature of the project demanded that particular emphasis was to be placed in the assessment exercise on:

1. The implications for the implementing entity resulting from the MRT project's internal rate of return (IRR), taking into account prevailing regulatory and legal demands and limitations
2. A realistic financing plan, and
3. Implications for a suitable long-term institutional structure for MRT realization and its operations and management.

[3]) See Chapter 2 of the Interim Report (Volume II) for details.

Chapter 3

MRT Project Definition

3. MRT Project Definition

3.1 Core Problems & Issues

It is necessary to structure the difficulties impeding on MRT realization and to identify the principal decision takers (actors) together with the implicit alternative courses of action, which they have, in order to address such difficulties. Key factors of MRT realization are summarized as:

1. **Core Problem**. Increasing economic and social cost measured in terms of growing travel time, air pollution and lost economic activities are the core problem caused by the expanding traffic volume on the road network. Average travel speeds on the "TB Simatupang – Kota" survey route were recorded by the travel speed survey as 17.3 km/h (bus) and 18.7 km/h (car) during morning peak hours, and 9.3 km/h (bus) and 13.7 km/h (car) during evening peak hours[1]. Such average travel speeds are close to a "stop-and-go" traffic flow. This situation is likely to worsen in future with associated economic and social cost. Figure 3.1.1 illustrates the major components of problems and issues related to MRT realization.
2. **Primary Project Objective and Target**. The primary objective of the project is, therefore, in the perception of the authorities, to provide a major impact on reducing congestion in the MRT corridor in particular and in the whole region in general by providing appropriate means for mass transit.
3. **Implementing Entity**. However, there are many intertwined issues that need to be addressed in the context of MRT realization. The proposed MRT would be Indonesia's first urban mass transit system and cross-country analysis and/or "best international practice" in the planning, construction and operation & management of such systems cannot be used easily as a "model" for the particular circumstances prevailing in DKI Jakarta.

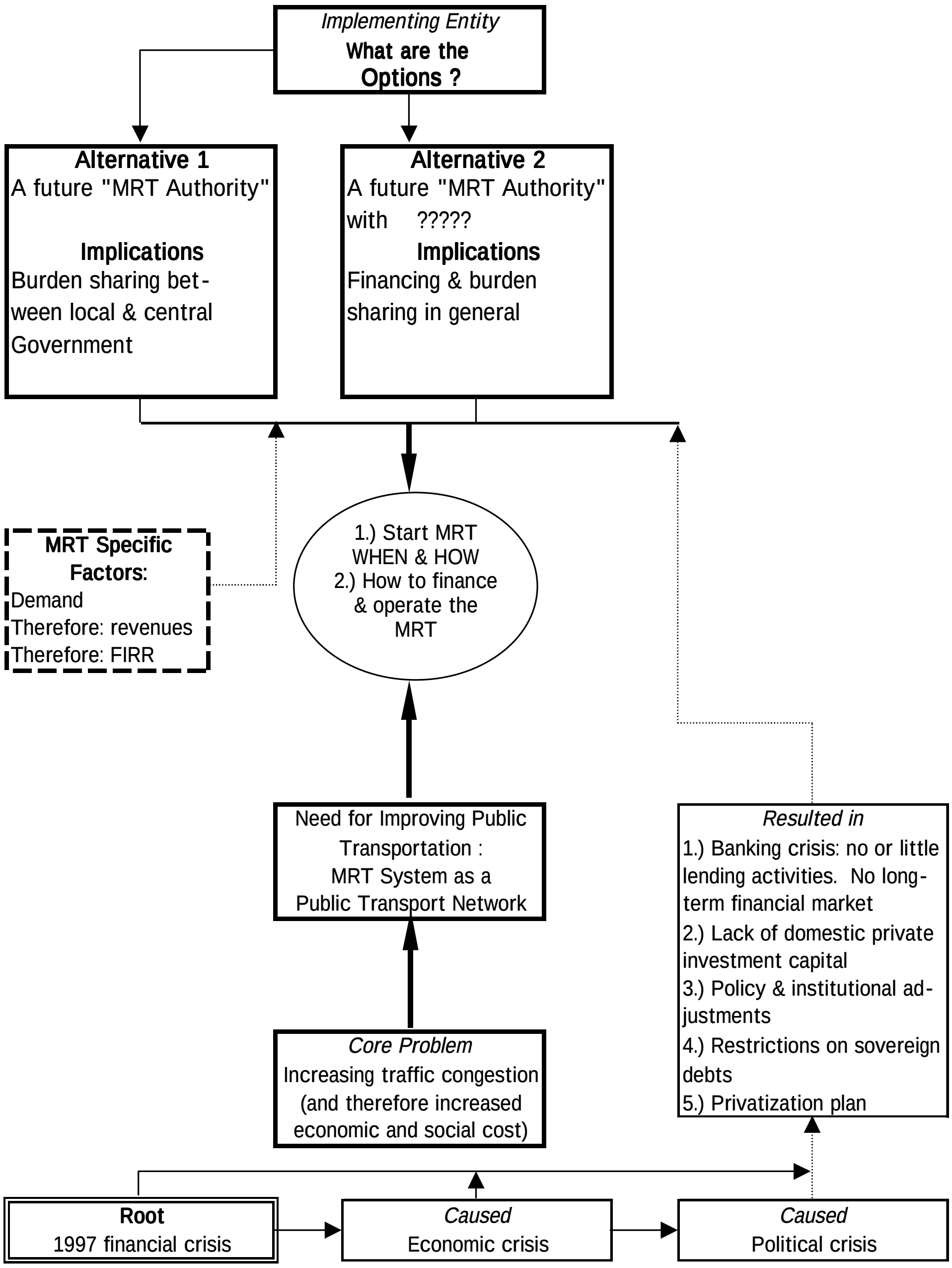
   First, most MRT systems in the world currently in operations are no financial success stories. Secondly, the existing Railway Law No.5 stipulates that the Government is responsible for the provision and maintenance of railway infrastructure, including tracks and stations. The law allows the delegation of such functions to an "executing body".

   The management of railway infrastructure may, de jure, be undertaken by such "executing body". The primary responsibility of the executing body is the provision, management and maintenance of rolling stock. The law allows that function to be implemented by other business entities, including private business entities.

   The law identifies the existing P.T. KAI as this executing body. This regulatory framework has an obvious direct and strong impact on the potential MRT project structure, a financing plan, as well as any risk distribution among major stakeholders, and so on.

[1]) According to the travel speed survey conducted by the Study Team in May, 2000.

4. **Principal Implementation Options/Alternative 1.** There are two major alternative courses of action or implementation options that can be pursued. However, both options will have to involve, because of the legal situation, in one way or another both, DKI Jakarta and P.T. KAI. Alternative 1 may entail that a new entity, say a "Mass Rapid Transit Authority", or MRTA, is legally established. It is not sure how long the legal establishment of a MRTA would take. Be that as it may, if the MRTA would be established there would have to be involvement of the entities already identified above. The risk distribution among these entities would, in principle, depend on their individual functions and well as the "stake" they are holding in the MRTA.



Source: JICA Study Team.

Figure 3.1.1 Core Problem and Key Issues

5. **Alternative 2**. This alternative implies that the MRTA "teams up" with other than the above entities including private sector entities. Such approach is possible, but difficult to visualize under the currently prevailing economic and project specific risk circumstances. A full private sector driven MRT project is unrealistic.
6. **Absolute Factors.** It should also be highlighted with respect to these scenarios that what constitutes a realistic course of action is determined to a very large extent by the demand on the MRT, therefore potential revenues and, therefore, the project's financial capacity. This and related issues are discussed in detail later.

3.2 MRT Project Definition

It was essential for the review and assessment of the MRT project, in view of the dynamics in Indonesia's overall enabling environment and potentially conflicting positions of various Indonesian stakeholders, to ascertain the MRT project scope or in other words the MRT's basic system configuration, by scrutinizing and confirming fundamental assumptions. Basic assumptions and related important indirect parameter were confirmed by employing a simple assumption matrix discussed with the relevant Indonesian authorities. In fact, the Study Team discussed and verified in detail five (5) different MRT system configurations[2] with their various alignment and elevated/underground options. "Alternative 3B" was eventually selected[3].

The following components have been confirmed and they constitute therefore the elements of the MRT review exercise. They also constitute the major elements for base cost and any subsequent calculations[4]:

1. The alternative 3B case is a revised "alternative 3A" case with shallow cut & cover method at the Fatmawati station, in order to decrease the construction cost vis-à-vis case 3A.
2. The depot location will be at Fatmawati at ground level;
3. The total length of the MRT will be around 15.5 km between Fatmawati depot and Monas;
4. There will be 13 stations, out of which 7 will be underground (including the station at Fatmawati) and six elevated stations;
5. The project will comprise investment for initial rolling stock; and
6. Engineering services covering design and supervision services for the MRT itself and the installation, testing and supervision of the hardware components form an integral part of the project definition.

All further considerations in this review exercise are based on the MRT project definition as outlined above.

[2]) Please consult Section 4.1.4 in Chapter 4 for an in-depth discussion on this issue.
[3]) Please consult Chapter 4 for the technical reasons.

Chapter 4

Review of MRT Engineering Aspects

4. Review of MRT Engineering Aspects

4.1 Alignment Plan

4.1.1 Basic Concept of Alignment Plan for New Urban Railway

Road and railway networks in Jakarta have developed principally along a north-south axis, due mainly to the northward flow of rivers/canals and other physical constraints. The existing Jabotabek railway function has evolved from an inter-city transport service to an urban transport service, and the latter function is set to expand further with such new MRT network developments as the Fatmawati-Kota (North-South) and Tangerang-Cakung (East-West) routes.

In order to implement the MRT, the alignment plan needs to be examined from a technical as well as planning aspects, such as:

- **National Plan:**

The new urban railway should be planned based on the national interests and people's consensus, because of the huge investment cost required at the very beginning of the implementation stage.

- **Grade Separation:**

In principle, the new urban railway shall be planned with grade separated crossings. An underground, elevated or a ditch type structure can be employed to achieve grade separation.

- **Construction Period:**

It is likely that the construction of new railway will take a relatively longer period, due to safety reasons and the relocation of utility facilities under roads, and it will be more difficult to stick to the construction schedule.

- **Options of tunnel construction method:**

The cut & cover construction or shield tunnel methods are now technically viable as the countermeasure to the soft ground.

Since the shield tunnel method is not affected from flood except the surrounding area of vertical shaft, this method can be advantageous to reduce construction period significantly.

4.1.2 Condition of Adoption for Underground Railway and Elevated Railway

The structure of an underground railway should be adopted in general since the difficulty of land acquisition for the railway corridor in downtown has been increasing. On the other hand, in case of suburban area, an elevated railway is adopted in most cases. Therefore, the combination of underground and elevated railway is of significant importance.

Comparisons with underground railway and elevated railway are shown in Table 4.1.1.

Table 4.1.1 General Comparison with Underground and Elevated Structure

Item	**Underground Railway**		**Elevated Railway**	
1.Construction Cost	In general, construction costs of subway are as three times high as that of elevated railway		Depend on the conditions planned site.	
2.Construction Period	long		short	
3.Auxiliary Railway Facilities	Ventilation, drainage, fire prevention and waterproof facilities are required		Elevated railway needs fewer facilities	
4.Urban Scenery	-As the viewpoint of urban space :	Better	-As the viewpoint of urban space :	Worse
5.Riding Comfort	-A fine view : -Noise in the car :	Worse Worse	-A fine view : -Noise in the car :	Better Better
6.Noise Pollution	-For people living along railway :	Almost no problem	-For people living along railway :	Worse
7.Earthquake Disaster	A few damages of disaster by strong structure of tunnel		Much damage by earthquake	
8.Disaster Prevention	By the fire accident in tunnel, it is possible to become a big disaster.		Better than underground	

Source: Based on "Railway Technical Handbook in 1997" by Hiroshi Kubota

4.1.3 Plan of Revised Basic Design (Base Case) for MRT

The section between Fatmawati and Kota in "Revised Basic Design" is approximately 19.6 km and it includes 18 stations. This alignment, as shown in the Figure 4.1.1, runs along the corridor starting from the southern Jakarta at R.S. Fatmawati, and goes up to Panglima Polim, Sisingamangaraja, Jenderal Sudirman, M.H. Thamrin and Gajah Mada / Hayam Wuruk.

In Revised Basic Design of MRT, five elevated stations are planned between Fatmawati and Monas in Phase-1. Five elevated stations between Harmoni and Jakarta Kota are planned as Alternative 1 in the Phase 2. In addition, an underground guideway between Harmoni and Jakarta Kota is planned as Alternative-2.

Hereinafter, the Alternative-1 of Revised Basic Design is called as "Base Case", and it will be developed to several cases.

The alignment plan of Base Case (Phase 1) is shown in Table 4.1.2.

Table 4.1.2 Base Case (Based on Revised Basic Design)

Section	Distance	No. of Station	Structures
Fatmawati Depot	-	-	Ground
Fatmawati – Blok M	7.6 km	5 Stations	Elevated Guideway
Senayan – Monas	7.8 km	8 Stations	Underground
Total	15.4 km	13 Stations	

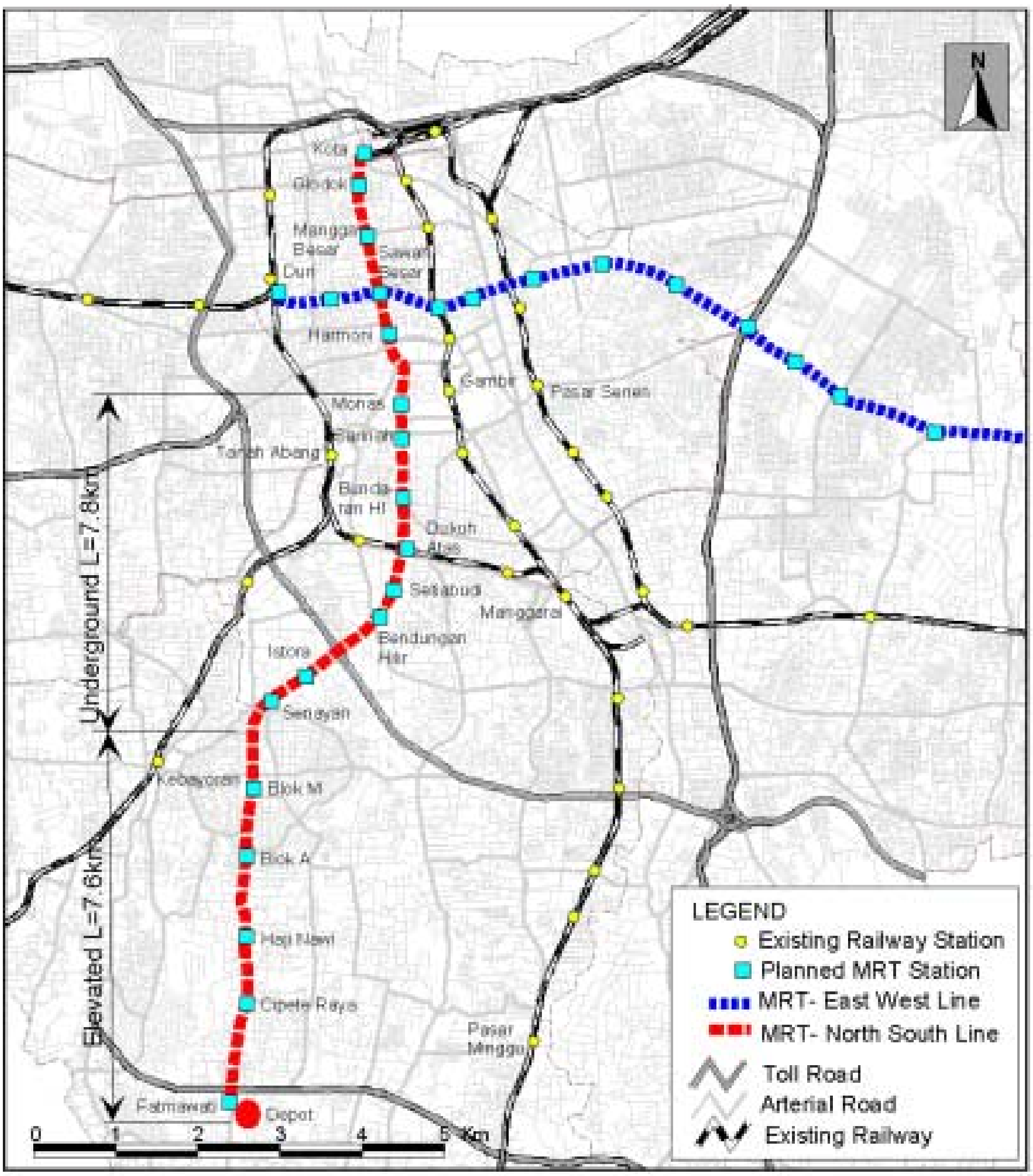


Figure 4.1.1 Route Plan of Base Case

Base Case:

This case was recommended in the “Revised Basic Design” conducted by JTCA in 1999. Elevated structure between Fatmawati and Blok M was recommended in order to minimize the construction cost of this section.

4.1.4 Review of Alternative Alignment Plans

Alternative alignment/structure plans of Base Case were discussed in technical / working group meetings and revised accordingly. The main issues of discussions are described below.

(1) Main Points of Modification from “Base Case Alignment”

a) Since a transition trough section (opening section) between underground and viaduct structure is located on JL. Sisingamangaraja (11 k 670 m – 11 k 910 m) it is difficult to acquire private land for widening the relevant road sector.

⇩

Modification to Alternative 2

b) The elevated structure plan crossing the existing toll way at Fatmawati should be revised to an underground guideway plan to avoid relatively steep vertical alignment and adverse environmental impact on Fatmawati Hospital.

⇩

Modification to Alternative 3A(Refer to Table AP4-1,AP4-2 and AP4-3)

c) If the land acquisition to the west of Jl. Fatmawati is possible, Alternative-3A shall be revised from double floor to single floor station. At the same time, shallow cut & cover construction method shall be applied, since hard silt was found around Fatmawati area during the excavation of toll road construction.

⇩

Modification to Alternative 3B

Eventually, the four Alternatives were selected as the results of discussions on the alignment plan of MRT at the technical / working group meetings. Outline of the Base Case and other alternative plans are shown in Table 4.1.3 and Figure 4.1.2.

Table 4.1.3 Outline of Alternative Plans

Case	Elevated	Underground	No. of Station	Remarks
Base Case	7.6 km	7.8 km	13 Stations	Revised Basic Design
Alternative-1	0 km	15.6 km	13 Stations	Similar to Basic Design
Alternative-2	9.2 km	6.2 km	13 Stations	
Alternative-3A	7.8 km	7.8 km	13 Stations	
Alternative-3B	7.5 km	8.0 km	13 Stations	Shallow Cut & Cover

Note : Types of structures of each case are shown in Table AP 4.17 through 4.20.

Figure 4.1.2 Comparative Case of Jakarta MRT

(2) Outline of Alternative 1

Table 4.1.4 Alternative 1

Section	Distance	No. of Station	Structures
Fatmawati Depot	-	-	Ground
Fatmawati – Monas	15.6 km	13 Stations	Full Underground
Total	15.6 km	13 Stations	

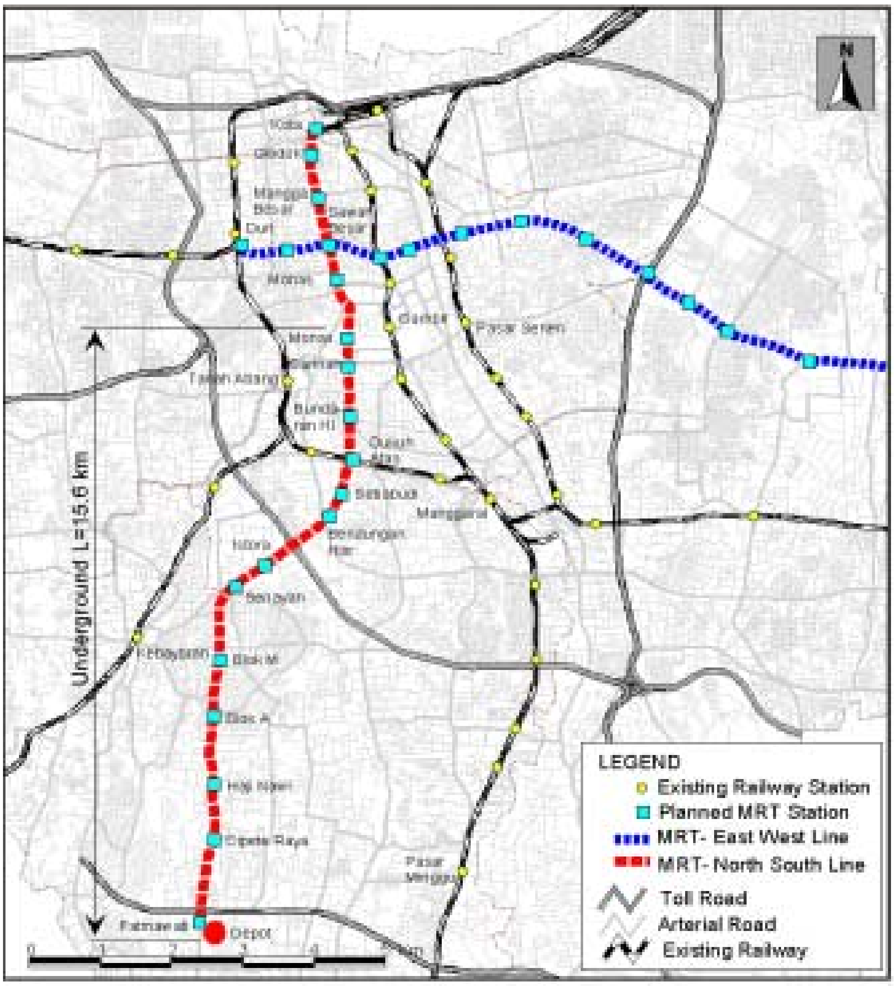


Figure 4.1.3 Route Plan of Alternative 1

Alternative 1:

This case is almost the same as “Basic Design” studied by IJEG in 1996. Basic Design recommended a full underground and Jakarta Gudang freight yard as a MRT Depot. A difference between “Basic Design” and “Alternative 1” lies in the location of depot. In this case, Fatmawati, instead of Kota is recommended to place the depot, because of a change in construction priority by the occurrence of social and economic turmoil in Kota area in 1998.

(3) Outline of Alternative 2

Table 4.1.5 Alternative 2

Section	Distance	No. of Station	Structures
Fatmawati Depot	-	-	Ground
Fatmawati – Istora	9.2 km	7 Stations	Elevated Guideway
Bendungan Hilir – Monas	6.2 km	6 Stations	Underground
Total	15.4 km	13 Stations	

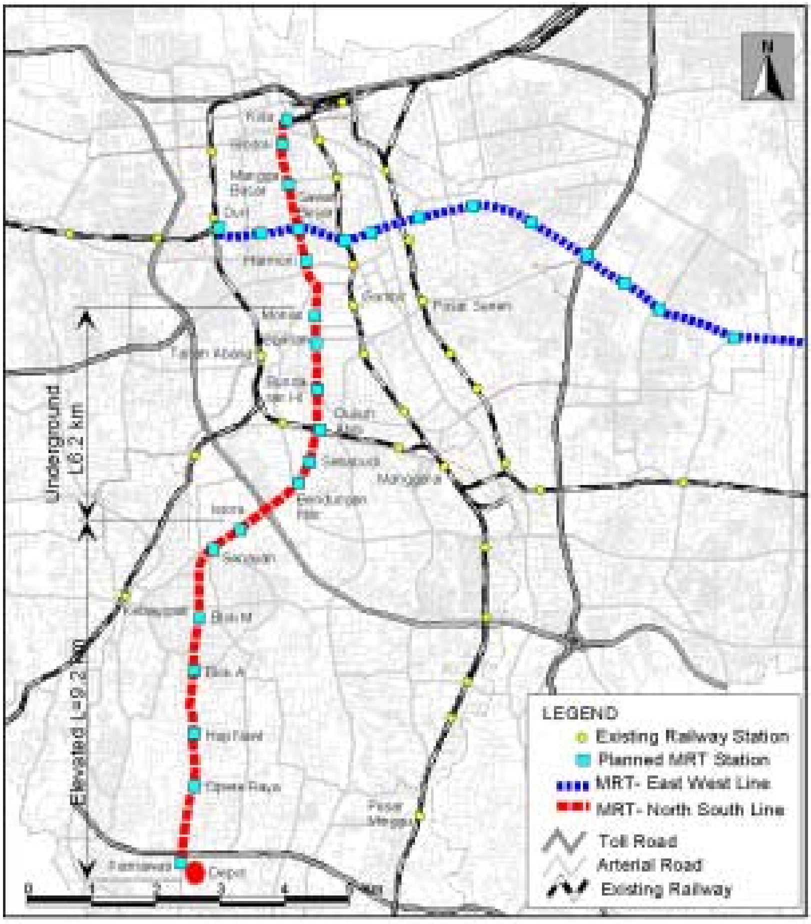


Figure 4.1.4 Route Plan of Alternative 2

Alternative 2:

Alternative 2 is derived from "Base Case". Results of the site survey around the planned transition trough show that the area along Jl. Sisingamangaraja was dominated by residential land use. Therefore, a widening road required to place the transition trough is difficult in this road section. The entrance to the underground is moved closer to Semanggi Inter-change in Alternative-2. This change results in the extension of elevated structure and lower construction costs accordingly. (Extended length=1.7 km).

(4) Outline of Alternative 3B

Table 4.1.6 Alternative 3B

Section	Distance	No. of Station	Structures
Fatmawati Depot	-	-	Ground
Fatmawati Station	1.3 km	1 Station	Underground
Cipete Raya - Istora	8.0 km	6 Stations	Elevated Guideway
Bendungan Hilir – Monas	6.2 km	6 Stations	Underground
Total	15.5 km	13 Stations	

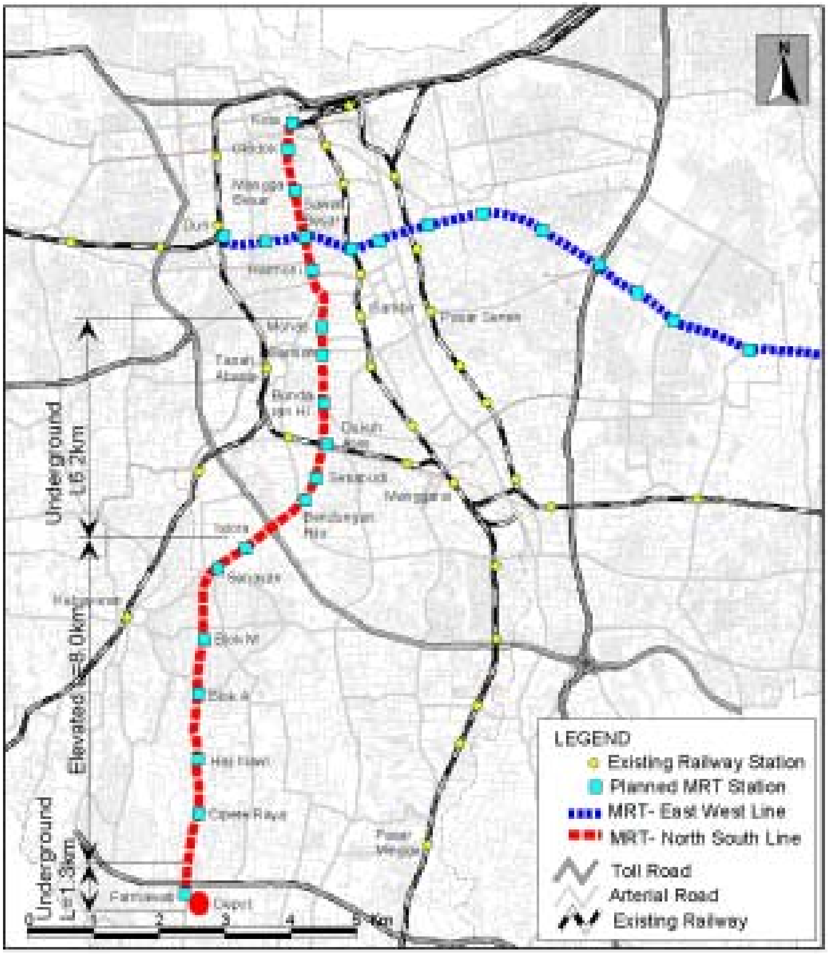


Figure 4.1.5 Route Plan of Alternative 3B

Alternative 3B:

This case is based on "Alternative 2", but it employs the underground structure right before the existing toll way where it crosses by a shallow cut & cover method up to Fatmawati depot. It could decrease negative environmental impact to the Fatmawati area. However, land acquisition (A=21,000m2) is required additionally to Base Case to build Fatmawati station. A Single layer type station will be adopted for Fatmawati station because of hard silt and reduction of construction cost. (Refer to Figure 4.1.6)

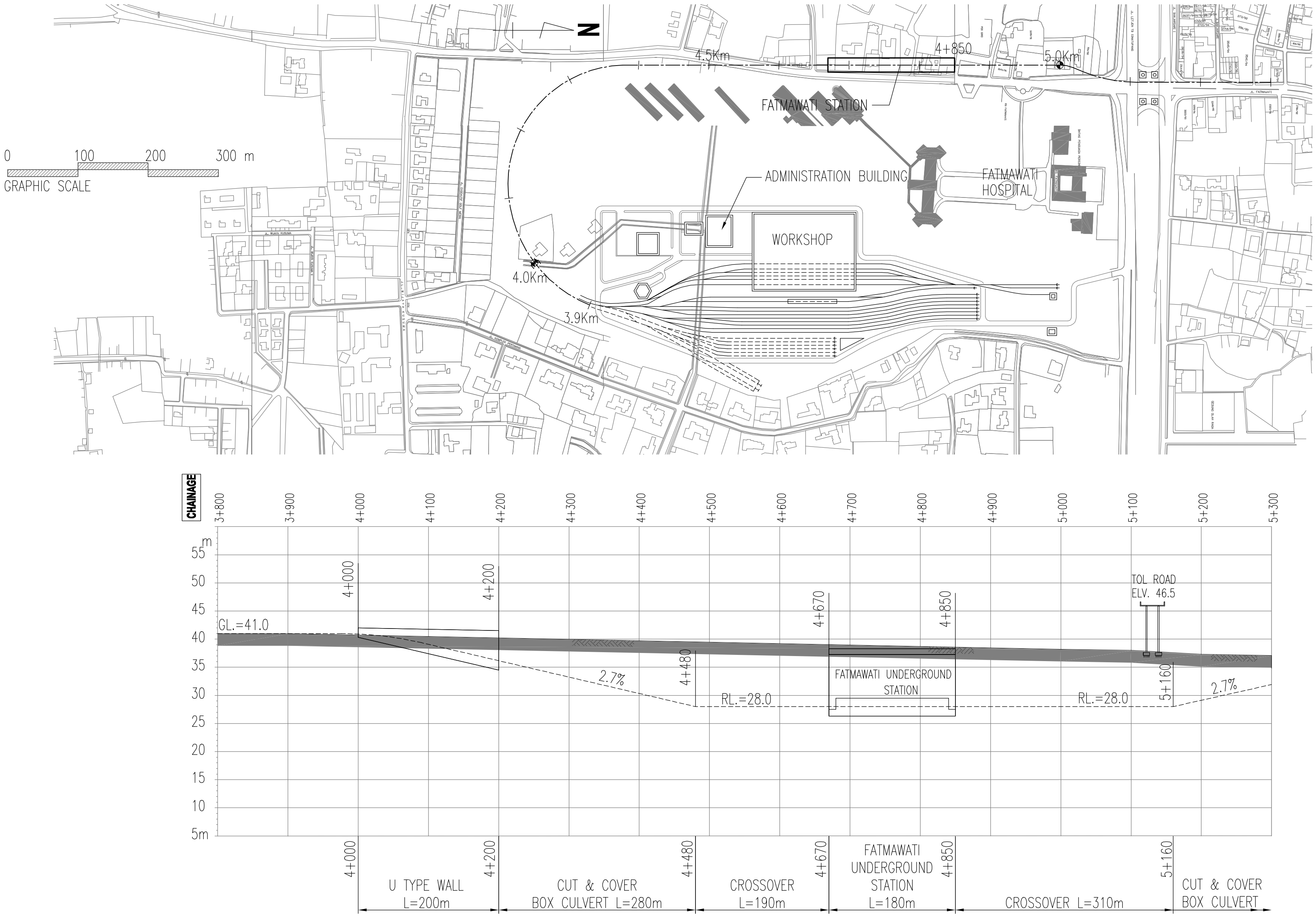


Figure 4.1.6 Plan and Profile Transition Trough at Fatmawati Depot (In Case of Alternative 3B)

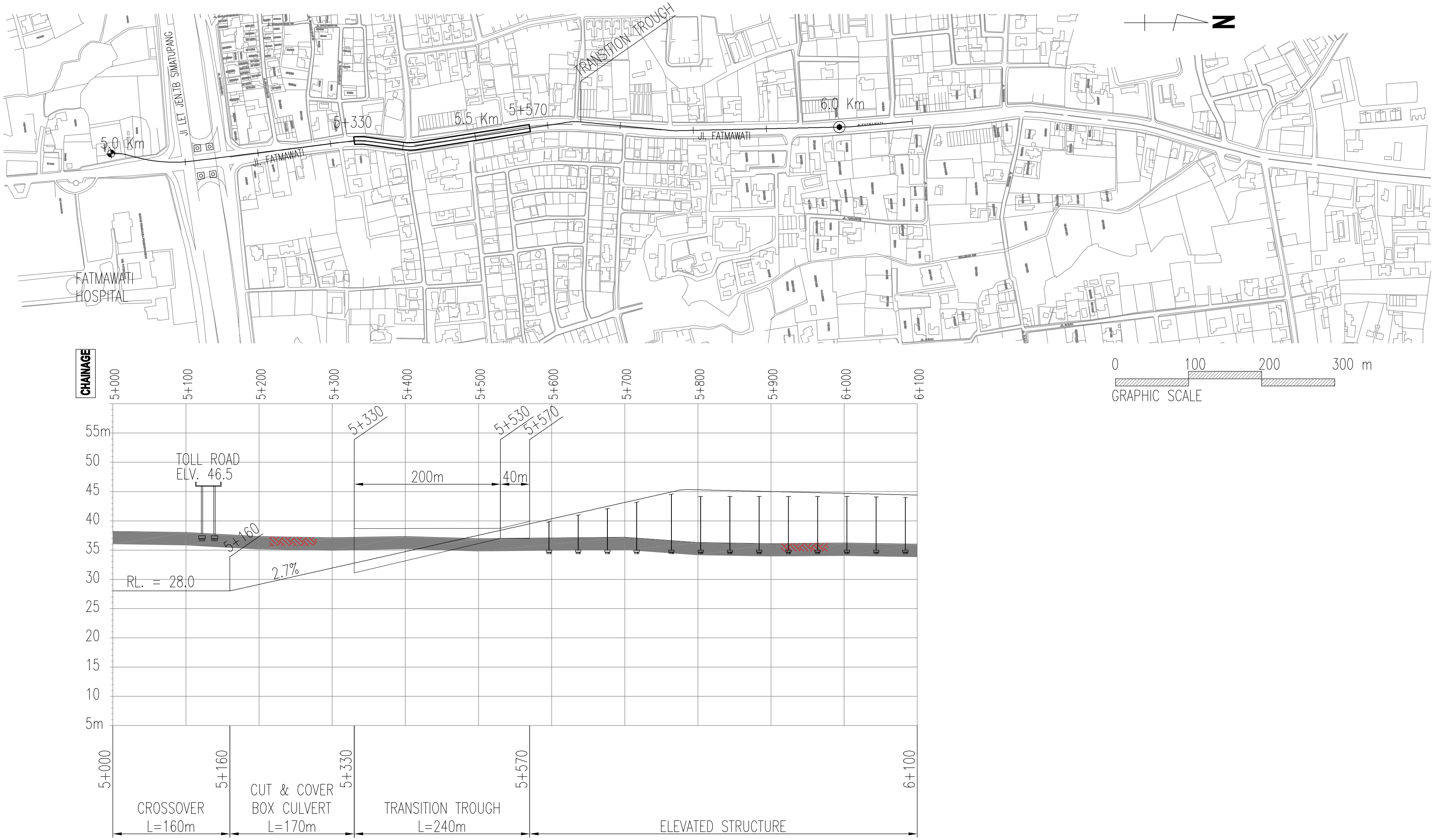


Figure 4.1.7 Plan and Profile Transition Trough (In Case of Alternative 3B)

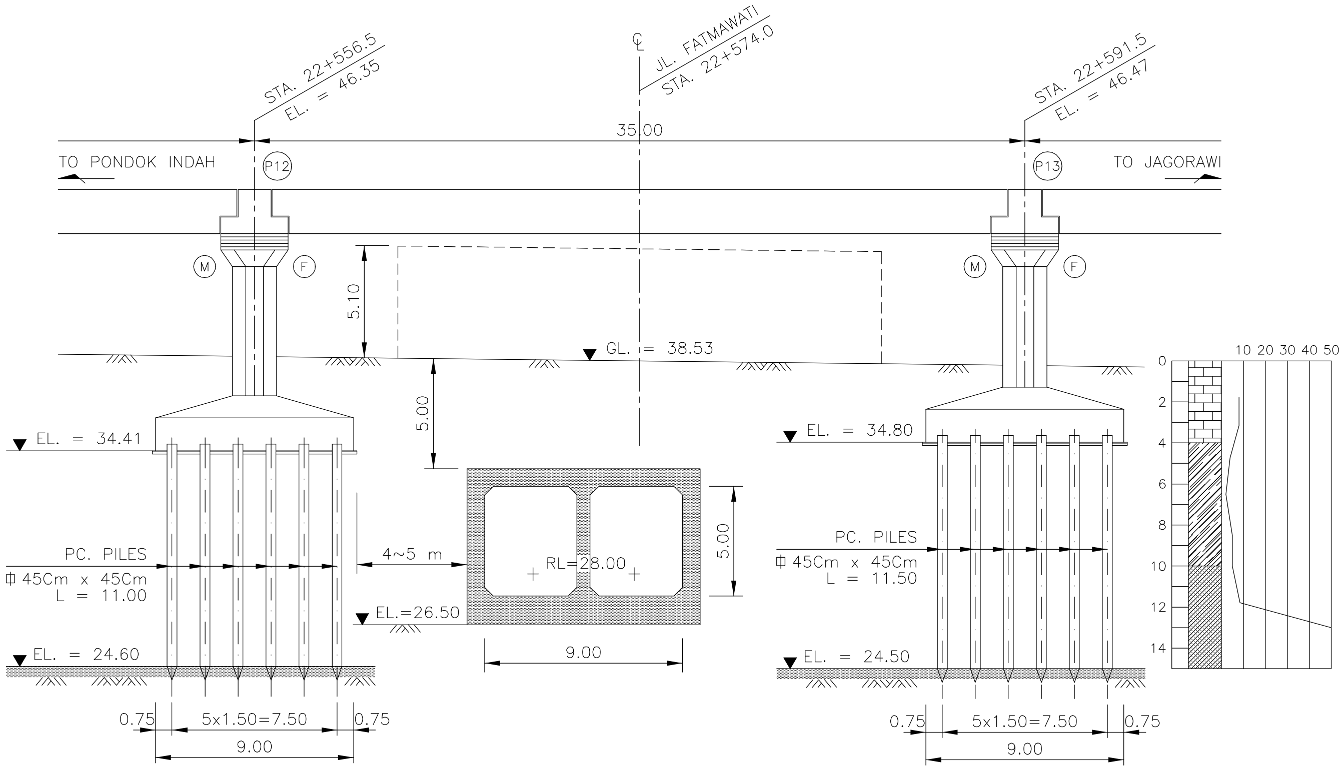


Figure 4.1.8 Profile Plan at Fatmawati Tollway below

4.1.5 Recommendation of MRT Alignment Plan

As compared among 4 Alternatives, “Alternative 3B” is recommended for the following reasons:

- The location of transition trough from the elevated structure to the tunnel is suitable than other Alternatives except Alternative 1 (Because alignment of Alternative 1 is full underground).
- The route alignment of Alternative 3B entails comparatively lower construction cost.
- The construction of Fatmawati underground station by using shallow cut & cover method is environmentally sound compared to other Alternatives (Base Case, Alternative 1 and Alternative 2).

Characteristics of Alternative 3B Route plan and profile between Cipete Raya – Monas are shown in Appendix Figure AP4-4 through AP4-10. Review of transition trough section is described in Appendix chapter 4.9.

- As the length of elevated structure is longer than other Alternatives, the length of tunnel section can be minimized.
- The location of transition trough at Semanggi inter-change is better than Base Case at Jl. Sisingamangaraja, because of less difficulty land acquisition. Other Alternative locations for transition trough couldn’t be found along this corridor.
- With respect to environmental issues, the connection guideway to depot is better, because the gradient of the guideway structure can be minimized.

4.2 Design Standards

Design standards of Revised Basic Design for MRT take into account, efficiency and cost as the major criteria. In addition, these consider the attractiveness of the MRT system to passengers and the public.

4.2.1 Capacity of Transport System

Various options shall be taken into account prior to deciding the design standards of the MRT system.

The maximum capacity per train formation, number of train formation and operation plan were based, in this study on the transport capacity applied to the MRT / Subway as shown in Table 4.2.1.

Table 4.2.1 Transport Capacity per train formation

System	Normal Capacity (Congestion Ratio=100%)	Maximum Capacity (Congestion Ratio=200 - 250%)	Target Transport Capacity (Congestion Ratio=180%)
MRT / Subway	140 Psn x 6 cars = 840 Psn	(140x250%) x 10 cars =3,500 Psn	(140x180%) x 10 cars =2,520 Psn
Liner Metro	100 Psn x 4 cars = 400 Psn	(100x235%) x 8 cars = 1,880 Psn	(100x180%) x 8 cars = 1,440 Psn
Monorail	115 Psn x 2 cars = 230 Psn	(115x225%) x 6 cars = 1,550 Psn	(115x180%) x 6 cars = 1,240 Psn
New Transport	75 Psn x 2 cars = 150 Psn	(75x225%) x 6 cars = 1,010 Psn	(75x180%) x 6 cars = 810 Psn
LRT	57 Psn x 3 cars = 171 Psn	(57x225%) x 4 cars =510 Psn	(57x180%) x 4 cars =410 Psn
Bus	50 Psn/car	100 Psn /car	-

Source: "Urban Transport Plan Manual for Developing Country" in 1998

4.2.2 General Design Standards

The main design standards for the MRT system were discussed with the Indonesian counterpart and resulted as shown in Table 4.2.2.

Issues on the gauge are discussed further in "Major Issues in Engineering Review in Section 4.3.

Table 4.2.2 Main Design standards of Civil & Track Works

Main Items	Contents	Remarks
Gauge	1,067 mm	(Refer to Chap. 4.3)
Min. curvature radius		.
On Main track	300 m (desirable)	200 m (absolute minimum)
Along platform	800 m	-
At platform ends	500 m	-
On side track	140 m	including forwarding track
Max. cant	150 mm	
Max. gradient		
At main track	3.5 %	Min. 0.2 %
Along Platform	0.0 %	-
At forwarding track	4.0 %	-
Min. of drainage	0.2 %	
Min. vertical radius of curvature	3,000 m (desirable)	1,600 m (absolute min.)
Thickness of bed		
Concrete bed	500 mm from rail top to bottom surface	
Ballast bed	650 mm	in general
Unit weight of rail		
Main track	54 kg/m	
Side track	54 kg/m	including Depot
Distance between Centers of double Track		
Main track	Not less than 3.9 m	
Side track	Not less than 3.6 m	
Platform, staircase		NFPA-130
Effective length	Train length + 5 m	
Width incl. Stairs (island type)	Not less than 7.5 m	more than 3 m at platform end
Width incl. Stairs (separate type)	Not less than 4.0 m	more than 2 m at platform end

Note: Based on Review of "Revised Basic Design"

4.2.3 Review of Main Design Parameter

(1) General Design Standards

Differences in the project configuration and main design standards between “Revised Basic Design” and its review result by JICA Study (Alternative 3B) are shown in Table 4.2.3.

Table 4.2.3 Differences of Revised Basic Design and Review by JICA Study (General)

Item	Revised Basic Design (Phase 1) Issued 1999	Review Result by JICA Study (Phase 1 : Alternative 3B)
Project Configuration		
1.Planned Section	Fatmawati – Monas (L=15.3 km)	Fatmawati – Monas (L=15.6 km)
2.Planned Structure	-Elevated: Fatmawati – Blok M -Underground: Senayan - Monas	-Underground: St. Fatmawati -Elevated: Cipete Raya – Istora -Underground: Bendungan Hilir - Monas
3.No. of Station	-5 Elevated Stations -8 Underground Stations	-6 Elevated Stations -7 Underground Stations
4.Depot Location	-Fatmawati Golf Course	-Fatmawati Golf Course
Alignment		
1.Horizontal Alignment	Refer to Figure 4.1.14 - 20	Refer to Figure 4.1.14 - 20
2.Vertical Alignment	-Max. 3.1 % (At Transition Trough)	-Max. 2.8 % (At Depot Connection)
3.Cross Passages	-1 Cross Passages and 2 CP with Exit Shaft	Same as Revised Basic Design (Hereinafter “R.B.D.”)
Main Design Parameters		
1.Gauge	1,435 mm	1,067 mm
2.Unit Weight of Rail	- Main track : 54 kg / m - Depot : 43 kg / m	- Main track : 54 kg / m - Depot : 54 kg / m
3.Maximum Gradient	- At main track : 3.5 % - At forwarding track : 4.0 %	- At main track : 3.5 % - At forwarding track : 4.0 %
4.Average Speed	35 km/ h	35 km/ h
Stations		
1.Width of Platform in Underground Station	-Platform width : Island type 11 m, Side type;5mx2 -Station Box width: 19 m (in case of 1 island platform)	Same as R.B.D.
2.Width of Platform on Elevated Station	-Platform width : Island type 8m, Side type;5mx2	Same as R.B.D.
3.Length of Platform	145 m	145 m
4.Escalator	Up and down-escalators	No need down-escalator
5.Toilet	Public toilet	Same as R.B.D.

Source: JICA Study Team

Major review results on design standards are described as follows:

- Issues about the gauge are discussed in “Major Issues in Engineering Review” in chapter 4.3.
- The unit weight of rail at depot is recommended to be 54 kg / m in order to gain the advantage of minimum maintenance.

(2) Platform Width

Generally, a formula to obtain a platform width is applied, and which requires the number of alighting and boarding passengers per train, and the number of trains per unit hour as input parameters. However, it is acceptable at preliminary study stage to determine the platform width in accordance with the criteria shown in Table 4.2.4. If an enough platform width cannot be obtained because of limitations, such as overhead road width, there are some countermeasures to avoid convergence of alighting and boarding passengers. For instance, an increase of the number of stairways is one effective way to solve the problem.

Table 4.2.4 Platform Width

Station	Daily Passengers	Island Platform	Opposite Facing Platform
Residential areas	Less than10,000	8 m	4 m
Residential and commercial areas	130,000	8-10 m	4-5 m
Commercial areas	350,000	10-12 m	5-6 m
Commercial area and terminal stations	More than 50,000	More than 12 m	More than 6 m

(3) Station and Platform Depth

A platform depth depends on the depth of the tunnel. Tunnel depth is determined by the underground water level, thickness of coverage, underground structures and so on. The specifications of stations are shown in Table 4.2.5. Basic Forms of subway station are described in Appendix chapter 4, Section 4.17.

Review results of other design standards are summarized in Appendix to Chapter 4, and which deals with E/M for Rolling Stock, Power Distribution System, Overhead Contact Line, Signaling System, Safety and Security System and Communication System. Cut – and – cover shield method is described in Appendix chapter 4, Section 4.13.

Table 4.2.5 Specification for MRT Stations

Name of Station	Location	Ground Height	Rail Level	Type of Platform	Protection Wall
Fatmawati	4+760	38.8	28.0	Island x 2	Soil Mixing Wall
Cipete Raya	6+700	28.2	39.5	Side x 2	(Elevated)
Haji Nawi	8+010	28.1	39.3	Side x 2	(Elevated)
Blok A	9+415	25.0	37.2	Side x 2	(Elevated)
Blok M	10+810	23.1	34.3	Island x 1	(Elevated)
Senayan	12+300	15.3	28.0	Side x 2	(Elevated)
Istora	13+020	14.8	22.0	Side x 2	(Elevated)
Bendungan Hilir	14+719	11.0	-7.0	Island x 1	Soil Mixing Wall
Setiabudi	15+524	11.9	-5.4	Island x 1	Soil Mixing Wall
Dukuh Atas	16+464	7.4	-8.9	Island x 1	Soil Mixing Wall
Bundaran HI	17+334	4.2	-12.0	Island x 1	Diaphragm Wall
Sarinah	18+229	3.4	-13.2	Island x 1	Diaphragm Wall
Monas	19+150	3.8	-13.0	Island x 1	Diaphragm Wall

4.2.4 Overview of Recommended MRT System and Operation

The recommended design standards for the overall operation system are summarized in Tables 4.2.6 and 4.2.7.

Table 4.2.6 MRT Operation System / Depot Facility

Item	Specification
1.Depot Area / Maintenance Capacity	19.6 ha / 66 Railcar / Stabling Tracks, Inspection Shed
2.Gauge and Track	1,067 mm and UIC 54 kg/m Class
3.Traction Power System	DC 1500 kV, Overhead Catenary Line
4.Power Substation System	150 kV Bulk Supply, Dual Incoming Substation
5.Signal and Train Control	Automatic Signal with CTC and ATS System
6.Telecommunication System	Train Radio and Communication System

Table 4.2.7 Train Operation

Item	Specification
1.Electric Railcar	6-Railcars, Electric Multiple Unit (E.M.U)
2.Max. Train Speed	100 km/h with VVVF Control
3.Max. Acceleration	0.9 m/sec^2 (Acceleration and Deceleration)
4.Number of Train	11 E.M.U (66 Railcars) – 23 E.M.U (138 Railcars)
5.Railcar Dimension	Approx. 3.1m(Width) x 3.7m(Height) x 23m(Length)
6.Accommodation Capacity	Approx. 48psn(Seat), 140psn(Normal), 350psn(Max.)

The MRT will be planned as a heavy rail mass transit system, operating in a north-south 15.5 km corridor between Fatmawati and Monas on elevated and underground guideways. There will be five elevated stations and eight underground stations at approximately 0.8 to 1.9-km intervals. Almost all of the guideway will be constructed over or under the public right-of-way. The elevated guideway will be constructed 12 m above the ground, while the underground will be 16 m beneath. Gradients are limited to a maximum of 2.7 %. The minimum curvatures are 300 m horizontally and 3,000 m vertically.

Passengers enter stations from the street level entrances, using stairways and escalators. Elevators are equipped for the handicapped. An automated fare collection system will be applied for minimal passenger delays. Stairways and escalators provide access to platforms. A sufficient space and capacity is set aside to ensure safe evacuation in an emergency. The underground platforms are segregated from the tracks by a full-height platform screen door system along the length of the platform.

One train consists of six cars with air-conditioning equipment. The cars are made of stainless steel and steel wheels running on a narrow gauge (1,067 mm) track. Each vehicle is about 23 m long and 3.2 m wide with 48 seats. The cars have four doors on each side to get smooth boarding and alighting. Trains receives 1,500 V DC power from an overhead line and use a VVVF (Variable Voltage Variable Frequency) drive system to accelerate and decelerate the train at 0.9 m/s2 (maximum).

Review of E/M for rolling stock, power distribution system, overhead contact line, signaling system, communication system and safety/security system are described in Appendix to Chapter 4, Section 4.2 through 4.7.

4.3 Major Issues in Engineering Review

4.3.1 Track Gauge

There are some discussions about the stability and axle load between the narrow gauge and standard gauge. Comparing the operated lines of the both gauges, there is no difference on the cost performance. So the main issue is whether those lines intend to connect with other lines. If a planned line will be connected with an existing line, the first priority to select the gauge shall be given to the possibility of operation between the two lines. Main features between narrow gauge and standard gauge are shown in Tables 4.3.1 and 4.3.2.

Table 4.3.1 Difference of in Main Features between Narrow Gauge and Standard Gauge

Comparison Item	Narrow Gauge	Standard Gauge
1.Width (mm)	1,067	1,435
2.Construction Cost	A little bit lower	A little bit higher
3.Maintenance Cost	Even	Even
4.Safety of Train Running	Even	Even
5.Passenger Comfort	A little bit worse	A little bit better
6.Through Operation	Possible in future	Impossible
Total Evaluation	Better	A little bit worse

Table 4.3.2 Technical Comparison of Track Gauge

Comparative Item	(a) Narrow Gauge	(b) Standard Gauge
1. Stability of Rail Speed	Speed at R300 is 70km/h	Speed at R300 is 74km/h.
2. Size of Tunnel	It is defined by PT.KAI size at existing track.	It is 37cm wider at ballast track.
3. Cut and Cover	No difference, same above. Minimum thickness of 2nd pour concrete shall be 30 cm, 20 cm is not enough.	No difference, same with above. Load for invert concrete is small (about 15kg/cm^2). As concrete of invert shall be poor concrete (260kg/cm^2), cost is no problem.
4. Track Bed	They are favor for reduction of track maintenance work (a little) and worry of buckling (large)	It is necessary to pay attention on the volume of ballast and to supply ballast frequently.
5. Track Standard	Almost standard can be introduced from PT.KAI. It is necessary to standardize by Indonesia condition.	There is no international (common) standard. Standards of every railway are slightly different.
6. Track Maintenance	Strength of ballast track, which uses 54-kg rail, is stronger by 3-4 times than an economical standardized track structure.	Cross level allowance is a little (17%) favor. Both gauges are same (negligible difference).
7. Signal	3 minutes operation needs high tech.	No relation with gauge.
8. Power Distribution	Same at any gauges.	No relation with gauge.
9. Track Machines	All machines are designed for narrow gauge size, it is no problem in a narrow tunnel. Idling of 95% shall be used at PT.KAI. Moreover, PT.KAI or contractors hold operation technology.	Operation company needs to own full range of machines. Instead of few days' operation, firing of an engine is necessary every week.

4.3.2 Comparison of Traction Power Supply

The traction power supply has two systems, which are the overhead contact system and the third rail system. The comparisons between the two are shown in Table 4.3.3.

Table 4.3.3 Comparison with Traction Power Supply

Comparison Item	Overhead Contact	Third Railway
1.Construction Cost	Even	Even
2.Maintenance Cost	Even	Even
3.Safety of Staffs and Workers	Better	Worse
4.Protection against Passenger's Accident	Better	Worse
5.Tunnel Section	Less economical	More economical
6.Through Operation	Even	Worse
Total Evaluation	Better	Worse

4.3.3 Recommendation about Track Gauge and Traction Power Supply

A mega-city like Jakarta must have a convenient transfer system using railway network because the city area is so large that one railway system cannot cover all of the intra - city road transit system. The most preferable system is a through operation to link various railway systems. To realize it, the gauge and the traction power supply system must be the same as those of the existing lines. PT. KAI adopted the narrow gauge and the catenary system. In order to integrate MRT in Jabotabek transport network, the existing track gauge and traction power supply system should be applied to the MRT project.

4.4 Outstanding Engineering Subjects

4.4.1 Impacts of MRT

(1) Impacts of Full Integration of MRT and Jabotabek Railway

To keep an option of the full integration between MRT and Jabotabek railway, the impact on the MRT would be as follows:

- Track gauge has to be 1,067 mm (alternatively 1,435 mm; in this case the Jabotabek railway would have to be replaced with a MRT system).
- Kinematics vehicle gauge (KVG) has to be the same or smaller than KVG of the Jabotabek Railway.
- Traction power supply has to be an overhead contact system. (identical voltage)
- Train direction would have to be "Right Side Going".
- Provision of common ticketing system

- Provision of common handling and management of train and passengers

(1) Impacts on Jabotabek Railway

The characteristics of typical MRT and Jabotabek railway differ considerably (Refer to Table 4.4.1). Full integration of MRT and the Jabotabek railway can be achieved, only if the existing Jabotabek railway's hardware and software are upgraded to the level of MRT. The basic requirements are indicated as follows:

- Upgrade the signaling system to MRT standards
- Upgrade the communication system to MRT standards
- Increase platform length to MRT standards (if shorter)
- Common ticketing
- Common handling and management of trains
- Procurement of MRT vehicles, if PT.KAI wants to utilize MRT line

Table 4.4.1 Major Characteristics of the MRT and Jabotabek Railway

Item	MRT	Jabotabek Railway
1. Train Operation (per day)	Approx. 200 trains	Central line 267 trains Eastern line 112 trains Bogor line 178 trains (L/M distance + Commuter trains)
2. Train Intervals in peak hour	Approx. 2 - 3 min.	6 – 10 min.
3. Train Length	135 m (6 cars)	160 m (8 cars)
4. Train Width (inner)	2800 or 3000 mm	2800 mm
5. Platform Length	Train Length + 5 m	Train Length + 20m
6. Distance between Stations	0.8 - 1.9 km	2.5 km (Average)
7. Gauge	1,067 mm	1,067 mm
8. Traction Power	Overhead 1500 V	Overhead 1500 V
9. Signaling System	Fixed Block System or Moving Block System	Fixed Block System
10. Train Capacity	42,000 pass/h (#)	13,500 pass/h
11. Max. Acceleration	0.8 - 0.9 m/sec^2	0.5 m/sec^2
12. Maximum Speed	Approx. 100 km/h	Intra City ; Approx. 60 km/h Suburbs ; Approx. 100 km/h

Note : 20 trains x 6 cars x 350 pass = 42,000 pass/h
Mass transit system in ASEAN countries is described in Appendix to Chapter 4, Section 4.8.

4.4.2 Review of Connection with Station Dukuh Atas

The wicket of Station Dukuh Atas of Jabotabek railway leads to the eastern side of JL. Sudirman. MRT will most likely be constructed at the western side of JL. Sudirman as an underground structure or an elevated structure.

In both cases, transfer passengers must walk under the flyover of JL. Sudirman to transfer to MRT. The distance between the existing platforms and MRT station will be approximately 200 m. The distance should be shortened by a relocation of Station Dukuh Atas.

Photo 1: Station Dukuh Atas (Passenger Bridge and Flyover of JL. Sudirman)

Photo 2: Walking Passengers from Station Dukuh Atas

4.4.3 Integration with Other Rail Service

(1) East-West Line

The D.K.I. Jakarta Master Plan emphasizes east-west orientated developments and restrains the southbound extension in order to preserve natural resources, such as the aquifer recharge zone between Bogor and South Jakarta. The recommended direction of growth made it indispensable to develop a mass transport system plying the east-west corridor.

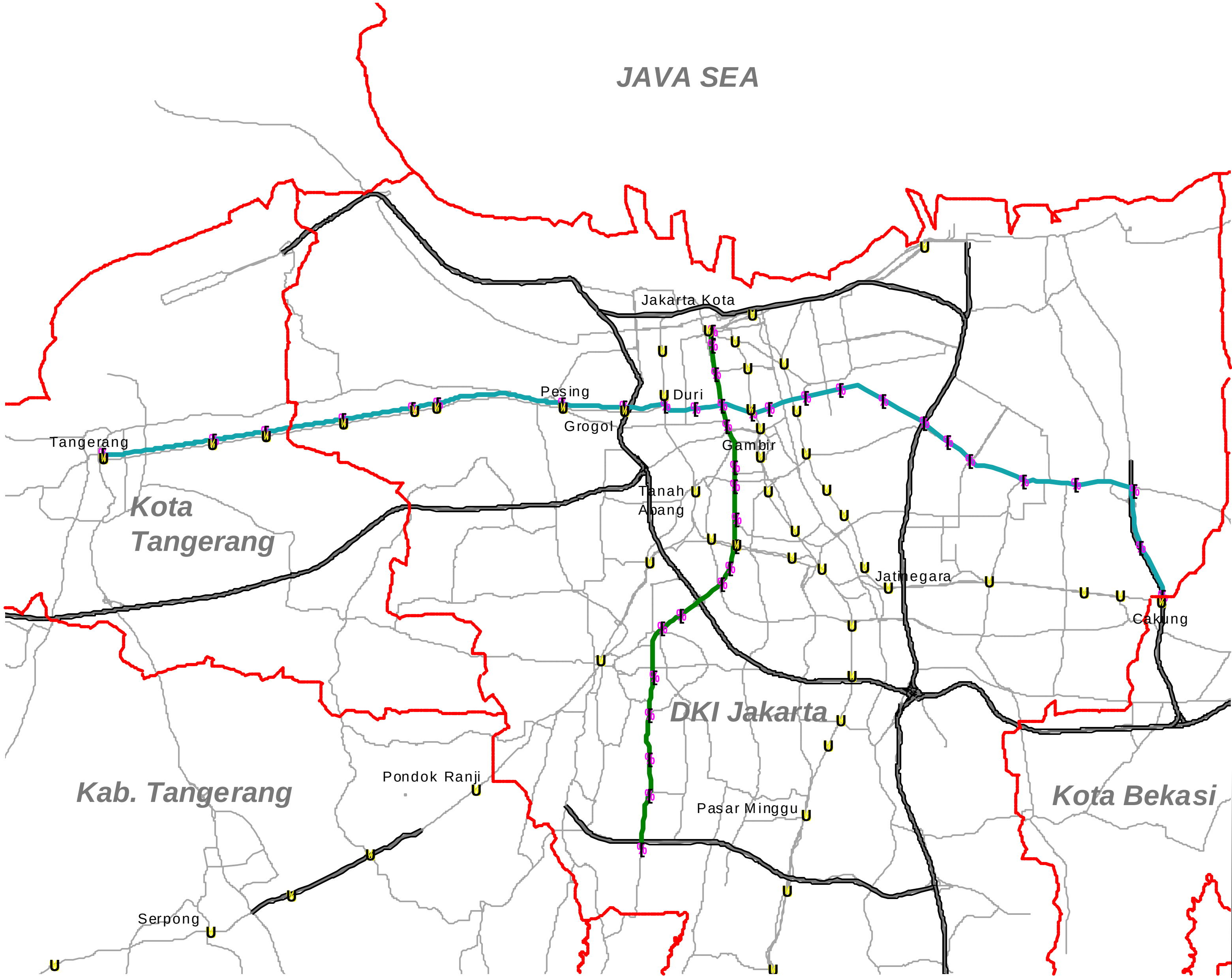
The implementation of the mass transit system between Tangerang and Cakung is planned in accordance with the consolidated network proposals issued by the Indonesian Ministry of Communication in February 1993. It illustrates a four-phase program whose first step includes the initial section of the Tangerang-Bekasi line extending from Tangerang to the Outer Ring Road in the east of Jakarta.

The integration of MRT (N-S Line) with future MRT extensions, which is shown in Figure 4.4.1, will have to be considered in the Phase 2 of Fatmawati – Kota route.

(2) JABOTABEK Railway Lines

Both the Loop Line in Jakarta, which is a PT.KAI’s railway line, and the N-S Line of MRT pass through Dukuh Atas. However, the existing Dukuh Atas Station on the Loop Line is located on the east side of Jl. Sudirman, while the future location of the MRT Dukuh Atas Station will be on the west side of Jl. Sudirman. This means that transfer passengers will have to walk approximately 200 m and cross under the existing flyover. To provide better access to both MRT and the PT.KAI railway, as well as to promote higher ridership levels on both lines, the existing Dukuh Atas Station will be relocated to the west side of Jl. Sudirman.

Figure 4.4.1
Integration plan of
East - West Line
between Tangerang and Cakung



LEGEND

- Planned MRT Station
- Existing Railway Station
- Planned MRT East - West Line
- Planned MRT North - South Line
- Existing Railway
- Tollroad
- Kabupaten Boundary

0 3 6 9 Km

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In addition to the above, it is recommended that the following facilities should be constructed to generate further desirable synergistic effects:

- A passenger concourse between the MRT and PT.KAI Kota stations; and
- A short-cut line that permits trains from the Serpong Line to go directly to Manggarai Station on the Loop Line, instead of the present operation that requires Serpong Line riders to go in the opposite direction to Tanah Abang Station (also on the Loop Line) and then switch back to Manggarai Station.

4.4.4 Review of MRT Entrance / Exits

The 5 stations of Fatmawati, Cipete Raya, Haji Nawi, Blok A and Blok M are planned on JL. Fatmawati and Panglima Polim. These streets are not so wide, which width are 14 m to 22 m. Therefore, "Revised Basic Design" should be reconsidered in detail for stairs and escalators outside station buildings, and bus network plans for East – West corridor.

Most stations (excluding St.Glodok and St.Kota in Alternative 1 of "Revised Basic Design") will be located in the existing Right of Way of roads. Passengers-access to the stations will be accommodated by stairs and escalators from pedestrian sidewalks. However, the pedestrian sidewalks do not always have sufficient width to maintain smooth pedestrian flows. The solution for MRT station entrances is to acquire small parcels of land from properties(Generally within the building set-back dimension) adjacent to the station entrances.

The locations of MRT entrance / exits at the various stations are shown in Appendix Figure AP 4.10 through AP 4.18.

All the entrances and exits of the MRT ascend to ground level and are to interface with existing facilities with minimal disruption. However, because of narrow pedestrian footpaths in some locations, it will be necessary to place an entrance/exit on adjacent private or public property. Based on existing available information, the forty or more entrance/exit sites of the MRT were selected (see Appendix Figure AP 4.10 to 4.18) by minimizing detrimental effects to major facilities.

For example;

- Narrow roads are to remain unchanged by placing MRT entrances/exits on adjacent private or public land.
- Vacant space will be used when possible, but in the case of a MRT entrance/exit being built in an existing facility, co-ordination is required so as not to impair any existing functions.

4.4.5 Review of Fatmawati Depot

The layout of Fatmawati Depot is shown in Figure 4.3.2. This candidate place is golf course with nine holes, which is the area of 19.6 ha. This depot area will also plan to contain the headquarters and the operations control center for MRT.

The facilities provided in this depot area include the below.

1) Stabling Yard

2) Integrated heavy and light maintenance workshop
3) Permanent way workshop
4) Fixed facilities workshop
5) Washing plant

The position and orientation of the depot affects the efficiency and capacity of the depot. In this respect, Fatmawati Golf Course is great flexibility and a marginally higher total stabling capacity.

The Fatmawati depot should be minimized the environmental impact on the surrounding neibourhood.

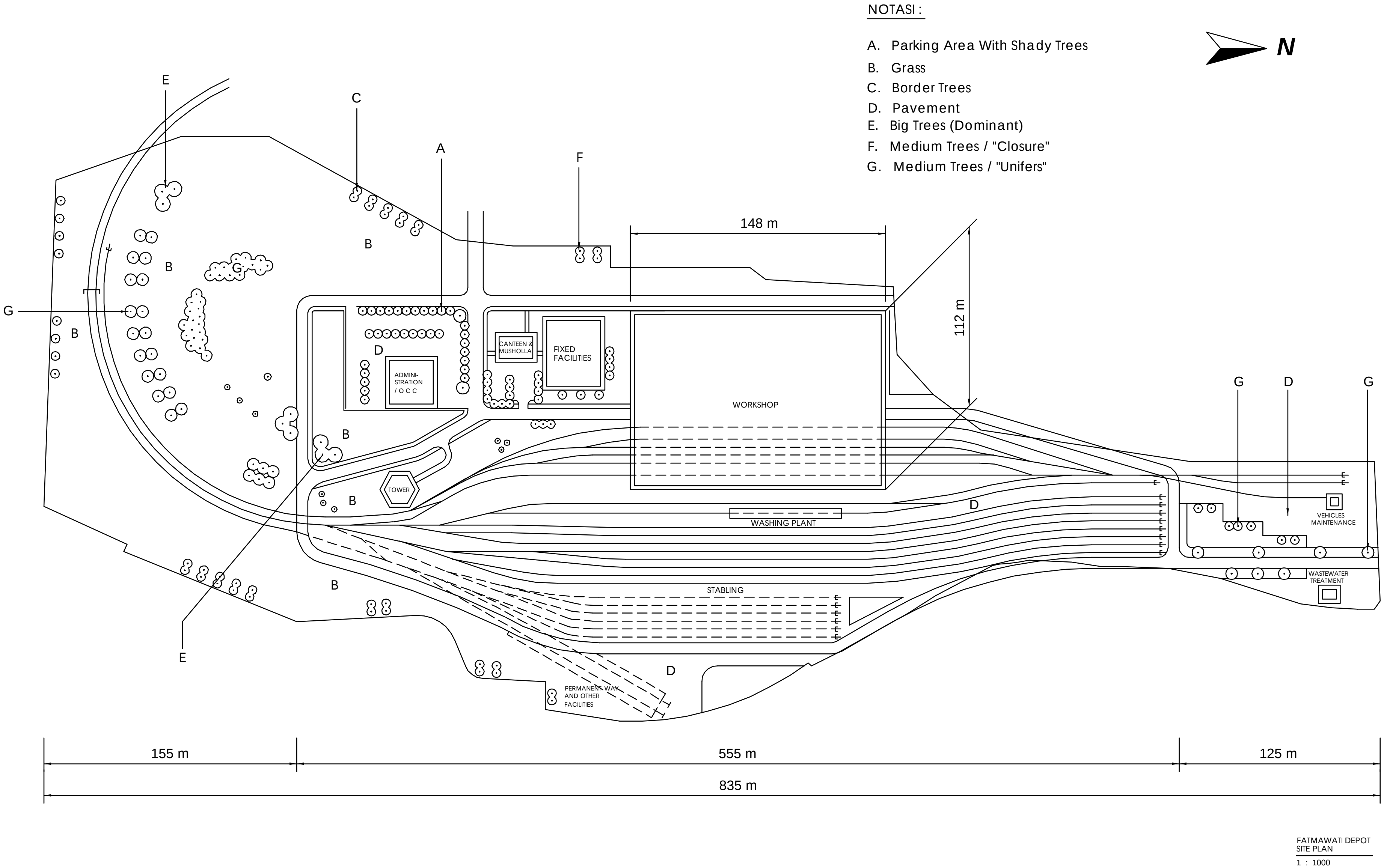

Figure 4.4.2 Plan of Depot in Fatmawati

4.5 Cost Estimates

4.5.1 Engineering Base Cost Estimates

1) The base costs of Alternative 3B for MRT are stated in US Dollars and based on 2000 prices with no allowance made at this stage for inflation and currency fluctuations. The costs are based on the following rates of exchange :
2) 1 US $ = Rp. 7,950 / $ = 106 Yen / $
3) For other currency: prevailing rates in September of 2000.
4) The construction costs (Civil, E & M, Project Management) in Table 4.5.1 below include the following.
    - Contractor's contingencies
    - Insurance
    - Condition & structural survey & monitoring
    - Settlement prevention measures
    - Duties and taxes
    - Land procurement
    - Land procurement for temporary works
5) There are separately provisions for contingency (10% for civil works) and for Project Management (3%; covering coordination activities between the civil works and the E&M works). Cost estimates of each case are shown in Appendix to Chapter4, Table AP4.16.

Table 4.5.1 Base Cost of Alternative 3B (as of September 2000)

Unit : Million Rupiah

Work Item	Cost Components		
	Foreign Currency	Domestic Currency	Total
< 1 > Elevated Station & Guideway	513,108	664,641	1,177,749
< 2 > Underground Station & Guideway	2,524,265	1,348,388	3,872,653
< 3 > Trackworks	340,234	99,968	440,202
< 4 > Platform Screen Door System	121,070	14,579	135,649
< 5 > Elevators	9,358	3,441	12,799
< 6 > Escalators	163,098	44,913	208,011
< 7 > Environmental Control Systems	148,978	17,929	166,907
< 8 > Special Structures (Additional Foot Bridges, etc.)	11,046	31,321	42,367
< 9 > Auxiliary Civil Works 1 (Traffic Management, Fencing, etc.)	26,320	111,739	138,059
< 10 > Auxiliary Civil Works 2 (Bulk Supply Substation, etc.)	8,188	50,527	58,715
< 11 > Depot Building Facilities - Civil Works	33,422	144,881	178,303
< 12 > Power Supply & Distribution System (Incl. Cabling)	417,271	50,256	467,527
< 13 > Automatics fare Collection System	121,822	14,488	136,310
< 14 > Safety and Security	15,207	1,581	16,788
< 15 > Depot / Workshop Maintenance Equipment / Auxiliary Vehicle	285,756	16,055	301,811
< 16 > Rolling Stock (6-Car Trains)	566,082	262,999	829,081
< 17 > Signaling & Train Control System (Station & Trackside)	357,028	25,173	382,201
< 18 > Communications System	274,894	18,110	293,004
< 19 > SCADA System	76,452	9,417	85,869
< 20 > Control Equipment in Operations Control Center	63,334	3,803	67,137
< 21 > SUB TOTAL (Civil Works & Equipment) <1> + - - - + <20>	**6,076,933**	**2,934,209**	**9,011,142**
< 22 > Design & Tender Assistance	183,566	88,166	271,732
< 23 > Construction Supervision	364,616	176,052	540,668
< 24 > System Integration / Trial Running	39,438	5,976	45,414
< 25 > Physical Contengency Civil Works	346,352	321,586	667,938
< 26 > Physical Contengency E & M	131,018	24,137	155,155
< 27 > Insurance	212,693	102,697	315,390
< 28 > SUB TOTAL : (<22> + ---+ < 27>)	**1,277,683**	**718,614**	**1,996,297**
< 29 > Engineering Base Cost : (<21> + < 28>)	**7,354,616**	**3,652,823**	**11,007,439**
< 30 > Land Acquisition, Compensation, Administration	0	771,457	771,457
< 31 > Duty & Levises on Import	0	911,540	911,540
< 32 > Ppn (VAT)	0	992,268	992,268
<33> GOI Contribution Sub-Total (<30>+<31>+<32>)	**0**	**2,675,265**	**2,675,265**
<34> Project Base Cost(<29> + <33>)	**7,354,616**	**6,328,088**	**13,682,704**

NOTE :

(1) Exchange rates ; 7,950 Rp./US $ = 106 Yen/US$ (2000.Sep.)
(2) Physical Contengency is assumed at 10% for the ciivil works and 5% for the equipment component import.
(3) It reflects also 10% on Land acquisition, compensation, administrative overhead and utility relocation costs.
(4) A average 15% import duty and levy has been assumed on all F/C component imports.
(5) A 10% Ppn has been assumed on all business transactions.
(6) Construction supervision costs are estimated at 6% of the civil works and equipment costs.
(7) Insurance portion land acquisition cost occuring in 2000 has been allocated in 2001.
(8) Insurance cost are estimated at 3.5% of the civil works and equipment costs.

4.5.2 Analysis of Cost Estimates

The main diversities with the cost of "Base Case (Revised Basic Design)" and "Alternative 3B" are due to the length of shield tunnel and elevated structure, and station type whether it is underground station or elevated station.

Table 4.5.2 Comparison of Cost Estimates

Work Item	Base Case	Alternative 3B
1. Elevated Station & Elevated Guideway	Elevated St. : 5 stations Elevated Guideway Length =6.79 km ***Cost = 1,222 Bil. Rp***	Elevated St. : 6 stations Elevated Guideway Length =6.78 km ***Cost = 1,178 Bil. Rp***
2. Shield Tunnel & Underground Station	Underground St. : 8 stations Tunnel Length L= 5.08 km ***Cost = 3,679 Bil. Rp***	Underground St. : 7 stations Tunnel Length L= 4.21 km ***Cost = 3,308 Bil. Rp***.
3. Cut & Cover Works	L= 1.08 km ***Cost = 530 Bil. Rp***	L= 1.60 km (Fatmawati St. is revised to the underground station.) ***Cost = 564 Bil. Rp***
4.Traffic Management Works	***Cost = 176 Bil. Rp***	***Cost =138 Bil. Rp***
5. Others	***Cost = 3,857 Bil. Rp***	***Cost =3,823 Bil. Rp***
(Civil Works & Equipment Cost) Total	***Cost =9,464 Bil. Rp***	***Cost =9,011 Bil. Rp***

4.5.3 Operations and Maintenance Costs

(1) Train Operation Time

Assumptions used to estimated operation time are as follows:

- Stopping Time at Stations

A passenger handling time at a stations should be determined taking into account the number of boarding and alighting passengers. For this examination 25 sec. is used for each station.

- Average Traveling Time

The average traveling time is based on the passenger handling time and a running train speed.

The plans assumptions made for train operation time are shown in Table 4.5.3.

Table 4.5.3 Train Operation Time

Particulars	Plans / Assumptions
No. of stations	13 stations
Schedule time	Running time =17.6 min. Stopping time =25 sec. @ 13 stations = 5.4 min.
Turning time	Terminal station: 2 min. @2 = 4 min.
1 cycle time	**(17.6+5.4)@2+4 min. = 50min.**

(2) Transportation Demand and the Number of Required Cars

Main elements of the train operation planning are a headway and a car-composition per train. In this report, the cost effectiveness was examined in terms of the balance between the initial investment cost, and the maintenance and operation cost.

Based on the estimated transportation demand, train headways in peak hours for year are assumed to be 10 min., 7 min., 6 min., 5 min., 4 min., 3 min., and 2 min., and the number of required cars were estimated as shown in Table 4.5.4.

Table 4.5.4 Number of Required Cars (In case of Peak Ratio : 16% / direction)

Table 4.5.4 Number of Required Cars (In Case of Peak Ratio : 16 % / direction)

Train-set	10 minutes (Headway minutes in peak hour)	7 minutes (Headway minutes in peak hour)	6 minutes (Headway minutes in peak hour)	5 minutes (Headway minutes in peak hour)
6 cars / train	140psn x 6cars x 60/10 x 250% = 12,600 psn/hour	140psn x 6cars x 60/7 x 250% = 18,000 psn/hour	140psn x 6cars x 60/6 x 250% = 21,000 psn/hour	140psn x 6cars x 60/5 x 250% = 25,200 psn/hour
	12,600 / 0.16 = (78,7500 psn/day/dir)	18,000 / 0.16 = (112,500 psn/day/dir)	21,000 / 0.16 = (131,250 Psn/day/dir)	25,200 / 0.16 = (157,500 Psn/day/dir)
	157,500 psn/day	**225,000 psn/day**	**262,500 psn/day**	**315,000 psn/day**
	5 trains (30 cars)	**7 trains (42 cars)**	**8 trains (48 cars)**	**10 trains (60 cars)**

Train-set	4 minutes (Headway minutes in peak hour)	3 minutes (Headway minutes in peak hour)	2 minutes (Headway minutes in peak hour)
6 cars / train	140psn x 6cars x 60/4 x 250% = 31,500 psn/hour	140psn x 6cars x 60/3 x 250% = 42,000 psn/hour	140psn x 6cars x 60/2 x 250% = 63,000 psn/hour
	31,500 / 0.16 = (196,875 Psn/day/dir)	42,000 / 0.16 = (262,500 psn/day/dir)	63,000 / 0.16 = (393,750 psn/day/dir)
	393,750 psn/day	**525,000 psn/day**	**787,500 psn/day**
	12 trains (72 cars)	**16 trains (96 cars)**	**23 trains (138 cars)**

Note:
(1) Cogestion Ratio; 100% = 140 psns
(2) Cost of 6 cars / train = 8.80 Million US$
(3) Maximum Congestion Ratio = 250%

Note : Operation & maintenance cost are shown in Appendix Chapter 4, Table AP 4.21 through AP4.26.

4.6 Construction Plan & Method

4.6.1 Construction Schedule

The construction schedule that is recommended for building the MRT is shown in Figure 4.6.3. Details on some matters, which are diverted from the Revised Basic Design and will affect the timing and construction cost of MRT are discussed with counterpart.

The phase 1 will be sub-divided into two, i.e. the phase 1-1 is the section (L=12.7 km) between Fatmawati and Dukuh Atas, and the phase 1-2 is the section (L=2.8 km) between Harmoni and Monas. The construction plan of phase 1-1 and phase 1-2 are shown in Figure 4.6.1.and 4.6.2. (Refer to Appendix to Chapter 4, Section 4.10)

4.6.2 Construction Period

The total construction period for the Fatmawati - Monas MRT will require approximately 57 months. Therefore, if construction starts in January 2003 the trial runs and of commercial operation for the MRT will begin at times shown below:

- Start of Trial Runs: May 2007
- Start of Commercial Operation:
  (Phase1-1); September 2007,
  (Phase1-2); January 2008

Alignment of Phase 2 between Glodok and Kota is described in Appendix chapter 4, Section 4.12.

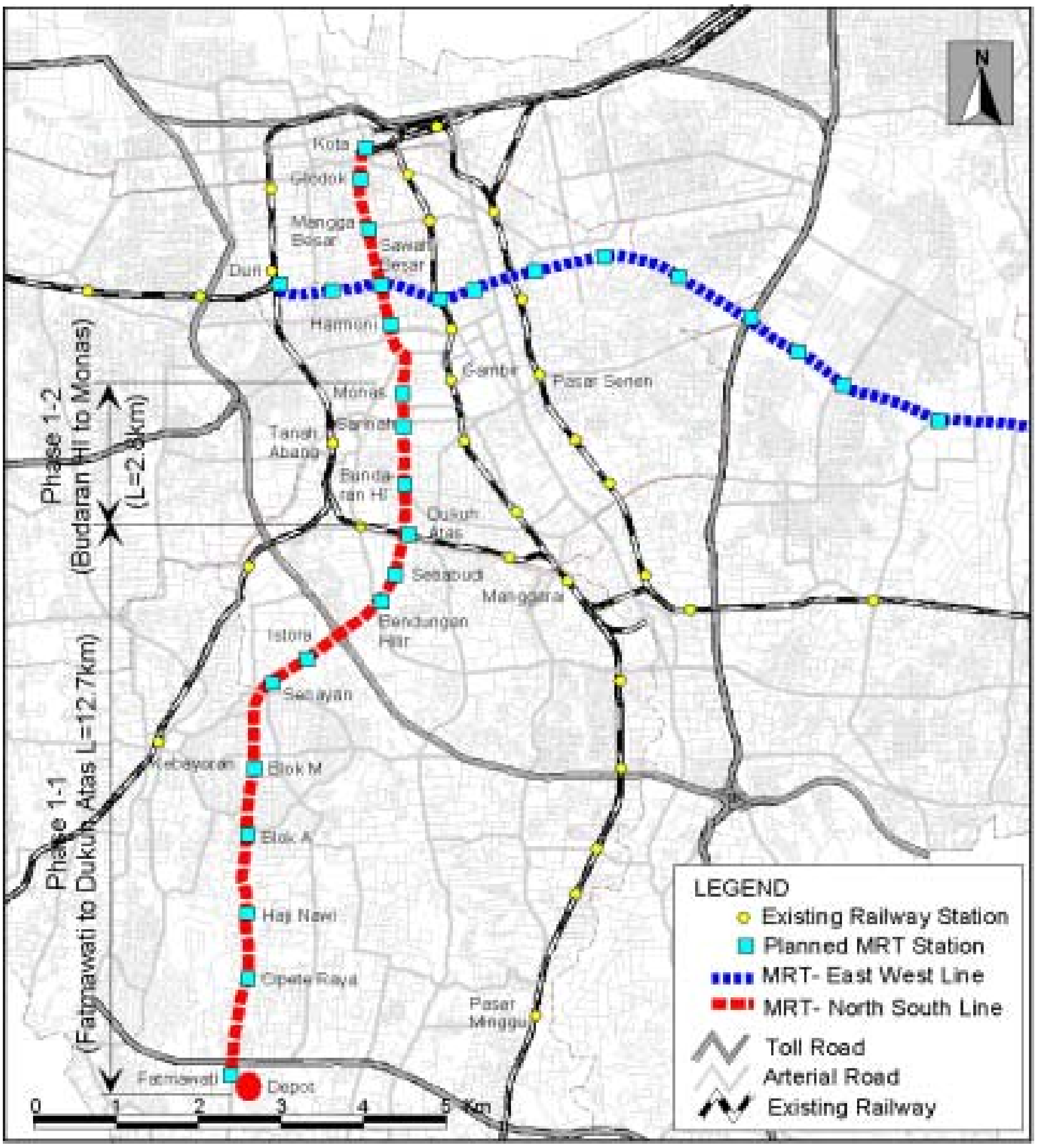

Figure 4.6.1 Construction Plan of Phase 1-1 & 1-2

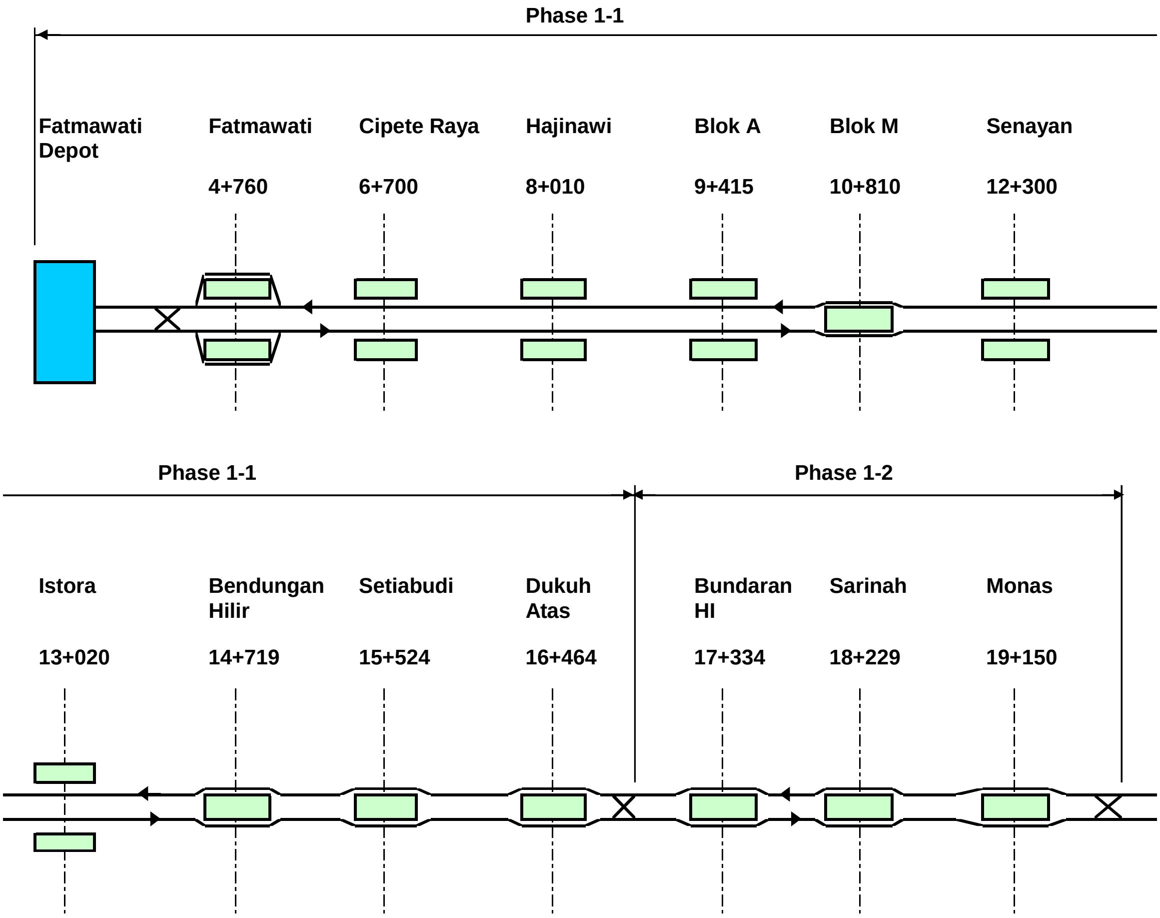

Figure 4.6.2 Track Layout of Right Side Operation (Alternative 3B)

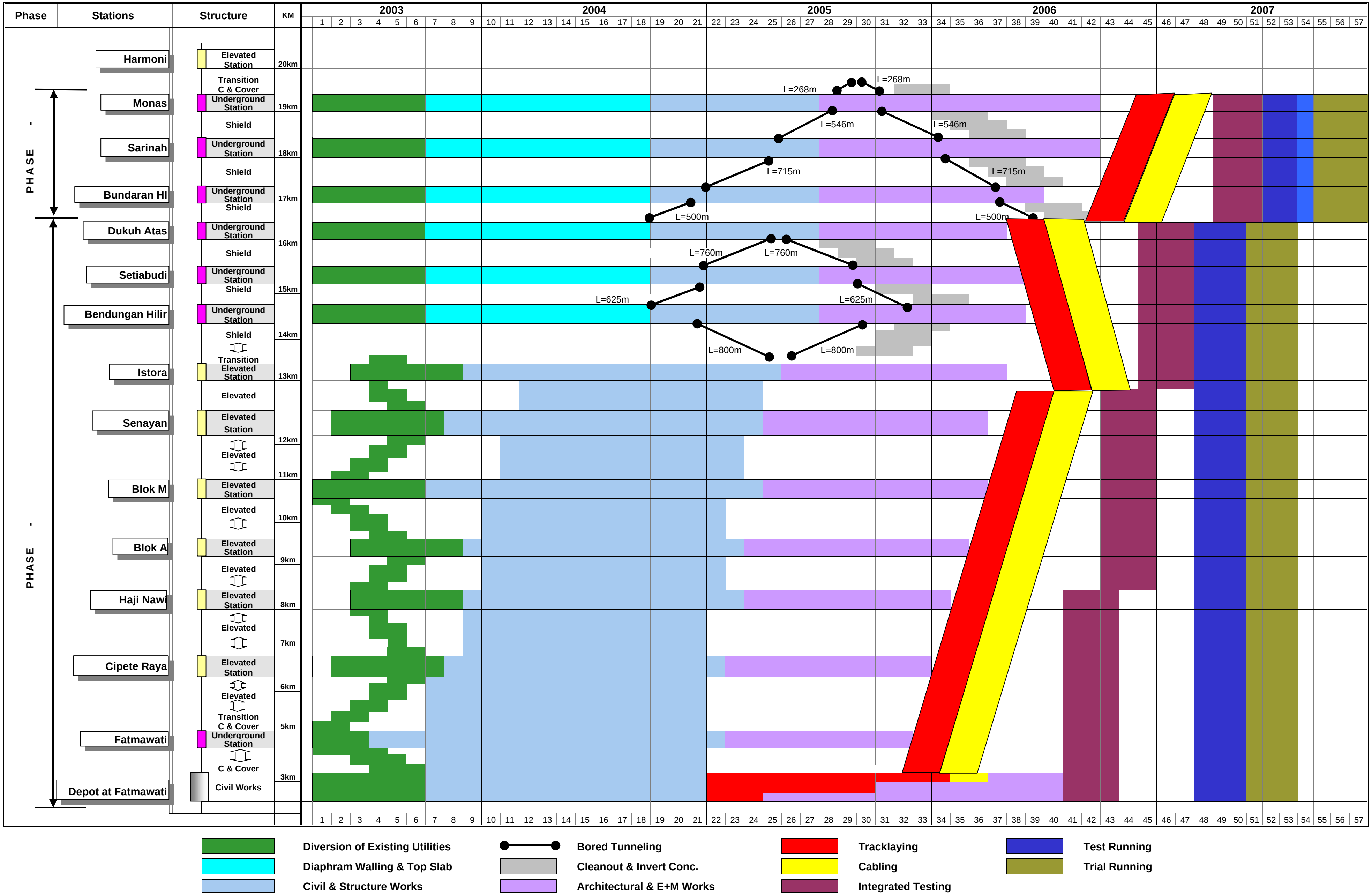

Figure 4.6.3 Estimated Implementation Schedule
Fatmawati to Monas - Depot at Fatmawati (Alternative 3B)

Chapter 5

Passenger Demand Profile

5. Passenger Demand Profile

5.1 Present Trip Patterns

Information on the characteristics of person trip movements by those using bus services along the Fatmawati-Blok M-Kota corridor was gathered by means of a bus passenger survey conducted on all bus shelters on this MRT corridor as well as at Blok M and Lebak Bulus bus terminals. Such bus travelers are deemed to represent the greatest potential MRT market.

The origin and destination pattern of bus users along the MRT corridor was derived from the interview survey carried out at representative bus shelters and bus terminals. A preliminary OD matrix was then developed by expanding the samples to the population as established through the passenger count survey. Since the interview survey was conducted only for boarding passengers, it is important to note that the collected samples thus represent trips which have at least one leg inside the MRT corridor. Under these circumstances, trips which are fully inside the corridor (i.e. origin and destination zones are inside the corridor) may be satisfactorily replicated. On the other hand, movements with either the origin or destination is outside the corridor were assumed to have a balanced “going” and “returning” trip.

Analysis of the trip pattern reveals that the dominant movement related to MRT corridor is for bus passenger trips between origin zones inside MRT corridor to destination zones elsewhere in DKI Jakarta and vice versa (22.6% of total each). Trips which are fully inside MRT corridor account for only 18% of the total bus passenger trips. Trips between MRT corridor and Botabek area account for slightly above 10% of total trips each direction. Longer distance trips which pass by the corridor (i.e. origin and destination are outside the corridor; or whereby the corridor is used as transfer point) generally have a lower share.

Table 5.1.1 Bus Passenger OD Pattern, 2000

	MRT Corr	DKI Jakarta	Botabek	External	Total
MRT Corr	18.0%	22.6%	10.4%	0.1%	51.1%
DKI Jakarta	22.6%	8.4%	3.0%	0.1%	34.0%
Botabek	10.5%	3.0%	1.2%	0.0%	14.7%
External	0.1%	0.1%	0.0%	0.0%	0.2%
Total	51.1%	34.0%	14.7%	0.2%	100.0%

Source: Bus Passenger Survey, JICA Study Team

In total, trips originated (or destined) from/to zones inside MRT corridor account for about half (51 percent) of total trips, followed by trips from/to other zones in DKI Jakarta but outside the corridor (34%) and trips from/to zones outside DKI Jakarta (almost 15%).

The spatial distribution of trip origin/destination of bus passengers along the MRT corridor is shown in Figure 5.1.1 which indicate the wide spread of passenger origin-destination throughout Jabotabek. This to some extent explains the relatively low percentage of “intra” movement within the corridor.

The condition is further confirmed by an analysis of the route structure of buses that traverse, at least partially, along the MRT corridor (Figure 5.1.2). In line with origin/destination spatial distribution, the route structure is also widely spread beyond the corridor. Table 5.1.2 shows that more than 70 bus routes pass by Jl. Sudirman/Thamrin, but only very few serve the whole stretch of the corridor. The sections between Sisingamangaraja, Senayan, Sudirman, and Thamrin are known to be a high activity corridor (i.e. the "fat" line), therefore many of the bus operators include these sections, as much as they can, in their route structure; resulting in a heavy overlap.

Table 5.1.2 Number of Bus Routes Passing MRT Corridor

	Number of Bus Route				
Street Name	*Patas AC*	*Patas*	*Reguler*	*Med.Bus*	*Total*
Antasari	2	1	1	3	7
Panglima Polim/Fatmawati	4	4	1	3	12
Sisingamaraja	23	17	11	3	54
Senayan	28	23	14	2	67
Sudirman	31	25	12	4	72
Thamrin	24	19	10	2	55
Medan Merdeka Barat	17	13	7	-	37
Majapahit	15	11	5	-	31
Gajah Mada	16	13	7	-	36
Pintu Besar Selatan	16	13	7	-	36

The preliminary OD matrix resulted from this process provides an illustration of the trip-making characteristics of bus passengers along Fatmawati-Blok M-Kota corridor. Subsequent efforts were conducted during the traffic modeling phase, however, to establish a comprehensive public transport trip tables integrated with the overall Jabotabek transportation system.

Work related trips (i.e. "to work" and "from work") are the dominant trip purpose of bus passengers along the corridor, accounting for 60% of all the trips, followed by school-related trips which account for 15% of the trips (Table 5.1.3). The imbalance proportion between "to work" (25%) and "from work"(35%) might have been resulted from the different mode used by the passengers, for example by joining a car-pool in the morning and then return home by bus.

Table 5.1.3 Trip Purpose of Bus Passengers along MRT Corridor, 2000

	Number of Passengers by Trip Purpose								
	To Work	**From Work**	**To School**	**From School**	**To Other**	**From Other**	**Busi-ness**	**Misc Purp**	**Total**
Composition (%)									
Northbound shelter	32%	32%	7%	4%	5%	2%	8%	9%	100%
Southbound shelter	19%	49%	6%	6%	3%	2%	6%	8%	100%
Bus Terminals	22%	27%	8%	12%	4%	7%	6%	14%	100%
Total	**25%**	**35%**	**7%**	**8%**	**4%**	**4%**	**7%**	**11%**	**100%**

Source: Bus Passenger Survey, JICA Study Team

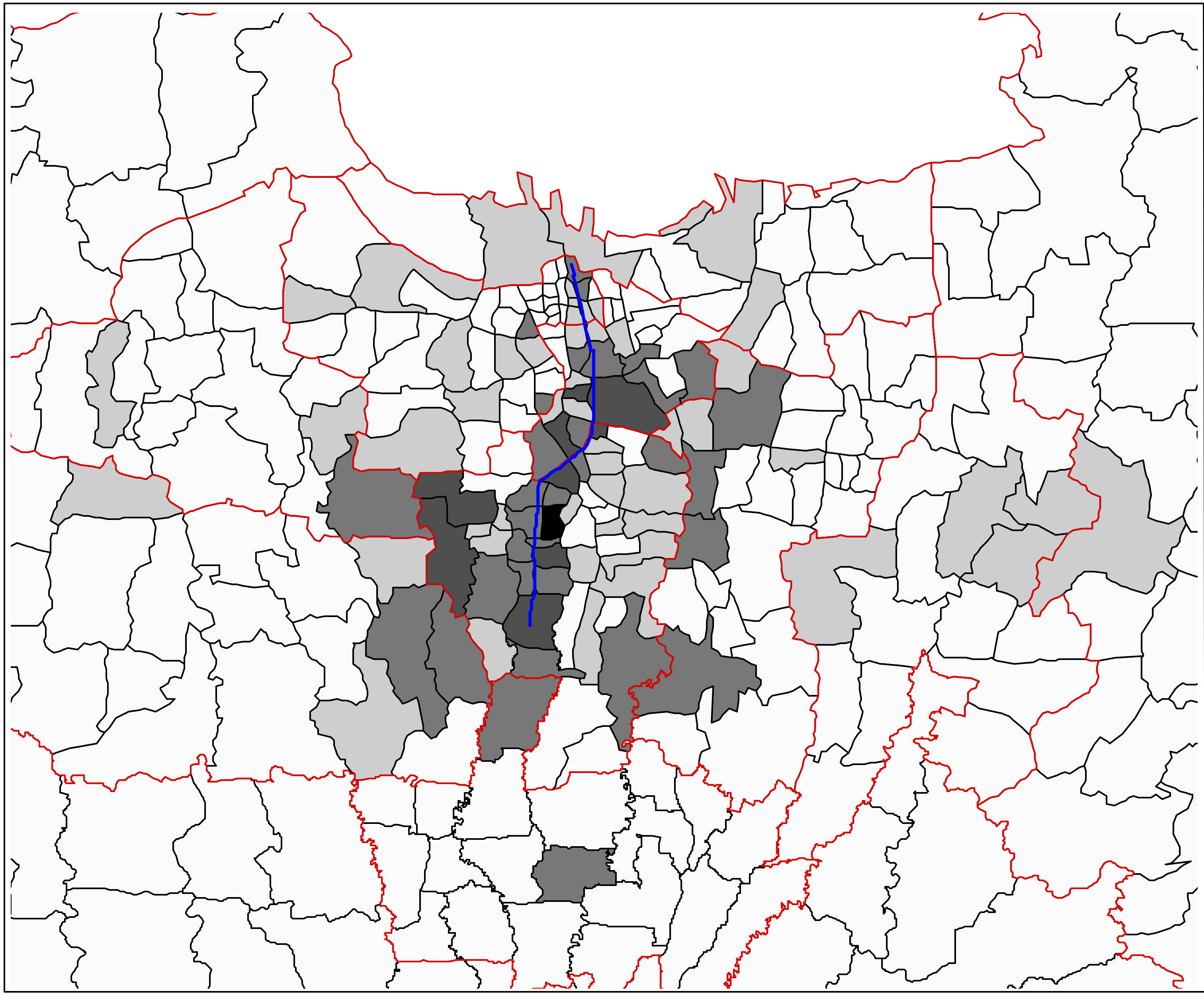

Figure 5.1.1

Distribution of Trip Origin/Destination by Bus Passenger along MRT Corridor Year 2000

Legend

Fatmawati-Blok M-Kota Corridor

Total Trip Origin & Destination (pax/day)

- 0 - 1500
- 1500 - 4000
- 4000 - 9000
- 9000 - 18000
- 18000 - 42000

N

0 5 10 Km

Source : Bus Passenger Survey
JICA Study Team

SITRAMP JABOTABEK

The Study on
Integrated Transportation Master Plan
for JABOTABEK
(Phase I)

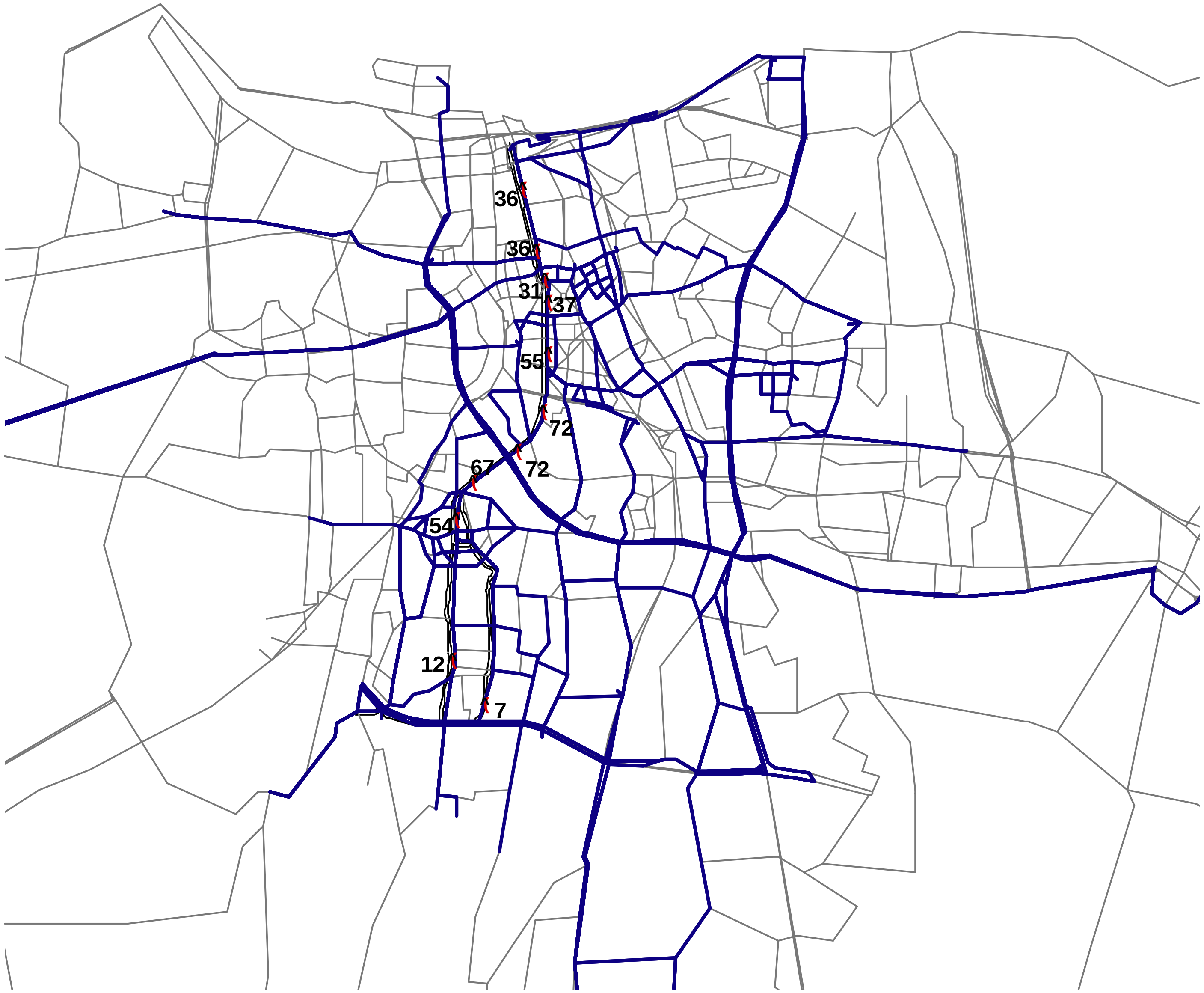

Figure 5.1.2

Structure of Bus Routes Passing MRT Corridor

Legend

Bus Routes

Main Road

123 Number of Bus Routes

N

SITRAMP JABOTABEK

The Study on
Integrated Transportation Master Plan
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(Phase I)

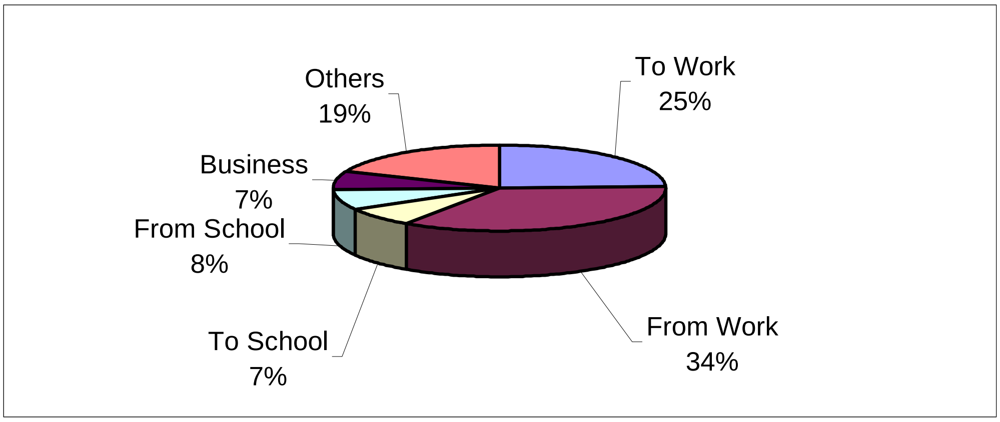


Figure 5.1.3 Trip Purpose Composition

5.2 Future Person Trip Demand

5.2.1 Trip Totals

Trip generation models were applied to forecast future levels of Jabotabek person trip demand for each zone, using as input the forecast distributions of the respective socio-economic and demographic variables. Trip totals were stratified into four trip purposes that are used during traffic modeling and forecast. Table 5.2.1 provides a summary of total person trip demand in Jabotabek area for the years 2000, 2005 and 2015.

Table 5.2.1 Jabotabek Total Person Trip Estimates by Trip Purpose

Trip Purpose	Total Trip (passenger/day) 2000	2005	2015
Home-based work	11,204,092	17,302,582	24,913,464
Home-based school	9,614,362	11,228,326	13,743,712
Home-based others	7,116,854	8,989,518	11,132,895
Non Home-based	1,233,022	1,772,383	2,542,698
Total	29,168,330	39,292,809	52,332,769

Source: JICA Study Team

Over 15 year period between 2000 and 2015, total person trips in Jabotabek area can be expected to increase from around 29 million to about 52 million trips per day. The relative share of daily person trips performed inside DKI Jakarta is forecast to decrease from 45 percent (13 million) in the year 2000 to 41 percent (16 million trips) in 2005 and 36% (19 million trips) in 2015.

Majority of the trip purpose is ’home-based work’ accounting for around 40% of trip purpose composition, followed by ’home-based school’ trips which account for roughly 30% of the total trip. Home-based work trips will be more than double in 2015 with a growth rate higher than the overall person trip growth.

5.2.2 Modal Split

Modal split analysis is undertaken in cascading steps; the first being segregation between motorized and non-motorized mode of travel. Roughly 70 percent of the trips were estimated to be performed by motorized mode of transport.

Subsequent to that, the split between different modes of the motorized trips was conducted utilizing multinomial logit diversion function taking into consideration the vehicle availability category. The person trip was therefore disaggregated into four modes of travel, namely: motorcycle, car, bus and train. Table 5.2.2 summarizes the forecast modal choice.

Table 5.2.2 Jabotabek Person Trip Demand by Motorized Mode of Transport

	Total Trips (passenger/day)		
Mode	**2000**	**2005**	**2015**
Motorcycle	2,954,512	3,956,113	5,335,223
Car	6,404,503	8,906,675	12,315,018
Bus	10,938,646	14,692,936	19,862,070
Train	416,426	543,778	712,633
Total	20,716,087	28,101,507	38,226,959

Source: JICA Study Team

Results from the modal split analysis show that public transport is by far the most used mode of transport throughout Jabotabek with a share of constantly above 50 percent of the available modes. At present, motorized trips performed entirely within DKI Jakarta boundary account for almost 46 percent of total Jabotabek trips (9.5 million person trips per day); the magnitude will increase to 14.2 million person trips per day in 2015, or 37 percent of total Jabotabek trips.

5.2.3 Forecast Assumptions

Needless to say that result and interpretation of demand forecast relies heavily on the assumptions underlying the forecast. The followings are the basic assumptions taken during the course of MRT demand forecasting:

1) The assignment scenario includes the “Without MRT Case” and “With MRT Case” to be utilized in comparing overall network performance and evaluating economic benefit in relation with MRT implementation.

2) The forecast years are 2005 and 2015; demand for other years was estimated based on the two basic forecast.

3) The MRT system stretch is between Fatmawati and Monas, hence the traffic assignment application; although modeling is prepared for the full Fatmawati-Kota alignment.

4) Traffic assignment is conducted on a daily basis which would provide necessary input for project evaluation. Peak hour volumes, where needed, shall be estimated based on the daily figure.

5) Fare system is based on a Rp. 500 access fee plus a Rp. 286 distance proportional fee which would give an average fare comparable to Patas AC.

6) No enhancement measures such as road pricing or additional parking charge were imposed to the system.

7) No intensive land use development along MRT corridor was assumed.

8) No captive market creation such as by restructuring of bus routes running parallel to MRT alignment.

9) Improvement of Jabotabek railway operation, particularly by assuming Stasiun Dukuh Atas as a key transport interchange.

10) Provision of higher accessibility in the southern end, by integration of Lebak Bulus bus terminal and Fatmawati Station.

5.2.4 MRT Passenger Demand Forecast Methodology

MRT passenger demand was predicted by the methodology as shown in Figure 5.2.1. First of all, employing the conventional four step method, the potential OD trips using public transport on the MRT corridor were predicted. Then the trips which are not likely to use the MRT system were excluded and the potential demand was identified according to the fare level. For these potential MRT users, diversion models were utilized and number of passengers diverted from private cars and buses were estimated respectively.

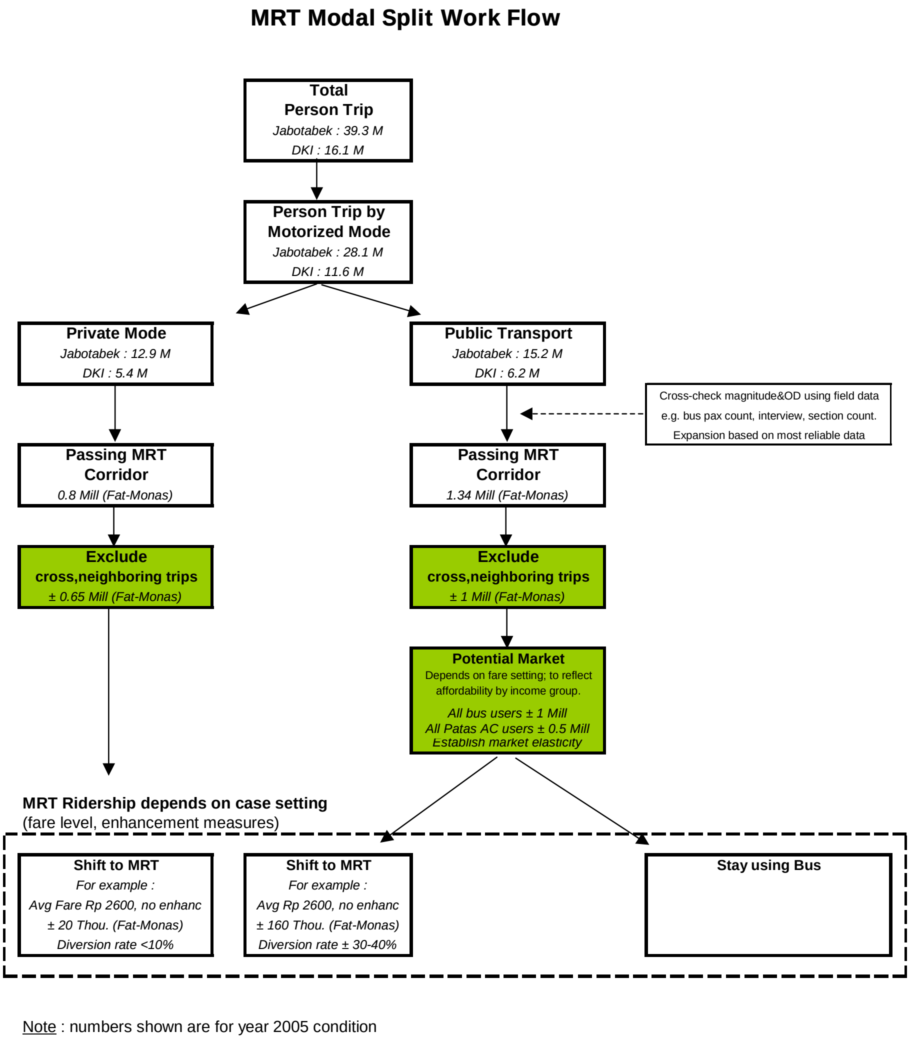


Figure 5.2.1 MRT Passenger Demand Forecast Flow

5.2.5 MRT Future Demand Forecast

Total passenger demand for the Fatmawati-Monas stretch of the Jakarta MRT is forecast to be 169,298 boarding passengers per day or around 51 million annual ridership in the year 2005 (Table 5.2.3). The demand in the year 2015 may reach 354,652 boarding passengers per day or around 106.5 million annual ridership. In both forecast years, Dukuh Atas and Blok M stations are predicted to become the busiest stations serving for around 27-28,000 boarding passengers per day in 2005 and in the order of 60,000 boarding passengers in 2015. Following, in order, are stations Bendungan Hilir, Sarinah and the two terminus. Some stations, however, are predicted to serve for only a modest magnitude of passenger volumes.

Table 5.2.3 Forecast MRT Passenger Boarding Volumes

Station Name	***Boarding Volume*** *(passenger/day)*	
	2005	**2015**
Monas	22,015	35,270
Sarinah	19,016	39,200
Bundaran HI	12,547	25,095
Dukuh Atas	28,338	60,355
Setiabudi	4,201	9,551
Bendungan Hilir	22,342	51,157
Istora	6,726	15,476
Senayan	2,218	5,459
Blok M	27,167	60,834
Blok A	1,102	2,278
Haji Nawi	2,574	5,153
Cipete Raya	2,086	4,217
Fatmawati	18,966	40,607
Total	**169,298**	**354,652**

Source: JICA Study Team

The MRT line loading and utilization is presented in Table 5.2.4. The line loading ranges between 38,000 to 95,000 passenger flow per day for both directions in the year 2005, increasing to a range of 70,000-203,000 passengers per day in the year 2015. Dukuh Atas – Setiabudi – Bendungan Hilir will become the busiest sections in the Jakarta MRT system.

The utilization of the MRT line is forecast to increase from 954,449 passenger-kilometers of travel per day in 2005 to slightly above 2 million passenger-kilometers of travel per day in the year 2015.

Table 5.2.4 Forecast MRT Line Loading and Utilization

Section	***Line Loading*** *(passenger/day - two way)*		***Passenger.km***	
	2005	**2015**	**2005**	**2015**
Monas-Sarinah	43,749	69,983	40,242	64,384
Sarinah-Bundaran HI	74,758	139,567	67,270	125,610
Bundaran HI-Dukuh Atas	91,364	178,709	79,477	155,477
Dukuh Atas-Setiabudi	94,697	200,903	89,002	188,849
Setiabudi-Bendungan Hilir	94,843	202,603	76,811	164,108
Bendungan Hilir-Istora	89,876	196,669	152,776	334,337
Istora-Senayan	88,468	194,585	63,693	140,101
Senayan-Blok M	87,307	192,377	130,082	286,642
Blok M-Blok A	46,161	97,819	64,628	136,947
Blok A-Haji Nawi	44,989	95,280	62,987	133,392
Haji Nawi-Cipete Raya	41,147	87,616	53,904	114,777
Cipete Raya-Fatmawati	37,926	81,219	73,578	157,565
Total			**954,449**	**2,002,189**

Source : JICA Study Team

5.2.6 Alternative Cases for MRT Passenger Demand Forecasting

Further analysis on MRT passenger demand is made for the following cases.

(1) Different Fare Level Setting
The passenger demand for different fare structure is examined as follows;

(a) Rp.500 (for boarding charge) + Rp. 286 /km (distance proportional)
Target: PATAS AC Users

(b) Rp.1000 (for boarding charge) + Rp. 575 /km (distance proportional)
Double of the Base Case

(c) Rp.500 (for boarding charge) + Rp. 100 /km (distance proportional)
Target: Regular Bus Users

(2) Traffic Restraint Case

It is assumed that private car usage is limited in the restricted zone at the year 2000 level, since the current level of traffic congestion is observed at around 0.8 to 0.9 on most of the road sections on Jl. Sudirman and Jl. Thamrin. The private car trips attracted in the zone exceeding the road capacity is diverted to the MRT.

(3) Limit Competitive Bus Services

If all the bus routes were assumed to be abandoned on the Sudirman and Thamrin corridors, all the potential public transport users would be diverted to the MRT. However it might cause social unrest if the MRT fare is too expensive for the majority of people, in particular, for those currently using regular bus services. Therefore it is recommended that only PATAS AC services which are competitive to the MRT will be deleted from the corridor.

(4) Intensive Land Development in the surrounding area of the MRT stations (Special Development Zone)

DKI Jakarta Government plans to introduce Special Development Zone, high intensity urban land development, along the JKT MRT corridor, though concrete site plan has not been prepared yet.

To attain higher patronage for the MRT, priority for an intensive land development should be given to the area surrounding key MRT stations. The key MRT stations include Monas, Dukuh Atas, Blok M, and Fatmawati.

Among these MRT stations the Monas station does not have room for building high rised building. The surrounding area of Dukuh Atas is built-up area but still low density thus it might possible to redevelop the area and develop terminal building with business/commercial building, since Dukuh Atas is located along the busiest street, Jl. Sudirman and interchange node with Jabotabek railway. The surrounding area of the planned Blok M station is also built up area, but South Jakarta City Government Office will be relocated and the building of Ministry of Finance also will be relocated. Therefore the area could be redeveloped in this area. The last candidate is the area in the Fatmawati station, which will be the terminus station of the Jakarta MRT including depot facilities. The study team proposed that the existing Lebak Rebus bus terminal should be relocated to this location, developing integrated public transport terminal. The terminal building will be built and the floors above terminal facilities can be utilized for commercial/business activities or residence.

5.2.7 Predicted MRT Passenger Demand by Fare Level and Enhancement Measure

According to the fare level and the various MRT demand enhancing schemes mentioned above, the passenger demand was forecast as shown in Table 5.2.5.

In addition, MRT passenger ridership by various fare levels is indicated in Figure 5.2.2. Obviously lower level of MRT fare attracts more passengers. At Rp. 1000 level for average trip, as many as 368 thousand persons would use the MRT system per day.

Based on the predicted passenger demand, the passenger revenue for each case was also estimated as shown in Figure 5.2.3. Rp. 2600 fare level would produce the largest revenue for the year 2005 condition.

Table 5.2.5 Predicted MRT Passenger Demand in 2005 and 2015

	Case Description	Year 2005 Total Passenger *(pax/day)*		Year 2005 Max Loading *(pax/day 2way)*	Year 2005 Pax.km *(daily)*	Year 2015 Total Passenger *(pax/day)*		Year 2015 Max Loading *(pax/day 2way)*	Year 2015 Pax.km *(daily)*	Note
Without Enhancement Measures										
CASE 1	**"Average Fare Rp.2100 level"** *Fare Structure :* Rp 500 access + Rp 286/km *Enhancement :* No enhancement	185,518	100%	108,462	1,029,971	340,651	100%	201,160	1,921,564	Avg Fare Rp. 2100 Target Market : Patas AC users
CASE 2	**"Comparable to Patas AC"** *Fare Structure :* Rp 800 access + Rp 325/km *Enhancement :* No enhancement	176,751	95%	103,012	975,103	325,043	95%	191,560	1,822,319	Avg Fare Rp. 2600 Target Market : Patas AC users
CASE 3	**"Fare 50% higher"** *Fare Structure :* Rp 800 access + Rp 425/km *Enhancement :* No enhancement	137,414	74%	79,661	745,778	285,870	84%	167,500	1,578,899	Avg Fare Rp. 3100 Target Market : Patas AC users
CASE 4	**"Double the Fare"** *Fare Structure :* Rp 1000 access + Rp 575/km *Enhancement :* No enhancement	84,309	45%	49,084	446,865	229,497	67%	133,131	1,238,110	Avg Fare Rp. 4050 Target Market : Patas AC users
CASE 5	**"Half the Fare"** *Fare Structure :* Rp 500 access + Rp 100/km *Enhancement :* No enhancement	367,782	198%	217,309	2,109,993	491,745	144%	293,454	2,857,681	Avg Fare Rp. 1075 Target Market : All bus users
With Enhancement Measure(s)										
CASE 6	*Fare Structure :* Rp 500 access + Rp 286/km *Enhancement :* Road capacity capping	286,409		165,613	1,480,034	586,514		330,207	2,969,576	"Push" car user on Senayan-Monas to use MRT
CASE 7	*Fare Structure :* Rp 800 access + Rp 325/km *Enhancement :* (1) Road capacity capping	277,633		160,189	1,425,287	570,912		320,590	2,870,380	
CASE 8	*Fare Structure :* Rp 800 access + Rp 325/km *Enhancement :* (1) Road capacity capping (2) Limit competition from bus	391,849		225,015	2,070,294	636,774		356,181	3,254,524	
CASE 9	*Fare Structure :* Rp 800 access + Rp 325/km *Enhancement :* (1) Road capacity capping (2) Limit competition from bus (3) Land Use Dev around sta.	402,395		230,888	2,133,827	649,806		363,902	3,337,777	

Source: SITRAMP Estimate

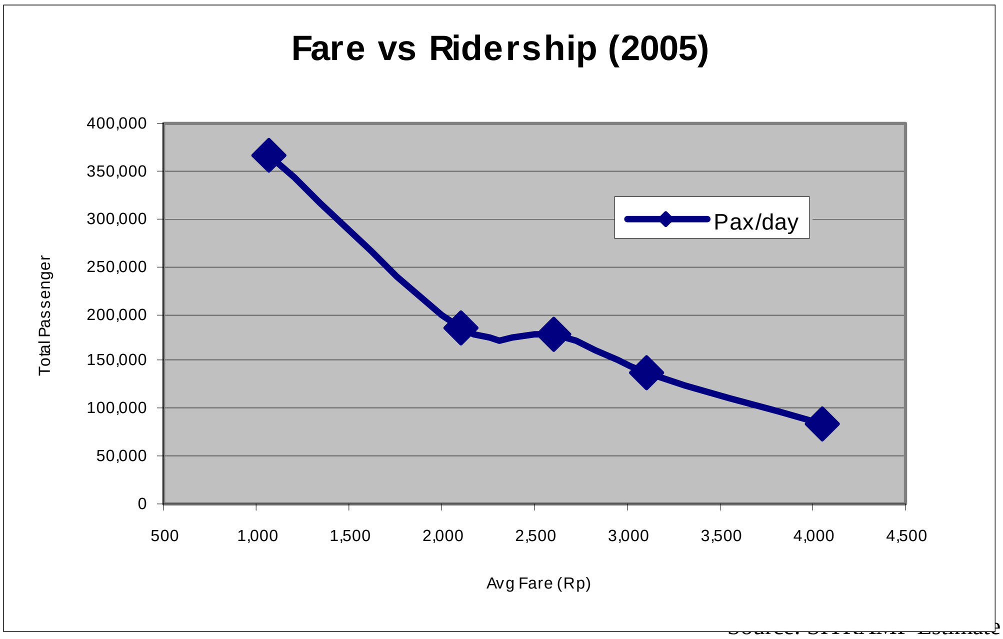
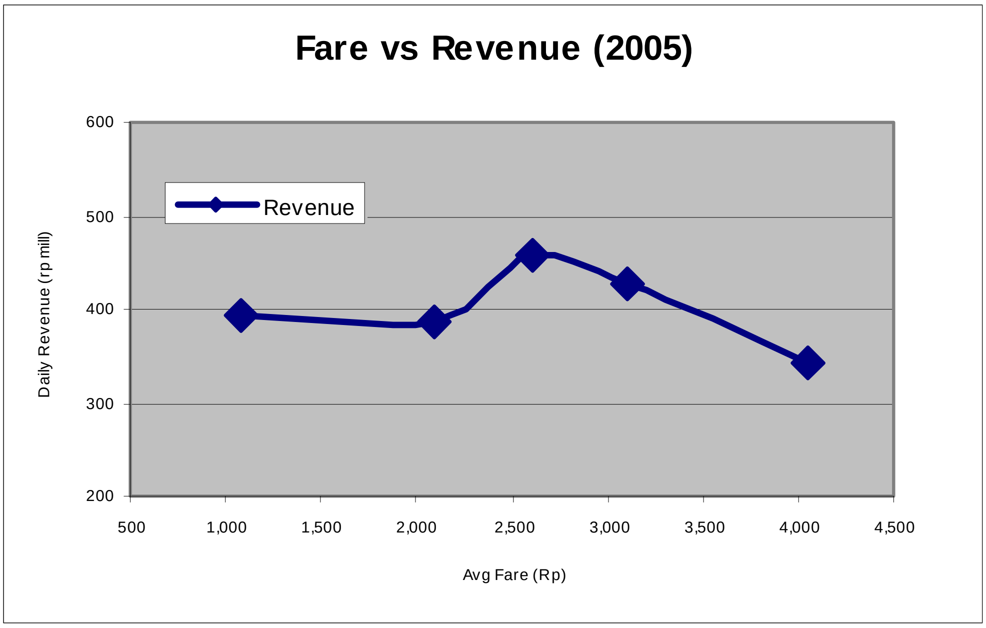


Figure 5.2.2 MRT Ridership by Fare Level



Source: SITRAMP Estimate

Figure 5.2.3 Total Passenger Revenue by Fare Level

Chapter 6

Review of MRT Environment Aspects

6. Review of MRT Environment Aspects

6.1 Results of Previous Environmental Study

6.1.1 Previous Environmental Study

The environmental impacts that were considered by "the Revised Basic Design Study for Jakarta MRT System, February 1999" are shown in Table 6.1.1. The environmental impact investigation used an environmental examination matrix with its vertical axis consisting of rows for environmental elements grouped in three categories; i.e. social, natural and living environment (including pollution), and its horizontal axis consisting of columns of project activities; i.e. planning stage, construction stage and operation stage.

A site reconnaissance/ hearing survey and an analysis of the existing data were carried out by JICA Study Team, based on the review of an environmental impact study prepared by the Revised MRT. The environmental key issues, to which special attention have to be paid in an environmental impact assessment (EIA) study, are also shown in Table 6.1.1 (right column of each development stage).

As shown in Table 6.1.1, the Revised MRT covers most of the issues that should be considered in an EIA Study. However, based on a review of the Revised MRT, the analysis of same issues are considered insufficient for the following reasons:

- Understanding of the existing environmental conditions along the MRT corridor is not satisfactory in most of the environmental items/ elements.
- A prediction and evaluation of the affects to the surroundings areas only covers noise & vibration and obstruction of sunshine, and
- A detailed consideration on the issues of environmental management and monitoring is not carried out.

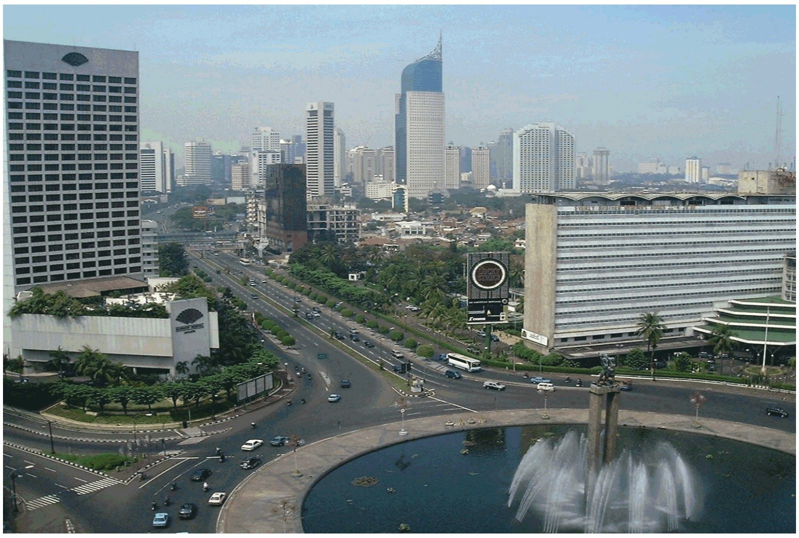
Therefore, an environmental impact assessment (EIA) should be carried out in order to 1) understand the present conditions, 2) predict the environmental impacts and evaluate their magnitudes, 3) propose countermeasures to mitigate the envisaged negative impacts, and 4) formulate plans for environmental management and monitoring.

6.1.2 Recent AMDAL Study

The Ministry of Communication started recently the AMDAL (environmental impact assessment in Indonesia) for the MRT Project, which is based on the contents of the Revised MRT. The AMDAL Commission for MRT Project, which is the first step of the AMDAL process, has been organized headed by BAPEDAL (Environmental Impact Assessment Board) in June 2000, in order to examine the draft terms-of-reference (KA-ANDAL) prepared/ submitted by the Ministry of Communication. Therefore, AMDAL, which is one of the key issues to implement the project in Indonesia, has just started.

The environmental matrix titled "Interaction Matrix between Activities and Environmental Components" described in the draft TOR of AMDAL is shown in Table 6.1.2.

[ENVIRONMENTAL ISSUES/ EFFECT OF MRT]



Central Business District (CBD) in DKI Jakarta (Jl. MH Thamrin)

Jl. Jend. Sudirman (Tube MRT is proposed)

Vehicle/ Bus discharging exhaust gases

Crowded train

Jl. RS Fatmawati (Elevated MRT is proposed)

Table 6.1.1 Environmental Examination Matrix for MRT

Major Facilities/ Activities			MRT Development					
Environmental Elements			Planning Stage		Construction Stage		Operation Stage	
			Rev. 99 Plan	JICA Study	Rev. 99 Plan	JICA Study	Rev. 99 Plan	JICA Study
Social Environment	1	Resettlement/ Land Acquisition	▲	xx				
	2	Economic Activities	○	+	○	++	○	++
	3	Traffic and Public Facilities			▲	xxx	○	++
	4	Split of Communities						
	5	Cultural Property	▲	x	▲	x		
	6	Water Right/ Right of Common						
	7	Public Health Condition						x
	8	Waste (Solid Waste)			▲	xx	▲	x
	9	Hazards (Risk)						
	10	Religious Consideration						
Natural Environment	11	Topography and Geology						
	12	Soil Erosion						
	13	Groundwater			▲	xx		
	14	Hydrological Situation (Flood)				x		
	15	Coastal Zone						
	16	Fauna and Flora						
	17	Meteorology						
	18	Landscape (Urban landscape)			▲	x	▲	xx
Living Environment (including Pollution)	19	Air Pollution			▲	xx	○	++
	20	Water Pollution			▲	xx	▲	xx
	21	Soil Contamination						
	22	Noise and Vibration			▲	xx	▲	xxx
	23	Land Subsidence			▲	x		
	24	Offensive Odor						
	25	Disturbance of Radio Wave					▲	x
	26	Obstruction of Sunshine					▲	x
	27	Infringement of Privacy						

Remarks:

1. ▲ : Negative impact predicted by "Revised Basic Design Study for JKT MRT System, Feb. 1999".
2. While, ▲ shows the element in which detailed environmental analysis had been carried out by revised MRT.
   ○ : Positive impact predicted by "Revised Basic Design Study for JKT MRT System, Feb. 1999"
3. xxx, xx : The environmental elements in which special attention has to be paid. The impacts should be analyzed in EIA study. While, " xxx " is predicted to have more negative impact than " xx ".
4. x : The environmental elements which may have a possible negative impact. However, its magnitude will not be significant.
5. ++, + : Positive impact.
6. No mark : The environmental items requiring no impact assessment since the anticipated impacts are, in general, not significant.

Table 6.1.2 Interaction Matrix between Activities and Environmental Components

No	Environment Component	the Activities might create significant impact																						Note
		Pre-Construction					Construction														Operation			
		P-1	P-2	P-3	P-4	P-5	C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9	C-10	C-11	C-12	C-13	C-14	O-1	O-2	O-3	
I	**Physical-Chemical**																							
1	Climate	-	-	-	-	-	-	-	v	-	-	-	-	-	-	-	-	-		-	v	-	-	Decrease on vehichle will reduce a heat
2	Air Quality	-	-	-	-	-	-	v	v	v	v	v	v	v	-	-	v	v		v	v	v	-	Air quality impact at construction stage is negative, but at operational
3	Noise	-	-	-	-	-	-	v	v	v	v	v	v	v	v	-	v	v		v	v	v	-	stage is possitive
4	Vibration	-	-	-	-	-	-	v	v	v	v	v	v	v	v	-	-	v		v	v	v	-	
5	Quality/Quantity of Surface Water	-	-	-	-	-	-	-	v	v	v	v	v	-	-	-	-	v		-	-	v	v	
6	Quality/Quantity of Ground Water	-	-	-	-	-	-	-	v	-	v	v	v	-	-	v	-	v		-	v	v	v	
7	Land Use	-	-	v	-	-	-	-	v		-	-	-	-	-	-	-	-		-	-	-	-	
8	Landscape	-	-	-	-	-	-	-	v		v	-	v	-	-	-	-	-		-	-	-	-	
9	Geology Structure	-	-	-	-	-	-	-	-		v	v	v	-	-	-	-	-		-	v	-	-	
10	Building	-	-	-	-	-	-	-	v		v	v	v	-	-	-	-	-		-	v	-	-	
11	Traffic	-	-	-	v	-	-	v	v		v	v	v	v	v	-	v	v		v	v	-	-	During at construction has negative impact, and at operation has
12	Waste Disposal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	v		-	-	v	v	possitive impact
13	Erosion Potential	-	-	-	-	-	-	-	v	v	v	v	v	-	-	-	-	-		-	-	-	-	
14	Flood Potential	-	-	-	-	-	-	-	v	v	-	v	-	-	-	-	-	-		-	v	-	-	During at oprational stage can stimulate on building development,
II	**BIOLOGY**																							
1	Land Flora/Fauna	-	-	-	-	-	-	-	v	-	v	-	v	v	-	-	-	-		-	-	-	-	creates on flood impact
2	Water Flora/Fauna	-	-	-	-	-	-	-	v	v	-	v	v	-	-	-	-	-		-	-	-	-	
3	Diseases Vector	-	-	-	-	-	-	-	-	v	-	v	-	-	-	-	-	-		-	-	-	-	
III	**SOCIAL-ECONOMIC & SOCIAL CULTURE & PUBLIC HEALTH**																							
1	Demography	-	v	v	-	-	v	-	-	-	v	v	v	-	-	-	-	-		-	v	-	-	
2	Public Health	-	-	-	-	-	-	v	v	v	v	v	v	-	-	-	v	v		-	v	-	-	
3	Income/Community Prosperity	-	v	v	-	-	v	-	-	v	v	v	v	v	v	-	v	v		v	v	-	-	
4	Labour and Work Opportuniy	-	-	v	-	-	v	v	-	v	v	v	v	v	v	-	v	v		v	v	v	v	
5	Public Transportation	-	-	-	v	-	-	-	-	-	-	-	-	-	-	-	v	-		-	v	-	-	
6	Hictoritical Building	-	-	-	-	-	-	-	v	v	v	-	v	-	-	-	-	-		-	-	-	-	
7	Community Perception	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v		v	v	v	-	
8	Land Owner	-	v	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	
9	Economic of City	-	v	v	-	-	v	-	-	-	-	-	-	-	-	v	-	-		-	v	-	-	

Note 'v' = Have Interaction between Activity and Environment Component

P1: Field Survey
P2: Land Acquisition
P3: Move Action
P4: Blocked and Change of Traffic Flow
P5: Community Consultation
C-1: Worker requiretment
C-2: Equipment Mobilization
C-3: land Clearing & Publ.Utility relocation
C-4: Tunnel Construction
C-6: Underground Station
C-7: Depo
C-8: : Work Place
C-9: I Supporting facility
C-10: Natural Resources/Quarry Explotation
C-11: Material and Soil Excavated Transportation
C-12: Pre-cast Yard Operation
C-13: Earthwork (Digging and Landfill)
C-14: Rail Construction
O-1: : System and Train Operational Process
O-2: : Maintenance and Inspection
O-3: : Waste Management

6.2 Environment Impact Assessment (EIA)

6.2.1 Introduction

(1) EIA Objectives

The objectives of EIA is summarized as follows:

- Understand the present condition of the environment in the study area
- Identify the particular activities of the project which may induce significant impact on the environment
- Predict the environmental impacts and evaluate their magnitudes
- Propose countermeasures to mitigate of the envisaged negative impacts
- Formulate plans for environmental management and monitoring

(2) Environmental Items

Based on the review of revised basic design of MRT and preliminary evaluation of the MRT project, its result is shown in Table 6.1.1, major environmental items in which potential significant and/or possible negative impacts are envisaged and it is necessary to be considered/ analyzed in the EIA study are listed in Table 6.2.1.

Table 6.2.1 Environmental Items Analyzed in EIA

Environmental Items	Project Activities		
	Planning Stage	Construction Stage	Operation Stage
Social Environment	• Resettlement/ Land acquisition	• Traffic and Public Facilities • Waste	-------
Natural Environment	-------	• Groundwater (Flood)	• Landscape (Urban Landscape)
Living Environment (Pollution)	-------	• Air Pollution • Water Pollution • Noise and Vibration	• Water Pollution • Noise and Vibration

(3) Project Description

Project description of proposed MRT project is mentioned in Chapter 4 of this report. In this JICA report, some modification of routing etc. has proposed, however, basically EIA study was prepared based on the project description of revised basic design.

6.2.2 Methodology

(1) Social and Natural Environmental Survey

Social and natural environmental conditions in the study area of proposed MRT were analyzed based on the existing data/ information, interview survey and site reconnaissance survey. Followings are the summary of these survey manners.

Existing data collection: Related data and information were collected from government agencies, libraries, universities, research institutions and other organizations concerned including NGO.

Interview survey: Interviews were held with officials in the related governmental agencies, specialists of various fields, NGOs and people who understand the environmental conditions of the study area and so on.

Site reconnaissance survey: To understand/ verify the current conditions of the Study area, site reconnaissance surveys were carried out in and/or surroundings of the study area.

(2) Field Survey for Living Environment

In order to understand the current environmental conditions and to evaluate/ forecast the various environmental elements, the following field surveys were carried out along and/or surroundings of proposed MRT corridor.

- Air Quality Survey
- Water Quality Survey
- Noise and Vibration Level and Traffic Survey

Please refer to Appendix 6.1. Field Surveys for detailed description on the Survey.

6.2.3 Environmental Impact Analysis

Major environmental items/ factors in which potential significant and/or possible negative impacts are to be envisaged in each project stage; namely planning, construction and operation stage, due to the MRT project are given in Table 6.2.1. In the following articles, existing condition, prediction/ evaluation and countermeasures of these items/ factors are described.

Prior to discuss about the impacts, in order to understand the existing general conditions of proposed MRT corridor, which located in CBD area of DKI Jakarta, land use features of the corridor are shown in Figure AP 6.2. In addition, locations of school & hospital, worship places and museum & monument in which special attention shall be given in the EIA study are shown in Figure AP 6.3, Figure AP 6.4 and Figure AP 6.5, respectively.

[Social Environment]

(1) Resettlement/Land Acquisition

Due to the land occupancy caused by the project, issues on resettlement/ land acquisition have to be addressed [Planning Stage].

1) Fatmawati – Monas Corridor (Phase-I)

Building numbers, conditions etc. affected by the project along Fatmawati – Monas corridor (Phase-I) are shown in Table 6.2.2. Along this corridor, 41 buildings are affected. Among them, 6 buildings (including one tennis court) might necessary to be demolished, while, remaining 35 buildings are necessary to be setback. All of the affected buildings are commercial buildings and located between Fatmawati depot and Block-A station.

Table 6.2.2 Affected Buildings (Phase-I: Fatmawati - Monas)

No	Station/Corridor	Affected Buildings and Number	Building Condition	Remarks*)
1	Fatmawati Depot		--	
2	Depot Connection	Passing on Tennis court (RS Fatm.) : 1 Incinerator plant : 1 East side Building in RS Fatmawati : 1	 Permanent/ Medium Permanent/ Medium	 D D S
3	Fatmawati Station	West side Show room building : 1 Office building : 1 Small shops within 1 building : 3	 Permanent/ Good Permanent/ Medium Semi Permanent/ Poor	 S D D
4	Cipete Station	Right side Restaurant : 1 Furniture shop : 1	 Permanent/ Good Permanent/ Bad	 S S
5	Haji Nawi Station	West Side Garage : 1 East Side Shops : 6	 Permanent/ Bad Permanent/ Good	 S S
6	Blok A Station	West Side 3 floor Shop buildings : 13 2 floor Shop buildings : 9 East Side Office building: 1 Warung : 1	 Permanent/ Good Permanent/ Good Permanent/ Medium Temporary/ Bad	 S S S S
7	Blok M–Monas Station	None	--	--
Total Buildings Affected		41 Buildings	--	--

Note: *) D: Demolish building might be required
S : Set-back (partial demolish) might be required
Source: JICA Study Team

Table 6.2.3 shows a required area for the land acquisition. Along the Phase-I corridor, total area of approx. 240,000m^2 will be the objected area for land acquisition. In 22,260m^2 of them, some building demolishment and/or setback are required.

Based on four (4) points/ sections traffic count survey; i.e. Jl.Fatmawati, Jl.Jend Sudirman, Jl.Gajah Mada and Jl. Taman Sari, a characteristics of the traffic along proposed MRT corridor has examined. The result of traffic count survey is summarized in Table AP6.3 in which shows traffic volumes in actual vehicle basis (not pcu) for each ten categorized vehicle for one day (24 hours).

There is not significant difference between weekday's traffic volumes and holiday's traffic volumes; holiday's traffic volume is around 70% of weekday's one. While, a morning peak traffic volumes is around 9.5-10% of 24 hours traffic volumes.

Table 6.2.3 Land Acquisition Requirement (Phase-I: Fatmawati - Monas)

Location/Segment	Type of Land Acquisition (m^2)						
	1A	1B	2A	2B	3A	3B	4
Fatmawati Depot	193,940	-	-	-	-	-	-
Depot Connection	1,630	7,320	-	-	-	-	1,830
Fatmawati Station	-	4,284	-	-	-	-	2,036
Corridor 1	-	-	-	-	-	-	21,624
Cipete Station	-	1,422	-	-	-	-	3,318
Corridor 2	-	-	-	-	-	-	16,100
Haji Nawi Station	-	1,264	-	-	-	-	3,476
Corridor 3	-	-	-	-	-	-	17,472
Blok A Station	-	1,580	-	-	-	-	3,160
Corridor 4	-	-	-	-	-	-	17,520
Blok M Station	-	-	-	-	-	-	4,898
Corridor 5	-	-	-	-	-	-	27,824
Senayan Station	-	1,002	-	896	-	-	6,822
Corridor 6	-	-	-	3,865	-	-	13,315
Istora Station	3,322	406	2,946	326	-	-	768
Corridor 7	-	-	-	3,210	-	-	35,279
Bendungan Hilir Station	-	1,794	-	1,377	-	-	7,165
Corridor 8	-	-	-	-	-	-	20,345
Setiabudi Station	240	1,090	-	950	-	-	6,804
Corridor 9	-	-	-	1,890	-	-	19,834
Dukuh Atas Station	-	-	-	213	-	-	8,647
Corridor 10	-	-	-	-	-	-	20,614
Bunderan HI Station	194	950	-	1,128	-	-	6,320
Corridor 11	-	-	-	-	-	-	23,108
Sarinah Station	-	1,157	-	578	-	-	6,398
Corridor 12	-	-	-	-	-	-	24,050
Monas Station	-	-	-	144	-	-	9,107
Total I	199,326	22,269	2,946	14,577	-	-	327,834

Note: 1. 1A: Permanent acquisition at vacant land
1B: Permanent acquisition w/ building set-back and/or demolishment required
2A: Permanent acquisition above under-ground MRT (no building exist above)
2B: Permanent acquisition above under-ground MRT (some building exist above)
3A: Temporary easement at vacant land
3B: Temporary easement w/ building set-back and/or demolishment required
4 : Project area within existing ROW
2. 3A and 3B will be decided at the construction stage
Source: JICA Study Team

A large amount of 250,000 traffic volumes was found at daily passing on Jl.Jend Sudirman. In a morning peak hour and also evening peak hour, traffic volumes in Jl. Jend Sudirman nearly reached to saturation level of road capacity including marginal strip lanes. Jl.Fatmawati has relatively small traffic volume compared with Jl. Jend. Sudrman, however, considering the road capacity of 4 lanes, traffic volume in peak hours also nearly reaches saturation level. The occupancy ratio of large sized vehicles such as truck and buses, which may cause an impact on noise and vibration, is relatively amall as 9.8% on Jl.Fatmawati and 6.32% on Jl. Jend. Sudrman. While the occupancy ratio of motorcycle, which may have impact on roadside noise, are higher as 33.75% and 20.50%, respectively.

Taking into account the current traffic volume on Jl.Gajah Mada/ Hayam Wuruk, which is planned for phase II of MRT, it relatively has room for its maximum capacity if the road is not occupied by the roadside parking.

(1) Public Facilities/Utilities

Due to the construction activities of the project, disturbance on the public facilities/ utilities, such as electric/ telephone cables, water supply piping, drainage facilities, and so on, will be predicted [Construction Stage].

Proposed MRT corridor is mainly located in CBD area of DKI Jakarta. Many public facilities/ utilities, some locations are un-known, are buried underground. Table 6.2.4 shows the public facilities/ utilities along and/or crossing the corridor and its handling authorities.

Table 6.2.4 Relevant Authorities for Public Facilities/ Utilities

No	Public Facilities/ Utilities	Authorities
1	Water supply/ piping	Perusahan Air Minum (PAM) - Water Supply Company -
2	Gas supply/ piping	Perusahan Gas Negara (PGN) - State Company for Gas -
3	Telecommunication/ cables	Persahan Umun Telecomunikasi (PERUMTEL) - Telecommunication Company -
4	Electric supply/ cables	Purusahan Listrik Negara (PLN) - State Company for Electricity -
5	Drainage/ sewer facilities	Dinas Pekerjaan Umum (DPU), DKI Jakarta - Public Works Agency in DKI Jakarta -
6	Traffic control facilities	Dinas Lalu Lintas Angkutan Jalan Raya (DLLAJR) - Public Transportation Agency in DKI Jakarta -
7	Street lighting facilities	Dinas Penerangan Jalan Umum (DPJU) - Public Road Lighting Agency -

(2) Waste

Due to the construction works, much quantity of surplus soil and/or demolished waste will be generated. Handling of these waste may cause the local traffic jam and the problem of its disposal [Construction Stage]. While accumulation of such a waste at the construction sites, which may cause a disturbance of the existing drainage system, may cause a local flood [Construction Stage].

1) Construction Waste

Estimated amount of surplus soil, demolished asphalt debris etc. which might be produced during the construction stage is shown in Table 6.2.5. Approx. 120,000m^3 of debris including surplus soil (equivalent to 38,400 units of 4 ton trucks to carry) will be produced in Phase-I and approx. 23,000 m^3 (equivalent to 7,400 trucks) in Phase-II.

Table 6.2.5 Estimated Construction Waste

No	Item/ Construction Works	Unit	Amount	Remarks
Phase-I: Fatmawati - Monas				
1	Elevated corridor	m^3	34,000	30% of cut soil will be backfilled
2	Transition through	m^3	50,000	10% of cut soil will be backfilled
3	Underground corridor	m^3	36,000	
	Total		120,000	
Phase-II: Monas - Kota				
1	Elevated corridor	m^3	23,000	30% of cut soil will be backfilled
	Total	m^3	23,000	
	G. Total	m^3	143,000	

Source: JICA Study Team

[Natural Environment]

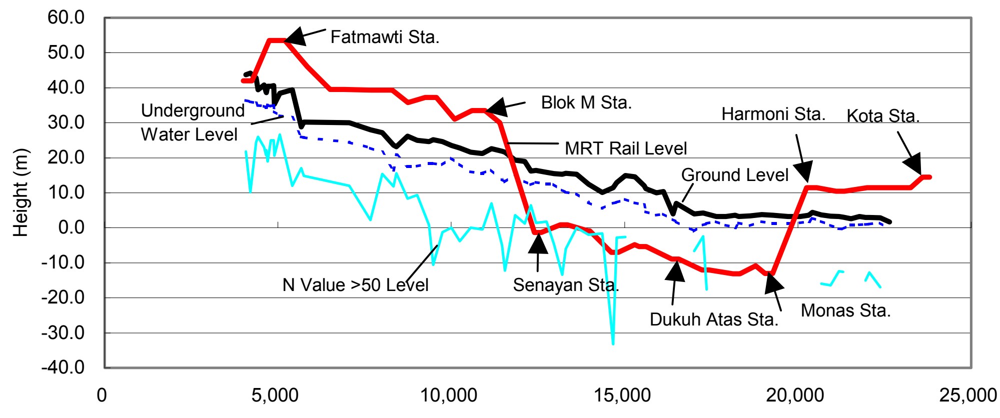
(3) Groundwater

Due to the pumpage of groundwater and/or large scale open cut by the construction activities (especially at the locations of underground station), a lowering of the groundwater table that may disturb the domestic usage of groundwater and/or may lead a land subsidence and local flood will be predicted [Construction Stage]

1) Groundwater Level

Groundwater level of MRT corridor is shown in Figure 6.2.6. Corridor of Fatmawati - Block M and Harmoni – Kota will be an elevated structure and piles will support the foundations of each structure; namely excavation will be limited. Therefore, impact on groundwater along these corridors might be small. While, along the corridor of Senayan – Monas, 8 underground stations (approx. 18-25m depth from ground level) and tunnels are planned. As show in Figure 6.2.1, groundwater level is higher than underground MRT level in this corridor. Therefore, lowering of groundwater level in and surroundings of this area will be predicted.

As shown in Figure 6.2.1, along the proposed underground corridor including underground stations (Jl. Jend Sudirman and Jl. M.H. Thamarin), water distribution system in this area is basically depending on the deep wells facilitated in each high-rise building and/or on PDAM distribution by piping. Therefore, an impact on the shortage of water distribution caused by the lowering of groundwater is not significant.



(Source: Revised Basic Desigb 1999)

Figure 6.2.1 Groundwater Level along MRT Corridor

(4) Flooding

Flooding in DKI Jakarta is still difficult problem to solve. The flooding problem in DKI Jakarta is basically caused by river overflow and water inundation due to the insufficiency of the drainage infrastructure. Moreover, this condition is deteriorating, because of the change in the land use in the catchments areas, and also the lack of discipline of the inhabitants in disposing garbage into the rivers and drainage channels.

The elevation level of the land surface in some areas of northern part of DKI Jakarta is lower than the elevation level of high-tide sea, which makes the said area susceptible to the occurrence of inundation/floods. Flooding occurs almost every year. The heaviest flooding occurred early in 1996 in the northern part of DKI Jakarta, due to overflow of Ciliwung River which across the MRT corridor. It was recorded that the rainfall intensity was 231 mm/hour. Figure 6.2.2 shows the potential and/or prone flood area and location of deep wells along the proposed MRT corridor.

(5) Land subsidence

Land subsidence can be observed in the northern part of DKI Jakarta, due to over extraction of groundwater and the pressure caused by the high-raised building load. The geological features and sinking groundwater level in this area might accelerate such caving-in.

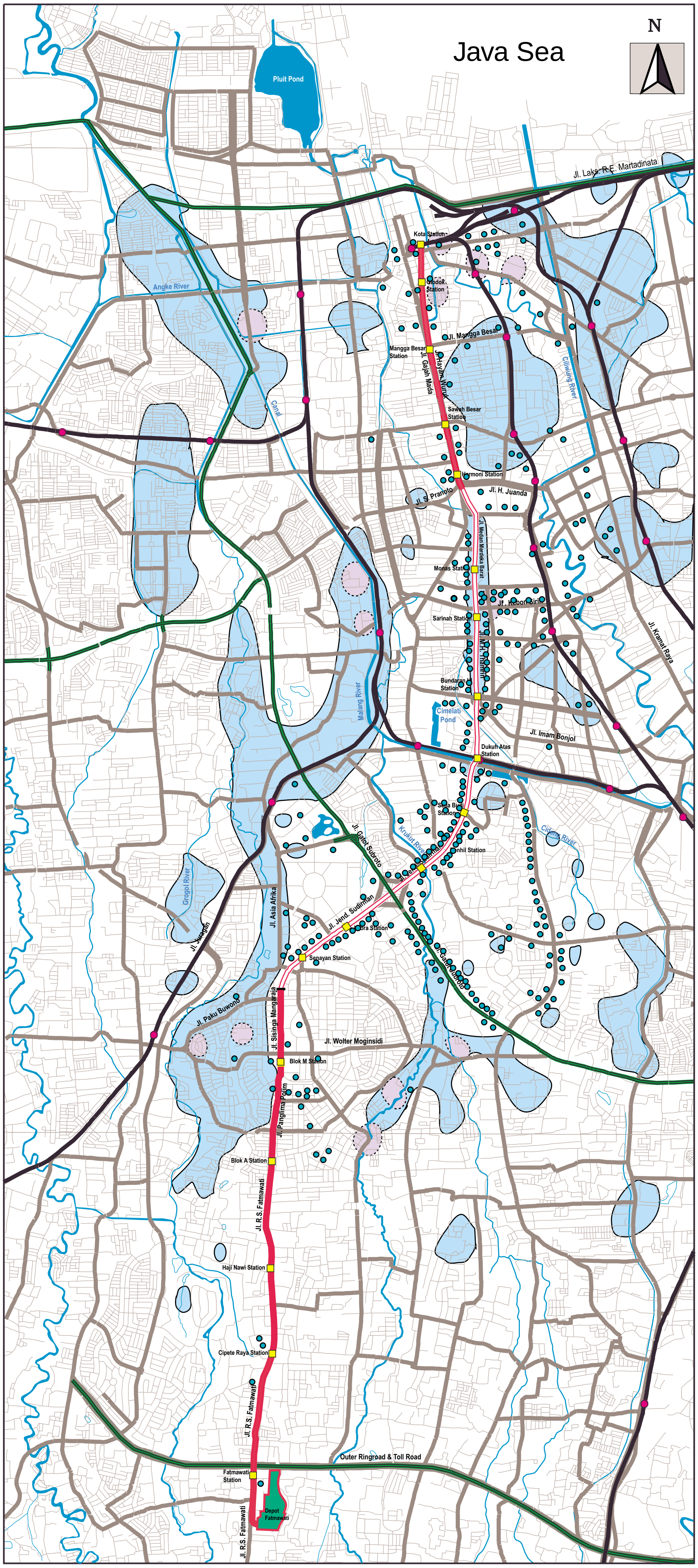
The possibility of land subsidence in DKI Jakarta has been reported by previous studies. *Jabotabek Water Resources Management Study in 1994 by IBRD* reported that land subsidence has been found in an area of 150 km^2 in the last 15 to 20 years, especially in the northern part of DKI Jakarta. The caving-in depth is estimated at between 10 and 99 cm. The lowered areas with a significant by degraded depth of more than 60 cm over the last twenty years are identified in Table 6.2.6.

Table 6.2.6 Land Subsidence in DKI Jakarta

Location	Evaluation Difference Between 1974/1978 and 1993/1994	Drainage System
Jl. Daan Mogot : Kec. Jakarta Barat	0.6m to 1.0m	Mookervaart Canal
Jl. Pangeran Jayakarta : Kec. Jakarta Pusat	0.6m to 0.9m	Ciliwung River
Jl. Perintis Kemerdekaan : Kec. Jakarta Timur	0.6m to 0.7m	Sunter River

Source: Jabotabek Water Resources Management Study in 1994, IBRD

Flood Area & Deep Well



LEGEND

- Planned MRT Station
- Planned MRT Route
- Elevated MRT Route
- Underground MRT Route
- Existing Railway Station
- Existing Railway
- Tollroad
- Mainroad
- Otherroad
- River
- Flood Prone Area
- Potential Flood Area
- Deep Well

0 1 2 3 Kilometers

Figure 6.2.2 Potential/Prone Flood Area and Deep Wells

(6) Landscape (Urban Landscape)

The existing urban landscape will be changed due to the existence of the elevated railway [Operation Stage].

1) Flora

- Depot: Depot facility is proposed to be constructed at Fatmawati Golf Club. In the area of 17 hectare here, grasses/ turfs cover most of the area and approx. 430 trees (about 5 to 10m height) are planted.
- Along elevated sections: Approx. 270 trees (about 5m height) are planted at the center and/or both sides of the road between Blok-M and Senayan.
- Underground sections: 8 underground stations will be constructed by cut-and cover method between Block-M and Monas corridor, while other part will be by shield method. Approx. 200 trees (about 5-7m height) are found at the station areas.

2) Landscape

- Precious/ valuable landscapes in which designated by concerned authorities and should be protected are not exist along MRT corridor. However, urban greenery landscape can be found along the corridor.
- Figure 6.2.3 shows the landscape photos along the proposed MRT corridor.

[Living Environmental (Environmental Pollution)]

(7) Air Pollution

Local air pollution will be predicted due to the activities of construction equipment and/or vehicles, [Construction Stage]. The traffic load of vehicles (including buses) will be reduced due to the operation of MRT. Accordingly, emissions will be reduced (positive impact) [Operation Stage].

Besides the above-described issues, the following global key issues will also be verified/examined in the EIA, as a positive factor due to the project activities.

Contribution for the Prevention of Global Warming Effect: MRT operation may lead the reduction of the traffic volume of vehicles; accordingly, emission/ pollutant including greenhouse effect gases (CO2, and so on.) will be reduced [Operation Stage].

1) Existing Condition

Ambient air quality along proposed MRT corridor (roadside measurement) measured by JICA Study Team is shown in Table 6.2.7. As a result, 24 hours concentration of Total Suspended Particles (TSP) exceeds the air quality standards in all three days samples at RS. Fatmawati, Cipte Utara and Gajah Mada, while, at Block M and P. Hotel, one-day sample exceeds the standards. The maximum value of 614.8 $\mu g/m^3$ was found at Gajah Mada in which shows 2.7 times the standards.

Existing Golf Range (Fatmawati Depot Plan)

Fatmawati Fly Over (Elevated MRT Plan)

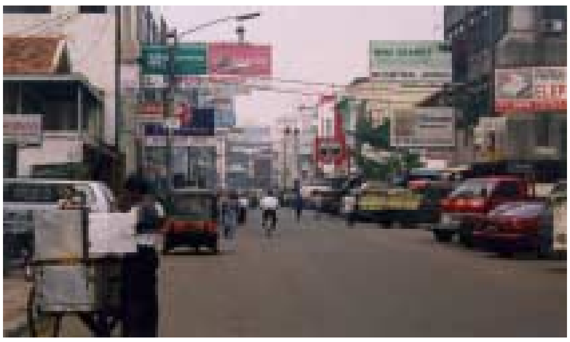
Jl. Fatmawati (Elevated MRT Plan)

Jl. Panglima Polim (Blok M Station Plan)

Jl. M.H. Thamrin (BHI Underground Station Plan)

Jl. M.H. Thamrin (Underground MRT Plan)

Jl. Hayam Wuruk (Elevated MRT Plan)



Jl. Jembatan Batu (Station Kota Plan)

Figure 6.2.3 Landscape Photos along MRT Corridor

Table 6.2.7 Air Conditions along Proposed MRT Corridor in DKI Jakarta

No	Location	Days	NOx	SO_2	CO	TSP	Pb
			Ppm	ppm	ppm	μg/m^3	μg/m^3
1	RS. Fatmawati (Jl. RS. Fatmawati)	Day1	0.0043	0.0037	11.08	316.7	0.6088
		Day2	0.0057	0.0073	6.55	374.3	0.3923
		Day3	0.0135	0.0069	9.21	409.9	0.5312
2	Cipte Utara (Jl. RS. Fatmawati)	Day1	0.0080	0.0023	4.21	246.8	0.6635
		Day2	0.0087	0.0034	9.73	354.7	1.4773
		Day3	0.0052	0.0027	3.10	347.9	0.4152
3	Block M (Jl. Panglima Polim)	Day1	0.0071	0.0097	4.50	317.5	1.7599
		Day2	0.0059	0.0031	3.96	202.7	0.1980
		Day3	0.0082	0.0037	4.19	208.1	0.7338
4	Plaza BRI (Jl. Jend. Sudirman)	Day1	0.0025	0.0068	5.46	179.1	1.5918
		Day2	0.0023	0.0074	5.47	199.3	1.2518
		Day3	0.0060	0.0076	2.79	86.5	0.1937
5	President H. (Jl. M.H. Thamrin)	Day1	0.0051	0.0020	1.40	196.4	0.2916
		Day2	0.0046	0.0164	2.33	185.3	0.2903
		Day3	0.0087	0.0031	2.58	271.1	0.2333
6	Gajah Mada (Jl. Gajah Mada)	Day1	0.0115	0.0103	6.69	361.8	0.5737
		Day2	0.0100	0.0062	7.50	614.8	0.2502
		Day3	0.0069	0.0045	5.73	571.0	0.2355
Air Quality Standard (National & DKI)			0.05	0.10	20	230.0	2.00

Note: 1. Measurement value of NOx, SO_2, TSP and Pb shows 24 hours concentration.
2. Day1, Day2: weekday / Day3: Sunday (All measurement has done at the roadside).
Source: Environmental Site Survey on MRT by JICA Study Team, July-August 2000

Lead (Pb) concentrations are under the Indonesian National Standards (2.0 μg/m^3: 24 hours concentration), however, almost all sampling locations, the values over the WHO (World Health Organization) standards (0.5-1.0 μg/m^3: 1-year average).

The concentrations of other pollutants (NOx, SO_2 and CO) were below the standards.

2) Improvement of Emission Load

Due to the implementation of MRT project, vehicle traffic load on MRT corridor (Fatmawati – Monas - Kota) will be reduced by modification/ reorganization of bus distribution system, passenger's transfer from bus to MRT, rider's transfer from passenger vehicle to MRT etc. Accordingly, pollutants emission load on the corridor will also be reduced.

In order to evaluate an improvement of pollutants emission load, the difference of the quantified load between the case of "with project (MRT implementation)" and the other case of "without project" have been calculated by use of parameters of segment length (km), emission factor of each pollutant, demand projection and estimated total traffic volume (t-vehicle/year).

Based on the location of traffic count survey, in this estimation, MRT corridor has divided into three segments; i.e. Fatmawati – Block M (5.8 km), Block M – Monas (8.6 km) and Monas – Kota (4.8 km). Table 6.2.8 shows emission factors for each pollutant of CO, HC, NOx and PM, which are mainly produced by vehicle traffic at CBD area.

Table 6.2.8 Emission Factors for each Vehicle Type

(unit : g/km/vehicle)

Parameter	Motorcycle	Passenger Car	Taxi	Microbus	Bus	Van	Small truck	Truck (2 axles)	Truck (3 axles)
CO	13.18	18.71	13.07	30.31	18.65	19.98	17.98	3.22	6.9
HC	4.57	2.44	1.73	3.7	4.08	2.44	2.22	1.89	4.05
NOx	0.09	2.24	2	6.21	11.73	2.95	2.83	7.21	15.45
PM	0.01	0.17	0.22	0.8	1.4	0.17	0.27	1.4	1.4

Source: The Study on The Integrated Air Quality Management for Jakarta Metropolitan Area, JICA 1997

Table 6.2.9 Estimation of Pollutant Emission Load w/ and w/o MRT

Year	Parameter	MRT Corridor/ Emission Load (ton/year)			Total
		Fatmawati – Block M	Block M – Monas	Monas – Kota	
2000	CO	2,250	12,800	5,500	20,550
	HC	419	2,110	1,050	3,579
	NOx	254	1,640	590	2,484
	PM	24	148	55	227
2006	CO	3,630	20,700	8,860	33,190
	HC	674	3,410	1,680	5,764
	NOx	410	2,640	950	4,000
	PM	39	238	88	365
2011 Without MRT	CO	4,850	27,600	11,900	44,350
	HC	902	4,560	2,250	7,712
	NOx	548	3,530	1,270	5,348
	PM	52	318	118	488
2011 With MRT	CO	4,260	24,600	10,500	39,360
	HC	825	4,150	2,070	7,045
	NOx	441	2,990	1.020	4,451
	PM	42	270	94	406

Source: JICA Study Team

Based on the above estimation, in case the MRT project is implemented, approx. 5,000 ton of CO emission load can be reduced in the year 2011 compare with "without project". As a same manner, approx. 670 ton of HC, 900 ton of NOx and 80 ton of PM can be reduced by "with project".

As a result, emission load of every pollutant (CO, HC, NOx and PM) caused by the vehicle traffic, along the most prominent north-south corridor of DKI Jakarta, will apparently decrease by the implementation of MRT project as compared with "without project".

(8) Water Pollution

Pollution on the public water bodies will be predicted due to the production/discharge of wastewater by the construction works [Construction Stage]. Due to the production/ discharge of wastewater by the operation of depot, pollution on the public water bodies will be predicted [Operation Stage].

1) Existing Condition

River water samples have taken from down stream of each river which across and/or flow parallel with proposed MRT corridor, namely Kurukut River (Category B), Malang River (Category B), Cideng River (Category B) and Ciliwung River (Category D). For the parameter of BOD_5, COD, T-P, Cl and N-Hexane, most samples from each river exceeds the standards. While, only

Cideng River exceeds the standards of Conductivity. Table 6.2.10 shows the survey results.

2) Prediction

Based on the experience of similar works in Japan, wastewater discharge to public water bodies due to the construction activities will lead the higher pH (hydrogen ion concentration) and SS (suspended solid) values. In case the current velocity of the river in which wastewater will be discharged is slow; the impact on the water quality tends to be higher. While, water contamination by oil, grease, fuel, soap, paint etc. produced by the operation activities in Fatmawati depot will be predicted.

River water samples have taken from down stream of each river which across and/or flow parallel with proposed MRT corridor; namely, Kurukut River (Category B), Malang River (Category B), Cideng River (Category B) and Ciliwung river (Category D). For the parameter of BOD_5, COD, T-P, Cl and N-Hexane extracts, most samples from each river exceed the standards. While, only Cideng River exceeds the standards of Conductivity. Table 6.2.10 shows the survey results.

Table 6.2.10 River Water Quality passing Proposed MRT Corridor in DKI Jakarta

No	Parameters	Unit	Location/ Sampling River								Standards			
			Krukut R. (B)		Malang R. (B)		Cideng R. (B)		Ciliwung R. (D)		Governor Decree's *1)		Regulation No 20 *2)	
			S-1	S-2	S-1	S-2	S-1	S-2	S-1	S-2	(B)	(D)	(B)	(D)
	Physical Data													
1	Water temperature	^{0}C	26	29	26	29	27	30	28	30	Normal	Normal	Normal	Normal
2	Air temperature	^{0}C	30	31.5	30	31	30.5	31.5	30.5	31.5	Normal	Normal	Normal	Normal
3	Chromaticity	Pt Co	11.2	11.1	11.7	14.8	12.1	11.8	10.6	12.2	100	-	-	-
4	Turbidity	NTU	6	4.5	5	1.5	3	3	2	3	100	-	-	-
5	Conductivity	umho/cm	240	300	240	260	550	600	330	400	500	1,000	-	2,250
6	TSS (Total Suspended Solid)	mg/l	88	38	24	102	12	8	44	36	100	200	-	-
	Chemic Data/ Analysis													
7	PH		7.6	7.65	7.4	7.6	6.15	6.9	7.55	7.7	6.0 - 8.5	6.0 - 8.5	5 - 9	5 - 9
8	Dissolved Oxygen	mg/l	2	0.9	1	1	1	1	0.8	1.2	3	3	6	-
9	BOD_5 *(Biochemical Oxygen Demand)*	mg/l	30.08	32.08	12.03	14.04	38.10	38.09	20.05	16.04	10	20	-	-
10	COD *(Chemical Oxygen Demand)*	mg/l	80.89	123.37	73.82	63.20	123.37	98.59	102.13	105.67	20	30	-	-
11	Total-Nitrogen	mg/l	4.202	5.883	4.482	3.922	12.186	14.987	6.303	4.202	-	-	-	-
12	Total Phosphate	mg/l	0.355	1.218	0.516	0.345	1.086	1.902	0.795	0.550	0.5	0.5	-	-
13	Chlorine	mg/l	2.84	2.18	3.55	3.55	2.84	1.42	2.13	2.84	-	-	0.003	-
14	Salinity	SL	0	0	0	0	0	0	0	0	-	-	-	-
15	Free carbon dioxide (CO_2)	mg/l	16.78	20.74	19.58	14.38	28.36	23.97	15.58	13.98	-	-	-	-
16	Heavy carbonate ion (HCO^{4+})	mg/l $CuCO_3$	136	141	116	132	258	254	160	222	-	-	-	-
17	N-hexane extracts	mg/l	2.30	3.74	2.68	4.60	2.75	2.15	1.80	2.28	nihil	nihil	nihil	-
18	Chloride (Cl)	mg/l	19.5	19.5	28.0	19.5	37.2	35.5	33.7	30.2	250	-	600	-
19	Carbonate ion (CO_3^+)	mg/l $CaCO_3$	<0.01	<0.01	<0,01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-
	Microbiology data/ analysis													
20	Total Coliform (Coliform Group)	MPN/100 ml	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	10,000	20,000	10,000	-

Note: *1) : Governor Degree of DKI Jakarta No.582, 1985 concerning river quality standards in DKI, for river criteria B & D
*2) : Government Regulation No.20, 1990 concerning river water quality
Source: Environmental Site Survey on MRT by JICA Study Team, July-August 2000

(9) Noise and Vibration

Due to the construction activities, disturbance of surrounding living environment by noise and vibration will be predicted [Construction Stage]. While, due to the operation of MRT and the depot, disturbance of living environment by noise and vibration will be predicted [Operation Stage].

1) Noise

a. Existing Conditions

Existing noise levels caused by traffic along the proposed MRT corridor and by traffic & railway along existing elevated railway (Cikini and Taman Sari) are shown in Table 6.2.11.

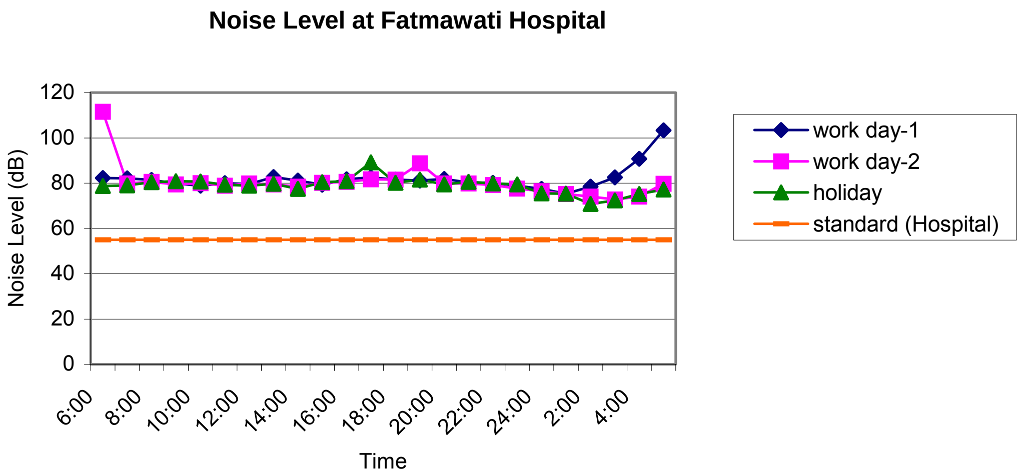
Table 6.2.11 Noise Level along MRT Corridor

No	Location	L_S (Leq)			L_M (Leq)			L_{SM} (Leq)			L_X	Standard *
		day-	day-	day-	day-	day-	day-	day-	day-	day-		
1	RS Fatmawati	81.1	99.5	81.6	94.6	76.7	76.6	94.9	97.8	81.6	103.3	55
2	Cipte Utara	79.9	79.8	80.7	74.9	75.2	74.4	79.9	79.9	80.3	82.4	70
3	Blok M	77.9	77.3	76.3	70.8	71.4	70.6	77.4	77.0	76.0	80.5	70
4	Jl. Sudirman	82.3	84.2	77.0	75.5	75.7	71.0	81.8	83.3	76.7	90.2	70
5	Jl.MH Thamrin	97.8	87.5	76.1	71.6	72.8	71.0	96.1	85.9	76.0	109.6	70
6	Gajah Mada	84.1	92.0	81.4	89.9	92.7	72.5	90.8	94.8	80.4	99.1	70
7	Cikini	89.2	74.5	88.1	64.9	63.3	61.8	87.5	73.3	86.3	97.5	65
8	Taman Sari	84.3	83.0	98.0	75.6	77.4	77.3	83.5	828	96.3	109.6	70

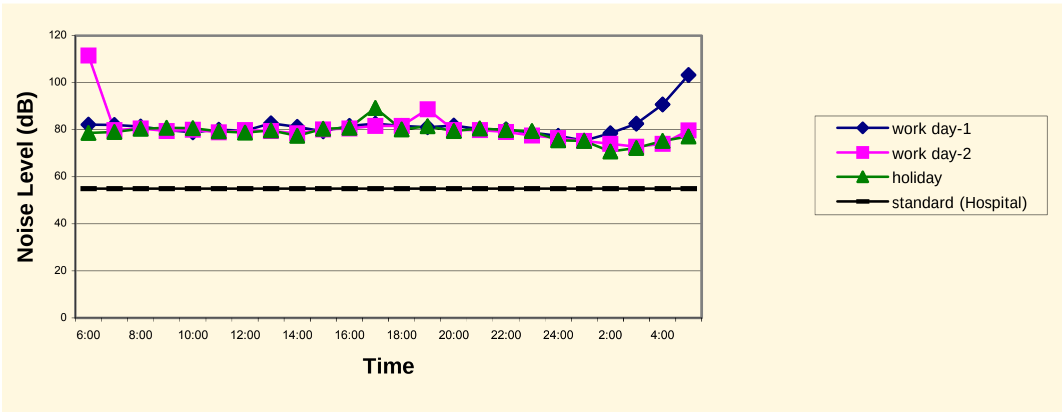
Note: L_S: Noise level at daytime
L_M: Noise level at nighttime
L_{SM} Noise level at day and nighttime (24 hours)
L_X: Leq maximum
Day-1 & 2: working day, Day-3: holiday
* : State Minister of Environment Degree KEP-48/MENLH/11/1996
Source: Environmental Site Survey on MRT by JICA Study Team, July-August 2000

As shown in Table 6.2.11, most of locations and days, each noise level at roadside exceeds the standards (except L_M value of Cikini). Weekday noise level tends to be higher than holiday's, and daytime noise tends to higher than nighttime's. Lx value at Fatmawati Hospital, Jl. M.H. Thamrin and Taman Sari exceed 100 dB.

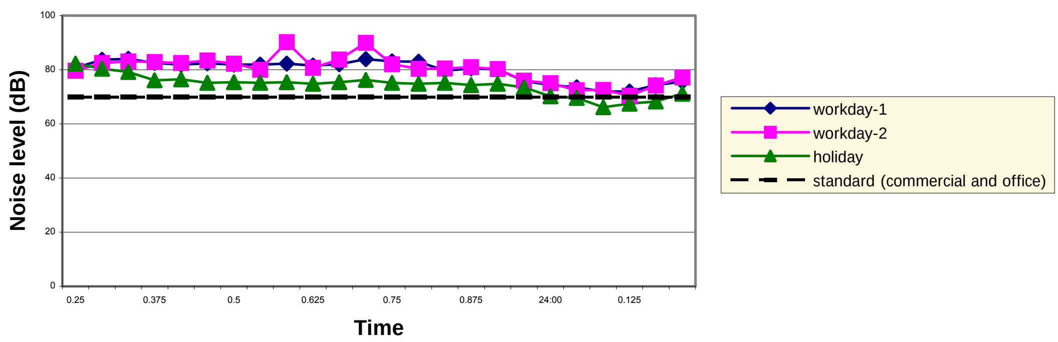
Figure 6.2.4 shows the daily noise level at Fatmawati Hospital, Jl. Sudirman and Cikini.



< Fatmawati Hospital/ by traffic >



< BRI Jl. Sudirman/ by traffic >



< Cikini/ by traffic and elevated railway >

Figure 6.2.4 Existing Noise Level along MRT corridor and Others

b. Prediction and Evaluation

Noise impact will be predicted at mainly; 1st surroundings of depot located behind Fatmawati Hospital and 2nd along Jl. Fatmawati and access to Kota Station from Jl. Gajah Mada in which road width is not wide and elevated MRT is proposed.

Along the elevated MRT corridor (represented to Fatmawati area), combined noise level of road traffic and railway can be predicted by the following equation:

$$L_{p(total)} = 10\log_{10}[10^{L1/10} + 10^{L2/10}]dB$$

Where;
$L_{p\,(total)}$: Total noise level
L_1 : Noise level of source 1 (from road traffic)
L_2 : Noise level of source 2 (from train/ MRT)

While, Noise level at certain distance from line sources can be predicted by the following equation.

$$L_{50} = P_W\text{-}8\text{-}20\log_{10}l + 10\log_{10}(\pi l/d \tanh 2\pi l/d) + \alpha$$

P_W : Power level
l : length from noise source to the observation point (m)
d : 1,000V/N (m)
V : Velocity of vehicle
N : Number of vehicle (number/h)
α : $\alpha_d + \alpha_i$ (constant which decided from parameter)

Here,

$$P_W = 85 + 0.2V + 10\log_{10}(a_1 + 3.2b_2 + 16b_3)$$

a_1 : ratio of passenger car
b_1 : ratio of small track and bus
c_1 : ratio of large track and bus
$a_1+b_1+c_1 = 1$

Table 6.2.12 shows the combined noise level of road traffic and railway/ MRT and the level at a certain distance from the line source in 2011 (operation stage), taking into account the survey results, traffic demand etc. As a result, predicted noise level along Jl. Fatmawati from combined line sources will be below the standards (65dB for commercial area) at about 30m from the road center. At proposed depot behind Fatmawati Hospital, noise level will be reduced to the standards (55dB for hospital) at about 30m from the road center.

Table 6.2.12 Combined Noise Level and Distance at Fatmawati in 2011

Noise Source	Distance from Line Source (Center of road)				
	20m	30m	40m	50m	60m
1. Jl. Fatmawati (Cipte)					
Road Traffic	61.4	55.4	49.8	44.6	39.5
MRT (Lw=110 dB)	63.8	63.8	63.4	63.1	62.7
Total noise	65.8	64.4	63.6	63.2	62.7
2. Fatmawati Hospital area					
Road Traffic	61.4	55.4	49.8	44.6	39.5
MRT (Lw=88 dB)	41.8	41.8	41.4	41.1	40.7
Total noise	61.4	55.6	50.4	46.2	43.2

Source: JICA Study Team

While, noise level during construction stage can be estimated by the following equation:

$$L \quad = PWL - 20\log10(r) - 8$$

Where :
L : Estimating noise level dB(A)
PWL : Power Level at source
r : Distance from noise source

Table 6.2.13 shows the noise level at source and at the roadside (15 meter from the source) due to the construction activities. Table 6.2.14 shows an estimate noise level at each distance from the source of the construction (settled at 105dB).

Table 6.2.13 shows the estimated noise level at the roadside (15 meter from the source).

Table 6.2.13 Noise Impact by Construction Activities

Major activity	Equipment	Noise Level at source (dB)	Noise level at roadside (dB)
Road surface cutting	Concrete cutter	105	73.5
Excavation	Bulldozer	101	69.5
	Backhoe	98	66.5
Asphalt braking	Heavy Breaker	105	73.5
	Asphalt breaker	98	66.5
	Hand breaker	105	73.5
	Compressor	101	69.5
Boring/pilling	Circulation drill	93	61.5
	Earth-orger	101	69.5
	Lead wall boring machine	105	73.5
Concrete work	Track mixer	110	78.5
Road compaction	Vibration roller	98	66.5
	Vibration compactor	101	69.5
Paving	Road roller	101	69.5
	Asphalt finisher	101	69.5

Source: Revised Basic design of MRT, 1999

Table 6.2.14 Estimated Noise Level at Each Distance from the Source

Noise Level at Source	Distance from Source (From center of the road): r				
	20m	40m	60m	80m	100m
PWL=105dB	71.0dB	65.0dB	61.4dB	58.9dB	57.0dB

Source: JICA Study Team

- Fatmawati Depot:

Noise impact caused by the line sources (traffic and railway) and construction activities to the surroundings of Fatmawati depot including Fatmawati Hospital is shown in Figure 6.2.5. In the operation stage (shown with black circle in the figure), a noise impact to Fatmawati Hospital and surrounding houses might be small.

However, in the construction stage, it takes about 100m from the sources to reach the noise standard level (55dB for residential, Hospital etc.), therefore, some attention shall be paid for the noise impact.

- Jl. Fatmawati & access from Jl. Gajah Mada to Kota Station:

Jl. Fatmawati and the access from Jl. Gajah Mada to Kota Station are categorized as a commercial area; therefore, standard noise level shall be settled as 65 dB (based on National standards). For buildings/ offices located along the corridor within 30m from the road center in both east and west sides, some attention shall be paid for the noise impact (operation stage). While, in construction stage, noise impact shall be taken into account for buildings/ offices located within 40m along the corridor.

As shown in Figure AP6.3 through Figure AP6.5, 8 schools, 2 hospital and 3 worship places are located within 100m in both sides (east and west) along the MRT corridor. Among them, 4 schools, 1 Hospital and 2 worship places are located within 30m. Therefore, both in the construction and operation stages, special attention shall be paid for these public facilities for the noise impact.

Noise impact caused by the line sources (traffic and railway) and construction activities to the surroundings of Fatmawati depot including Fatmawati Hospital is shown in Figure 6.2.5. In the operation stage (shown with black circle in the figure), a noise impact to Fatmawati Hospital and surrounding houses might be small. However, in the construction stage, it takes about 100m from the sources to reach the noise standard level, therefore, some attention shall be paid for the impact.

2) Vibration

Two kinds of vibration standards are regulated in Indonesia by the State Minister of Environment Degree No.KEP-49/MENLH/11/1996: i.e. one is a displacement level for the affects on amenity/ environment (human health) and the other is velocity level for the affects on building structure. Table 6.2.15 and Table 6.2.16 show each standard.

Table 6.2.15 Standard Vibration Level (Displacement) for Amenity and Environment

Frequency (Hz)	Vibration Level: Displacement (μm)			
	Not disturb	Disturb	Not comfortable	Sickness
4	< 100	100-500	500-1000	>1000
5	< 80	80-350	350-1000	>1000
6.3	< 70	70-275	275-1000	>1000
8	< 50	50-160	160-500	>500
10	< 37	37-120	120-300	>300
12.5	< 32	32-90	90-220	>220
16	< 25	25-60	60-120	>120
20	< 20	20-40	40-85	>85
25	< 17	17-30	30-50	>50
31.5	< 12	12-20	20-30	>30
40	< 9	9-15	15-20	>20
50	< 8	8-12	12-15	>15
60	< 6	6-9	9-12	>12

Source: State Minister of Environmental Degree KEP-49/MENLH/11/1996

Existing vibration level (maximum displacement level) caused by the traffic and/or railway measured along the proposed MRT corridor (6 locations) and other two locations (Cikini and Taman Sari) in which elevated railway are operated are shown in Table 6.2.17.

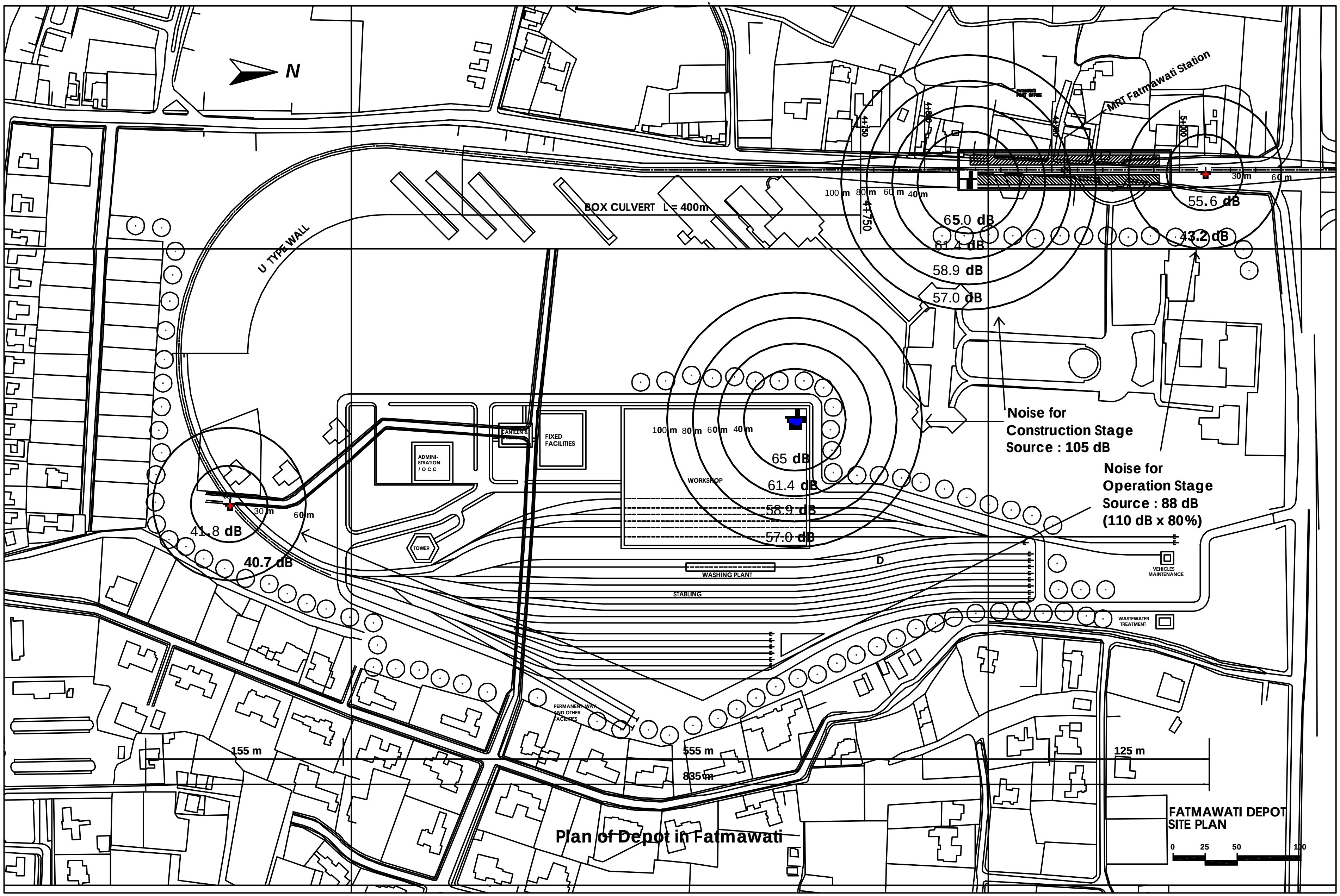


Figure 6.2.5 Noise Impact at Fatmawati Depot

Table 6.2.16 Standard Vibration Level (Velocity) for Building Structure

No	Type of Structure	Vibration velocity v_1 (mm/s)			
		At foundation			At upper floors
		Range of frequency			
		< 10 Hz	10-50 Hz	50 – 100 Hz *)	
1	Buildings used for commercial purposes, industrial buildings and building of similar design adopted	<10	20 to 40	40 to 50	40
2	Dwellings/houses and/or similar design adopted	5	5 to 15	20 to 25	15
3	Buildings (which is not mentioned in item 1&2) which has particular sensitivity to vibration and great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8.5
For frequencies above 100 Hz, at least the values specified in this column shall be applied.					

Source: State Minister of Environmental Degree KEP-49/MENLH/11/1996

Table 6.2.17 Maximum Displacement Level along MRT Corridor

(unit: μm)

Freq. (Hz)	STD	Fatmawati			Cipete			Block M			BRI, Jl. Sudirman		
		day-1	Day-2	day-3	day-1	day-2	day-3	day-1	day-2	day-3	day-1	day-2	day-3
4	<100	3.3279	2.0601	3.0110	1.0475	0.1838	0.2440	2.5356	2.5356	1.7432	0.1038	0.1275	0.1511
5	< 80	1.5213	1.0142	1.5213	0.4919	0.1774	0.1460	1.2170	1.2170	0.7911	0.4209	0.0822	0.0857
6.3	< 70	0.6324	0.4983	0.7666	0.1795	0.1526	0.2708	0.5366	0.4471	0.3385	0.4989	0.1252	0.0888
8	< 50	0.4358	0.2495	0.3803	0.1160	0.1461	0.0792	0.2495	0.2139	0.1505	0.1707	0.1949	0.1386
10	< 37	0.1622	0.1369	0.2408	0.1868	0.2992	0.0917	0.1217	0.1369	0.0963	0.2162	0.2713	0.1549
12.5	< 32	0.1282	0.0778	9.0875	0.1622	0.4203	0.1736	0.0843	0.0843	0.0762	0.2710	0.1866	0.2012
16	< 25	0.0703	0.0614	0.0851	0.2327	0.2585	0.1465	0.0564	0.0713	0.0574	0.1188	0.1000	0.1109
20	< 20	0.0500	0.0456	0.0570	0.1527	0.1857	0.1331	0.0316	0.0348	0.0304	0.0575	0.0728	0.0754
25	< 17	0.0344	0.0231	0.0377	0.1557	0.1411	0.0835	0.0170	0.0174	0.0178	0.0624	0.0399	0.0379
31.5	< 12	0.0140	0.0143	0.0212	0.0577	0.0587	0.0513	0.0081	0.0066	0.0076	0.0203	0.0225	0.0148
40	< 9	0.0082	0.0091	0.0109	0.0496	0.0491	0.0275	0.0060	0.0039	0.0057	0.0061	0.0045	0.0041
50	< 8	0.0052	0.0058	0.0058	0.0238	0.0159	0.0132	0.0023	0.0036	0.0032	0.0120	0.0090	0.0019
63	< 6	0.0026	0.0030	0.0042	0.0187	0.0128	0.0054	0.0008	0.0026	0.0054	0.0036	0.0017	0.0017
80	-	0.0018	0.0022	0.0028	0.0088	0.0078	0.0028	0.0031	0.0003	0.0002	0.0021	0.0012	0.0011
100	-	0.0007	0.0025	0.0017	0.0015	0.0090	0.0018	0.0002	0.0003	0.0001	0.0008	0.0013	0.0020

Freq. (Hz)	STD	Jl. Thamrin			Jl. Gajah Mada			Cikini			Tamansari		
		day-1	day-2	day-3	day-1	Day-2	day-3	day-1	day-2	day-3	day-1	day-2	day-3
4	<100	6.6559	0.6814	1.2202	1.5530	1.1251	0.3169	1.0427	1.3042	0.7131	0.1147	0.9746	0.8478
5	< 80	2.2313	0.3346	0.5578	0.5882	0.6795	0.4158	0.9341	1.0030	0.2687	0.1024	0.6055	0.1795
6.3	< 70	1.2138	0.1788	0.2683	0.2363	0.3130	0.1661	1.2968	0.8368	0.1916	0.1162	0.3066	0.1373
8	< 50	1.0300	0.2852	0.4358	0.3209	0.2892	0.0831	0.3304	1.1885	0.1164	0.1969	0.1533	0.0931
10	< 37	0.5324	0.7099	0.5831	0.1927	0.1394	0.0938	0.4538	0.6567	0.0316	0.1158	1.1182	0.2246
12.5	< 32	0.3083	0.4219	0.3083	0.0551	0.0632	0.0470	0.2450	0.8113	19.6356	0.5468	0.3635	0.0981
16	< 25	0.1683	0.1485	0.1485	0.0247	0.0287	0.0247	0.1594	0.3664	0.0222	0.2169	0.0397	0.0687
20	< 20	0.0633	0.0697	0.0564	0.0101	0.0114	0.0602	0.1965	0.2903	0.0254	0.1553	0.0324	0.0494
25	< 17	0.0377	0.0271	0.0223	0.0093	0.0121	0.0117	0.0912	0.1829	0.0187	0.0179	0.0339	0.1152
31.5	< 12	0.0664	0.0109	0.0099	0.0097	0.0051	0.0063	0.2097	0.1022	0.0242	0.0209	0.0787	0.0894
40	< 9	0.0443	0.0072	0.0109	0.0039	0.0041	0.0050	0.1142	0.0548	0.0191	0.0089	0.0633	0.0220
50	< 8	0.0507	0.0064	0.0141	0.0033	0.0033	0.0029	0.0895	0.0431	0.0143	0.0389	0.0522	0.0133
63	< 6	0.0059	0.0037	0.0033	0.0025	0.0021	0.0023	0.0747	0.0614	0.0074	0.0074	0.0417	0.0162
80	-	0.0099	0.0025	0.0022	0.0007	0.0009	0.0008	0.0396	0.0221	0.0052	0.0118	0.0028	0.0089
100	-	0.0103	0.0011	0.0009	0.0011	0.0012	0.0008	0.0144	0.0197	0.0018	0.0014	0.0007	0.0017

Source: Environmental Site Survey on MRT by JICA Study Team, July-August 2000

As shown in Table 6.2.17, all maximum displacement levels measured at 8 survey locations are rather lower than the Indonesian standards for all frequency level. Therefore, even taking into account the future vibration prediction caused by the traffic and/or railway, it can be concluded that the vibration levels for displacement caused by MRT are not disturb the human health and environment along the corridor.

While, velocity levels of vibration were measured at the roadside below the existing elevated railway, at Cikini and Taman Sari along Central Line, in each time of rail passing during three days. Table 6.2.18 show the survey result.

Table 6.2.18 Maximum Velocity Level when Elevated Railway Passing at Cikini

(unit: µm/s)

July 16 2000 (Sun.)				July 1 2000 (Mon.)				August 8 2000 (Tue.)			
Time	Frequency (Hz)			Time	Frequency (Hz)			Time	Frequency (Hz)		
	< 10	10-50	50-100		< 10	10-50	50-100		< 10	10-50	50-100
6.35	35.1	100.8	17.2	6.45	71.8	353.5	37.9	6.25	7.0	11.4	15.5
6.40	6.1	21.7	4.6	7.30	116.6	79.3	151.5	7.40	9.9	15.1	26.7
6.52	11.7	50.4	73.6	9.25	140.1	67.6	149.8	9.25	40.3	27.2	42.9
7.24	36.1	20.8	6.8	10.25	22.5	52.7	13.5	13.30	27.7	40.8	67.1
7.30	16.2	9.2	10.8	10.35	50.1	208.7	7.5	16.20	35.7	27.4	188.7
8.33	96.8	20.1	23.4	10.55	46.2	483.0	50.4	17.20	19.4	60.7	30.0
9.16	68.9	60.7	30.0	11.40	27.0	168.9	10.1	17.45	110.3	102.8	32.5
9.55	9.7	19.0	22.5	12.35	51.8	163.2	49.7	18.50	12.7	38.2	29.3
10.25	12.0	41.4	45.8	14.20	348.2	49.8	91.9	19.20	17.2	23.1	35.7
10.40	13.2	56.8	31.9	15.25	49.3	230.9	70.4	20.30	10.3	35.5	14.9
10.45	13.5	68.1	79.0	16.25	15.0	52.2	51.5	21.45	18.5	67.6	109.9
11.45	19.5	32.8	13.6	17.25	77.1	229.7	107.9		--	--	--
12.57	14.5	33.5	53.1	18.25	377.7	141.3	59.0		--	--	--
13.25	21.0	30.5	43.4	19.22	36.0	110.3	36.5		--	--	--
13.34	16.2	138.5	116.2	21.30	11.4	19.0	45.9		--	--	--
13.47	22.0	39.4	29.5	2.18	33.6	113.3	27.2		--	--	--
14.35	12.1	46.1	36.5		--	--	--		--	--	--
15.25	22.5	202.3	18.6		--	--	--		--	--	--
15.42	18.7	40.1	45.4		--	--	--		--	--	--
16.21	193.2	78.4	20.7		--	--	--		--	--	--
16.35	37.9	28.1	152.3		--	--	--		--	--	--
17.55	19.4	53.6	7.4		--	--	--		--	--	--
18.47	89.4	103.0	60.8		--	--	--		--	--	--
21.53	18.2	40.4	10.0		--	--	--		--	--	--
5.40	44.9	146.4	75.1		--	--	--		--	--	--

Source: Environmental Site Survey on MRT by JICA Study Team, July-August 2000

As a result, as shown in Table 6.2.18, similar with displacement results, all maximum velocity levels measured at Cikini are rather lower than the Indonesian standards for all frequency level. Therefore, even taking into account the future vibration prediction caused by the traffic and/or railway, it can be concluded that the vibration levels for the velocity caused by MRT operation will not disturb the building structures along the corridor.

6.2.4 Environmental Management and Monitoring

(1) Mitigation Measures

1) Resettlement/ Land Acquisition

Two regulations provide guidance on land acquisition in Indonesia: i.e. "Presidential Degree No.55/ 1993: *Acquisition of Land for Development in the Public Interest*" and "State Minister of Agrarian Affaires/Head of National Land

Agency (BPN) Regulation No.1 of 1994: *Operational Directive of Land Acquisition for Development in the Public Interest*". As stated in Presidential Degree No.55/ 1993, land acquisition shall be carried out under the coordination/ assistance of Land Acquisition Committee (Committee Nine/ *Panitia Sembilan*) established by the Governor/ Head of Provincial Government.

Proper resettlement/ land acquisition shall be carried out considering the followings:

- Preparation of resettle action plan (RAP) by the Committee and properly organization/ execution in the planning stage of the project (especially Phase-II of the project)
- Proper application of related standards/ legislation
- Socialization of the project; cooperation with local communities, NGO etc.
- Transparency; proper process of community consultation/ musyawarah
- Sufficient compensation based on NJOP (Selling value of taxation object) and prevailing postulates

2) Traffic Congestion

In the morning and evening peak hours, traffic volume in Jl. Jend Sudirman and Jl. R.S. Fatmawati nearly reached to saturation level of the road capacity. Therefore, special attention shall be paid to mitigate the traffic congestion during the construction stage in cooperation with DLLAJ, Police, DKI Jakarta etc., as follows.

- Set up the traffic markers and diversion route
- Application of cut and cover method
- Traffic arrangement by the officers at roadside
- Proper settlement of the construction hours
- Operation control of construction vehicles

3) Public Facilities/ Utilities

Public utility networks temporary disturbed by the construction activities; i.e. water supply, gas supply, telecommunication cables, electric cables, traffic control facilities etc. shall be restored to the original condition sooner by the contractor. Followings are items to be considered in order to mitigate the impact.

- Coordination with related agencies such as PAM, PGN, PERUMTEL, PLN, DPU, DLLAJ, DPJU etc.
- Publication of the project contents and its construction schedule in order to obtain peoples understanding
- Sooner rehabilitation of temporary disturbed facilities/ utilities by the contractor

4) Waste

- Dumping site of the surplus soil and demolished waste shall be properly settled in the construction plan and properly discharged to the designated sites, in coordination with DKI Jakarta etc.
- Construction waste shall not be piled up at the generated points a long time in order to prevent the disturbance of the existing drainage system and public water bodies due to outflow by the heavy shower.

5) Groundwater

To prevent an acceleration of land subsidence, which occasionally leads the local flood at northern part of DKI Jakarta, an impact on the lowering of groundwater by the construction activities shall be minimized by the following manner.

- Adoptions of technical method that can be minimize the affect on the groundwater lowering, both in tunnel part and underground stations (e.g. mud water pressured type shield tunnel method, cut-off sheet pile etc.).
- Installation of monitoring well to check the groundwater level periodically.
- Coordination with concerned agencies such as Mining and Energy Department, DKI Jakarta, PDAM etc.

6) Landscape

- Felling trees due to the construction activities shall basically be re-planted along the MRT corridor in order to keep the urban greenery landscape.
- Elevated structures shall be designed considering the urban landscape, in order to prevent the deterioration of an aesthetic harmony by the structures.

7) Air Pollution

In order to prevent the dust diffusion due to the construction activities, necessary measures shall be taken as follows.

- Installation of temporary cover boards at the open-cut working area
- Installation of temporary fences at the surroundings of construction yards
- Periodical watering and cleansing in the construction yards
- Covering the roof rack of transportation trucks for the construction waste

8) Water Pollution

In order to prevent the water contamination due to the project activities, necessary measures shall be taken as follows.

- Wastewater produced by the construction activities and operation of MRT and Fatmawati Depot shall meet the water quality standards before discharging to the public water bodies.
- In case the chemical-feed method is adopted for the tunneling works etc., special attention shall be paid and proper management is required.

- Wastewater drainage and treatment facilities shall be installed at the depot in Fatmawati.

9) Noise

In order to mitigate the noise impact due to the construction activities and operation of MRT and Fatmawati Depot, necessary measures shall be taken as follows.

- Noise impact shall be lower than the standards: 55dB for residential, Hospital etc. and 65 dB for commercial area.
- Selection of appropriate construction equipment in which the noise level is lower
- Consideration of the operation route, time and driving speed of the construction vehicles
- Installation of temporary fences at the construction yards
- Installation of permanent buffer zone with plantations and/or fences, especially at the surroundings of Fatmawati Depot (as shown in Figure 6.2.8) and school/ hospital/ worship places nearby the corridor.
- Adoption of the soundproof wall, ballast bed, ballast mat etc. along the elevated corridor of MRT

(2) Environmental Management and Monitoring

Environmental management and monitoring are indispensable in each stage of the project, i.e. planning, construction and operation stage. This includes not only the management/ monitoring of environmental issues related to the project, but also those related to environmental improvement in the surrounding region.

1) Management Body

Environmental management shall be handled by the implementation agency of the project based on AMDAL study coordinated by BAPEDAL. Close coordination with concerned agencies is inevitable for the management.

2) Monitoring Committee

To realize and monitor the countermeasures described in above 1) to 9) and/or in later prepared AMDAL study, a monitoring committee is recommended to be established. The committee might be headed by BAPEDAL or BAPEDALDA DKI Jakarta and consist of related agencies such as Ministry of Communication, Kinbangwill, DKI Jakarta, PT. KAI, NGOs, private entities etc.

3) Education Program

Education and/or social awareness program shall be prepared in order to introduce the safety and comfortable MRT. The program should be carried out in cooperation with schools, mass media, women association (*Darma Wanita*), NGOs, police officers and other public and private organizations.

Chapter 7

Review of Economic Project Analysis

7. Review of Economic Project Analysis

7.1 General Introduction

The overall objective of the economic analysis in general terms is to assess in quantitative terms the effect of the MRT on Indonesia's economic well being and to estimate the project's expected economic rate of return (EIRR) on all resources invested. This evaluation is a deterministic1 appraisal of the economic viability of the MRT that follows the conventional discounted cash flow methodology in computing the EIRR, the net present value and the economic internal rate of return. These measures are to establish the overall viability of the proposed JORR project and they are to test the sensitivity of the project's viability to possible changes in project related costs and benefits. The computations follow a strict procedural approach, in order to ensure adequacy of methodology and transparency of the computed results.

The following sections introduce the basic cost-structure, the financial or market and economic project cost, and the vehicle operating cost and value of time computations. The economic benefits are subsequently defined and the quantified project cost and benefits are set against each other, in order to determine the incremental project benefits, which form the basis for assessing the MRT's economic viability.

7.2 Total Project Base Cost

7.2.1 Cost Structure

The MRT project as defined in Chapters 3 and 4, identified as the selected "Alternative 3B", forms the basis for cost estimation purposes. The initial cost structure of the revised basic design was in a first step adjusted to reflect the requirements of the selected alternative 3B. However, the adjusted cost structure, which is attached in an Appendix, was still in October 1998 constant US dollar. The table identifies the major cost blocks, major cost components and some margins to be applied for September 2000 base cost computing purposes.

The unit costs of this cost structure were, in a second step, advanced to reflect constant 2000 prices, broken down into local and foreign cost components and expressed in Rupiah.

As has been outlined in Chapter 5, three fundamentally different demand scenarios were assumed for the MRT project. These scenarios are:

1) Demand that can be expected on the MRT, if no additional demand enhancement measures were taken by the GOI (demand scenario 1)

1) Deterministic as opposed to probabilistic feasibility studies, which determine, in the statistical sense, the "most likely" feasibility indicators. Deterministic feasibility studies illustrate only one out of many other possible and correct outcomes.

2) Demand that can be expected on the MRT, if “road capacity capping” enhancement measures are adopted (demand scenario 2), and
3) Demand that can be expected on the MRT, if “road capacity capping” “limited competition from bus routes” and “station plaza development” enhancement measures are adopted (demand scenario 3).

The three different demand scenarios caused differences in the following cost elements:

1) **Total project base cost (all resources)**. The difference in the total project base cost is in the initial investment for rolling stock needed to meet the estimated demand
2) **Only directly operations related initial project base cost**. The same as above, since rolling stock constitutes part of the directly operations related initial project base cost
3) **Additional investment requirements for rolling stock**. Differs among the three scenarios in accordance with the increase in physical demand
4) **Replacement investment requirements**. Differs among the three scenarios only as far as replacement of written-off rolling stock is concerned, and
5) **Operation & maintenance cost**. Differ among the three scenarios.

The differences in cost blocks and items have been taken fully into account in the economic and financial viability considerations. They are explained, where necessary, in footnotes to the relevant tables. The engineering base cost and the total project base cost for the MRT project under the above described three different demand scenarios are summarized in Table 7.2.1. The detailed cost of the major elements of the three different cost structures are attached in the Appendix Table AP 7.1(1) through Table AP 7.3(3), and shown by implementation phasing (i) Fatmawati to Dukuh Atas = 12.7 km, (ii) Bundaran HI to Monas = 2.8 km, and as a total (iii) Fatmawati to Monas = 15.5 km.

Table 7.2.1 Summary of Total MRT Project Base Cost Under Different Scenarios (constant 2000 prices)

(Unit: billion Rupiah)

Major Cost Element	Demand Scenario 1	Demand Scenario 2	Demand Scenario 3
Engineering Base Cost	10,575.9	10,748.6	11,007.5
Government Contribution	2,595.1	2,627.2	2,675.3
Total Project Base Cost	13,171.1	13,375.7	13,682.8

Source: JICA Study Team
Notes: 1.) Figures are taken from the tables in the Appendix and rounded.
2.) The assumptions for the different demand scenarios are explained in Chapter 5.

7.2.2 Construction Method

A construction method is assumed that follows the detailed technical specifications and explanations as outlined in Chapter 4. The implementation schedule and draw down schedule of costs follows the engineering implementation schedule identified in Figure 7.2.1.

7.2.3 Land Acquisition, Compensation and Utility Relocation Cost

Land acquisition cost includes the cost for actual land acquisition, compensation for buildings, agricultural use land and other physical assets; cost for utility relocation and administrative overhead.

7.2.4 Maintenance Equipment and Operation & Maintenance Cost

Operation and maintenance cost (O&M) comprise all pay items needed to preserve and keep the MRT and related facilities as near as possible in their original condition as constructed or subsequently improved. The following categories were included into the computations:

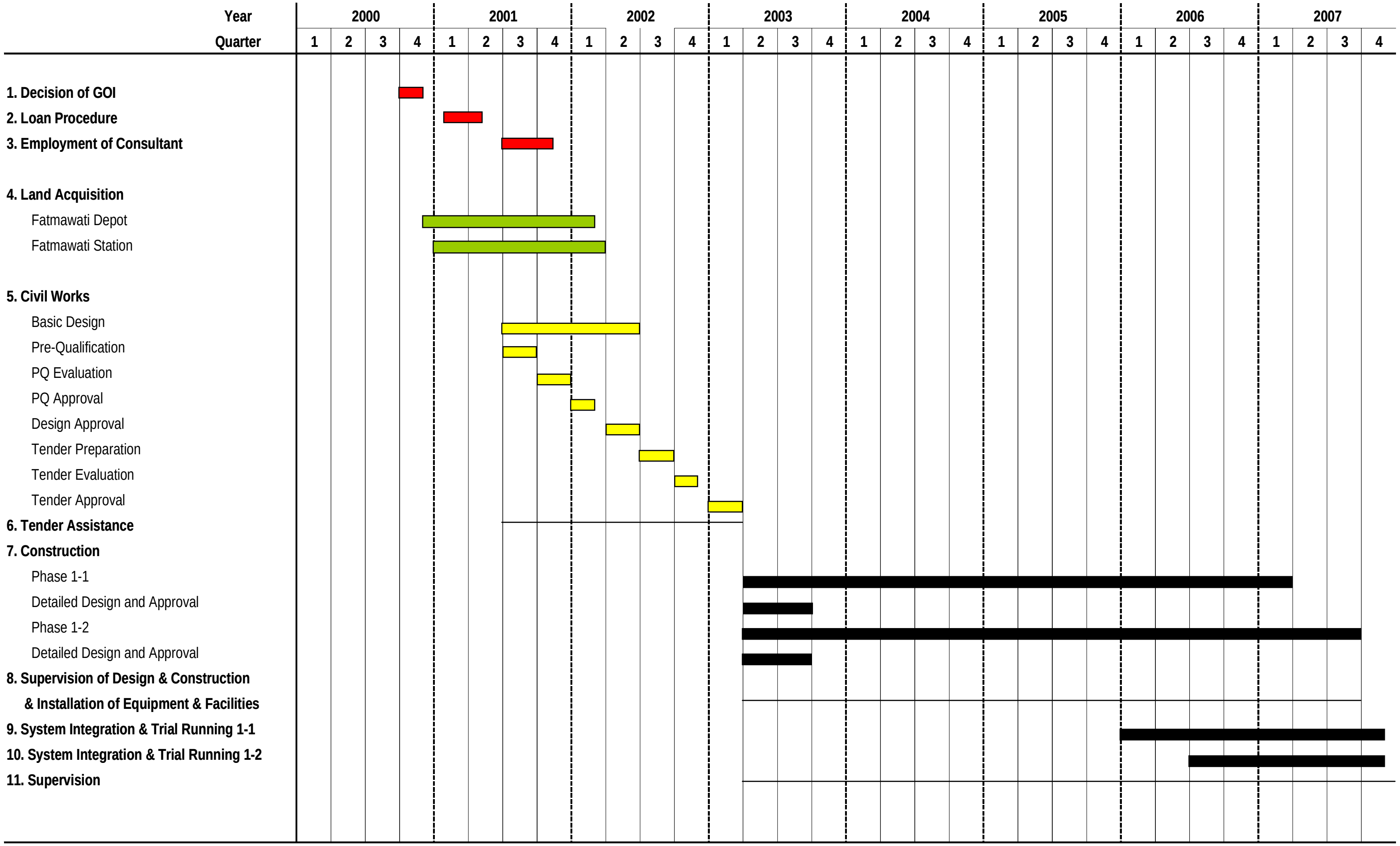
1) Additional investment requirements for MRT rolling stock
2) Replacement investment requirements for the MRT and facilities
3) Regular O&M expenditures.

The additional investment requirements for MRT rolling stock over the projects life cycle and the replacement investment requirements for the MRT over the project's life cycle for the three different demand scenarios are attached in the Appendix Table AP 7.4 through Table AP 7.9.

It is stated in summary that the MRT project is likely to require, in line with the three different demand scenarios, the following investments into additional rolling stock and replacement of written off rolling stock:

Demand Scenario 1 ("no" enhancement measures)

1) Investment into new rolling stock in the operational years 2012 (12 cars), 2018 (6 cars), 2021 (12 cars), 2024 (12 cars), 2027 (24 cars plus 6 reserve cars) and 2032 (42 cars). The number of additional cars over the life cycle of the MRT project is estimated at 114 units amounting to an accumulated total of 1,432.1.8 billion Rupiah in constant 2000 prices
2) Replacement cost for the identified items will have to be initiated in the operational years 2032 (36 cars), 2036 (12 cars), 2042 (6cars), and 2045 (12 cars). The total accumulated replacement investment cost are estimated at a total of 829.1 billion Rupiah in constant 2000 prices, and
3) Annual regular O&M expenditures, including spare parts, are estimated in constant 2000 prices at 121.9 billion Rupiah in 2008 increasing to 362.8 billion Rupiah in 2032.



Source: JICA Study Team.

Note: It is assumed that the MRT will be opened to the public in 2008.

Figure 7.2.1 Implementation Schedule MRT Project 2000 to 2007

Demand Scenario 2 ("road capacity capping enhancement measures")

1) Investment into new rolling stock in the operational years 2010 (6 cars), 2013 (12 cars), 2015 (12 cars), 2018 (24 cars plus 6 reserve cars), 2023 (42 cars). The number of additional cars over the life cycle of the MRT project is estimated at 102 units amounting to an accumulated total of 1,281.3 billion Rupiah in constant 2000 prices

2) Replacement cost for the identified items will have to be initiated in the operational years 2032 (48 cars), 2034 (6 cars), 2037 (12 cars), 2039 (12 cars), 2042 (30 cars) and 2047 (42 cars). The total accumulated replacement investment cost are estimated at a total of 1,884.3 billion Rupiah in constant 2000 prices, and

3) Annual regular O&M expenditures, including spare parts, are estimated in constant 2000 prices at 152.1 billion Rupiah in 2008 increasing to 362.8 billion Rupiah in 2023

Demand Scenario 3 ("all" enhancement measures)

1) Investment into new rolling stock in the operational years 2012 (12 cars), 2017 (24 cars plus 6 reserve cars), and 2024 (42 cars). The number of additional cars over the life cycle of the MRT project is estimated at 84 units amounting to an accumulated total of 1,055.2 billion Rupiah in constant 2000 prices

2) Replacement cost for the identified items will have to be initiated in the operational years 2032 (66 cars), 2036 (12 cars), and 2041 (30 cars). The total accumulated replacement investment cost are estimated at a total of 1,356.7 billion Rupiah in constant 2000 prices, and

3) Annual regular O&M expenditures, including spare parts, are estimated in constant 2000 prices at 183.6 billion Rupiah in 2008 increasing to 362.8 billion Rupiah in 2024.

The conversion factors employed to convert financial (or market) cost into economic cost are identified in Table 7.2.2.

Table 7.2.2 Factors for Converting Financial into Economic Prices

Cost Item	Cost Component	Conversion Factor
Land acquisition	LC	0.843
Civil works	LC	0.843
	FC	0.795
Engineering services	LC	0.843
	FC	1.00
Equipment Cost	LC	0.843
	FC	0.795
Project overhead	LC	0.872
O&M	LC/FC	0.86
Physical contingency	LC	0.843
	FC	0.795

Source: JICA Study Team
Note: LC = local cost; FC = foreign cost.

These factors were applied to adjust total project base cost (all resources), all cost components and MRT all stages Fatmawati to Monas into economic prices.

It is necessary, before the economic costs and benefits of the “with MRT” and “without MRT” cases can be computed, to determine vehicle operating and time cost in economic prices. The approach adopted and the values determined are explained in the following Sections, tables and relevant Appendices.

7.2.5 Unit Vehicle Operating Cost and Vehicle Time Costs

All cost components of unit vehicle operating cost, i.e. unit prices of the representative vehicles, tyres, fuel & oil and so on were obtained from information collected from GAIKINDO, dealers and motor vehicles makers in Jakarta. The following vehicle types and parameter were used in the estimations:

(1) **Representative vehicles**.

A major factor in determining vehicle operating cost is the type and therefore cost of the vehicles and there is, therefore, the necessity to identify first representative vehicles for the vehicle categories of the traffic assignment. Based on sales and market share data obtained from the marketing research department of a major car manufacturer the following representative vehicles were established: passenger car; van (private use); pick-up (private use); minibus (public use); medium bus; large bus; small truck, medium truck and large truck.

(2) **Unit prices of operating cost components.**

The year 2000 financial unit prices of the major cost components were collected in Jakarta by the Study Team. The tariff, levies and tax structures utilized in determining the economic unit prices are discussed item by item below:

- **Vehicles.** It was assumed here that all complete knocked down (CKD) parts imported by the major vehicle manufacturers of the representative vehicles are imported from production facilities within AFTA, in order to keep total cost of sales as low as possible. The import content of sedan was assumed at 25% and that of commercial vehicles at 35% of the retail price value, on which a 10% tariff is levied. After adjustment for import tariff, income tax and value added tax (VAT), the tax ratio for passenger cars and commercial vehicles has been established at 38.092 percent (Table 7.2.3 refers).
- **Tires.** The local market price of tires for the various representative vehicle types was obtained from retail dealers in Jakarta. It was assumed here that a local tubeless brand would be used. Hence tyre prices consist of the price for the tires to which the price of the tubes was added. The total tax ratio was determined at 32.66 percent of the actual retail price for determining the economic unit price.
- **Fuels & lubricants.** There is a subsidy on gasoline and diesel and implicitly also on lubricants. However, in view of a lack of reliable data[2] on the actual

2) The total budget for fuel subsidies is available. However, total sales data for premium gasoline, diesel and related engine and gear oils are not available. It is, therefore, not possible to estimate the actual subsidy amount per liter sold.

and implicit subsidy content in the retail price of fuels and lubricants, only the retailer margin and the VAT have been used to determine the economic prices of fuels and lubricants. The estimated transfer content is 18.18 percent

Table 7.2.3 Tax Components of Market Sales Price of Vehicles

Item	Parameter	Costs	Taxes
1	CIF price of CKD parts	1.0000	
2	Import tariff [10% on 1]		0.1000
3	Local assembly and manufacturing cost	0.7000	
4	PPH (Income tax) [1+2+3] x 35%	0.5950	0.5950
5	VAT [1+2+3] x 10%	0.1700	0.1700
6	Distributor price [1 to 5]	2.4650	
7	Dealer Commission [6] x 10%	0.2465	
8	Retail price [6+7]	2.7115	
9	Registration Fee [8] x 10%	0.2712	0.2712
10	Total Price	2.9827	1.1362
	Tax Ratio	**38.0920**	

Source : JICA Study Team

- **Wage rates** Wage rates were obtained from BPS and compared with actual wage data for maintenance personnel, bus drivers, bus conductors and assistants and truck drivers and their assistants. The income tax free threshold for salary and wage receivers is Rupiah 8,640,000 for a family with three children. Hence, the bus drivers are theoretically tax subjects. However, in view of the existing tax collection system, it was assumed that no income taxes are paid and the financial and economic rates are identical.
- **Interest costs** A rate of 16.5% per annum has been assumed. It was further assumed that representative vehicle owners' pay 50 percent in cash and 50 percent of the vehicle cost are financed at the above-mentioned rate.
- **Insurance cost** The average insurance premiums assumed in previous similar studies were reviewed and incorporated into the assumptions as 3.5 percent of the vehicle price for passenger car and pick-up, 4.0 percent for buses and 6.0 percent for trucks. It was further assumed that about 50 percent of the vehicle fleet is actually insured.
- **Wages costs of crews** The average crew sizes were obtained from survey results as public minibus: one driver and 0.5 conductors; medium bus: one driver and one conductor/assistant; large bus: one driver and one conductor/assistant; small and medium truck: one driver and one assistant; and large truck: one driver and two assistants. Their wage costs were derived at from their traveling hours equated by average running speed.
- **Overhead costs** The overhead costs of commercial vehicles were assumed at a 10 percent rate of the total of the other cost items.

- **Cost equations of VOC** Costs at different levels of speed on a level tangent road were calculated by using standard equations for each individual cost component as summarized in the relevant Appendices.

The representative vehicle types and their major features are attached in an Appendix to this document. They are the same as used throughout other parts of this study. Table 7.2.4 identifies the financial and economic cost of the major components for VOC calculations. Table 7.2.5 identifies the vehicle operating cost VOC (in economic prices) individually for motorcycle, sedan, van, pick-up, small, medium and large bus, and small/medium and large truck and the table shows the weighted VOC for the three vehicle categories used in the VOC saving estimations. The value of time was obtained from the survey conducted by the study.

7.2.6 Economic Cost and Benefit Analysis

The quantified direct economic benefits in travel costs, comprising vehicle operating costs (VOC) and time costs (TC), are defined as the savings in economic travel costs achieved through a comparison of the “with MRT” with the “without MRT” project conditions.

The total daily economic vehicle operating costs were calculated by taking the daily section volume PCU-kilometers by average operating speeds and multiplying these by the respective vehicle category operating costs by speed and surface condition. The economic benefits in VOC were obtained for the “with MRT” and “without MRT” cases and the difference taken as the VOC savings.

The economic benefits in TC savings were estimated by applying the total vehicle-hours in the “with MRT” and” without MRT” project conditions directly to the value of time. The daily values were converted to yearly costs and the difference resulted in the TC savings.

The following other intangible benefits that would be realized have not been taken into account in this analysis:

- Reduction in accident costs resulting from improved travel conditions and increased comfort in travel
- Reduction of air pollution caused by automobiles by diverting car users to MRT
- Indirect development benefits along the direct influence area of the MRT, and
- Short term employment opportunities arising from the MRT project.

The evaluation of the three different economic cost and benefit streams that relate to the three different demand scenarios use a conventional discounted cash flow methodology, in order to determine the net present value (NPV) and the economic rate of return (EIRR). The fundamental assumptions for the economic evaluation are:

Table 7.2.4 Components for Vehicle Operating Cost Calculations

(Unit : Rupiah)

Parameter		**Financial Price**	**Economic Price**
A. Price of vehicle			
Passenger car	Toyota Corolla 1800 A/T	207,000,000	128,149,560
Van	Toyota Kijang Minibus	90,000,000	55,717,200
Pick-up	Toyota Kijang KF 60 FD	62,000,000	38,382,960
Taxi	Toyota Corolla 1800 A/T	207,000,000	128,149,560
Minibus (public)	Toyota Kijan Minibus	85,000,000	52,621,800
Medium Bus	Mitsubishi Colt FE 304	93,500,000	57,883,980
Large Bus	Mitsubishi FE 114/119	145,000,000	89,766,600
Small Truck	Mitsubishi Colt FE 304	93,500,000	57,883,980
Medium Truck	Mitsubishi FE 114/119	145,000,000	89,766,600
Large Truck	Mitsubishi Fuso FM 517	204,000,000	126,292,320
B. Price of one Set of Tyre/Tube *)			
Passenger Car	185 x 14	1,288,300	867,541
Van/Pick-up	550 x 13	1,102,400	742,356
Medium Bus	750 x 16	2,529,600	1,703,433
Large Bus	900 x 20	4,830,100	3,252,589
Small Truck	750 x 15	2,439,200	1,642,557
Medium Truck	900 x 20	4,830,100	3,252,589
Large Truck	900 x 20	7,245,150	4,878,884
C. Fuel and Engine Oil Price [per litre]			
Gasoline [Premium]		1,100	900
Diesel		600	491
Engine oil/Passenger Car		13,000	10,637
Engine oil/Minibus & Petrol Truck		13,000	10,637
Engine oil/Bus & Diesel Truck		8,000	6,546
D. Wages **) [per hour]			
Maintenance		3,385	3,385
Driver (Bus)		3,955	3,955
Driver (Truck)		4,520	4,520
Conductor (Bus)		2,424	2,424
Assistant (Truck)		2,260	2,260

Source: JICA Study Team.

Note: The depreciable value of the vehicles is 90 percent of their price.

*) Locally made requiring tubes. Price includes therefore cost for tubes.

**) Bus driver wages are based on Rp.200,000 regular salary, Rp. 650,000 work allowance; Rp.50,000 for medical and Rp. 4,000 for insurance. Monthly actual work time is adjusted as 160 hrs./month at 70%. Truck driver wages are roughly factor 1.1 that of bus drivers. Bus conductors wages are based on Rp. 125,000 basic salary, Rp. 375,000 work allowance; Rp. 50,000 medical and Rp. 4,000 insurance.

Table 7.2.5 Individual & Weighted Vehicle Operating Costs (VOC) (Economic Prices)

(Unit: Rupiah)

Speed (km/hour)	Motor-cycle	Passenger Car			Bus			Truck	
		Sedan	Van	Pick-up	Small	Medium	Large	S/M	Large
10	276.03	3,321.0	1,421.9	1,093.5	1,332.3	1,384.6	2,012.7	1,747.3	2,689.3
15	219.24	2,474.1	1,080.2	830.9	1,042.5	1,065.0	1,557.7	1,330.0	2,071.0
20	187.25	2,027.2	896.6	689.5	887.7	904.6	1,330.5	1,119.3	1,759.4
25	166.03	1,744.8	778.8	598.5	789.9	809.9	1,197.7	993.7	1,574.9
30	150.86	1,547.6	695.6	534.4	722.8	749.6	1,114.7	912.4	1,456.9
35	139.71	1,401.4	633.7	486.7	675.1	710.0	1,062.2	857.7	1,379.4
40	131.52	1,288.5	586.1	450.4	641.1	684.3	1,030.5	820.7	1,328.9
45	125.70	1,199.2	548.9	422.3	617.5	668.7	1,014.1	796.4	1,298.1
50	121.91	1,127.4	519.8	400.8	602.5	660.8	1,009.6	781.6	1,282.2
55	119.90	1,069.1	497.2	384.6	594.8	659.3	1,015.0	774.5	1,278.5
60	119.51	1,021.8	480.1	372.9	593.5	662.9	1,028.8	773.6	1,284.7
65	120.64	983.4	467.6	365.2	598.0	671.2	1,050.0	778.0	1,299.7
70	123.20	952.7	475.9	361.0	607.9	683.5	1,077.9	787.1	1,322.2
75	127.12	976.9	489.0	360.0	622.9	699.4	1,111.8	800.3	1,351.5
80	132.36	996.2	503.8	362.1	642.8	718.7	1,151.4	817.2	1,387.1
85	138.89	1,010.8	521.2	366.9	667.3	741.2	1,196.5	837.6	1,428.5
90	146.67	1,020.5	545.0	374.5	696.3	766.7	1,246.6	861.2	1,475.3
95	155.68	1,025.5	579.0	384.5	729.7	795.0	1,301.7	887.7	1,527.3
100	165.90	1,026.0	628.0	397.0	767.4	826.1	1,361.6	917.2	1,584.2

Source: JICA Study Team

Motorcycle & Weighted Vehicle Operating Costs

Speed [km/hour]	Motorcycle	Passenger Car	Bus	Truck
10	276.03	1,944.3	1,461.2	2,004.2
15	219.24	1,451.3	1,136.8	1,532.1
20	187.25	1,190.7	968.4	1,293.9
25	166.03	1,025.8	865.0	1,152.2
30	150.86	910.5	796.4	1,060.9
35	139.71	824.9	749.4	1,000.0
40	131.52	759.0	717.3	959.3
45	125.70	706.9	696.5	933.2
50	121.91	665.1	684.7	918.1
55	119.90	631.4	680.4	911.9
60	119.51	604.2	682.7	913.0
65	120.64	582.4	690.8	920.3
70	123.20	566.6	704.3	933.0
75	127.12	580.4	722.8	950.6
80	132.36	591.9	746.0	972.6
85	138.89	601.3	773.7	998.7
90	146.67	608.9	805.8	1,028.6
95	155.68	615.0	842.0	1,062.2
100	165.90	620.1	882.4	1,099.1

Source: JICA Study Team

Base year:	2000
Analysis period:	Life cycle of the project, i.e. 2000 to 2047, or 47 years
Prices:	Constant 2000 price base, and
Residual value:	None.

Tables 7.2.6 to 7.2.8 identify the cost and benefit streams and they summarize the results of the economic cost benefit analysis. The results of the EIRR for the three alternative demand scenarios are:

Demand scenario 1: EIRR = 7.48%

Demand scenario 2: EIRR = 13.19%, and

Demand scenario 3: EIRR = 14.11%.

In sum the MRT demand enhancement measures such as traffic restraint scheme, abandon of the competitive bus routes on the corridor and intensive land development in the surrounding areas of the MRT stations, should be employed in order to make the MRT project viable at internationally acceptable level.

Table 7.2.6 MRT Economic Costs and Benefits (all resources ; life cycle cost) (Constant 2000 economic prices) (Demand Scenario 1 with "no enhancement" measures)

(Unit: billion Rupiah)

Year	Life Cycle Year	ECONOMIC COSTS: Land Acquisition	Civil Works	Engineering Consulting Services	Equipment Component	Physical Contingency	Insurance	Levies & Duty	Taxes	O&M Costs	Additional Rolling Stock	Replacement Investment	TOTAL	TOTAL ECONOMIC SAVINGS	NET ECONOMIC BENEFITS
2000	-8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	-7	542	0	76	0	54	0	0	0	0	0	0	672	0	(672)
2002	-6	108	0	119	0	11	0	0	0	0	0	0	238	0	(238)
2003	-5	0	615	62	3	62	21	0	0	0	0	0	763	0	(763)
2004	-4	0	1,587	103	124	165	60	0	0	0	0	0	2,039	0	(2,039)
2005	-3	0	2,024	190	517	233	103	0	0	0	0	0	3,067	0	(3,067)
2006	-2	0	858	105	566	111	53	0	0	0	0	0	1,693	0	(1,693)
2007	-1	0	149	22	71	20	9	0	0	0	0	0	271	0	(271)
2008	1	0	0	0	0	0	0	0	0	103	0	0	103	318	215
2009	2	0	0	0	0	0	0	0	0	103	0	0	103	346	243
2010	3	0	0	0	0	0	0	0	0	103	0	0	103	376	273
2011	4	0	0	0	0	0	0	0	0	128	0	0	128	409	281
2012	5	0	0	0	0	0	0	0	0	128	122	0	250	445	195
2013	6	0	0	0	0	0	0	0	0	128	0	0	128	484	356
2014	7	0	0	0	0	0	0	0	0	128	0	0	128	526	398
2015	8	0	0	0	0	0	0	0	0	128	0	0	128	572	444
2016	9	0	0	0	0	0	0	0	0	128	0	0	128	623	495
2017	10	0	0	0	0	0	0	0	0	138	0	392	530	677	147
2018	11	0	0	0	0	0	0	0	0	138	61	0	199	737	538
2019	12	0	0	0	0	0	0	0	0	138	0	0	138	802	664
2020	13	0	0	0	0	0	0	0	0	155	0	0	155	872	717
2021	14	0	0	0	0	0	0	0	0	155	122	0	277	948	671
2022	15	0	0	0	0	0	0	0	0	155	0	0	155	1,032	877
2023	16	0	0	0	0	0	0	0	0	189	0	452	641	1,122	481
2024	17	0	0	0	0	0	0	0	0	189	122	0	311	1,221	910
2025	18	0	0	0	0	0	0	0	0	189	0	392	581	1,328	747
2026	19	0	0	0	0	0	0	0	0	228	0	0	228	1,445	1,217
2027	20	0	0	0	0	0	0	0	0	228	305	0	533	1,572	1,039
2028	21	0	0	0	0	0	0	0	0	228	0	816	1,044	1,709	665
2029	22	0	0	0	0	0	0	0	0	228	0	0	228	1,860	1,632
2030	23	0	0	0	0	0	0	0	0	228	0	0	228	2,023	1,795
2031	24	0	0	0	0	0	0	0	0	228	0	0	228	2,200	1,972
2032	25	0	0	0	0	0	0	0	0	306	427	366	1,099	2,394	1,295
2033	26	0	0	0	0	0	0	0	0	306	0	0	306	2,604	2,298
2034	27	0	0	0	0	0	0	0	0	306	0	0	306	2,832	2,526
2035	28	0	0	0	0	0	0	0	0	306	0	71	377	3,081	2,704
2036	29	0	0	0	0	0	0	0	0	306	0	122	428	3,352	2,924
2037	30	0	0	0	0	0	0	0	0	306	0	0	306	3,646	3,340
2038	31	0	0	0	0	0	0	0	0	306	0	0	306	3,966	3,660
2039	32	0	0	0	0	0	0	0	0	306	0	0	306	3,966	3,660
2040	33	0	0	0	0	0	0	0	0	306	0	0	306	3,966	3,660
2041	34	0	0	0	0	0	0	0	0	306	0	0	306	3,966	3,660
2042	35	0	0	0	0	0	0	0	0	306	0	61	367	3,966	3,599
2043	36	0	0	0	0	0	0	0	0	306	0	0	306	3,966	3,660
2044	37	0	0	0	0	0	0	0	0	306	0	392	698	3,966	3,268
2045	38	0	0	0	0	0	0	0	0	306	0	122	428	3,966	3,538
2046	39	0	0	0	0	0	0	0	0	306	0	452	758	3,966	3,208
2047	40	0	0	0	0	0	0	0	0	306	0	0	306	3,966	3,660
Accumulated		650	5,233	677	1,281	656	246	0	0	8,787	1,159	3,638	22,327	81,215	58,889
														EIRR	7.48%
														NPV at 5%	5,587.43
														NPV at 10%	-2,178
														NPV at 16.5%	-3,110

Source: JICA Study Team.

Table 7.2.7 MRT Economic Costs and Benefits (all resources; life cycle cost) (Constant 2000 economic prices) (Demand Scenario 2 with "road capacity capping" measures)

(Unit: billion Rupiah)

Year	Life Cycle Year	ECONOMIC COSTS: Land Acquisition	Civil Works	Engineering Consulting Services	Equipment Component	Physical Contingency	Insurance	Levies & Duty	Taxes	O&M Costs	Additional Rolling Stock	Replacement Investment	TOTAL	TOTAL ECONOMIC SAVINGS	NET ECONOMIC BENEFITS
2000	**-8**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	**-7**	542	0	76	0	54	0	0	0	0	0	0	672	0	-672
2002	**-6**	108	0	119	0	11	0	0	0	0	0	0	238	0	-238
2003	**-5**		615	62	3	61	21	0	0	0	0	0	762	0	-762
2004	**-4**	0	1,587	103	141	166	61	0	0	0	0	0	2,058	0	-2,058
2005	**-3**	0	2,024	190	569	236	104	0	0	0	0	0	3,123	0	-3,123
2006	**-2**	0	858	105	620	113	54	0	0	0	0	0	1,750	0	-1,750
2007	**-1**	0	149	22	71	20	9	0	0	0	0	0	271	0	-271
2008	**1**	0	0		0		0	0	0	128	0	0	128	1,109	981
2009	**2**	0	0	0	0	0	0	0	0	128	0	0	128	1,187	1,059
2010	**3**	0	0	0	0	0	0	0	0	138	61	0	199	1,270	1,071
2011	**4**	0	0	0	0	0	0	0	0	138	0	0	138	1,359	1,221
2012	**5**	0	0	0	0	0	0	0	0	155	0	0	155	1,455	1,300
2013	**6**	0	0	0	0	0	0	0	0	155	122	0	277	1,557	1,280
2014	**7**	0	0	0	0	0	0	0	0	189	0	0	189	1,666	1,477
2015	**8**	0	0	0	0	0	0	0	0	189	122	0	311	1,783	1,472
2016	**9**	0	0	0	0	0	0	0	0	189	0	0	189	1,908	1,719
2017	**10**	0	0	0	0	0	0	0	0	228	0	392	620	2,042	1,422
2018	**11**	0	0	0	0	0	0	0	0	228	305	0	533	2,186	1,653
2019	**12**	0	0	0	0	0	0	0	0	228	0	0	228	2,340	2,112
2020	**13**	0	0	0	0	0	0	0	0	228	0	0	228	2,504	2,276
2021	**14**	0	0	0	0	0	0	0	0	228	0	0	228	2,680	2,452
2022	**15**	0	0	0	0	0	0	0	0	228	0	0	228	2,869	2,641
2023	**16**	0	0	0	0	0	0	0	0	306	427	452	1,185	2,984	1,799
2024	**17**	0	0	0	0	0	0	0	0	306	0	0	306	3,105	2,799
2025	**18**	0	0	0	0	0	0	0	0	306	0	392	698	3,230	2,532
2026	**19**	0	0	0	0	0	0	0	0	306	0	0	306	3,360	3,054
2027	**20**	0	0	0	0	0	0	0	0	306	0	0	306	3,495	3,189
2028	**21**	0	0	0	0	0	0	0	0	306	0	816	1,122	3,636	2,514
2029	**22**	0	0	0	0	0	0	0	0	306	0	0	306	3,783	3,477
2030	**23**	0	0	0	0	0	0	0	0	306	0	0	306	3,935	3,629
2031	**24**	0	0	0	0	0	0	0	0	306	0	0	306	4,094	3,788
2032	**25**	0	0	0	0	0	0	0	0	306	0	488	794	4,259	3,465
2033	**26**	0	0	0	0	0	0	0	0	306	0	0	306	4,259	3,953
2034	**27**	0	0	0	0	0	0	0	0	306	0	61	367	4,259	3,892
2035	**28**	0	0	0	0	0	0	0	0	306	0	71	377	4,259	3,882
2036	**29**	0	0	0	0	0	0	0	0	306	0	0	306	4,259	3,953
2037	**30**	0	0	0	0	0	0	0	0	306	0	122	428	4,259	3,831
2038	**31**	0	0	0	0	0	0	0	0	306	0	0	306	4,259	3,953
2039	**32**	0	0	0	0	0	0	0	0	306	0	122	428	4,259	3,831
2040	**33**	0	0	0	0	0	0	0	0	306	0	0	306	4,259	3,953
2041	**34**	0	0	0	0	0	0	0	0	306	0	0	306	4,259	3,953
2042	**35**	0	0	0	0	0	0	0	0	306	0	305	611	4,259	3,648
2043	**36**	0	0	0	0	0	0	0	0	306	0	0	306	4,259	3,953
2044	**37**	0	0	0	0	0	0	0	0	306	0	392	698	4,259	3,561
2045	**38**	0	0	0	0	0	0	0	0	306	0	0	306	4,259	3,953
2046	**39**	0	0	0	0	0	0	0	0	306	0	452	758	4,259	3,501
2047	**40**	0	0	0	0	0	0	0	0	306	0	427	733	4,259	3,526
Accumulated		**650**	**5,233**	**677**	**1,404**	**661**	**249**	**0**	**0**	**10,427**	**1,037**	**4,492**	**24,830**	**127,679**	**102,850**
														EIRR	**13.19%**
														NPV at 5%	19,206.92
														NPV at 10%	2,987
														NPV at 16.5%	-1,268

Source: JICA Study Team.

Table 7.2.8 MRT Economic Costs and Benefits (All Resources; Life Cycle Cost) (Constant 2000 Economic Prices) (Demand Scenario 3 with "all enhancement" measures)

		ECONOMIC COSTS													
Year	Life Cycle Year	Land Acquisi-tion	Civil Works	Enginee-ring Con-sulting Services	Equip-ment Compo-nent	Physical Contin-gency	Insurance	Levies & Duty	Taxes	O&M Costs	Additional Rolling Stock	Replace-ment Investment	TOTAL	TOTAL ECONOMIC SAVINGS	NET ECONOMIC BENEFITS
2000	**-8**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	**-7**	542	0	76	0	54	0	0	0	0	0	0	672	0	(672)
2002	**-6**	108	0	119	0	11	0	0	0	0	0	0	238	0	(238)
2003	**-5**	0	615	62	3	62	21	0	0	0	0	0	763	0	(763)
2004	**-4**	0	1,587	103	178	168	62	0	0	0	0	0	2,098	0	(2,098)
2005	**-3**	0	2,024	190	643	240	107	0	0	0	0	0	3,204	0	(3,204)
2006	**-2**	0	858	105	693	118	57	0	0	0	0	0	1,831	0	(1,831)
2007	**-1**	0	149	22	72	20	9	0	0	0	0	0	272	0	(272)
2008	**1**	0	0	0	0	0	0	0	0	155	0	0	155	1,173	1,018
2009	**2**	0	0	0	0	0	0	0	0	155	0	0	155	1,257	1,102
2010	**3**	0	0	0	0	0	0	0	0	155	0	0	155	1,347	1,192
2011	**4**	0	0	0	0	0	0	0	0	155	0	0	155	1,443	1,288
2012	**5**	0	0	0	0	0	0	0	0	189	122	0	311	1,546	1,235
2013	**6**	0	0	0	0	0	0	0	0	189	0	0	189	1,657	1,468
2014	**7**	0	0	0	0	0	0	0	0	189	0	0	189	1,775	1,586
2015	**8**	0	0	0	0	0	0	0	0	189	0	0	189	1,903	1,714
2016	**9**	0	0	0	0	0	0	0	0	189	0	0	189	2,039	1,850
2017	**10**	0	0	0	0	0	0	0	0	228	305	392	925	2,184	1,259
2018	**11**	0	0	0	0	0	0	0	0	228	0	0	228	2,341	2,113
2019	**12**	0	0	0	0	0	0	0	0	228	0	0	228	2,508	2,280
2020	**13**	0	0	0	0	0	0	0	0	228	0	0	228	2,687	2,459
2021	**14**	0	0	0	0	0	0	0	0	228	0	0	228	2,879	2,651
2022	**15**	0	0	0	0	0	0	0	0	228	0	0	228	3,085	2,857
2023	**16**	0	0	0	0	0	0	0	0	228	0	452	680	3,306	2,626
2024	**17**	0	0	0	0	0	0	0	0	306	427	0	733	3,542	2,809
2025	**18**	0	0	0	0	0	0	0	0	306		392	698	3,795	3,097
2026	**19**	0	0	0	0	0	0	0	0	306	0	0	306	4,067	3,761
2027	**20**	0	0	0	0	0	0	0	0	306	0	0	306	4,358	4,052
2028	**21**	0	0	0	0	0	0	0	0	306	0	816	1,122	4,669	3,547
2029	**22**	0	0	0	0	0	0	0	0	306	0	0	306	5,003	4,697
2030	**23**	0	0	0	0	0	0	0	0	306	0	0	306	5,361	5,055
2031	**24**	0	0	0	0	0	0	0	0	306	0	0	306	5,744	5,438
2032	**25**	0	0	0	0	0	0	0	0	306	0	671	977	6,155	5,178
2033	**26**	0	0	0	0	0	0	0	0	306	0	0	306	6,155	5,849
2034	**27**	0	0	0	0	0	0	0	0	306	0	0	306	6,155	5,849
2035	**28**	0	0	0	0	0	0	0	0	306	0	71	377	6,155	5,778
2036	**29**	0	0	0	0	0	0	0	0	306	0	122	428	6,155	5,727
2037	**30**	0	0	0	0	0	0	0	0	306	0	0	306	6,155	5,849
2038	**31**	0	0	0	0	0	0	0	0	306	0	0	306	6,155	5,849
2039	**32**	0	0	0	0	0	0	0	0	306	0	0	306	6,155	5,849
2040	**33**	0	0	0	0	0	0	0	0	306	0	0	306	6,155	5,849
2041	**34**	0	0	0	0	0	0	0	0	306	0	305	611	6,155	5,544
2042	**35**	0	0	0	0	0	0	0	0	306	0	0	306	6,155	5,849
2043	**36**	0	0	0	0	0	0	0	0	306	0	0	306	6,155	5,849
2044	**37**	0	0	0	0	0	0	0	0	306	0	392	698	6,155	5,457
2045	**38**	0	0	0	0	0	0	0	0	306	0	0	306	6,155	5,849
2046	**39**	0	0	0	0	0	0	0	0	306	0	452	758	6,155	5,397
2047	**40**	0	0	0	0	0	0	0	0	306	0	0	306	6,155	5,849
Accumulated		**650**	**5,233**	**677**	**1,589**	**673**	**256**	**0**	**0**	**10,505**	**854**	**4,065**	**24,502**	**168,148**	**143,646**

EIRR	**14.11%**
NPV at 5%	26,241.11
NPV at 10%	4,486
NPV at 16.5%	-1,014

Source: JICA Study Team.

Chapter 8

Financial Project Analysis

8. Financial Project Analysis

8.1 General

The overall objective of the financial viability analysis in general terms is to determine in quantitative terms the MRT project's simple internal rate of return (IRR) on the basis of total project base cost (all resources) in constant prices. Based on the numerical result of the IRR analysis and related sensitivity testing, the following project key elements can subsequently be decided upon:

1) The maximum borrowing rate that the project can support. It is usually expected that the long-term debt coverage ratio (measured in net cash flow after financing and before long-term debt service) is well above 1
2) The project structure, typically defining the debt/equity ratio, the equity structure, and the debt structure
3) Determination of the actual investment cost that need to be financed for project realization, based on the above fundamental assumptions, without which no realistic financing plan and realization plan can be decided.

As has been the case for the EIRR, three alternative cases that correspond to the three alternative demand scenarios were computed.

8.2 Fare Rate System

Most urban rail based transport systems use a zonal and therefore distance proportional fare rate structure. The following assumptions were made for the fare rate system:

1) There will be a split fare rate comprising an "access" fee and a "distance proportional" fare
2) The fare level will have to be competitive with existing higher level bus fares. This is necessary, inter alia, in order to attract ridership from existing competing bus routes
3) An "access fare" of Rupiah 800 and a distance proportional fare of Rupiah 325/km were subsequently assumed for revenue computations, taking into account of the estimated travel distance of MRT users and the target MRT market of the existing air conditioned express bus service (Patas AC = Rp.2500), that eventually resulted in the revenue maximization.

8.3 Return on Investment (ROI or Simple IRR)

8.3.1 IRR Base Case Selection

It is imperative, in order to decide on a proper and viable project structure[1], to determine the project's "base case", i.e. the most likely project internal rates of return (IRR) achievable under the three demand scenarios. This requires a realistic project implementation schedule and, based on such schedule, a realistic

[1]) The project structure is defined as the debt to equity ratio; the equity structure and the debt structure.

drawdown estimation of funds required. The MRT's project implementation schedule is based on the engineering schedule. The drawdown schedules assumed for the MRT project comprising all project cost components, i.e. including indirect cost of the GOI project contribution for the MRT project, were already introduced in Chapter 7 and are attached in the Appendix to that Chapter.

Revenues that are achievable under the three demand scenarios were estimated using the traffic demand forecast results obtained from the modeling exercise in combination with the split fare introduced in Section 8.2 above. Table 8.3.1 shows a summary of the projected revenue streams for the first ten operational years of the MRT, as well as the accumulated revenue streams over the life span of the MRT project, i.e. up to the year 2047. The detailed annual revenue projections under the three demand scenarios, including revenue values that take into account standard demand modeling error margins, are attached to the Appendix Table AP 8.1 through Table 8.3.

Four (4) different investment scenarios in combination with the three demand scenarios were computed (or in other words 12 case studies) for determining the MRT project's simple IRR and subsequent base case selection. The difference in the investment scenarios is explained below and the results of the project's simple IRR for the 12 cases are summarized in Table 8.3.2.

Table 8.3.1 Comparison of Revenue Projections Under Three Demand Scenarios (constant 2000 price base)

(Unit: billion Rupiah)

Year	Demand Scenario 1 [1]	Demand Scenario 2 [2]	Demand Scenario 3 [3]
2008	165.62	254.16	349.44
2009	176.22	272.78	365.80
2010	187.50	292.76	382.93
2011	199.50	314.20	400.86
2012	212.26	337.22	419.63
2013	225.85	361.92	439.28
2014	240.31	388.43	459.85
2015	255.69	416.88	481.39
2016	272.05	447.42	503.95
2017	289.45	480.20	527.57
2018	307.97	515.37	552.30
Accumulated 2008 to 2047	**24,699**	**30,903**	**31,709**

Source: JICA Study Team

Notes: [1] Demand Estimation is based on "no enhancement" measures are implemented.
[2] Demand Estimation is based on "road capacity capping" measures are implemented.
[3] Demand Estimation is based on the implementation of "road capacity capping", limiting competition from bus and "land use development around stations" measures.
[4] Demand for scenario 1 is capped as of 2038.
[5] Demand for scenario 2 is capped as of 2031.
[6] Demand for scenario 3 is capped as of 2032.

Investment Scenario 1. It assumes on the cost stream side a total life cycle cost approach, i.e. total project base cost, plus additional investments into rolling stock, plus replacement investments for existing assets.

Investment Scenario 2. Reduces the project base cost to those components of direct importance to the operations of the MRT. It retained, however, the additional investments into rolling stock, plus replacement investment for existing assets.

Investment Scenario 3. It maintains the reduced project base cost of those components of direct importance to the operations of the MRT. It eliminated, however, the additional investments into rolling stock and retained replacement investment for existing assets.

Table 8.3.2 Simple Internal Rate of Return of MRT Project Under Three Different Demand Scenarios (constant 2000 prices)

(Unit: percent)

Investment Scenario	Parameter	Demand Scenario 1 [1]	Demand Scenario 2 [2]	Demand Scenario 3 [3]
1	Total Project Base Cost & All Life Cycle Investments into New Rolling Stock and Replacement Investments	Negative	Negative	Negative
2	Only Operations Related Initial Investment Cost & All Life Cycle Investments into New Rolling Stock and Replacement Investments	4.16%	6.39%	7.06%
3	Only Operations Related Initial Investment Cost and Replacement Investments	5.10%	7.56%	7.94%
4	Only Operations Related Initial Investment Cost No Investment into New Rolling Stock & No Replacement Investments	7.12%	9.35%	9.63%

Source : JICA Study Team

Notes:
[1] This demand scenario is based on "no enhancement " measures.
[2] This demand scenario is based on "road capacity capping" measures.
[3] This demang scenario is based on "road capacity capping", limited competition from bus" an use development measures.
[4] The terminology "no investment into…" means that such cost are treated as "sunk cost" in the computations.
[5] All revenue streams reflect "capping" when maximum capacity is reached.

Investment Scenario 4. It maintains the reduced project base cost of those components of direct importance to the operations of the MRT. It eliminated, however, the additional investments into rolling stock and also the replacement investment for existing assets.

The results of the simple IRR computations for the 12 combined investment & demand scenarios are presented in Appendix Table AP8.4 through AP8.15, and summarized as:

1) The full-scale investment assumed under investment scenario 1 results in the financially negative feasibility with any of the demand scenarios 1, 2 and 3
2) In order to achieve a positive simple IRR (or return on investment –ROI), the direct operations related initial investment, which amount to about 20 per cent of the required total project base cost, has to be borne by the implementing entity and the balance, about 80 per cent of the initial total project cost, has to be borne by the central government
3) Only if the precondition identified in 2. above is met does the MRT project result in a positive simple IRR ranging from 4.16 per cent to a maximum of 9.63 per cent
4) In general, the simple IRRs for the demand scenarios 2 and 3 are superior than the ones achievable under demand scenario 1, hinting at the fact that the MRT project will require the implementation of demand enhancement measures, in order to increase the project's financial strength.

The implications of these results are elaborated upon in Chapter 9.

During the course of Draft Final Report discussions with the Ministry of Communication, it was requested by the Ministry to examine the case where only the rolling stock cost should be borne by the operating entity together with the annual operation/maintenance costs. This case study was conducted for the different three demand scenarios (refer to Appendix Table AP 8.16 through 8.18), and the result of the simple IRR calculation is shown in Table 8.3.3.

Table 8.3.3 Simple IRR of MRT under Sharing Rolling Stock Cost Only

	Demand Scenario 1	Demand Scenario 2	Demand Scenario 3
Simple IRR (%)	14.87%	17.97%	18.40%
Rolling Stock Investment Cost (billion. Rupiah.):			
- Initial Cost	452.2	603.0	829.1
- Additional Cost	1,432.1	1,281.3	1,055.2
Total Initial Investment Cost (billion Rupiah)	13,171.0	13,375.7	13,682.7
% Share by Operating Entity against Total Initial Investment Cost	3.4%	4.5%	6.1%

Source: JICA Study Team

This case study shows outstanding improvement of the simple IRRs in any of the alternative demand scenarios. A reduction of the required total initial investment to only 3% - 6% resulted in the simple IRRs ranging from 14% to 18%. Such reduction of the initial investment cost will enable the operating entity to pay a track access charge to the track owner (i.e. the central government). This approach will be one of options for the financial arrangement. However, the initial investment cost will have to be shouldered even more by the central government, compared to the investment scenario 2, which the operating entity shares about 17.5%(Demand scenario 1) - 19.5%(Demand scenario 3) of the respective initial investment costs.

Chapter 9

Suggested Realization Scenario

9. Suggested Realization Scenario

9.1 General

There seems to be the general perception among planners and decision takers since the early 80s that DKI Jakarta will need sooner or later a mass rapid transit system, in order to cope with expanding urban transport problems. Quite a number of mass transit system configurations have been discussed in the past that focused, inter alia, on how such a system is to be integrated with the heavy rail and road transport systems. In fact, a basic design study for a MRT along the Fatmawati – Kota corridor was finalized in 1996 under the umbrella of a commercial arrangement between DKI Jakarta and private parties. The full implementation of this MRT realization initiative came to a hold as a consequence of the 1997 financial crisis. The basic design was subsequently revised in 1999 with one primary objective in mind, namely to decrease the initial investment cost thereby improving the overall economic and financial viability of the MRT project itself.

This very MRT project review is based primarily on the 1999 revised basic design study. The review has arrived at the following findings, conclusions and recommendations that are introduced below.

9.2 Economic and Financial Assessment

The need for a MRT system is commonly accepted and an essentially political decision needs to be made to proceed with the realization of the MRT project. There are in this context several closely intertwined financial key factors that will influence strongly realization of the MRT within the proposed Fatmawati to Monas (later to be extended to Kota) corridor. These factors are introduced and discussed below.

9.2.1 Demand & Projected Revenues

It is illustrated clearly by the results of the different demand scenarios that projected ridership on the MRT (measured in terms of both, annual ridership and passenger-km) depends crucially on the development scenario and/or enhancement measures underlying the demand projections. The magnitude of revenues, which in turn have in combination with project base cost, a profound impact on the MRT project's simple IRR and therefore financial viability, are strongly dependent on the passenger-km achieved on the MRT system. If a split fare system of "access fee" plus "distance proportional fee" is applied, as was the case in this review's case study computations, generated revenues depend to only around 25 percent on the access fee (estimated annual ridership), but to around 75 percent on the total annual passenger-km. Hence, projected revenues are highly sensitive to the average travel distance that the "average" MRT user will realize. Therefore, a more important factor than only increasing absolute annual ridership will be to intensify the use of the MRT system in terms of passenger-km-year. The demand projections indicate that this will only be possible by adopting various enhancement measures geared at creating "captive markets" through, for example, MRT supporting area developments along the MRT corridor and so on, as described under the assumptions adopted for the demand scenarios.

9.2.2 Economic Internal Rate of Return

The three EIRR cases investigated in Chapter 7 illustrate that the MRT project will result in an economic return between about 7.5 percent to about 14.1 percent. The range of these EIRRs is not unusual for rail-based projects. However, the key feature to be noted in this context is that the demand scenarios 2 and 3, both of which assume a basket of enhancement measures, result in a clearly higher project EIRR (demand scenario 2 = about 13.2 per cent and demand scenario 3 = about 14.1 per cent) than can be achieved under demand scenario 1, which assumed no enhancement measures. In other words, the realization of enhancement measures is a vital element for increasing the MRT project's economic viability.

9.2.3 Return on Investment (ROI or Simple IRR)

The combined investment and demand scenario computations have demonstrated clearly that a positive simple IRR of between 4.2 per cent (demand scenario 1 and investment scenario 2) to 9.6 per cent (demand scenario 3 in combination with investment scenario 4) is achievable. The simple IRR is the most fundamental indicator of the MRT project's capacity to cover long-term debt service, generate a return on equity for the shareholders and generate a profit margin for the implementing entity itself. It is self-evident from the resulting simple IRR numbers that, assuming a usual equity to debt ratio of 30 to 70 per cent, the maximum interest rate (borrowing rate for the implementing entity) is at or around 5 per cent in Rupiah terms.

9.2.4 Sensitivity of Simple Internal Rate of Return

Notwithstanding the above fundamental fact, the two demand/investment scenario combinations that resulted in the highest simple IRR, i.e. demand scenario 2 in combination with investment scenario 4 and demand scenario 3 in combination with investment scenario 4 were tested for their sensitivity to demand and/or cost over- and underestimations. The results of these two sensitivity tests are presented in Table 9.2.1 and 9.2.2, respectively.

The major conclusions to be drawn from the sensitivity test are that the differences between both demand and investment scenario combinations (i.e. between demand –investment scenario combinations 2-4 and 3-4) are almost negligible. Furthermore, since demand under- or overestimations are more likely than cost over- or underestimation the most likely range of the MRT project's simple IRR remains in the about 4 to 10 per cent range (refer to table 8.3.2).

Table 9.2.1 MRT Sensitivity of Simple IRR to Demand or Cost Over and Underestimation (Demand Scenario 2, Investment Scenario 4)

	TRAFFIC DEMAND/ NET REVENUES				
COST	Minus 20%	Minus 10%	Unchanged Base Case	Plus 10%	Plus 20%
Minus 20%	9.35%	10.71%	11.96%	13.12%	14.22%
Minus 10%	8.00%	9.35%	10.57%	11.69%	12.74%
Unchanged Base Case	6.80%	8.14%	9.35%	10.45%	11.47%
Plus 10%	5.69%	7.06%	8.26%	9.35%	10.35%
Plus 20%	4.65%	6.05%	7.27%	8.35%	9.35%

Source: JICA Study Team.
Notes: Changes in costs cover both, project and O&M costs.

Table 9.2.2 MRT Sensitivity of Project IRR to Demand or Cost Over- and Underestimation (Demand Scenario 3, Investment Scenario 4)

	TRAFFIC DEMAND/ NET REVENUES				
COST	Minus 20%	Minus 10%	Unchanged Base Case	Plus 10%	Plus 20%
Minus 20%	9.63%	11.08%	12.43%	13.70%	14.90%
Minus 10%	8.21%	9.63%	10.93%	12.14%	13.28%
Unchanged Base Case	6.95%	8.36%	9.63%	10.80%	11.90%
Plus 10%	5.80%	7.22%	8.48%	9.63%	10.70%
Plus 20%	4.74%	6.17%	7.44%	8.58%	9.63%

Source: JICA Study Team.
Notes: Changes in costs cover both, project and O&M costs.

9.2.5 Cash Flow & Debt-service Capability

The cash flow and debt service capability of the implementing entity was tested for the following five (5) combined demand and investment scenarios:

1. **Demand scenario 1 and investment scenario 4.** This combination resulted in a 7.12 per cent simple IRR
2. **Demand scenario 2 and investment scenario 2.** This combination resulted in a 6.39 per cent simple IRR
3. **Demand scenario 2 and investment scenario 4.** This combination resulted in a 9.35 per cent simple IRR
4. **Demand scenario 3 and investment scenario 2.** This combination resulted in a 7.06 per cent simple IRR, and

5. **Demand scenario 3 and investment scenario 4.** This combination resulted in a 9.63 per cent simple IRR.

It was furthermore assumed in all five cases that the equity to debt ratio would be a classical 30 to 70 percent and that the long-term loan would have a repayment period of 40 years with a 10 years grace period. On-lending terms from the central government to the implementing entity were assumed unilaterally at 5 per cent per annum. The results of the cash flow analysis and debt-service capability for the five cases are tabulated in Tables 9.2.3 to 9.2.7. The supporting tables for capital cost estimations for the three demand scenarios, interest during construction computations and long-term debt service are attached in the Table AP 9.1 through Table AP 9.7.

The results of the analysis are summarized as:

1. **Demand scenario 1 and investment scenario 4.**

The net cash flow after servicing long-term debts is negative for the first 8 operational years with a accumulated negative net cash flow of some 312.8 billion Rupiah in the 2015. Hence, not only is the debt-service coverage ratio negative, but the annual negative cash flows would have to be financed with short-term borrowing at or around 18 to 20 per cent. The case is, therefore, not considered realistic.

2. **Demand scenario 2 and investment scenario 2.**

The net cash flow after servicing long-term debts is negative in the operational years 2008, 2010, 2013 and so on. Hence, not only is the debt-service coverage ratio negative in these years, but the annual negative cash flows would have to be financed with short-term borrowing at or around 18 to 20 per cent. The case is, therefore, also not considered realistic.

3. **Demand scenario 2 and investment scenario 4**.

The net cash flow after servicing long-term debts is negative only in the first in the operational years of 2008. This could be balanced by increasing slightly the project’s equity ratio. As of operational year 2009 the debt coverage ratio is about 1.1 and increasing in the years thereafter. Hence, the case is considered realistic as an implementation scenario.

4. **Demand scenario 3 and investment scenario 2**.

The net cash flow after serving long-term debts is positive in the first four operational years of 2008 and 2011. Although net cash flow shortfalls take place, when the additional capital investment is required, the cumulated net cash flow will manage to cover these shortfalls in the following years. A proper management of future additional investment will maintain a sound financial condition of this case.

5. **Demand scenario 3 and investment scenario 4**.

The net cash flow after servicing long-term debts is positive in all operational years. The debt coverage ratio is well above 1.2 in the first operational year and increasing thereafter. Hence, the case is considered realistic as an implementation scenario.

Table 9.2.3 Projected Cashflow MRT Project for Demand Scenario 1 - No Enhancement Measures & Investment Scenario 4"
(in constant September 2000 prices)

(Unit:bilion Rupiah)

Year	Project Cycle Year	Cashinflow Total System Revenues	CASH OUTFLOW Capital Cost	O&M Cost	ROE	Total Outflow	Net Cashflow Before Financing	FINANCING INFLOW Equity	Foreign LT Loan	Other LT Loan	Total Inflow	Cumulative Inflow	FINANCE OUTFLOW Foreign LT Repayment	Other LT Repayment	Total Debt Service	Net Financing	Net Cashflow after LT Financing	Cumulative Net Cashflow after LTF	Corporate Tax Payments	Net Cashflow after Tax	Balance after ST Financing
2000	-8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	-7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	-5	0.0	(3.6)	0.0	0.0	(3.6)	(3.6)	3.6	0.0	0.0	3.6	3.6	0.0	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0
2004	-4	0.0	(311.0)	0.0	0.0	(311.0)	(311.0)	311.0	0.0	0.0	311.0	314.6	0.0	0.0	0.0	311.0	0.0	0.0	0.0	0.0	0.0
2005	-3	0.0	(1,328.7)	0.0	0.0	(1,328.7)	(1,328.7)	214.9	1,113.8	0.0	1,328.7	1,643.3	0.0	0.0	0.0	1,328.7	0.0	0.0	0.0	0.0	0.0
2006	-2	0.0	(1,098.7)	0.0	0.0	(1,098.7)	(1,098.7)	150.0	948.8	0.0	1,098.8	2,742.0	0.0	0.0	0.0	1,098.8	0.0	0.0	0.0	0.0	0.0
2007	-1	0.0	(221.5)	0.0	0.0	(221.5)	(221.5)	150.0	71.4	0.0	221.4	2,963.4	0.0	0.0	0.0	221.4	0.0	0.0	0.0	0.0	0.0
2008	1	165.6	0.0	(121.9)	0.0	(121.9)	43.7	0.0	0.0	0.0	0.0		(103.1)	0.0	(103.1)	(103.1)	(59.4)	(59.3)	0.0	0.0	0.0
2009	2	176.2	0.0	(121.9)	0.0	(121.9)	54.3	0.0	0.0	0.0	0.0		(106.6)	0.0	(106.6)	(106.6)	(52.3)	(111.6)	0.0	0.0	0.0
2010	3	187.5	0.0	(121.9)	0.0	(121.9)	65.6	0.0	0.0	0.0	0.0		(106.7)	0.0	(106.7)	(106.7)	(41.1)	(152.7)	0.0	0.0	0.0
2011	4	199.5	0.0	(152.0)	0.0	(152.0)	47.5	0.0	0.0	0.0	0.0		(106.7)	0.0	(106.7)	(106.7)	(59.2)	(211.9)	0.0	0.0	0.0
2012	5	212.3	0.0	(152.0)	0.0	(152.0)	60.2	0.0	0.0	0.0	0.0		(106.7)	0.0	(106.7)	(106.7)	(46.5)	(258.4)	0.0	0.0	0.0
2013	6	225.9	0.0	(152.0)	0.0	(152.0)	73.8	0.0	0.0	0.0	0.0		(106.7)	0.0	(106.7)	(106.7)	(32.9)	(291.3)	0.0	0.0	0.0
2014	7	240.3	0.0	(152.0)	0.0	(152.0)	88.3	0.0	0.0	0.0	0.0		(106.7)	0.0	(106.7)	(106.7)	(18.4)	(309.7)	0.0	0.0	0.0
2015	8	255.7	0.0	(152.0)	0.0	(152.0)	103.6	0.0	0.0	0.0	0.0		(106.7)	0.0	(106.7)	(106.7)	(3.0)	(312.8)	0.0	0.0	0.0
2016	9	272.1	0.0	(152.0)	0.0	(152.0)	120.0	0.0	0.0	0.0	0.0		(106.7)	0.0	(106.7)	(106.7)	13.3	(299.4)	0.0	0.0	0.0
2017	10	289.5	0.0	(163.3)	0.0	(163.3)	126.2	0.0	0.0	0.0	0.0		(106.7)	0.0	(106.7)	(106.7)	19.5	(280.0)	0.0	0.0	0.0
2018	11	308.0	0.0	(163.3)	0.0	(163.3)	144.7	0.0	0.0	0.0	0.0		(106.7)	0.0	(106.7)	(106.7)	38.0	(241.9)	0.0	0.0	0.0
2019	12	327.7	0.0	(163.3)	0.0	(163.3)	164.4	0.0	0.0	0.0	0.0		(106.7)	0.0	(106.7)	(106.7)	57.7	(184.2)	0.0	0.0	0.0
2020	13	348.6	0.0	(183.6)	0.0	(183.6)	165.0	0.0	0.0	0.0	0.0		(181.8)	0.0	(181.8)	(181.8)	(16.8)	(201.0)	0.0	0.0	0.0
2021	14	*371.0*	0.0	(183.6)	0.0	(183.6)	187.3	0.0	0.0	0.0	0.0		(177.8)	0.0	(177.8)	(177.8)	9.5	(191.5)	0.0	0.0	0.0
2022	15	*394.7*	0.0	(183.6)	0.0	(183.6)	211.1	0.0	0.0	0.0	0.0		(173.9)	0.0	(173.9)	(173.9)	37.2	(154.3)	0.0	0.0	0.0
2023	16	*419.9*	0.0	(224.2)	0.0	(224.2)	195.7	0.0	0.0	0.0	0.0		(169.9)	0.0	(169.9)	(169.9)	25.8	(128.5)	0.0	0.0	0.0
2024	17	*446.8*	0.0	(224.2)	0.0	(224.2)	222.6	0.0	0.0	0.0	0.0		(166.0)	0.0	(166.0)	(166.0)	56.6	(72.0)	0.0	0.0	0.0
2025	18	*475.4*	0.0	(224.2)	0.0	(224.2)	251.2	0.0	0.0	0.0	0.0		(162.0)	0.0	(162.0)	(162.0)	89.1	17.2	0.0	0.0	0.0
2026	19	*505.8*	0.0	(269.9)	0.0	(269.9)	235.9	0.0	0.0	0.0	0.0		(158.1)	0.0	(158.1)	(158.1)	77.9	95.0	0.0	0.0	0.0
2027	20	*538.2*	0.0	(269.9)	0.0	(269.9)	268.3	0.0	0.0	0.0	0.0		(154.1)	0.0	(154.1)	(154.1)	114.2	209.2	0.0	0.0	0.0
2028	21	*572.6*	0.0	(269.9)	0.0	(269.9)	302.7	0.0	0.0	0.0	0.0		(150.2)	0.0	(150.2)	(150.2)	152.6	361.8	0.0	0.0	0.0
2029	22	*609.3*	0.0	(269.9)	0.0	(269.9)	339.4	0.0	0.0	0.0	0.0		(146.2)	0.0	(146.2)	(146.2)	193.2	554.9	0.0	0.0	0.0
2030	23	*648.3*	0.0	(269.9)	0.0	(269.9)	378.4	0.0	0.0	0.0	0.0		(142.3)	0.0	(142.3)	(142.3)	236.1	791.0	0.0	0.0	0.0
2031	24	*689.7*	0.0	(269.9)	0.0	(269.9)	419.8	0.0	0.0	0.0	0.0		(138.3)	0.0	(138.3)	(138.3)	281.5	1,072.5	0.0	0.0	0.0
2032	25	*733.9*	0.0	(362.8)	0.0	(362.8)	371.1	0.0	0.0	0.0	0.0		(134.4)	0.0	(134.4)	(134.4)	236.7	1,309.2	0.0	0.0	0.0
2033	26	*780.8*	0.0	(362.8)	0.0	(362.8)	418.0	0.0	0.0	0.0	0.0		(130.4)	0.0	(130.4)	(130.4)	287.6	1,596.9	0.0	0.0	0.0
2034	27	*830.8*	0.0	(362.8)	0.0	(362.8)	468.0	0.0	0.0	0.0	0.0		(126.5)	0.0	(126.5)	(126.5)	341.5	1,938.4	0.0	0.0	0.0
2035	28	*884.0*	0.0	(362.8)	0.0	(362.8)	521.1	0.0	0.0	0.0	0.0		(122.5)	0.0	(122.5)	(122.5)	398.6	2,337.0	0.0	0.0	0.0
2036	29	*940.5*	0.0	(362.8)	0.0	(362.8)	577.7	0.0	0.0	0.0	0.0		(118.6)	0.0	(118.6)	(118.6)	459.2	2,796.2	0.0	0.0	0.0
2037	30	*1,000.7*	0.0	(362.8)	0.0	(362.8)	637.9	0.0	0.0	0.0	0.0		(114.6)	0.0	(114.6)	(114.6)	523.3	3,319.5	0.0	0.0	0.0
2038	31	*1,064.8*	0.0	(362.8)	0.0	(362.8)	701.9	0.0	0.0	0.0	0.0		(110.7)	0.0	(110.7)	(110.7)	591.3	3,910.8	0.0	0.0	0.0
2039	32	*1,064.8*	0.0	(362.8)	0.0	(362.8)	701.9	0.0	0.0	0.0	0.0		(106.7)	0.0	(106.7)	(106.7)	595.2	4,506.0	0.0	0.0	0.0
2040	33	*1,064.8*	0.0	(362.8)	0.0	(362.8)	701.9	0.0	0.0	0.0	0.0		(102.7)	0.0	(102.7)	(102.7)	599.2	5,105.2	0.0	0.0	0.0
2041	34	*1,064.8*	0.0	(362.8)	0.0	(362.8)	701.9	0.0	0.0	0.0	0.0		(98.8)	0.0	(98.8)	(98.8)	603.1	5,708.4	0.0	0.0	0.0
2042	35	*1,064.8*	0.0	(362.8)	0.0	(362.8)	701.9	0.0	0.0	0.0	0.0		(94.8)	0.0	(94.8)	(94.8)	607.1	6,315.5	0.0	0.0	0.0
2043	36	*1,064.8*	0.0	(362.8)	0.0	(362.8)	701.9	0.0	0.0	0.0	0.0		(90.9)	0.0	(90.9)	(90.9)	611.0	6,926.5	0.0	0.0	0.0
2044	37	*1,064.8*	0.0	(362.8)	0.0	(362.8)	701.9	0.0	0.0	0.0	0.0		(86.9)	0.0	(86.9)	(86.9)	615.0	7,541.5	0.0	0.0	0.0
2045	38	*1,064.8*	0.0	(362.8)	0.0	(362.8)	701.9	0.0	0.0	0.0	0.0		(83.0)	0.0	(83.0)	(83.0)	619.0	8,160.5	0.0	0.0	0.0
2046	39	*1,064.8*	0.0	(362.8)	0.0	(362.8)	701.9	0.0	0.0	0.0	0.0		(79.0)	0.0	(79.0)	(79.0)	622.9	8,783.4	0.0	0.0	0.0
2047	40	*1,064.8*	0.0	(362.8)	0.0	(362.8)	701.9	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	701.9	9,485.3	0.0	0.0	0.0
Accumulated Values		**24,699**	**-2,964**	**-10,416**	**0**	**-13,379**	**11,319**	**830**	**2,134**	**0**	**2,963**	**n.a.**	**-4,798**	**0**	**-4,798**	**-1,834**	**9,485**	**n.a.**			

Source: JICA Study Team.

Notes:
1.) The computation allows for 5% return on equity(ROE) during the first five operational years and 20% in the years thereafter (before tax). No ROE will be paid during the construction period.
2.) The capital cost exclude the equity portion of Rp. 830,800 million for the existing assets due to the assumed debt for equity swap, which is cashflow neutral.
3.) ROE = return on equity. Computation is based on net cashflow after long-term financing.
4.) n.a. = not applicable.

Table 9.2.4 Projected Cashflow MRT Project for Demand Scenario 2 - Road Capacity Capping Measures & Investment Scenario 2"
(in constant September 2000 prices)

(Unit:bilion Rupiah)

Year	Project Cycle Year	Cashinflow Total System Revenues	CASH OUTFLOW Capital Cost	O&M Cost	ROE	Total Outflow	Net Cashflow Before Financing	FINANCING INFLOW Equity	Foreign LT Loan	Other LT Loan	Total Inflow	Cumulative Inflow	FINANCE OUTFLOW Foreign LT Repayment	Other LT Repayment	Total Debt Service	Net Financing	Net Cashflow after LT Financing	Cumulative Net Cashflow after LTF	Corporate Tax Payments	Net Cashflow after Tax	Balance after ST Financing
2000	-8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	-7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	-5	0.0	(3.6)	0.0	0.0	(3.6)	(3.6)	3.6	0.0	0.0	3.6	3.6	0.0	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0
2004	-4	0.0	(258.7)	0.0	0.0	(258.7)	(258.7)	258.7	0.0	0.0	258.7	262.3	0.0	0.0	0.0	258.7	0.0	0.0	0.0	0.0	0.0
2005	-3	0.0	(1,409.1)	0.0	0.0	(1,409.1)	(1,409.1)	185.8	1,223.3	0.0	1,409.1	1,671.4	0.0	0.0	0.0	1,409.1	0.0	0.0	0.0	0.0	0.0
2006	-2	0.0	(1,182.8)	0.0	0.0	(1,182.8)	(1,182.8)	230.2	952.5	0.0	1,182.7	2,854.1	0.0	0.0	0.0	1,182.7	0.0	0.0	0.0	0.0	0.0
2007	-1	0.0	(229.4)	0.0	0.0	(229.4)	(229.4)	184.9	44.6	0.0	229.5	3,083.5	0.0	0.0	0.0	229.5	0.0	0.0	0.0	0.0	0.0
2008	1	254.2	0.0	(152.0)	0.0	(152.0)	102.1	0.0	0.0	0.0	0.0		(108.8)	0.0	(108.8)	(108.8)	(6.7)	(6.7)	0.0	0.0	0.0
2009	2	272.8	0.0	(152.0)	0.0	(152.0)	120.7	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	9.7	3.0	0.0	0.0	0.0
2010	3	292.8	(75.4)	(163.3)	0.0	(238.6)	54.1	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	(56.9)	(53.9)	0.0	0.0	0.0
2011	4	314.2	0.0	(163.3)	0.0	(163.3)	150.9	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	39.9	(14.0)	0.0	0.0	0.0
2012	5	337.2	0.0	(183.6)	0.0	(183.6)	153.6	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	42.6	28.6	0.0	0.0	0.0
2013	6	361.9	(150.7)	(183.6)	0.0	(334.4)	27.5	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	(83.5)	(54.9)	0.0	0.0	0.0
2014	7	388.4	0.0	(224.2)	0.0	(224.2)	164.2	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	53.2	(1.7)	0.0	0.0	0.0
2015	8	416.9	(150.7)	(224.2)	0.0	(375.0)	41.9	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	(69.1)	(70.8)	0.0	0.0	0.0
2016	9	447.4	0.0	(224.2)	0.0	(224.2)	223.2	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	112.2	41.3	0.0	0.0	0.0
2017	10	480.2	(468.1)	(269.9)	0.0	(738.0)	(257.8)	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	(368.8)	(327.5)	0.0	0.0	0.0
2018	11	515.4	(376.9)	(269.9)	0.0	(646.8)	(131.4)	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	(242.4)	(569.9)	0.0	0.0	0.0
2019	12	553.1	0.0	(269.9)	0.0	(269.9)	283.2	0.0	0.0	0.0	0.0		(186.4)	0.0	(186.4)	(186.4)	96.9	(473.0)	0.0	0.0	0.0
2020	13	593.7	0.0	(269.9)	0.0	(269.9)	323.8	0.0	0.0	0.0	0.0		(182.4)	0.0	(182.4)	(182.4)	141.4	(331.6)	0.0	0.0	0.0
2021	14	*637.2*	0.0	(269.9)	0.0	(269.9)	367.3	0.0	0.0	0.0	0.0		(178.4)	0.0	(178.4)	(178.4)	188.8	(142.8)	0.0	0.0	0.0
2022	15	*667.0*	0.0	(269.9)	0.0	(269.9)	397.1	0.0	0.0	0.0	0.0		(174.5)	0.0	(174.5)	(174.5)	222.7	79.9	0.0	0.0	0.0
2023	16	*698.3*	(1,067.8)	(362.8)	0.0	(1,430.6)	(732.3)	0.0	0.0	0.0	0.0		(170.5)	0.0	(170.5)	(170.5)	(902.8)	(822.9)	0.0	0.0	0.0
2024	17	*731.1*	0.0	(362.8)	0.0	(362.8)	368.2	0.0	0.0	0.0	0.0		(166.5)	0.0	(166.5)	(166.5)	201.7	(621.2)	0.0	0.0	0.0
2025	18	*765.3*	(468.1)	(362.8)	0.0	(830.9)	(65.5)	0.0	0.0	0.0	0.0		(162.6)	0.0	(162.6)	(162.6)	(228.1)	(849.3)	0.0	0.0	0.0
2026	19	*801.2*	0.0	(362.8)	0.0	(362.8)	438.4	0.0	0.0	0.0	0.0		(158.6)	0.0	(158.6)	(158.6)	279.8	(569.5)	0.0	0.0	0.0
2027	20	*838.8*	0.0	(362.8)	0.0	(362.8)	476.0	0.0	0.0	0.0	0.0		(154.6)	0.0	(154.6)	(154.6)	321.4	(248.1)	0.0	0.0	0.0
2028	21	*878.2*	(972.8)	(362.8)	0.0	(1,335.6)	(457.4)	0.0	0.0	0.0	0.0		(150.7)	0.0	(150.7)	(150.7)	(608.1)	(856.2)	0.0	0.0	0.0
2029	22	*1,005.9*	0.0	(362.8)	0.0	(362.8)	643.1	0.0	0.0	0.0	0.0		(146.7)	0.0	(146.7)	(146.7)	496.4	(359.7)	0.0	0.0	0.0
2030	23	*1,021.2*	0.0	(362.8)	0.0	(362.8)	658.3	0.0	0.0	0.0	0.0		(142.7)	0.0	(142.7)	(142.7)	515.6	155.9	0.0	0.0	0.0
2031	24	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(138.8)	0.0	(138.8)	(138.8)	535.5	691.4	0.0	0.0	0.0
2032	25	*1,037.1*	(603.0)	(362.8)	0.0	(965.8)	71.3	0.0	0.0	0.0	0.0		(134.8)	0.0	(134.8)	(134.8)	(63.5)	628.0	0.0	0.0	0.0
2033	26	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(130.8)	0.0	(130.8)	(130.8)	543.5	1,171.4	0.0	0.0	0.0
2034	27	*1,037.1*	(75.4)	(362.8)	0.0	(438.2)	598.9	0.0	0.0	0.0	0.0		(126.9)	0.0	(126.9)	(126.9)	472.1	1,643.5	0.0	0.0	0.0
2035	28	*1,037.1*	(85.9)	(362.8)	0.0	(448.7)	588.4	0.0	0.0	0.0	0.0		(122.9)	0.0	(122.9)	(122.9)	465.5	2,109.0	0.0	0.0	0.0
2036	29	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(119.0)	0.0	(119.0)	(119.0)	555.4	2,664.4	0.0	0.0	0.0
2037	30	*1,037.1*	(150.7)	(362.8)	0.0	(513.6)	523.6	0.0	0.0	0.0	0.0		(115.0)	0.0	(115.0)	(115.0)	408.6	3,073.0	0.0	0.0	0.0
2038	31	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	563.3	3,636.3	0.0	0.0	0.0
2039	32	*1,037.1*	(150.7)	(362.8)	0.0	(513.6)	523.6	0.0	0.0	0.0	0.0		(107.1)	0.0	(107.1)	(107.1)	416.5	4,052.8	0.0	0.0	0.0
2040	33	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(103.1)	0.0	(103.1)	(103.1)	571.2	4,624.0	0.0	0.0	0.0
2041	34	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(99.1)	0.0	(99.1)	(99.1)	575.2	5,199.2	0.0	0.0	0.0
2042	35	*1,037.1*	(376.9)	(362.8)	0.0	(739.7)	297.5	0.0	0.0	0.0	0.0		(95.2)	0.0	(95.2)	(95.2)	202.3	5,401.5	0.0	0.0	0.0
2043	36	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(91.2)	0.0	(91.2)	(91.2)	583.1	5,984.7	0.0	0.0	0.0
2044	37	*1,037.1*	(468.1)	(362.8)	0.0	(830.9)	206.3	0.0	0.0	0.0	0.0		(87.2)	0.0	(87.2)	(87.2)	119.0	6,103.7	0.0	0.0	0.0
2045	38	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(83.3)	0.0	(83.3)	(83.3)	591.1	6,694.8	0.0	0.0	0.0
2046	39	*1,037.1*	(540.2)	(362.8)	0.0	(903.0)	134.2	0.0	0.0	0.0	0.0		(79.3)	0.0	(79.3)	(79.3)	54.9	6,749.6	0.0	0.0	0.0
2047	40	*1,037.1*	(527.6)	(362.8)	0.0	(890.4)	146.7	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	146.7	6,896.3	0.0	0.0	0.0
Accumulated Values		**30,904**	**-9,792**	**-12,360**	**0**	**-22,153**	**8,751**	**863**	**2,220**	**0**	**3,084**	**n.a.**	**-4,938**	**0**	**-4,938**	**-1,855**	**6,896**	**n.a.**			

Source: JICA Study Team.

Notes:
1.) The computation allows for 5% return on equity(ROE) during the first five operational years and 20% in the years thereafter (before tax). No ROE will be paid during the construction period.
2.) The capital cost exclude the equity portion of Rp. 830,800 million for the existing assets due to the assumed debt for equity swap, which is cashflow neutral.
3.) ROE = return on equity. Computation is based on net cashflow after long-term financing.
4.) n.a. = not applicable.

Table 9.2.5 Projected Cashflow MRT Project for Demand Scenario 2 - Road Capacity Capping Measures & Investment Scenario 4"
(in constant September 2000 prices)

(Unit:bilion Rupiah)

Year	Project Cycle Year	Cashinflow Total System Revenues	CASH OUTFLOW Capital Cost	O&M Cost	ROE	Total Outflow	Net Cashflow Before Financing	FINANCING INFLOW Equity	Foreign LT Loan	Other LT Loan	Total Inflow	Cumulative Inflow	FINANCE OUTFLOW Foreign LT Repayment	Other LT Repayment	Total Debt Service	Net Financing	Net Cashflow after LT Financing	Cumulative Net Cashflow after LTF	Corporate Tax Payments	Net Cashflow after Tax	Balance after ST Financing
2000	-8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	-7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	-5	0.0	(3.6)	0.0	0.0	(3.6)	(3.6)	3.6	0.0	0.0	3.6	3.6	0.0	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0
2004	-4	0.0	(258.7)	0.0	0.0	(258.7)	(258.7)	258.7	0.0	0.0	258.7	262.3	0.0	0.0	0.0	258.7	0.0	0.0	0.0	0.0	0.0
2005	-3	0.0	(1,409.1)	0.0	0.0	(1,409.1)	(1,409.1)	185.8	1,223.3	0.0	1,409.1	1,671.4	0.0	0.0	0.0	1,409.1	0.0	0.0	0.0	0.0	0.0
2006	-2	0.0	(1,182.8)	0.0	0.0	(1,182.8)	(1,182.8)	230.2	952.5	0.0	1,182.7	2,854.1	0.0	0.0	0.0	1,182.7	0.0	0.0	0.0	0.0	0.0
2007	-1	0.0	(229.4)	0.0	0.0	(229.4)	(229.4)	184.9	44.6	0.0	229.5	3,083.5	0.0	0.0	0.0	229.5	0.0	0.0	0.0	0.0	0.0
2008	1	254.2	0.0	(152.0)	0.0	(152.0)	102.1	0.0	0.0	0.0	0.0		(108.8)	0.0	(108.8)	(108.8)	(6.7)	(6.7)	0.0	0.0	0.0
2009	2	272.8	0.0	(152.0)	0.0	(152.0)	120.7	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	9.7	3.0	0.0	0.0	0.0
2010	3	292.8	0.0	(163.3)	0.0	(163.3)	129.5	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	18.5	21.5	0.0	0.0	0.0
2011	4	314.2	0.0	(163.3)	0.0	(163.3)	150.9	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	39.9	61.4	0.0	0.0	0.0
2012	5	337.2	0.0	(183.6)	0.0	(183.6)	153.6	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	42.6	104.0	0.0	0.0	0.0
2013	6	361.9	0.0	(183.6)	0.0	(183.6)	178.3	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	67.3	171.2	0.0	0.0	0.0
2014	7	388.4	0.0	(224.2)	0.0	(224.2)	164.2	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	53.2	224.4	0.0	0.0	0.0
2015	8	416.9	0.0	(224.2)	0.0	(224.2)	192.6	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	81.6	306.0	0.0	0.0	0.0
2016	9	447.4	0.0	(224.2)	0.0	(224.2)	223.2	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	112.2	418.2	0.0	0.0	0.0
2017	10	480.2	0.0	(269.9)	0.0	(269.9)	210.3	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	99.3	517.5	0.0	0.0	0.0
2018	11	515.4	0.0	(269.9)	0.0	(269.9)	245.5	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	134.5	651.9	0.0	0.0	0.0
2019	12	553.1	0.0	(269.9)	0.0	(269.9)	283.2	0.0	0.0	0.0	0.0		(186.4)	0.0	(186.4)	(186.4)	96.9	748.8	0.0	0.0	0.0
2020	13	593.7	0.0	(269.9)	0.0	(269.9)	323.8	0.0	0.0	0.0	0.0		(182.4)	0.0	(182.4)	(182.4)	141.4	890.2	0.0	0.0	0.0
2021	14	*637.2*	0.0	(269.9)	0.0	(269.9)	367.3	0.0	0.0	0.0	0.0		(178.4)	0.0	(178.4)	(178.4)	188.8	1,079.0	0.0	0.0	0.0
2022	15	*667.0*	0.0	(269.9)	0.0	(269.9)	397.1	0.0	0.0	0.0	0.0		(174.5)	0.0	(174.5)	(174.5)	222.7	1,301.7	0.0	0.0	0.0
2023	16	*698.3*	0.0	(362.8)	0.0	(362.8)	335.5	0.0	0.0	0.0	0.0		(170.5)	0.0	(170.5)	(170.5)	165.0	1,466.7	0.0	0.0	0.0
2024	17	*731.1*	0.0	(362.8)	0.0	(362.8)	368.2	0.0	0.0	0.0	0.0		(166.5)	0.0	(166.5)	(166.5)	201.7	1,668.4	0.0	0.0	0.0
2025	18	*765.3*	0.0	(362.8)	0.0	(362.8)	402.5	0.0	0.0	0.0	0.0		(162.6)	0.0	(162.6)	(162.6)	240.0	1,908.3	0.0	0.0	0.0
2026	19	*801.2*	0.0	(362.8)	0.0	(362.8)	438.4	0.0	0.0	0.0	0.0		(158.6)	0.0	(158.6)	(158.6)	279.8	2,188.2	0.0	0.0	0.0
2027	20	*838.8*	0.0	(362.8)	0.0	(362.8)	476.0	0.0	0.0	0.0	0.0		(154.6)	0.0	(154.6)	(154.6)	321.4	2,509.5	0.0	0.0	0.0
2028	21	*878.2*	0.0	(362.8)	0.0	(362.8)	515.4	0.0	0.0	0.0	0.0		(150.7)	0.0	(150.7)	(150.7)	364.7	2,874.2	0.0	0.0	0.0
2029	22	*1,005.9*	0.0	(362.8)	0.0	(362.8)	643.1	0.0	0.0	0.0	0.0		(146.7)	0.0	(146.7)	(146.7)	496.4	3,370.7	0.0	0.0	0.0
2030	23	*1,021.2*	0.0	(362.8)	0.0	(362.8)	658.3	0.0	0.0	0.0	0.0		(142.7)	0.0	(142.7)	(142.7)	515.6	3,886.3	0.0	0.0	0.0
2031	24	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(138.8)	0.0	(138.8)	(138.8)	535.5	4,421.8	0.0	0.0	0.0
2032	25	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(134.8)	0.0	(134.8)	(134.8)	539.5	4,961.3	0.0	0.0	0.0
2033	26	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(130.8)	0.0	(130.8)	(130.8)	543.5	5,504.8	0.0	0.0	0.0
2034	27	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(126.9)	0.0	(126.9)	(126.9)	547.4	6,052.2	0.0	0.0	0.0
2035	28	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(122.9)	0.0	(122.9)	(122.9)	551.4	6,603.7	0.0	0.0	0.0
2036	29	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(119.0)	0.0	(119.0)	(119.0)	555.4	7,159.0	0.0	0.0	0.0
2037	30	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(115.0)	0.0	(115.0)	(115.0)	559.3	7,718.4	0.0	0.0	0.0
2038	31	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(111.0)	0.0	(111.0)	(111.0)	563.3	8,281.7	0.0	0.0	0.0
2039	32	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(107.1)	0.0	(107.1)	(107.1)	567.3	8,848.9	0.0	0.0	0.0
2040	33	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(103.1)	0.0	(103.1)	(103.1)	571.2	9,420.2	0.0	0.0	0.0
2041	34	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(99.1)	0.0	(99.1)	(99.1)	575.2	9,995.4	0.0	0.0	0.0
2042	35	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(95.2)	0.0	(95.2)	(95.2)	579.2	10,574.5	0.0	0.0	0.0
2043	36	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(91.2)	0.0	(91.2)	(91.2)	583.1	11,157.6	0.0	0.0	0.0
2044	37	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(87.2)	0.0	(87.2)	(87.2)	587.1	11,744.7	0.0	0.0	0.0
2045	38	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(83.3)	0.0	(83.3)	(83.3)	591.1	12,335.8	0.0	0.0	0.0
2046	39	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		(79.3)	0.0	(79.3)	(79.3)	595.0	12,930.8	0.0	0.0	0.0
2047	40	*1,037.1*	0.0	(362.8)	0.0	(362.8)	674.3	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	674.3	13,605.1	0.0	0.0	0.0
Accumulated Values		**30,904**	**-3,084**	**-12,360**	**0**	**-15,444**	**15,460**	**863**	**2,220**	**0**	**3,084**	**n.a.**	**-4,938**	**0**	**-4,938**	**-1,855**	**13,605**	**n.a.**			

Source: JICA Study Team.

Notes:
1.) The computation allows for 5% return on equity(ROE) during the first five operational years and 20% in the years thereafter (before tax). No ROE will be paid during the construction period.
2.) The capital cost exclude the equity portion of Rp. 830,800 million for the existing assets due to the assumed debt for equity swap, which is cashflow neutral.
3.) ROE = return on equity. Computation is based on net cashflow after long-term financing.
4.) n.a. = not applicable.

Table 9.2.6 Projected Cashflow MRT Project for Demand Scenario 3 - All enhancement Measures & Investment Scenario 2"
(in constant September 2000 prices)

(Unit:bilion Rupiah)

Year	Project Cycle Year	Cashinflow Total System Revenues	CASH OUTFLOW Capital Cost	CASH OUTFLOW O&M Cost	CASH OUTFLOW ROE	CASH OUTFLOW Total Outflow	Net Cashflow Before Financing	FINANCING INFLOW Equity	FINANCING INFLOW Foreign LT Loan	FINANCING INFLOW Other LT Loan	FINANCING INFLOW Total Inflow	FINANCING INFLOW Cumulative Inflow	FINANCE OUTFLOW Foreign LT Repayment	FINANCE OUTFLOW Other LT Repayment	FINANCE OUTFLOW Total Debt Service	Net Financing	Net Cashflow after LT Financing	Cumulative Net Cashflow after LTF	Corporate Tax Payments	Net Cashflow after Tax	Balance after ST Financing
2000	-8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	-7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	-5	0.0	(3.6)	0.0	0.0	(3.6)	(3.6)	3.6	0.0	0.0	3.6	3.6	0.0	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0
2004	-4	0.0	(309.8)	0.0	0.0	(309.8)	(309.8)	309.8	0.0	0.0	309.8	313.4	0.0	0.0	0.0	309.8	0.0	0.0	0.0	0.0	0.0
2005	-3	0.0	(1,520.1)	0.0	0.0	(1,520.1)	(1,520.1)	185.8	1,334.4	0.0	1,520.1	1,833.5	0.0	0.0	0.0	1,520.1	0.0	0.0	0.0	0.0	0.0
2006	-2	0.0	(1,302.9)	0.0	0.0	(1,302.9)	(1,302.9)	251.5	1,051.4	0.0	1,302.9	3,136.5	0.0	0.0	0.0	1,302.9	0.0	0.0	0.0	0.0	0.0
2007	-1	0.0	(245.2)	0.0	0.0	(245.2)	(245.2)	195.9	49.2	0.0	245.1	3,381.6	0.0	0.0	0.0	245.1	0.0	0.0	0.0	0.0	0.0
2008	1	349.4	0.0	(183.6)	0.0	(183.6)	165.8	0.0	0.0	0.0	0.0		(119.3)	0.0	(119.3)	(119.3)	46.5	46.5	0.0	0.0	0.0
2009	2	365.8	0.0	(183.6)	0.0	(183.6)	182.2	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	60.4	106.9	0.0	0.0	0.0
2010	3	382.9	0.0	(183.6)	0.0	(183.6)	199.3	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	77.5	184.5	0.0	0.0	0.0
2011	4	400.9	0.0	(183.6)	0.0	(183.6)	217.2	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	95.5	279.9	0.0	0.0	0.0
2012	5	419.6	(150.7)	(224.2)	0.0	(375.0)	44.6	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	(77.1)	202.8	0.0	0.0	0.0
2013	6	439.3	0.0	(224.2)	0.0	(224.2)	215.0	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	93.3	296.1	0.0	0.0	0.0
2014	7	459.9	0.0	(224.2)	0.0	(224.2)	235.6	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	113.9	410.0	0.0	0.0	0.0
2015	8	481.4	0.0	(224.2)	0.0	(224.2)	257.1	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	135.4	545.4	0.0	0.0	0.0
2016	9	504.0	0.0	(224.2)	0.0	(224.2)	279.7	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	158.0	703.3	0.0	0.0	0.0
2017	10	527.6	(844.9)	(269.9)	0.0	(1,114.8)	(587.3)	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	(709.0)	(5.7)	0.0	0.0	0.0
2018	11	552.3	0.0	(269.9)	0.0	(269.9)	282.4	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	160.7	155.0	0.0	0.0	0.0
2019	12	578.2	0.0	(269.9)	0.0	(269.9)	308.3	0.0	0.0	0.0	0.0		(204.4)	0.0	(204.4)	(204.4)	103.9	258.9	0.0	0.0	0.0
2020	13	605.3	0.0	(269.9)	0.0	(269.9)	335.4	0.0	0.0	0.0	0.0		(200.0)	0.0	(200.0)	(200.0)	135.4	394.3	0.0	0.0	0.0
2021	14	*633.7*	0.0	(269.9)	0.0	(269.9)	363.8	0.0	0.0	0.0	0.0		(195.7)	0.0	(195.7)	(195.7)	168.1	562.4	0.0	0.0	0.0
2022	15	*663.4*	0.0	(269.9)	0.0	(269.9)	393.5	0.0	0.0	0.0	0.0		(191.3)	0.0	(191.3)	(191.3)	202.2	764.5	0.0	0.0	0.0
2023	16	*694.5*	(540.2)	(269.9)	0.0	(810.1)	(115.6)	0.0	0.0	0.0	0.0		(187.0)	0.0	(187.0)	(187.0)	(302.5)	462.0	0.0	0.0	0.0
2024	17	*727.0*	(527.6)	(362.8)	0.0	(890.4)	(163.4)	0.0	0.0	0.0	0.0		(182.6)	0.0	(182.6)	(182.6)	(346.0)	116.0	0.0	0.0	0.0
2025	18	*761.1*	(468.1)	(362.8)	0.0	(830.9)	(69.8)	0.0	0.0	0.0	0.0		(178.3)	0.0	(178.3)	(178.3)	(248.0)	(132.0)	0.0	0.0	0.0
2026	19	*796.8*	0.0	(362.8)	0.0	(362.8)	434.0	0.0	0.0	0.0	0.0		(173.9)	0.0	(173.9)	(173.9)	260.1	128.0	0.0	0.0	0.0
2027	20	*834.2*	0.0	(362.8)	0.0	(362.8)	471.4	0.0	0.0	0.0	0.0		(169.6)	0.0	(169.6)	(169.6)	301.8	429.8	0.0	0.0	0.0
2028	21	*873.3*	(972.8)	(362.8)	0.0	(1,335.6)	(462.3)	0.0	0.0	0.0	0.0		(165.2)	0.0	(165.2)	(165.2)	(627.5)	(197.7)	0.0	0.0	0.0
2029	22	*914.3*	0.0	(362.8)	0.0	(362.8)	551.5	0.0	0.0	0.0	0.0		(160.9)	0.0	(160.9)	(160.9)	390.6	192.9	0.0	0.0	0.0
2030	23	*957.2*	0.0	(362.8)	0.0	(362.8)	594.3	0.0	0.0	0.0	0.0		(156.5)	0.0	(156.5)	(156.5)	437.8	630.7	0.0	0.0	0.0
2031	24	*1,002.0*	0.0	(362.8)	0.0	(362.8)	639.2	0.0	0.0	0.0	0.0		(152.2)	0.0	(152.2)	(152.2)	487.0	1,117.7	0.0	0.0	0.0
2032	25	*1,049.0*	(829.1)	(362.8)	0.0	(1,191.9)	(142.9)	0.0	0.0	0.0	0.0		(147.8)	0.0	(147.8)	(147.8)	(290.7)	827.0	0.0	0.0	0.0
2033	26	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(143.5)	0.0	(143.5)	(143.5)	542.7	1,369.8	0.0	0.0	0.0
2034	27	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(139.1)	0.0	(139.1)	(139.1)	547.1	1,916.9	0.0	0.0	0.0
2035	28	*1,049.0*	(85.9)	(362.8)	0.0	(448.7)	600.4	0.0	0.0	0.0	0.0		(134.8)	0.0	(134.8)	(134.8)	465.6	2,382.4	0.0	0.0	0.0
2036	29	*1,049.0*	(150.7)	(362.8)	0.0	(513.6)	535.5	0.0	0.0	0.0	0.0		(130.5)	0.0	(130.5)	(130.5)	405.0	2,787.5	0.0	0.0	0.0
2037	30	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(126.1)	0.0	(126.1)	(126.1)	560.1	3,347.6	0.0	0.0	0.0
2038	31	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	564.5	3,912.1	0.0	0.0	0.0
2039	32	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(117.4)	0.0	(117.4)	(117.4)	568.8	4,480.9	0.0	0.0	0.0
2040	33	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(113.1)	0.0	(113.1)	(113.1)	573.2	5,054.1	0.0	0.0	0.0
2041	34	*1,049.0*	(376.9)	(362.8)	0.0	(739.7)	309.4	0.0	0.0	0.0	0.0		(108.7)	0.0	(108.7)	(108.7)	200.7	5,254.8	0.0	0.0	0.0
2042	35	*1,049.0*	(468.1)	(362.8)	0.0	(830.9)	218.2	0.0	0.0	0.0	0.0		(104.4)	0.0	(104.4)	(104.4)	113.8	5,368.6	0.0	0.0	0.0
2043	36	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(100.0)	0.0	(100.0)	(100.0)	586.2	5,954.8	0.0	0.0	0.0
2044	37	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(95.7)	0.0	(95.7)	(95.7)	590.6	6,545.3	0.0	0.0	0.0
2045	38	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(91.3)	0.0	(91.3)	(91.3)	594.9	7,140.3	0.0	0.0	0.0
2046	39	*1,049.0*	(540.2)	(362.8)	0.0	(903.0)	146.1	0.0	0.0	0.0	0.0		(87.0)	0.0	(87.0)	(87.0)	59.1	7,199.4	0.0	0.0	0.0
2047	40	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	686.2	7,885.6	0.0	0.0	0.0
Accumulated Values		**31,709**	**-9,337**	**-12,453**	**0**	**-21,789**	**9,919**	**947**	**2,435**	**0**	**3,382**	**n.a.**	**-5,415**	**0**	**-5,415**	**-2,034**	**7,886**	**n.a.**			

Source: JICA Study Team.

Notes:
1.) The computation allows for 5% return on equity(ROE) during the first five operational years and 20% in the years thereafter (before tax). No ROE will be paid during the construction period.
2.) The capital cost exclude the equity portion of Rp. 830,800 million for the existing assets due to the assumed debt for equity swap, which is cashflow neutral.
3.) ROE = return on equity. Computation is based on net cashflow after long-term financing.
4.) n.a. = not applicable.

Table 9.2.7 Projected Cashflow MRT Project for Demand Scenario 3 - All enhancement Measures & Investment Scenario 4"
(in constant September 2000 prices)

(Unit:bilion Rupiah)

Year	Project Cycle Year	Cashinflow Total System Revenues	CASH OUTFLOW Capital Cost	O&M Cost	ROE	Total Outflow	Net Cashflow Before Financing	FINANCING INFLOW Equity	Foreign LT Loan	Other LT Loan	Total Inflow	Cumulative Inflow	FINANCE OUTFLOW Foreign LT Repayment	Other LT Repayment	Total Debt Service	Net Financing	Net Cashflow after LT Financing	Cumulative Net Cashflow after LTF	Corporate Tax Payments	Net Cashflow after Tax	Balance after ST Financing
2000	-8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	-7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	-5	0.0	(3.6)	0.0	0.0	(3.6)	(3.6)	3.6	0.0	0.0	3.6	3.6	0.0	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0
2004	-4	0.0	(309.8)	0.0	0.0	(309.8)	(309.8)	309.8	0.0	0.0	309.8	313.4	0.0	0.0	0.0	309.8	0.0	0.0	0.0	0.0	0.0
2005	-3	0.0	(1,520.1)	0.0	0.0	(1,520.1)	(1,520.1)	185.8	1,334.4	0.0	1,520.1	1,833.5	0.0	0.0	0.0	1,520.1	0.0	0.0	0.0	0.0	0.0
2006	-2	0.0	(1,302.9)	0.0	0.0	(1,302.9)	(1,302.9)	251.5	1,051.4	0.0	1,302.9	3,136.5	0.0	0.0	0.0	1,302.9	0.0	0.0	0.0	0.0	0.0
2007	-1	0.0	(245.2)	0.0	0.0	(245.2)	(245.2)	195.9	49.2	0.0	245.1	3,381.6	0.0	0.0	0.0	245.1	0.0	0.0	0.0	0.0	0.0
2008	1	349.4	0.0	(183.6)	0.0	(183.6)	165.8	0.0	0.0	0.0	0.0		(119.3)	0.0	(119.3)	(119.3)	46.5	46.5	0.0	0.0	0.0
2009	2	365.8	0.0	(183.6)	0.0	(183.6)	182.2	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	60.4	106.9	0.0	0.0	0.0
2010	3	382.9	0.0	(183.6)	0.0	(183.6)	199.3	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	77.5	184.5	0.0	0.0	0.0
2011	4	400.9	0.0	(183.6)	0.0	(183.6)	217.2	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	95.5	279.9	0.0	0.0	0.0
2012	5	419.6	0.0	(224.2)	0.0	(224.2)	195.4	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	73.6	353.6	0.0	0.0	0.0
2013	6	439.3	0.0	(224.2)	0.0	(224.2)	215.0	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	93.3	446.9	0.0	0.0	0.0
2014	7	459.9	0.0	(224.2)	0.0	(224.2)	235.6	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	113.9	560.7	0.0	0.0	0.0
2015	8	481.4	0.0	(224.2)	0.0	(224.2)	257.1	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	135.4	696.1	0.0	0.0	0.0
2016	9	504.0	0.0	(224.2)	0.0	(224.2)	279.7	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	158.0	854.1	0.0	0.0	0.0
2017	10	527.6	0.0	(269.9)	0.0	(269.9)	257.7	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	135.9	990.0	0.0	0.0	0.0
2018	11	552.3	0.0	(269.9)	0.0	(269.9)	282.4	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	160.7	1,150.6	0.0	0.0	0.0
2019	12	578.2	0.0	(269.9)	0.0	(269.9)	308.3	0.0	0.0	0.0	0.0		(204.4)	0.0	(204.4)	(204.4)	103.9	1,254.6	0.0	0.0	0.0
2020	13	605.3	0.0	(269.9)	0.0	(269.9)	335.4	0.0	0.0	0.0	0.0		(200.0)	0.0	(200.0)	(200.0)	135.4	1,389.9	0.0	0.0	0.0
2021	14	*633.7*	0.0	(269.9)	0.0	(269.9)	363.8	0.0	0.0	0.0	0.0		(195.7)	0.0	(195.7)	(195.7)	168.1	1,558.0	0.0	0.0	0.0
2022	15	*663.4*	0.0	(269.9)	0.0	(269.9)	393.5	0.0	0.0	0.0	0.0		(191.3)	0.0	(191.3)	(191.3)	202.2	1,760.2	0.0	0.0	0.0
2023	16	*694.5*	0.0	(269.9)	0.0	(269.9)	424.6	0.0	0.0	0.0	0.0		(187.0)	0.0	(187.0)	(187.0)	237.6	1,997.8	0.0	0.0	0.0
2024	17	*727.0*	0.0	(362.8)	0.0	(362.8)	364.2	0.0	0.0	0.0	0.0		(182.6)	0.0	(182.6)	(182.6)	181.6	2,179.4	0.0	0.0	0.0
2025	18	*761.1*	0.0	(362.8)	0.0	(362.8)	398.3	0.0	0.0	0.0	0.0		(178.3)	0.0	(178.3)	(178.3)	220.0	2,399.5	0.0	0.0	0.0
2026	19	*796.8*	0.0	(362.8)	0.0	(362.8)	434.0	0.0	0.0	0.0	0.0		(173.9)	0.0	(173.9)	(173.9)	260.1	2,659.5	0.0	0.0	0.0
2027	20	*834.2*	0.0	(362.8)	0.0	(362.8)	471.4	0.0	0.0	0.0	0.0		(169.6)	0.0	(169.6)	(169.6)	301.8	2,961.3	0.0	0.0	0.0
2028	21	*873.3*	0.0	(362.8)	0.0	(362.8)	510.5	0.0	0.0	0.0	0.0		(165.2)	0.0	(165.2)	(165.2)	345.3	3,306.6	0.0	0.0	0.0
2029	22	*914.3*	0.0	(362.8)	0.0	(362.8)	551.5	0.0	0.0	0.0	0.0		(160.9)	0.0	(160.9)	(160.9)	390.6	3,697.2	0.0	0.0	0.0
2030	23	*957.2*	0.0	(362.8)	0.0	(362.8)	594.3	0.0	0.0	0.0	0.0		(156.5)	0.0	(156.5)	(156.5)	437.8	4,135.0	0.0	0.0	0.0
2031	24	*1,002.0*	0.0	(362.8)	0.0	(362.8)	639.2	0.0	0.0	0.0	0.0		(152.2)	0.0	(152.2)	(152.2)	487.0	4,622.0	0.0	0.0	0.0
2032	25	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(147.8)	0.0	(147.8)	(147.8)	538.4	5,160.4	0.0	0.0	0.0
2033	26	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(143.5)	0.0	(143.5)	(143.5)	542.7	5,703.2	0.0	0.0	0.0
2034	27	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(139.1)	0.0	(139.1)	(139.1)	547.1	6,250.2	0.0	0.0	0.0
2035	28	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(134.8)	0.0	(134.8)	(134.8)	551.4	6,801.7	0.0	0.0	0.0
2036	29	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(130.5)	0.0	(130.5)	(130.5)	555.8	7,357.5	0.0	0.0	0.0
2037	30	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(126.1)	0.0	(126.1)	(126.1)	560.1	7,917.6	0.0	0.0	0.0
2038	31	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(121.8)	0.0	(121.8)	(121.8)	564.5	8,482.1	0.0	0.0	0.0
2039	32	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(117.4)	0.0	(117.4)	(117.4)	568.8	9,050.9	0.0	0.0	0.0
2040	33	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(113.1)	0.0	(113.1)	(113.1)	573.2	9,624.1	0.0	0.0	0.0
2041	34	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(108.7)	0.0	(108.7)	(108.7)	577.5	10,201.6	0.0	0.0	0.0
2042	35	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(104.4)	0.0	(104.4)	(104.4)	581.9	10,783.5	0.0	0.0	0.0
2043	36	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(100.0)	0.0	(100.0)	(100.0)	586.2	11,369.7	0.0	0.0	0.0
2044	37	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(95.7)	0.0	(95.7)	(95.7)	590.6	11,960.3	0.0	0.0	0.0
2045	38	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(91.3)	0.0	(91.3)	(91.3)	594.9	12,555.2	0.0	0.0	0.0
2046	39	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		(87.0)	0.0	(87.0)	(87.0)	599.3	13,154.5	0.0	0.0	0.0
2047	40	*1,049.0*	0.0	(362.8)	0.0	(362.8)	686.2	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	686.2	13,840.7	0.0	0.0	0.0
Accumulated Values		**31,709**	**-3,382**	**-12,453**	**0**	**-15,834**	**15,874**	**947**	**2,435**	**0**	**3,382**	**n.a.**	**-5,415**	**0**	**-5,415**	**-2,034**	**13,841**	**n.a.**			

Source: JICA Study Team.

Notes:
1.) The computation allows for 5% return on equity(ROE) during the first five operational years and 20% in the years thereafter (before tax). No ROE will be paid during the construction period.
2.) The capital cost exclude the equity portion of Rp. 830,800 million for the existing assets due to the assumed debt for equity swap, which is cashflow neutral.
3.) ROE = return on equity. Computation is based on net cashflow after long-term financing.
4.) n.a. = not applicable.

9.2.6 Income Statement for Implementing Entity

The most favorable case has been identified as demand scenario 3 in combination with investment scenario 4. Table 9.2.8 shows the financing plan for that scenario, Table 9.2.9 identifies the sources and uses of funds and Table 9.2.10 shows a tentative income statement for the implementing entity, if this scenario is realized.

According to the analysis of income statement it can be said that:

1) The implementing entity shows a positive gross profit throughout operational years
2) The operational profit is also kept positive in overall operation years, despite cash flow neutral depreciation needs
3) If additional capital costs are required the profit before tax is quite negative until the operational year 2017, and the implementing entity shows only as of the year 2018 any positive net profit after taxes
4) Therefore any investment, needed between 2008 and 2018 will have to be financed by loans

9.3 Conclusions and Recommendations

All previous studies have confirmed the need for a MRT system in the Fatmawati-Kota corridor, in which commercial, financial, administrative, diplomatic and other economic activities at international, national and regional levels are located on an intensive scale.

The traffic demand on this corridor has already exceeded the road capacity (a volume/capacity ratio at a cross section in front of Atmajaya University near Semangi Interchange was 1.16 in the peak one hour, 2000) and the ratio is estimated to rise up to 1.76 in 2015 without MRT network condition. Therefore, it is absolutely necessary to introduce the MRT system as planned either in the Jakarta Structure Plan 2010 and/or the Jabotabek Structure Plan 2015.

The economic internal rate of return (EIRR) analysis proved the economic feasibility of the MRT project at a rate of over 13%-14% with enhancement measures of the MRT rider-ship.

The financial viability can be confirmed only when the government guarantees to provide the operating entity with the infrastructure component (equivalent to about 80% of the initial investment cost). Under this condition, the investment scenario 2 and 3 will attain a Return on Investment (ROI or Project IRR) of over 7%.

The recommendations that enable a financially viable MRT project are summarized as follows:

1) It is quite essential for the central government to procure a very soft loan, such as the Special Yen Loan (i.e. interest rate: 0.75% p.a. for 40 years repayment period including 10 years grace period), and on-lend these resources to the operating entity at an as low as possible interest rate of around 5% p.a.

2) The central government may on-lend funds to the operating entity at 7-8% p.a., but the investment scenario 2 combined with any of the alternative demand scenarios shows that the operating entity cannot service its long-term debt at such a high rate. If the higher on-lending rate is the condition, it is indispensable to apply the investment scenario 3, which requires the central government to provide the operating entity with additional investments for future rolling stock requirements and facility replacement. On the other hand, a lower on-lending rate would eliminate such additional investments by the government in future operation.

3) The government's limited, but clear-cut support to the operating entity at the initial investment stage will help foster stronger responsibility and management of the operating entity in future, rather than the management/additional investment continues to rely on the central government even after the MRT operation starts. Therefore, the investment scenario 2 is recommended as a government policy on the MRT investment.

4) If the investment scenario 2, which assumes that the operating entity should shoulder directly operations related initial investments, additional rolling stock and facility replacement investments additionally to the annual O/M costs, the target MRT rider-ship will require more than 400,000 passengers per day in 2005, and 650,000 passengers in 2015 (demand scenario 3), in order to achieve a sound financial condition of the operating entity.

5) In any event, all efforts to encourage the use of the MRT should be made through such transport policy measures as vehicular traffic demand management, re-structuring of bus routes, improvement of access and interchange facilities, intensive land uses around rail stations and development of the extensive MRT network in Jabotabek.

Table 9.2.8 Worksheet for Financing Plan

(Unit: billion Rupiah)

Project Year	Capital Cost	Equity Portion	Long-term Loan	Interest on Disburse-ment	Interest on Last Year's Loan Balance	Total Loan Taken During Year	Loan Balance at Year-end	Interest During Construc-tion
2000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2003	3.60	3.60	0.00	0.00	0.00	0.00	0.00	0.00
2004	309.80	309.80	0.00	0.00	0.00	0.00	0.00	0.00
2005	1,520.10	185.76	1,270.84	63.54	0.00	1,334.38	1,334.38	63.54
2006	1,302.90	251.53	937.77	46.89	66.72	1,051.38	2,385.76	113.61
2007	245.20	195.90	0.00	0.00	49.23	49.23	2,434.99	49.23
2008	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**3,381.60**	**946.59**				**2,434.99**		**226.38**

Source: JICA Study Team

Table 9.2.9 Projected Sources and Uses of Funds (Current Rupiah)

(Unit:billion Rupiah)

Project Year	SOURCES OF FUNDS: Net Profit (after tax)	Depreciation of Assets	Interest Depreciation	Equity Portion	Long-term Loan	TOTAL SOURCES	USES OF FUNDS: Capital Cost	IDC	Total Project Cost	Long-term Debt Service	Short-term Debt Service	TOTAL USES	Sources Minus Uses	Short-term Loan	Net Cash Flow	Accumulated Net Cash Flow
2001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	0.0	0.0	0.0	3.6	0.0	3.6	3.6	0.0	3.6	0.0	0.0	3.6	0.0	0.0	0.0	0.0
2004	0.0	0.0	0.0	309.8	0.0	309.8	309.8	0.0	309.8	0.0	0.0	309.8	0.0	0.0	0.0	0.0
2005	0.0	0.0	0.0	185.8	1,334.4	1,520.1	1,456.6	63.5	1,520.1	0.0	0.0	1,520.1	0.0	0.0	0.0	0.0
2006	0.0	0.0	0.0	251.5	1,051.4	1,302.9	1,189.3	113.6	1,302.9	0.0	0.0	1,302.9	0.0	0.0	0.0	0.0
2007	0.0	0.0	0.0	195.9	49.2	245.1	196.0	49.2	245.2	0.0	0.0	245.2	-0.1	0.0	-0.1	-0.1
2008	107.8	67.0	78.4	0.0	0.0	253.2	0.0	0.0	0.0	119.3	0.0	119.3	133.9	0.0	133.9	133.8
2009	118.4	67.0	78.4	0.0	0.0	263.8	0.0	0.0	0.0	121.8	0.0	121.8	142.1	0.0	142.1	275.9
2010	129.5	67.0	78.4	0.0	0.0	274.9	0.0	0.0	0.0	121.8	0.0	121.8	153.2	0.0	153.2	429.0
2011	141.2	67.0	78.4	0.0	0.0	286.6	0.0	0.0	0.0	121.8	0.0	121.8	164.9	0.0	164.9	593.9
2012	127.0	67.0	78.4	0.0	0.0	272.4	0.0	0.0	0.0	121.8	0.0	121.8	150.7	0.0	150.7	744.5
2013	139.8	67.0	78.4	0.0	0.0	285.2	0.0	0.0	0.0	121.8	0.0	121.8	163.5	0.0	163.5	908.0
2014	153.1	67.0	78.4	0.0	0.0	298.5	0.0	0.0	0.0	121.8	0.0	121.8	176.8	0.0	176.8	1,084.7
2015	167.1	67.0	78.4	0.0	0.0	312.5	0.0	0.0	0.0	121.8	0.0	121.8	190.8	0.0	190.8	1,275.5
2016	181.8	67.0	78.4	0.0	0.0	327.2	0.0	0.0	0.0	121.8	0.0	121.8	205.5	0.0	205.5	1,480.9
2017	167.5	67.0	78.4	0.0	0.0	312.9	0.0	0.0	0.0	121.8	0.0	121.8	191.2	0.0	191.2	1,672.1
2018	183.6	67.0	78.4	0.0	0.0	329.0	0.0	0.0	0.0	121.8	0.0	121.8	207.3	0.0	207.3	1,879.3
2019	200.4	67.0	78.4	0.0	0.0	345.8	0.0	0.0	0.0	204.4	0.0	204.4	141.4	0.0	141.4	2,020.8
2020	218.0	67.0	78.4	0.0	0.0	363.4	0.0	0.0	0.0	200.0	0.0	200.0	163.4	0.0	163.4	2,184.1
2021	236.5	67.0	78.4	0.0	0.0	381.9	0.0	0.0	0.0	195.7	0.0	195.7	186.2	0.0	186.2	2,370.4
2022	255.8	67.0	78.4	0.0	0.0	401.2	0.0	0.0	0.0	191.3	0.0	191.3	209.9	0.0	209.9	2,580.3
2023	276.0	67.0	78.4	0.0	0.0	421.4	0.0	0.0	0.0	187.0	0.0	187.0	234.4	0.0	234.4	2,814.7
2024	236.7	67.0	78.4	0.0	0.0	382.1	0.0	0.0	0.0	182.6	0.0	182.6	199.5	0.0	199.5	3,014.2
2025	258.9	67.0	78.4	0.0	0.0	404.3	0.0	0.0	0.0	178.3	0.0	178.3	226.0	0.0	226.0	3,240.2
2026	282.1	67.0	78.4	0.0	0.0	427.5	0.0	0.0	0.0	173.9	0.0	173.9	253.6	0.0	253.6	3,493.8
2027	306.4	67.0	78.4	0.0	0.0	451.8	0.0	0.0	0.0	169.6	0.0	169.6	282.2	0.0	282.2	3,776.0
2028	331.8	67.0	78.4	0.0	0.0	477.2	0.0	0.0	0.0	165.2	0.0	165.2	312.0	0.0	312.0	4,087.9
2029	358.4	67.0	78.4	0.0	0.0	503.8	0.0	0.0	0.0	160.9	0.0	160.9	342.9	0.0	342.9	4,430.9
2030	386.3	67.0	78.4	0.0	0.0	531.7	0.0	0.0	0.0	156.5	0.0	156.5	375.2	0.0	375.2	4,806.0
2031	415.5	67.0	78.4	0.0	0.0	560.9	0.0	0.0	0.0	152.2	0.0	152.2	408.7	0.0	408.7	5,214.7
2032	446.0	67.0	78.4	0.0	0.0	591.4	0.0	0.0	0.0	147.8	0.0	147.8	443.6	0.0	443.6	5,658.3
2033	446.0	67.0	78.4	0.0	0.0	591.4	0.0	0.0	0.0	143.5	0.0	143.5	447.9	0.0	447.9	6,106.2
2034	446.0	67.0	78.4	0.0	0.0	591.4	0.0	0.0	0.0	139.1	0.0	139.1	452.3	0.0	452.3	6,558.5
2035	446.0	67.0	78.4	0.0	0.0	591.4	0.0	0.0	0.0	134.8	0.0	134.8	456.6	0.0	456.6	7,015.1
2036	446.0	67.0	78.4	0.0	0.0	591.4	0.0	0.0	0.0	130.5	0.0	130.5	461.0	0.0	461.0	7,476.0
2037	446.0	67.0	78.4	0.0	0.0	591.4	0.0	0.0	0.0	126.1	0.0	126.1	465.3	0.0	465.3	7,941.3
2038	446.0	67.0	78.4	0.0	0.0	591.4	0.0	0.0	0.0	121.8	0.0	121.8	469.7	0.0	469.7	8,411.0
2039	446.0	67.0	78.4	0.0	0.0	591.4	0.0	0.0	0.0	117.4	0.0	117.4	474.0	0.0	474.0	8,885.0
2040	446.0	67.0	78.4	0.0	0.0	591.4	0.0	0.0	0.0	113.1	0.0	113.1	478.4	0.0	478.4	9,363.3
2041	446.0	67.0	78.4	0.0	0.0	591.4	0.0	0.0	0.0	108.7	0.0	108.7	482.7	0.0	482.7	9,846.0
2042	446.0	67.0	78.4	0.0	0.0	591.4	0.0	0.0	0.0	104.4	0.0	104.4	487.0	0.0	487.0	10,333.1
2043	446.0	67.0	78.4	0.0	0.0	591.4	0.0	0.0	0.0	100.0	0.0	100.0	491.4	0.0	491.4	10,824.5
2044	446.0	67.0	78.4	0.0	0.0	591.4	0.0	0.0	0.0	95.7	0.0	95.7	495.7	0.0	495.7	11,320.2
2045	446.0	67.0	78.4	0.0	0.0	591.4	0.0	0.0	0.0	91.3	0.0	91.3	500.1	0.0	500.1	11,820.3
2046	446.0	67.0	78.4	0.0	0.0	591.4	0.0	0.0	0.0	87.0	0.0	87.0	504.4	0.0	504.4	12,324.7
2047	446.0	67.0	78.4	0.0	0.0	591.4	0.0	0.0	0.0	0.0	0.0	0.0	591.4	0.0	591.4	12,916.1
Total				946.6	2,435.0		3,155.3	226.4	3,381.7	5,415.4						

Source: JICA Study Team.
Notes: Net Profit after tax is based on the net revenue stream minus 35% tax.

Table 9.2.9

Table 9.2.10 Projected Income Statement (Current Rupiah)

(Unit:billion Rupiah)

Project Year	Revenues	O&M Cost	Other Cost	Gross Profit	Asset Depreciation	Interest Depreciation	Operational Profit	Interest on Long-term Loan	Interest on Short-term Loan	Profit Before Tax	Corporate Tax [35%]	Net Profit after Tax	Accumulated Net Profit
2001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	349.4	183.6	0.0	165.8	67.0	78.4	20.4	119.3	0.0	-98.9	0.0	0.0	0.0
2009	365.8	183.6	0.0	182.2	67.0	78.4	36.8	121.8	0.0	-85.0	0.0	0.0	0.0
2010	382.9	183.6	0.0	199.3	67.0	78.4	53.9	121.8	0.0	-67.9	0.0	0.0	0.0
2011	400.9	183.6	0.0	217.2	67.0	78.4	71.8	121.8	0.0	-49.9	0.0	0.0	0.0
2012	419.6	224.2	0.0	195.4	67.0	78.4	50.0	121.8	0.0	-71.8	0.0	0.0	0.0
2013	439.3	224.2	0.0	215.0	67.0	78.4	69.6	121.8	0.0	-52.1	0.0	0.0	0.0
2014	459.9	224.2	0.0	235.6	67.0	78.4	90.2	121.8	0.0	-31.5	0.0	0.0	0.0
2015	481.4	224.2	0.0	257.1	67.0	78.4	111.7	121.8	0.0	-10.0	0.0	0.0	0.0
2016	504.0	224.2	0.0	279.7	67.0	78.4	134.3	121.8	0.0	12.6	0.0	0.0	0.0
2017	527.6	269.9	0.0	257.7	67.0	78.4	112.3	121.8	0.0	-9.5	0.0	0.0	0.0
2018	552.3	269.9	0.0	282.4	67.0	78.4	137.0	121.8	0.0	15.3	5.3	9.9	9.9
2019	578.2	269.9	0.0	308.3	67.0	78.4	162.9	117.4	0.0	45.5	15.9	29.6	39.5
2020	605.3	269.9	0.0	335.4	67.0	78.4	190.0	113.1	0.0	76.9	26.9	50.0	89.5
2021	633.7	269.9	0.0	363.8	67.0	78.4	218.4	108.7	0.0	109.7	38.4	71.3	160.8
2022	663.4	269.9	0.0	393.5	67.0	78.4	248.1	104.4	0.0	143.7	50.3	93.4	254.2
2023	694.5	269.9	0.0	424.6	67.0	78.4	279.2	100.0	0.0	179.2	62.7	116.5	370.7
2024	727.0	362.8	0.0	364.2	67.0	78.4	218.8	95.7	0.0	123.2	43.1	80.1	450.7
2025	761.1	362.8	0.0	398.3	67.0	78.4	252.9	91.3	0.0	161.6	56.6	105.0	555.8
2026	796.8	362.8	0.0	434.0	67.0	78.4	288.6	87.0	0.0	201.6	70.6	131.1	686.8
2027	834.2	362.8	0.0	471.4	67.0	78.4	326.0	82.6	0.0	243.4	85.2	158.2	845.0
2028	873.3	362.8	0.0	510.5	67.0	78.4	365.1	78.3	0.0	286.8	100.4	186.4	1,031.5
2029	914.3	362.8	0.0	551.5	67.0	78.4	406.1	73.9	0.0	332.1	116.2	215.9	1,247.4
2030	957.2	362.8	0.0	594.3	67.0	78.4	448.9	69.6	0.0	379.4	132.8	246.6	1,494.0
2031	1,002.0	362.8	0.0	639.2	67.0	78.4	493.8	65.2	0.0	428.6	150.0	278.6	1,772.5
2032	1,049.0	362.8	0.0	686.2	67.0	78.4	540.8	60.9	0.0	480.0	168.0	312.0	2,084.5
2033	1,049.0	362.8	0.0	686.2	67.0	78.4	540.8	56.5	0.0	484.3	169.5	314.8	2,399.3
2034	1,049.0	362.8	0.0	686.2	67.0	78.4	540.8	52.2	0.0	488.6	171.0	317.6	2,716.9
2035	1,049.0	362.8	0.0	686.2	67.0	78.4	540.8	47.8	0.0	493.0	172.5	320.4	3,037.4
2036	1,049.0	362.8	0.0	686.2	67.0	78.4	540.8	43.5	0.0	497.3	174.1	323.3	3,360.7
2037	1,049.0	362.8	0.0	686.2	67.0	78.4	540.8	39.1	0.0	501.7	175.6	326.1	3,686.8
2038	1,049.0	362.8	0.0	686.2	67.0	78.4	540.8	34.8	0.0	506.0	177.1	328.9	4,015.7
2039	1,049.0	362.8	0.0	686.2	67.0	78.4	540.8	30.4	0.0	510.4	178.6	331.8	4,347.4
2040	1,049.0	362.8	0.0	686.2	67.0	78.4	540.8	26.1	0.0	514.7	180.2	334.6	4,682.0
2041	1,049.0	362.8	0.0	686.2	67.0	78.4	540.8	21.7	0.0	519.1	181.7	337.4	5,019.4
2042	1,049.0	362.8	0.0	686.2	67.0	78.4	540.8	17.4	0.0	523.4	183.2	340.2	5,359.7
2043	1,049.0	362.8	0.0	686.2	67.0	78.4	540.8	13.0	0.0	527.8	184.7	343.1	5,702.7
2044	1,049.0	362.8	0.0	686.2	67.0	78.4	540.8	8.7	0.0	532.1	186.2	345.9	6,048.6
2045	1,049.0	362.8	0.0	686.2	67.0	78.4	540.8	4.4	0.0	536.5	187.8	348.7	6,397.3
2046	1,049.0	362.8	0.0	686.2	67.0	78.4	540.8	0.0	0.0	540.8	189.3	351.5	6,748.9
2047	1,049.0	362.8	0.0	686.2	67.0	78.4	540.8	0.0	0.0	540.8	189.3	351.5	7,100.4
Total	31,708.6			19,256.1	2,680.0		13,440.1	2,980.4	0.0	10,459.7			

Source: JICA Study Team.
Notes: Net Profit after tax is based on the net revenue stream minus 35% tax.