Technical Assistance Consultant's Report

Project Number: 39500
November 2010

Socialist Republic of Viet Nam: Preparing the Ho Chi Minh City Urban Mass Rapid Transit Line 2 Project
(Financed by Technical Assistance Special Fund)

Prepared by

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For Ho Chi Minh City People's Committee (HCMC PC)
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Asian Development Bank

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OTHER DOCUMENTS (PREPARED UNDER THIS STUDY)

Environmental Documents

- Environmental Assessment Review Framework (EARF), August 2010
- Initial Environmental Examination (IEE) for depot priority area, August 2010

Resettlement and Social Documents

- Resettlement Framework (RF), July 2010
- Resettlement Plan (RP) for depot priority area, July 2010
- Social Impact Assessment (SIA), May 2010

Other Documents

- Executive Summary Report, November 2010
- Drawings, November 2010
- Preliminary design report & drawings for depot priority area, November 2010
- Minutes of Fact Finding and other key meetings

REFERENCE DOCUMENTS (PREPARED UNDER TA4862-VIE)

PPTA Reports

- Alignment Review and Project Concept, August 2007
- Mid-Term Report, December 2007
- Project Context and MRT Master Plan Report, December 2007
- Ridership and Revenue Forecast Study, January 2008
- Technical Paper on Bus Services Restructuring, July 2008
- Environmental Impact Assessment, November 2008
- Resettlement Plan, November 2008
- Final Report: Volume 1 – main text
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PPIAF Reports

- Financial Modelling Working Paper and Model, June 2008
- Fares and Ticketing Working Paper, June 2008
- Issues and Options for Private Sector Participation and Concession Template Working Paper, April 2008
- Implementation Arrangements: Institutional Options Working Paper, March 2008
- Stakeholder Engagement Plan, March 2008
- Technical Paper: Implementation Arrangements February 2010

ABBREVIATIONS

ADB	Asian Development Bank
AP	Affected Person
CP	Compensation Plan
CPC	Commune Peoples' Committee
DARD	Department of Agriculture and Rural Development
DCC	District Compensation Committee
DMS	Detailed Measurement Survey
DOC	Department of Construction
DOF	Department of Finance
DONRE	Department of Natural Resources and Environment
DPC	District People's Committee
DPI	Department of Planning and Investment
DOT	Department of Transport
EARF	Environmental Assessment and Review Framework
EIA	Environmental Impact Assessment
EMA	External Monitoring Agency
EMP	Environmental Management Plan
FS	Feasibility Study
GOV	Government of Vietnam
HCMC	Ho Chi Minh City
HOUTRANS	Study On Urban Transport Master Plan And Feasibility Study In HCMC
IEE	Initial Environmental Examination
IFI	International Financial Institution
IOL	Inventory of Losses
JBIC	Japan Bank for International Cooperation
JICA	Japan International Corporation Agency
LURC	Land Use Rights Certificate
MARD	Ministry of Agriculture and Rural Development
MAUR	Management Authority of Urban Railways (MAUR)
MOF	Ministry of Finance
MOLISA	Ministry of Labor, Invalids and Social Assistance
MONRE	Ministry of Natural Resources and Environment
MOT	Ministry of Transport
MRT	Mass Rapid Transit
MVA	MVA Asia Limited
NGOs	Non-governmental Organizations
OCS	Overhead Catenary System
PC	People's Committee
PIMSSC	Project Implementation Management and Support Supervision Consultants
PMT	Project Management Team
PPC	Provincial People's Committee
pphpd	Passengers per hour per direction
PPIAF	Public Private Infrastructure Advisory Facility
PPTA	Project Preparation Technical Assistance
PT	Public Transport
RF	Resettlement Framework
RP	Resettlement Plan
SES	Socio-Economic Survey
TA	Technical Assistance
UMRT	Urban Mass Rapid Transit
UMRT2	Urban Mass Rapid Transit Line 2
VEIA	Vietnamese EIA (Approved by DONRE May 2009)
VND	Viet Nam Dong
VRA	Viet Nam Railway Administration, Ministry of Transport

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November 2010

Disclaimer

The views expressed in this report are those of the consultant team, unless otherwise indicated. They are not necessarily the views of the Asian Development Bank nor of the Government of Vietnam

1. INTRODUCTION

1.1 Background

1.1.1 A feasibility study for Ho Chi Minh City (HCMC) Mass Rapid Transit (MRT) Line 2 project was undertaken during 2007-2008, under a project preparatory Technical Assistance (TA) grant from ADB reference TA4862-VIE. The TA was accepted and approved by ADB in 2009.

1.1.2 This report presents the results of a further TA; reference TA7343-VIE, which was commissioned in January 2010. The purpose of TA7343-VIE was to update the HCMC MRT Line 2 studies, in order to finalise the Feasibility Study (FS) and to complete the due diligence activities. The new TA also examines further the proposed institutional and implementation arrangements; and measures for development of a sustainable urban transport system, with MRT system integration, for Ho Chi Minh City.

1.1.3 The overall objective is to provide advice to the HCMC People's Committee (HCMC PC) – the Executing Agency (EA), and to the Management Authority for Urban Railways (MAUR) – the Implementing Agency (IA). The TA recommends on the integrated development of MRT Line 2 in HCMC, which will provide convenient, comfortable, safe, affordable and clean climate friendly urban transport that improves the quality of urban living and reduce reliance on private modes of transport.

1.1.4 The objective of the TA is also to assist in preparation of the documentation for approval of the project by the Government and ADB, finalize the assessment of key institutional capacity development and urban transport policy measures, and provide project management support to the EA and IA for timely implementation of the project.

1.1.5 The outputs from the TA include (i) a revised Feasibility Study, (ii) proposed institutional and implementation arrangements; and (iii) measures for development of sustainable urban transport with MRT system integration in HCMC.

1.2 Supporting PPIAF and Institutional Studies

1.2.1 At the time of TA4862, to support the work of the PPTA the ADB mobilized a grant from the Public Private Infrastructure Advisory Facility (PPIAF) to develop appropriate short term and longer term implementation and management arrangements for MRT in the context of wider urban transport, including options for how best to optimize private sector participation in MRT. The results of the PPIAF study were incorporated in TA4862.

1.2.2 As part of the current studies, further work has been commissioned by ADB from the institutional specialist, and the results are again incorporated within this final report for TA7343.

1.3 Laws, Decrees, Decisions and Other Documents Supporting the Project

1.3.1 Key decisions and other documents supporting the project preparation include:

- Letter No. 1464/CP-CN dated October 06, 2004 of the Prime Minister of Vietnam ratifying main contents of the Pre-Feasibility Study of Two Priority Lines of the HCMC Metropolitan Rail System;
- Decision no.1551/QD-UBND dated 10 April 2007 of the city People's Committee approving the Technical Assistance Project "Preparing Metro project in Ho Chi Minh City" funded by the Asian Development Bank.
- No.: 2442/QD-UBND dated 04 June 2007 of the of the city People's Committee approving the Bidding Plan for Technical Assistance Project "Preparing Metro project in Ho Chi Minh City" funded by Asian Development Bank.

1.4 Purpose of this Report

1.4.1 This Final Report presents the results of the TA7343 studies, also incorporating in full the relevant earlier findings from the TA4862 study.

1.4.2 The report is comprised of the following chapters:

- Chapter 1: Introduction.
- Chapter 2: Project Context presents the project's demographic, social and environmental conditions, the historic trends in transport demand and supply, and the recent government policies in urban and transport development.
- Chapter 3: Transport Master Plan & Patronage Demand Forecasts summarizes the current UMRT development plans, the potential future UMRT demand, recommendations for optimal UMRT network development, and the demand forecasts for Line 2.
- Chapter 4: Sustainable Transport explains the sustainable transport proposals that can enhance the patronage of the MRT system and create a successful integrated transport network for Ho Chi Minh City.
- Chapter 5: Design Characteristics presents the project's scope, location, alignment and rolling stock, and discussed engineering issues.
- Chapter 6: Service Operations Plan outlines the characteristics of the proposed metro services on Line 2 including train capacities; headways etc, and also provides an outline of the operation & maintenance (O&M) requirements.
- Chapter 7: Capital and O&M Costs sets out the main components of the costs of constructing the project, and the anticipated operating and maintenance costs for the system once it is up and running.
- Chapter 8: Social Safeguards summarizes the land acquisition and resettlement aspects, and the social analysis and poverty assessment.
- Chapter 9: Environmental Safeguards summarises the initial environmental examination and monitoring program.
- Chapter 10: Economic and Financial Assessment presents the economic analysis and the financial appraisal for the project.
- Chapter 11: Project Implementation presents the aspects related to the project implementation, including project approvals, institutional arrangements and capacity building, sources of finance, and risk identification and management.
- Chapter 12: Risk Identification and Management presents the possible risks to a successful Project and the mitigation / monitoring measures that are or will be put into action.

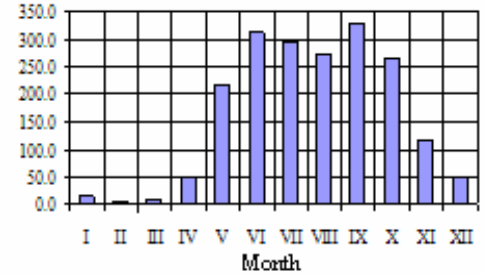
2. PROJECT CONTEXT

2.1 Local Conditions

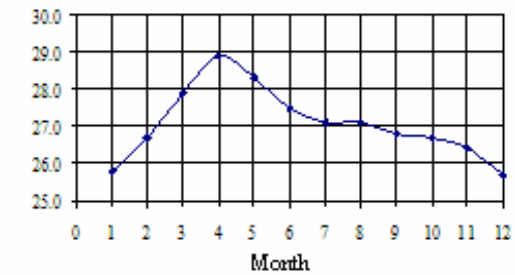
Climate

2.1.1 Ho Chi Minh City is fairly warm and humid year-round, with highest temperatures averaging 29C in May, and lowest at around 26C in December / January. Humidity is fairly constant at around 80%, and there is a distinct wet season between May and October when tropical showers and thunderstorms are frequent.

Figure 2.1 Climatic Conditions



Rainfall (mm)



Average Temperature (^{o}C)

2.1.2 Climatic conditions are not well suited to walking more than short distances, particularly during summer months – and this is confirmed from observations of existing travel characteristics. Conditions for construction are better in winter, though not impossible during the summer due to the generally brief and predictable rainfall patterns.

Geology and Hydrology

2.1.3 Ho Chi Minh City is situated over a thick accumulation of quaternary loose sediment layers, overlying layers of stiff clays and dense sands. This results largely from the accumulation of particles carried and deposited by the Saigon River. It is observed that the constitution of soils in Ho Chi Minh City varies considerably depending on their vertical and lateral distribution.

2.1.4 Water level is usually 1 m to 3 m below ground level but the level may vary with different factors like tide. Another aquifer lies in the sandy clay layer 40 m below ground level

2.1.5 Overall the distribution of the geotechnical units along the Line 2 tunnel alignment is well documented on the first 40m below ground level. However, almost no data is available deeper than 40m bellow ground level and very little data at this depth is available for the elevated section. Additional boreholes, reaching a depth of more than 50m are needed, in particular at the station locations, to clarify the position of the boundary between the clay and sand layers, and on the aerial sections in order to precisely determine the level of foundations of the viaduct. These investigations were specified early in the FS, but data could not be made available during the timeframe of the study, and the feasibility study is therefore presented on the basis of the data available.

Topography

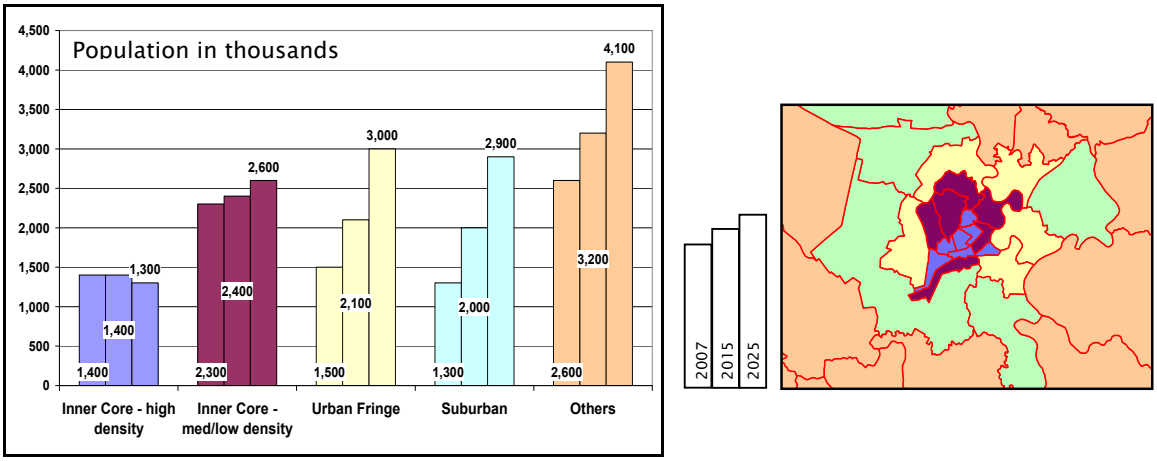
2.1.6 Ground levels along the route of the alignment are fairly flat, as is typical of most of the urban area of Ho Chi Minh City. Levels are generally around +3m to +4m, with a low of +2.2m near Ben Thanh, and a high of +5.5m.

2.2 Socio-economic and Demographic Circumstances

2.2.1 The last national population census in Vietnam was in 1999. For the purposes of the project estimates of population at base year (2007) and design years (2015, 2025) were made based on the projection data in the reports from HOUTRANS[1] and from the Study on the Adjustment of HCMC Master Plan[2].

2.2.2 In 2007 the estimated population of Ho Chi Minh City was over 6.5 million, growing at around 2.9% per year. In addition, more than 2.5 million people live in the adjoining provinces of Long An, Dong Nai and Binh Duong, totalling more than 9 million people in the Study Area. It is forecast that the Study Area population will reach over 13.8 million by 2025, with 10 million people in HCMC[3]. Most of the population growth is projected to happen in outer areas (the urban fringe, suburban and other outlying communities), while the inner core areas are projected either to decrease their populations (in high density areas) or increase moderately (in medium/low density areas). Figure 2.2 provides an overview of the estimated populations for 2007, 2015 and 2025 in the Study Area.

Figure 2.2 Population Estimates for 2007, 2015 and 2025 by Study Area Types

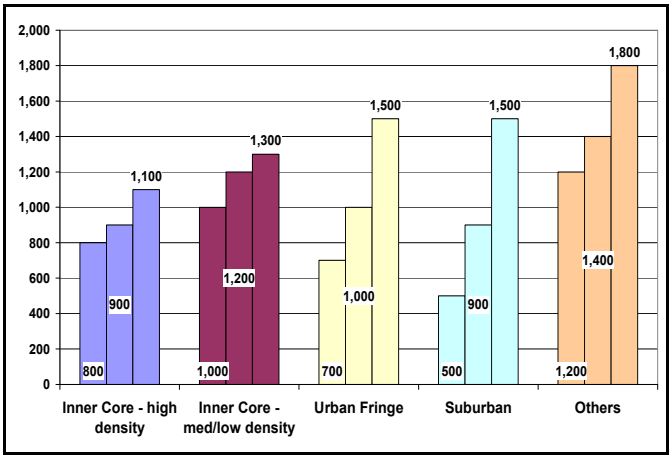


2.2.3 In 2007, HCMC employed more than 3 million people and the Study Area almost 4.2 million people. By 2025, it is projected that HCMC will employ more than 5.5 million people and the Study Area more than 7.2 million people. While the employment growth is projected to spread throughout the Study Area ore evenly, the outer areas are still expected to generate most of the future employment. Figure 2.3 provides a view of the projected employment for 2007, 2015 and 2025 in the Study Area.

2.2.4 Viet Nam was among the world's fastest-growing economies with GDP growth rates above 7.0% in 2001-2004 and above 8.0% in the last three years. In 2008, The GDP growth forecast was around 8.5%. HCMC is the largest city in Viet Nam and the primary centre of economic activity and, as such, its GDP growth has outpaced the national level growth: between 10% and 12% in 2001-2004 and more than 12% in 2004-2007. In the prospective future HCMC will continue to be the major centre of economic activity of the country.

[1] The Study On Urban Transport Master Plan And Feasibility Study In Ho Chi Minh Metropolitan Area (HOUTRANS), JICA, ALMEC, 2004
[2] The Study of the Adjustment of HCMC Master Plan up to 2025, Nikken Sekkei, Urban Planning Institute, April 2007
[3] For more details on socio-economic conditions the reader is referred technical documents prepared as part of the PPTA: Project Context and MRT Master Plan Report, December 2007, and HCMC Master Plan Ridership and Revenue Forecast Study, Final Report, January 2008.

Figure 2.3 Projected Employment in 2007, 2015 and 2025 by Study Area Types



2.3 Historic Trends in Transport Demand and Supply

2.3.1 Since 2003 bus ridership in HCMC has grown steadily. Following the development of the subsidized public transport network ridership has grown from 130,000 daily in March 2003 (42 lines) to 605,000 in 2006 (110 lines). This has built public awareness and trust in the system. In July 2007, the weekday ridership was 675,000 passengers.

2.3.2 Despite the recent improvements to the bus system and increases in bus network patronage, the current share of total motorised trips by public transport is still extremely low for a major international city, at less than 5%. The vast majority of trips are made by motorcycle. Car and taxi trips, whilst still a tiny proportion of the total, are increasing fast, and roads are rapidly becoming congested and dangerous due to the mix of traffic and pedestrians.

2.3.3 In 2007, private vehicles represented an abnormally high proportion (93%) of total journeys (19.1 million non-pedestrian journeys per day), broken down between motorcycles 78%, cars 1.2%, and bicycles 14%. Historically, car ownership has been lower than in comparable economies in the region. With continued growth of the economy expected in the medium term, there is significant potential for household incomes to rise, enabling many more families to be able to afford to purchase cars (particularly as on 1 May 2006 the Government again allowed used cars to be imported, a move that is expected to lead to falls in prices). Between 2004 and 2007, motorcycle ownership in Ho Chi Minh Province has grown at an annual rate of 8.4% to almost 3.1 million motorcycles. Private car ownership has increased even faster, at 20.7% per year to more than 200,000 vehicles and total car numbers (including taxis, other non-private owners) have grown to almost 400.000.

2.3.4 If current trends are not offset by better transport infrastructure and public transport systems, HCMC will face congestion, road safety, and air pollution difficulties similar to those in other large Asian cities such as Bangkok, Beijing, Manila, and Jakarta. The goal of HCMC People's Committee is to raise the share of public transport to carry 25% of all daily motorized trips by 2010 and 50% by 2020, a sharp increase from mid 2007 levels which were as low as 3% in the study Area.

2.4 Government Policies on Urban and Transport Development

2.4.1 Many relevant recent studies have been carried out in the last 10 years concerning urban and transport development for HCMC. The most significant of the above studies in terms of identifying government policies and HCMC urban and transport master plan refinement is the "HCMC Transport Development Planning to 2020" completed in 2006, since this formed the basis for "Decision 101" in 2007 and the Official Master Plan which were approved by the Prime Minister. This approved Master Plan targets public transport mode share of 22-26% by 2010-2015 and 47-50% by 2020, and proposes national, suburban and urban rail networks to achieve this objective.

2.4.2 In addition, the approved Master Plan stresses the need for restraint on private vehicle use due to inability to develop the road network as fast as the rising (unrestrained) demand for private vehicle use. The report proposes three complementary measures:

- To develop the road network according to the principle "integrating road development into public transport development": segregated lanes for buses and trams must be planned on cross-sections of bridges, roads or wide enough median must be reserved for development of light train, metro.
- To develop multi-modal public transport system with wide network; to organize "from-door-to-door" transport in order to create convenience for passengers.
- To manage demand; to limit private means in order to support development of public transport, by means of vehicle ownership restraint (high registration fees); high parking charges; road pricing charges on trips to central areas.

2.4.3 In March 2009 'Decision No. 35' approved the adjustments to Viet Nam's transport development strategy up to 2020 with a vision to 2030. Relevant to HCMC this included:

- Increase in annual state budget investment in transport infrastructure to 3.5-4% of GDP
- To promptly build modern urban transport infrastructure, giving priority to mass transit and static traffic system for dealing with traffic congestion and limiting environmental pollution in big cities (such as HCMC)
- To enhance management and quality of transport routes especially passenger transportation (such as buses in HCMC)
- An emphasis on strongly developing the bus systems in big cities including HCMC
- Introduction of traffic control technology systems to manage traffic in cities
- Building sections of north-south expressway between HCMC and provinces
- Building express railway between HCMC and provinces
- Restrict growth in use of motorcycles and personal cars in HCMC

3. TRANSPORT MASTER PLAN & PATRONAGE DEMAND FORECASTS

3.1 HCMC Urban Transport Sector Assessment

3.1.1 An Urban Transport Sector Assessment (ASR) has been produced to summarise the rationale behind ADB investment in the Project. The ASR is included as Appendix H.

3.1.2 The transport sector plays a key role in facilitating economic and social development by enabling access to places of employment, leisure, education etc. The efficient movement of freight is also of key importance to sustain the level of economic growth in HCMC experienced in recent years.

3.1.3 An improved urban transport network is vital to meet the growing travel demand in HCMC. Convenient and efficient accessibility to employment, education and public services and goods access is vital to the economic development of HCMC.

3.1.4 Development of public transport modes such as the MRT network will help to mitigate the pressures from the growing private transport demand. If current trends are not offset by better transport infrastructure and public transport systems, HCMC will face congestion, road safety, and air pollution difficulties similar to those in other large Asian cities such as Bangkok, Beijing, Manila, and Jakarta.

3.1.5 The GoV have identified transport and particular public transport as key investment and development areas for the next 10 to 20 years[4]. It is important that the key financial and institutional constraints (as discussed in Chapter 10 and 11 and Appendix E and H) are addressed to achieve the GoV targeted growth in public transport.

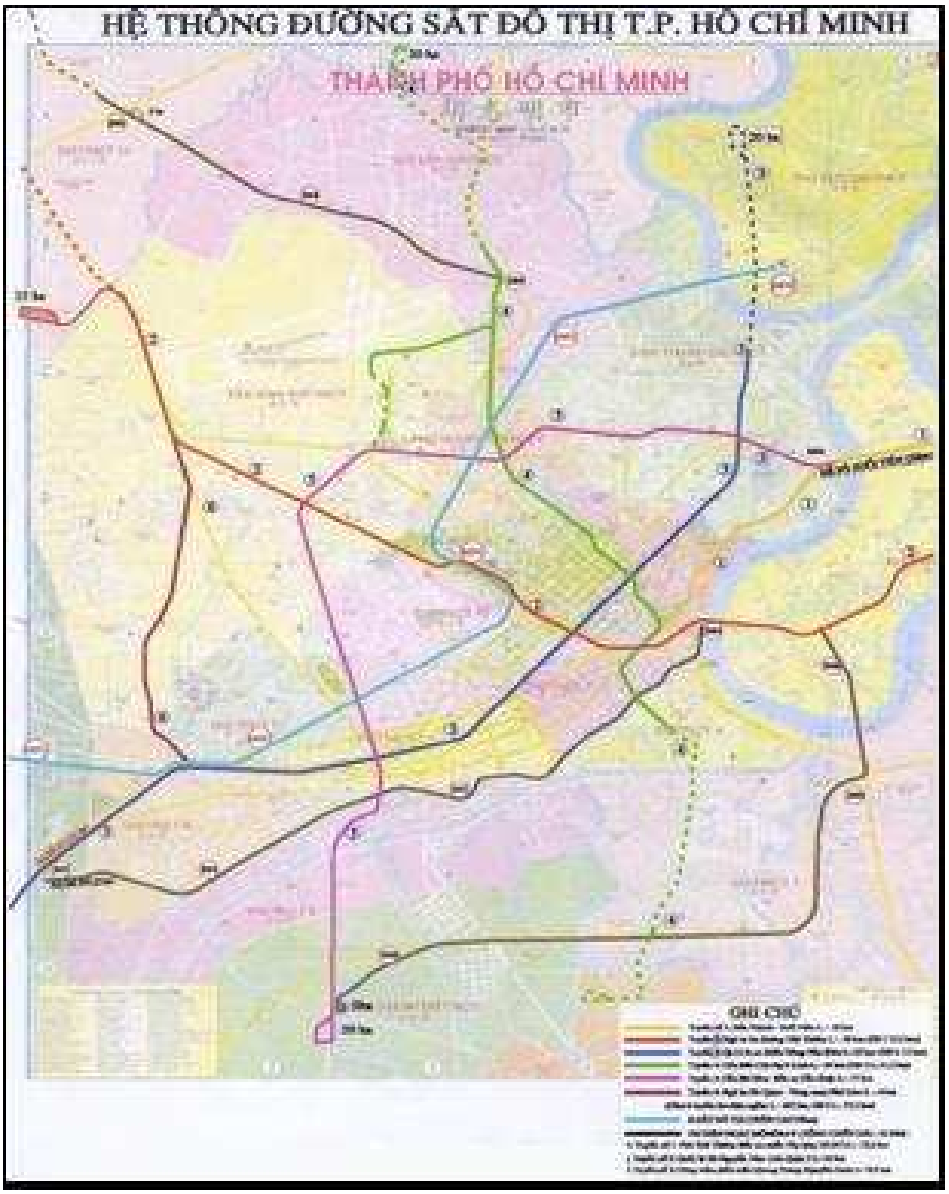
3.2 The 2007 Approved Transport Plan

3.2.1 A Transport Network Master plan for HCMC was approved by the Prime Minister in January 2007. This plan is part of the recommendations for future transport development of the city, which envisage very high priority for public transport development. Modal share of travel in urban areas by public transport is targeted to be 40-50% by year 2025, compared with only around 5% today, and development of an urban rail network is seen as the backbone to achieve this.

3.2.2 The transport plan features a network of urban rail lines as shown on Figure 3.1. The urban rail network comprises 6 Metro rail (MRT) lines with total length of 109km, as well as two monorail routes, and a tramway.

[4] Decision No 35/2009/QD-TTg (March 3rd 2009) approving adjustments to the transport development strategy up to 2020 with a vision toward 2030.

Figure 3.1 Approved HCMC Transport Master Plan MRT Lines



3.2.3 Four priority MRT lines are identified on this plan:

- Line 1: Ben Thanh – Suoi Tien, 19.7km (shown in yellow on the Figure)
- Line 2: Tham Luong – Ben Thanh, 12.3km, with planned extension across the river to Thu Thiem (red)
- Line 3: Mien Dong – Phu Lam, 13km, with planned northern extension (dark blue)
- Line 4: Nga Sau Go Vap – Khanh Hoi, 11.3km, with planned extensions in both directions (green).

3.2.4 The other urban rail lines on the master plan are understood to have secondary priority:

- Line 5 – a northern inner semi-loop line (purple)
- Line 6 – a north-south section in the western suburbs (brown)
- Southern Monorail – through Districts 7 and 2 along Van Linh Parkway (grey)
- Northern Monorail – feeder service to Line 4 (grey)
- Tramway – along riverfront south of CBD (black)

3.2.5 Four suburban train operating services are proposed in the master plan, where suburban trains operate together with long distance trains along existing VNR corridors (shown in light blue on the Figure), as follows:

- Hoa Hung – Bien Hoa – Xuan Loc: 17km (on Trang Bom – Hoa Hung section under North – South Railway);
- Hoa Hung – Phu My: 50km (under HCMC – Vung Tau Railway);
- Hoa Hung – Chon Thanh: 81.5km (under HCMC – Loc Ninh Railway);
- Hoa Hung – My Tho: 70km (under HCMC – My Tho – Can Tho Railway).

3.2.6 Two further high-speed "LRT" lines are proposed to serve the development of new urban centres, industrial zones and new international airport, namely:

- Tan Thoi Hiep (near north-west corner of proposed Western Ring Railway) to Trang Bang (just beyond Cu Chi District in Tay Ninh Province). This line would be 33km long, and is eventually planned to extend further to Moc Bai on the Cambodian border;
- Thu Thiem – Nhon Trach – Long Thanh International Airport line is 56km long (serving the new urban area and airport).

3.3 Recommended Modifications to the Transport Master plan

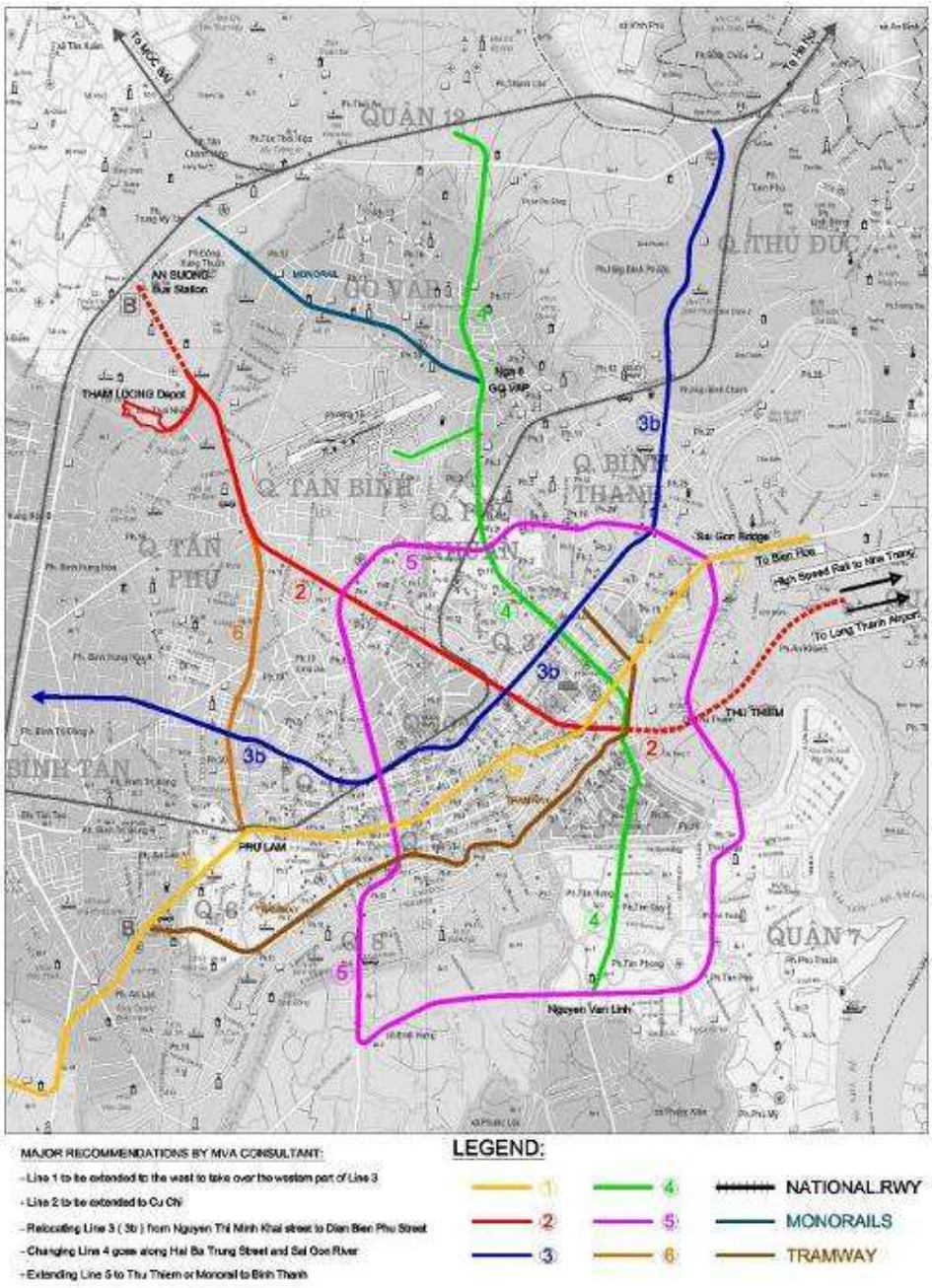
3.3.1 As with any such plan, the Transport Network Master Plan provides a basis for future planning, but it must also be regarded as a "fluid" plan which is constantly under review as situations and policies change and develop. A major objective of the TA4862 study was to review the master plan, aiming to further optimize the network and provide a foundation for more detailed study of the individual lines. At the same time, it was recognized that the "approved" plan provides a framework for various agreements between the City and other parties, and as such no fundamental changes should be proposed in order not to put ongoing projects at risk.

3.3.2 One fundamental issue investigated was the extension of Line 1 in the city centre. It was generally agreed that terminating the line at Ben Thanh was not optimal from a network point of view, and various options were investigated for extending Line 1. The preferred option is to extend Line 1 westward onto the current Line 3 alignment. The remaining eastern section of Line 3 would then be relocated northwards for optimal network coverage, and extended to serve the western suburbs of the city which are not served by a radial MRT under the approved master plan.

3.3.3 Other revisions suggested for the master plan are summarised below, and the overall "optimized" MRT network is shown on Figure 3.2-1. Line 3 (to be renamed Line 3A) would be realigned as an extension to the southwest of Line 1 (as above);

- A new Line 3B is created running parallel to the northwest of the former Line 3 and across Line 2;
- Extend Line 2 northwards to An Suong bus terminal (about 3.7 km), in order to provide important interchange with buses and future regional rail;
- Realign Line 4 central section to bypass Ben Thanh market and run along the river instead – this improves station distribution in District 1, and simplifies the interchange station at Ben Thanh;
- Line 5 realigned as an MRT circular line, completing the "missing link" and taking over the proposed southern monorail with mass transit;
- Extend and connect all lines radially outwards to connect with the future regional railways services;
- Extend the planned tramway northwards to interchange with the new Line 3B, and to improve catchment in the CBD.

Figure 3.2 "Optimised" HCMC MRT Master Plan



3.3.4 Analysis was undertaken of various master plan improvement options using the transport forecasting models under TA4862. The alignment and engineering feasibility of the options was also briefly reviewed in determining the preferred solutions. The indicative estimated changes and benefits of the proposed modifications to the master plan are summarized in Table 3.2-1 below. As can be seen, the improvements require an increase in MRT network of 11%, but increase in investment of only 8%, and yet a revenue increase of 16%.

Table 3.1 Summary Comparison of Reference Case and the Possible Future Network

	Approved Master Plan (1)	Possible Future Network (2)	Difference (3) = (2)-(1)	Percent Difference (4) = (3)/(1)
MRT Km	144.37	160.67	16.30	11.3%
Investment Costs (million US$)	8,992	9,713	721	8.0%
Daily Revenues (million US$)	0.702	0.814	0.112	16.0%
Daily Passengers (million)	2.808	3.256	0.448	16.0%
Daily hours in public transport (thousand)[1]	2,658	2,593	-65	-2.4%
Investment (million US$)/MRT km	62.28	60.45	-1.83	-2.9%
Daily revenues (US$)/MRT km	4,862.51	5,066.28	203.78	4.2%
Daily passengers/MRT km	19,450.02	20,265.14	815.12	4.2%

Note 1: Includes rail and bus ridership.
Source: Own estimates.

3.4 Latest Master Plan Issues (October 2010)

3.4.1 Whilst the recommendations in the Optimised MRT Master Plan were proposed to MOC, only some elements have to date been put forward for formal approval by the Prime Minister. The main proposal to be adopted is the extension of Line 1 onto Line 3A, but leaving the "old" eastern section of Line 3 (confusingly now also called "Line 3B") as per the original masterplan. This results in the "Latest" Master Plan as shown on Figure 3.3.

3.4.2 Whilst it appears that the Latest MRT Master Plan might be considered as an interim step toward the Optimised Plan, it also appears that the Latest Plan is being used as the basis for planning and design of the individual MRT Lines, and interchanges between lines. This raises several areas of serious concern, both for Line 2 and the network as a whole.

Line 2 Extension to An Suong

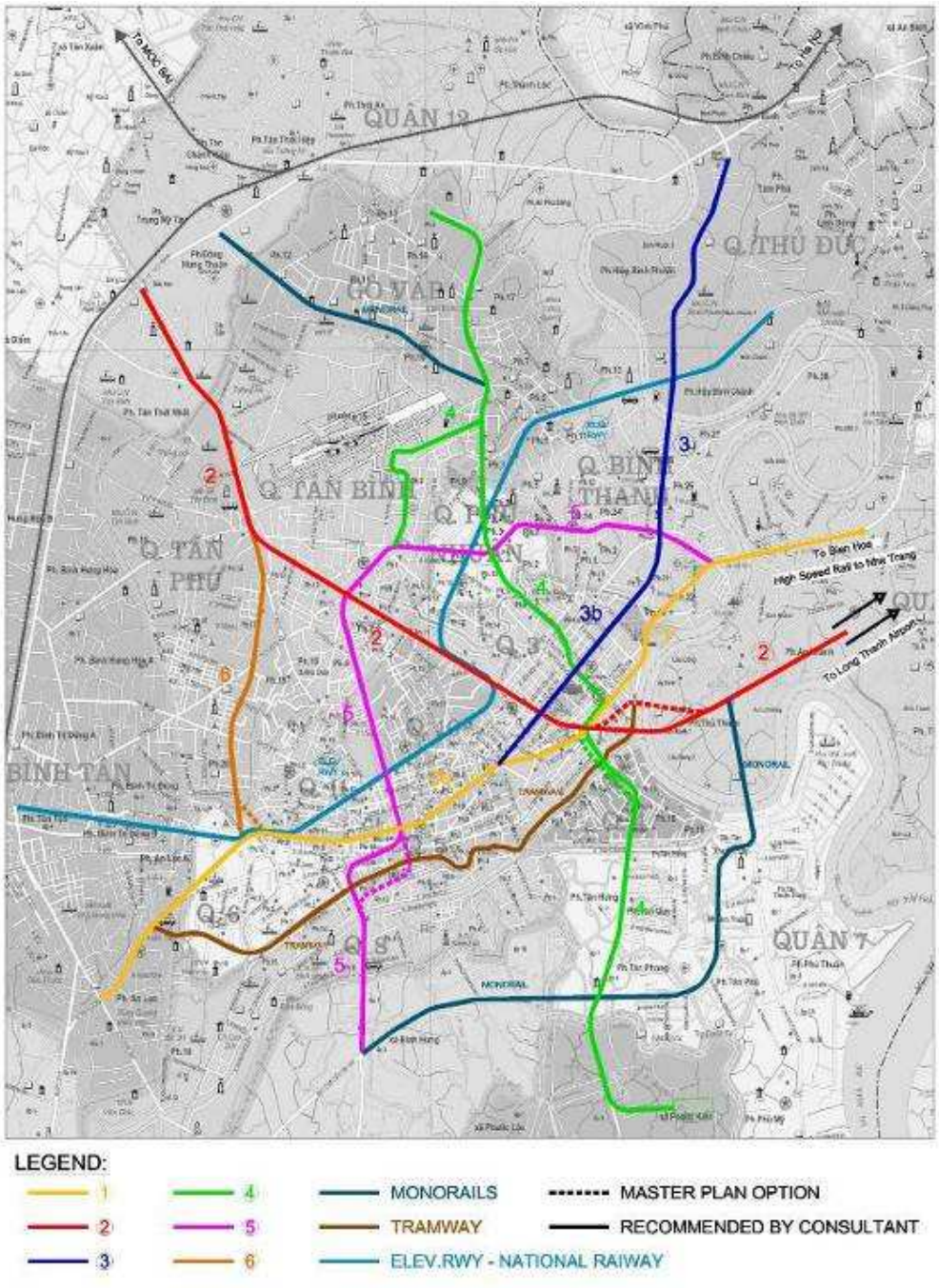
3.4.3 This extension is considered essential for Line 2, since a very large proportion of Line 2 passengers are expected to interchange from the regional buses which currently terminate at An Suong bus station. The An Suong extension is assumed in the long term forecasts and project appraisal for Line 2 although the feasibility will be studied further during Tranche 1 of the ADB loan for the Project.

Line 2 Alignment along Ham Nghi toward Thu Thiem

3.4.4 The alignment of Line 2 toward the river, as shown on the Approved (and Latest) Master Plan, is not feasible due to the narrow streets, dense development and high rise buildings in this area. The current feasibility studies for Line 2 assume the straighter alignment along the wide Ham Nghi boulevard toward the future river crossing.

3.4.5 With the Ham Nghi alignment, Line 2 will pass under the river close to the road tunnel which is currently under construction. The plans for the road tunnel and alignment on Thu Thiem have been checked, and it is confirmed that the planned Line 2 tunnel and alignment is viable. Of course the master plan for future development on Thu Thiem will need to be reviewed to accommodate the proposed alignment for Line 2.

Figure 3.3 "Latest" HCMC MRT Master Plan



Line 3B

3.4.6 One of the main reasons of the recommended Line 1 – Line 3A proposal in the Optimised Master Plan was to avoid having an MRT line terminating in the city centre. The Latest Master Plan replaces a terminating Line 1 with a terminating Line 3B, and thus defeats the objective. This is not considered desirable, but clearly needs further study.

3.4.7 The Line 3B (Dien Bien Phu) as proposed in the Optimised Master Plan was an integral and complimentary part of the Line 1 – Line 3A proposal. To do one without the other would result in a far less optimal network.

3.4.8 Line 2 will have an interchange station with Line 3B – either at the "Latest" Line 3B location (Tao Dan), or at the "Optimised" Line 3B (Dien Bien Phu) location. For the purpose of the current FS, the interchange at Tao Dan is assumed. However, it has been noted that if the interchange were to be changed to Dien Bien Phu at a later stage, this would not have a major impact on the current Line 2 design.

Line 4 – CBD and Ben Thanh

3.4.9 The alignment of Line 4 through the CBD as shown on the Approved and Latest Master Plans appears to conflict with recent and planned construction of major tall buildings in this area – notably the skyscraper currently under construction at the corner of Pasteur and Le Loi. However, MAUR has advised that solutions to this are being investigated.

3.4.10 The revised Line 4 alignment as proposed in the Optimised MRT Master Plan aimed to avoid the new buildings, and would not pass through Ben Thanh. It is considered that this issue requires considerable further study. The issue has very major implications on the design of Ben Thanh interchange station, and on the level of Line 2 at Ben Thanh.

Line 5 / Monorail

3.4.11 It can be seen on the Latest and Approved Master Plan that there is a "missing link" on the MRT network between Line 5 and the Monorail in Thu Thiem. As noted, the optimized Master Plan proposed that this link is completed, also that the Monorail is changed to a full MRT Line.

3.4.12 This will have longer term implications for the future extension Line 2 to Thu Thiem, as the Optimised network proposal will provide much better integration of the MRT network, and accessibility for the future development planned at Thu Thiem. Further study is required.

3.5 Inter-Operability of MRT Lines

3.5.1 In this section, the term "inter-operability" between MRT lines refers to the ability to physically run trains from one line on the tracks and system of another. This may be advantageous for purposes such as shared depot and maintenance facilities – provided of course that connections are provided between the various lines to manoeuvre trains from one line to another.

3.5.2 For limited or small scale MRT networks it would generally be desirable for inter-operability between lines. For larger scale MRT networks such as that planned for HCMC, it is likely that each line will require its own depot facilities, and that physical connection between all lines may not be feasible. Most cities world-wide with extensive MRT networks tend to have more than one type of system, and full inter-operability between all lines is not a key issue. Examples of such cities in Asia include Tokyo, Singapore, Bangkok and Shanghai.

Inter-Operability between HCMC Lines 1 and 2

3.5.3 In HCMC, MRT Line 1 is being financed with assistance from Japan. MRT characteristics are generally conforming to Japanese standards (Strasya), and rolling stock will be provided by Japanese manufacturers. Key features of the system include:

- Standard gauge (1,435mm) steel track
- Overhead catenary 1,500V power supply to trains
- 6-car trains

3.5.4 Line 2 on the other hand is being financed with assistance from Germany, who will supply the rolling stock. MRT characteristics are thus generally conforming to German standards. Key features of the system include:

- Standard gauge (1,435mm) steel track
- Third rail 750V power supply to trains
- 6-car trains with cars 3.2m wide x 22m long

3.5.5 Thus in the case of Lines 1 and 2 the trains operating on each line would not be able to run on the tracks of the other line. In other words, inter-operability between Lines 1 and 2 would not be possible. During TA4862, this issue was studied in some depth to determine: (a) whether inter-operability between these lines was a critical issue; and (b) whether the 3rd rail technology and selected train / design characteristics were the right choice for Line 2.

Inter-Operability on HCMC MRT Network

3.5.6 After careful study of the planned HCMC MRT network, it was concluded as follows:

- Inter-operability between groups of lines would be desirable, but full inter-operability between all lines across the whole network was neither practical nor necessary (as noted with other major cities)
- Physical connection between Lines 1 and 2 (which would have to be at or near Ben Thanh Station) would be extremely difficult if not impossible, due to the many high rise buildings and committed land plots in the area
- Inter-operability between Lines 2 and 6 on the other hand was essential, since Line 6 would share the Line 2 depot (refer to earlier discussion)
- Under the Latest Master Plan, Line 1 and Line 3A would necessarily be designed to the same standards for the same rolling stock; with the possible connection of Line 3B to Line 3A, then inter-operability between these lines was desirable

3.5.7 Following on from this, it was agreed with MAUR that the MRT lines should be planned as two main groups: inter-operability within each group of lines would be desirable or essential; whilst inter-operability between different groups was not essential. The two groups of lines are as follows, whilst Line 4 remains subject to further study:

- Lines 1, 3A, 3B
- Lines 2, 6 and possibly 5

3.6 Transport Demand Forecasts

Overview

3.6.1 Travel demand forecasts for HCMC, including the whole MRT network, were prepared during the early stages of the TA4862 study. A network based multi-modal forecasting model was developed and calibrated to a base year of 2007, and forecasts were derived for design years of 2015 (tentative opening for Line 2) and 2025 (assumed completion of full MRT master plan). It is noted that these are “notional” design years since actual dates for expected opening of the various lines may change.

3.6.2 This chapter draws on data and forecasts from the previous study. It should be noted that no further detailed demand forecasting studies have been carried out under the current TA.

3.6.3 Transport forecasts were prepared using a state-of-the-art, 4-stage, multi-modal forecasting model based on the CUBE Voyager software. The model coverage included the whole of the greater HCMC area together with parts of the adjoining Dong Nai, Binh Duong and Long An provinces. Fares for all lines were assumed to be VND 4,000 per boarding at 2007 prices (i.e. adjusted for future years in line with inflation), which is based on comparison with bus fares, allowing for the higher comfort, reliability and convenience of MRT.

3.6.4 In order to reflect the Government policy objectives, forecasting assumptions and inputs for the models were set accordingly, reflecting the major policy and other measures which may be required in future. On this basis the model predicts 44% of trips at year 2025 by public transport to, from and within the MRT network area. Sensitivity tests were carried out to understand the implications on MRT patronage if these policy targets could not be achieved

Land Use Context

3.6.5 As noted, the transport demand model covered the whole of HCMC, including surrounding provinces. Within this area, the planned MRT network will cover just the central part of the city, roughly that area bounded by Ring Road No 2. For the purpose of this study, this central area covered by the MRT network is referred to as the “Metro Area”. It is useful to review the existing and forecast populations within these areas as shown in Table 3.2. Similar figures for employment forecasts are shown in Table 3.3.

Table 3.2 Population Forecasts

Region	Population (millions)		
	2007	2015	2025
HCMC "Metro Area"	4.3	4.7	5.2
Outer Areas of HCMC	2.3	3.3	4.7
TOTAL	6.6	8.0	9.9

Table 3.3 Employment Forecasts

Region	Employment (millions)		
	2007	2015	2025
HCMC "Metro Area"	2.2	2.8	3.7
Outer Areas of HCMC	0.8	1.2	1.7
TOTAL	3.0	4.0	5.4

3.6.6 The figures above provide some important indicators for transport issues:

- The MRT network covers an area occupied by just over half of the city residents (59% in 2015, reducing to 52% in 2025). Of this population, only a portion will be within close catchment of an MRT station.
- Whilst population in the Metro area is forecast to increase by only 21% between 2007 and 2025, population in the outer areas will more than double.
- Conversely, employment in the Metro area is forecast to increase by 68% between 2007 and 2025

3.6.7 Thus there will be a huge increase in commuting demand over the years, for residents living in outer areas of the city with workplaces in the Metro areas. This clearly highlights the need for other public transport systems – i.e. buses – to serve the outer areas and to connect with the MRT network. Indicative demands for these bus trips are estimated below.

Overall Travel Demands

3.6.8 Total transport demand for the study area at year 2025 is forecast to be 35M person trips per day, and at 2015 it is 24M. Mode share at each year is illustrated in Figures 3.4 and 3.5 below.

Figure 3.4 Year 2025 Mode Split (based on policy forecasts)

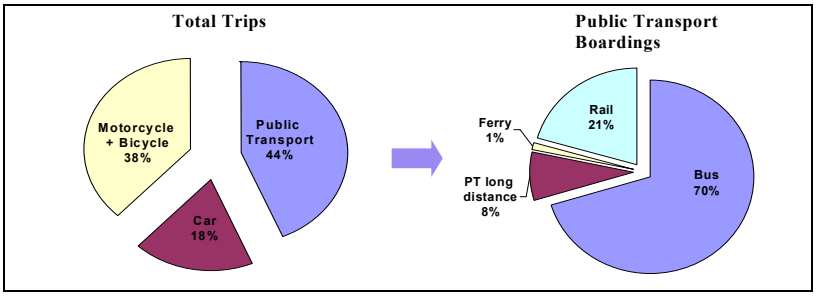
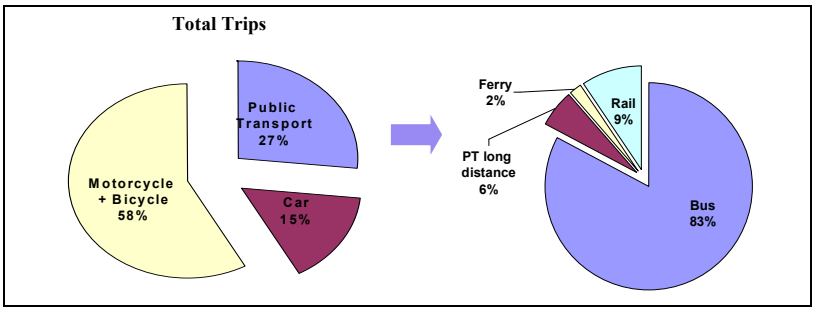


Figure 3.5 Year 2015 Mode Split (based on policy forecasts)



3.6.9 Using the demand forecasting models developed under TA4862, it is estimated that the total number of trips to be carried by public transport at the notional design years will be as shown in Table 3.4 (actual numbers for 2007 are included for comparison). These figures are very indicative, but provide a clear indication of the very important role of buses (and other public transport modes) as well as MRT in the future Transport Plan.

Table 3.4 Public Transport Trip Forecasts

Design Year	Network	Total MRT Daily Boardings	Total Bus Daily Boardings	PT Mode Share
2007	No MRT	0	<1 million	<5%
2015	MRT Network: Lines 1, 2 (phase 1), 3, 4 only	0.6 million	7 million	25%
2025	MRT Network: All lines on MRT Master Plan	2.8 million	15 million	45%

3.6.10 The total number of bus trips in 2007 is estimated at around 0.9 million per day. These trips are served by a fleet of around 3,000 buses on a network of some 150 routes.

3.6.11 The future year forecasts clearly show the need for an enormous increase in bus services if the target public transport modal share is to be achieved. It is emphasized that these figures are very preliminary and intended to be indicative only at this stage, but the message is clear. In interpreting these numbers it should be noted that:

- These are “boarding” trips with bus to bus and / or bus to MRT transfer will have more than one boarding
- A large proportion of the bus boardings will also be feeder services to MRT (it was noted earlier that some 60% of MRT trips will require bus feeders to access the stations)
- In these indicative figures, “buses” may include a variety of services including franchised routes, unofficial routes, minibuses, MRT feeder services, residents shuttle services, etc
- The figures are derived using the rather dated forecasting models developed under TA4862, and these models were not designed to study bus requirements in detail; they do however provide meaningful indicators for future more detailed study

3.6.12 Even allowing for the above uncertainties, the figures indicate a need for the city to increase its bus fleet from the current level of 3,000 buses, to some 10,000 or more by 2015, and 20,000 or more by 2025. This is a massive undertaking and requires considerable further study. The issues to be addressed will need to include not just actual provision of bus vehicles, but institutional arrangements, provision of depot areas, integrated route and fare planning, bus priority and traffic management measures, etc.

3.6.13 Furthermore, this is a process which must start urgently, well in advance of the opening of MRT lines. More discussion on this topic is included in Chapter 4 of this report.

MRT Demand Forecasts – Year 2025 (full master plan)

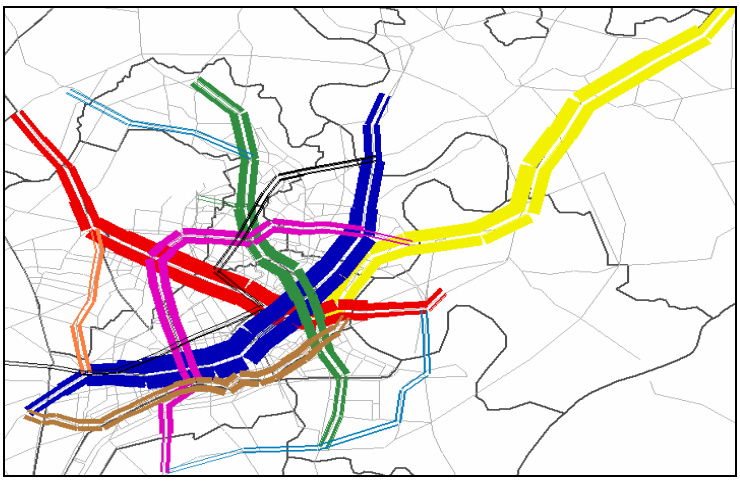
3.6.14 MRT demand forecasts were prepared for both the “approved” and “optimised” MRT network master plan scenarios. For the purpose of this report full results are presented for the approved plan, since this represents official policy. Forecasts for Line 2 are checked against the optimised network. Demand forecasts for each line under the approved master plan scenario are shown in Table 3.5 and Figure 3.6 below.

Table 3.5 Ridership Forecast per Line – Master Plan Case 2025

Line	Stations	Daily ridership	Peak Loading
1	14	386,000	25,300
2	18	594,000	26,600
3	17	670,000	21,500
4	14	364,000	13,200
5	18	352,000	9,200
6	7	69,000	2,900
Tram	22	290,000	8,100
XD2	8	60,000	2,000
XD3	4	23,000	1,500

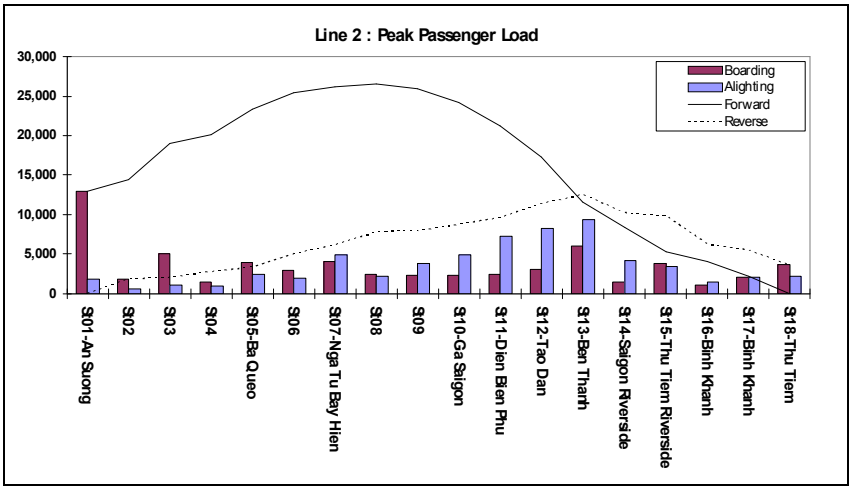
Source: Own estimates

Figure 3.6 Schematic of MRT Lines 2025 Demand Forecast – Master Plan Case



3.6.15 The morning peak hour station loadings for Line 2 under the above scenario are shown below. It can be seen that the proposed terminal station at An Suong acts as a very major transport interchange with feeder and other buses, and that the busiest alighting stations are in the CBD, with Ben Thanh (interchange with Lines 1 and 4) being the busiest central station.

Figure 3.7 Peak AM Passenger Load in 2025 for Line 2 (complete length) – Master Plan Case



3.6.16 Under the "optimised" MRT master plan scenario it was found that Line 2 demands would be slightly less, at 551,000 passengers per day, and peak loading of 24,900 pphpd.

MRT Demand Forecasts – Line 2 "Project Line"

3.6.17 The ultimate master plan includes Line 2 running from An Suong in the northwest, across the river to terminate at Thu Thiem in the southeast, with a total of 18 stations. This feasibility study however presents the initial Line 2 "Project Line", running from Tham Luong in the northwest to Ben Thanh in the southeast, a total of 11 stations. In order to evaluate the Project Line it is therefore necessary to consider demand forecasts for the reduced line.

3.6.18 Forecasts for year 2025 were prepared with other assumptions as above, but with the project line of only 11 stations. Bus networks were restructured to optimise the project line, and thus the end station Tham Luong would provide the major interchange rather than An Suong with the full Line 2. Similarly, for 2015 Line 2 was represented with 11 stations, whilst the other Lines 1, 3 and 4 were included in the network.

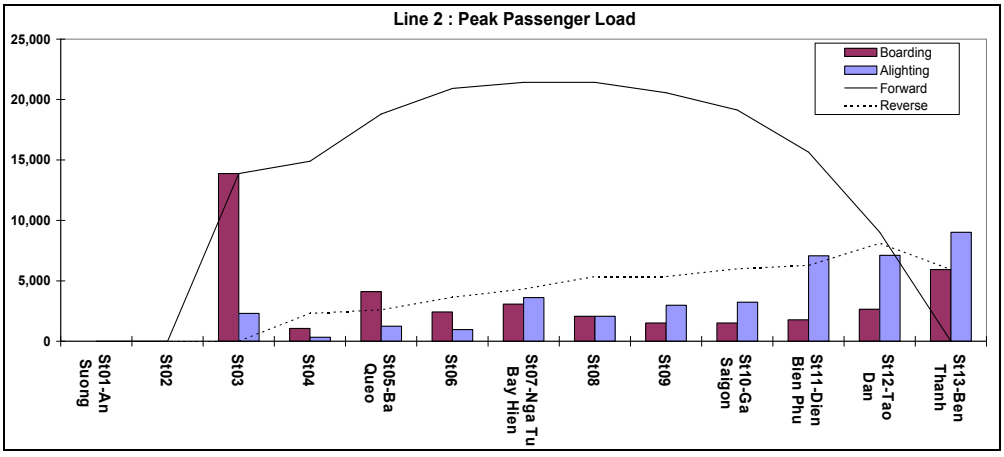
3.6.19 The forecast model was utilised to project 2015 and 2025 ridership demands. Beyond the 2025 time horizon it is difficult to predict metro patronage with any confidence. However these are required for financial analyses and estimates were calculated on the basis of a steady annual growth from 2025 to 2035 of 3.5%. This is similar to the growth rate used in other projections for MRT in HCMC, a figure that reflects HCMC PC's public transport growth policy. Resulting forecasts are shown in Table 3.6 and Figure 3.8 below.

Table 3.6 Summary Demand Forecasts for Line 2 – Ben Thanh – Tham Luong

Year	Daily Boarding	AM Peak Load
2015	173,800	8,500
2025	481,700	21,400
2035[(1)]	679,500	30,200

(1) Considers 2025-2035 annual growth rate of 3.5%.

Figure 3.8 Peak Passenger Load in 2025 for Line 2 Tham Luong to Ben Thanh – Master Plan Case



Ultimate Capacity for Line 2

3.6.20 The forecasts indicate the peak passenger demand estimates for Line 2 at the key design years, and the project is designed on this basis for the purpose of this feasibility study. At year 2035, 20 years after opening, peak loading is forecast as follows:

- Project line (Ben Thanh – Tham Luong) 30,200 pphpd
- Full line (Thu Thiem – An Suong) 37,500 pphpd

3.6.21 Since Line 2 is expected to operate for considerably longer than the 2035 design year projection, and there is likely to be continued growth in demand beyond this time, it is clear that the project should be designed for an ultimate capacity of at least 40,000 pphpd.

3.6.22 Based on the proposed technology with minimum headways reduced to 2 minutes (the minimum feasible for the proposed system), the Line 2 is capable of providing an ultimate capacity of 40,000 - 60,000 pphpd. The range depends on the assumed degree of passenger crowding, of between 5 persons per m^2 (normal crowded conditions) to 8 persons per m^2 (absolute crush conditions). To achieve this capacity would require improvements to signalling and access capacity, but demonstrates that the Line will be capable of serving well into the long term future for the city.

Transport Interchanges and Park & Ride

3.6.23 As noted, the demand forecasts have assumed that bus routes will be restructured so that the buses feed passengers to MRT stations, rather than providing a competing alternative mode. This implies that there will be high interchange demands between bus and MRT at MRT stations.

3.6.24 Furthermore, it is expected that there will also be high demand for interchange between private modes (car and in particular motorcycles) at MRT stations, as it may be attractive to many people to use their motorcycle to ride from their home to the MRT station, and then take the MRT into the city centre. This will be especially the case if policies are put in place to make motorcycle access and parking in the city centre prohibitively expensive or restricted (such policies will be essential if the high PT mode share is to be achieved).

3.6.25 The two main stations requiring bus “public transport interchange” (PTI) will be the end stations, Tham Luong and Ben Thanh, although it must be noted that Tham Luong may be an interim end station if the line is later extended to An Suong. At both of these stations it is recommended that suitably sized PTI’s are planned and constructed integral with the MRT stations and surrounding areas

3.6.26 Demand for motorcycle parking is also expected to be particularly high at the terminal station (Tham Luong or An Suong), and it is recommended that a motorcycle (and car) “park’n’ride” facility be planned at this station, again to be fully integrated with the MRT station, PTI and surrounding land uses. There is expected to also be demand for motorcycle parking at most interim stations, since the line passes through areas of high residential density. It may not be necessary to provide parking at all stations, and it is recommended that opportunities are studied in conjunction with station area planning studies to determine optimal locations and integrated designs for park’n’ride facilities.

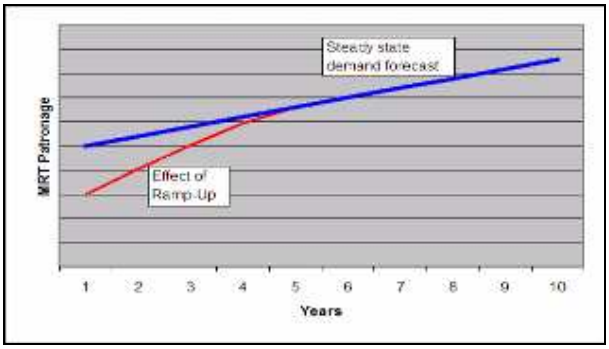
3.6.27 Further discussion regarding MRT interchange proposals are presented in Chapter 4.

Ramp-Up

3.6.28 Experience with other new MRT systems both in Asia and worldwide shows that it usually takes some time before actual ridership patterns build up to those forecast by the demand models. This is due to time taken for people to understand the new system, adjust their travel habits, and may also be affected by time taken to implement bus restructuring, to develop good station accesses to nearby buildings, and to implement the complementary policy measures to encourage usage of public transport. Ramp-up can also be affected by other “external” factors such as political or economic changes, fuel prices, and even natural disasters. The ramp-up effect and period can be significantly influenced by advertising and promotional campaigns both in advance of, and upon, opening of the new Line

3.6.29 Thus the extent of the ramp-up effect depends on many factors, and is very difficult to quantify precisely. Our estimate for HCMC Line 2 is based on experience in other cities, and in particular in Bangkok where the first MRT line opened in late 1999. In Bangkok it is estimated that opening year patronage was some 30-40% below “steady state” estimates, and that it took some 4-5 years for the effect to dissipate. The ramp-up effect on opening year patronage is illustrated in Figure 3.9 below.

Figure 3.9 Ramp-up Effect



Sensitivity Tests

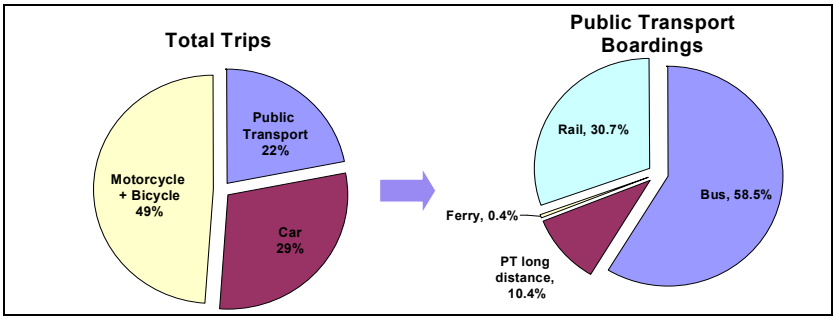
3.6.30 In order to understand the uncertainty and risk in the demand projections, a number of sensitivity tests were carried out. Key findings are summarised below.

Trend Forecasts

3.6.31 As noted earlier, the above demand models were adjusted to reflect the Government "policy" objective of achieving 40-50% PT mode share by 2025. This will entail a massive shift in travel behaviour and introduction of some very strong transport and policy initiatives. Clearly there is a risk that this may not happen as quickly or to the extent targeted. Therefore forecasts were developed for a "trend" scenario – still based on major PT transport improvements and strong policy initiatives, but with parameter values based on the consultants' experience of what has been achieved in other cities.

3.6.32 This scenario resulted in a much lower PT mode share at 2025 as illustrated in Figure 3.10 below. Under this scenario ridership demand for Line 2 (still based on the master plan network) is estimated at 135,000 in 2015, and 405,000 passengers in 2025. These compare to 174,000 and 594,000 respectively under the master plan policy scenario.

Figure 3.10 Projected Modal Split in 2025 – Trend Case Scenario



Fare Sensitivity

3.6.33 The fare assumed on Line 2 (and other MRT Lines) in the forecasts above is VND4,000 per boarding (constant in real terms, i.e. adjusted for future years in line with inflation). Sensitivity tests indicated that this fare would be close to optimum for maximising revenues at year 2015, but that by year 2025 a higher fare of VND6-7,000 would yield higher revenues, as a result of increasing prosperity and hence willingness to pay for the premium service.

Bus Network and Bus Restructuring

3.6.34 Various tests were carried out on different bus network, speeds, interchange convenience, etc. The most significant of these was the implication of bus restructuring. In the base case forecasts it is assumed that bus routes are restructured on introduction of MRT such that there is no significant competition, and that the bus routes complement rather than compete with the MRT. In effect this forces PT passengers to use the MRT lines, thus ensuring good usage of MRT and minimising the need for road-based PT in the city centre.

3.6.35 Experience in other cities has shown that such restructuring does not always happen in practice. The model tests indicated a major impact on MRT ridership if buses are allowed to compete freely with MRT, with MRT ridership reduced by 18% overall, and for Line 2 up to 38%.

4. SUSTAINABLE TRANSPORT

4.1 Introduction

4.1.1 HCMC travel characteristics have developed differently to most other cities. Normally the traditional non-motorised travel modes such as walking and cycling give way to motorised transport – usually buses and then as incomes grow motorcycles and then cars. However, in HCMC bus travel has never been established like most other cities and motorcycle use accounts for approximately 70% of all trips with public transport (bus mainly) accounting for less than 5%.

4.1.2 As the economy and population grows in HCMC there is an increased demand for travel. To be able to fight the challenges created by increased private vehicle ownership (such as congestion leading to poor air quality and high carbon emissions) it is necessary that a sustainable alternative to private transport is developed. A sustainable public transport system is important to meet the demand for travel in HCMC and improve the quality of urban living and the environment.

4.1.3 A sustainable transport system can be defined as:

- Access and movement of people and goods in a way that promotes healthy living and economic and social growth;
- Affordable, efficient travel with choices of mode;
- A transport system that is energy efficient and space saving with low impact on the environment.
- A transport system that is financially sustainable

4.1.4 A sustainable transport system is important because more people will be encouraged to use public transport and non motorised modes of travel resulting in:

- Less traffic congestion therefore a reduction in carbon emissions from private vehicles (compared with business as usual scenario) which will reduce greenhouse gas emissions and damage to the environment
- Improved personal health (through exercise and less exposure to vehicle emissions)
- Greater accessibility for all to public services, employment opportunities, education etc resulting in increased social and economic growth
- A safe urban travel experience

4.1.5 This chapter considers the physical and policy measures that are required to create a sustainable transport system in HCMC and especially how this can be achieved in combination with the proposed MRT system and in particular MRT Line 2.

4.2 HCMC Public Transport Mode Share Targets

4.2.1 The current transport plan for HCMC and suburbs was approved in 2007[5]. It contains the fundamentals for development of communications and transport up to 2020 and a vision for beyond 2020. Generally the plan sets out improvements to the road network and infrastructure as well plans for the extension of the urban railway network and new MRT lines. There is very little proposed to enhance the bus network and operation of services although the principles of creating an integrated public transport network are defined.

4.2.2 The most significant target set by the Plan is the proportion of public transport trips to reach 22-26% of travel demand by 2010-2015 and 47-50% by 2020. However, current estimates are that only 5% of trips are undertaken by public transport which is mainly attributed to trips by bus.

4.2.3 Investment in the bus network and policy to encourage public transport use has not been sufficient to rapidly increase its popularity. However, some level of investment in road infrastructure has occurred which is important physically for the bus network.

[5] Prime Minister Decision No. 101/QD-TTg 'Approving the planning on development of communications and transport in Ho Chi Minh city up to 2020 and an after 2020 vision'

4.2.4 When the mode share targets were set by Government it was probably assumed that the MRT Master Plan would be implemented by 2020 although this is now likely to be 2025.

4.3 Key Measures to Achieve Public Transport Mode Share Targets

4.3.1 To come close to achieving the desired public transport mode share and MRT passenger forecasts it is necessary that many transport measures in addition to construction of MRT lines are developed in HCMC. Inputs to the forecasting models developed under TA4862 were adjusted to achieve the "policy" mode share objectives. The model predicted that 44% of all trips would be made by public transport in 2025 with the following assumptions:

- Public transport network according to the Approved MRT Master Plan
- Sufficient bus routes and services would be provided to cater for the public transport mode share in the suburbs, and to supplement the MRT lines in the central area.
- Bus services would be structured to provide complementary feeders to MRT, and direct competition between bus and MRT would generally be avoided.
- Introduction of bus priority measures through traffic management, provision of bus lanes, bus turning priority through junctions, etc.
- Parking for both cars and motorcycles within the MRT area would be discouraged through both aggressive pricing and limitation on available parking spaces. In particular for motorcycles this implies measures such as removing all on-street parking (i.e. parking areas on footpaths which is very common today).
- Increases in vehicle ownership and usage costs such as through increased license / registration fees, taxes, fuel charges, etc.
- Possible introduction of road pricing or similar strategies, to further discourage use of private vehicles in the MRT area.
- Very good integration of MRT stations with surrounding areas and developments, through improvements to pedestrian systems, direct connections to buildings, etc.
- Very good integration of public transport services and interchanges, including design of integrated bus / MRT interchange facilities, park & ride facilities at MRT stations, and integrated fares and ticketing.

4.3.2 A sensitivity forecasting test was developed for a "trend" scenario which still assumes the above public transport improvements and policy initiatives, but with more realistic parameter values based on experience from other cities. The "trend" scenario assumes 22% public transport mode share for 2025. It should be noted that the model includes the greater area of HCMC with a population of 9.1 in 2007 and 13.8 in 2025.

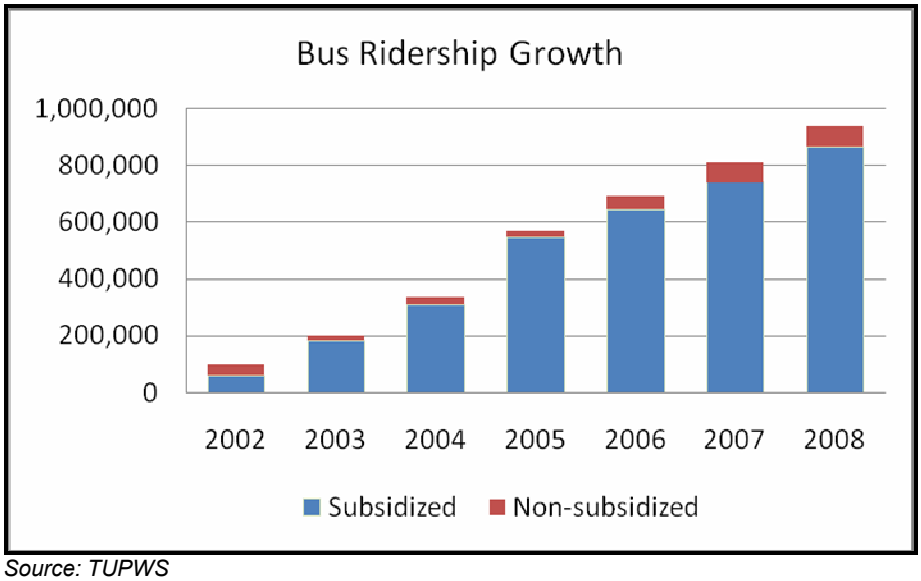
4.3.3 For the more central area of HCMC, the preceding chapter provided some estimates of MRT and Bus Boardings per day for 2007(bus only), 2015 (bus and MRT lines 1 to 4) and 2025 (full MRT and bus network). For a population of roughly 10 million it is estimated that in 2025, based on a 44% public transport mode share, there will be up to 15 million bus boardings per day compared to 1 million in 2007. MRT boardings will be in the region of 3 million a day in 2025. Clearly significant improvement to the bus network is required not only to support the use of MRT but also to achieve public transport mode share and bus travel demand in HCMC.

4.4 Development of Bus Network

Existing Bus Network and Policy

4.4.1 The number of passengers using the bus system has increased since 2003 as a result of the introduction of subsidised routes (see Figure 4.1). However, most bus routes are still subsidized and there are constraints towards growth of the bus network.

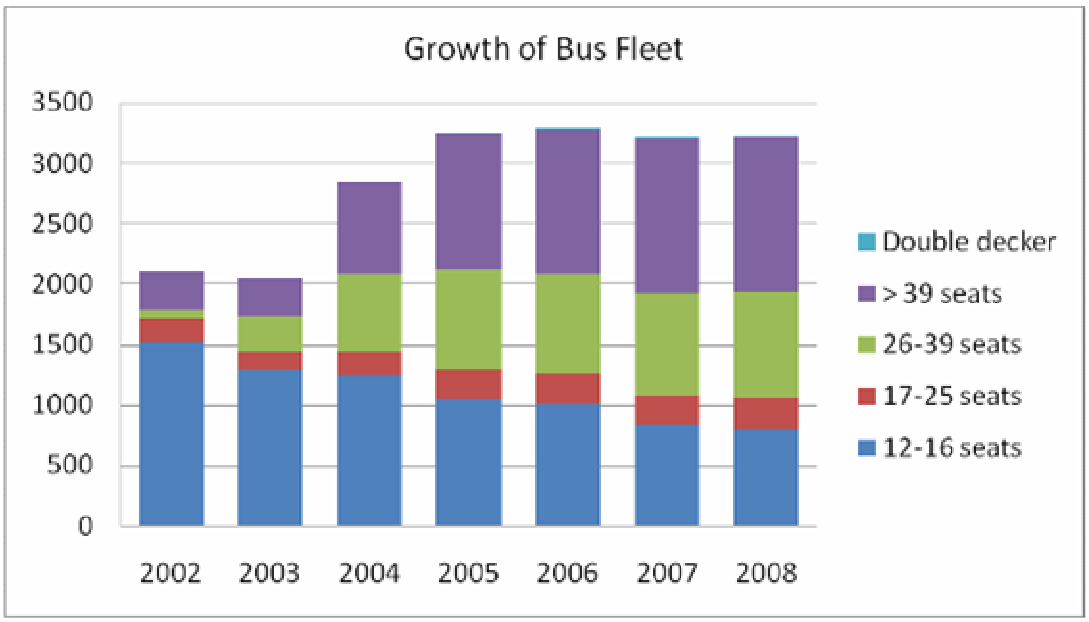
Figure 4.1 Bus Ridership Growth 2002 to 2008



Source: TUPWS

4.4.2 Although Bus ridership has increased the bus fleet has been almost the same since 2005 as can be seen in Figure 4.2. The dynamics of the bus fleet has changes somewhat with a steady decline in minibuses (12 to 16 seats) meaning that the overall capacity of the bus fleet has increased.

Figure 4.2 Growth of Bus Fleet 2002 to 2008



Source: TUPWS

4.4.3 The main issues with the existing bus network serving HCMC are as follows:

- Competition with motorcycle travel which is more convenient
- Lack of road space or land allocated for buses (for routes and parking / depots / terminals)
- Lack of bus priority planning
- Limited number of bus stations and depots / lay over areas
- Bus routes are interrupted and not continuous or with convenient interchanges
- Overlapping of routes occurs

- Cost to Government / PC of Subsidising bus routes
- Lack of quality control or monitoring of route contracts and operators
- Reliability of services and lack of timetable / route information to public
- Safety and comfort of journeys for passengers
- Ageing bus fleet
- Dispersed population is difficult to serve by bus
- Traffic congestion in the city affects efficiency of buses (see Figure 4.3)

Figure 4.3 Buses on the road in HCMC

4.4.4 All the above contributes to a relatively low patronage experienced on bus routes in HCMC compared to total travel demand and other Asian cities (Bangkok experiences approximately 40% of trips by bus). Although the number of passengers is rising (as is the population); without addressing some of the above issues, bus use and target public transport mode share will be threatened.

4.4.5 In 2007 it was recorded that 151 bus routes serving HCMC and provinces of which 111 are subsidised routes. In 2008 a new system of appointing bus operators was started whereby routes are awarded based on criteria to meet capacity, bus parking requirements as well as capability and experience of the bidding operator. So far only 5 routes have been awarded this on 3 year contracts. The cost and percentage of subsidy is also an important factor.

4.4.6 As well as the obvious issues that directly affect the bus routes and passengers, there is also difficulty in monitoring bus routes and operators to ensure that they are doing enough to maximise patronage and contribute to public transport mode share increases. Of the circa 3000 bus fleet it is estimated that 50% of these buses can be out of action in one day for private use or maintenance. The bus is also perceived to be unreliable and uncomfortable and generally not attractive to the population, especially compared to the motorcycle.

4.4.7 The University of Technology (UoT) for the Department of Transport (DoT) has prepared a vision for bus development up to 2025 which is a step in the right direction to change and improve the way the bus system is managed and functioned. There is a short (up to 2015), medium (up to 2020) and long term (up to 2025) vision that includes restructuring of routes to maximise coverage and integrate with MRT, more routes at higher frequency, bus priority and general principles to increase patronage significantly. This vision is reflected in the following paragraphs.

Short Term Bus Network Development pre MRT

4.4.8 Improvements to the existing bus network are required in the short term even before the construction of MRT. It is necessary to encourage people to use the bus so that they develop a habit for using public transport and can shift to the MRT as lines open. The following measures will be necessary within the next 5 years:

- Restructuring of routes to ensure efficient coverage of the city
- Improved roads, busways and bus priority measures including bus stops
- Improved and greater number of bus terminals, depots and interchanges

- Policy reform to restrict vehicle use and make access to bus routes safer and more convenient (improved pedestrian links to bus stops and interchanges).
- Marketing and availability of bus information (timetables, routes etc)
- One authority to govern the operation and management of the bus network
- Increased bus fleet that is modern, fuel efficient and accessible
- Improved franchising and tendering procedures – change to gross cost
- Driver training and availability of information to passengers

4.4.9 Currently bus contracts are of net cost and subsidy which means that the operator keeps fare revenue. It may be necessary in the future to move to a more flexible system such as formal gross cost as recommended by ADB/ PPIAF (2008). Payment for services on the basis of distance operated plus an incentive to increase patronage levels could stimulate operators to be both willing to change routes and coordinate with say MRT and operate higher quality services. This is reflected in the UoT report and the DoT.

Long Term Bus Development post MRT

4.4.10 The introduction of an MRT system in HCMC will provide the backbone for public transport in the city in the future and this means that the whole bus network will need to be reviewed for its suitability to integrate with the MRT. Restructuring of routes and fares will be required to serve the MRT network rather than compete with it.

4.4.11 Bus restructuring and the implementation of feeder bus routes will be vital to achieving the public transport mode share targets and to attract passengers to the MRT. The passenger forecast model for MRT Line 2 suggests that MRT ridership could be reduced by up to 38% if buses are allowed to compete with the MRT rather than feed to it.

4.4.12 It is roughly estimated that up to 20,000 buses will be required with approximately 500 routes in the year 2025 to cater for around 10 – 15 million bus passenger trips per day. This broadly corresponds to the existing situation in Bangkok where there is 40% bus mode share and a current fleet of around 16,000 serving approximately 8 million passengers.

4.4.13 Feeder buses to stations along the MRT Line are beneficial because:

- Buses can provide a link between origin and the MRT station (if no feeder service then people may use their car or motorcycle for the whole journey)
- Road based public transport can be limited in the City Centre because people are using the MRT

4.4.14 It is recommended that bus feeder routes are operated by the MRT line operators. This is an integrated approach successfully implemented in for example, Hong Kong that benefits the operators because the feeder buses offer a pick and drop off service for the MRT thereby increasing overall patronage and public transport attractiveness.

Public Transport Interchanges with MRT

4.4.15 Public Transport Interchanges (PTI's) refer to key areas of connectivity between more than one public transport mode and a fundamental inclusion in a sustainable integrated transport network. In HCMC public transport is comprised of bus, urban railway, ferry and in the future MRT. Taxis are also a form of public transport to some extent but are not 'mass' passenger modes.

4.4.16 The long term vision should include provision for major bus / MRT interchanges that would predominantly be located at the outer MRT terminals of Line 1, 2, 3(a/b) and 4. Bus Rapid Transit (BRT) as an extension of the MRT network should be considered to serve the growing population on the outskirts of HCMC. The Master Plan would need to be finalised and further study carried out to investigate the exact locations of PTI's that should ideally connect with urban rail as well.

4.4.17 Interchange between public ferry piers and bus and where possible MRT should also be considered. MRT to MRT interchanges are covered elsewhere in this report but would again need to be confirmed following the approval of the final / updated Master Plan.

4.4.18 PTI's should be designed to allow easy pedestrian transfer from one mode to another. Between bus and MRT this should ideally take no more than 10 minutes from platform to platform.

4.5 Creating an Integrated MRT Network

4.5.1 In addition to the development of the bus network there are other interventions that need to be considered for the development of a sustainable transport system. The MRT network must integrate with all transport modes and society to maximise its convenience and attractiveness and therefore patronage.

Inter-Modal Transfer Facilities (ITF)

4.5.2 The MRT Stations will need to cater for drop off / pick up by private vehicle, bus and taxi. Some stations will require modest facilities such as road side bus stops and drop off / pick up bays and other stations more significant off street inter-modal interchanges (such as PTI's).

4.5.3 The population of the outer areas of HCMC is expected to more than double from 2007 to 2025. This is due to large residential and 'new town' developments. As the MRT network is not planned to serve most of these areas, it is recommended that the railway network as well as the bus network is expanded and allowed to interchange with the MRT system in the future. As discussed in section 4.4 this should also consider BRT as an extension of the MRT.

4.5.4 Taxis may be the preferred mode of choice for some people to connect to and from the MRT. It will be necessary to consider not only drop off and pick up vehicles but also a separate taxi waiting area that will vary in size depending on the station and demand. With some stations, especially elevated ones located in the centre of the road, drop off and pick up areas will need to be carefully planned to avoid blocking of through traffic and especially buses.

Park & Ride

4.5.5 Given the extreme popularity of motorcycles in HCMC it has to be considered that many people will choose to access the MRT by this mode for transfer onto MRT for the journey into the central area. This will be especially the case if, as recommended, strong policy and parking pricing measures are adopted to discourage travel into the city by private transport modes. It is therefore strongly suggested that park & ride facilities are provided at key MRT stations especially where stations are located close to the outer ring roads. The main barrier to implementation of park & ride is availability of space to construct parking areas.

4.5.6 Where possible, park & ride vehicle parks should be designed within the footprint of the MRT station, either elevated or underground but preferably not large open seas of car / motorcycle parking. This may not be possible at some stations and therefore further investigation is required to assess the feasibility of constructing a park & ride lot. Parking areas will need to be convenient and there should be direct access to the MRT (i.e. no barriers such as having to cross large roads at grade).

4.5.7 In line with sustainable transport policy, priority location within park & ride areas should be provided for bicycles, electric motorcycles and environmentally friendly fuelled cars.

Fares and Ticketing

4.5.8 Best practise dictates that an integrated ticketing system should be applied to the MRT network in HCMC. Ideally this should be an integrated ticketing system for all public transport modes (bus, rail, MRT and ferry). It is probably more practical that this is implemented for an integrated bus and MRT network where the bus complements rather than competes with the MRT. The EZ-Link card in Singapore is a good example.

4.5.9 The MRT Line 1 project is proposing an Automatic Fare Collection (AFC) system. At present there is no proposal to expand this to other MRT lines or buses. It is necessary for the authorities to make a decision on an integrated ticketing system and fare structure with the convenience for passengers prioritised.

4.5.10 The fares applied to public transport travel will directly influence the number of people that will use it and in turn the mode share. A uniform fare is recommended where the fare is the same

per km on all modes of similar quality. Further recommendation on this can be found in Appendix D.

4.5.11 The HCMC PC has already indicated a desire to operate a public transport system with an integrated 'smart- card' ticketing system. The benefit of this system would be that one central authority would collect fare revenue and control pricing and management.

Integration with Surrounding Developments

4.5.12 Integration between MRT stations and adjacent developments can enhance the accessibility to the public transport network. For example direct connections (over head footways / subways) could be constructed to provide direct access above or below ground.

4.5.13 Integration with surrounding developments will largely be dictated by the planning system and land use recommendations and policy which should encourage high density development near to MRT stations.

4.5.14 Land use planning policies should encourage appropriate development adjacent to MRT stations (and where appropriate within stations) to reduce the need for people to travel further and to maximise the convenience of using the MRT. Retail, leisure and large office developments have potential to generate high numbers of passengers on the MRT and therefore these are best located adjacent to stations or within a short walk.

Intelligent Transport Systems (ITS)

4.5.15 ITS can enhance the efficiency of a sustainable transport network and make it more attractive by using modern technology such as:

- Smart Card Ticketing System such (similar to EZ-link in Singapore or Oyster in London)
- Variable Message Signing for car park availability (at park and ride sites)
- GPS tracking systems for buses
- Bus Real time information
- MRT Real time information
- CCTV to reassure passengers of safety
- Congestion / road user charging through automatic number plate recognition
- Bus Priority – inductive loops to alert traffic signals of approaching buses at junctions

4.6 Sustainable Transport Policy

Private Vehicle Demand Management

4.6.1 Improved public transport services will provide the opportunity to impose restraints on private vehicle usage to encourage sustainable travel. Conversely, deterrent measures will be needed to "force" people to switch from private to public transport, in order to achieve the Government policy objectives. But such deterrent measures can only be implemented in conjunction with the public transport enhancements.

4.6.2 Policy measures need to be aimed at discouraging vehicle use whilst ensuring that a suitable alternative public transport mode is available. It is also important to ensure that policy measures promote social and economic growth in HCMC and that accessibility in the city is improved overall. Recommended policies are:

- Creation of a parking strategy to discourage long term commuter parking within MRT catchment (with the exception of Park & Ride, to give priority to bus and greater public space for people
- Restriction of parking on pavements to improve pedestrian circulation
- Create 'parking free' streets to improve traffic management and bus movements
- Create pedestrianised areas, especially around City Centre MRT Stations

- Enforce maximum parking standards for new developments depending on accessibility to public transport
- Congestion charging / road user charging in central area
- Increase / introduce public parking charges in the centre of the city (ensure that public transport is cheaper than using private modes)
- Enforce parking charges and fines for illegal parking
- Make the cost of ownership of vehicles higher through taxes and fuel pricing and feed money back into public transport investment

Bus Priority Policy

4.6.3 Some level of bus priority is required to make bus journeys more efficient by minimising delays and improving reliability. Currently buses have to compete for road space with motorcycles and cars and in the city centre this can be at times dangerous. It is clear that to improve the attractiveness of bus travel that buses will need more priority of the road space. The following are bus priority measures that should be considered in HCMC:

- Bus lanes on major roads where width permits (with or without median)
- Limit street parking on bus routes especially by bus stops
- Bus priority at signals (inductive loops / bus detectors)
- Traffic management to improve the flow of all traffic
- Law enforcement to penalise misuse of bus lanes and to enforce on street parking restrictions

4.6.4 One of the major issues is defining the responsible authority for promoting and funding bus priority. Much of the emphasis at present is on the bus operator to improve the quality of routes. Much of the improvements could be achieved through a traffic management plan that is developed as part of the construction of MRT Lines.

Fuel Efficient Vehicle Policy

4.6.5 The use of fuel efficient vehicles to replace regular gasoline or diesel vehicles can have significant benefits to the environment by reducing carbon emissions. Vehicle fuel efficiency standards and transport and land use planning are the major policy contributors to a reduction in carbon emissions[6]. Many countries (particularly China and India in Asia) have adopted policies at Government level to encourage more sustainable private vehicles and this can be introduced in HCMC (and Viet Nam as a whole). Such policies could be:

- Lower taxes for fuel efficient vehicles (especially Natural Gas and electric powered)
- Facilitate the introduction of electric motorcycles and scrapping of gasoline motorcycles
- Set vehicle fuel efficiency standards and encourage vehicle scrapping policy
- Ensure all buses meet with EURO fuel emission standards
- Set age limits for vehicles
- Facilitate the production and distribution of Compressed Natural Gas (CNG) in conjunction with the private sector[7]

4.7 Critical Sustainable Transport Components for MRT Line 2

4.7.1 Prior to completion of the MRT Line 2 it is important that the HCMC bus network is improved in the short term to encourage people into the habit of using public transport. MRT and other light rail lines traditionally attract passengers from bus but there is usually an established comprehensive bus system in place. Following the opening of MRT lines the buses can be restructured to provide feeder routes to the MRT.

[6] 'Energy Efficiency and Climate Change Considerations for On-road Transport in Asia' ADB (2006) – see Figure 25.

[7] CNG resources are high in southern Vietnam and PetroVietnam and Saigon Bus already piloting CNG buses with PetroVietnam promising to invest in CNG stations. Note that CNG vehicles are only really more efficient when purchased new rather than converted vehicles.

4.7.2 Sustainable transport components for the MRT Line 2 project are recommended as follows.

Bus Interchange Requirements along MRT line 2

4.7.3 Currently Line 2 is planned to terminate at Tham Luong but it appears favourable that the line should extend to An Suong where there is an existing major bus interchange. This also makes sense in terms of encouraging smooth transfer from bus (provincial and local) to the MRT. Therefore at Tham Luong or An Suong there needs to be a major bus interchange.

4.7.4 The proceeding chapter illustrated that there is a very high demand for boarding at the terminal station, An Suong during the morning peak hour (commuters travelling to the city). This reflects that a very high proportion of commuters in future will live in the outer areas of the city, and will need to use bus or other modes to access the MRT. An Suong will clearly be a very important public transport interchange for Line 2; similar interchange demands are expected to be required on the various other MRT Lines.

4.7.5 In very approximate terms, the above indicative demands at An Suong can be further analysed as follows:

- Total boarding demand at An Suong is approximately 14,000 passengers in the peak hour
- Most of this demand will access An Suong via other modes of transport including bus, drop-off, park & ride, etc
- Given the target public transport mode share, and based on experience in other countries, it is estimated that around 70-75% of the MRT boarding passengers might transfer from bus services, i.e. around 10,000 passengers in the peak hour
- Assuming an average bus occupancy of 40 passengers, this indicates a throughput of 250 buses per hour
- Assuming bus routes would operate at an average headway of around 10 minutes (6 buses per hour), this indicates around 40 bus routes terminating or transferring at An Suong station

4.7.6 Whilst these figures are very indicative, they allow an appraisal of the public transport interchange facilities that will need to be provided. To cater for 40 bus routes, a bus station or public transport interchange (PTI) will be required with around 15 - 20 bus laybys (assuming some sharing between routes), with additional space for bus parking (for layover and when not in service)

4.7.7 In terms of land area for such a bus interchange, an area of some 9,0000 m^2 (150m x 60m) would be required, i.e. approx 1 hectare. Similar PTI facilities may also be required at other key stations to be served by bus feeders.

4.7.8 The above clearly requires further study, but it is important that these facilities are planned and provided in a timely manner, in order that the full potential catchment and usage of the MRT is realised.

4.7.9 Ideally all other MRT Line 2 Stations should have at least two road side bus stops so that the bus can act as an extension of the MRT and make public transport travel continuous and attractive.

Park & Ride for MRT Line 2

4.7.10 Taking An Suong / Tham Luong as an example, if it is estimated that, say, 20% of the boarding demand may be from motorcycle park & ride, this would be a peak hour demand of some 3,000 passengers. Allowing for more than just the peak hour arrivals, but also some double occupancy on motorcycles, one can envisage a requirement for a park & ride facility to accommodate say 5,000 motorcycles. In addition provision would be required for cars to park & ride. Very roughly this might indicate a parking facility of some 20-30,000m^2 (which may require a multi-storey facility).

4.7.11 The final 3 or 4 stations up to Ben Thanh should limit parking because the population is denser and there will be a greater coverage of bus travel and other MRT stations.

Private Vehicle Demand Management for Line 2

4.7.12 Restrictions on private vehicle use should be focused around Ben Thanh proposed interchange and other central interchanges (MRT to MRT and MRT to Bus). It is important that people have an alternative choice of travel (i.e. public transport) where private vehicle use is restricted to maintain accessibility and continue economic activity.

4.7.13 Parking policies need to be enforced in the central area, especially around Ben Thanh (which is to be a major MRT to MRT interchange) to make the area more accessible by public transport than private car.

4.7.14 It is understood that there are proposals by HCMC PC for an underground car park at Tao Dan. If this is to go ahead then it is important that this is a replacement for on street car / motorcycle parking rather than additional car parking that could encourage more private vehicle use rather than public transport (especially the MRT Line 2 which will have a station at Tao Dan).

Pedestrian Access to Line 2 Stations

4.7.15 Currently the MRT Line 2 route has limited pedestrian facilities and footways are cluttered with motorcycles and street furniture (see Figure 4.4 and 4.5).

Figure 4.4 Near Dien Bien Phu Station **Figure 4.5 Near Hoa Hung Station**

4.7.16 Pedestrian access to MRT stations should be free of obstruction and safe including formal pedestrian crossings or underpasses. During the widening of the road and construction of the MRT there is opportunity to improve pedestrian footways to ensure good access to stations and surrounding developments as well as considering space for bus stop / taxi shelters.

4.7.17 The MRT actually provides an opportunity to improve overall pedestrian circulation and safety especially regarding crossing of roads. However, underpasses should be safe routes that are well lit with CCTV coverage.

Summary

4.7.18 There is a comprehensive list of measures and policies to create a sustainable transport network for HCMC but it is necessary for the purposes of this study to select the most viable and feasible options for MRT Line 2. The priorities are:

- Improve the bus network in the short term to encourage people into the habit of using public transport before the operation of MRT Line 2
- Accessibility to the Line 2 Stations
  a. Bus feeder routes
  b. Motorcycle park and ride
  c. Good pedestrian routes

- Policies to restrict private vehicle use in the City Centre

4.7.19 The above items can be implemented within the control of the HCMC PC providing that the funding an expertise is available.

4.8 Funding and Implementation of Sustainable Transport Measures

4.8.1 Implementing a sustainable transport network and policy requires extensive funding that in the case of Viet Nam will require external financial support. On top of the MRT funding support there are additional resources of financing from the World Bank / ADB that in the future can be distributed in HCMC such as:

- Clean Technology Fund (CTF)
- Global Environment Fund (GEF)
- Clean Development Mechanism (CDM)

4.8.2 In addition to the above some HCMC PC funding will be required which could include money raised through road user charging, parking charges and fines or congestion charging which can be fed back into the public transport system development. Private companies can also be encouraged to fund initiatives for example dedicated bus routes, pedestrian connections from developments to MRT stations, facilitating CNG or other cleaner fuels in vehicles.

Clean technology Fund (CTF)

4.8.3 The Clean Technology Fund (CTF) Viet Nam Country Investment Plan (CIP) proposes financing of $250 million to support Vietnam in meeting its midterm goals of reducing national energy consumption relative to business as usual assumptions by 5-8% in 2015, with renewable energy consumption accounting for 5% by 2020 and to expand the public transport mode share closer to the Government target of 50%.

4.8.4 The loan proposed to be used to reduce carbon emissions from the transport sector is $US 50 million. The CIP is agreed between the GOV, ADB, International Finance Corporation (IFC) and the World Bank.

4.8.5 The US$50 million is proposed to be allocated to measures associated with the HCMC MRT Line 2 that could have a significant effect on the reduction of carbon emissions.

4.8.6 The following projects are proposed to be studied for their feasibility, utilising US$1 million of the CTF fund to be released during Tranche 1 of the MFF for the Line 2 Project:

- Bus route restructuring study including study / implementation of Line 2 feeder routes or BRT extensions to Line 2
- Creation of Multi Modal Station Interchanges (bus interchanges with Line 2 and Park & Ride, drop off / pick up facilities)
- Policy reform to encourage public transport through restrictions in vehicle use and parking in City Centre to coincide with the opening of Line 2.
- Pedestrian / bicycle connections to and from Line 2 stations and surrounding area

4.8.7 The above measures all aim at encouraging people to use the MRT and have been chosen because they are projects can be replicated (scaled-up) across the whole of HCMC / MRT network in the future and in other cities such as Hanoi.

4.8.8 However, the above projects would cost more than US$1million to study and therefore Tranche 1 funding for the Project would need to cover the cost of these very important studies.

4.8.9 Although the above projects require further investigation into feasibility and deliverability which will be considered during Tranche 1, Table 4.1 shows some indicative costs. The projects are chosen based on the ability to maximise the public transport share of trips and hence mode shift from private vehicles and carbon emission savings.

4.8.10 Additional detail on cost assumptions and CTF programming is included in Appendix F. Appendix H provides indicative scope and costs for studies to be undertaken during Tranche 1.

Table 4.1 Indicative Costs for potential CTF / Sustainable Transport Projects

Project	Details	Indicative Cost $US million
Bus Restructuring and Reform for HCMC	• Bus route planning for before and after the MRT • Support to PC to facilitate changes to the management and operation of the bus network • Implementation of bus priority measures • Introduction of fuel Efficient buses	• **1 – 2 million for city wide study** • **20 – 50 million for implementation (of bus priority measures, technology and buses)** *Fuel efficient buses cost approx 100,000).*
Bus Feeder Services for Line 2	• Fuel efficient buses (100) • Bus stop infrastructure (20 bus stops) • Route planning	• 10 - 15 million • 1 – 3 million • 1 million • **Total approx 12 – 20 million**
BRT Extension to Line 2	• Implementation of route (e.g. 10km)	• **10 - 15 million**
Station Interchanges for Line 2	• Study / feasibility of facilities • Major PTI at outer terminal station • Park & Ride at terminal • Intermodal facilities along route	• 0.5 - 1 million • 10 million • 5 – 10 million • 5 million • **Total approx 20 – 30 million**
Transport Policy for HCMC	• Consultant support to PC to create sustainable transport policy including private vehicle demand policies	• **0.5 million**
Pedestrian Access to Line 2 Stations	• Study / Feasibility of facilities • Pedestrian / cycle access improvements to stations	• 0.5 – 1 million • 2 – 3 million • **3 – 4 million**

Projects to be Funded from other Resources

4.8.11 Projects that could be eligible for funding outside of CTF either using Line 2 Tranche 1 funding or other World Bank / ADB or GoV funds could be:

- Bus restructuring study for entire city
- Bus Feeder services and BRT extensions to serve entire MRT network
- Accessibility and Interchange facilities for bus and MRT network
- Integrated Ticketing System for whole public transport network
- Development of sustainable transport policies city / nation wide
- Fuel Efficient Vehicle Implementation Study

5. DESIGN CHARACTERISTICS OF LINE 2

5.1 Overview

5.1.1 This chapter describes the preliminary design of the proposed metro line, including the alignment, stations and the rolling stock. The main engineering features of the proposed project are summarised in Table 5.1. Further details of engineering design and construction issues are presented in Appendix A.

Table 5.1 Summary of the Project Engineering Components

Components	
Underground line [1]	9463 m
Open cut tunnel	280 m
Elevated line (in Main line)	865 m
Link to depot (elevated and at grade)	1083 m
Underground Stations [1]	10
Elevated station	1
Depot (including workshop)	1
Repair and maintenance equipment	1 set
Signalling system	ATC
Trains (opening year)	12 x 3-car units

Note (1) – includes Ben Thanh station and garage, to be built by others

5.1.2 The project has been designed with the primary objective to provide a user-friendly and convenient means of transport that will attract large numbers of passengers and thereby contribute to achieving the Government's high public transport usage targets. It is based on the use of large, high-capacity metro trains.

5.1.3 Design standards are based on a range of international and local standards, which are reflected in the Vietnamese Technical Standards Framework, and are elaborated in the technical appendices with this report.

5.1.4 The rolling stock for Line 2 will be 22m x 3.15m cars, initially operated as 3-car trains and ultimately 6-car trains. Platforms will be of length 135m.

5.2 Alignment

Overview

5.2.1 The overall horizontal alignment is illustrated in Figure 5.1 and summary details of the station locations are shown in Table 5.2.

5.2.2 Starting at Ben Thanh, Line 2 is deep underground in order to pass beneath Lines 1 and 4 at the planned Ben Thanh Interchange station. As Ben Thanh is a complex interchange station combined with Lines 1 and 4, as well as major surface transport interfaces and garage / turn-around facilities, it is planned to be completed under a separate project.

5.2.3 Moving northwest, Line 2 remains underground for around 9.4km until just after the airport. Typical station depths are minimized for passenger convenience at around 15m below ground level. All underground stations must be constructed by cut-and-cover method, but tunnels between stations will be twin bored tunnels using Tunnel boring Machines (TBM). The TBM tunnels will generally dip between stations to optimal ground conditions.

5.2.4 Just north of the airport, the alignment will emerge from tunnel via a cut-and-cover transition section onto elevated structure. There will be just one elevated station on the current project, before the alignment turns toward the depot at Tham Luong. The line will include a spur of about 1.1 kilometres to the depot.

5.2.5 In a future phase, it is planned that Line 2 will extend to An Suong in the north, and across the river to Thu Thiem and beyond in the east.

Figure 5.1 Alignment Plan

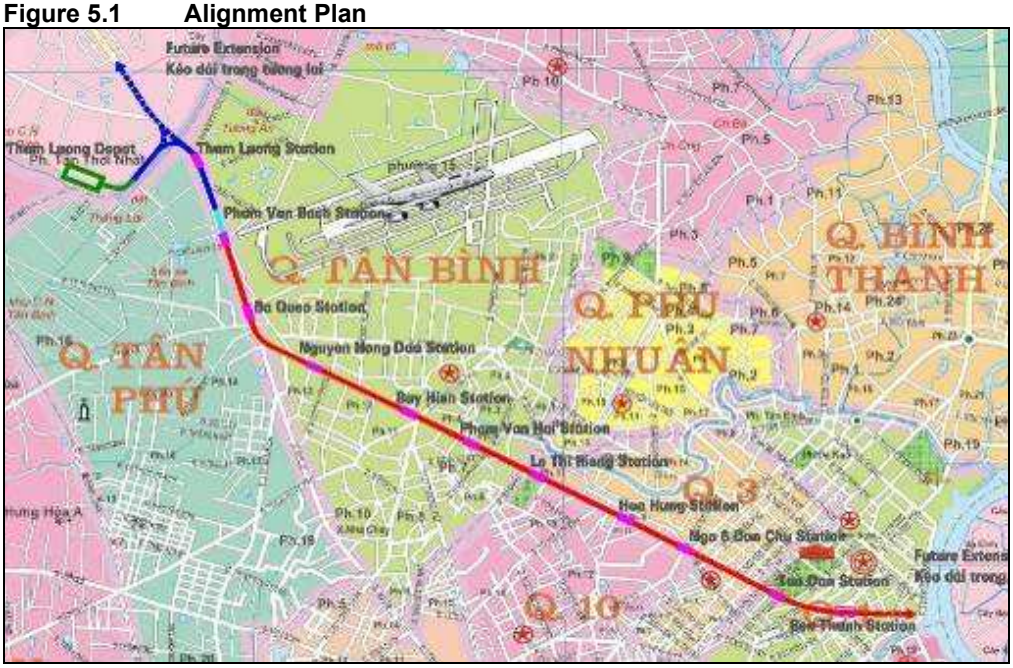


Table 5.2 Alignment Summary

No	Name of Station	TA 7343			Interchanges
		Chainage	Spacing	Level	
1	Bến Thành	372		-30.0	Lines 1, 4
2	Tao Đàn	1,261.5	889.5	-14.6	Line 3B
3	Dân Chủ	2,293.3	1,031.8	-11.0	
4	Hòa Hưng	3,214.8	921.5	-11.0	
5	Lê Thị Riêng	4,341.3	1,126.5	-13.0	
6	Phạm Văn Hai	5,135.2	793.9	-13.0	
7	Bảy Hiền	5,956.6	821.4	-12.0	Line 5
8	Nguyễn Hồng Đào	7,171.9	1,215.3	-11.0	
9	Bà Quẹo	8,288.6	1,116.7	-13.0	Line 6
10	Phạm Văn Bạch	9,081.3	792.7	-11.0	
11	Tham Lương	10,057.7	976.4	+15.5	
			9,685.7		

Alignment Design Issues

5.2.6 Twin single-track bored tunnels are proposed for the underground alignment, with cut-and-cover construction at stations. Underground stations have a central island platform to suit the choice of twin tunnels, and the width of the central platform fixes the spacing of the twin tunnels at stations at 16.5m. Platform levels are generally around 15m below ground, with a concourse above the platform level.

5.2.7 At the northern end the alignment is on viaduct. For the elevated station(s), concourse is provided beneath the platform level and above road level. As a result, platform level for elevated stations is typically around 12m above ground level.

5.2.8 Key design features of the proposed alignment are as follows:

- Maximum gradient in tunnels generally 3.5%, maximum gradient on elevated structure to Depot 4%
- Minimum radius on operational alignment 300m

- TBM tunnel spacing generally 2 diameters (D), minimum 1.5D

5.2.9 At the northern end of the alignment, a cross-over between tracks is provided for service turn-around operations on the elevated tracks north of Tham Luong station.

5.3 Station Design

Design Principles

5.3.1 The public areas of the stations are designed and dimensioned in order to give conformity to both comfort in everyday use and in emergency. All public parts of the stations are accessible to those of reduced mobility by means of lifts. Escalators are generally provided in the upward direction only, with down escalators in cases where demands are very high or level difference is high.

5.3.2 The technical areas of the stations are divided into Technical rooms and the Operational Rooms. Their sizing and arrangement is based upon experience and similar systems around the world. Underground stations have considerable ventilation and air-conditioning plant rooms, while the public areas of elevated stations are open and naturally ventilated.

5.3.3 All stations lie either under or above heavily trafficked roads. It is worth noting that in addition to being MRT stations, the stations will provide very convenient grade-separated means for pedestrians to cross these busy roads. Together with properly designed traffic management systems and pedestrian railings (which should be incorporated as part of the final station area design plans), this will allow for enhanced pedestrian convenience and safety, and can help reduce the severance effects of the major road corridors.

5.3.4 Finally it must be noted that integration with other transport feeder modes must also be an important consideration in the detailed design of stations. Whilst currently bus and other public transport services are not heavily used nor well integrated, the city has future plans to considerably enhance these services in line with the objectives to drastically increase public transport mode share. Careful detailed design of traffic management, pedestrian and public transport services around each MRT station will be very important to achieve well integrated transport systems, and hence passenger convenience.

Design Standards

5.3.5 Stations are designed in accordance with international standards, in particular the NFPA 130, 2007 edition. Station and access/egress sizing is generally dictated by emergency evacuation criteria, for which key assumptions and parameters used in the design are based on:

- Full train loads of 6-car trains at 2 minute headway, with 1.5 surge factor
- Platform evacuation within 4 minutes or evacuation to point of safety (concourse slab) 6 minutes
- Maximum platform loading of 5 persons per square metre

5.3.6 For normal operations, escalators are provided in the upward direction at all stations (between both platform – concourse, and concourse – street), but provision is made for future incorporation of additional downward escalators. Lifts are also provided at all stations to facilitate access for the disabled.

5.3.7 In general minimum provision of stairs between each platform and concourse is as follows, but this is cross-checked against forecast demands, and greater provision is made where necessary.

- 1 stair width (useable) 1.9m + 1 escalator width 1m
- 1 stair width 3.7m (useable)
- 2 emergency stairs width 2.2m (useable per stair)

5.3.8 All underground stations feature island (central) platforms. Ben Thanh station (the design of which will be studied separately) will need to be particularly deep, and should be planned as part of an overall integrated structure with Lines 1, 2 and 4. Tao Dan station is also deep with 3 levels (platform, intermediate and concourse), whilst all others have 2 levels below ground (platform and concourse). At Ba Queo station provision is made for the future interchange with Line 6. Platform length is 135m at all stations, and the overall length of the station box including technical and plant rooms is typically 193m.

Station Typical Layouts – Underground

5.3.9 Whilst it is to be expected that station designs will be refined during subsequent design stages, layouts for sizing and costing purposes at this stage are based on international best practice for this type of Metro project.

5.3.10 For underground stations, two typical layout models have been considered as shown in Figures 5.2 and 5.3. At this stage station layouts are based on layout option 1, which features a central concourse area feeding stairs and escalators which are spaced regularly along the length of the central island platform. From the concourse area stairs and escalators are provided, via passageways if/as needed, to access ground level and the surrounding catchments above. Technical and plant rooms are provided at either end of the station at both platform and concourse levels as shown.

5.3.11 Layout option 2 aims to spread the surface access points at either end of the station, and features two separate concourse areas which then connect via stairs and escalators to either end of the platform. This has the advantage to extend the accesses into surrounding catchment areas (though this can also be achieved with option 1 by adding longer pedestrian walkway connections), but has the operational disadvantage of inefficiencies in having two separate concourse areas (each with ticketing, staffing, etc) and possible confusion for passengers exiting from trains.

5.3.12 Underground stations will normally have at least four access points (stairs / escalators) to ground level, but the locations of these will be tailored to suit surrounding land uses and developments at each station. In addition, underground stations will require 2 ventilation shafts (normally at either end of the station) to serve tunnel ventilation, plus 1-2 cooling / ventilation shafts for the platforms and concourse. Stairs and escalators are generally provided within existing or planned right of way, on footpath areas but ensuring sufficient width of footpath also remains for passing pedestrians. The ventilation and cooling shafts are significant structures and are located outside the right of way. These shafts also require 5m clearance from nearby buildings at ground level, and are thus major considerations for the station design and footprint.

Figure 5.2: Typical Layout of an Underground Station (1)

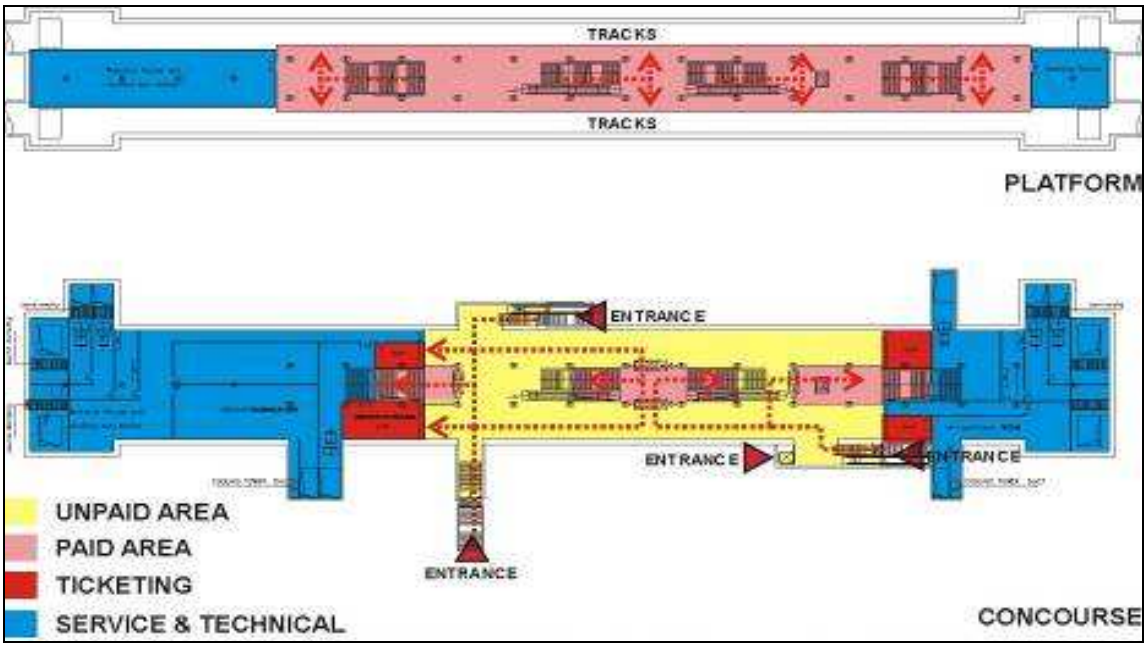
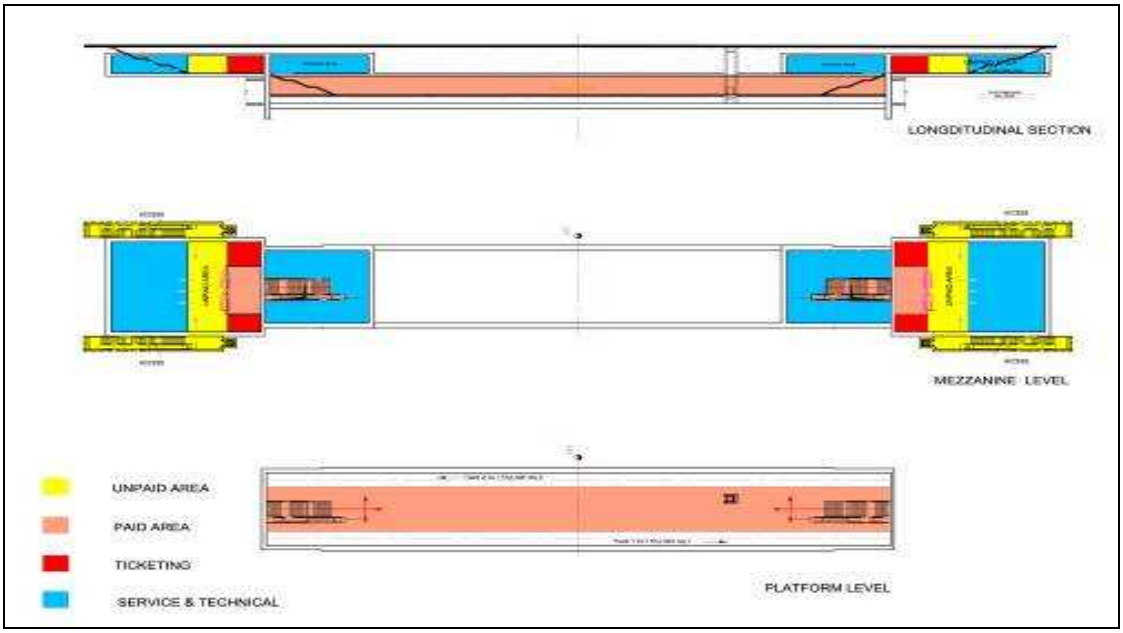


Figure 5.3: Typical Layout of an Underground Station (2)

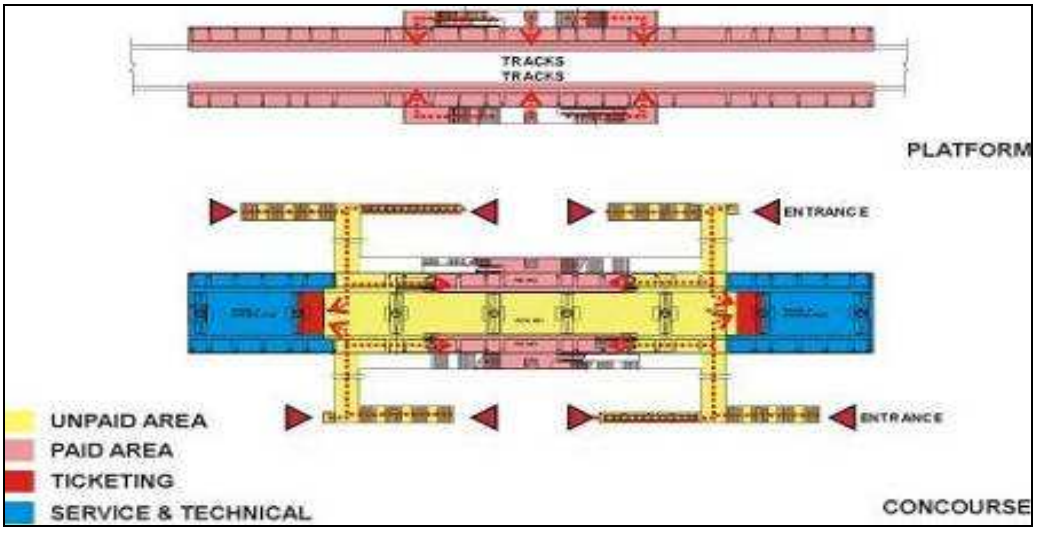


Station Typical Layout – Elevated

5.3.13 There is only one elevated station in the initial Line 2 project, at Tham Luong, although there will be future similar stations when the line is extended to An Suong as planned. These elevated stations will lie above the existing highway, generally with single column supports in the median. The typical layout for an elevated station is shown in Figure 5.4. The concourse level is located approximately 7.5m above the road, with platform levels approximately 5.4m above the concourse.

5.3.14 An alternative form would be to keep the track level lower with the concourse above the platforms at stations. Either form could be considered at detailed design stage, but the option shown is preferred at this stage based on international best practice (similar, for example, to the Skytrain in Bangkok and recently opened Dubai and Delhi Metro systems), and to allow greater flexibility for road bridges and footbridges to be constructed beneath the MRT structure if needed in future.

Figure 5.4 Typical Layout of an Elevated Station



Platform Screen Doors

5.3.15 Platform screen doors are proposed for all underground stations. A detailed review of the platform screen doors, including capital costs and savings in operating costs, is provided in Appendix A. Platform screen doors are nowadays a fairly standard requirement for underground stations on modern MRT systems, and offer a number of advantages:

- Passenger safety
- Reduced dust pollution
- Reduce air conditioning requirements and costs
- Noise reduction
- Pressure wave protection
- Advertising surface
- Improved ambiance and atmosphere within stations

5.3.16 Platform screen doors would be constructed initially to suit the 3-car train configuration (with plain panels along the remainder of the platform length), and later extended to the full platform upon introduction of 6-car trains.

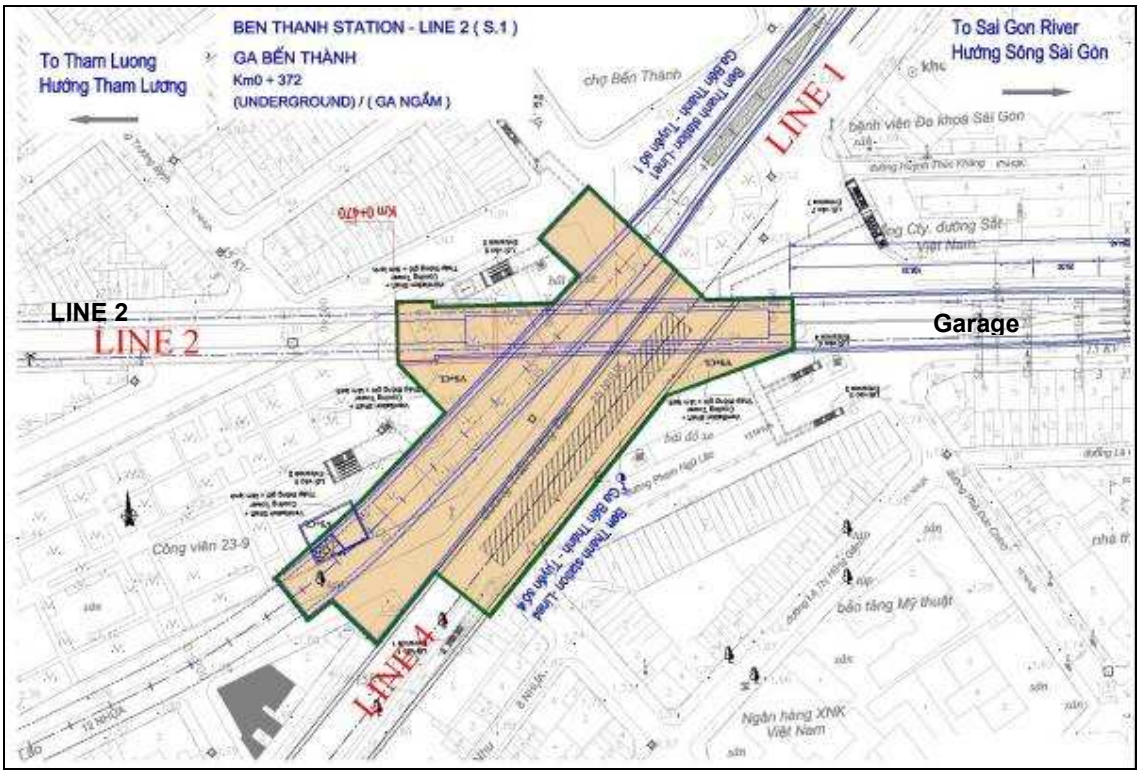
5.4 Stations and Interchanges

5.4.1 The following paragraphs provide brief descriptions of all stations, with discussion on key issues at the more complex stations. Drawings of all stations are provided in Volume 2.

Ben Thanh Station

5.4.2 Ben Thanh will be a major interchange station between Metro Lines 1, 2 and 4 (based on the Latest MRT master plan), together with surface transport (bus terminal, taxis, etc) and surrounding developments. An indicative possible layout of Ben Thanh station is shown below.

Figure 5.5 Indicative Layout for Ben Thanh Station



5.4.3 A separate design and planning study is proposed for the station, and the final design of Ben Thanh interchange station will be developed by that study. The Ben Thanh station study will also need to consider coordination of construction works (including TBM's) for Lines 1, 2 and 4, together with phasing of excavation works, temporary traffic management, etc. Some of the issues to be considered in detail by the future study includes:

- Direct passenger connections between platforms from different lines
- Common concourses and entrances / exits to street level and connection to surrounding developments – which in turn implies that accesses must be designed for all lines, and not just one individual line – furthermore, direct connection with planned future major buildings in this area should be provided where possible
- Integration with surface transport modes – public transport interchange with buses, taxis, car drop-off, etc – again requiring design for the full integrated passenger interchange demands
- Common fares and ticketing to allow direct connection between lines via common "paid" and "unpaid" concourse areas
- Integration of air conditioning and ventilation systems for the common station
- Design of fire and emergency evacuation facilities for the interchange as a whole rather than for individual lines
- Design of a new and improved traffic, pedestrian and urban design landscape above the completed interchange station, providing convenient passenger access and crossings for the whole area
- Coordination of phased construction works (including TBM launch areas) and temporary traffic and pedestrian management during construction of the stations and surface transport and development features for the area as a whole

5.4.4 Whilst the design and construction of Ben Thanh station will be part of a separate project, the design and alignment requirements have necessarily been considered in this study, and concept plans are included in the drawings for future reference. Particular issues to be included in the design include:

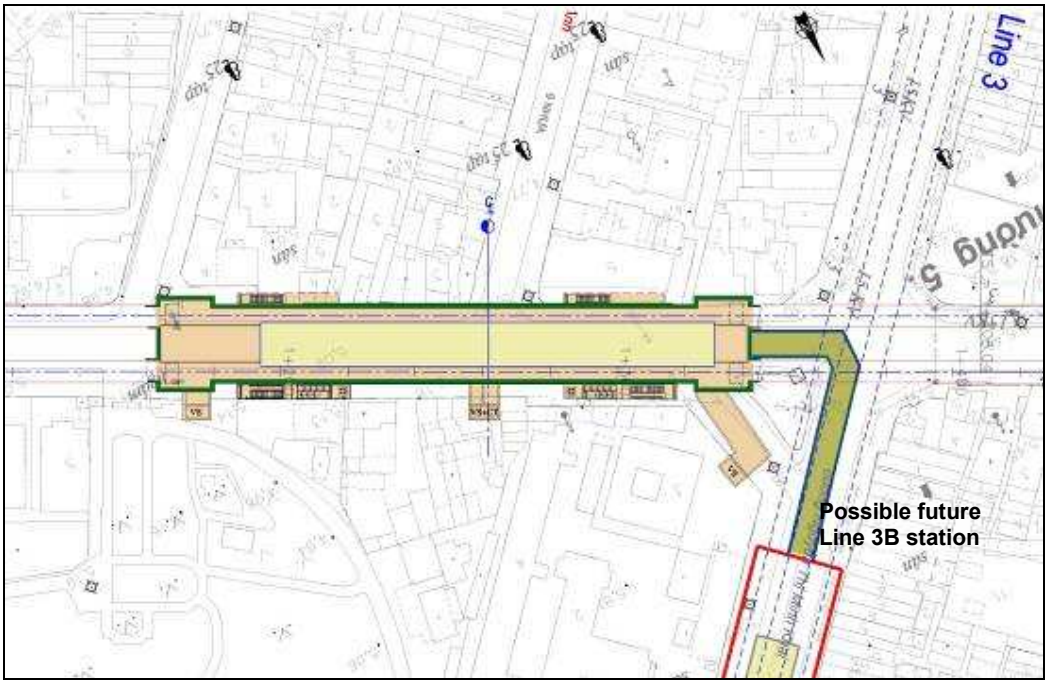
- It is assumed that the Line 2 platforms will be beneath both Lines 1 and 4, and therefore an additional concourse level will be needed to provide for interchange between the various lines. This leads to a very deep alignment for Line 2, with track level at over 30m below ground.
- Provision must be made beyond on Line 2 beyond Ben Thanh station for turn-around or trains, including storage space for an additional train, for normal operations. This facility was designed under the current study as a cut-and-cover garage beneath Ham Nghi; the location and layout of this garage should be reappraised as part of the Ben Thanh design, and it's construction included under the Ben Thanh contract.
- In future, Line 2 will extend beneath the Saigon River toward Thu Thiem. Therefore the design of Ben Thanh station, the garage and cross-over tracks must be also designed to suit the future Line 2 extension.

5.4.5 It is an important requirement that construction of the Ben Thanh Interchange station and associated Line 2 garage and other facilities must be completed in time for opening of Line 2 operations. This will need to include appropriate time to complete the Line 2 track work, control and operating systems at Ben Thanh station and garage, and to allow time for finishings and commissioning tests.

Tao Dan Station

5.4.6 Tao Dan station is deep due to its proximity to the deep Ben Thanh station. It therefore features an intermediate level between platform and concourse, but otherwise adopts the typical station layout as noted above. The station is located in front of Tao Dan Cultural Park and beside Trong Dong Outdoor Theatre, both of which are major attractions where large amount of people often gather.

Figure 5.6 Tao Dan Station



5.4.7 At both Ben Thanh and Tao Dan stations, because of the extra depth, technical and plant rooms can be accommodated at intermediate levels within the station rather than at the ends. Therefore these stations are shorter than the standard 2-level stations, at 175m (compared with 193m).

5.4.8 Based on the Latest MRT master plan, Tao Dan station will be an interchange station between Line 2 and Line 3B. As noted in the earlier chapter on MRT master plan issues, the choice of this alignment for Line 3B is considered very sub-optimal, but is assumed for present purposes. Studies of Line 3B on this alignment to date are very preliminary, and proper design of an interchange station between Lines 2 and 3B would need to be incorporated in subsequent Line 3B studies.

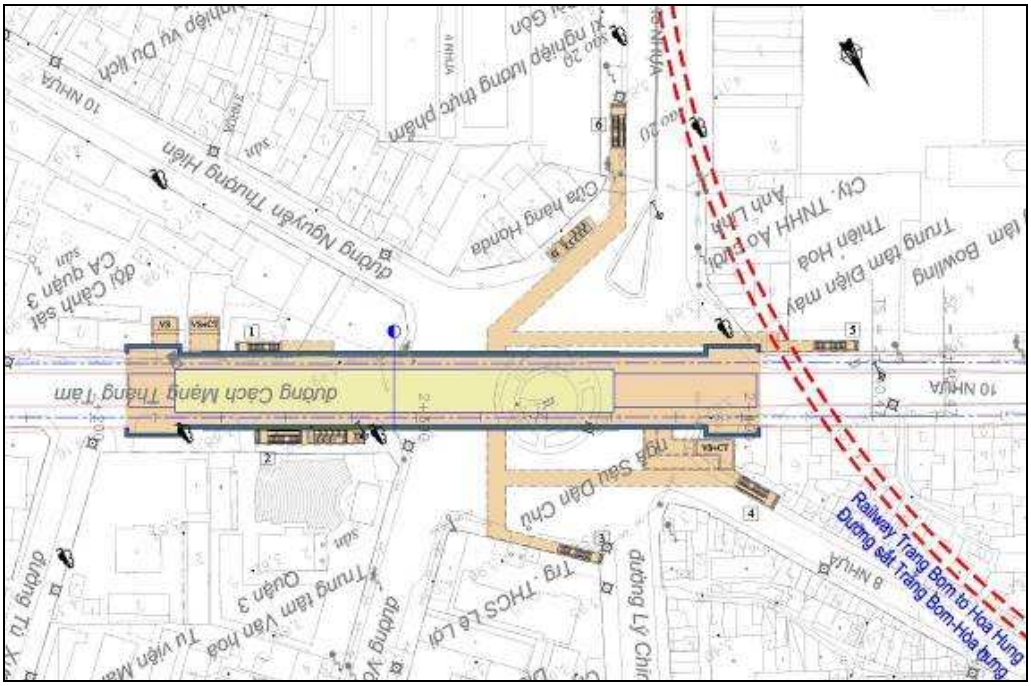
5.4.9 For present purposes it is assumed that Line 3B will pass beneath Line 2, and that interchange may be provided between the two stations via a simple connecting passageway as indicated below. This is not an optimal design – if Line 3B does go ahead at this location, locations of both L2 and L3B stations should be reviewed to provide optimal combined interchange station with common concourses and direct passenger interchange.

Dan Chu Station (formerly Dien Bien Phu)

5.4.10 Dan Chu station lies beneath the large 6-leg roundabout road intersection on Cach Mang Thang 8 as shown on Figure 5.7. Several passageways and access points are proposed for this station to penetrate surrounding catchments. It will also be important to integrate the station accesses in this area with future bus and other public transport services on the various roads.

5.4.11 These accesses should thus be considered in further detail at ongoing design stages in order to optimise connections to future surrounding land uses, planned developments and transport facilities, with direct connections to future buildings where possible. In this regard alternative station design concepts may also be considered, such as that proposed as “option 2” in the earlier section of this chapter.

Figure 5.7 Dan Chu Station



Hoa Hung Station

5.4.12 Hoa Hung station lies in a densely populated residential area, and is close to the main railway station Ga Saigon. Convenient passenger connection between the MRT and Ga Saigon may be provided via pedestrian subways or footbridges, to be integrated with the planned future urban redevelopment in the area.

Le Thi Rieng Station

5.4.13 This station lies adjacent to the important Le Thi Rieng Park, which features a large forecourt and possible opportunity for future transport interchange provision. Whilst a typical station design is proposed at this stage, opportunities should be investigated to optimize transport integration and feeder services in this area.

5.4.14 In the future phase of Line 2 a second electrical substation will be required near this station, to take power from the 110kV supply which passes nearby.

Pham Van Hai Station

5.4.15 Pham Van Hai station also lies in a densely populated residential area. The existing road has high frontage activity, though future development setbacks may allow opportunity for integration with feeder buses and surface transport.

Bay Hien Station (formerly Hoang Van Thu)

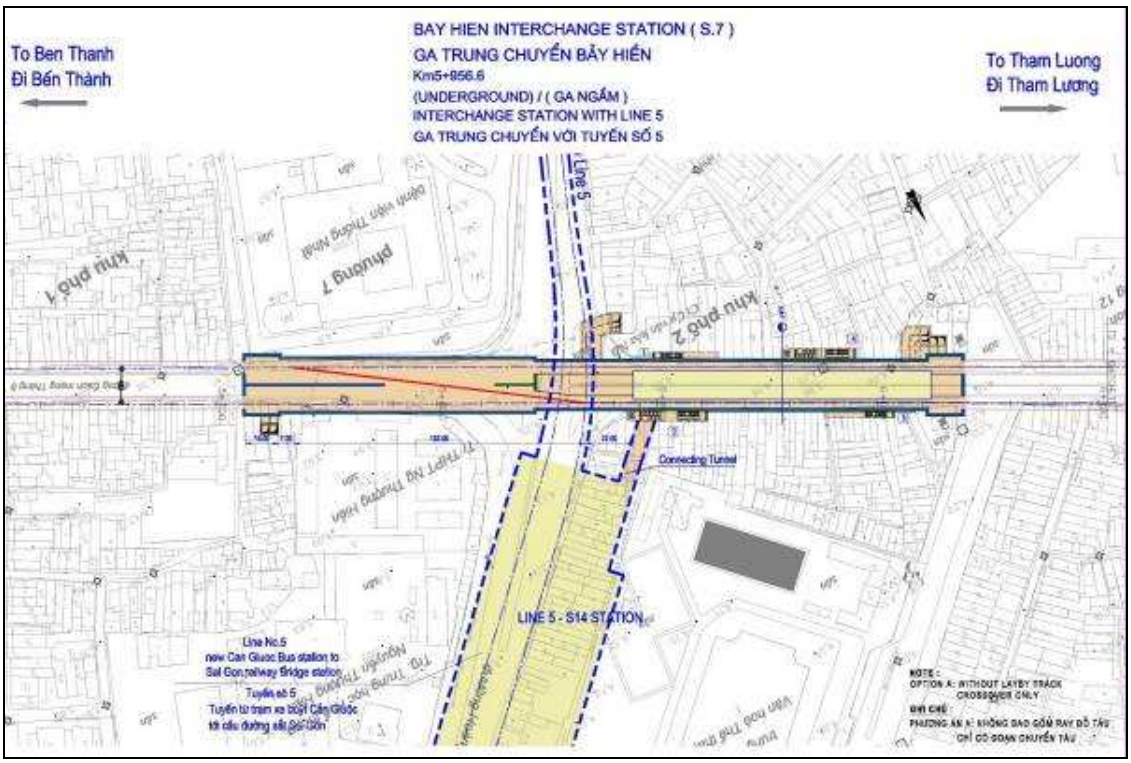
5.4.16 Bay Hien will be a future interchange station with Line 5. An indicative layout is shown on Figure 5.8, but this is not an optimal design, and as the design of Line 5 becomes clearer, the locations of both Line 2 and Line 5 stations should be reviewed to provide optimal combined interchange station with common concourses and direct passenger interchange.

5.4.17 The feasibility study of Line 5 is currently underway, and based on current plans it is assumed that Line 5 will pass beneath Line 2, and that passenger interchange will be provided between the two. Furthermore, it is understood that the Line 5 design may require a physical connection with the Line 2 tracks at this location, in order to share depot facilities during early years of operation. Similarly, integration of both stations with bus and other transport services on the major roads at this location should be a priority in future planning and design considerations.

5.4.18 Also included at Bay Hien is a cross-over between tracks (refer to chapter 6). A simple cross-over is proposed as shown on the Figure, and this requires an extended cut-and-cover structure for construction. A longer cross-over, including space for a third "layby" track was also considered in the study, but was omitted for cost reasons. The plan for this layby cross-over is included in the drawings and Appendix for reference, and may be considered further at detailed design stage if/as required.

5.4.19 Thus it is clear that Bay Hien will be a complex interchange station, including cross-over track on Line 2, and possible track connection with line 5. It is strongly recommended that a proper integrated study of this whole interchange station is carried out at detailed design stage. Such a study may be included as part of either the Line 2 or Line 5 detailed design, or as a separate project (similar to Ben Thanh above).

Figure 5.8 Bay Hien Station



Nguyen Hong Dao Station

5.4.20 This station also lies in a densely populated residential area with high frontage activity, though future development setbacks may allow opportunity for integration with feeder buses and surface transport.

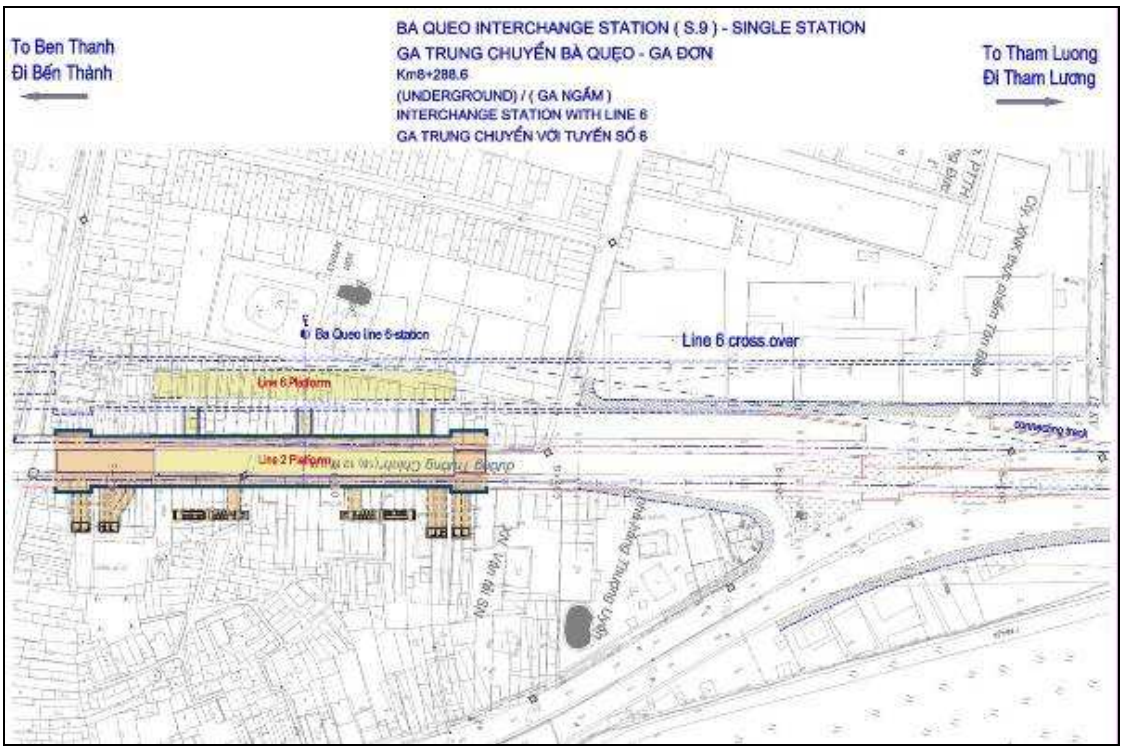
Ba Queo Station

5.4.21 Ba Queo station will provide future interchange with Line 6. Line 6 is planned as a spur line from Line 2, and will interconnect with Line 2 at Ba Queo in order to share depot facilities. Whilst the planning and design of Line 6 is at a very preliminary stage, it is assumed and has been confirmed with MAUR that:

- Line 6 will adopt similar design characteristics to Line 2 for full inter-operability capability between the two lines, and sharing of the same depot facilities
- Line 6 will operate 3-car train units with cars designed to the same dimensions and specifications as Line 2 trains

5.4.22 Convenient passenger interchange between the two lines at Ba Queo station is important, and various layout options for the stations have been examined, and are included for reference in the drawings and Appendix with this report. At this stage, a simple station layout for Line 2 only is included within the current project, as shown on Figure 5.9. The Line 6 station could be constructed adjacent to this station (as indicated) with suitable connections, or alternatively a better integrated combined station could be built. It is recommended that this issue should be considered further at the next design stage, taking into account initial and overall costs and resettlement requirements together with overall design efficiency and convenience for passengers.

Figure 5.9 Ba Queo Station



Pham Van Bach Station (previously Truong Chinh)

5.4.23 Pham Van Bach is the final underground station and lies under the wide Truong Chinh Road. The station is directly in line with the Tan Son Nhat airport runway (and for this reason an elevated station was not possible at this location).

Tham Luong Station (also known as Tan Binh)

5.4.24 This is the only elevated station on the project line, and is located above the intersection of Truong Chinh road and the entrance to Tan Binh Industrial Zone. Without the need for air-conditioning plant, technical rooms are accommodated beneath the platforms at either end of the station, and the overall station length is just 140m.

5.5 Depot

Sizing Requirements

5.5.1 The depot to be constructed for Line 2 may be required to serve three purposes in the long term:

- The Line 2 "project line" from Ben Thanh – Tham Luong
- Line 6 spur line (may be including phase 1 of Line 5)
- Future extensions of Line 2 to Thu Thiem and An Suong

5.5.2 Train requirements for the "project" line are discussed in the following chapter, which shows that to meet the traffic forecast for the Ben Thanh – Tham Luong Line 2 until 2035, it has been calculated that 19 6-car trains will be necessary.

5.5.3 Studies for Line 6 are still at a very preliminary stage and precise train requirements are not known. It is understood that 3-car train units will be used for Line 6, and based on a rough estimate by comparing the line length with Line 2, it is estimated that around 10 3-car trains may be required at 2035.

5.5.4 Similarly for the extended Line 2, detailed studies have not yet been carried out but initial estimates can be made. On this basis, the full train requirements are estimated as shown in Table 5.3.

Table 5.3 Possible Stabling Requirements for the Depot

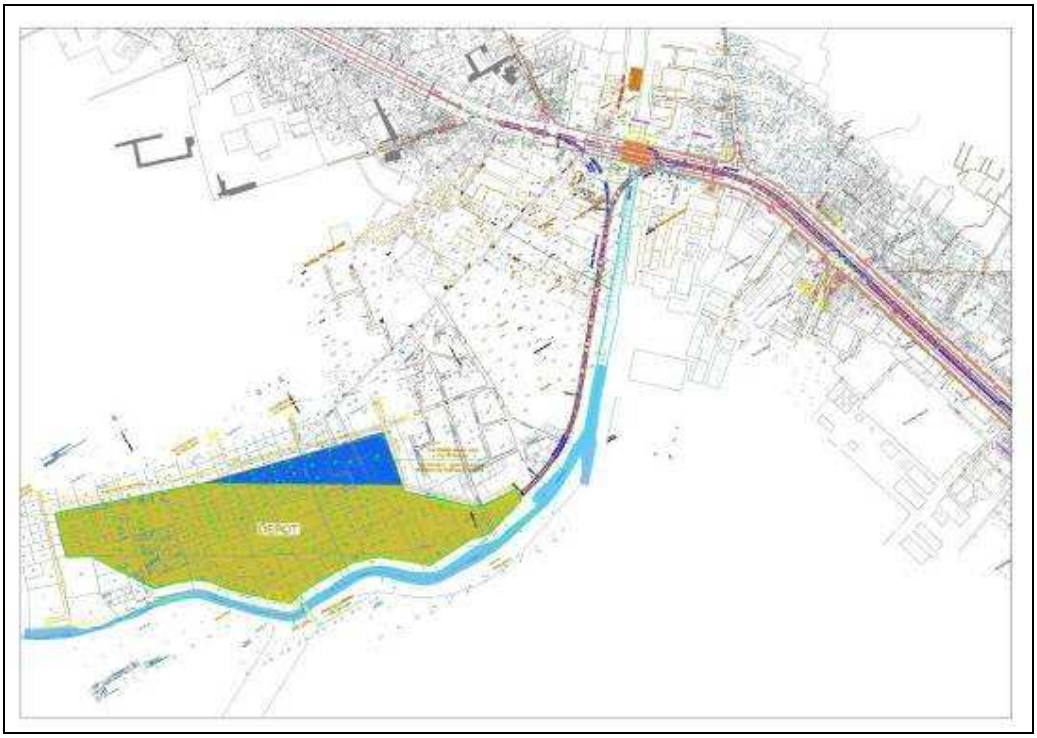
	No of stations	No of Trains		
		2015	2025	2035
(1) Line 2 initial phase only				
Line 2 Ben Thanh - Tham Luong	11	12 (3-car)	14 (6-car)	19 (6-car)
Line 6 spur line	6	N/A	12 (3-car)	18 (3-car)
Total no of 6-car trains			**20**	**28**
(2) Extended Line 2				
Line 2 Thu Thiem - An Suong	18	N/A	18 (6-car)	26 (6-car)
Line 6 spur line	6	N/A	12 (3-car)	18 (3-car)
Total no of 6-car trains			**24**	**35**

5.5.5 As shown below, the proposed depot has capacity for stabling 28 6-car trains and is therefore more than adequate for the project requirements up to 2035, and has sufficient capacity to accommodate both the Extended Line 2 and Line 6 until beyond 2025. However, additional stabling may be required to accommodate the Extended Line 2 to 2035 and beyond (subject to further study). It must also be borne in mind that not all trains will necessarily need to be in the stabling area at the same time – for example, some may be in maintenance workshops; others may be stored on spare sections of track.

Depot Site and Specification

5.5.6 The proposed site for the depot is located on an area of land of some 25ha at Tham Luong, connected to the main line by a spur line of around 1km. The site of the proposed depot is well located to enable efficient operation of Line 2 as shown on Figure 5.10.

Figure 5.10 Depot Site Location Plan



5.5.7 The main components required for the depot are as follows:

- Train washing machine
- Lathe on pit
- Motor traction maintenance
- Test track
- Traction office
- Substation,
- Parking position
- Different shop dedicated to different level

5.5.8 Three conceptual layout options for the depot have been examined during the feasibility studies, each containing similar facilities within the same land area, but with different layout arrangements. These layout concepts are shown in Appendix A. The choice of layout should be made at the next design stage, in consultation with the proposed operator. Further studies on design, value engineering, environmental impacts, etc will be required to optimize and select the final detailed layout plan.

Depot Spur Line

5.5.9 As indicated, the depot is connected to the revenue tracks by a spur line, with a second connection to be added upon future construction of the Line 2 extension northwards. With the two connections in operation, only a single track would be required in each direction. For the initial phase, a single track connection would also suffice in the short term, and this is included in the current project. This should be reviewed at detailed design stage. Further discussion on these options is included in Appendix A.

5.6 Power Supply

Train Power Pick-Up

5.6.1 Power is normally supplied to metro systems in one of two ways, either via a conductor rail alongside the track known as '3rd Rail' (usually 750V), or via an overhead catenary wire system (usually 1500V or 25kV). Line 2 is being financed with assistance from Germany, who will supply the rolling stock, and German standards generally adopt the former 3rd rail option.

5.6.2 Considerable research was undertaken into the proposed use of 3rd rail power supply for Line 2, particularly in view of the fact that HCMC Line 1 is proposing an overhead catenary system. In summary it was concluded that:

- Both systems are commonly in use for urban and suburban MRT systems around the world
- 3rd rail is commonly used for urban Metro systems, serving central city areas with dense station spacing
- Overhead catenary is generally adopted for longer distance and faster speed routes such as suburban metro (and indeed, inter-city and high speed rail)
- Key advantages of 3rd rail for urban Metro such as Line 2 include:
  - Much lower and simpler maintenance requirements and costs
  - Less vertical clearance meaning that tunnels can be smaller for the same size of train, giving a significant saving in costs
  - Less visually intrusive for elevated or at-grade sections
  - Lower electro-magnetic impacts on passengers and equipment in the trains
  - Lower voltage drops between sub-stations

5.6.3 Some examples of other systems in operation around the world are noted in Table 5.4.

Table 5.4 International Examples of Metro Power Supply

Region	Country	3rd Rail Systems	Catenary Systems
Asia	China	Beijing	Shanghai, Guangzhou, Shenzen
	Hong Kong		MTRC
	India	Kolkata	Delhi
	Japan	Tokyo, Nagoya, Sapporo, Yokohama	Tokyo, Osaka, Kyoto
	Korea		Seoul, Incheon, Daegu, Busan, Daejon, Gwangju
	Singapore	MRT	
	Thailand	BTS, MRT	
	Taiwan	Taipei	
Europe	Czech Republic	Prague	
	Denmark	Copenhagen	Copenhagen
	France	Paris, Lyon, Marseille, Lille, Rennes, Toulouse	
	Germany	Berlin, Munich, Nuremberg, Hamburg	Cologne, Bonn
	Greece	Athens	
	Hungary	Budapest	
	Italy	Milan	
	Netherlands	Amsterdam, Rotterdam	
	Romania	Bucharest	
	Spain	Barcelona	
	Sweden		Stockholm
	UK	London, Glasgow	Tyne and Wear
N & S America	Argentina	Buenos Aires	Buenos Aires
	Brazil	Rio de Janeiro	Sao Paulo
	Canada	Toronto	Montreal
	USA	New York, Washington	Pennsylvania
Australasia	Australia		Sydney, Adelaide

5.6.4 Overall it was concluded that the 3rd rail technology as proposed for Line 2 was entirely suitable for this type of urban MRT line in HCMC. It is noted that the decision to adopt 3rd rail power supply for Line 2 has been formally proposed by MAUR, and has recently been endorsed by MOT.

Power Supply from HCMC Grid

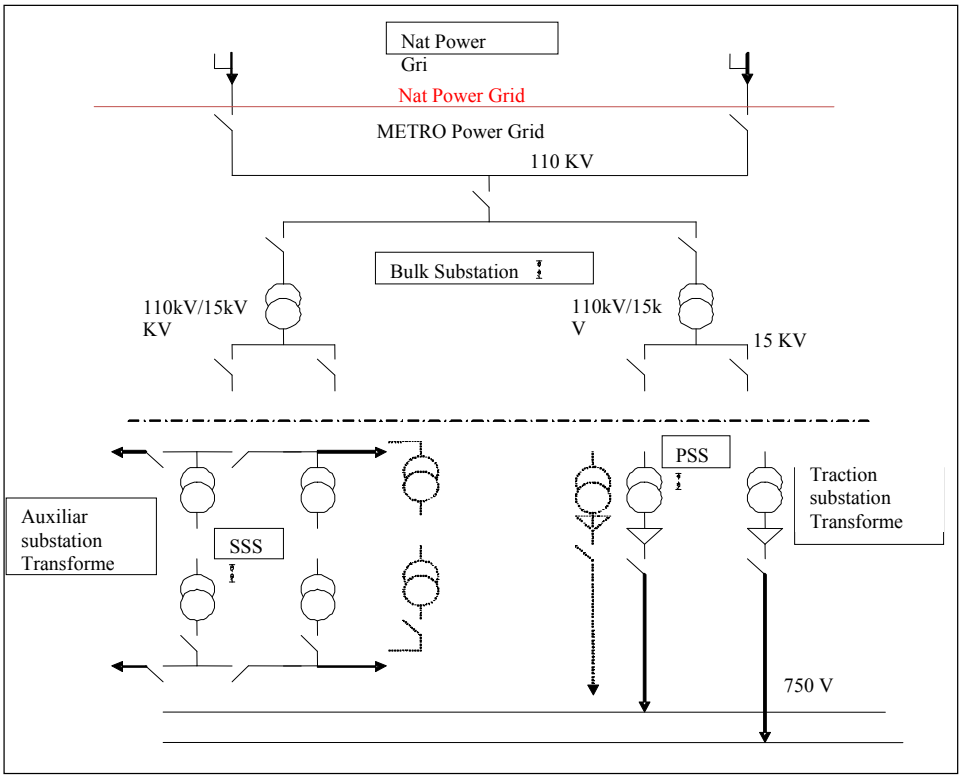
5.6.5 There are two systems of power supply available for metro network, one system receives power from a medium voltage grid (typically 35kV, 22kV or 15kV); another one receives power from the high voltage arteries of 110kV or 220kV.

5.6.6 Drawing power for MRT Line 2 in HCMC from the medium voltage grid would be less expensive than from the HV grid due to the need for fewer and simpler transformer substations. However, after detailed study the MV supply was considered to be not sufficiently reliable for operation of an MRT project.

5.6.7 In view of the uncertainties of the medium voltage network in HCMC, to improve the reliability of the sources of power supply, it is agreed that is better to have the line connected to the high voltage network (110 kV) than to the medium voltage network. The power supply is fed by either the 220kV ring or the 110kV ring; this system should have a minimum of one BSS (Bulk Supply Substation) to receive the VHV distribution. The cost will be higher in purchase, installation and maintenance but it will result in a higher availability, reliability, convenient and less risk of voltage perturbation in operation.

5.6.8 The principle of power supply from high voltage grid is illustrated on Figure 5.10.

Figure 5.11 Power Supply from HV Grid



5.6.9 For the full (Thu Thiem – An Suong) Line 2 project, in order to get close to 100% availability, two main transformer substations, each one connected to the main power plant by a different artery, would be installed. Each power station shelters two transformers to 25 kV which feed the station and traction substations through two independent circuits.

5.6.10 For the first phase of operation, the power demand and the request of power availability for peak hours is not such that two power stations are necessary. Only one power station, located in Ben Thanh will therefore be built initially.

5.7 Signalling

5.7.1 Two types of signalling have been considered for Line 2: a “loop” system which is fairly conventional based on cabled systems; and the rather more recent “CBTC” (Communication Based Train Control) system, which uses radio / microwave signals. It is considered that either system could be successfully adopted for Line 2. As more and more modern Metro projects are now adopting the CBTC system, it is assumed at this stage that CBTC will be the preferred choice for Line 2.

5.8 Fare Collection and Ticketing

5.8.1 The options for fare collection and ticketing including integrated systems were discussed in the PPIAF Report ‘Fares and Ticketing Working Paper, June 2008’ and key issues are summarised in Appendix E. Passenger convenience will be essential for the success of the HCMC metro system, and to this end comprehensive integration of fares and ticketing across all metro lines, and other public transport systems if possible, should be the target.

5.8.2 At the present time, tenders for Line 1 have recently been invited, including implementation of an Automatic Fare Collection (AFC) system. As a first step, it would be a requirement that Line 2 should adopt and be integrated with the Line 1 AFC system.

Line 1 Ticketing System

5.8.3 An AFC is proposed for Line 1 MRT at a cost of approximately US$50M. At present there is no proposal to expand the system to other MRT lines or to bus, but it is understood that in principle the system is capable of being expanded. The proposal for fares on Line 1 is to have a boarding charge of VND5,000 rising to a maximum fare of VND12,000 for a trip along the entire line. It is understood that a smart card (Type C) is proposed but cash payments will also be accepted. There is no current proposal under the Line 1 contracts to integrate fares with other MRT lines (i.e. have a common fare structure and a single boarding charge no matter how many line are used) or with bus.

Ticketing System for Line 2

5.8.4 For the purpose of the present study, it is assumed that Line 2 will adopt the Line 1 system. This is clearly the simplest option given the status of the Line 1 procurement, and should be extended in future to other MRT lines and buses. This solution would be expected to provide full interoperability of ticket products on all MRT lines, and between MRT and bus.

5.8.5 In terms of costs for Line 2, this can be broadly estimated based on the Line 1 costs, taking into account the fewer number of stations on Line 2, and the fact that much of the common systems and software will already be provided under Line 1 and will need enhancing for Line 2. On this basis an indicative cost estimate of US$15M is included for the Line 2 project.

Need for Further Studies on Integrated Fares and Ticketing

5.8.6 As noted above the fare assumptions for Line 1 are quite different to those for Line 2, and there is a clear need to study the implications of integrated fares for MRT and bus. This is a complex task and would require: (a) extensive consultation with stakeholders; (b) analysis of the impact of different fares levels and structures on community welfare and user acceptance, and (c) assessment of the impact on public financial support to public transport services over the long term. This in turn would require detailed analytical models capable of assessing the impacts of alternative fare structures on patronage and revenues, both for individual MRT Lines, buses and public transport overall. Further discussion on this subject is provided in the Appendix E and referenced documents.

5.9 Construction Issues

Construction Programme

5.9.1 The overall estimated construction programme for the Line 2 project is shown on Figure 5.12. This programme assumes deployment of two TBM's, both to be launched from the Ben Thanh Garage works area at the southern end of the project. Cut-and-cover excavations for each station must be completed prior to arrival of the TBM's. As shown, the overall programme from award of construction contracts to commencement of services on this basis is estimated at around 6.5 years.

5.9.2 In order to reduce the construction period, it could be considered to deploy three or four TBM's. A broad appraisal of this option has been undertaken, and it is estimated that the construction programme could be reduced by around 12 months, but at an additional cost of around US$30-40 million. Using additional TBM's also raises other issues, such as the need for additional teams of track-layers, additional contract packages, doubling up of spoil removal works, greater traffic disruption, etc.

Drainage & Utilities

5.9.3 It was known during TA4862 that various existing and planned utilities would need to be catered for in the design and construction of Line 2, but at that stage only limited details of these utilities were available. Full details are still not clear, but it can be seen that installation of 1-2m diameter drainage pipes is currently in progress on sections of the route.

5.9.4 All the stations of line 2 are built with diaphragm walls, meaning that utilities will have to be cut temporarily or permanently due to diaphragm walls construction. For small utilities such as cables or water pipes this is not normally a problem, and the cables of pipes can fairly easily be rerouted either temporarily or permanently around the works.

5.9.5 Drainage or sewage pipes (or culverts) are more difficult, partly due to their size, but also because of the need to maintain levels and gradients at all times for the flow of the liquids. The current design for Line 2 stations has the top slab 2m below ground level. This appears sufficient based on available information and observation of the existing and planned utilities, but will need to be checked at detailed design. It will generally be necessary to construct a replacement sewer (parallel to the existing) on the first phase of top slab construction, and then permanently divert the flow before demolition of the existing pipes.

5.9.6 These construction issues for drainage and utilities are considered further in Appendix A.

Further Studies prior to Construction

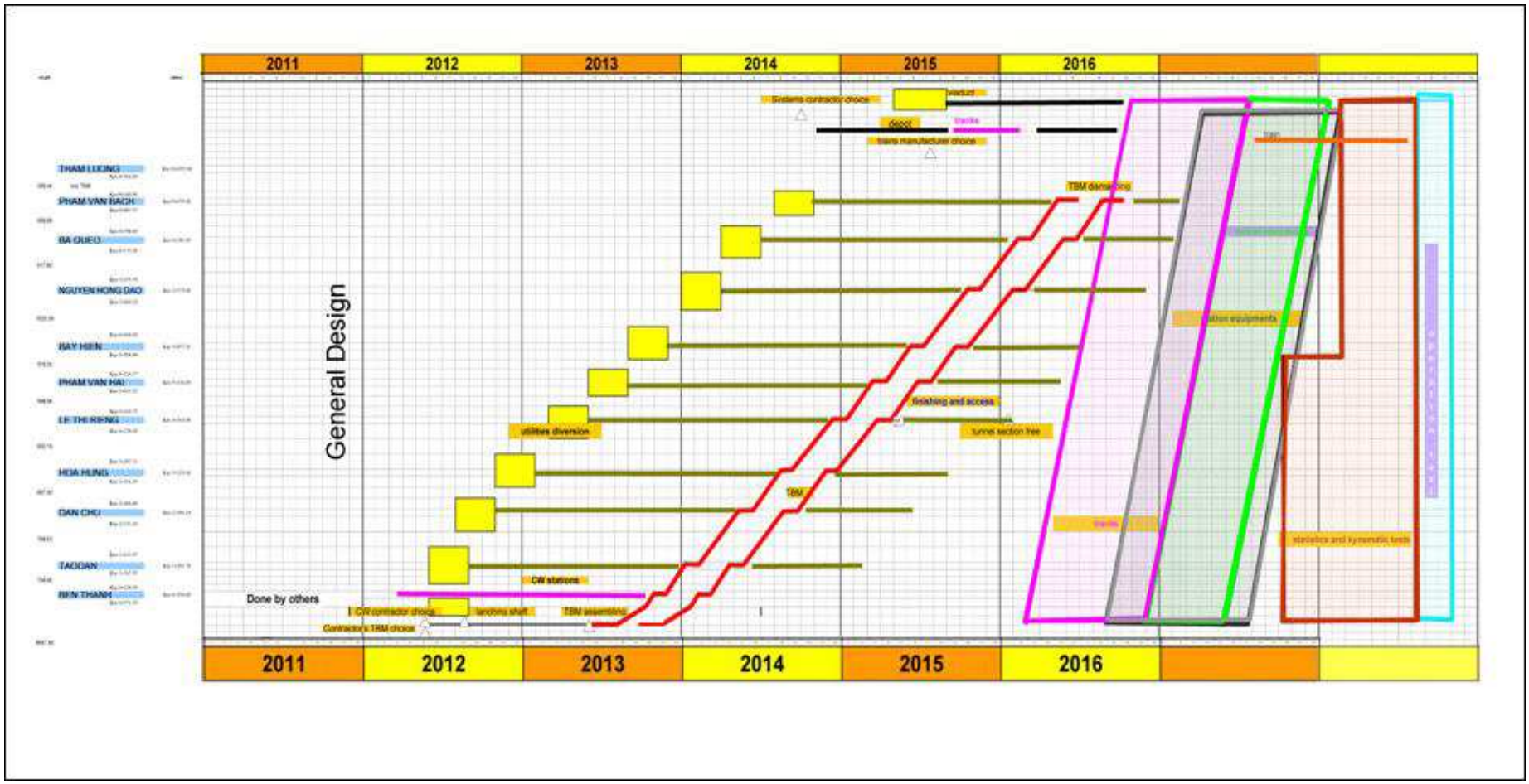
5.9.7 The preliminary design presented at the Feasibility Study stage gives an overall view of the constraints for construction. Prior to preparation and award of construction contracts, various further investigations should be undertaken in order that the contract terms may be clearly defined. These will form some of the functional and basic design studies to be undertaken by the appointed consultant. Some examples of these studies are provided below.

Soil Conditions

5.9.8 Complementary geological investigation is necessary for tunnel and station works in order to confirm the parameters taken in the present study (more precise localization of the geotechnical units for studying TBM face stability and for station depth of diaphragm walls). Also, further study is required of the localization of the existing piles and study of the influence of TBM on piles for sizing remedial works.

5.9.9 It would also be necessary to undertake further study of the evacuation of spoil from the tunnel and station excavations (by river or by truck) in view of getting an agreement with the relevant authorities. This may require complementary investigations of traffic routes and environmental impacts.

Figure 5.11 Construction Programme



Utilities

5.9.10 As noted, there are various utilities along the alignment which will require diversion and/or repositioning during construction, and that some of these may require fairly major works, and may affect the final depth of stations. However, only limited information is available on these utilities at this stage, and therefore further survey investigation is needed in order to define more precisely the final solutions. The amount and the schedule of utilities diversion must also be agreed with authorities prior to construction.

Traffic Management during Construction

5.9.11 The construction works, particularly at the cut-and-cover stations, will have very major impacts on traffic flows. Major traffic diversions will be required, which may affect roads and areas well beyond the Line 2 corridor itself, and must therefore be planned on a city wide basis. Furthermore, traffic management plans will need to be coordinated with any other construction works on other projects which will inevitably occur during the Line 2 construction programme. A thorough traffic management study and plan is therefore essential to provide guidance and conditions for the construction works.

Design Refinement

5.9.12 Whilst much of the detailed design can be left to the design and build contractor, certain elements would benefit from further refinement prior to issue of the tender documents. This may include more detailed investigation of station layouts and accesses, and in particular much more detailed review of the interchange stations, taking into account the latest studies for the other MRT lines.

Civil Works Contract Packaging

5.9.13 Under the proposed co-financing arrangement, it is planned that there will be a turnkey contract under KfW financing for the E&M systems, whilst civil works will be financed under the tranche 2 loan from ADB, combined with financing from EIB.

5.9.14 An implementation consultant will be appointed (under KfW finance) to assist MAUR with functional design, procurement and construction supervision for all packages. The consultancy services will consist of two phases:

- The first phase includes preparation of the operation concept, elaboration of the functional design for the E&M / Rolling Stock Package, tender documents for that package, basic design for up to 4 civil works packages including non-system E&M and respective tender documents as well as the evaluation of offers and the assistance in contract negotiations.
- The second phase includes check and approval of designs of E+M/RS and civil works, supervision of construction works and installations for quality assurance and assistance with interface and claim management. This will also cover the commissioning, system integration and final acceptance.

5.9.15 For the civil engineering works (including non-system E&M), the consultant will prepare basic design, tender documents and evaluation of tenders. The main components of the civil works will include:

- Bored tunnels (using TBM's)
- Underground stations
- Elevated station, viaducts and depot civil works
- Non-system E&M (tracks, tunnel equipment, station equipment, lighting, ventilation, etc)

5.9.16 In terms of the number of contract packages for these works, there are various considerations. A limited number of large contracts (or indeed a single contract) would have the advantage of reduced interface management for the owner, but puts the contractor in a very strong position for negotiation and claims. A large number of smaller contracts would maximize fee competition for the various works, and would give the owner greater control. On the other hand this leads to a large number of interfaces between the various contractors, with risk of claims and disruption if not tightly controlled.

5.9.17 For the Line 2 project, it is proposed that the works will be split into four main contract packages as noted above. These packages are each relatively self contained, and interfaces between the packages can be well defined and controlled.

Contract for tunnel

5.9.18 The two tunnels are running parallel from the same TBM launching station. Whilst the total length of tunnels is very large at nearly 14 km, it is considered that this would be best managed under a single contract.

5.9.19 The key issue for tunnel construction is the interface with station in terms of timing. If a TBM is somewhere delayed, the stations downstream may not be finished on time. If a station is delayed, the Tunnel is reciprocally delayed. Clear milestones with penalties must therefore be set in the respective contract.

Contract for underground stations

5.9.20 A single contract is proposed for all nine underground stations (excluding Ben Thanh to be under a separate contract by others). All underground stations will require diaphragm wall construction method. The underground stations contract will also include the garage at Ben Thanh, and the cross-over section at Bay Hien.

Contract for viaduct and depot

5.9.21 There is only one elevated station and the structure is integral with the viaduct structures. Construction is generally proposed to be of twin pre-cast “U-shape” viaducts, except for special areas such as the tight curve to the depot spur where segmental or in-situ construction will be required.

5.9.22 Depot works consists of earth works and buildings. These works are fairly straightforward and likely to be well within the capability of local contractors.

Contract for non-system E&M

5.9.23 Since separate contracts are proposed for the tunnels and stations, it is preferable to have an independent contract for track work. This contract can also conveniently include all other non-system E&M which applies to both tunnels, stations and the depot.

6. SERVICE OPERATIONS AND MAINTENANCE

6.1 Service Plans for Normal Operations

6.1.1 The operations plan provides the suggested train configurations headways, timetables, etc for the system. The plan is based on the forecast travel demands, but as with any new MRT it is expected that the actual plan will be refined by the operator prior to commencement of services.

6.1.2 The operating plan below considers the project line including Ben Thanh interchange station (which will be developed under a separate project). Consideration of requirements for the future full Line 2 (Thu Thiem – An Suong) is also noted.

Design Demand

6.1.3 For the purpose of the current study, the operational design and costing is based on the Line 2 project from Ben Thanh to Tham Luong, total 11 stations. Three time horizons considered in the Study the maximum passengers per hour per direction (pphpd) demand are the following:

- Year 2015 – notional year of opening: 8,500 pphpd
- Year 2025 – medium horizon where other UMRT lines included in the Master Plan are in operation: 21,400 pphpd.
- Year 2035 – long-term horizon with continued growth beyond 2025: 30,200 pphpd.

6.1.4 For the off-peak period, based on experience of other systems, it is estimated for planning purposes that the traffic will be 75% of the peak load, and the evening demand 50% of the peak load. For Sundays and holidays it is estimated that the traffic represents 75% of the working days passengers.

6.1.5 With the full Line 2 extended northwards to An Suong and across the river to Thu Thiem, peak loading is estimated at 37,500 pphpd at year 2035.

Structure of Services

6.1.6 The schedules of service are assumed to start at 5.00 a.m. and finish at 12.00 p.m. On working days the peak periods are estimated to be around 6.30 - 8.30 am and 4.00 - 6.30 pm (based on observed demand distribution). Table 6.1 summarizes the service frequency for years 2015, 2025 and 2035, based on the forecast demands as above. In practice, minimum service frequencies to be agreed with the operator may be lower than these values.

Table 6.1 Service Headways at the Various Time Horizons

Period	Working Days			Sundays and Holidays		
	2015	2025	2035	2015	2025	2035
Peak period	5’00	4’00	2’45	6’30	5’15	3’45
Off-peak period	6’30	5’15	3’45	7’45	7’00	5’00
Night service	10’00	8’00	5’30	12’00	10’30	7’30

Commercial Speed

6.1.7 The commercial speed for Line 2 – Ben Thanh – Tham Luong was estimated taking into account the running time between stations, the reserve time (and, thus, running time with coasting) and station dwell time. The running time and reserve time between stations was calculated using specialised software (MATYS), taking into account the train and line’s characteristics. The dwell time was calculated based on estimated boarding and alighting per station, the number of doors (4 doors per car) and lanes per door (2 lanes per door) in the train, the passenger flow rate (1 passenger per lane per second), the headway, and the time required for technical reasons (door opening, door closure warning time and door closing).

6.1.8 The total estimated running time between Ben Thanh to Tham Luong, a distance of 9.5 km, is 930 seconds, with a resulting commercial speed of approximately 36.5 km/h.

Fleet Size Calculation

6.1.9 The calculation of fleet requirements to meet the forecast patronage demands at 2015, 2025 and 2035 are given below. Fleet requirement is determined by the total estimated running time detailed in the previous paragraph, plus the last stations' track changing time and regulation time at terminal (estimated at 280 seconds at Tham Luong and 320 seconds at Ben Thanh), divided by the target schedule for the peak period.

6.1.10 The operational design considers a 5% train reserve (rounded up), to replace potentially defective trains during the daily service. In this way, the operational design maintains normal headway between trains, as well as the standard transportation capacity, by eliminating any of the consequence that would result from a train failure (delays and increased headways between trains, etc.).

6.1.11 Additional trains are necessary, based on maintenance needs. Due to preventative and corrective maintenance requirements, some trains are not always available. On average, 10 % (rounded up) of trains in operation are under maintenance. The calculations of rolling stock fleet shown in Table 6.2 consider this percentage.

6.1.12 In order to maintain a convenient service to customers under predicted passenger growth numbers additional trains are typically purchased at intervals of 5 years (4 x 6-car trains in 2020, 4 in 2025, 3 in 2030 and 2 in 2035).

Table 6.2 Rolling Stock Fleet Size Estimation for Line 2 – Ben Thanh – Tham Luong

	2015	2025	2035
Operation headway Minutes)	5'00	4'00	2'45
Trains in operation (rounded up)	9	11	16
Operation reserve (5% rounded up)	1	1	1
Maintenance reserve (10% rounded up)	2*	2	2
Total fleet size	**12* (3-car)**	**14 (6-car)**	**19 (6-car)**

**Note: 11 3-car trains are adequate for 2015, but an even number is required to be later combined into 6-car trains as these should be comprised of units of the same specification and age.*

6.2 Track Cross-Overs and Layby Tracks

6.2.1 Cross-over connections between tracks and / or additional layby tracks are required for turning around trains in normal operations, for stabling of spare trains to meet peak demands, and to facilitate removal of defective trains in the event of a breakdown. Various options were considered in the study (refer to the Appendix), and the proposed configuration for Line 2 (Ben Thanh – Tham Luong) is shown in Figure 6.1.

6.2.2 In addition to cross-overs at each end of the alignment, which are necessary to turn around trains in normal operation, a cross-over between tracks is provided near Bay Hien station. This cross-over allows trains to switch between tracks in the event of breakdown or disturbance. An enhancement of this feature would be to include a section of third "layby" track as well as the cross-over, so that a defective train could be stored without disrupting normal operations. Such a layby track would provide more flexibility for operations, but would be very much more expensive (including requiring additional resettlement), and is therefore not included in the current project. However, a plan of this layby configuration is included in the drawings, and may be considered further at the next design stage if needed.

6.2.3 In considering the track configuration, it is necessary to assume Ben Thanh Interchange Station will be constructed and the future context when Line 2 is extended to An Suong and Thu Thiem. In this case the proposed track layout is as shown in Figure 6.2 below.

Figure 6.1 Sketch of Track Layout and Stations – Initial Project

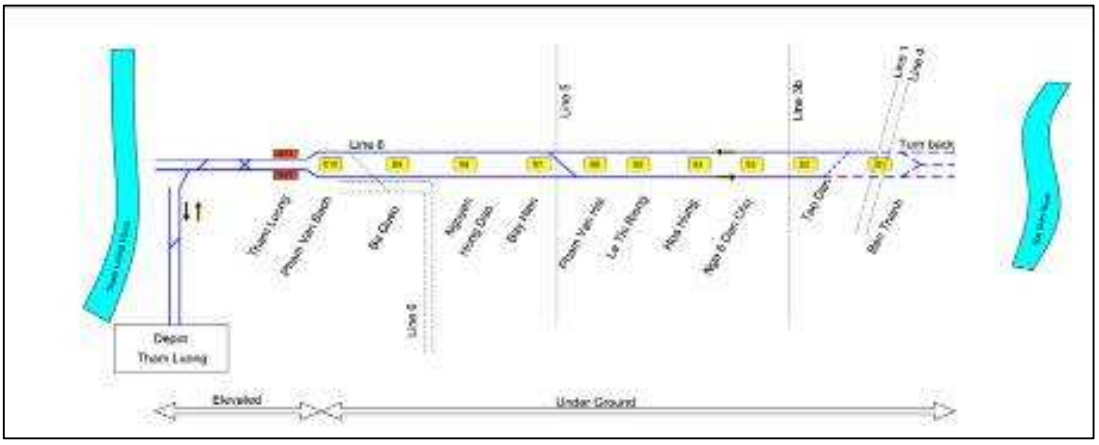
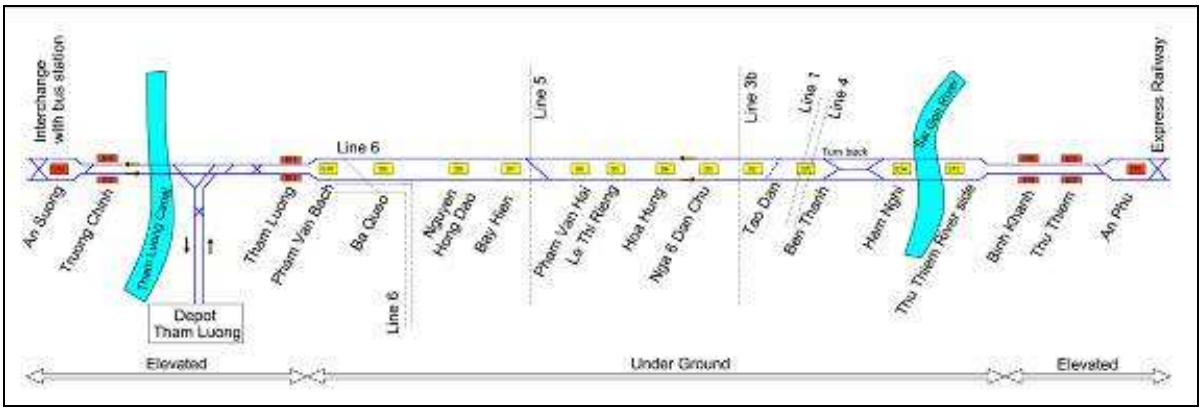


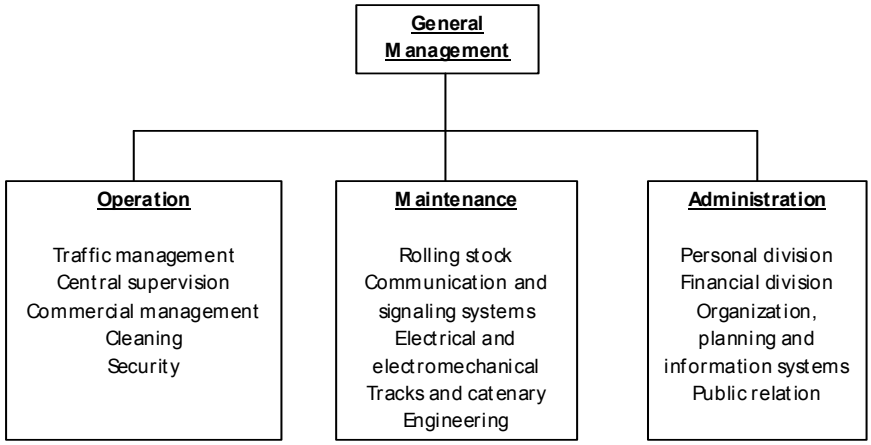
Figure 6.2 Sketch of Track Layout and Stations – Future Situation



6.3 Operations and Maintenance Plans

Global Organization

6.3.1 The proposed Metro line 2 organization is defined according to the following operational departments:

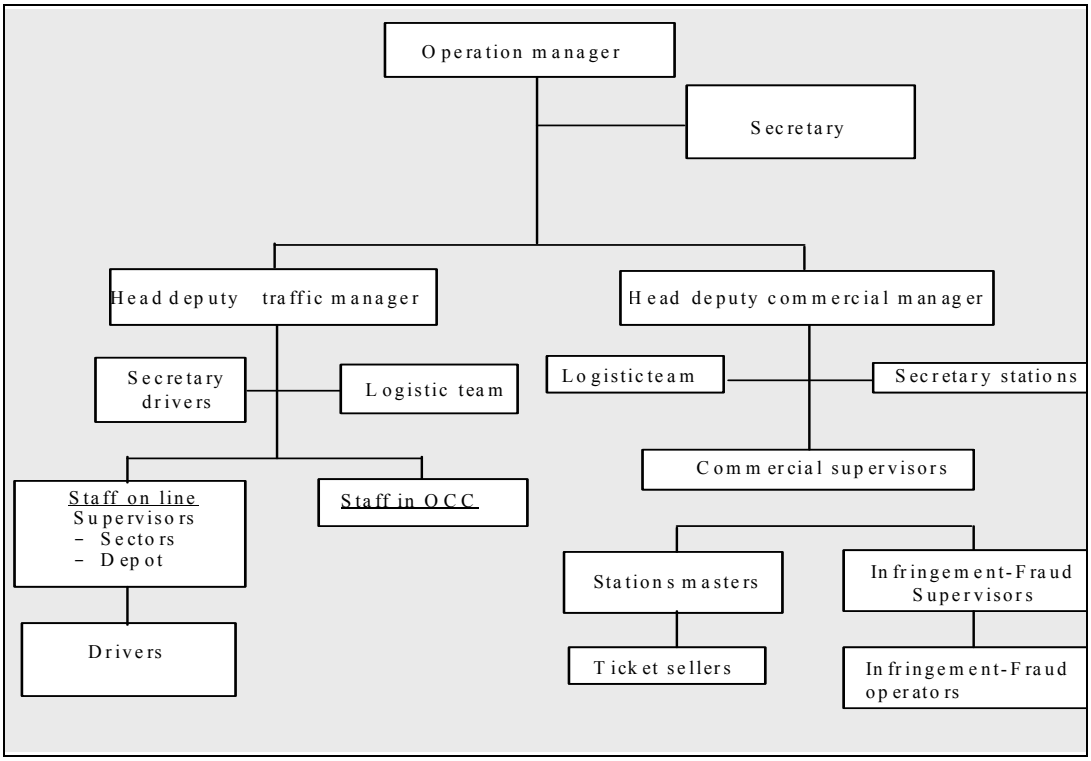


The General Management Department

6.3.2 The general management is made of the general manager with his or her assistants, and a safety and quality group.

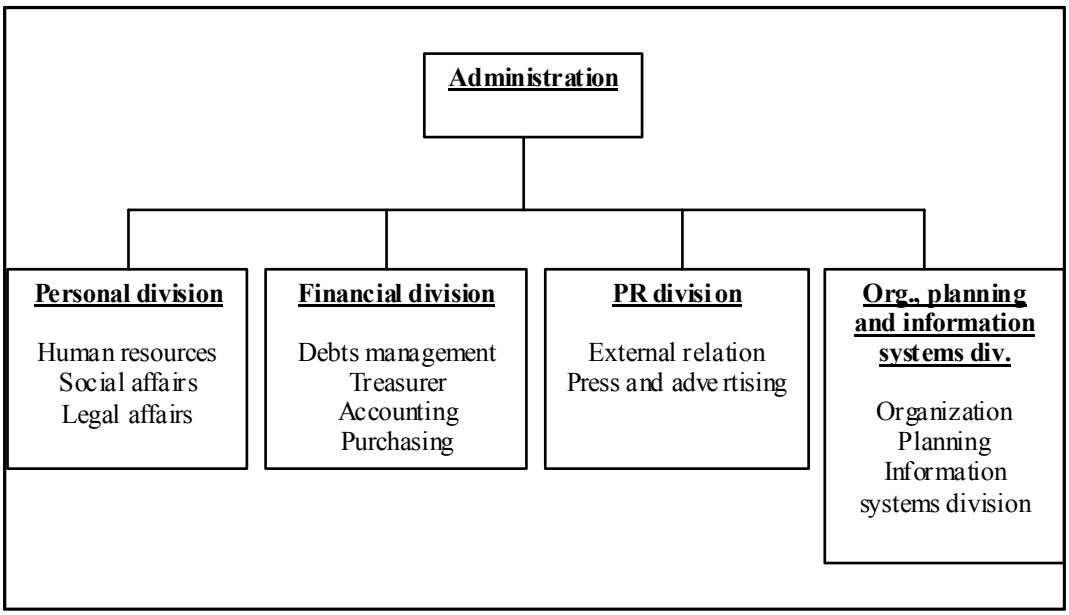
Operation Department Organization

6.3.3 The typical structure for the operations department is as shown below.



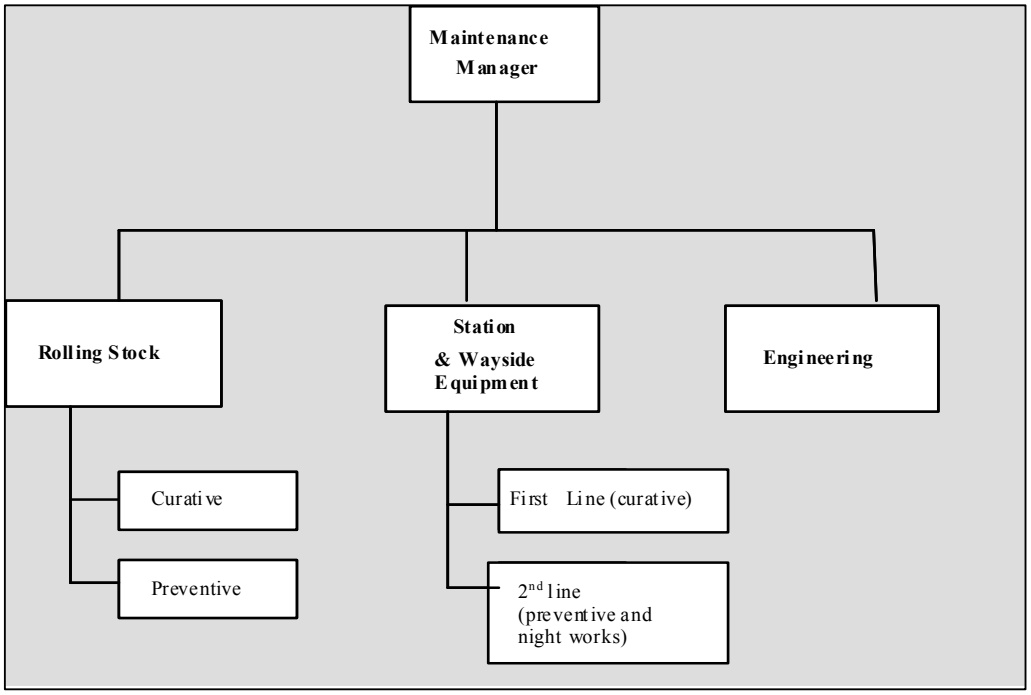
The Administration Department

6.3.4 The typical structure for the administration department is as shown below.



The Maintenance Department

6.3.5 The typical structure for the administration department is as shown below. Within the maintenance department are 3 main divisions: rolling stock; stations & equipment; and engineering.



6.3.6 It is recommended that the maintenance department is planned as follows:

- The operation staff is lightly involved in the maintenance process: vehicle reconfiguration by drivers, equipment reset or restarts by station staff. This is fundamental to guarantee the availability of the transit system. These operations are strictly documented by procedures and do not require any special tool equipment
- The maintenance division groups all the maintenance activity: rolling stock, wayside and stations equipment and maintenance engineering.
- The maintenance team is internal and sized to produce the first levels of maintenance. This structure allows the operator to control the maintenance activity (corrective and preventive) and its reactivity.
- The heavy patrimonial maintenance is contracted
- The line replaceable units fixing or electronic modules is contracted, for such a system the number of annual failure is low and does not justify the creation of an internal workshop for this activity.
- The computers maintenance is contracted
- The purchasing and contracts management will be under the responsibility of the engineering team

Rolling Stock Maintenance

6.3.7 The team performs the preventive and corrective maintenance (Level 1 & 2) on the rolling stock equipment and maintenance vehicles in adherence with the maintenance plan and procedures. The team is in charge of providing Vehicles with the defined level of performance (availability, reliability and safety) to operation. The team is also responsible for the maintenance of vehicles used for track or tunnel maintenance.

6.3.8 Field of Technical Skill are as follows:

- Rolling stock
- Maintenance vehicles
- Onboard ATO/ATP
- Onboard Communication equipment

6.3.9 Detailed staffing for the Rolling Stock maintenance team includes, and numbers will be increased to suit the numbers of trains in operation:

- One maintenance manager and one maintenance supervisor.
- Team 1: 1 team leader, 3 technicians
- Team 2: idem team 1
- Team 3: 2 team leaders, 4 technicians and 4 workers

Stations and Wayside Maintenance

6.3.10 The maintenance group is in charge of the maintenance of the entire wayside and stations equipment, it is divided in groups:

- Teams 1 and 2: these groups are responsible of the continuity of service they are in charge of repairing failed equipment such as the impact on availability is as low as possible. They work early in the morning and late in the evening to cover the operation period. If no corrective maintenance is needed these teams are available to produce preventive maintenance.
- Team 3 is mainly in charge of producing the preventive maintenance, and is available for corrective maintenance if needed. This team includes a special competency for structure inspection.
- Night team: this team works out of operation hours and is dedicated to tracks and wayside equipment. They can be called on heavy failures during the day.

6.3.11 Detailed staffing for the stations and wayside maintenance team:

- One maintenance manager.
- Team 1: 2 team leader, 6 technicians
- Team 2: idem team 1
- Team 3: 2 team leaders, 6 technicians and 6 workers
- Night team: 3 team leaders, 12 technicians and 10 workers

Maintenance Engineering

6.3.12 This department supports Maintenance Division and all technical studies of the company. The activities of maintenance support are:

- To define maintenance policy to improve technical and economic productivity
- To organize and analyze feedback of experience
- To organize training sessions for maintenance staff
- To manage subcontract maintenance and manage the spares purchasing
- To support maintenance teams in computer maintenance and administrate the MMS database
- To support maintenance teams in complex technical problems
- To elaborate and update maintenance procedures
- To manage equipment renewal and projects

6.3.13 Detailed staffing for the maintenance engineering team:

- One maintenance engineering manager.
- Warehouse: 2 team leader, 2 technicians and 2 workers
- Maintenance engineering : 9 team leaders

7. CAPITAL AND OPERATIONS & MAINTENANCE COSTS

7.1 Capital Cost Estimates

Basis for cost estimates

7.1.1 The estimates of capital cost were based on results of preliminary engineering design of the Consultant, quantity estimates of each work item and studies on construction planning and method as described in the preceding chapters. Total investment cost was calculated for the line from Ben Thanh (excluding the station as this is to be constructed under a separate project) to Tham Luong and access to Tham Luong depot, and 10 stations, 9 underground stations and 1 elevated station.

Quantities Estimates and Unit prices

7.1.2 Table 7.1 summarizes the main quantities of each category of works and equipment. Unit prices of construction works are based on material cost, equipment cost, labour cost, administration cost and profit for detailed work items.

Table 7.1 Main Quantity of Works Estimates

Item	Quantity
Overall length of line including connection to depot	**11.691 km**
Overall length of underground line including stations and garage	9.463 km
Overall length of elevated line including connection to depot	1.713 km
Overall length of at grade line (part of connection to depot only)	0.325 km
Overall length of open cut tunnel (from underground to elevated)	0.19 km
Main Line (not including depot link)	
Length of bored tunnel section (single bored)	6.586 km
Total length of bored tunnels	13.172 km
Cumulative length of underground stations including crossover	2.877 km
Length of tunnel in open cut section	0.19 km
Length of elevated section	0.955 km
Link to Depot	
Length of elevated section	0.758 km
Length of at-grade section	0.325 km
Stations	
Number of underground stations	9[1]
Number of elevated stations	1
Cross Passages	
Number of large cross passages	14
Number of small cross passages	2
Equipment	
Trains (opening year)	12 x 3-car trains
Repair and maintenance equipment in depot	1 set

Note (1): Not including Ben Thanh Station

Construction and Equipment Costs

7.1.3 Civil works construction and equipment costs are based on the above items. This does not include land use cost and cost for removal and relocation of technical infrastructure works which are included under a separate item. The equipment costs include all non-system related and system related electrical and mechanical equipment, and rolling stock (12 x 3-car trains plus spares). Depot costs includes civil works and equipment for the depot complex, including rolling stock stabling areas, maintenance areas, and administrative and operations areas, and fencing.

7.1.4 Unit prices are based on current price indicators for middle of 2010. For special works such as underground boring, railways equipment installation (which have never been carried out in Vietnam before), unit prices are calculated according to the Consultant's assessment of Ho Chi Minh City's conditions and experience international experience.

7.1.5 Costs for ticketing systems are based on an extension of the Line 1 system (refer to previous chapter). Additional costs for design, supervision, etc are based on industry standard rates

Table 7.2 Construction and Equipment Cost Estimates (in US$ million)

ITEM	COST US$ M excl VAT 10%	VAT 10% US$ M	TOTAL US $ M
Civil works & equipment			
- TBM tunneling	168.8	16.88	185.68
- cut & cover tunnels (not incl Ben Thanh garage etc)	40.3	4.03	44.33
- viaduct (incl depot spur) + at grade (spur line to depot)	11.4	1.14	12.54
- stations	204.5	20.45	224.95
	425.0	**42.5**	**467.5**
Non-system E&M			
- track work incl 3rd rail	50.9	5.09	55.99
- other (HVAC, fire protection, escalators, etc)	38.1	3.81	41.91
	89.0	**8.9**	**97.9**
System E&M			
- power supply	47.7	4.77	52.47
- signaling system	29.7	2.97	32.67
- telecommunication	17.5	1.75	19.25
- platform screen doors	8.6	0.86	9.46
- electrical and other systems	6.1	0.61	6.71
	109.6	**10.96**	**120.56**
Rolling stock			
- 12 x 3-car trains + parts	60.1	6.01	66.11
Depot			
- depot civil works and equipment	42.0	4.2	46.2
Ticketing			
- ticketing and AFC systems	14.9	**1.49**	16.0
TOTAL Civil Works & Equipment (1)	**740.6**	**74.06**	**814.7**
Pre-Investment Stage Costs			
- consulting services	58.55	5.85	64.40
- incremental administrations	16.616	1.384	18.0
- capacity development, social development costs	2.54	0.254	2.8
- integrated sustainable urban transport	3.54	0.35	3.9
	81.25	**7.84**	**89.09**
Resettlement Costs			
- main line	115.1		115.1
- depot area	12.5		12.5
	127.6		**127.6**
VAT (see schedule)			
Contingencies (physical + prices)	**232.0**		**232.0**
Financing Charge	**111.1**		**111.10**
TOTAL COST	**1292.6**	**81.9**	**1374.5**

Note - price contingencies and financing charge may change slightly depending on final details of financing plan (see chapter 10)

Resettlement Costs

7.1.6 Land acquisition and resettlement costs were estimated based on the preliminary land acquisition requirements estimates and market rates, as described in this report.

Taxes, Duties and Contingencies

7.1.7 Physical contingencies are allowed for at 10% of the total capital infrastructure and system costs, resettlement costs and consultancy and general item costs. These allow for uncertainties due to the construction of other risks (e.g. geology, ground conditions, major service diversion, changes in market conditions, etc). Price contingencies and financial charges during construction are also added to estimate the total project costs, and are discussed further in the later chapter.

7.1.8 VAT has been calculated based the rates as shown in Table 7.3 below. Cost items other than those shown in the table, such as rolling stock and resettlement cost, are 0% VAT.

Table 7.3 Application of VAT

VAT (10%)	
Civil works:	all civil works
Non-system E&M:	Lighting
E&M systems:	Earthing/protection
Depot:	Depot civil works and equipment
Consulting services:	Detail design, Supervision
Incremental administration:	Other general items
VAT (5%)	
Non-system E&M:	Pumping, Heating, ventilation, aircon, Escalator, Elevator
E&M systems:	Aux voltage transformers & high voltage station

7.2 Operating and Maintenance Cost Estimates

7.2.1 The annual operating and maintenance (O&M) cost estimates for Line 2 have been estimated for notional design years of 2015, 2025 and 2035. The O&M cost comprises two main categories of costs:

- Staff costs, including administrative, operation, maintenance and engineering
- External costs, including electricity, materials, consumables and insurance.

Staff Costs

7.2.2 The annual personnel cost is calculated following the organization and staffing described in the earlier chapter. The organization is a simple structure with a General Management and three line departments: operations, maintenance and administration.

7.2.3 For the purpose of staff cost estimation, the staff was split in the following 6 categories, with estimated annual salaries in US$ for end 2009 as shown (based on exchange rate of US$1 = VND19,000):

- Employees in managing position (US$6,030)
- Administrative and managerial clerks, OCC supervisors, engineers (US$5,250)
- Drivers (US$4,730)
- Station supervisors, skilled workers (US$3,460)
- Secretaries, drivers, platform ticket controller, security staff(US$2,570)
- Unskilled workers (US$2,340).

7.2.4 Staff salary costs were increased (in real terms) in future in line with projected increases in GDP per capita.

External Costs

7.2.5 The electricity consumption is based on trains (traction and auxiliary on-board equipment), stations and depot consumptions. The onboard auxiliary equipment consumption is function of the time when trains are switched on. It was considered 15 hours a day for each train and 50kWh for the auxiliary consumption. For underground stations, the required power supply was estimated in 950 kW. For elevated stations, the required power supply was estimated in 270 kW. For depot, it was considered a total power consumption of 1 MWh. Account was also taken of the savings in electricity consumption at stations with platform screen doors.

7.2.6 The weighted average (based on train operating hours) electricity price, considering it will be supplied by a voltage of 110 KW, is estimated at 819 VND/kWh at 2009 prices.

7.2.7 The consumables category includes all the necessary material and fluids to operate and maintain the system: lubricant materials, sand, water and detergents. This category also includes the power supply for administrative and maintenance buildings (lighting, power, air conditioning). Based on experience, this cost item is assumed to be 15% of staff cost.

7.2.8 This materials category includes all the material pieces to be bought for the maintenance activity, the outsourced maintenance for specific equipment such as electronic parts, optical fibre components or computers, with 70% considered of foreign source and 30% of local source. The estimated amounts are elaborated from costs database from various similar systems (infrastructure, trains and fixed equipment).

Insurance

7.2.9 The cost of general insurance coverage was based on comparison with similar systems in operation in Asia. Insurance costs were assumed to increase in proportion to MRT patronage.

Annual O&M Cost Estimates

7.2.10 Table 7.4 provides the annual O&M cost estimates for 2015, 2025 and 2035, in 2009 prices.

Table 7.4 Annual Operating and Maintenance Cost Estimates

Item	Costs in Year (US$ millions)		
	2015	2025	2035
Staff costs	3.06	5.14	7.30
Consumables (15% x staff costs)	0.46	0.77	1.09
Electricity consumption	5.90	11.12	16.44
Materials (estimated)	2.88	2.95	3.09
VAT (10% x material costs)	0.29	0.30	0.31
Insurance (estimated)	2.00	5.54	7.82
TOTAL COSTS PER YEAR	**14.59**	**25.82**	**36.04**

8. SOCIAL SAFEGUARDS

8.1 Land Acquisition and Resettlement

Resettlement Framework

8.1.1 In compliance with ADB requirements for MFF Loan Processing, a draft Resettlement Framework (RF) has been prepared to guide land acquisition and resettlement activities in all components of the project, including those funded by other funding agencies and local funds of the Government of Viet Nam (GOV). In consultation with MAUR PMU, a revised draft of the RF was prepared under this supplemental TA. This revised draft has been translated to Vietnamese and submitted to MAUR Management for comments and discussion with ADB and other donors.

8.1.2 Earlier, a draft Resettlement Plan (RP) was prepared under ADB TA 4862-VIE that covered the estimated land acquisition and resettlement impacts on the depot-link and the main line. Based on the preliminary alignment and design, a census of affected households and two rounds of consultations were conducted. The draft RP will be updated under Tranche 1 of the MFF once the detailed design has been finalized and detailed measurement surveys (DMS) have been completed.

8.1.3 In January 2010, a due diligence assessment was conducted on the completed and ongoing land acquisition activities at the 25.3 hectare depot site. The overall compensation plan for the 25.3 hectares of land, of which 24.9 hectares is agricultural land and 0.4 hectare is residential land, with a total amount of 165 billion VND has been approved in March 2009. Compensation/assistance provided to households affected at the depot site include compensation for loss of income from agricultural production, and loss of structure, as well as, allowances for occupational change and bonuses for timely hand-over of assets. An independent land/structure appraiser was engaged to determine the current market values of the affected assets.

8.1.4 Preparation, review and monitoring of RPs prepared under the Project will be based on the RF approved for the Project. Likewise, the approval of civil works contracts will depend on the satisfactory completion of RP implementation.

Impacts of the Project

8.1.5 A total of 69 households and 12 factories will be affected at the depot site. The assessment noted 9.89 hectares of agricultural land has been acquired. Thirty-nine households with agricultural lands have already received their compensation. Plots owned by 51 households have been subjected to DMS. Two factories have also been surveyed and are currently preparing their relocation proposal. The District 12 Compensation Board is currently conducting detailed inventory of the affected lands and structures of 30 households and 10 factories, in preparation for compensation payments and relocation assistance. Twenty-five households will need to relocate. Only a small portion (30%) of the affected agricultural land at the depot is actively used for agricultural. These portions are planted with vegetables and lotus. The majority of the affected agricultural land has been idle for a number of years.

8.1.6 Based on the preliminary design, another 0.753 hectare will be needed for the depot-link and 1.46 hectares for the stations. The census and inventory of losses at the depot-link and main line conducted in 2008 under ADB TA 4862-VIE identified 403 properties to be affected by land acquisition that would impact on 376 private households (HH) and 27 public properties. 322 shops will also be displaced. Several utilities, such as water supply system, drainage, electricity network, telecommunication, etc. will also be affected.[8]

[8] MVA. ADB TA 4862-VIE. Ho Chi Minh City Urban Mass Translit Line 2 Project: Consultant Final Report (Revised). February 2009, Ho Chi Minh City

8.1.7 **Legal and Policy Framework:** The legal and policy framework for compensation, resettlement and rehabilitation under the Project is defined by the relevant laws and regulations of the GOV and the ADB policies[9]. The principal Vietnamese legislation includes the Land Law of 2003, providing Viet Nam with a comprehensive land administration law; Decree No. 197/2004/NĐ-CP, on compensation, rehabilitation and resettlement in the event of land recovery by the State, as amended by Decree No. 17/2006/NĐ-CP; Decrees No. 188/2004/ND-CP and 123/2007, specifying the methods for land pricing and land price frameworks in the event of land recovery by the State and Decree no 69/2009/NĐ-CP dated 13/8/2009 providing additional guidelines on land use, compensation, support and resettlement.

8.1.8 ADB Policy on Involuntary Resettlement aims to: (i) avoid involuntary resettlement wherever possible; (ii) minimize involuntary resettlement by exploring project and design alternatives; (iii) enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels; and, (iv) improve the standards of living of the displaced poor and other vulnerable groups. In case of discrepancies between the Borrower's laws, regulations, and procedures and ADB's policies and requirements, ADB's policies and requirements will prevail, consistent with Decree No. 131/2006/ND-CP which provides that in case of "discrepancy between any provision in an international treaty on Official Development Assistance, to which the Socialist Republic of Viet Nam is a signatory, and the Vietnamese Law, the provision in the international treaty on ODA shall take precedence" (Article 2, Item 5).

8.1.9 **Project Entitlements:** People and other entities affected by Project activities will be compensated and assisted based on the entitlement matrix developed for the Project. The Entitlement Matrix combines those provided under local legislation and those required under ADB Policy. Persons occupying/using the affected land/asset prior to the cut-off date are entitled to be compensated/assisted regardless of their tenure on the affected land. These entitlements may be enhanced, as necessary, following the conduct of DMS and consultation with APs to ensure that their livelihoods and living conditions are restored, if not improved. The draft Entitlement Matrix is shown in Table 8.2.

8.1.10 **Resettlement Site Development:** 3.39 hectares beside the depot site will be developed into a Resettlement Site for the Project and other development projects in the City. The Resettlement Site will have 100 plots and 450 apartment units. For the APs affected at the depot site who need to relocate, three options are presented: transfer directly to the site (if the site is ready by April 2010), transfer temporarily to another site while waiting for the completion of the resettlement site, or move to another existing resettlement site at Tin Phong area (located about 500 m from the resettlement site). Households losing idle agricultural land may also opt to receive residential plots or apartments equivalent to 10% of the land lost.

8.1.11 **Participation, Disclosure and Grievance Redress**: Consultations were organized earlier during the draft RP preparation for the access link and main line between December 2007 to August, 2008 with APs and concerned agencies. Project policies and options with regard to relocation, compensation and income restoration have been discussed during the meetings. Concerns and suggestions raised by the affected people were elicited and incorporated in the draft RP for the depot-link and main line, as well as for the draft RF for the entire project. In March 2010, consultation was also conducted at the depot site to solicit the views of affected persons and other stakeholders**,** provide information about the Project and create opportunity for affected people and stakeholders to clarify information. The consultation provided opportunity to fill-in gaps in the information disclosure and enabled the APs to express the relocation preferences. Concerns from the affected factories and impact on their workers were also noted.

[9] The ADB Involuntary Resettlement Policy (1995) was consolidated with its Policy on Indigenous Peoples (1998) and Environment Policy (202) into one Safeguard Policy Statement dated June 2009. ADB Policy applies to all ADB-financed and/or ADB-administered sovereign and non-sovereign projects and their components regardless of the source of financing. ADB will not finance projects that do not comply with its Safeguard Policy Statement

8.1.12 Additional consultations will be done during the updating of the draft RP. Information dissemination and community consultation may include participatory rapid rural appraisal and consultation of relevant parties, visits to affected households, community/group meetings, focused-group discussions and socioeconomic surveys. The approved RF and RP will be submitted to ADB for uploading into the ADB website. Information brochures (written in Vietnamese) summarizing impacts, Land Acquisition ad Resettlement LAR policy, and grievance procedures will be sent to all APs. MAUR shall be responsible for widely presenting the Project to the public through multi-media means (i.e. central and local television programs, newspapers) and posting in public areas. A clear mechanism of complaint and settlement is also developed based on the laws of Viet Nam through three main steps from Ward to the City levels. Complaints that cannot be resolved at the HCMC-PC levels will be referred to the Court for final resolution. A Grievance Facilitation Unit (GFU) will be established at MAUR to receive, record, follow-up/facilitate, and report on complaints from APs and the public.

8.1.13 The funding for all compensation, assistance and resettlement will be financed by the City. Finalization of the RP and external resettlement monitoring will be funded under the Tranche 1 of the ADB MFF. Table 8.1 shows the estimated resettlement cost for the Project.

Table 8.1: Cost Estimate to Implement the RP

No	Item	Total (in 1,000 VND)	Total (in USD)
1	**Depot**		
1.1	Compensation for land, including crops/trees	165,564,348	9,390,730
1.2	Compensation for houses/other structures	22,483,132	1,275,232
1.3	Allowances	1,233,541	69,966
1.4	Training allowance for occupational change	9,464,051	536,796
1.5	Relocation/reconstruction of infrastructure	3,500,000	198,518
1.4	Cost for relocation administration and assessment	3,821,050	216,728
	Subtotal: Depot	206,066,122	11,687,971
2	**Depot-link and Main Line**		
2.1	Compensation for land	1,371,919,000	77,814,584
2.2	Compensation for houses	196,010,100	11,117,593
2.3	Compensation for secondary structures (auxiliary equipment)	2,335,600	132,474
2.4	Compensation for public facilities	23,000,000	1,304,549
2.5	Allowances	221,544,180	12,565,879
2.6	Cost for relocation administration and assessment	7,400,000	419,724
	Subtotal: Depot-link and Main Line	1,822,208,880	103,354,803
3	**Resettlement Site Development**	to be determined	tbd
4	**External monitoring**	990,000	56,152
5	**Contingencies** (1% of items 1, 2 3, and 4)	20,293	1,151
	Total	**2,029,285,295**	**115,100,083**

Source: Project team.

(NB: cost of the development of the resettlement site in Tham Luong needs to be added around 12.5 million US$)

Table 8.2 Draft Entitlement Matrix

Type of impact	Eligibility/ application	Entitlement policy	Implementation Measure
1. Agricultural land	All APs with LURC or long-term land use rights	Cash for land -cash for land compensation at replacement cost. Higher compensation rate for agricultural lands that are interspersed with residential land or within residential area. Residential land for agricultural land -APs losing agricultural land may opt to be compensated with a residential plot at the resettlement site at a ratio of 1:10.	-Carry out DMS, approve compensation plan and pay AP at replacement value for affected properties. Disseminate compensation plan to APs and post at the Ward office as required by law.
2. Residential land	All APs with LURC or, in absence of it, APs recognized as stable occupants by local authorities or simply APs included in the census.		
2.1 fully affected (includes APs whose remaining area is less than 15m^2 or from 15m^2 to 36m^2 but do not want to stay. (Viet Nam standard 353-2005)		Land or apartment for land: -allocation of plot or apartment according to DPC-approved allocation regulation. Area of the plot or apartment is at least as the same as the lost plot. -Land provided with joint title to husband and wife Cash for land: -Cash for land compensation at replacement cost. -APs who manage their own relocation will receive an additional assistance based on the areas of affected houses as stipulated in the relocation policy of HCMC. -APs will be allowed to pay in installments with low or zero interest if the compensation package for lost land is not enough to buy plots or apartments at new sites which have been developed by authorities of HCMC.	-Clearly inform APs about the sites and apartments which will be developed or are available in each affected district. -Develop relocation sites and apartment units at the affected districts or within HCMC for APs. -allocate replacement plots or apartments at least 5 months prior to land clearance for the project. The site must be ready for housing and with physical infrastructure and social services according to Viet Nam standards. LURC will be granted to APs with no cost. -Pay other allowances at least 1 month prior to displacement. -Carry out DMS, approve compensation plan and pay APs at replacement value for affected properties. Disseminate compensation plan to APs and post at the Ward office as required by law.
2.2 Partially affected (APs whose remaining area is more than 15m^2 and less 36m^2 and do not want to relocate and PA with a remaining area of 36m^2 or above.		-Cash compensation for affected area at replacement cost. -Cost for owners to rent equivalent properties during the time that reconstruction is not possible (due to station construction) and during the period of reconstruction.	-Carry out DMS, approve compensation plan and pay AP at replacement value for affected properties. Disseminate compensation plan to APs and post at the Ward office as required by law. -Pay compensation at least 5 months and allowances at least 1 month before land is acquired for the project.

Type of impact	Eligibility/ application	Entitlement policy	Implementation Measure
3. Structures on land (house; substructures)	All APs with structures on the affected land including those without sufficient basis for compensation for land (i.e. encroachers).	-Cash compensation for existing building or structure based on full replacement cost (cost of new building material). -If remaining structure is no longer viable, compensation will be for the entire structure. -For partially affected structures, compensation will include support for repair to bring back to original status. -Structures constructed after the cut-off date will be paid cash compensation for demolition equivalent to 10% of the value of a new structure. -APs with affected houses will be provided allowance for renting equivalent premises for the period of station construction plus 6 months for reconstruction of the structure. -self-relocation allowance of 50,000,000 VND/hh for households subject to relocation who choose to manage their own relocation.	-No deduction in compensation will be made for salvageable materials. -District to carry out DMS to identify if remaining area is sufficient to rebuild the structure or not. -DCB to disseminate compensation plan and post at the ward office. -APs have a choice (i) cash for self-construction for their structures or (ii) request the project to provide new structures at the resettlement site. -Compensation will be provided to APs at least 4 to 5 months prior to displacement depending on type of housing. -Pay compensation at least 2 months before deadline for house demolition.
4. Rented structures	4.1 APs renting the affected house or building from private owners	-Cash compensation equivalent to the remaining value of the house rent contract not exceeding the house rent value for 3 months -Transportation support to a new location (Article 27, Decree 197/2004/ND-CP	
	4.2 Owner of the rented building	-cash compensation for income loss from rental of structure.	
5. Basic housing/building facilities (water supply connection, cable, telephone, power, etc)	All APs (owners or lessees of the structure)	-Compensation for cost of installation and connection fees	-compensation will be paid at least 1 month before deadline for house demolition.
6. Affected business	-All APs who run businesses (including APs who lease structure to operate their business) (includes those with registration certificate or those certified by local authorities)	-Cash compensation equivalent to 30% of one-year net-income based on a 3-year average based on certification from the Tax Agency. -Cash assistance to change business (values vary depending on the cost of the new business)	-Non-registered businesses will be assisted in registering so that they can be compensated based on legislation. -AP proposal to change business will be reviewed by the District Social Affairs Office.
7. Workers/staff of affected business	All workers who are employed by the affected manufacturing or business enterprise	-Cash compensation equivalent to 6-months minimum basic salary level plus grade of work as stipulated in current regulations. -If the worker cannot be rehired by the original employer, the worker will be assisted to find new jobs similar to their previous job in the same or neighboring areas.	-The census will record all employees/workers of the affected businesses, including the duration of work disruption (permanent or temporary) to determine eligibility and amount of compensation.

Type of impact	Eligibility/ application	Entitlement policy	Implementation Measure
8. Crops	Landowners/renters of agricultural lands who plant/grow crops on the affected land	-Cash compensation based on the average market price of the crop.	Identify through DMS and compensate at least one month before acquiring the land for the project. Advance notice should be provided to APs with crops on the date of acquisition so they can have sufficient time to harvest their crops.
9. Trees	Landowners/renters of land who plant the affected tree	-Cash compensation at replacement cost.	Identify through DMS and compensate at least one month before acquiring the land for the project.
10. Tombs and graves	APs who have affected tombs and graves	-Cash compensation to cover cost for excavation, movement, reconstruction and other reasonable direct costs. -In case the City has not land for transferring the tomb or if the owner opts to transfer the tomb himself, the owner will be compensated and additional fee of 3,000,000 VND/tomb	
11. Public facilities (electric poles, telecom, irrigation system, ward/village structures, pagoda, etc.)	Owners of the affected assets	-Cash compensation at replacement cost for the affected facilities or reconstruction, reinstallation, if required by the owners	-compensate in cash and with time sufficient for reconstruction/ reinstallation. -compensated in kind (if required by the owners) before demolishing the affected structure.
12. Affected vulnerable groups (women-headed HH, poor families, disabled HH head, etc.	All vulnerable APs	Additional assistance as defined by the laws and policies of HCMC (3,000,000 VND/hh)	-Pay in cash at least one month before land acquired for the project. -Implement programs designed for vulnerable APs.
13. Relocation transition period	All APs who need to relocate	-Displacement support of 3,000,000 VND/hh if relocating within HCMC or 5,000,000 VND/hh if relocating to another province. -house rental support not exceeding 3,000,000 VND/month/hh (for 6 months if the house is totally affected, and for 3 months if the house is only partially affected)	
14. bonus for timely handover	All APs with affected land and structures		
	a. households	Cash bonus of 1,000,000 to 5,000,000 VND/hh depending on the severity of impact and timeliness of handing over the affected land/asset	
	b. factories	10.000 VND/m^2 but not lower than 5,000,000 VND or higher than 500,000,000 VND	
15. temporary impacts during construction	APs affected by temporary land acquisition/impacts	-cash compensation for affected structures, and temporary loss of income -restoration of land to its original state or better condition when there is no project.	

8.1.14 **Implementation Arrangements:** Responsibilities of all relevant authorities and institutions from Central to Commune/ward levels are clearly described in the Decree 197/ND-CP-2004 and Decree 84/ND-CP-2007 as following.

- The HCMC PC and its relevant departments are responsible for reviewing, approving land acquisition; compensation costs at replacement values, relocation site development and directing the lower levels in implementing the RP.
- The MAUR under the HCMC PC will oversee the preparation and updating of the RF and RPs, disclose resettlement documents to the APs and the public, secure budget for implementing RPs, internally monitor implementation of RPs, assist in resolving grievance and complaints of the APs, and prepare regular reports.
- District People's Committees, District Compensation Committees (DCC), people's committees of affected wards will be responsible for carrying out DMS and compensation plans and payment for each AP as well as settling complaints from APs.
- An External Resettlement Monitoring Agency (EMA) will be engaged to objectively report on the implementation and completion of the RP activities.

8.1.15 It is proposed that a Social Safeguard Team (SST), under the Vice Chairman for Line 2 be formed for the Project. The SST will be headed by a Senior Social Development and Rehabilitation Officer (SSDRO) who has background in the social sciences, and has experience in preparing, reviewing, implementing and monitoring compensation/ resettlement plans as required by GOV and ADB. The SSDRO will be supported by two technical staff with experience in the field of participation and consultation, gender and poverty reduction, relocation site development, public works and social services, and economic rehabilitation.

8.1.16 The SST will be concurrently designated as the Grievance Facilitation Unit (GFU) which will receive, follow-up and report on a weekly basis all complaints, disputes or questions received about the Project. The SST will develop and maintain a database of complaints received related to the Project.

8.2 Social Analysis and Poverty Assessment

8.2.1 The 2006 Poverty Assessment for Viet Nam noted that the country has maintained high economic growth while significantly reducing poverty. GDP grew by more than 7% in 2002, 2003, 2004 and average of 7.5% in 5 years (2001-2005). In 2009, the country's GDP continued to grow despite the weak external environment. Data from the General Statistics Office showed that poverty rate dropped from 58.1% in 1993, to 37.4% in 1998, 28.9% in 2002, and 19.5% in 2004, while in the same years food poverty declined from 24.9%, to 15%, 10.9%, and 7.4%. Although poverty rates in urban areas, like HCMC are much lower than in rural regions, a significant portion of the population are still living in poverty. Especially vulnerable are the unregistered migrant workers and households from other provinces and those in the informal sector.

8.2.2 The Project is a general intervention, as opposed to a targeted intervention that specifically addresses poverty reduction through interventions at the level of households, specific services, or geographical determinants of poverty. Consequently, a full poverty analysis was not conducted.

8.2.3 HCMC's population now stands at 7.12 million with an average increase of 280,000 person per year. In the districts traversed by Metro Line 2 (Districts 1, 3, 10, 12, Tan Binh and Tan Phu), current population is about 1.8 million. The Project is expected to contribute in reducing bottlenecks in transport infrastructure, ease congestion and improve air quality in the City, although during construction traffic congestion and disruption are expected to be exacerbated.

8.2.4 The population in HCMC is mostly composed of ethnic Vietnamese (Kinh) at about 90%. Other ethnic minorities include Chinese (Hoa) with 8%, and other minorities (Khmer, Cham, Nung, Rhade) 2%. None of these ethnic groups maintain cultural and social identifies separate from the mainstream Vietnamese society fitting the ADB definition of Indigenous Peoples. They have full and equal access to institutions and economic opportunities as the rest of the population. Hence, the Project will not trigger the ADB policy on Indigenous peoples.

8.2.5 There will be both direct and indirect beneficiaries of the Project in HCMC and neighbouring districts. The beneficiaries include students in universities and colleges along the MRT Line 2 alignment, workers and traders traveling between the eastern part of HCMC and the central business district and service/commercial establishments near the Metro Stations. Women, children and older people, who are more inclined to use public transport, are expected to benefit the most from the improved transportation.

8.2.6 Design measures will be needed to ensure safe and convenient access of women, children, older people and disabled. This includes provision of escalators/elevators, and pedestrian overpasses or controlled pedestrian crossings. Provision of women-only coaches may also need to be considered. Motorcycle users (who now account to majority of the current road users) may also be encouraged to use the MRT through the provision of adequate parking area for motorbikes/bicycles (Park & Ride). Provision of designated drop off / pick up and waiting areas will also be needed at the stations to minimize traffic congestion.

8.2.7 Other positive impacts include jobs and income generation from construction and maintenance of the Project, and improved access to markets and social services. The Project is expected to generate considerable local employment, particularly for unskilled labor, although female participation may be limited where worker camps are established, unless the contractors make special provisions available to attract women to the sites.

8.2.8 Epidemiological studies conducted in recent years have shown a slight increase in the prevalence of HIV/AIDs in HCMC especially among the high risk subgroups in the population (drug users and female sex workers). Street children are also at risk. The establishment of workers' camps for migrant workers may increase demand for sex workers and increase the risk of the transmission and spread of HIV.

8.2.9 Related to this, public information leaflets focusing on HIV/AIDS transmission will be distributed at camp sites. Moreover, in order to improve public awareness especially among children and youth population, posters on HIV/AIDS campaign will be put up in strategic spots of the MRT Stations. These initiatives, and others, will be incorporated in the Investment Program in support of the existing Government Program on HIV/AIDs management and reduction.

8.2.10 The summary poverty reduction and social strategy (SPRSS) and the draft Gender Plan have been prepared and are available as separate documents.

9. ENVIRONMENTAL SAFEGUARDS

9.1 Environmental Workstream Overview

9.1.1 Environmental assessments have been carried out for HCMC MRT2 in ADB TA 4862 VIE following *ADB Environmental Assessment Guidelines 2003.* MAUR engaged local consultants to conduct environmental assessments following the Viet Nam Law on Environmental Protection 2006 and GOV environmental assessment regulations and guidelines. However both of the environmental assessments were concluded in 2008; before the requirements of *ADB's Safeguard Policy Statement 2009*[10] (SPS) were known. ADB requires that the operational requirements of the SPS shall be followed by all projects being implemented after January 2010 and all such projects shall follow the revised requirements for environmental assessment in the SPS.

9.1.2 The two environmental assessments have broad similarities in terms of their objectives and approaches but they differ significantly in their content, assumptions and neither environmental assessment meets the requirements for an Environmental Impact Assessment under ADB's SPS (2009).

9.1.3 It is a working assumption of this TA 7343 VIE that the in-depth evaluation and preparation of the full EIA, to follow ADB SPS 2009 guidelines, will be deferred and undertaken under Tranche 1 of the MFF loan for the project. Alternatively the EIA may be completed before Tranche 1 and be financed by European Investment Bank (EIB)[11]. For avoidance of doubt the forthcoming EIA is referred to as the Tranche 1 EIA. The objectives of this section of the report are mainly to identify further studies and additional environmental assessments needed to meet the requirements of ADB SPS 2009.

9.1.4 There are several main areas of concern that the forthcoming EIA must respond to (i) ongoing design changes, (ii) the need to review the EIA approved by Vietnamese authorities (in 2009) because of subsequent design changes, (iii) the need to review the EIA submitted to ADB due to any additional environmental assessment requirements of ADB that derive from the SPS, (iv) adopt a thorough approach to environmental assessment that considers not only all aspect of environmental assessment as required in Viet Nam but that is also in line with all ADB, EIB and KfW requirements for environmental assessment.

9.1.5 This chapter addresses the key concerns for environmental assessment by providing information in five key areas as follows:

- Review of the approved Vietnamese Environmental Impact Assessment report (VEIA) submitted by MAUR under Viet Nam regulations for substantive compliance with ADB guidelines, including identifying the need for further studies to be undertaken (Appendix B1).
- Review of the draft Environmental Impact Assessment (EIA) prepared under TA 4862-VIE and complete the matrix on ADB comments (Appendix B2).
- Clarify updated proposals for arrangements for physical works and implementation that are indicated by consultants for TA 7343 VIE and identify additional adverse and or beneficial impacts of the project emanating from the design revisions. Identify issues that will require further study under Tranche 1 and implementation arrangements for the consulting services (Appendix B3).
- Prepare the Environmental Assessment and Review Framework in accordance with ADB Safeguard Policy Statement (2009) that will be finalized after consultation with Vietnamese authorities, MAUR and ADB (stand alone document).
- Complete and Initial Environmental Examination for the advance enabling works and office construction at the MRT2 Depot (stand alone document).

[10] ADB's Safeguard Policy Statement 2009, Asian Development Bank, Manila, June 2009.
[11] During Fact Finding in March 2010 EIB indicated that it would be possible for EIB to pay for the EIA before Tranch 1 in order to match with EIB procedures,

9.1.6 In addition to the design works on the main MRT Line 2, MAUR also wishes to construct the offices at the depot in advance in Tranche 1. In order to build the offices in Tranche 1 advance enabling works will be commenced as soon as practicable to secure the site and to prepare the site for building. Therefore a fifth element of concern has been identified prior to the approval of the MFF and all necessary environmental assessments for components of Tranche 1 need to be completed before appraisal of the MFF. The advance enabling works and office construction are category B therefore a draft Initial Environmental Examination (IEE) has been completed for the works at the depot and the IEE must be disclosed to the public by MAUR and on the ADB website before appraisal or before the management review meeting if there is no appraisal.

9.2 Environmental Assessments

Review of the Vietnamese Environmental Impact Assessment in comparison to ADB Safeguard Policy Statement 2009

9.2.1 The Vietnamese Environmental Impact Assessment report (VEIA) submitted by MAUR was prepared by local consultants and submitted to Department of Natural Resources and Resource Management (DONRE) and the PC under Viet Nam regulations and received approval from DONRE in May 2009. Several conditions were attached to the approval[3].

9.2.2 The VEIA for the Project has therefore already received approval from GOV via the PC and DONRE[12]. DONRE approved the Project under delegated powers from MONRE, however the extent to which the central environmental authority, MONRE, has been consulted has not yet been ascertained. This should be clarified and included in the EIA.

9.2.3 The key observations with regard to the VEIA and differences between the VEIA and the ADB requirements under SPS are presented in Appendix B1 including a preliminary assessment of how to address SPS requirements.

9.2.4 The Decision document[2] has been unofficially translated by the TA consultants for purposes of this review. There are 5 clauses which are in effect conditions of the approval that have bearing on requirements for further environmental assessment studies.

9.2.5 Clause 1 describes the project and is broadly correct but there are revisions to the design that are pending. DONRE must be informed of any changes to the assumptions that were reported in the approved VEIA.

9.2.6 Clause 2 requires that the “owner” must implement the mitigation measures in the VEIA construction phase and also mentions several standards (TCVN) to be met in the operational stages but in some cases these standards are not those used in the assessment section of the VEIA. [i.e. a more up to date standard needs to be used for assessment]. Additional requirements are included to cover sewage disposal, drainage, waste disposal, fire and emergencies, and an environmental management programme. This is not a major issue as all these are aspects that will be covered in the EMP in the EIA conducted in Tranche 1 to satisfy the requirements of SPS.

9.2.7 Clause 3 requires that the progress on matters in Clause 2 is reported to the “state managing authorities” [DONRE]. This has been clarified and will be included in the EMP in the Tranche 1 EIA to satisfying the reporting requirements of DONRE and SPS 2009.

9.2.8 Clause 4 requires that the DONRE must be informed of any changes to the assumptions reported in the approved EIA, that these changes are reported in a statement to DONRE and that the changes cannot be implemented until DONRE has approved or accepted the statement. Therefore DONRE must be informed of the changes so far and further fine tuning at the detailed design stage. At this stage DONRE have indicated that they will use such a report to decide if there are a lot of changes to the assumptions, if a complete resubmission of the VEIA is necessary, if the VEIA as already approved can be amended or if there is a need for a supplementary EIA for the sections with changes. This is not a major issue but should be clarified before work starts on the EIA in Tranche 1.

[12] HCMC PC DONRE Decision 28 May 2009 to approve the VEIA with conditions

9.2.9 The MRT system will be developed by the Peoples Committee (PC) and the central GOV will also be involved through various approval processes and financing. The key technical and legal steps and the roles of the various government agencies for project approval in environmental terms and environmental requirements for implementation have been broadly clarified. MAUR will need to and is desirous to develop environmental capability for MRT Line 2 and other projects.

9.2.10 Therefore prior to implementation of the subproject packages, MAUR and PC will need to comply with several environmental requirements. This includes (i) specifying the MRT Line 2 subproject scope and any changes to DONRE through submission of a report, in accordance with the conditions of DONRE's endorsement of the VEIA (ii) clarification of any additional environmental assessments required by the DONRE and (iii) completing all environmental assessment and monitoring required by ADB. MAUR has no environmental capability and environmental requirements are usually covered by external consultants, although one officer has been identified for liaison purposes on environmental matters. The need for consulting support including capacity building for MAUR to develop environmental and safety capability has been recognized by MAUR and is supported by DONRE.

9.2.11 MAUR will require support from consultants in the early stages to provide the necessary reports for DONRE and environmental assessments for ADB and ideally capacity building should also be undertaken at this stage in order to develop environmental and safety capability for MRT Line 2 and other future components of the HCMC MRT system. It is recommended that dedicated environmentally trained staff are retained by MAUR and will be instructed and trained by an international environmental specialist (IES) to ensure the environmental performance of the MRT Line 2 and the MFF as a whole.

Review of draft Environmental Impact Assessment prepared under TA 4862 VIE and responses to ADB comments

9.2.12 A description of the MRT Line 2 project environmental baseline conditions, project alternatives, anticipated environmental impacts and mitigation measures, environmental management and monitoring proposals and public consultation and information disclosure are contained in the draft Environmental Impact Assessment (EIA) completed in August 2008 under TA 4862 VIE. However the assessment must be updated in response to changes in the design assumptions and the requirements of SPS.

9.2.13 Responses have been made to the matrix of comments provided by ADB in 2009. The complete matrix is presented as Appendix B2. The consultant has noted that there are numerous aspects of the MRT Line 2 project where the ADB comments require changes and updating of the EIA. Therefore as the EIA will be conducted under the MFF Tranche 1 or before, for purposes of this report, the consultant has made the appropriate reference and added additional information and concerns that have emerged during this study for TA 7343 VIE.

9.2.14 The EIA conducted under TA 4862 does not meet the additional requirements and standards expected for an EIA under the ADB guidelines explained in the SPS. In responding to the matrix of ADB comments provided earlier the consultant has identified many of the detailed requirements to cover all the requirements of SPS in order to complete an EIA in line with current guidelines. This has been referred to elsewhere as a gap analysis and is included in Appendices B2 and B3.

Additional Environmental Assessment Requirements and Issues

9.2.15 The detailed requirements to upgrade the EIA to the required standard are included in the matrix of comments (Appendix B2). However there are some other key issues that have emerged through this TA 7343 VIE that will also need to be addressed in the Tranche 1 EIA. The issues have implications in the design, preconstruction, construction and operational phases. The issues have been brought to the attention of MAUR and it will be necessary for the stakeholders and authorities to make preparations to address these issues. The MFF can be structured to provide the necessary consulting support where MAUR cannot yet take on all these issues and capacity strengthening so that capability can be built for the future environmental management of the maturing MRT system. The Key Issues are listed in Appendix B3.

9.2.16 The majority of the issues can be dealt with by the implementation of a thorough environmental management plan (EMP) and this will be a key integral section of the EIA. The EIA and EMP will be included in the tender documents and contracts. However environmental assessment is also a legitimate part of the design process and there are several issues that need to be dealt with in the design phase. This is especially important because the further design details will be elaborated by design consultants. In due course the design consultants must address design criteria that will reduce environmental impacts to within criteria set by the IFC EHS standards[13] or if they are stricter, the local Vietnamese TCVN standards[14].

9.2.17 The designs must therefore allow the project to operate to meet the strictest of either the IFC EHS standards or the current local Vietnamese TCVN standards. The main areas of concern are the design of the depot and the design of the stations.

9.2.18 The majority of the issues can be dealt with by the implementation of a thorough environmental management plan (EMP). Monitoring budgets as required under both ADB and GOV requirements have not yet been prepared for the main component of HCMC MRT Line 2. These will be included as part of the Tranche 1 EIA that will also incorporate all design assumptions that have subsequently emerged or that are reported in this feasibility study report for TA 7343.

9.3 Initial Environmental Examination of Depot

9.3.1 The Initial Environmental Examination (IEE) has been prepared in accordance with ADB Safeguard Policy Statement (2009) and the ADB operations manual.

Requirements for environmental assessment before MFF approval

9.3.2 The national and local requirements for environmental assessment are described in section 9.2. The ADB SPS and requirements for MFF are to provide environmental assessments for all components of Tranche 1 before approval of the MFF loan. The main components of Tranche 1 are generally consultative but there will also be construction of certain advance enabling works and construction of the offices at the depot that requires categorization, scoping and environmental assessment. The advance enabling works and office construction works have therefore been subject to Rapid Environmental Assessment[15] and review by ADB has indicated that this component is Category B. Therefore and IEE has been carried out for the advance enabling works and office construction.

9.3.3 The proposed works to be financed by ADB will build the offices, but in order to do this other enabling works are required in advance. The enabling works will therefore also include to provide security fencing for the depot site, build the internal access road and a road along the periphery of the site, lighting for the peripheral road and building three guard houses, including filling the site to raise the level to avoid flooding and provide the basic infrastructure for surface drainage.

9.3.4 The design for the depot currently being considered differs from that presented in earlier reports and the VEIA and therefore the changes have been reported in the IEE and should also be notified to DONRE in due course in line with Clause 4 of the approval letter[3].

Location, local environment and design of the Than Long depot

9.3.5 The depot will be located mainly on derelict agricultural land that will be acquired by MAUR for building the depot. This land is located to the north west of Tham Luong adjacent to a canal. At the west end of the site there are some industrial, residential and commercial enterprises that will need to be relocated and this is covered under the social and resettlement work-stream. There are several light industrial enterprises to the east of the site including cement batching plant, a masonry wholesale depot and several other factories. To the north of the depot site there is an existing resettlement area of 38ha that is mainly residential that serves HCMC PC as a decant facility for other projects. Access to the depot for purposes of the advance enabling works will be through the residential area.

[13] Environmental Health and Safety General Guidelines 30th April 2007, IFC, World Bank Group
[14] Directorate of Standards, Meteorology and Quality STAMEQ – http://en.tcvn.vn
[15] Rapid Environmental Assessment submitted to ADB in March 2010

9.3.6 The current depot design plan shows the existing residential resettlement area to the north, the residential and commercial resettlement area that will serve the MRT Line 2 project immediately to the north of the depot boundary and the offices inside the depot near that boundary. The majority of the site under consideration is unused agricultural land that is waterlogged and the surrounding local area is highly disturbed.

9.3.7 There are several depot designs that have been iterated during the course of TA 4862 VIE and TA 7343 VIE. The final design has not been chosen but the constituent parts such as train stabling area, maintenance area, test track, office areas and water treatment facilities have been broadly identified. All designs have been reviewed by MAUR and they will decide later on the final layout in response to the final maintenance and and operational requirements. However the areas identified for the offices are broadly similar in the MVA plan under TA 7343 and other options for the depot design and the area allocated for the offices is on the northern side of the depot and just south of the proposed commercial residential resettlement area. There is not yet a detailed plan for the office layout but the location is consistent in all designs; proposed to be north of the centre of the site, north of the train stabling tracks with views over the depot to the south. This common location for offices is advantageous from an environmental point of view as it would provide a buffer between the proposed commercial residential resettlement area and the operational areas of the depot.

Scale of advance enabling works covered by the IEE

9.3.8 MAUR wishes to construct the administration offices, operational and depot control centre (OCC and DCC) and training centre offices within the depot site before the main operational area of the depot is constructed. This will provide MAUR much needed office space at the inception of the project implementation. A letter was presented to MAUR on 4th February 2010 requesting details of the office buildings and site preparation. MAUR has established funds of approximately 27billion VND for the advance enabling works excluding the office construction for the depot that are described in the IEE.

9.3.9 Although there is not yet a design for the offices the broad scale of buildings (minimum) can be ascertained from the available funding from ADB. It is proposed to utilize about US$ 5million of ADB funding in Tranche 1 on the construction of offices. This is roughly equivalent to or about VND 100billion. Costs for the OCC on the Line 1 project have been estimated at about 5,600,000VND/m^2. If construction costs in future were at a price of say 7,000,000VND/m^2 there would be sufficient ADB funding have about 14,000m^2 (100,000 million / 7.0 million = 14,285). MAUR may well choose to supplement this with local funding. MAUR provided a plan of the area for office development in the Fact Finding in March 2010. The areas earmarked for the advance enabling works will not exceed 34,000m^2.

9.3.10 The areas earmarked for the offices on the preliminary plans for the depot in TA 7343 VIE have footprints of about 14,000m^2. For comparison the planned area for the OCC building for Line 1 is about 6,346m^2. Therefore in considering the area and height of buildings, if the US$ 5million is all used on the construction (without supplementary local funding) it is possible that a single story building could be built on the whole area or a two storey building could be built on part of the area earmarked for the offices. There is no information to suggest that a multi-storey building will be built unless much more substantial funding is made available. Further details are in the IEE.

Environmental impacts and mitigation measures

9.3.11 The construction of the depot offices should be straightforward. The environmental impacts will be typical for building construction. In the location indicated for the nearest works would be about 50m from the nearest residential sensitive receivers to the north and this should allow ample buffer distance to attenuate potential nuisances from dust. Other impacts will require further mitigation measures. Foundations for the site will be required and based on observation it seems likely that some sort of raft foundation on driven piles would be used (subject to design). There would not be any need for blasting. The designs for drainage and sewerage infrastructure and utilities are not available, but MAUR have stated that in principle it should be possible to connect to the utilities that serve the residential area to the north of the depot site without major disruption.

9.3.12 There are access roads that run to the northern edge of the site through the residential area. Unsuitable organic spoil (black soil) from the agricultural areas will also have to be removed and disposed from most of the site. Although the extent of land filling required for roads and the depot is likely to be extensive it will be possible to control impacts from the removal of spoil and the transport fill materials using the mitigation measures indicated in the EMP.

9.3.13 Disturbance to the surrounding areas should be manageable to within acceptable standards there will be a significant buffer distance between the works and the nearest sensitive receivers. The IEE concludes that the construction impacts will be manageable if the mitigation measures are implemented thoroughly. The Environmental Management Plan (EMP - Appendix B of the IEE) is based on the type, extent and duration of the identified environmental impacts. The EMP has been prepared by close reference to best practices and in line with ADB's Safeguards Policy Statement (2009) and Environmental Assessment Guidelines (2003). The effective implementation of the EMP for the depot should be audited as part of the Tranche 1 activities and the executing agency must be prepared to accomplish this with assistance from the PSC.

9.3.14 Prior to implementation of the works in Tranche 1, the IEE and EMP shall be reviewed and amended by the PSC / MAUR environmental staff after the depot office detailed designs are complete and contracting arrangements are known. Although no major additional impacts would be anticipated based on the information provided to date, the EMP should be revised as necessary.

9.3.15 There should be no significant adverse cumulative impacts expected from the advance enabling works for the depot offices and there are no other known planned projects in the area. Although the depot access will be via existing roads, there is not likely to be any significant change to the current pattern of movements caused by the depot construction other that temporary road use by heavy vehicles during construction. These impacts can be adequately managed by the thorough implementation of the EMP.

Information disclosure, consultation and participation

9.3.16 The MRT Line 2 construction has been subject to public consultation and information disclosure with the HCMC Districts along the line throughout the environmental assessment process in TA 4862 VIE and the VEIA was approved by DONRE. The IEE has also included further consultations with the community and official representatives around the depot site in District 12. The planned advance enabling works for construction of the depot offices have been brought to the attention of the local stakeholders through the consultation process to disseminate information on the project and its expected impact. Information has been gathered on the extent of the concerns amongst the community and these have been addressed through appropriate mitigation measures. The feedback received will be used to address these issues at an early stage of project design. Stakeholders included the community living in this area, the local road users, the businesses associated near the depot and the local officials.

9.3.17 The results of the public consultations are presented in the IEE. The local community indicated that it expected the authorities to control the contractors and implement all necessary mitigation measures. The main concerns included preventing damage to local roads and infrastructure, increased road traffic noise and controlling sanitation during construction. During the operational phase the concerns were night-time noise from the depot and flooding that could result from inadequately designed drainage. However the community near the depot indicated they would fully support MRT Line 2 project (i.e. will not interfere with constructions or cause problems but they currently require full resolution of outstanding companion for property losses and livelihood. They also expect employment for the local labour force. These issues are the subject to due diligence via the social and resettlement workstream. The community also fully expect that the necessary arrangements to compensate loss of property are addressed before construction commences.

9.3.18 Concerns with respect to depot design and drainage design and the disturbance of private property and community disturbance have been brought to the attention of MAUR and the relevant parties are well aware of the potential for local disturbance that can result from poorly controlled contractors. The main issues raised have been addressed in the environmental management plan, as far as is reasonably practicable at this stage, and a resettlement framework has been prepared to compensate for the financial problems that can reasonably be predicted at this stage.

9.3.19 Unforeseen impacts will also be captured by the requirements to update the environmental management plan and inform ADB in response to any unpredicted impacts that arise periodically.

Grievance redress mechanism

9.3.20 The construction of the depot offices should be routine. The environmental impacts will be typical for building construction. In the location indicated for the nearest works would be about 50m from the nearest residential sensitive receivers to the north and this should allow ample buffer distance to attenuate potential nuisances. MAUR will establish a Grievance Redress Mechanism (GRM) to facilitate resolution of affected peoples' complaints, and grievances about the project's environmental performance in line with SPS requirements. The details of the GRM will be determined later but it will likely be coordinated by the designated MAUR officer with portfolio for environmental matters in liaison with the peoples committees at the district level. The public will be made aware of the relevant contact numbers and contact person in MAUR through media publicity and notice boards at the local authority offices and depot constructions sites.

Conclusions

9.3.21 The IEE report for the advance enabling works at the depot has assessed the main potential environmental impacts. Environmental impacts associated with the preparation of the site and construction of offices will be mitigated and institutional arrangements for environmental management are available. Additional human and financial resources will be required by MAUR to incorporate the environmental recommendations effectively and efficiently in the contract documents, and it will be included in the overall project costs. The proposed mitigation and management plans are practicable and can be implemented with available methods.

9.3.22 Monitoring activities will need to focus on compliance with permit conditions, recording implementation of mitigation measures, reviewing contractor environmental performance and proposing remedial actions to address unexpected impacts.

9.3.23 The IEE report is prepared based on the preliminary designs for the depot. At the implementation stage MAUR will make arrangements to monitor the schedules of mitigation measures and monitoring programs provided in the IEE report (including Environmental Management Plans and Monitoring Plan). With these measures in place environmental impacts of the Project should be manageable and will not result in any residual impacts which are above accepted environmental standards. No further or additional impact assessment for the depot offices is considered necessary at this point.

9.4 Environmental Assessment and Review Framework

9.4.1 The Environmental Assessment and Review Framework (EARF) has been prepared in accordance with ADB Safeguard Policy Statement (2009) and is presented as a reference report to TA 7343 VIE.

9.4.2 The EARF identifies the scope of the MFF and outlines the policy, procedures and institutional requirements for preparing subsequent sub-projects under the MFF loan. The executing agency (EA) will be the Ho Chi Minh City Peoples Committee (HCMC PC) and the implementing agency (IA) will be the Municipal Authority for Urban Railways (MAUR). The implementation of the Project will be managed by a Programme Support Consultant (PSC) located in the MAUR working in coordination with the relevant departments of MAUR.

9.4.3 Prior to implementation of the subproject packages, MAUR and PC will need to comply with several environmental requirements. This includes disclosure of the subprojects to DONRE through submission of a report in accordance with the conditions of DONRE's endorsement of the environmental assessments required by the Government. MAUR has no environmental capability and environmental requirements are usually covered by external consultants, however, one officer has been identified for liaison purposes on environmental matters and the need for MAUR to develop environmental and safety capability has been recognized by MAUR and DONRE is in agreement with those developments. MAUR will require support from consultants in the early stages to provide the necessary environmental assessments for DONRE and ADB and for capacity building in order to develop

environmental and safety capability for MRT2 and other future components of the HCMC MRT system.

9.4.4 MAUR will allocate sufficient resources to establish an environmental, health, safety and social monitoring cell. Initially an International Environmental Specialist (IES) possibly with the PSC will work with and train environmental officers (EOs) in MAUR. MAUR will facilitate the IES and the EOs will (i) ensure that the EARF is strictly implemented (ii) that environmental assessments are completed in a timely manner and (iii) supervise the implementation of mitigation measures and monitoring programs as part of the EMP. It will be if necessary to hire environment consultants, under the guidance of the IES and the EO and ADB, to prepare IEEs and EIAs for any other follow-up subprojects if included in later tranches. The responsibility for preparing the monthly monitoring report on implementing the EMP will rest with the EO (supported by the IES). The EIA in Tranche 1 will incorporate a revised budget and resources needed to (i) implement the environmental review and screening procedure, (ii) undertake the environmental assessments studies for the follow-up subprojects, (iii) undertake environmental mitigation measures as required and (iv) monitor the implementation of EMPs. A review of the medium and long term capacity building assistance to the EO in the environmental cell will be undertaken annually by independent third party auditors.

9.4.5 Environmental monitoring will consist of regular systematic checking that the above-mentioned environmental management measures have been implemented effectively during each stage of the project.

9.4.6 The Environmental Officer at the local level in MAUR (supported by the PSC and IES) will be responsible for monitoring of the EMP implementation by contractors, and will forward monthly progress reports to PSC, MAUR. The reports will contain progress made in EMP implementation with particular attention to compliance with the principles and matrix set out in the EMP for each subproject. A section on compliance with the EMP will be included in the twice yearly report that is prepared for ADB as a requirement for the loan. The MAUR will submit semi-annual monitoring report to ADB.

9.4.7 General good practice requires that an EMP monitoring report will be completed according to the following schedule:

- a report at the end of project design in Tranche 2. Prepared by IES (in PSC) and EO (in MAUR),
- a report prepared every 1 month during construction, by the contractor,
- a report prepared every 3 months by the IES and EO for DONRE,
- a report prepared every 6 months by the IES and EO for ADB and,
- a yearly report that is prepared by PMISSC/MAUR during operation for as long as the monitoring is specified in the EMP.

9.4.8 Environmental monitoring will consist of regular systematic checking that the above-mentioned environmental management measures have been implemented effectively during each stage of the project.

10. ECONOMIC AND FINANCIAL ASSESSMENT

10.1 Development Context

10.1.1 Rapid and sustained economic growth is a targeted outcome of the Government's 2006-2010 Socio-economic Development Plan (SEDP). For this, accelerated infrastructure development is needed to support economic activities of the private sector, which in the past decade and a half have been the engine of rapid growth and job creation, and continue in this position today. In support of the Plan, ADB's 2007-10 Country Strategy and Program pledges to help the Government remove transport, power and urban infrastructure bottlenecks.

10.1.2 The Government gives a high priority to shaping the future urban transport system of Ho Chi Minh City, an economic main engine expected to account for 40% of national GDP in 2010. Reflecting a desire to pre-empt problems that rapid socio-economic development and income improvements are known to bring, the HCMC urban transport master plan targets a system in which public transport would carry a 40-45% share of the travel demand in greater HCMC, comprised of the city and three adjacent provinces. For a more effective and efficient solution, that public transport would need to offer a combination of comparative travel experience, quality and price likely to produce the desired mode selection by travellers, while reducing cost for the Region's urban transport system. For this intended impact, a single integrated rail mass transit (MRT) and bus system is indicated, with MRT and bus assigned to trunk and minor travel corridors so carrying capacity is matched with intensity of travel volumes.

10.1.3 The master plan identifies alignments for six MRT lines that are to be in operation by 2025. Providing more detail, MVA's January 2008 ridership study identifies four travel corridors suitable for deployment of MRT as a transport mode, on account of their expected volume of travel demand. The corridors have peak demand per hour per direction ranging from above 13,000 to some 25,000 in 2025. Designed to serve the two highest demand corridors, HCMC MRT Lines1 and 2 form natural anchor components in a future HCMC urban transport system.

10.2 Economic Analysis

Introduction

10.2.1 Economic analysis was carried out for the Ho Chi Minh City rail mass transit Line 2 by comparing two alternative scenarios. In the with-project scenario the constructed MRT system is assumed to be operating in the presence of measures implemented to ensure an integrated rail and road urban transport in HCMC. In the without-project case, it is assumed that Line 2 has not been constructed, and measures to ensure coordinated and coherent rail and road public transport in particular, and urban transport in general, are not in place.

10.2.2 The economic assessment covers 7 years of project preparation and construction (2010-2016), followed by a 20 year benefit period for a total of 27 years (2010-2036). Benefits and costs are in 2010 constant prices. Values in the economic analysis are at border equivalent prices for tradable goods, and for non-tradable goods at domestic prices after removing the effects of taxes and subsidies. For the urban rail system, 10.6 kilometre (km) long (9.4 km underground) with an additional 1.1 km link to the depot, the project design and cost effectiveness considerations are described elsewhere in this report. Other cost improvement options that may arise would be addressed during the process of detailed engineering design.

Demand Forecast

10.2.3 For the economic analysis, transport demand forecasts were prepared covering HCMC Region, comprised of HCMC and three adjacent provinces of Long An, Dong Nai and Binh Duong, with a combined population of 9.1 million in 2007. The transport forecasts were prepared using a 4-stage transport model based on the CUBE Voyager software; it allows

simulation of the project impact on daily vehicle and passenger trips, travel hours, distances, speeds, by vehicle category and public-private modal distinction[16] .

10.2.4 A summary of the forecast passenger trips appears in Table 10.1. Private transport passengers are grouped by vehicle type. Trips made purely on foot are excluded. Forecast Line 2 daily boardings are shown for comparison.

Table 10.1 Daily Passenger Trips (thousands) (2017-2036)

Scenario	Year	Car	Motorcycle	Bicycle	Public Transport	All modes	MRT Line 2 (unit: boarding)
WO	2017	2,382	8,063	230	4,586	15,262	n/a
WO	2025	3,293	6,940	235	7,830	18,298	n/a
WO	2036	-	-	-	-	22,751	n/a
W	2017	2,376	8,024	230	4,630	15,260	213,106
W	2025	3,272	6,871	233	7,927	18,303	481,700
W	2036	-	-	-	-	22,757	703,267

n/a – not applicable; W - with project; WO -without project; - means details not estimated
Source: this study

10.2.5 The transport model provided detailed forecasts for two design years, 2015 and 2025. For the years following 2025, the design of the Line 2 service operation assumes an annual patronage growth of 3.5%, which is in line with expected long term average income growth in the HCMC Region. To forecast the project's impact for the years following 2025, the same assumption was applied to observed correlations across the modelled years among forecast Line 2 daily ridership and total daily vehicle travel time and distance with and without the project. The result is summarized in Table 10.2.

Table 10.2 Expected Impact over Time of the Project on Travel in HCMC Region

Indicator (average annual growth rate)	2017-25 model	2025-35 extrapolated
HCMC Region gross regional product	8.5%	5.5%
MRT Line 2 daily patronage	13.3%	3.5%
Total daily travel hours saved	14.3%	3.5%
Total daily travel kilometers saved	11.1%	3.0%

Source: this study

10.2.6 For demographic trends extrapolation and travel costs projection, the transport model assumes an average annual growth of gross regional product (GRP) in HCMC Region of 8.5% for the period 2001-2025. For the period 2025-35, a 5.5% rate of growth is assumed for the analysis.

10.2.7 Table 10.3 shows historical growth patterns of GRP in HCMC (ie excluding the three provinces) and nation-wide GDP. Excluding the years 1998-2000, in which the Asian financial crisis took its toll, trend extrapolations of the two time series in Table 10.3 could be taken as natural upper and lower confidence limits when projecting growth for the HCMC Region. The transport model growth assumption of 8.5% for HCMC Region is seen to be close to the lower limit.

Table 10.3 Historical growth of gross regional product in HCMC (% per annum)

Area	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
HCMC	12.1%	6.2%	9.0%	9.5%	10.2%	11.2%	11.6%	12.2%	12.0%	12.0%
Vietnam	5.8%	4.8%	6.8%	6.9%	7.0%	7.2%	7.5%	8.4%	8.2%	8.0%

Source: Demand Study

Costs

10.2.8 The project economic costs were derived from financial construction and equipment costs for capital cost, and recurrent financial operation and maintenance (O&M) cost for recurrent O&M cost.

[16] For details of model assumptions and procedures see HCMC Master Plan Ridership and Revenue Forecast Study, January 2008, technical paper prepared for ADB TA 4862 VIE ('Demand Study').

10.2.9 The project capital cost includes the cost of construction, equipment, project administration, design and management consultancy, and land acquisition and resettlement compensation. The equipment cost includes acquisition in 2020, 2025, 2030 and 2035 of new rolling stock to expand service capacity. It also includes the cost of mid-life refurbishment of rolling stock and replacement of electrical and mechanical (E&M) systems at expiry of a 15 year useful life.

10.2.10 Economic costs exclude taxes, duties, price contingencies, interest during construction but include physical contingencies. The built MRT infrastructure has a typically long economic life of 100 years for underground tunnel and rail structures, and 50 years for above ground rail and depot structures, while equipment life is 30 years for non-system E&M equipment such as railway tracks. Rolling stock has a 30-year useful life, and other E&M systems 15 years. Table 10.4 summarises the project capital cost estimate.

10.2.11 The project investment cost of $1,374.5 million excludes the cost of the main HCMC MRT network interchange infrastructure, Ben Thanh station and garage. Likewise, the investment cost in institutional capability building for sustainable transport, a cost to achieve total improvement in urban transport in HCMC Region, is also excluded.

Table 10.4 Project Capital Cost Estimate ($ million)

Year	Construction	Equipment	Other	Land and resettlement	Total
2011	2.1	0.0	8.1	0.0	10.1
2012	46.7	0.0	60.2	63.8	170.7
2013	97.6	30.3	93.2	63.8	284.9
2014	142.2	69.6	110.1	0.0	322.1
2015	157.2	82.1	135.1	0.0	374.3
2016	21.3	91.6	100.8	0.0	213.7
Investment	**467.1**	**273.6**	**507.5**	**127.6**	**1374.5**
2017-2026	0.0	82.5	0.0	0.0	82.5
2027-2036	0.0	374.2	0.0	0.0	374.2

Note: Other fee including: Consultant services Administration taxes & duties, Contingencies (physical & prices) and Financing charges.
Source: this study

10.2.12 Recurrent O&M costs are made of up of approximately 20% manpower cost, 40-45% electricity cost, and 35-40% other costs, including insurance. The estimated O&M cost includes an allowance for recurrent cost in administering and evaluating the project.

Benefits and Beneficiaries

10.2.13 **Time and vehicle operating cost saved**. By using the transport model, two core project economic benefits were identified through estimating the difference in travel time and vehicle operating cost (VOC) per passenger trip with the project and without. The benefits were valued based on users' willingness to pay the time cost and VOC per trip, with new trips generated assumed to have a uniformly distributed willingness to pay ranging between just below the cost per trip without the project and just above the cost per trip with the project.

Table 10.5 Value of Passenger Time

Passenger type	2015		2025	
	VND/min	$/hour	VND/min	$/hour
Car owning household	470	1.48	663	2.09
Multiple motorcycle owning household	331	1.05	470	1.48
Single motorcycle owning household	214	0.68	299	0.94
Non-motorized household	150	0.47	214	0.68

Source: based on Demand Study
Exchange rate VND19,000=$1

10.2.14 Distinguished by household category defined by vehicle ownership, how HCMC Region residents discerned travel time in money terms was used for valuing the time saving benefit. The unit value of time by household category is derived from the transport model

assumptions, and is shown in Table 10.5 for design years 2015 and 2025. The model assumes that value of passenger time grows in line with average income in HCMC Region, which results in an effective annual growth rate of 3.9% up to 2025. Extending the principle, value of traveller time was assumed to grow at 3.5% annually after 2025.

10.2.15 The unit VOC used in valuing the VOC saving benefit is based on a standard model in current use by an international transport authority for project economic cost-benefit assessment [17]. Fuel prices were independently estimated. The estimate of economic price of fuel is based on applying standard refining margins to the economic price of crude oil to obtain petrol and diesel prices. The price assumed for the analysis is $90 per barrel in constant 2007 prices. A fossil fuel depletion premium of 2% per annum is assumed to apply starting in the year 2015. Differences in fuel consumption with and without the project are small; consequently the VOC in the two alternative cases are not significantly influenced by the fuel price level.

10.2.16 Table 10.6 summarises the core time and VOC user costs per passenger trip with and without the project. The users of HCMC Region urban transport are the beneficiaries.

10.2.17 Besides the two core user benefits, five additional benefits could be calculated and valued using the model forecasts. Two of these are costs that would be incurred without the project but are avoided with project.

10.2.18 **Avoided bus capital cost.** From differences in the forecast daily operating buses with and without the project, bus capital cost savings were estimated[18]. The bus VOC saving benefit is already included in the VOC saving portion of the user benefits.

Table 10.6 User Cost per Passenger Trip (US$) (2017-2036)

Year & scenario	User cost type	Car	Motorcycle	Bicycle	PT[a]	All modes	User cost saving (per 1,000 trips)	
2017 WO	Time	0.563	0.315	0.129	0.796	0.495	2017	4.24
	VOC	1.107	0.408	0.024	0.015	0.491		2.14
	Total	1.670	0.723	0.153	0.811	0.987		6.38
2017 W	Time	0.561	0.313	0.129	0.782	0.491	2025	14.35
	VOC	1.107	0.407	0.024	0.014	0.489		6.61
	Total	1.668	0.720	0.152	0.796	0.980		20.96
2025 WO	Time	0.973	0.419	0.163	1.144	0.826	2035	28.23
	VOC	1.674	0.493	0.027	0.017	0.673		11.85
	Total	2.647	0.912	0.190	1.161	1.499		40.07
2025 W	Time	0.961	0.413	0.161	1.114	0.811	2036	30.20
	VOC	1.671	0.490	0.027	0.016	0.666		12.56
	Total	2.633	0.903	0.189	1.130	1.478		42.76

PT - public transport (bus and mass rail transit); VOC - vehicle operating cost; W - with project; WO - without project.
[a]Only the bus VOC is included. Except for the Line 2 cost, the MRT operating costs in the two alternatives are the same and so cancel out. Meanwhile the Line 2 operating cost is included under cost in the cost-benefit assessment.
Source: this study

10.2.19 **Avoided road maintenance cost**. This benefit was estimated using UK Government transport statistics on road maintenance cost to estimate the required road maintenance budget for HCMC Region.[19] The avoided road maintenance cost was calculated as the sum of i) the road maintenance budget saved, and ii) the avoided cost (in extra VOC) to users of a shortfall in the road maintenance budget, estimated by the World Bank to be at least 50%[20] .

17 California Transport Department Cal Benefit/Cost VOC model. See Booze Allen Hamilton, Hagler Bailly, Parsons Brinkerhoff, 1999, California Life-Cycle Benefit/Cost Analysis Model, Technical Supplement to Users Guide. The model calculates VOC for cars and trucks. Motorcycle VOC was assumed to be 44% of the car VOC travelling in the same speed range, based on US Department of Transport comparative statistics of car and motorcycle fuel consumption at http://www.bts.gov/publications/national_transportation_statistics/html/table_04_11_m.html

18For road vehicles other than buses, by reference to vehicle market hire purchase rates, the difference in daily vehicle hours with and without the project could be valued for the implied savings in real vehicle capital employed. However with the limited resource this was not attempted.

19From www.transport-watch.co.uk/transport-fact-sheet-8.htm
referencing Transport statistics Great Britain and Department for Transport communicated information, in particular for estimating the required maintenance spending per passenger or freight tonne kilometre (with one freight tonne set equivalent to one passenger load).

20 World Bank, Transport in Vietnam, website resource at
http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/EASTASIAPACIFICEXT/VIETNAMEXTN/

The user cost impact of insufficient maintenance cost was based on a factor of 2-3 multiple of the maintenance spending shortfall[21].

10.2.20 **Carbon dioxide emission and road fatality savings.** These benefits were also valued. UK Government estimates of carbon emission by vehicle type and World Bank broad estimate of annual fatal accidents in HCMC provided the base data for the calculations[22],[23] The beneficiaries are the residents and visitors of HCMC Region. In the case of carbon emission savings, the global community also benefits from a reduced contribution to climate change.

10.2.21 **Public transport reliability improvement**. MRT being operated on a dedicated way, journey time on the system can be made predictable. By contrast buses operating in mixed traffic can show wide divergency from schedule, leading to journey time uncertainty. In the corridor proposed to be served by Line 2, the improved service quality will be available to public transport users only with the project, since without it buses will be the sole public transport choice. The benefit was valued using the transport model assumption that buses carry an unreliability factor equivalent to a perceived 15% addition to time in-vehicle. The average Line 2 boarder was assumed for the purpose to travel an average 3 km, resulting in an average in-vehicle time of 6 minutes at a 30 kilometer per hour average service speed. HCMC public transport users are the beneficiaries.

10.2.22 Table 10.7 illustrates the streams of project economic benefits valued in the analysis.

Table 10.7 Project Economic Benefits (US$ million)

Year	User benefits	Avoided bus capital cost	Avoided road main-tenance cost	PT reliability improved	CO_2 emission reduced	Road fatality reduced	Total benefits
2017	33.0	5.0	1.6	1.1	1.5	0.1	42.4
2018	39.2	5.0	1.7	1.3	1.6	0.1	48.9
2019	46.5	5.0	1.8	1.5	1.7	0.1	56.6
2020	55.2	5.0	1.9	1.7	1.8	0.2	65.8
2021	65.5	5.0	2.0	1.9	1.9	0.2	76.6
2022	77.8	5.0	2.2	2.2	2.0	0.2	89.4
2023	92.3	5.0	2.3	2.5	2.1	0.2	104.5
2024	109.6	5.0	2.4	2.9	2.2	0.3	122.4
2025	130.1	5.6	2.5	3.3	2.7	0.3	144.5
2026	141.4	5.6	2.6	3.5	2.8	0.3	156.2

CO2- carbon dioxide; PT- public transport
Source: this Study

Benefit-Cost Comparison

10.2.23 With capacity maintained to required service levels, the MRT Line 2 can continue to provide into the indefinite future its transport services and their associated benefits. By means of capitalized annuities included in terminal values of the project cost streams, allowances were made to ensure that Line 2 is equipped for patronage growing by an assumed 3.5 % annually from 2036 to 2056. Using growth rates illustrated in Table 10.2, corresponding terminal values were calculated for inclusion in the benefits streams. Table 10.8 shows the complete cost and benefit streams considered in the analysis. The net benefit stream was used to calculate the project economic internal rate of return (EIRR).

21 Heggie and Vickers, 1998, Commercial Management and Financing of Roads, World Bank Technical Paper 409.

22 For the estimate of carbon emissions, House of Commons Transport Committee, Eighth Special Report of Session 2006-7, June 2007, and http://directgov.transportdirect.info/Web2/JourneyPlanning/JourneyEmissionsCompare.aspx?repeatingloop=Y For the estimate of the unit global environmental cost of carbon dioxide emission, Steer Davies Gleave, 2006, Driving Up Carbon Dioxide Emissions from Road Transport, especially Table 3.3 referencing UK Government Economic Services.

23 World Bank website resource cited in footnote 5, and also US Government time series statistics of annual road fatalities at http://www.bts.gov/publications/national_transportation_statistics/excel/table_02_18.xls

Results of the Economic Analysis

10.2.24 The project EIRR is 12.4%; economic net present value discounted at 12% is $ 36.8 million.

Sensitivity and Risk Analysis

10.2.25 **Sensitivity tests**. The project was analysed for its sensitivity to changes in two key variables: i) the project capital costs for possible impact of unexpected changes in fuel and other raw material costs; ii) the projects benefits, to account for the uncertainties of estimation and the possible impact of high raw material and oil prices on growth and incomes; and iii) a combination of the changes to both variables.

10.2.26 The project has been prepared under extensive ADB technical assistance[24]. Few uncertainties are judged to remain in the project basic design and economic cost, which includes a physical contingency allowance of 10% on top of the most likely base cost for construction and equipment. It is considered that there is little likelihood of the project capital cost exceeding by more than 5% its value in the base case, representing the most likely value considered in the economic analysis.

10.2.27 Income growth in HCMC Region is a key determinant of MRT Line 2 patronage growth and its impact on urban travel, from which the project benefits were estimated. As noted earlier in 10.2.6, the regional growth rate assumed in the analysis is close to the lower confidence limit represented by the expected growth trend for the whole country, a rate substantially lower than that anticipated for the city's economy. With that in mind the likelihood of the benefits turning out to be less than 95% of the base case is considered to be small.

10.2.28 Conducted tests found that the EIRR remains equal to or above 12% if capital costs rise by not more than 5% above the base case. The EIRR falls below 12%, indicating project economic non-viability, if costs exceed the base case by 6.6% (switching value).

10.2.29 Tests also found that the EIRR remains equal to or above 12% if benefits are at least 95% of the base case; the EIRR is less than 12%, indicating the project is non-viable, if benefits are 5.5% below the base case. In the event that project capital costs exceed by 5%, and at the same time the project benefits fall 5% below, the respective most likely value, the EIRR drops below 12%, indicating project non-viability. Table 10.9 summarises the sensitivity test results.

Table 10.9 Results of Sensitivity Tests

Scenario	EIRR	SV
Base case	12.4%	-
Capital costs are 5% above most likely value	12.0%	6.6%
Benefits are 5% below most likely value	12.0%	-5.5%
Capital costs 5% above and benefits 5% below most likely value	11.7%	-

SV – switching value; - means not applicable
Source: this Study

10.2.30 **Risk analysis**. The risk of the project not being viable has been assessed using Monte Carlo analysis applying hyper-geometric probability distributions to the parameters that are analyzed in the sensitivity analysis. Based on 5,000 iterations, the analysis indicates that there is less than 12.2% (i.e. less than one in eight) risk that the project will not meet the target of 12% economic return in real terms.

[24] TA 4862 VIE Ho Chi Minh City Metro Rail System, 2006, 2007 and 2008, and TA 7343 VIE Ho Chi Minh City Urban Mass Transit Line 2, 2009

Table 10.8 Economic Analysis

($ million)

Year	Costs			Total costs	Benefits						Total benefits	Net benefits stream
	Invest-ment cost	Other capital cost	O&M cost		User	Saved bus capital cost	Saved road main-tenance	PT reliability improved	CO_2 emission reduced	Road fatality reduced		
2011	10.1	0.0	0.0	10.1	0.0	0.0	0.0	0.0	0.0	0.0	0	-10.1
2012	170.7	0.0	0.0	170.7	0.0	0.0	0.0	0.0	0.0	0.0	0	-170.7
2013	284.9	0.0	0.0	284.9	0.0	0.0	0.0	0.0	0.0	0.0	0	-284.9
2014	322.1	0.0	0.0	322.1	0.0	0.0	0.0	0.0	0.0	0.0	0	-322.1
2015	374.3	0.0	0.0	374.3	0.0	0.0	0.0	0.0	0.0	0.0	0	-374.3
2016	213.7	0.0	0.0	213.7	0.0	0.0	0.0	0.0	0.0	0.0	0	-213.7
2017	0.0	0.0	15.9	15.9	33.0	5.0	1.6	1.1	1.5	0.1	42.3	26.4
2018	0.0	0.0	16.8	16.8	39.2	5.0	1.7	1.3	1.6	0.1	48.9	32.1
2019	0.0	0.0	17.9	17.9	46.5	5.0	1.8	1.5	1.7	0.1	56.6	38.7
2020	0.0	20.6	18.9	39.5	55.2	5.0	1.9	1.7	1.8	0.2	65.8	26.3
2021	0.0	20.6	20.0	40.6	65.5	5.0	2.0	1.9	1.9	0.2	76.5	35.9
2022	0.0	0	21.2	21.2	77.8	5.0	2.2	2.2	2.0	0.2	89.4	68.2
2023	0.0	0	22.5	22.5	92.3	5.0	2.3	2.5	2.1	0.2	104.4	81.9
2024	0.0	0	23.8	23.8	109.6	5.0	2.4	2.9	2.2	0.3	122.4	98.6
2025	0.0	20.6	25.2	45.8	130.1	5.6	2.5	3.3	2.7	0.3	144.5	98.7
2026	0.0	20.6	26.1	46.7	141.4	5.6	2.6	3.5	2.8	0.3	156.2	109.5
2027	0.0	0	27.0	27.0	153.7	5.6	2.7	3.8	2.9	0.3	169.0	142.0
2028	0.0	0	27.9	27.9	167.0	5.6	2.8	4.0	3.0	0.4	182.8	154.9
2029	0.0	0	28.8	28.8	181.6	5.6	3.0	4.3	3.2	0.4	198.1	169.3
2030	0.0	30.9	29.8	60.7	197.4	5.6	3.1	4.6	3.3	0.4	214.4	153.7
2031	0.0	0	30.8	30.8	214.5	5.6	3.2	4.9	3.4	0.4	232.0	201.2
2032	0.0	69.5	31.9	101.4	233.2	5.6	3.3	5.3	3.5	0.4	251.3	149.9
2033	0.0	85.7	33.0	118.7	253.5	5.6	3.5	5.7	3.7	0.4	272.4	153.7
2034	0.0	0	34.1	34.1	275.6	5.6	3.6	6.1	3.8	0.4	295.1	261.0
2035	0.0	20.6	35.2	55.8	299.7	5.6	3.8	6.3	4.0	0.4	319.8	264.0
2036	0.0	177.4	460.4	637.8	8,010.00	111.2	47.7	141.4	50.3	5.4	8,366.0	7,728.2
CO2 - carbon dioxide; O&M - operation and maintenance; PT - public transport												
											EIRR	10.708%

Source: this study

Conclusion

10.2.31 The major beneficiaries of the HCMC MRT 2 project will be the users of transport services and the residents and visitors of the project area. Through reducing travel time and vehicle operating cost, the project will free up resources to promote and support private sector economic activities in the HCMC Region, a main engine of the Viet Nam economy. The project's primary economic benefits come from travel time and vehicle operating cost saved while using the urban transport system, which is predominantly road-based. The reduction in daily road vehicle time and distance will also mean lower road maintenance and vehicle capital employed, reduction in carbon dioxide emission, and fewer fatal road accidents. Moreover, being operated on a dedicated way unlike general road-based transport, the project's MRT Line 2 can offer more reliable journey time on the system, a quality improvement for public transport.

10.2.32 The estimated economic internal rate of return (EIRR) for the project is 10.708%, indicating economic viability; the economic net present value discounted at 12% is $20.44 million. Sensitivity testing and risk analysis indicate a low risk of the project EIRR falling below the minimum acceptable economic yield of 12%.

10.3 Summary Financial Analysis

Introduction

10.3.1 The details of the financial analysis, including methodology, other assumptions and input data, projected financial statements, other calculations, and sensitivity tests, are to be found in Appendix C of this Volume. Financial analysis has been carried out to assess the project viability and sustainability by determining if the project's anticipated financial revenues, net of the capital investment and operating cost and net of taxes yield a financial internal rate of return (FIRR) that is adequate when compared to the weighted average cost of capital (WACC).

10.3.2 The FIRR is estimated in real terms, using 2010 constant prices, and is based on project capital cost excluding interest and other financing charges during implementation (FCDI). To test the project capital structure and debts service capacity, and to identify the subsidy requirement, an analysis of the project's estimated financial statements was carried out for a period comprised of implementation over six years (2011-2016) and operation in the twenty-five years following. The financial projections are expressed in nominal terms, taking into account the effects of domestic and foreign inflation and currency fluctuations. The investment and financing plans are based on the assumption that the ADB loans will be supplemented with contributions from co-financiers.

10.3.3 The data input into the analysis include a passenger demand forecast, estimated project investment, and operation and maintenance costs, which are discussed in detail elsewhere in this report. Table 10.9 summarizes the project investment plan on which the analysis is based.

10.3.4 The project base case (Base Case) assumes that by the start of project operation HCMC People's Committee will have implemented a reorganization of bus routes to optimize the benefits from the city's public transport, including the new MRT Line 2. At the assumed fare of VND4,000 per boarding, the forecast of patronage and annual fare revenue yields a fare box ratio (fare revenue divided by operating and maintenance cost) of 0.8 times in the opening year and quickly rising to 1 or about. The demand forecast shows expectation of high patronage growth, including an assumed 3.5% p.a. average rise in patronage in the period 2025-35, while operating performance also advances strongly over the project life, as indicated by fare box ratios of 2.1 in 2025 and 2.3 in 2035. Based on the anticipated demand and the implied level of fare box recovery of operating cost, the total subsidy requirement for the project in the Base Case is $791 million equivalent. Details will be found in Table 10.10.

Table 10.9 Project Investment Plan (US$ million)

Item		Total [a]
A.	**Base Cost** [b]	
1.	Civil works	513.70
2.	E&M systems	234.46
3.	Rollingstock	66.11
4.	Land acquisition and resettlement	127.6
5.	Integrated Sustainable Urban	3.9
6	Capacity Development, Social Development	2.8
7.	Consulting services	64.4
8.	Incremental administration	18.0
	Sub-total (A)	**1,031.4**
B.	**Contingencies** [c]	
	Physical & Price	232
	Sub-total (B)	**232**
C.	**Financial Charge During Implementation** [d]	111.1
	Sub-total (C)	**111.1**
	Total (A+B+C)	**1,374.5**

[a] *Includes local taxes and duties of $ 81.9 million.*

[b] *at 2010 prices.*

[c] *Physical contingencies computed at 10% of civil works & equipment, 5% of pre-investment stage cost, 0% of resettlement. Price contingencies are computed at 1.5% in 2010, 0.7% on 2011, 0.5% in 2012, and 0.5% from 2013 onward on foreign exchange costs, and 9.0% in 2010, 5.5% in 2011, 5% in 2012, and 5% from 2013 onwards on local currency costs. No price contingencies for land resettlement.*

[d] *Includes interest and commitment charges. ADB (OCR # 1): Interest during the 7-year grace period has been computed at the 7-year swap rate, plus a spread of 0.2%. (equivalent to 3.39%) Commitment: 0.15% pa.*
ADB (OCR # 2): 7-year grace and - ditto -
KfW: 7-year grace and 5.85% interest. Commitment: 0.25% pa.
EIB: 7-year grace and 3.89% interest. Commitment: 0.25% pa.
Exchange rate: Euro 1.0 = $1.3

ADB = Asian Development Bank, OCR = ordinary capital resources, CTF = Clean Technology Fund, KfW = German development bank (Kreditanstalt für Wiederaufbau), EIB = European Investment Bank.

Source: Asian Development Bank estimates.

Table 10.10 Project level of subsidy: Base Case, and without bus reorganization

Scenario	Revenue and cost recovery indicators				Total subsidy ($ million)
	Year	Daily passenger boardings	Annual fare revenue ($m)[b]	Fare box ratio (times)	
Base Case	2015[a]	127,863	20.7	0.8	791
	2025	481,700	124.5	2.1	
	2035	679,500	314.6	2.3	
No bus routes reorganization	2015[a]	74,972	12.2	0.5	1,232
	2025	326,500	84.4	1.4	
	2035	460,560	213.2	1.6	

Source: this study
Notes:
[a] *2017 instead of 2015 for annual fare revenue and fare box ratio*
[b] *Non-fare revenue is forecast to be equal to 5% of fare revenue*

10.3.5 Table 10.10 also indicates the effects on revenue and cost recovery if the bus routes reorganization does not materialize. The starting year daily patronage and fare revenue drop by 40%, and the fare box ratio falls below 1 but advances to a level which is considered high by comparison with international experience[25]. While the assumed rate of growth in patronage is the same, the effects of lower starting daily boardings are seen in the consistently lower fare box recovery ratio compared to the Base Case. In summary, the total

[25] For example, Hong Kong MTR has a company-wide fare box ratio in 2007 of around 2 (source: HK MRT 2007 annual report).

subsidy required, should bus reorganization fail to be implemented, is $1.23 billion, up 56% from the Base Case. This would be a substantial increase in the subsidy burden.

Conclusion

10.3.6 The project is expected to require a total subsidy of $791 million equivalent. This has been derived assuming that the project debt service coverage ratio (operating profit before interest, corporate income tax, depreciation and amortization plus annual subsidy, all divided by debt service) would be maintained at 1.2 times until the loans have been fully repaid. At the D 4,000 fare per boarding, the project shows a consistent recovery of annual operating cost out of fare revenue, from early on in the operation. Having a predominantly underground alignment[26], which makes it more costly to build compared to lines that are predominantly elevated or at-grade, the MRT Line 2 has a higher construction cost per kilometre. Where there are significant differences in MRT lines' vertical alignment, there is a general need to accept differences in their level of cost recovery under a uniform fare policy, necessary for an integrated MRT network.

10.3.7 The free cash flow in real terms, including capital expenditure on equipment renewal, and additional rolling stock to serve expected demand growth, and including subsidy, yields an after-tax Financial Internal Rate of Return (FIRR) of 3.33%, above the 2.10% WACC. Development of MRTs as a key transport mode in major cities is confirmed as a fundamental state policy in the framework Railway Law 2005[27]. The law assigns the responsibility for policy implementation to the provincial and centrally administered city level, and also stipulates GOV's responsibility to provide support to approved investment in MRTs. Since the principle of a balanced local budget[28] operates, it is anticipated that HCMC will be assigned a share of the subsidy funding that is within the city's budget resources, with the balance to be funded through the central budget.

10.4 Financing Plan

10.4.1 The Government has requested that ADB provide an OCR loan (Tranche 1) of $40 million and an OCR loan (Tranche 2) of $500 million to finance a portion of the project cost. The OCR loan (Tranche1) is for part of the consulting services, part of the depot, and related taxes. The OCR loan (Tranche 2) is for part of the civil works activities, and related taxes. The OCR loans are at an interest rate determined in accordance with ADB's London interbank offered rate (LIBOR)-based lending facility plus 0.2% and a commitment charge of 0.15% per annum on the undisbursed amount of the loan. Both OCR loans will have a 27 years term, including a grace period of 7 years. The ADB financing represents 43.3% of the total project cost.

10.4.2 It is intended that the project will be co-financed by the German development bank Kreditanstalt für Wiederaufbau (KfW) and European Investment Bank (EIB): see Table 10.11. The co-financing will finance all of the rolling stock, all of the electrical and mechanical systems and equipment, some civil works and some consulting services.

10.4.3 The remaining cost, of about $326.5 million equivalent (including Resettlement cost), will be financed through Government counterpart funding. All the loans will be to the Government of Viet Nam. Counterpart funds will cover all of incremental administration, and all of land acquisition and resettlement cost.

10.4.4 While considered by ADB to be an integral part of the project, it has been decided to finance sustainable urban transport measures separately using funds provided by the Clean Technology Fund (CTF).

[26] Unlike for example Line 1, where the opposite is the case.
[27] Railway Law No 35/2005/QH11, Article 56.
[28] Law on the State Budget No 01/2002/QH1, Article 4, 2d.

Table 10.11 Summary of Financing Plan (US$ million)

Source	Total	%
Asian Development Bank	540.0	39.28%
Kreditanstalt für Wiederaufbau	313.0	22.77%
European Investment Bank	195.0	14.18%
Clean Technology Fund [a]	0.0	0.0
Government of Vietnam	326.5	23.77%
Total Project cost	**1374.5**	**100.0%**

[a] $60 million of investment will be undertaken as a separate cross-linked project, consisting of $10 million ordinary capital resource(OCR) funds from ADB and $50 million from CTF. No costs are included in MRT 2 project financing plan.
Exchange rate: Euro 1.0 = $1.30
Source: Asian Development Bank

10.4.5 Of the entire loan proceeds of $1,048 million, it is anticipated that GOV will provide $111.5 million as a grant and the balance of $396.5 million will be borrowed by Ho Chi Minh City from the Ministry of Finance through a subsidiary loan agreement, on terms acceptable to and at the applicable interest rates of the project lenders to the Government, plus the MOF's lending fee of 20 basis points, and $540 million will be borrowed by HCMC from the SBV through a Subsidiary loan agreement. The detailed financing plan is presented in Table 10.12.

Table 10.12 Detailed Financing Plan (US$ million)

	ADB		ADB		KfW		KfW		EIB		GOV Vietnam		Total
	(OCR # 1)		(OCR # 2)		Loan 1		Loan 2		Loan				
	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%	Amount
A. Investment Cost													
1. Civil works	0	0.0%	340	80.0%		0.0%		0.0%	85	20.0%		0.0%	425
2. Non - system E &M	0	0.0%		0.0%		0.0%	39.1	43.9%	49.9	56.1%		0.0%	89
3. E&M systems	0	0.0%		0.0%	23.4	18.8%	101.1	81.2%		0.0%		0.0%	124.5
4. Rolling stock	0	0.0%		0.0%		0.0%	60.1	100.0%		0.0%		0.0%	60.1
5. Land resettlement	0	0.0%		0.0%		0.0%		0.0%		0.0%	127.6	100.0%	127.6
6. Depot	22.7	54.0%		0.0%		0.0%		0.0%	19.3	46.0%		0.0%	42
7. Urban transport measures	0												0
8. Consulting services	12.1	18.7%		0.0%	13	20.1%	39	60.3%		0.0%	0.6	0.9%	64.7
9. Taxes and duties	0	0.0%		0.0%		0.0%		0.0%		0.0%	81.9	100.0%	81.9
Sub - Total A	**34.8**	**3.4%**	**340**	**33.5%**	**36.4**	**3.6%**	**239.3**	**23.6%**	**154.2**	**15.2%**	**210.1**	**20.7%**	**1014.8**
B. Recurrent costs													
1. Incremental Administration	0	0.0%		0.0%		0.0%		0.0%		0.0%	16.6	100.0%	16.6
Sub - Total B	**0**	**0.0%**	**0**	**0.0%**	**0**	**0.0%**	**0**	**0.0%**	**0**	**0.0%**	**16.6**	**100.0%**	**16.6**
C. Financial Charge during Implementation													
1. Interest During construction	4.9	5.5%	46.9	52.5%		0.0%		0.0%		0.0%	37.6	42.1%	89.4
2. Commitment charges	0.25	3.7%	2.4	35.6%		0.0%		0.0%		0.0%	4.1	60.7%	6.75
3. Greman Export Credot Insurance		0.0%		0.0%		0.0%	15	100.0%		0.0%		0.0%	15
Sub - Total C	**5.15**	**4.6%**	**49.3**	**44.4%**	**0**	**0.0%**	**15**	**13.5%**	**0**	**0.0%**	**41.7**	**37.5%**	**111.15**
D. Contingencies	0	0.0%	110.7	47.7%		0.0%	22.3	9.6%	40.8	17.6%	58.2	25.1%	232
Sub - Total D	**0**	**0.0%**	**110.7**	**47.7%**	**0**	**0.0%**	**22.3**	**9.6%**	**40.8**	**17.6%**	**58.2**	**25.1%**	**232**
Total Disbursement (A + B + C + D)	**40.0**	**2.9%**	**500.0**	**36.4%**	**36.4**	**2.6%**	**276.6**	**20.1%**	**195.0**	**14.2%**	**326.5**	**23.8%**	**1374.5**

See notes overleaf

Notes

ADB = Asian Development Bank, OCR = ordinary capital resources, KfW = German development bank (Kreditanstalt für Wiederaufbau), EIB = European Investment Bank.

[a] *at 2009 prices. Each cost component is inclusive of physical contingency and price contingency.*

[b] *Physical contingencies computed at 10% of civil works & equipment, 5% of pre-investment stage cost, 0% of resettlement. Price contingencies are computed at 1.5% in 2010, 0.7% on 2011, 0.5% in 2012, and 0.5% from 2013 onward on foreign exchange costs, and 9.0% in 2010, 5.5% in 2011, 5% in 2012, and 5% from 2013 onwards on local currency costs. No price contingencies for land resettlement*

[c] *Includes interest and commitment charges. ADB (OCR # 1): Interest during the 7-year grace period has been computed at the 7-year swap rate, plus a spread of 0.2%. (equivalent to 3.39%) Commitment: 0.15% pa.*

ADB (OCR # 2): 7-year grace and - ditto -
KfW: 7-year grace and 5.85% interest. Commitment: 0.25% pa.
EIB: 7-year grace and 3.89% interest. Commitment: 0.25% pa.
Exchange rate: Euro 1.0 = $1.3

Source: Asian Development Bank estimates.

10.5 Fiscal Measures to Optimize Urban Transport

Objectives and Focus

10.5.1 To optimize the benefits of MRT and urban transport in general there is a need for government to identify and take concrete steps in order to increase the likelihood of success in achieving the goal of a liveable city, in which mobility needs are met effectively, efficiently and sustainably. Fiscal measures which can be used for this ultimate goal have different focuses, which should be clearly distinguished. These can include:

- **Eliminating distortions in the urban transport market**. There may be distortions in the urban transport market discriminatory to public transport. These include for example: fuel subsidies, taxes and duties which have the effect of encouraging popular private vehicle ownership; absence or non-collection of fines for breaking safety, road use, and environmental laws and regulations (e.g. regulations about helmets, traffic, illicit parking, noise and exhaust emission). The distortions should be identified and examined holistically, under a goal of optimizing the use of public transport.
- **Managing road use**. MRT provides an expanded choice for travel and with that the opportunity to introduce fiscal measures to manage excessive road use leading to congestion, poor air quality, high accidents, health issues, high urban maintenance cost etc. These measures could aim at limiting the number of vehicles in a busy area or on specific roads during restricted hours through one of a number of charging methods, e.g. by the day, for each entry during the day, for the amount of time spent etc. Vehicle tracking and charge collection methods of varying costs are involved. Singapore and London provide frequently studied examples of the measures.
- **Promotion of efficient urban development**. Certain forms of urban development have synergies with public transport e.g. a compact urban layout based on using MRT and other public transport to serve people's mobility needs. These can be encouraged by tax incentives and/or disincentives. Examples from the international experience should be studied.
- **Value capture**. A benefits tax aims at allowing the community to share in the gain when property increases in value for being adjacent to a new MRT line or lines. With value capture, property owners can be considered to be returning some of their gain as a contribution to the public expense in building the MRT. The idea applies generally to any subsidized urban infrastructure program resulting in improved property values. Examples of the tax can found in countries including USA, UK and Australia.

Urban Transport Fund and Alternatives

10.5.2 There is no parallel of a universal cure in designing the fiscal measures referred to above. To be effective, designs need to be based on a careful study of the local context, including fiscal laws and laws governing the management of public finance, besides socio-economic factors. Different options on how the funds collection and disbursement are managed are possible. For example, specific revenues could be earmarked for an urban transport fund account which is managed by a particular unit of city or central government. Alternatively there is no earmarking and the revenues are managed under a centralized state budgetary system. The right choice of options would depend among other things on the adopted public accountability institutions and system of public audit.

11. PROJECT IMPLEMENTATION

11.1 Implementation Overview

11.1.1 Critical to the smooth implementation of the project is the timely delivery of project documents meeting mandated requirements to relevant district and city-level agencies in HCMC and national ministries in Hanoi who will need to approve them without delay.

11.1.2 Several national and HCMC level agencies have approval responsibilities as shown in Table 11.1. Similarly, the requirements of ADB, KfW and EIB must also be met.

11.1.3 MAUR will have overall responsibility for project implementation and formal correspondence with HCMC-PC and its other departments, the line ministries, provincial authorities, and ADB, KfW and EIB. MAUR will engage and direct the work of consultants, and will procure and direct all contractors. MAUR will delegate responsibility for day-to-day project implementation to the Line 2 Project Management Unit (PMU) which will be established from within the ranks of MAUR. The PMU will in turn be assisted by the Project Management Consultant. The HCMC-PC has established district compensation boards including commune resettlement task forces for all districts through which the project will pass. With the exception of the depot, where compensation planning is underway, the district compensation boards will be responsible for preparing and implementing compensation plans during Tranche 1 of the Project, based on the approved resettlement plan. MAUR will have overall responsibility for implementation of the environmental management plan during design and construction.

11.1.4 Prior to implementation, requirements also include: (a) environmental and resettlement frameworks and plans; (b) detailed engineering designs, and Procurement Plan including contract packaging and mode of procurement for civil works,, E&M works and railway systems including rolling stock, and automated ticketing system, and (c) provision for operation and maintenance if this is to be included in (b) above. In addition, discussions related to the overall management of the MRT network including integration with other modes of public transport; sustainable transport initiatives; and capacity building requirements including TA support, should be well advanced.

11.1.5 ADB will employ a MFF financing modality initially involving two loan tranches that will support the HCMC-PC's long-term investment plan for MRT. KfW and EIB will co-finance selected components.

Table 11.1 Key Vietnamese Agencies and Broad Responsibility for Approvals

Stakeholder	Responsibility
National Level	
Ministry of Transport (MOT)	Through its different modal administrations and departments (a) plans, manages and maintains national infrastructure through its different departments and administrations; (b) assists local governments in developing transport plans and selecting transport projects; and (c) manages public bus transport plans by approving cities master plans
Vietnam Railways Administration (VNRA)— under MOT	Plans and manages the development of the sub sector Regulates the sub-sector including national and other rail systems including metro or MRT in cities and provinces. Provides oversight of City and Provincial rail and MRT Master Plans and is charged with approval of technical standards and safety of rail and MRT systems. Main functions of relevance to project: • Informal MRT Master Plan approval • MRT technical standards • MRT safety standards & compliance
Ministry of Finance (MOF)	Arranging of finance from external agencies including IFIs and provision of finance to local governments. Currently, financial planning aspects of future MRT development in Vietnam.
Transport Development Strategy Institute (TDSI)- under MOT	Develops long and medium term transport sector strategies and plans (in collaboration with modal administrations)

Stakeholder	Responsibility
Department of Planning and Investment (DPI)-under MOT	Integrates investment plans prepared by modal administrations for submission to MPI for inclusion in the PIP and to MOF for inclusion in the State Budget.
The Ministry of Natural Resources and the Environment (MONRE)	Reviews and approves environmental impact assessments for transport projects (DONRE in PC for HCMC MRT. Approved EIA through Powers delegated from MONRE) in effect PC is approving its own project?
HCMC PC level	
People's Committee	Approves key issues such as fares, opening and closing of routes, schedules and subsidies.
Department of Transport (DOT), Transport and Industry Management Department (TIMD); and the Management and Operations Centre for Public Transport (MOCPT).	Develops cities' transport strategies; Plans and manages construction; Maintains urban transport infrastructure; Manages bus transport; Coordinates planning and implementation of traffic management with Police. Main functions of relevance to project: • Transport Strategy • Traffic management and parking • Bus route planning & franchising incl bus-MRT integration • Bus system ticketing
HCMC Management Authority for Urban Railways	Plans / implements rail-based mass transit plans and has responsibility for managing and arranging for operations and maintenance. Main functions of relevance to project: • MRT civil infrastructure development incl land acquisition • MRT rolling stock & E&M supply • MRT ticketing • MRT operations procurement and/or operations directly
HCMC Investment Fund (HIFU)	Arrangement of finance through bond issue for counterpart funds, coordination with private sector incl private financial institutions, possible shareholding role in a JV operating entity
Department of Finance (DOF)	Treasury functions such as processing of project-related local expenditures including counterpart payments
District Level and Commune Governments	Relevant district governments through which a project passes will have a role in land acquisition, preparation of RAPs & other facilitation
Urban Planning and Architecture Department (DUPA)	Land Use Master Plan preparation and approval of developments. Land approvals are separately made by the Department of Natural Resources and Environment (DONRE) with little linkage to the Master Plan.
Department of Planning and Investment (DPI)	Investment programming including one year annual budget and five year Public Investment Program (PIP)
Traffic Police under the Public Security Department	Enforces traffic management including the operation of traffic signals in coordination with DOT

11.2 Implementation Schedule

11.2.1 A summary of the requirements for approvals are summarized in Table 11.2 up to the end of Year 3 of project implementation which would correspond generally to mid-term review.

11.2.2 In the Table, calendar year 2010 is assumed to be year prior to project implementation while the first year of project implementation is assumed to be 2011. ADB's Tranche 2 loan would be finalized in Year 1 as shown in the Table.

11.2.3 The overall implementation schedule of approximately eight years is shown in Figure 11.1. The detailed requirements set out in Table 11.2 up to the end of Year 3 of project implementation, which would correspond to mid-term review, are reflected in Figure 11.1. The detailed schedule of requirements will be updated at appraisal of ADB's tranche 2 facility.

Table 11.2 Requirement, Approval Body and Timing (to end of Year 3 of Project Implementation)

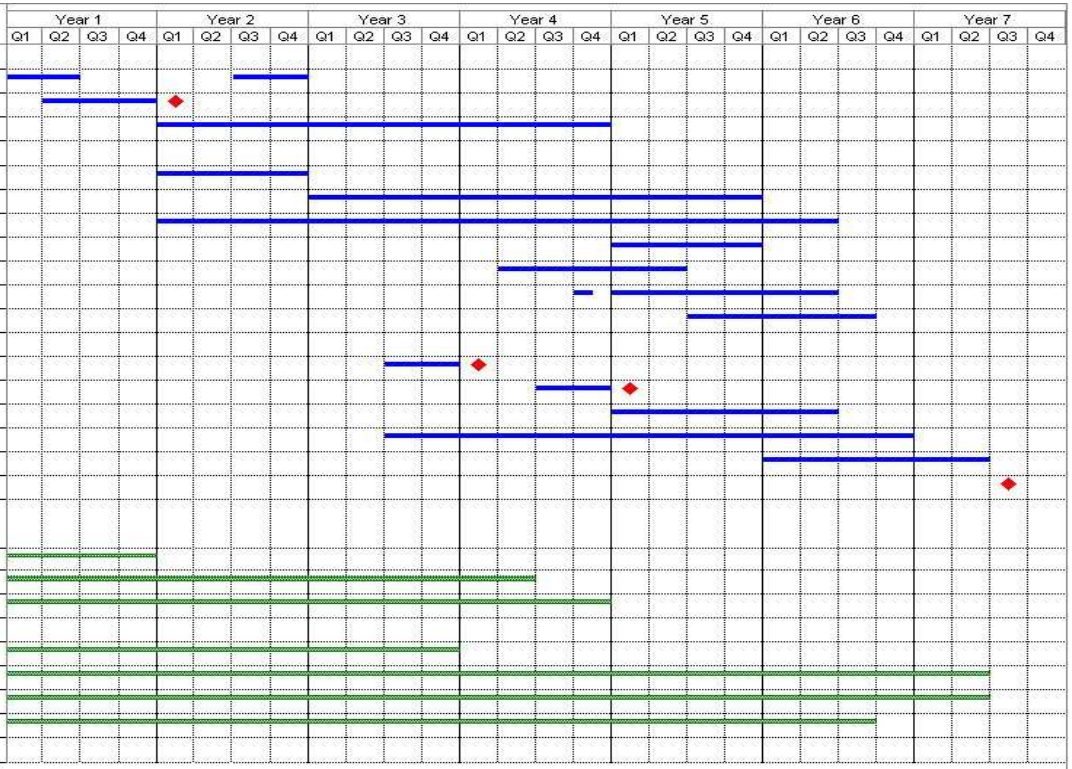
Key Requirement	Timing
Environmental Impact	
Prepare an Environmental Assessment and Review Framework (EARF) and IEE for the Tranche 1 advance covering enabling works at depot and disclose on ADB website	Prior to Tranche 1 Appraisal (June 2010)
Satisfy environmental requirements for Tranche 1 with approval of EARF and IEE from DONRE and ADB before loan approval and disclosed locally by MAUR and ADB on website (and as appropriate by EIB and KfW)	Disclosure must be one month before MRM which is 1st week May 2010 therefore disclosured in 1st week April 2010.
Monitoring by Project Management & Implementation Support Services Consultant (PMICCS) to ensure that EMP for advance works at depot is implemented. ADB monitor inclusion of IEE requirements and updated EMP in bidding documents and contracts for depot advance enabling works	Appropriate time
Satisfy environmental requirements for Tranche 2 with report to DONRE and disclosure of draft EIA by ADB before loan approval and disclosed locally by MAUR and ADB on website 120 days before (and as appropriate by other EIB and KfW)	Prior to Tranche 2 Loan approval (late 2011 or Year 1 of project implementation)
Review and updating of EMP in response to detailed designs resulting from Tranche 2. Inclusion of EIA and updated EMP in bidding documents and contracts	Appropriate time
Monitoring by third independent party and ADB that EMP is updated in response to detailed designs resulting from Tranche 2. Third independent party and ADB monitors inclusion of EIA requirements and updated EMP in bidding documents and contracts	Appropriate time
Capacity building by PMISSC for MAUR to monitor EMP. Establishment of environment, health and safety and social cell by MAUR.	Appropriate time
Resettlement and Social	
Resettlement Framework for the whole MFF and Resettlement Plan for Tranche 1 endorsed by MAUR and accepted by ADB Resettlement Framework accepted by EIB and KfW	Prior to ADB Management Review Meeting 1st week of May 2010
RF and RP (for the depot-section) disclosed locally by MAUR and uploaded to the ADB website (and as appropriate by EIB and KfW)	Prior to MFF appraisal
Full implementation of retrofitted RP for the 9.39 hectare section of the depot.	Condition for ADB no-objection for the Issuance of notice-to-proceed (NTP) for the construction of depot buildings
Final RP for the access link, main line/stations and remaining sections of the depot based on detailed design accepted by MAUR and ADB	Prior to MRM for the PFR (Periodic Financing Request) for Tranche 2
Disclosure of the Final RP for the access link, main line/stations and remaining sections of the depot	Prior to Tranche 2 PFR appraisal
Full implementation of RP in specific sections of the access link, main line and stations, as reported by the External Resettlement Monitoring Agency (EMA)	Condition for ADB no-objection for the Issuance of notice-to-proceed (NTP) for civil works in specific sections.

Key Requirement	Timing
Infrastructure Plans, Designs and Procurement	
Prepare ToR for KfW functional design for civil works	Prior to Tranche 1 Appraisal (June 2010)
Mobilize KfW's functional design consultant for civil works and E&M	2nd Quarter of 2011
Appoint EPC turnkey contractor for E&M	Mid - 2012
Mobilise ADB consultant for project management support to MAUR (Tranche 1)	End of 1st Quarter 2011
Other ADB studies and activities under Tranche 1	Jan-Dec 2011
Consultancy services for ADB CTF initiatives	2011- 2012
ADB board approval for Tranche 2	Jul 2011
Appoint contractors for civil works packages	Late 2011 onwards
E&M works and Railway Systems including Rolling stock and Train Operations and Maintenance	
Prepare ToR for ADB's Project Management & Implementation Support Services Consultant	Prior to Tranche 1 Appraisal (Oct 2010)
Mobilize ADB's Project Management & Implementation Support Services Consultant	Early Year 1 of project implementation (early 2011)
(a) Confirm train operating plan for first five years & other operational including safety requirements	Early Year 1 of project implementation (early 2011)
(b) Provide input to functional design and procurement package for EPC contract for E&M, railways systems and rolling-stock and offer for provision of O&M services (6 months)	Prior to mid Year 1 of project implementation (by mid 2011)
(c) Commence procurement for EPC contract for E&M, railways systems and rolling-stock and offer for provision of O&M services (1 year)	Prior to end Year 1 of project implementation (by end 2011)
(d) Prepare standalone tender document for provision of O&M services (if required)	Prior to end Year 1 of project implementation (by end 2011)
(e) Evaluate tenders, procure EPC provider for E&M, railways systems and rolling-stock & decide on whether to accept O&M offer (1 year)	Prior to end Year 2 of project implementation (by end 2012)
(f) If MAUR do not accept O&M offer, commence procurement for separate O&M service provider	Prior to end Year 2 of project implementation (by end 2012)
(g) Evaluate tenders, procure separate O&M service provider (1 year)	Prior to end Year 3 of project implementation (by end 2013)
Other Operations and Maintenance Needs	
(a) Establish financial arrangements for counterpart funding and budgetary provision for O&M if not contracted out.	Prior to Tranche 1 Appraisal
(b) HCMC-PC decision to establish O&M organization	Prior to Tranche 1 Appraisal
(c) Establish O&M organization	Early Year 2 of project implementation
(d) Establish "ring-fenced" operational entity for management of O&M services on Line 2	Early Year 2 of project implementation
(e) Prepare and implement Public Service Agreement to define responsibilities between "ring-fenced" operational entity and MAUR's O&M organization consistent with contract between MAUR and O&M service provider	Early Year 2 of project implementation
Ticketing System Plan and Procurement Package	

Key Requirement	Timing
(a) HCMC-PC to confirm desire for integrated MRT ticketing & fares, & whether to include bus and ferry	Prior to Tranche 1 Appraisal
(b) Prepare ToR for ticket system study & functional specification/ contract documents & associated integrated fares	Prior to mid Year 1 of project implementation
(c) Procure consultant for ticket system study & functional specification & associated integrated fares (6 months)	Prior to end Year 1 of project implementation
(d) HCMC-PC to agree to form of ticket system and integrated fares & delivery model	Prior to end Year 2 of project implementation
(e) Commence procurement of integrated ticketing system provider (1 year)	Prior to end Year 2 of project implementation
(f) Commence implementation of integrated ticketing system (over three years to end 2016)	Prior to end Year 3 of project implementation
MRT Management Plan for all MRT Lines including Integration with Other Public Transport	
(a) HCMC-PC to confirm desire for Integrated Public Transport Authority	Prior to Tranche 1 Appraisal
(b) Prepare TA for Implementation Support for Integrated Public Transport Authority	Prior to Tranche 1 Appraisal
(c) HCMC-PC decision to establish for Integrated Public Transport Authority	Prior to end Year 1 of project implementation
(d) Establish Integrated Public Transport Authority	Early Year 2 of project implementation
(e) Tender and procure consultant for TA for Implementation Support for Integrated Public Transport Authority (4 years)	Early Year 2 of project implementation
I. Prepare bus/ MRT Lines 1 and 2 integration plan (6 months)	Prior to mid Year 2 of project implementation
II. Develop phased plan for modification of existing bus franchises (6 months)	Prior to mid Year 2 of project implementation
III. Other implementation support	On-going
Sustainable Transport Initiatives	
(a) Prepare ToR for Sustainable Transport TA	Prior to Tranche 1 Appraisal
(b) Procure consultant to undertake Sustainable Transport TA	Early Year 1 of project implementation
(c) Implement agreed sustainable transport initiatives	Early Year 2 of project implementation
Capacity Building and Other Project Support (as part of ADB's Project Management & Implementation Support Services)	
(a) Undertake needs analysis of MAUR, and develop capacity building plan and TOR	Prior to Tranche 1 Appraisal
(b) Procure capacity building TA services	Prior to end Year 1 of project implementation
(c) Develop & implement monitoring and evaluation program	Early Year 1 of project implementation
(d) Establish International Advisory Panel	Early Year 1 of project implementation

Figure 11.1 Implementation Schedule

ID	Task Name
1	**Preparatory work**
2	- Detailed design & other design work *3
3	- Contruction contractor(s) selection
4	- Land resettlemant & utilities relocation
5	**EPC,install,test,commission**
6	- TBM order ,assembly & shafts
7	- Tunnel construction
8	- Station construction
9	- Viaduct construction
10	- Depot construction
11	- Trackwork
12	- Station & tunnel equipment
13	Preparing operation and maintenance
14	- Select systems contractor
15	- Sellect rolling stock supplier
16	- Delivery of rolling stock
17	- O&M planning, staff recruitment / training
18	- Train & systems testing
19	- Start of operation
20	**Institutional framework for MRT as part of an integrated urban transport in HCMC *4**
21	MRT regulation
22	MRT ticketing and fare integration
23	MAUR strengthening
24	Public transport (PT) integration
25	- Extending MRT beyond Lines 1-3
26	- MRT & bus in Live 2 corridor
27	- MRT network with other PT
28	HCMC Urban Transport funding
29	**Notes**



1. For design and preparation of tender documents for utilities relocation , construction , E&M and train acquisition , for advice in tender evaluation , preferred bids negotiation , contract preparation and supervision of the CW and E&M and rolling stock consractors. An O&M consultants is under a separate contract from the rest.
*3. For elevated and at grade civil works.Underground section will mostly be design - build. E& M and rolling stock will be based on an engineering design-manufacture approach.

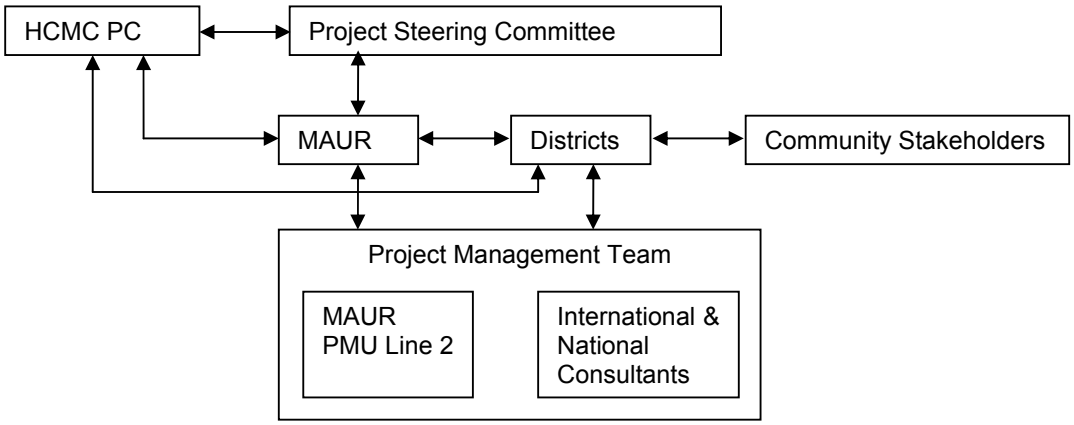
*4. Output of activities under technical assistance topics as listed.The activities go beyond donors immediate project due diligence and post-invesment monitoring & evalution requirements

11.3 Institutional Arrangement and Capacity Building

Project Management

1.1.1. The project management team will comprise staff from the MAUR PMU assisted by international and local consultants (see Figure 11.2). The team will work under the guidance of a project Steering Committee, which will be chaired by HCMC PC. Day-to-day liaison will be maintained with MAUR and also with the Districts and community groups.

Figure 11.2 Project Management Structure

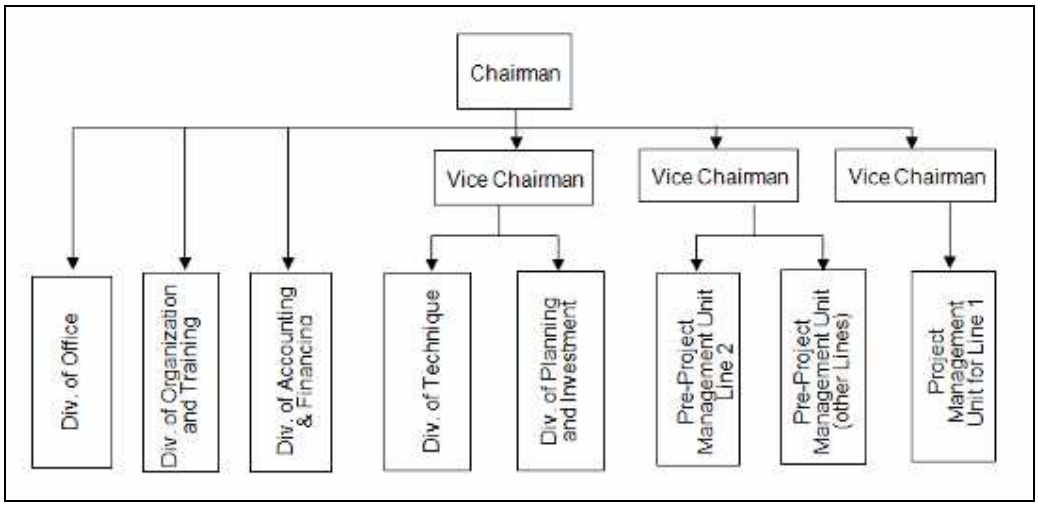


11.3.1 In support to the HCMC PC regarding the Project is a Consultative Council to provide advice to HCMC PC on MAUR proposals. This is made up of officers from different PC departments headed by MAUR Chairman. Also the Inter Ministerial Team that will provide a links between Government ministries and HCMC PC to aid in approval process, headed by the HCMC PC Chairman.

Implementing Agency

11.3.2 The Implementing Agency (IA) for the Project will be MAUR. As such MAUR will have overall responsibility for project implementation and formal correspondence with the line ministries, city authorities, ADB and the other funding agencies. The existing organization of MAUR is shown in Figure 11.3.

Figure 11.3 Existing MAUR Organization



11.3.3 As shown in Figure 11.3, MAUR has already established a division, or Project Management Unit (PMU), with responsibility for overseeing the development of MRT Line 2. The PMU will engage and direct the work of consultants and will procure and direct all contractors. The PMU will be staffed with a full time director, engineers, accountants, social, resettlement and environmental specialists, and other specialists, as may be required. Through MAUR, the PMU will coordinate with the HCMC-PC and District-PCs on construction works, environmental management, planning and land acquisition and resettlement activities.

Capacity Building

11.3.4 The proposed Line 2 MRT (the Project) is very complex from an engineering and ongoing operational point of view. The Project has to operate a network of services that are desirably integrated with bus and ferry services. Further, the choice of technical systems such as communications and ticketing need to have a system wide basis. That is, to achieve technical integration and desirable policy outcomes requires thinking now beyond the initial Line 2 project to avoid locking in irreversible decisions that in future could constrain the operation and financial sustainability of The Project as a whole.

11.3.5 Currently, MAUR consists of 133 staff and has grown rapidly since its formal creation in 2007. The current MAUR structure includes the functions shown in Figure 11.3 all under the Board of Management. It is also understood that it is proposed to revise the current structure of MAUR in the near future to better reflect the need to commence preparations for operations and maintenance and associated management functions.

11.3.6 An initial assessment of MAUR's management and financial capacities and procedures has been undertaken using the ADB Financial Management Assessment (FMA) questionnaire. MAUR was established in September 2007. It is a young organisation that is still developing its capacity. At the time of the FMA questionnaire none of the staff had previous experience in the management of ODA projects (other than the short time working with JBIC on Line 1 since March 2008). MAUR is now actively undertaking recruitment of people with ODA experience.

11.3.7 It is clear that MAUR will require extensive strengthening, particularly in project management skills.

11.3.8 Priority needs to be given to those activities which are (a) crucial to the sustained functioning of MAUR, and (b) where the gap between available skills or experience and current requirements is greatest. These are considered to be:

- Financial management and project accounting
- Planning, arrangement, management and maintenance of metro services
- Planning, management and maintenance of related urban services and infrastructure
- Construction management and supervision
- Management of health and safety and environmental compliance and social and environmental safeguard issues
- Community participation

11.3.9 Strengthening MAUR needs to involve a combination of:

- Organizational strengthening: reviewing current organisation structure, and advising on change
- Systems and procedures: designing and introducing new procedures as basis for the delivery of its responsibilities
- Formal specialized training in fundamental aspects of the new tasks
- Structured on-the-job training in conjunction with the delivery of the Project, setting performance targets and monitoring against achieved improvement.
- Recruitment of qualified / experienced staff to cover health and safety and environmental compliance and social and environmental safeguard issues

11.3.10 On-the-job training will be provided via the project implementation consultancy services including (i) overall project management, budgeting and reporting; (ii) detailed design; (iii) assistance with bid preparation and tendering; (iv) assistance with contract management (v) orientation and training for health and safety and environmental compliance and social and environmental safeguard issues.

11.3.11 The full range of skills and capabilities required by MAUR and other departments of the HCMC-PC to effectively and efficiently manage the implementation of MRT Line 2, ensure the safe and efficient operation of MRT Line 2, and its interface with MRT Line 1, other future MRT lines and bus services, while fully meeting all legal requirements of HCMC-PC, GVN and loan conditions of the donor agencies, is set out in Table 11.3.

11.3.12 The key activities and associated skills and capabilities to fulfill those activities are identified under the following headings in Table 11.3:

- Line 2 Physical Implementation
- MRT operations (whole system)
- MRT Operations and Maintenance – build-up of own organization, implementation of operations and maintenance including health, safety and environmental compliance and social and environmental safeguard issues.
- Public transport management (whole system).

11.3.13 The activity entitled "MRT Operations and Maintenance – build-up of own organization, implementation of operations and maintenance" is included for completeness although it is expected that a separate O&M SOE will be created to arrange and manage O&M service provision under the management and regulation of a "slimmed down" MAUR. The skills and capabilities shown in Table 11.3 therefore are applicable in total to both MAUR and their O&M SOE.

11.3.14 MAUR's Organization and Training Division, working with the Department of Internal Affairs Human Resources Division, will undertake a survey of the breadth and depth of relevant skills and capabilities in HCMC-PC. The survey will focus on units within the PC with known skills and capabilities of relevance such as MAUR, and DOT / MOCPT, DPI and Department of Finance.

11.3.15 The results of the survey which will be available prior to the end of 2010 will be used to more precisely target capacity building activities during project implementation.

Table 11.3 Identified Key Activities & Required Skills and Capabilities

Line 2 Physical Implementation – Key Activities	**Relevant Skills and Capabilities**
Approvals and prerequisites e.g. property acquisition, meeting legal requirements for EIA, design approval etc	• Knowledge of, and experience with, national and local approval processes, including technical and legal requirements
Resettlement and other safeguards issues identification, implementation and management	• Knowledge of, and experience with, Vietnamese and ADB safeguard procedures including resettlement, environmental assessment, cultural property, natural habitats etc

Project management for Civil Works implementation	• Skills and capability in MRT/ railway physical works design and/or management. • Skills and capability in large public or private infrastructure design and/or management • Management of during construction traffic control, utility implementation and/or maintenance coordination • Management of during construction of maintenance including health, safety and environmental compliance and coordination of social and environmental safeguard issues • Providing information to the public on traffic disruption due to MRT or other major construction
Project management for trains/M&E implementation	• Skills and capability in MRT/ railway M&E design and/or procurement
Management of MRT Operations (whole system) – Key Activities	**Relevant Skills and Capabilities**
Project Management for Integrated Ticketing System for Lines 1 and 2 and other lines (and possibly bus)	• Skills and capability in public transport ticketing system implementation
Contracting of train operations and maintenance of facilities and track	• Skills and capability in railway operating concessions – arrangement, management and performance monitoring • Skills and capability in bus route franchising, their management and performance monitoring
Programming of works, development of multi-year investment programs, budgeting and monitoring	• Preparing multi-year works programs and budgeting • Implementation of works programs and revision based on progress and budget changes
Business case development – including technical, economic, financial and social/ environmental assessments	• Preparing feasibility studies • Preparing EIA including social impact assessment • Economic analysis • Financial Analysis
Development, implementation and management of safety and security systems & procedures	• Planning and implementation of safety and security systems in public facilities • Coordination with other authorities e.g. police, army, emergency response units at planning and operational stages
Marketing, provision of transport information and customer service	• Public communications – provision of information on relevant services to the public • Community engagement including public consultation • Active management responsibility in devising and managing dealings with a large customer base

Build-up of Organization for Operations and Maintenance – Key Activities	**Relevant Skills and Capabilities**
Administration and planning for Operations	• Service planning and design • Driver and other staff scheduling • Develop health, safety social and environmental management system.
Operations and maintenance	• Train operations control, inspection, driver instruction • Train maintenance (for E&M etc including spare parts stock control) • Infrastructure maintenance (telecommunications, Scada, signaling, power supply, track work) • Compliance with operating contract requirements • Compliance with statutory requirements for health, safety and environmental control and coordination of social and environmental safeguard issues.
Strategic financial planning and corporate development	• Business planning • Programming and budgeting • Policy development • Marketing • Performance monitoring including… • Reporting on sustainability of programme health, safety social and environmental management system.
Support services	• Accounting • Human resource planning and recruitment • Legal affairs • Customer service/ call center • Information, Communications and Other Technology Services
Public Transport Management (whole system) – Key Activities	**Relevant Skills and Capabilities**
Strategic urban transport planning and policy development and implementation	• Preparation of transport (all modes) or other modal masterplan • Preparation of land use plan for a city or region • Development and implementation of policies on public transport fares, vehicle taxation etc, parking
HCMC-PC finance management (initial focus on financial systems to ensure timely provision of counterpart funds during implementation and during operation)	• Local government financial planning • Coordination of regular funding for payment for services purchased by the city
Public transport service integration including short to medium term bus planning and bus service procurement to complement MRT	• Preparation of bus service route and service plans • Procurement of bus services • Forecasting of recurrent financial support to public transport

Options for the Future Institutional Arrangements

11.3.16 To some extent the scope of capacity building required in MAUR will depend on the options selected for the future operation of the metro line services. A number of options were discussed in the PPIAF Working Paper on Implementation Arrangements - Institutional Options, submitted in March 2008. The four options considered are summarised below:

Option 1: Strengthen MAUR

11.3.17 This Option 1 requires a strengthened MAUR that goes beyond treating MRT as a series of construction projects i.e. an Authority for MRT or Metropolitan Transit Authority (MTA). In this option, MAUR would be responsible for ensuring the planning and arrangement of operation for a fully integrated passenger rail system for HCMC. As an Authority MAUR would (a) plan effectively by seeking to meet demand (b) consider the whole of life attributes of proposed MRT; (c) arrange construction and operations (d) procure contractors for construction of civil works; (e) procure services to be operated so that they are all on the same basis; and (f) plan and program works and budgets in a disciplined manner. It would take overall transport policy and transport guidance from DOT of which its predecessor organization was a part.

Option 2: Interim Public Transport Authority

11.3.18 This option builds on Option 1 and proposes also a high level permanent committee at the PC level most likely chaired by the Chairman of the PC (or the Vice Chairman) to provide strong direction from the top and improve coordination horizontally between DOT and MAUR and with other important departments such as Department of Planning and Investment, Department of Finance and Department of Urban Planning and Architecture. This option is unlikely to be able to maintain the concerted effort

Option 3: Integrated Public Transport Authority

11.3.19 In this option the proposed Integrated Public Transport Authority would be solely responsible for ensuring the delivery and operation of a fully integrated public transport system (MRT and bus) for HCMC. This option would enable all public transport ticketing and fares to be integrated as long as MRT and bus operating arrangements are consistent. The proposed new Authority would take overall transport policy and transport guidance from DOT as for previous options. It would create a new formal structure in which civil works design and procurement and services would be arranged by new Engineering Design and Procurement and Operations Divisions respectively. Care would be taken to ensure that in a single organization (as for Option 1) that policy and operational functions are sufficiently separated to avoid a conflict of interest. Under this option, close links would be developed with DOT (as for Options 1 and 2) and with the Department of Planning and Investment, Department of Finance and Department of Urban Planning and Architecture.

11.3.20 As a true apex organization the proposed Authority would be staffed by very senior and respected official to direct the organization and cultivate the needed relationships for the new organization to fulfil its potential.

Option 4: Integrated Transport Authority

11.3.21 In this option, which is not considered feasible in the short to medium term, or necessary, a wholly integrated Authority would plan the multi-modal network, specify the services, program the investment (including roads, MRT and bus) in conjunction with the PC and Department of Planning and Investment and Department of Finance, and procure the services to be operated so that they are all on the same basis, thus enabling integrated fares and ticketing and integrated investment according to overall need. A close coordinating role with the Department of Urban Planning and Architecture is also envisaged to coordinate land use developments at MRT stations and in conjunction with new road developments. As for Option 3 it is envisaged that very close coordination between DPI and the Authority would exist. An independent rail safety regulator is also envisaged.

11.3.22 The options were assessed using the following criteria:

- Clarity of public transport management, e.g. ability to ensure consistent direction and priorities for public transport, a focus on core functions, involvement of transport users, and the risk of BITA reverting to inertia given its comprehensive role.
- Appropriateness of the institutional structure, e.g. clear allocation of responsibilities, accountability for outcomes, separation of potentially conflicting functions, links with key partners, and ease of implementation.
- Ability to deliver projects and services, e.g. businesslike, prepare programs, secure funding, tender, award and supervise concessions.
- Ability to meet passenger needs, e.g. integration of fares and services, provision of information on services, integration with land use.

11.3.23 A summary comparison of the assessed options is shown in Table 11.4.

Table 11.4 Comparison of Institutional Options for Metro Operation and Management

	Existing Arrangements	Option 1 Strengthen MAUR	Option 2 Interim PT Authority	Option 3 Integrated PT Authority	Option 4 Integrated Transport Authority
Clarity of strategic direction					
Ensure consistent directions & priorities	**-**	**✓**	**✓✓**	**✓✓**	**✓✓✓**
Focus on core functions	✓	✓	✓	✓✓	✓✓
Involvement of transport users	-	-	✓	✓✓	✓✓
Risk of inertia	-	-	-	×	××
Appropriateness of the institutional structure					
Clear allocation of responsibilities	✓	✓✓	✓✓	✓✓	✓✓
Accountability for outcomes	-	✓	✓	✓✓	✓✓
Separation of conflicting functions	-	✓	✓	✓✓	✓✓
Links with key partners	-	✓	✓✓	✓✓	✓✓✓
Pace/extent of change	na	✓	✓	✓✓	✓✓✓
Ability to deliver projects and services					
Businesslike arrangements	-	✓	✓	✓	✓
Ability to prepare and manage programs	-	✓	✓	✓	✓
Secure funding	-	✓	✓	✓✓	✓✓
Project implementation	-	✓	✓	✓	✓
Concession management	-	✓	✓	✓	✓
Ability to meet passenger needs					
Ticket and fare integration	-	✓	✓✓	✓✓✓	✓✓✓
Marketing and information	-	✓	✓	✓✓	✓✓
Integration of public transport and land use	-	-	-	✓	✓✓
Conclusion	**Change needed**	**Fair for Integrated MRT**	**Fair for Integrated Bus and MRT**	**Good for Integrated Bus and MRT**	**Good for Integrated Transport**

Preferred Option

11.3.24 There is a unique opportunity to create an Integrated Public Transport Authority by expanding the functions of the MAUR's proposed O&M SOE. The combination of two functions (a) the centralized collection of fare revenue, and (b) tactical bus service and MRT service planning with bus and MRT O&M procurement and payment for services, offers the basis for creation of an Integrated Public Transport Authority. These functions currently reside in (a) the Management Centre for Operations of Public Transport (under DOT) for bus, and (b) in the proposed new O&M SOE for MRT (under MAUR). Other functions which must be added include (a) contract compliance, (b) fares and service policy, (c) investment planning and programming, and (d) other relevant functions. With this model, the current DOT would become a Strategic Transport Planner, and Roads and Public Works Department.

11.3.25 HCMC-PC should be requested to create an Integrated Public Transport Authority (Option 3 proposed by ADB/PPIAF 2008). As some of the various functions of a suitable Authority are currently performed by existing agencies the creation of a new body with appropriate influence must be carefully planned and implemented.

11.3.26 Support to the HCMC-PC on the detailed design of the Authority, necessary changes to relevant laws and regulations, the development of new procedures and capacity building for staff transferred into an embryonic Authority, supported by medium term advisory support is essential to create a fully functional and effective Authority.

11.3.27 A TA for development and implementation of an Integrated Public Transport Authority is required and could be implemented in the following broad steps:

1. Short-list options and benefits and consult with Stakeholders;
2. Articulate preferred model;
3. Design implementation procedures;
4. Support to HCMC-PC for implementation including MRT opening year bus/ MRT integration plan; and
5. Capacity building on medium term basis.

11.3.28 The TA should commence by beginning of the second year of implementation of physical works and will take up to five years. Steps 1 to 3 should be completed within one year i.e. by end of Year 2 of implementation of physical works. Steps 4 and 5 would continue for a period of at least five years or to the end of Year 1 of MRT Line 2 operations, and could be included under the component entitled "MAUR Advisory Services including Capacity Development" described above.

11.4 Sources of Finance

Introduction

11.4.1 The financing options and issues for Line 2 need to be examined in the context of the logical framework for the project development. The goal or impact—to improve the liveability of HCMC through the provision of an integrated urban transport—and the purpose, or outcome—to assist the MAUR deliver a sustainable MRT Line 2 that provides a reliable, safe and attractive urban public transport service—together raise complex challenges going beyond issues of technology. No less important matters relate to identifying alternative approaches in organizing and financing the project delivery, and to understanding their potential to be effective and efficient—that is, produce the outcome and impact while incurring the least cost to the community. These non-technological issues form the focus of the PPIAF assignment which parallels the present feasibility study. The financing plan for the project is described in Chapter 8 of this report.

Financing and Delivery Options

11.4.2 The PPIAF study identifies for detailed examination four alternative approaches—including private sector participation and public private partnerships (PPP)—to project development of Line 2: (i) the project is developed by a state-owned enterprise (SOE), with government taking maximum responsibility in project management, financing and service delivery; (ii) the service delivery is by a private sector concessionaire, with government retaining the remaining project responsibility; (iii) the operating concessionaire supplies (i.e. also finances) the required trains and signalling and communications, and government retains all other responsibility; and (iv) the project is developed as a build-operate-transfer (BOT) concession, where the private sector take the maximum project responsibility, allowing government to play only a monitoring and evaluation role, at least in theory. The key features of the four options are summarized in Table 11.5.

The Integrated Transport Test

11.4.3 The first three options are consistent with an integrated MRT policy in that Government, with the appropriate concession format (i.e. the Gross Cost concession), ensures it retains control over fare policy and an unencumbered potential to integrate ticketing and other dimensions, physical and financial, bearing on passenger transfer between lines as the MRT network expands and ultimately also across public transport modes. The fourth, the BOT option, fails this test, because it naturally involves a Net Cost contract—i.e. the BOT concessionaire collects and keeps the fare revenue specified in the concession contract. The BOT concessionaire also requires a payment from government because Line 2 has a funding gap, and unless the concessionaire has a sole monopoly of MRT lines—which would not be in the public interest—it could have little incentive to act to facilitate passenger transfers between lines. As a result the BOT option conflicts with the TA's goal and purpose for Line 2. Details of this assessment appear in the PPIAF report.[29]

Value for Money (VFM) Test

11.4.4 The potential cost to the community of the four options is also evaluated and compared in a quantitative value-for-money (VfM) test. It is common experience that government generally faces a lower financing cost compared to the private sector. At the same time, statistical analyses of international transport projects provide well-founded evidence of substantial public sector optimism bias (a propensity for actual cost to exceed forecast or for actual revenue to fall short of forecast) in project capital cost estimates. Now, common experience suggests that, much more than the bureaucratic organization, a private sector enterprise is generally under strong motivation to manage uncertainly in project planning and implementation.

11.4.5 Meanwhile, studies of privatized public transport, especially bus, indicate that the private sector can be expected to deliver service at a cost significantly lower than the public sector. Thus, in theory, an MRT project development with an appropriate assignment of responsibility and risk between government and the private sector concessionaire could yield a lower expected cost, risk taken into account, compared to a e.g. a pure government effort.

Test Results

11.4.6 A VfM test carried out for the four options indicates that option (iii), private sector trains and train-related systems supply and service operation, incurs the lowest expected cost to the community; with option (ii) the next lowest. The BOT option shows a lower optimism bias than all the other options, but, since it uses the concessionaire's private sector financing for the full project investment, it incurs a maximum premium on the government's financing cost; this option turns out to have the highest expected cost to the community, the SOE option included. Evidently the BOT option is a doubly inappropriate approach to MRT project development. Details of the VfM test methodology, input data and parameters, as well as results can be found in the PPIAF report.[30]

[29] PPIAF Institutional Issues and Options Paper, 2008
[30] See the PPIAF Financial Model Paper (summarised in Appendix E)

Table 11.5 Alternative Approaches to Project Development: Summary of Features

Responsibility and risk	State owned enterprise (1)	Private sector operating concession (2)	Private trains E&M supply w/operating concession (3)	Build-operate-transfer (BOT) (4)
Financing				
Civil works and fixed equipment	Government sourced capital		Government sourced capital	Concessionaire sourced capital
Trains with related systems & equipment			Concessionaire sourced capital	
Passenger service with maintenance of civil works & equipment	Government sourced working capital	Concessionaire sourced working capital	Concessionaire sourced working capital	Concessionaire sourced working capital
Delivery				
Civil works and fixed equipment	Government procures by competitive tender		Government procures by competitive tender	Through Net Cost contract by competitive tender
Trains with related systems & equipment			Through Gross Cost contract by competitive tender	
Passenger service with maintenance of civil works & equipment	Via SOE's contract with government	Through Gross Cost[a] contract by competitive tender		
Payment/funding				
Fare revenue	Revenues collected under a separate arrangement	Paid to government	Paid to government	Concessionaire retains
Other revenue		Paid to government/ shared	Paid to government/ Shared	
Payment from government	Gross Cost contract style payment	Concessionaire receives competitively bid payment from government.		Competitively bid external support
Risk				
Investment cost-civil works and fixed equipment	Government transfers some risk to the private sector via the design, construction and equipment supply contracts	Government transfers some risk to the private sector in the design, construction and equipment supply contracts	Government transfers some risk to the private sector in the design, construction and equipment supply contracts	Transferred to private sector, except for agreed indexation
Investment cost-trains & related systems & equipment			Transferred to private sector	
Service operating cost & all maintenance costs	Contracting transfers some risk to SOE but state ownership means ultimate recourse to government	Transferred to private sector, except what is retained through indexation[b] plus the risk of government provided trains not matching operator needs	Transferred to private sector, except what is retained through indexation	
Revenue	Risk transfer to SOE for a similar purpose as in (2)-(3) seems less effective, perhaps because it is realised that government is not likely to let an SOE fail financially	Some patronage risk is transferred to private sector linked to an incentive payment to keep up service quality standards		Transferred to private sector, except for any agreed fare indexation

Source: adapted from PPIAF Institutional Issues and Options paper, this Study
Notes: [a]For a description of the Gross Cost and Net Cost concession forms see Section 2.9 Issues and Options paper, especially Figure 2.2.

[b]In the context of a concession agreement, indexation embodies the principle of allowing the price of a good or service to be adjusted upward or downward to keep its original purchasing power parity.

Assumptions and Contingencies

11.4.7 It is important to understand what assumptions are necessary for, and what contingencies would invalidate, the VfM test results. These are summarized below.

11.4.8 **Market competition.** VfM requires a competitive tender market for the concession and for related sub-contracting of the technology (eg design, construction, systems integration and installation, operation and maintenance in MRT service provision) and financing services to ensure that concession payment of concessionaires and sub-contractors is not in excess of a normal risk-weighted remuneration for effort. This means that an option which has cleared a VfM test could at the procurement stage be facing a market failure (eg only one bidder), threatening its ability to deliver the anticipated VfM . Thus, transition and emerging countries in particular often cannot count on a reliable international supply of private sector financing. The threat of market failure in a specialised field such as MRT concessioning and sub-contracting should not be dismissed lightly.

11.4.9 **Financial and services market distortions.** Here are some examples of distortions that can threaten or dilute VfM.

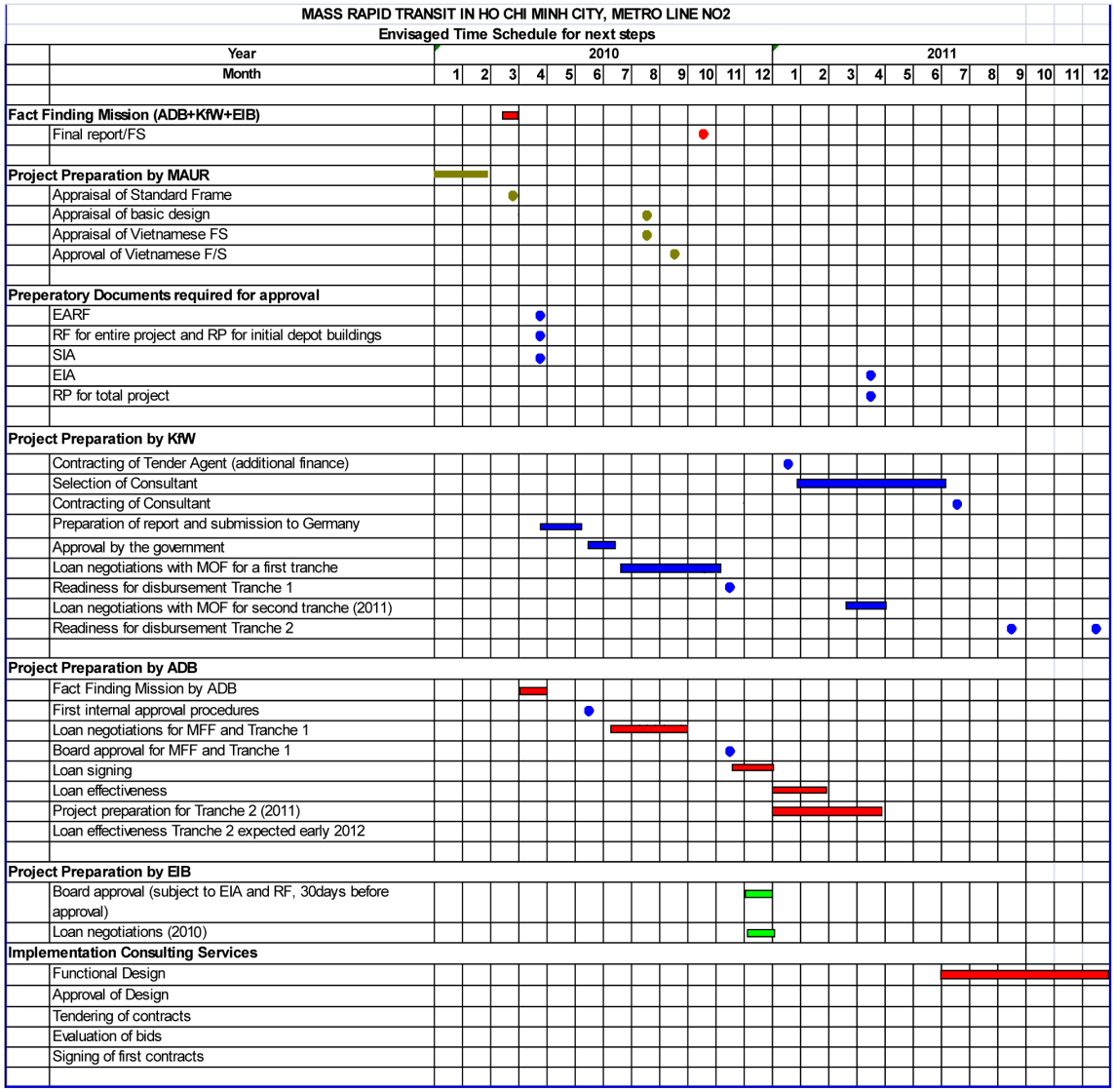
- Limited recourse financing of a PPP concession promotes VfM because the senior lenders, usually financial institutions regulated by a central bank, will for as long as the debt is outstanding have an interest in the project which is aligned with the authority granting the concession and bring professional skill to the monitoring of the concessionaire's performance. The lenders' incentive to monitor the concessionaire performance is diluted with the lenders' use of credit risk transfer (CRT) products. This practice dilutes the concession authority's effort to share an exposure to the concessionaire's performance level with the senior lenders, minimizing the monitoring cost in the process.
- Bilateral ODA financing can also introduce distortions in the sub-contracting markets. The tying of an ODA loan to supply of goods and services of a national origin restricts the competitive tendering for the procurement of MRT consulting and construction services and systems supply. An opportunity can be created for vendors to use the concessionary pricing of a loan to build in an additional margin on goods and services. In the long term, the practice can create a situation where, in a narrow field, the potential suppliers tacitly agree to live and let live instead of competing, with adverse effect on supply prices and therefore VfM.
- Partnering developed over time among financiers and sub-contractors while having a potential to be an effective project risk management tool for a concessionaire can be abused if allowed to develop into a collusive arrangement, which in the end threatens VfM.

11.4.10 **PPP procurement capability.** Ability to procure well is important for realising VfM. The balance of opinion, if not of evidence, is that a greater capability is required of the public sector in the procurement of a PPP concessionaire, than conventional public works procurement. Ad hoc outsourcing for the required skills leads to limited results. For example, legal firms skilled in PPP contracting, forced to make a choice through conflict of interest rules, can tend to opt for working for the concessionaire side rather than government. Institutional capability building is required.

11.5 Next Steps

11.5.1 The envisaged schedule for the project preparation is shown in Table 11.6. This highlights the next steps for MAUR and the Donors (ADB, KfW and EIB) from the present to the release of the Tranche 2 loan to fund construction of the Project.

Table 11.5 Envisaged Schedule of Next Steps



12. RISK IDENTIFICATION AND MANAGEMENT

12.1 Financial and Economic Risks

12.1.1 The financial and economic viability of the Project depends to a large extent on the implementation of other aspects of the HCMC transport strategy. This includes the other MRT lines and also includes the implementation and enforcement of policies to promote public transport. Implementation of Line 1 has started and commitment to future lines appears to be strong, so the risk of non-implementation is minimal unless there is a major shift in the region's economic climate.

12.1.2 The Project will benefit the whole of HCMC by providing a safe, comfortable and affordable mode of travel that will contribute to the public transport masterplan and reduce the growth of private transport. Through reducing travel time and vehicle operating cost, the project will free up resources to promote and support private sector economic activities in the HCMC Region, a main engine of the Viet Nam economy.

12.1.3 The Project's primary economic benefits come from travel time and vehicle operating cost saved while using the urban transport system, which is predominantly road-based. The reduction in daily road vehicle time and distance will also mean lower road maintenance and vehicle capital employed, reduction in carbon dioxide emission, and fewer fatal road accidents. Moreover, being operated on a dedicated way unlike general road-based transport, the project's MRT Line 2 can offer more reliable journey time on the system, a quality improvement for public transport.

12.1.4 The estimated Economic Internal Rate of Return (EIRR) for the project is 12.4%, indicating economic viability; the economic net present value discounted at 12% is $36.8 million. Sensitivity testing and risk analysis indicate a low risk of the project EIRR falling below the minimum acceptable economic yield of 12%.

12.1.5 The Project is estimated to yield a Financial Internal Rate of Return (FIRR) of 3.38%. The Project will be a public sector investment as the Viet Nam Railway Law (No 35/2005/QH11, Article 56) assigns the responsibility for policy implementation to the provincial and centrally administered city level and also stipulates GOV's responsibility to provide support to approved investment in MRTs. The Project is to be financed through loans from ADB, KfW, EIB with the remainder funded by the GOV (See Chapter 10, Table 10.11).

12.2 Operation Risks

12.2.1 There are risks associated with the effectiveness of the planning and operation of the MRT system as a whole, and similarly with other elements of an integrated multi-modal public transport system. There is no certainty over the Government's commitment and ability to enforce pro-public transport policies, and there is a risk that the mode of private transport will continue to increase unchecked.

12.2.2 Mitigation for these risks will be through the strengthening of MAUR in terms of its planning, management and operational capacities. This will also depend on the Government's continued support to MAUR.

12.2.3 The city's transport strategy includes an increase in the involvement of the private sector as investors and operators. There is a risk that the private sector may be unwilling to take a significant role in public transport infrastructure. Clearly, variations in costs and potential revenues will influence profit margins and thereby the investment decisions of private undertakings.

12.3 Environmental, Social and Resettlement Risks

12.3.1 A full Environmental Impact Assessment (EIA) with mitigation measures and a monitoring timetable included to reduce the affects of the project on the environment. This will be carried out in accordance with Government and ADB guidelines.

12.3.2 Social and resettlement risks involve the possibility that compensation, resettlement, and income restoration measures might not be delivered as agreed, thereby disadvantaging affected people and possibly delaying the start of civil works. This risk is in part safeguarded by the Resettlement Framework and Social Impact Assessment carried out for the Project.

12.3.3 The above risks should be mitigated by ensuring that the consultants and PMU have appropriate and competent specialists to assist in updating and implementing the EIA, RF and SIA. MAUR will also engage an independent monitoring organization to supervise implementation of resettlement and compensation.

12.4 Risks to Achieving Expected Ridership

12.4.1 The transport demand and revenue forecasts assume a series of strategies, policies and actions as set out in Chapter 4 which have to be put in place as a package to maximize the chances of achieving the target public transport mode split (refer to section 4.3).

12.4.2 These strategies, policies and actions are therefore needed to mitigate the risks likely to reduce public transport demand, including MRT demand and associated fare revenue.

12.4.3 In the context of MRT Line 2 the risks can be broadly classified by the extent of control that MAUR or the HCMC-PC has to mitigate the risk factors. The risks can be classified as:

- Those risks not under the control of MAUR and the HCMC-PC – e.g. those due to faster private vehicle ownership and use than forecast due to more rapid economic growth than assumed;
- Those risks partially under the control of MAUR and the HCMC-PC such as that those risks affecting the duration of demand ramp up – extensive ramp up for both MRT Lines 1 and 2 is expected due to the newness of the “MRT product” in the market place. Ramp up is a function of community understanding of how to make use of MRT and how to accommodate the cost of fares in household budgets but the duration of ramp up can be shortened by appropriate marketing and fare pricing campaigns.
- Those risks under the control of MAUR – those due to the quantity and quality of MRT services operated and the ease of using the MRT system including extensions to Line 2, implementation of other MRT lines as planned, physical integration of Line 2 with other MRT lines, implementation of integrated ticketing for MRT, and installation of lifts and escalators at other stations to facilitate convenient pedestrian access;
- Those under the control of other departments of the HCMC-PC such as those that affecting the extent of bus service provision and its integration with MRT, the quality of those bus services, the implementation of integrated public transport fare pricing, the effective management of during construction traffic impact to limit land use dispersal away from the Line 2 corridor which would weaken Line 2’s performance and the provision of traffic management measures to efficiently manage post construction traffic, and effective land use planning and development both within the vicinity of MRT stations on Line 2 and other lines, and at the metropolitan level.

12.4.4 Candidate strategies, policies and actions which can assist to mitigate the demand and associated revenue risks are listed below where the risks are partially or in theory fully controllable by MAUR or the HCMC-PC as a whole.

Table 12.1 Candidate Strategies, Policies and Actions to Enhance the Role of the MRT Line 2 and Overall Public Transport

Strategy/ Policy/ Action	Time Frame			
	During construction	Period after opening (0-2 years)	Period after opening (3-5 years)	Longer Term
UNDER CONTROL OF MAUR				
– **MRT Line 2 System**				
1. Undertake marketing/ passenger information campaigns and implement fare pricing strategy	→	→ →	→ →	→ →
2. Improve access to stations (escalators and footpaths)	→	→ →		
3. Implement P&R and K&R facilities at stations	→	→ →		
4. Operate Line 2 to high standard		→ →	→ →	→ →
5. Implement Line 2 extensions	→	→ →	→ →	→ →
– **Other MRT Lines**				– –
6. Ensure good physical connections between Line 2 and other lines	→	→ →	→ →	
7. Implement integrated ticketing system with Line 1 and other Lines and Bus/ ferry	→	→ →		
8. Provide support facilities at MRT stations	→	→ →		
UNDER CONTROL OF HCMC-PC				
(a) Integrated Bus Services with MRT (all Lines)				
9. Acquire buses and develop integrate public transport services	→	→ →	→ →	→ →
10. Implement during construction traffic management	→	→ →		
11. Implement permanent traffic management		→ →	→ →	→ →
12. Improve urban design in station environs	→	→ →		
(b) Transport Policy Development				
13. Update urban transport plan and policies	→	→ →	→ →	→ →
14. Investigate & implement other demand management policies	→	→ →	→ →	
(c) Land Use Development				
15. Improve pedestrian linkages between buildings and Line 2 and other MRT stations	→	→ →	→ →	
16. Modify building regulations to encourage denser development in vicinity of Line 2 and other MRT stations	→	→		
17. Investigate and implement land use taxation policies to favour intensive development adjacent to MRT stations	→	→ →		
18. Implement comprehensive and effective city land use planning	→	→ →	→ →	→ →

12.5 Conclusion

12.5.1 The Project has no major implementation risks as international standards will be applied to the design and construction of the MRT Line 2. Safeguards will be put in place to monitor the impact on the environment and affected persons. A Resettlement Plan and Social Impact Study have been undertaken for the Project. It is expected that benefits and impacts will outweigh any mitigation costs.

Table 12.1: Summary Risks and Mitigating Measures

Risks	Mitigating Measures
Sector policies - lack of integration / planning of MRT lines - inadequate investment in bus network and sustainable transport measures to integrate with MRT - Increase in private transport	The Government: – To approve the updated HCMC Masterplan (MRT network) – to allocate funding and resources to implement pre and post MRT bus network and sustainable transport measures - to implement policies to reduce the attractiveness of the private vehicle and promote the use of public transport
Project fails to be maintained and operated to international standards	Consultants will be appointed to help further strengthen maintenance planning, funding, and implementation.
Corruption	Close project monitoring through ACAP
Land Acquisition and safeguards implementation delays	Full consultation and participation of potential affected parties and environment during alignment study to ensure agreed and acceptable solutions recommended

Source: Project Team