REPUBLIC OF THE PHILIPPINES
LIGHT RAIL TRANSIT AUTHORITY

PREPARATORY STUDY
FOR
LRT LINE2 EXTENSION PROJECT

FINAL REPORT

OCTOBER 2011

JAPAN INTERNATIONAL COOPERATION AGENCY

ORIENTAL CONSULTANTS CO., LTD.
KATAHIRA & ENGINEERS INTERNATIONAL
TONICHI ENGINEERING CONSULTANTS, INC.

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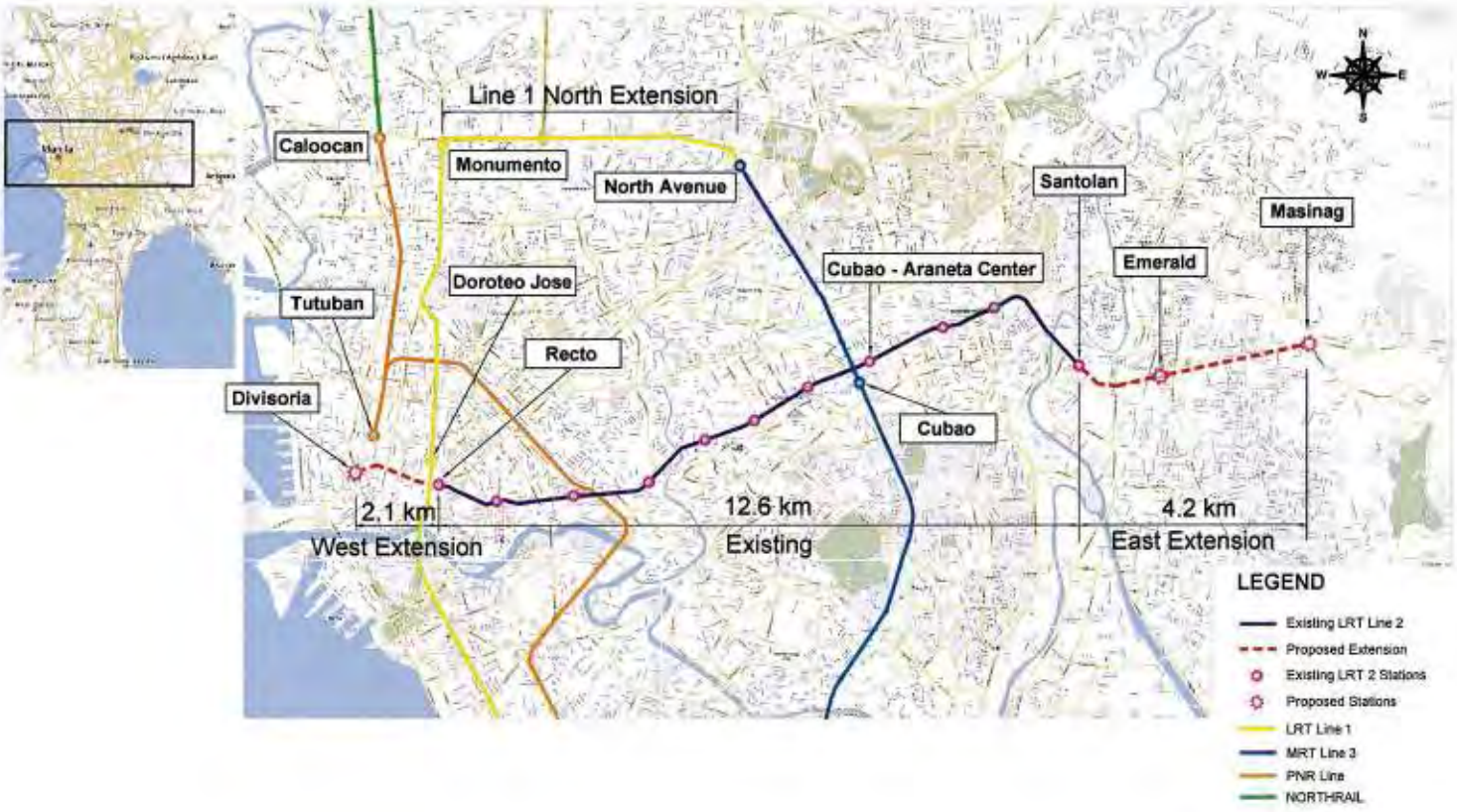

LOCATION MAP

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ABBREVIATION LIST

Term	English
AASHTO	American Association of State Highway and Transportation Officials
ABC	Approved Budget for Contract
ACI	American Concrete Institute
ADB	Asian Development Bank
AFC System	Automatic Fare Collectin System
AISC	American Institute of Steel Construction, Inc.
APIT	Asia Pacific International Terminals
APS	Automatic Paging System
APTA	American Public Transportation Association
AREA	American Railway Engineering Association
AREMA	American Railway. Engineering and Maintenance Association
ASCE	American Society of Civil Engineers
ASEP	Association of Structural Engineers of the Philippines
ASTM	American Society of Testing and Materials
ATC	Automatic Train Control
ATI	Asian Terminals Inc.
ATO	Automatic Train Operation
ATP	Automatic Train Protection
ATS	Automatic Train Stop
AWS	American Welding Society
BAC	The Bids and Awards Committee
BGTOM	Build - Gradual Transfer - Operate & Maintain
BIR	Bureau of Internal Revenue
BLMT	Build -Lease to Own-Maintain-Transfer
BLT	Build-Lease-Transfer
BMS	Building Management System
BOO	Build -Own-Operate
BOP	Balance of Payment
BOT	Build -Operate-Transfer
BT	Build-Transfer
BTO	Build-Transfer-Operate
CAAP	Civil Aviation Authority of the Philippines
CAO	Contaract-Add-Operate
CBD	Central Business District
CBR	Cost Benefit Ratio
CCPSP	Coordinating Council for Private Sector articipation
CCTV	Closed Circuit Television
CEZA	Cagayan Economic Zone Authority
CIIP	Comprehensive Integrated Infrastructure Program
CLPDC	Cagayan Land Property Development Corporation
CO_2	Carbon deoxide
COA	Commission on Audit
CRL	Certificate Revocation List
CTC	Centralized Traffic Control
CTL	
CTS	Common Ticketing System
DBM	Department of Budget and Management
DENR	Department of Environment and Natural Resources

Term	English
DMIA	Diosdado Macapagal International Airport
DOF	Department of Finance
DOT	Develop-Operate-Transfer
DOTC	Department of Transportation and Communication
DPWH	Department of Public Works and Highways
DTI	Development of Trade and Industry
E&M	Electrical & Mechanical
E&M	Electrical and Mechanical
EDCF	Economic Development. Cooperation Fund
EIRR	Economic Internal Rate of Return
FHWA	Federal Highway Administration
FIRR	Financial Internal Rate of Return
GCEs	Government Corporate Entities
GDP	Gross Domestic Product
GFIs	Government Financial Institutions
GHG	Greenhouse Gas
GICPs	Government Instrumentalities with Corporate Powers
GPPB	The Government Procurement Policy Board
GRMS	General Repair and Maintenance Section
GTF	Guadalupe Tuff Formation
HHICC	Hanjin Heavy Industries and Construction Company
IBC	International Building Code
ICAO	International Civil Aviation Organization
ICC	Investment Coodinating Council
ICC	International Code Council
ICTSI	International Container Terminal Service, Inc.
IEC	International Electrotechnical Commission
IGBT	Insulated Gate Bipolar Transistor
IPP	Independent Power Producers
IRR	Implementing Rules and Regulation
ISO	International Organization for Standardization
ITU	International Telecommunication Union
JBIC	Japan Bank For International Cooperation
JV	joint venture
LGUs	Local Government Units
LRFD	Load and Resistance Factor Design
LRT	Light Rail Transit
LRTA	Light Rail Transit Authority
LRV	Light rail vehicle
LTFRB	Land Transportation Franchising and Regulatory Board
MARINA	Maritime Industry Authority
MERALCO	The Manila Electric Company
METI	Ministry of Economy, Trade and Industry
MIAA	Manila International Airport Authority
MICT	Manila International Container Terminal
MMDA	Metropolitan Manila Development Authority
MMEIRS	Metro Manila Earthquake Impact Reduction Study
MMPTS	Mega Manila Public Transport Study
MMUTIS	Metro Manila urban Transportation Integration Study
MR	Materials Request

Term	English
MRT	Metro Rail Transit
MRTC	Metro Rail Transit Corporation Limited
MTPDP	The Medium-Term Philipines Development Plan
MTPIP	The Medium-Term Philipines Public Investment Plan
MWSS	Metropolitan Waterworks and Sewerage System
NAIA	Ninoy Aquino International Airport
NAVFAC	Naval Facilities Engineering Command
NCR	National Capital Region
NDC	National Development Council
NEDA	National Economic Development Authority
NEP	North Extension Project
NFPA	National Fire Protection Association
NGAS	New Government Accounting System
NLEX	North Luzon Expressway
Nox	Nitrogen Oxide
NPV	Net Present Value
NRIMP2	National Road Improvement Project Phase 2
NSCP	National Structural Code of the Philippines
O&M	Operation & Maintenance
OCC	Operation Control Center
OCS	Overhead Catenary System
OD	Origin-Destination
ODA	Official Development Assistance
OEM	Original Equipment Manufacturer
PABX	Private Automatic Branch eXchange
PC	Prestressed Concrete
PCAB	Philippine Contractors Accreditation Board
PCG	Philippine Coast Guard
PDF	Project Development Fund
PFI	Private Finance Initiative
PHIVOLCS	Philippine Institute of Vulcanology and Seismology
PIATCO	Philippine International Air Terminals Corporation
PIS	Passenger Information System
PLDT	Philippine Long Distance Telephone Company
PMO	Project Management Office
PNCC	Philippine National Construction Corporation
PNR	Philippine National Railways
PPP	Public Private Partnership
PPP-LCC	Public Private Partnership - Life Cycle Cost
PSAs	Priority Strategy and Activities
PSC	Public Sector Comparator
ROO	Rehabilitate-Own-Operate
ROT	Rehabilitate-Operate-Transfer
ROW	Right-of-Way
RTU	Remote Terminal Unit
SCADA	Supervisory Control And Data Acquisition
SCF	Standard Conversion Factor
SCM	Supply Chain Management
SDH	Synchronous Digital Hierarchy
SEAOC	Structural Engineers Association of California

Term	English
SEC	Securities and Exchange Commission
SER	Signaling Equipment Room
SONA	State of the Nation Address
SPC	Special Purpose Company
SPM	Suspended Prticulates
STRADA	System for Traffic Demand Analysis
SUCs	State Universities and Colleges
TCRP	Transit Cooperative Research Program
TEC	Traffic Engineering Center
TMV	Ticket Vending Machine
TPI	Tutuban Properties Inc.
TRB	Toll Regulatory Board
TTC	Travel Time Cost
UBC	Uniform Building Code
UIC	International Union of Railways
UPS	Uninterruptible Power-supply System
USTDA	US Trade and Development Agency
VAT	Value Added Tax
VFM	Value For Money
VGF	Viability Gap Fund
VOC	Vehicle Operation Costs
VOT	Value of Time
VVVF	Variable Voltage Variable Frequency
WACC	Weighted Average Cost of Capital

INTRODUCTION

Background of the Study

The population of the Manila metropolitan area of the Republic of the Philippines, which was 7.95 million in 1990, rapidly increased 1.45-fold to 11.5 million by 2007. Urbanization is increasingly worsening traffic conditions. Nationwide, the total number of registered automobiles has increased at a rate of approximately 6% annually and exceeded 5.9 million in 2008. These circumstances accentuate the need to reduce air pollution, curtail greenhouse gases and improve mass transportation.

Urban railways available in the Manila metropolitan area are Light Rail Transit (LRT) Lines 1 and 2 operated by the Light Rail Transit Authority (LRTA) MRT Line 3 operated by the Department of Transportation and Communications (DOTC), and commuter trains operated by Philippine National Railways (PNR). In their current state these systems are unable to cope with demand and further upgrading and expansion is ought.

The Government of the Philippines plans to expand the mass transit system in the Manila metropolitan area to solve the increasingly serious transportation problem. The LRT Line 2 extension project ("the Project") is a top priority project under DOTC's Manila Metropolitan Area Transportation Master Plan and cited in the Comprehensive Integrated Infrastructure Program (CIIP) of the National Economic Development Authority (NEDA).

The Project is supported by Japan's Individual National Assistance Program for the Philippines, which promotes "Sustainable economic growth to create employment opportunities" and also JICA's development goal, "Constructing a Foundation for Economic Growth," which prioritizes "Transportation Network Improvement Program". JICA efforts include the "LRT Line 1 Enhancement Program," and the "Metro Manila Metropolitan Traffic Congestion Alleviation Project," to facilitate development of railway transportation and build sustainable transportation systems. These programs are viewed as high-priority assistance areas. In addition, the Ministry of Economy, Trade and Industry (METI) conducted a "Study on Manila LRT Line-2 East-West Extension Project in Philippines" (hereinafter "the METI Study") and proposes a specific extension section.

Based on these plans, the Philippine Government has requested that the Japanese Government conduct a feasibility study for the LRT Line 2 extension project, which is aimed at resolving serious traffic congestion in the Manila metropolitan area, reducing air pollution and greenhouse gases, and contributing to alleviating climate change.

The need of the Public sector to engage the Private sector in a partnership for funding of public infrastructure or development project is to relief public debt burden. The most common manner to attract private investor in these ventures is first by allowing them to collect revenue or fees; and secondly, by closing the viability gap and/or with a proper allocation of risks, making what would be a non-commercially viable project viable. Therefore, it has been declared a policy of the GOP to recognize the indispensable role of the private sector as the main engine for national growth and development and provide the most appropriate incentives to mobilize private resources for the purpose of financing the Construction, Operation and Maintenance of infrastructure and development projects normally financed and undertaken by the Government.

Objectives of the Study

This Preparatory Study will verify the necessity and validity of the Project, and it will conduct a feasibility study including a preliminary design and quantity survey. It will also investigate solutions related to lessons and recommendations from the past railway transportation projects in Manila metropolitan area and examine efficiency and sustainability in railway business operations. In addition,

as infrastructure projects are being planned and implemented under PPP schemes following the direct instructions from the Government of the Philippines, in this study, the feasibility of realizing the Project under a PPP scheme, and in particular attention to the probability of assistance from Japanese ODA, will be investigated. This study is, as stated above, to pave the way for possible ODA and PPP mixed implementation scheme by evaluating feasible alternatives for the realization of the Project.

Area of the Study

The area of this study is the NCR (National Capital Region), and two sections totaling approximately 6 km in length designated for LRT extension — the LRT Line 2 east (Santolan – Masinag) extension which is about 4 km long, and a 2-km western extension section (Rect – Divisoria).

Items to be Studied

Items which are being studied are as indicated below.

Items to be Studied

Classification	Substance
1 Confirming necessity and background of project	1.1 Confirming situation and issues in Manila metropolitan area transportation sector 1.2 Confirming transportation sector's policies and high-priority projects 1.3 Review of PPP-related laws and regulations in the Philippines 1.4 Review of transportation sector projects resembling PPP in the Philippines, private sector utilization, and confirmation of privatization trend 1.5 Confirming LRTA situation and establishing challenges 1.6 Financial analysis of implementing institution 1.7 Establishing challenges and review of development/business plans of other implementing institutions in Manila metropolitan area 1.8 Confirming assistance policies and programs of other donors for transportation sector 1.9 Confirming necessity of the Project
2 Demand forecast	2.1 Review of fiscal year passenger count in LRT Line 2 2.2 Examination of extension routes 2.3 Creation modal split models 2.4 Demand forecast for the extended routes 2.5 Consistency between extended routes and high-priority projects and confirmation of necessity and appropriateness of project implementation
3 Development of project plan	3.1 Review of standards and specifications of existing railway facilities and systems 3.2 Geotechnical survey 3.3 Route planning 3.4 Train operation plan 3.5 Project design standards 3.6 Rolling stock procurement plan 3.7 Civil engineering facilities plan 3.8 Power distribution, machinery, signals and telecommunication facilities plan 3.9 Technical Review of Compatibility with Existing Railway System
4 Sustainable Railway Business Operations	4.1 Review of the ex-post evaluations of Manila railway sector projects 4.2 Review of solutions pertaining to the lessons and recommendations 4.3 Adequacy Evaluation of solutions and recommendation for direction 4.4 Study of efficient project management scheme 4.5 Review of roles and powers of related organizations for efficient project management

Classification		Substance	
5	Project implementation plan	5.1 5.2 5.3 5.4 5.5 5.6 5.7	Construction method Procurement of materials and equipment Project implementation schedule Study of technical assistance package Project cost estimation Reducing project costs Key points in project implementation
6	Confirming project implementation structure	6.1 6.2 6.3 6.4	Confirming implementation structure Risk allocation table for project implementation under PPP scheme Issues pertaining to PPP projects/identification of limitations faced by ODA side Confirming management and maintenance system
7	Environmental and social considerations	7.1 7.2	Environmental impact assessment report Assisting preparation of simplified inhabitants relocation plan
8	Confirming project effects	8.1 8.2 8.3 8.4	Calculation of operation and effect indexes Qualitative effects for surrounding area of new stations Estimating greenhouse gas reduction EIRR & FIRR (Economic & Financial Evaluation)
9	Considerations and recommendations	9.1 9.2	Considerations in implementing the Project and recommendations Review of feasibility for efficient project management

CHAPTER 1

BACKGROUND & NECESSITY

CHAPTER 1 BACKGROUND & NECESSITY

1.1 Manila Transport Sector Condition

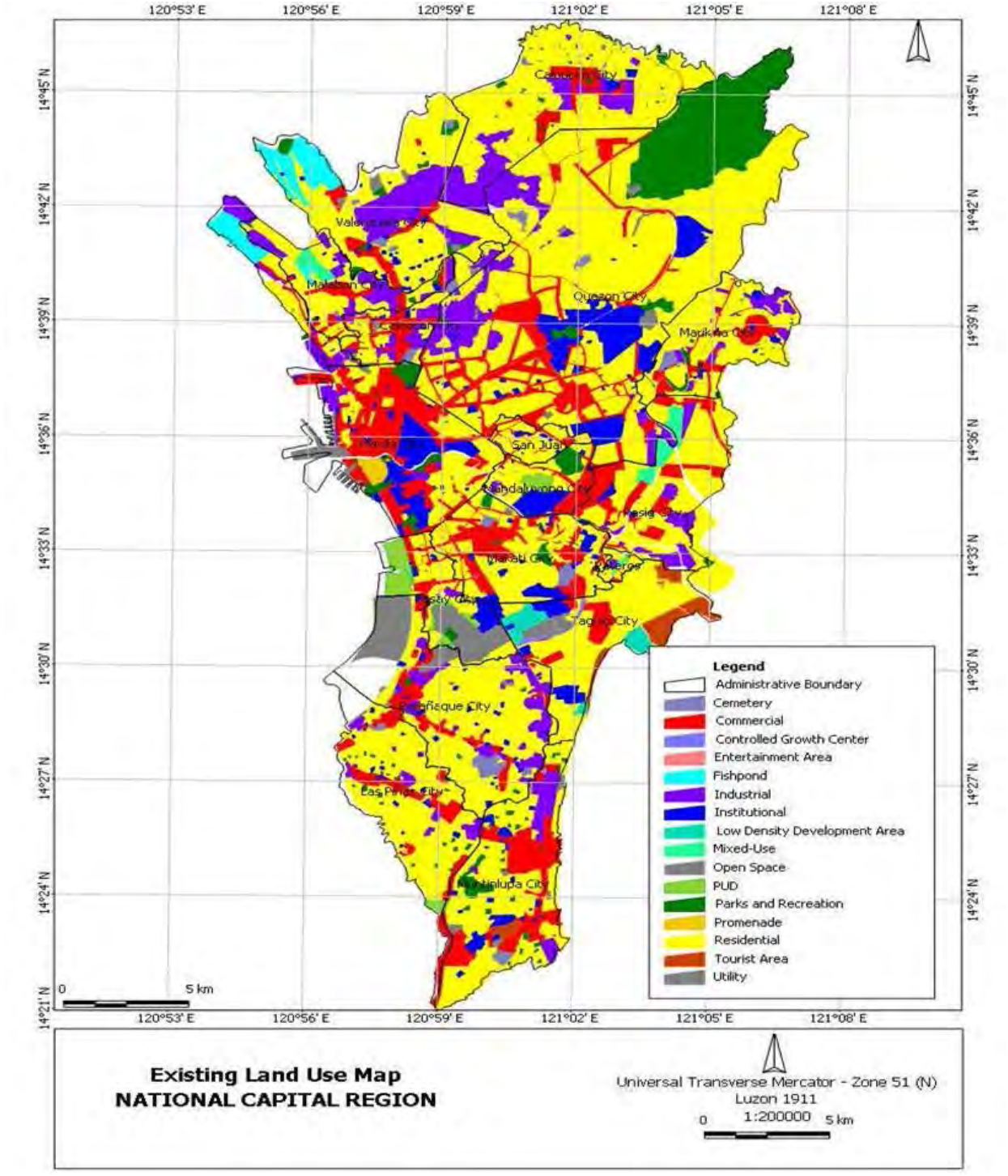
1.1.1 General

Metro Manila is the smallest of the country's administrative regions in terms of land area and is the only region without any provinces (**Figure 1.1-1**). It consists of 14 cities and three municipalities. As of the 2007 census, its population stood at 11.6 million and the population density was at 18,052 people per square kilometer. It is among the world's twenty most populous metropolitan areas. Metro Manila is the single most economically productive region in the Philippines, contributing 32% of the Gross Domestic Product (GDP). Metro Manila is the center of the country's industrial and commercial activities. Almost 50% of the country's industrial production and more than 35% of the total services are produced in the National Capital Region.

Metro Manila is characterized by the concentration of economic, social and political activities as evidenced by the presence of 90 out of the 100 biggest corporations in the country, all major newspapers, radio and TV networks and 60% of the country's non-agricultural labor force. The area serves as the distribution center for exports and capital goods. In addition, about 90% of the internal revenue collections for the entire country are taken from the area and almost 80% of the national imports/exports pass through the Port of Manila. The metropolis is also the nation's center for non-primary production, providing almost half of the total national output in manufacturing, commerce and services.

Source: TTPI,LRT2 West & East Extension Ridership Study

Figure 1.1-1 (1) Metro Manila Political Composition and Land Use



Source: TTPI,LRT2 West & East Extension Ridership Study

Figure 1.1-1 (2) Metro Manila Political Composition and Land Use

Metro Manila has the largest international airport in the country. As a result it is the main tourism gateway to the Philippines. The centrality of Manila in the air transport network means that it is a prime take-off point for foreign tourists going to other destinations within the country. The foremost attractions in Metro Manila for foreign and local tourists include the combination of the conveniences of modern life and the density of social and cultural events taking place all over the metropolis.

1.1.2 Road Condition

The transport system in most cities in the Philippines, including Metro Manila, is road-based. In terms of vehicle population, about 29% of the 5.9 million total motor vehicles were registered in the cities and municipalities of Metro Manila in 2008, not including close to 1.6 million vehicles from CALABARZON and Region III which mainly operate daily within the metropolis.

Of the total road network in Manila of 5,000 kilometers, about 1,600 are private roads, while the rest are public roads: national roads (1,000 km) and city roads (2,400 km). The condition of Metro Manila's road network reflects the level of service of the overall urban transport system. Deteriorating road conditions and lack of proper maintenance reduce further the efficiency level of the road network, thereby resulting in longer travel times and worsening traffic congestion. Similarly, ineffective and outdated drainage systems further contribute to the situation especially during rainy seasons where flash floods become normal occurrences in urban areas. The Philippines is home to numerous variants of urban public transport modes. Some of the more "conventional" forms such as buses and urban railways are in use mainly within Metro Manila and its surrounding areas. However, jeepney dominates as public transport mode in Metro Manila, as well as in many of the larger cities in the Philippines. Other public utility vehicles include taxis, FX[1], vans, multicab[2], tricycles, and other localized transport such as the "trisikad" which is a pedal-powered tricycle.

1.1.3 Urban Railway Condition

Mass urban railway services are operated currently in Metro Manila only. It consists of a network of electrified, rail-based mass transit systems that augment the road network system in meeting the transport demand in the metropolis. Three urban railway transit systems are now operational and four more are in the planning stage or already in the pipeline for construction. The three railway transit systems in operation are the following:

- LRT Line 1, from Roosevelt in Quezon City to Baclaran in Pasay City;
- MRT Line 2, from Santolan in Pasig City to CM Recto in the City of Manila; and
- MRT Line 3, from North Avenue in Quezon City to EDSA in Pasay City.

Besides these three systems, there is one long-distance diesel powered system operated by Philippine National Railways (PNR). **Figure 1.1-3** shows the existing railway network in Metro Manila

LRT Line 1 is operating along a 20.5 km elevated railway system servicing the Taft Avenue - Rizal Avenue and North EDSA corridors. It currently handles about 457,000 passengers per weekday, with peak traffic reaching 525,000 passengers during special festive dates of the year. Due to the increased ridership of LRT 1, a train acquisition project was conceptualized with the primary objective of expanding the LRT Line 1 capacity by 50% from a nominal carrying capacity of 18,000 passengers per peak-hour per direction to 27,000 or 235,000 additional commuters to be carried by the system daily. This objective was achieved in 2000 through the procurement of seven new, air-conditioned 4-car trains and the transformation of the existing 2-car trains to 3-car trains with corresponding modifications to the existing vehicles, systems, facilities, and structures to support the operation of the expanded system. Recently, the Light Rail Transit Authority (LRTA) has completed Phase II of the LRT 1 Capacity Expansion Project, which effectively increased the capacity of LRT Line 1 to 40,000 passengers per hour per direction from the current capacity (Phase I) of 27,000 hourly passengers.

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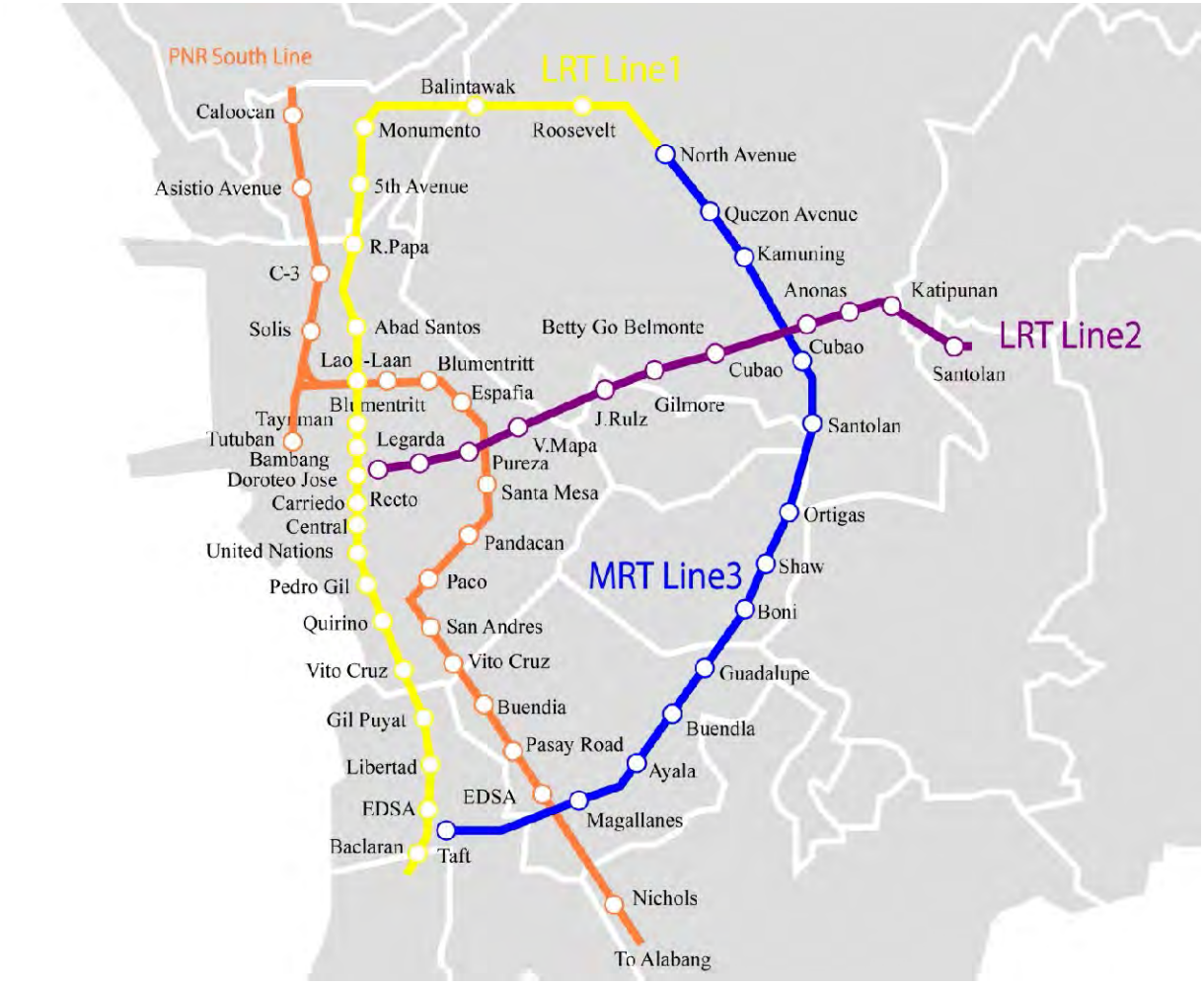
[1] *An "FX" uses the type known as Asian Utility Vehicle (AUV) which usually has a basic capacity of ten or fewer passengers, is arranged more like an automobile, but with short row seats at a hatched compartment.*

[2] *A "multicab" has a jeepney-like arrangement but seats only twelve passengers. Its fare usually follows the jeepney fare system.*

The LRT Line 1 North Extension is a 5.7 km elevated viaduct that has recently added two more stations (Balintawak and Roosevelt) to the revenue operation of Line 1. The last phase of this project is to build a Common Station that will connect the Line 1 and MRT Line 3, and in the future with Line 7 as well. The construction of this station is up for bidding now, and it is scheduled to enter in operation later in 2012.



Source: LRTA Website

Figure 1.1-2 Metro Manila Existing Railway Network

The Megatren, more popularly known by its generic name LRT Line 2, is a 13.8 km mass transit line that traverses four cities in Metro Manila namely Pasig, Quezon, San Juan and Manila along the major thoroughfares of Marcos Highway, Aurora Boulevard, Ramon Magsaysay Boulevard, Legarda and Recto Avenue. The Megatren, which started initial commercial operation in April 2003, is the latest of its kind in the world today. It is an Automatic Train Operation system which is at par in terms of facilities and technology with those in other parts of the world. It is equipped with a CCTV system that enables the railway operator to monitor activities of passengers and employees at the stations and inside the trains. Moreover, the LRT 2 is commuter friendly and has facilities especially designed for the elderly and persons with disabilities. The Megatren system has 18 new four (4) - car trains. Each train is 92.6 meters long and consists of four motorized cars. One train can seat 232 passengers. It can accommodate 1,396 more standing passengers along its spacious coaches.

Under a BLT contract to Metro Rail Transit Corporation (MRTC), the EDSA MRT or MRT Line 3 (Metrostar Express), a 16.9-kilometer modern rail system stretching along EDSA's from North Ave. in

Quezon City to Taft Ave., Pasay City was constructed from 1998 to 2001. This Metro Rail system is designed to carry traffic in excess of 23,000 passengers per hour per direction initially, and is expandable to accommodate 48,000 passengers per hour, per direction. The rail system has a total fleet of 73 Czech-made modern air-conditioned rail cars, of which up to 60 cars in three-car trains are operated daily during the peak hours. Each train can seat 216 passengers and carry under crush capacity 1,182 riders. **Table 1.1-1** shows a summary of the main parameters of the three railway lines.

Table 1.1-1 Main Parameters of Manila Railway Lines

Item /Description	Line 1	Line 2	Line 3
Structure Type	Elevated track with PC-I beams	Elevated PC concrete box girder	Elevated & underground track with PC-I beams
Route Length	13.9 km	13.52 km	16.9 km
No. Stations	20	11	13
Track Gauge	1435 mm	1435 mm	1435 mm
Min. curve radius	170 m main line, 28 m in yard	175m main line, 100m depot	370m main line, 25m depot
Maximum gradient	4.0%	5.0%	5.0%
Car-body length	26,000 mm	22,500 mm	31,720 mm
Height	3,320 mm	3,700 mm	3,250 mm
Car-body width	2,590 mm	3,200 mm	2,500 mm
Axle load	10.7 tons	16.6 ton	16.6 ton
Train make-up	4 cars/train	4 units/train	3 units/train
Capacity	1358 pax/train	1,628 pax/train	1,182 pax/train
Max, Speed	60 kph	80 kph	65 kph
Car Maker	Original: Bombardier Capex I: Adtranz Capex II: Kinki Sharyo	ROTEM, South Korea	CKD Tatra, Czech
Scheduled Speed	38 kph	32.8	30
Signalling	ATP, ATS, ATO	ATP, ATO, ATS	ATP, CTC
Fare	Distance-wise. Min P12, max P20	Distance-wise. Min P12, max P15	Distance-wise. Min P9.5, max P15
Voltage	750 kV DC	1500 V DC	750 kV DC
Feeder system	Over Head Contact	Over Head Contact	Over Head Contact
Travel Time	27.5 minutes	30 minutes	
Headway	112 sec. After Capex 2 Project	Min. 1.5 minutes	Min .3 minutes
Cost (US$ Millions)	$500, or $35 per km (₱ 3.5 billions of 1982)	$850, or $61.6 per km	$698, or $41.3 per km

Source: Study Team

1.1.4 Railway Sector Future Projects

In addition to the Line 2 Extension project, currently the subject of our Study, the following projects are being proposed, either by Government agencies or private investors, for future implementation.

1) Line 1 South Extension Project

The project aims to extend the existing 15km LRT Line 1 System southward by an additional 11.7km, of which approximately 10.5km will be elevated and 1.2km will be at-grade. The Extension will start from the existing line's last station at Baclaran and will traverse the cities of Parañaque and Las Piñas in Metro Manila and reach the municipality of Bacoor. The extension will initially include 8 new passenger stations with a provision for 2 additional passenger stations. A satellite depot for light rail vehicle (LRV) storage and light maintenance will be located at the southern end of the proposed line. Intermodal facilities will also be installed at high-demand stations.

The construction of the Cavite Extension Line is divided into two phases - the first phase shall be from Baclaran to Dr. Santos Avenue (Phase 1A) and the second phase shall be from Dr. Santos Avenue to Niyog Station (Phase 1B)

The key features of the Line 1 Cavite Extension Project, based on the Project Study conducted by SNC Lavalin, as approved by NEDA, are the following:

- Interconnectivity to the existing Line 1 at Baclaran Terminal to form a continuous line and transport more people
- Compatible technology with the existing Line 1 to permit through running of trains
- Integrated fare collection system, with ticket commonality for seamless travel
- Intermodal facilities at three high demand stations
- Common maintenance facility for the Extension and the Existing Line in Pasay City

The project seeks to (a) immediately provide safe, reliable and environment-friendly transportation services in Metro Manila and the suburbs; (b) immediately alleviate the worsening traffic condition in the Paranaque-Las Pinas-Cavite area and (c) catalyze commercial development around the rail stations.

This project is currently envisaged to be implemented under a PPP scheme, where the concessionaire would build the extension and would operate and maintain the entirety of Line 1 and 3 as a seamless network.

2) Metro Rail Transit Line 7 Project

The Metro Rail Transit Line 7 (MRT-7) will be the fourth rapid transit line to be built in Metro Manila. When completed, the line will be 23 km long with 14 stations, and will be operated by the Universal LRT Corporation. The line will run in a northeast direction, traversing Quezon City and a part of Caloocan City in Metro Manila before ending at the City of San Jose del Monte in Bulacan province. Passengers will be able to transfer to the Yellow Line and Blue Line through the Metro Manila Integrated Rail Terminal (a.k.a Common Station) that will link the three lines at North Avenue in Quezon City.

Under the proposal, the project will have a combined 45-km of road and rail transportation running from the Bocaue exit off the North Luzon Expressway (NLEX) to the intersection of North Avenue and EDSA. The 22-km, 6-lane asphalt road will connect the NLEX to the major transportation hub development in San Jose del Monte. The 23-km mostly elevated MRT starts from there and ends at the integrated station beside SM City North EDSA.
The construction period is expected to last 3-1/2 years. ULC will operate and manage the system on behalf of the government over 25 years while gradually transferring ownership of the system to the government in proportion to payments of annual capacity fees.

3) MRT-8 East Rail Project

Based on the concept developed by a private group, MRT-8 will be traversing portions of Manila in Sta. Mesa, Mandaluyong, Pasig, Quezon City and Rizal. It will be about 17-km long and will have 16 stations and a depot on a 13 ha lot owned by Filinvest, 1.75km from San Juan station. The original alignment starting at SM CenterPoint, will mainly traverse Shaw Boulevard going to Edsa (Crossing), San Miguel Avenue, Ortigas Avenue crossing C-5 and Mangahan Floodway until reaching the interchange with Antipolo Road and Manila East Road. At this point the alignment takes the latter road towards Taytay, which is the terminus of this line.

Recent reviews of all available data, possible future urban developments, interviews with the clients, and technical limitations of the rolling stock, led to some changes:

- Extension of alignment from SM CenterPoint to North Triangle via G. Araneta–Quezon Avenues.
- Change of alignment within Ortigas CBD area

The objective of the proposed extended alignment is to optimize the commercial viability of the proposed system by capitalizing on the sizable volume of additional passengers anticipated along this extension. The proposed route extension will reach the Veteran's Memorial Center via Quezon Ave. and Agham Road. Likewise, after reviewing the original alignment and considering the technical requirements of the proposed rolling stock manufacturer, it was determined that the sharp curves of 90m radius within the Ortigas CBD would be a hindrance to the proper operation of the system. Thus, a re-alignment of the route in this area which will allow larger radius of curves is suggested. Moreover, this new alignment will have less impact on the operation of businesses within this CBD, which is usually adversely affected by the construction of viaducts near them. This change in alignment is from the original EDSA station, where instead of the intended left turn to San Miguel Ave., the alignment will stay in its straight path to make a turn for Meralco Avenue going to Ortigas Avenue, where it will continue its original alignment.

Consequent to the proposed change of alignment, some of the proposed rail passenger stations in the original alignment have been eliminated, relocated, or replaced by other new stations. These changes will require 20 new stations instead of the originally planned 16 stations. The estimated ridership is around 570 thousands passengers daily, with a level of 41,000 pphpd, which translates to a rolling stock demand of 250 cars for the opening year.

4) NAIA Rail Link Project

The location of the country's busiest airport, the Ninoy Aquino International Airport (NAIA), in the metropolis is not spared from this traffic congestion, making passengers heading to the airport provide at least 2-3 hour lead time to make sure that they would make it to their scheduled flight. Unlike most new airports around the world, the NAIA is not connected to a rail system. To provide the fastest access to the NAIA, the NAIA Rail Link was conceptualized.

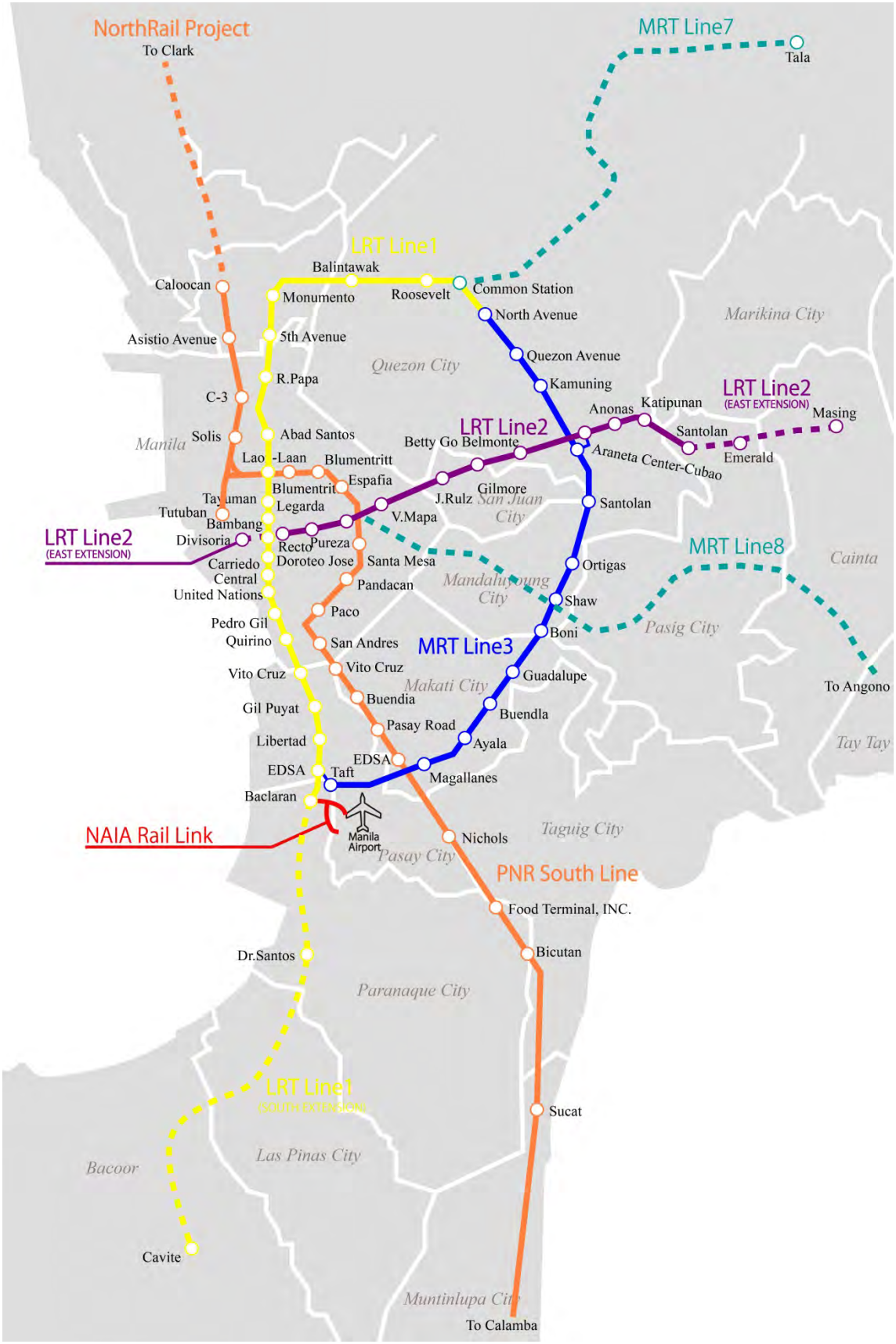
The proposed operational concept is basically two lines from Baclaran station of Line 1. One line connects directly to Baclaran with the Domestic Terminal, and Terminals 1 and 2, and a spur line connects to Terminal 3. Passengers heading to these terminals, except Terminal 3, can ride a single train all the way to their desired terminal, and vice-versa. Passengers to/from Terminal 3 will have to transfer at the Transfer Station. Passengers from Line 2 can easily transfer to Line 1 at Doroteo Jose Station within 7 minutes. In the same manner, Line 3 passengers can transfer to Line 1 at Taft/EDSA within 5 minutes. PNR passengers can transfer to Line 3 at Magallanes Station. Bus, jeepney and taxi passengers can transfer to the LRT lines at any station. When built, the current rail network will allow a passenger to reach NAIA in less than 66 minutes from points as far away as Santolan (Pasig), or North Avenue (Quezon City), or Monumento (Caloocan), regardless of the road traffic condition. One station will be servicing each airport terminal (Domestic, Terminals 1, 2, and 3). In addition, a transfer station will be built just before the Domestic Terminal to cater to passengers from/to Terminal 3.

In the future, after the completion of the Line 1 South Extension to Cavite, Line 2 East Extension to Masinag, and the completion of Phase 1 of the NorthRail Project, passengers from Cavite, Markina, and Calumpit will also be also beneficiaries of an easy and reliable access to NAIA.

5) NorthRail Project

The Northrail project involves the upgrading of the present-day single track to an elevated dual-track system, converting the rail gauge from narrow gauge to standard gauge, and linking Manila to Malolos City in Bulacan and further on to Angeles City and the Clark Special Economic Zone, as well as Diosdado Macapagal International Airport. This project is estimated to cost around US$500 million, since much of the right-of-way on Northrail will be brand new. China will provide some US$400

million in concessionary financing for this project. Construction began in early November 2006, and was expected to have been operational in 2010. Due to delays in the construction work, it is currently being renegotiated with the Chinese government. But construction continued in January 2009 with the support of the North Luzon Railways Corporation, and it was expected that the project could to be completed and fully operational by 2012, during the Midterm of President Benigno Aquino III. Northrail is set to use its high-speed trains to carry passengers in the Northern provinces and also on holidays. It is also a very important project as it would link the northern airports, Clark and Diosdado Macapagal with Metro Manila and the current airport, NAIA.



Source: Study Team

Figure 1.1-3 Metro Manila Future Railway Network

1.2 Confirming Transportation Sector's Policies and High-priority Projects

1.2.1 Master Plan for Transportation in Metro Manila

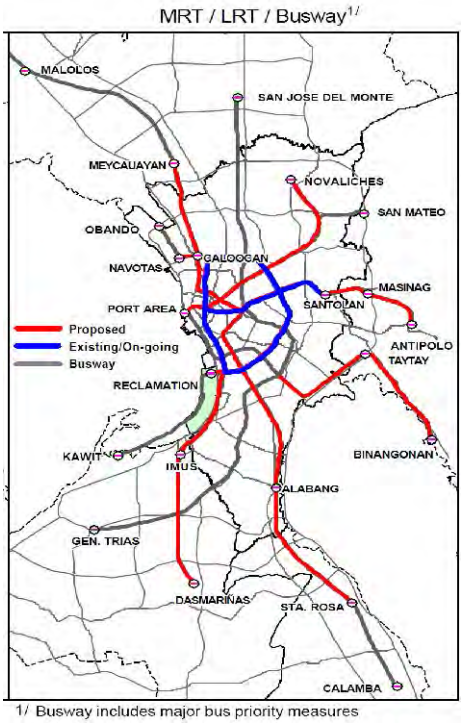
1) MMUTIS (1999)

The Metro Manila Urban Transportation Integration Study (MMUTIS) was conducted from 1996 to 1999 with assistance of JICA. MMUTIS conducted a series of field surveys including a Person-trip survey of Metro Manila and adjoining areas and created Transport Forecast Models. The MMUTIS produced major outputs were:

- Transportation Master Plan up to year 2015
- Medium-term Transportation Investment Plan (1999 – 2004)
- Urban Transport database and models including the System for Traffic Demand Analysis (STRADA)

2) MMPTS (2007)

The Mega Manila Public Transport Study (MMPTS) was conducted from November 2006 to April 2007 to update and revise MMUTIS. This Study was focused on updating travel patterns and characteristics of public transportation in Metro Manila and adjacent provinces from sample OD interview surveys for LRT/MRT/PNR and EDSA bus passengers



Source: MMUTIS

Figure 1.2-1 Metro Manila Future Railway Network

1.2.2 Prioritized Transportation Projects

1) MTPDP

In the Medium-Term Philippines Development Plan (MTPDP), 2004-2010, the prioritized transportation infrastructure projects are **roads and rail systems that will decongest Metro Manila** together with RORO[3] ports and the highway connecting, and roads and airports to tourism hubs. The MTPDP includes a comprehensive set of Priority Strategies and Activities (PSAs), which shall be jointly undertaken by the Government of the Philippines (GOP), Local Government Units (LGUs), Government Owned and Controlled Corporations (GOCCs), the Private Sector, and civil society.

2) MTPIP

The Medium-Term Public Investment Plan (MTPIP), 2005 – 2010, contains the priority programs and projects to be carried out by GOP in support of the MTPDP.

[3] *RORO(Roll-on / Roll-off) are ships designed to carry cargo vehicles ,such as trucks or trailers, driving on and off the ship on their own wheels.*

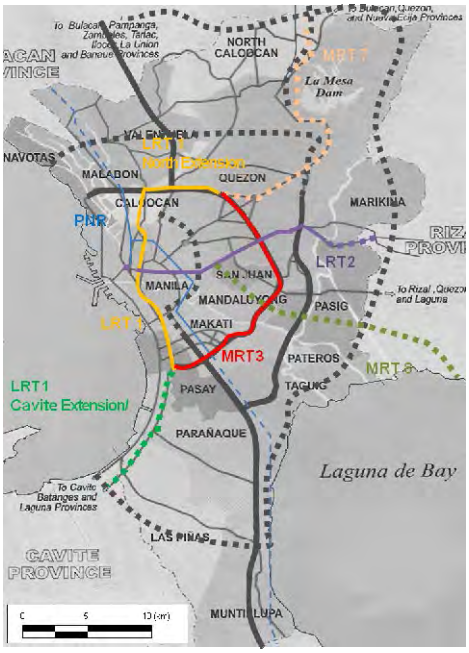
3) CIIP

The Comprehensive Integrated Infrastructure Program (CIIP), 2009-2013, contains the list of infrastructure projects to meet the goals and objectives set forth in the MTPDP. It includes projects appropriate for Purely Private Investment, Public-Private Partnership (PPP), and Purely Public Investment. Railway-concerned projects are extracted in **Table 1.2-1**. It contains both LRT Line2 East and West extension projects.

Table 1.2-1 Rail Transportation Priority Infrastructure Projects and PPP Priority Projects of CIIP 2009-2013

	PROJECT TITLE/DESCRIPTION	IMPLEMENTING AGENCY / INSTITUTION	REMAINING PROJECT COST (Mill. PhP)	FINANCING SOURCE
PPP	LRT Line 1 South Extension Project	LRTA	36,199.01	NG for Right of Way (ROW), Public-Private Partnership (PPP) for civil works
	LRT Line 2 Phase 2 (Line 2 East Extension to Masinag)	**LRTA**	**11,434.27**	**Public-Private Partnership (PPP)**
	LRT Line 2 West Extension Project	**LRTA**	**4,106.29**	**For ODA or Public-Private Financing**
	MRT 7 Build Gradual Transfer Operate & Maintain (BGTOM) (Capacity Fee Payment)Unsolicited	DOTC	61,750.00	Build Gradual Transfer Operate & Maintain (BGTOM)
	MRT 8 Build-Transfer/Build-Operate-Transfer (BT/BOT)	DOTC	51,464.00	Build-Transfer/Build-Operate-Transfer (BT/BOT)
	Common Ticketing System	DOTC	4,106.29	Build-Operate-Transfer (BOT)
	SUBTOTAL PROPOSED		165,310.87	
Ongoing	Northrail-Southrail Linkage Project, Phase I (Caloocan-Alabang)	DOTC-PNR	25,210.00	GAA-ODA (Economic Development Cooperation Fund/ The Export-Import Bank of Korea)
	NorthRail Project Phase 1 Section 1 (Caloocan to Malolos)	North Luzon Railway Cooperation (NLRC)	26,835.09	ODA / Other Sources (commercial borrowings)
	Re-opening the Line to Bicol	DOTC-PNR	1,551.99	General Appropriations Act (GAA)
	MRT Line 1 North Extension Project	LRTA	8,023.44	General Appropriations Act (GAA)
	SUBTOTAL ONGOING		61,620.52	

Source: CIIP 2009-2013, as of October 2009



Source: CIIP 2009-2013

Figure 1.2-2 Transportation Plan in Metro Manila

1.2.3 Railway Sector High-Priority Projects

1) Line 2 East & West Extension Project

The project subject to this study has been identified as a project to be implemented in the next year, and this announcement is hopefully expected in the next SONA of July 2011.

2) Line 1 Cavite Extension Project

This project is part of the inter-related MRT/LRT Expansion Program, which also includes the implementation of a Common Automatic Fare Collection System for all lines in Manila, and the outsourcing of services for Operation & Maintenance of the combined Lines 1 and 3.

Description of the proposed system is described in section 1.1.4 of this report. Status of the Project (as of July 18, 2011) for ROW issues:

- Acquired 77% of the total Right of Way (ROW) required (based on the purchased/title transferred and expropriated properties).
- Negotiations with private property owners for the remaining areas are on-going.
- Social Preparation, pre-relocation activities and screening of affected families are completed.
- The Provincial Government of Cavite is completing the development of the relocation site for informal settlers affected by the Project as per MOA between LRTA and the Province of Cavite dated February 20, 2008.
- Phase 1 Contract which includes the Site Grading, construction of fences and slope protection was completed on April 30, 2010.
- Phase 2 Contract which involves Roads and Water Systems, Drainage Systems and Construction of 180 units of Row houses is 99% accomplished as of July 18, 2011.

This project is planned to be bid out later this year.

3) Metro Rail Transit Line 7 Project

Universal LRT Corporation, composed of a consortium of the Tranzen Group, EEI Corporation and SM Prime Holdings and led by former Finance Secretary Roberto de Ocampo submitted an unsolicited proposal to the Philippine Department of Transportation and Communications in 2002. In June 2007, DOTC presented a Swiss Challenge in which four business firms submitted their counter proposal. In January 2008, DOTC announced that the ULC proposal emerged as winner and the contract was signed. In May 2009, The Investment Coordination Committee (ICC) of the National Economic and Development Authority (NEDA) approved the MRT-7 project.

The Metro Rail Transit Line 7 (MRT-7) will be the fourth rapid transit line to be built in Metro Manila, and it is the only unsolicited proposal that has been approved up to date. Description of the proposed system is described in section 1.1.4 of this report.

Construction of MRT-7 should have commenced in January 2010, but as of April 18, 2011, there were no signs that construction had been started.

4) Outsourcing of the Operation and Maintenance for LRT1 and MRT3

This project is part of the inter-related MRT/LRT Expansion Program, which includes the afore mentioned LRT 1 South Extension Project, the implementation of a Common Automatic Fare Collection System for all lines in Manila, and this outsourcing of services for Operation & Maintenance of the combined Lines 1 and 3.

Request for submission of Bids has been issued, and Bid Documents have been bought by several companies already. The deadline for submission of Bids was July 11, 2011.

This interim outsourcing of the O&M for LRT-1 and MRT-3 will proceed for a 4-year period, extendable one more year. The scope of work is inclusive of overall systems' O&M, security and janitorial services, and exclusive of maintenance of AFC subsystem. The latest Approved Bidding Cost (ABC) was PhP15 Billion.

1.2.4 PPP Projects

Ten projects were announced as PPP projects for 2011 rollout by GOP in November 2010, which were selected based on the criteria that a Feasibility study had to be completed within 2010 to 2011, Completed Feasibility Study being reconfigured for PPP, and Ready to tender in 2011. The PPP Projects 2011 Rollout includes only the LRT Line 2 East Extension Project whereas it did not include the west extension. Afterward in March 2011, the first 5 Projects were shown to be auctioned off before July 2011 except the LRT Line 2 extension project.

Table 1.2-2 PPP Projects for 2011 Roll out

No.	PROJECT TITLE/DESCRIPTION	Project Cost (Mill. PhP)	Implementation Schedule	Implementing Agency
1	CALAExpressway – Cavite Side Section(27.5km)	11,790	May 2012 to Dec 2015	DPWH
2	NAIA Expressway Phase II	10,590	Nov 2011 to Sep 2015	DPWH
3	**LRT Line2 East Extension Project**	**11,300**	**2011 to 2014**	**DOTC/ LRTA**
4	MRT/LRT Expansion Program: Privatization of LRT1 Operation and Maintenance	7,700	2011 to 2014	DOTC/ LRTA
5	MRT/LRT Expansion Program: Privatization of MRT3 Operation and Maintenance	6,300	2011 to 2014	DOTC/ LRTA
6	MRT/LRT Expansion Program: LRT 1 South Extension Project (11.7 km)	70,000	2011 to 2015	DOTC/ LRTA
7	New Bohol Airport Development	7,600	2012 to 2014	DOTC/ MIAA/ CAAP
8	Puerto Princesa Airport Development	7,600	2012 to 2014	DOTC/ MIAA/ CAAP
9	New Legaspi (Daraga) Airport Development	3,200	2012 to 2014	DOTC/ CAAP
10	Privatization of Laguindingan Airport Operation and Maintenance	1,500	2011 to 2013	DOTC/ MIAA/ CAAP

Note: MIAA stands for Manila International Airport Authority
CAAP stands for Civil Aviation Authority of the Philippines

Source: Public-Private Partnership Projects, the Republic of the Philippines, November 2010.
Concerning LRTA projects status are updated by LRTA.

Table 1.2-3 Four (4) Projects to be Bid Out in the first half of 2011

No.	Projects
1	The Five Year Operation & Maintenance Contracts LRT 1 & MRT-3
2	Daag Hari – South Luzon Expressway
3	NAIA Expressway Phase II
4	North Luzon – South Luzon Expressway Link

Source: Study Team

It should be mentioned that the MRT/LRT Expansion Programs for Privatization of the Operation and Maintenance for LRT1 and MRT3 have been combined in one single project with a budget of PhP15 Billions.

1.3 Review of Legal Framework

1.3.1 Foreword

This report examines Statutory Laws, Presidential Decrees, Executive Orders, Resolutions and other legal mechanisms that form the Legal Framework for Public-Private Partnership program implementation. In order to gauge the adequacy or insufficiency of PPP legal framework it is best to understand the nature of these legal mechanisms: how these laws evolved, the driving forces behind them, the issues and intents these addressed, and how these may alter in the future. The objective is for the prospective Private Sector Investor to have a clear view of this legal landscape as a basis for his risk analysis and decisions to engage in the PPP project.

The Legal System in the Philippines

The Philippine legal system may be considered as a unique legal system because it is a blend of civil law (Roman), common law (Anglo-American), Muslim (Islamic) law and indigenous law. There are two primary sources of the law: Statutes or Statutory Law and Jurisprudence or Case Law. Statutes are defined as the written enactment of the will of the legislative branch of the government rendered authentic by certain prescribed forms or solemnities and are also more known as enactments of congress. The Constitution is the supreme and fundamental law of the land and Legislative Enactments are laws promulgated by the Philippine Congress. In the Philippines, statutory law includes the Constitution, treaties, statutes proper or legislative enactments, municipal charters, municipal legislation, court rules, administrative rules and orders, legislative rules and presidential issuances. Jurisprudence or Case Law is composed of cases decided or written opinion by the Supreme Court..

The Legislature promulgates statutes, namely: Acts, Commonwealth Acts, Republic Acts, Batas Pambansa. The Executive promulgates presidential issuances (Presidential Decrees[4], Executive Orders, Memorandum Circular, Administrative Orders, Proclamations, etc.), rules and regulations through its various departments, bureaus and agencies. The Judiciary promulgates judicial doctrines embodied in decisions.

An Executive Order in the Philippines is an order issued by the President, the head of the Executive Branch. Presidents have issued Executive Orders usually to help officers and agencies of the Executive Branch manage the operations with the Government itself. Executive Orders do have the full force of the Law since issuances are made in pursuance of certain Statutory Laws, which should specifically delegate to the President some degree of discretionary power or are believed to have their authority for issuances based in a power inherently granted to the Executive by the Constitution.

1.3.2 PPP in the Philippines

On November 17-19, 2010 the administration of President Benigno Aquino III launched a campaign for the Government's policy thrust to undertake its infrastructure plans under the Public-Private Partnership program. Addressing a forum of foreign and local businessmen, Pres. Aquino acknowledged the country's need for private sector support. The President went straight into the problem, that is: "…for the longest time, those rules have been less than fair, far from clear, and not always applicable to all….. I

[4] *Presidential Decrees issued by President Ferdinand Marcos are considered statutes because under the 1973 Constitution, the President has the power to enact laws.*

have been told of problems encountered before: after signing a contract, it – and the rules governing it – all of a sudden changed without warning." He went further on to commit that, "…. what we shake hands on, should be what endures. To this end, what we will be doing in so far as solicited projects are concerned is to minimize your risk in a meaningful and fair manner.[5]"

In the same forum, the Philippine planning authority, NEDA, broadly defined PPP as a contractual arrangement between government and private sector to deliver infrastructure and/or public services.[6] PPP became synonymous to Build-Operate-&-Transfer (BOT)[7] with public sector involvement.

It would be recalled the Philippines took aggressive BOT policy in the 1990's with some legal framework but not well maintained and faced various difficulties such as, among others: project prioritization, land acquisition, and time consuming approval process.

During the forum, participants expressed the same concerns and additionally voiced their views on other matters closely relevant to PPP such as:

- The leadership strength of the Government having obtained an unquestionable political authority by virtue of the electoral mandate given by the people to President Aquino in the last May 2010 elections.
- The need to strengthen the institutional mechanism with the establishment of a one-stop clearing house for PPP Project implementation.8
- The need for the Government to develop and establish a comprehensive list of projects for PPP;filtered, prioritized, and reconciled with its development plans equally based on private sector investment interest to minimize cherry-picking of projects.
- The level of Government financial support to be provided in order to make project viable through PPP with guarantees or reserve funds to close in project viability gaps.
- A stronger Government participation in the acquisition of Rights-of-Way with its difficulties relating to identification of land owners (Titles), setting of land prices, and the commercial and judicial process of actual acquisitions (as price negotiations fail the court process, as the recourse, is protracted by temporary restraining orders), and
- The need for the Government to establish a Project Development Fund in order to undertake feasibility studies on identified projects to establish preliminary viability levels prior to proceeding towards bidding.

The current BOT Laws do not stipulate Joint Ventures or other options in detail[9]. To be incorporated supplementary to the new PPP Law is a set of standard model documents for the approval process that is applicable across all Government sectors.
It was remarked that in order to smoothly proceed with project development activities of nomination, prioritization, and selection of projects the establishment of sufficient regulatory and institutional framework is imperative. By comparison, the regulatory regime and key legal framework in the Philippines for PPP exists to certain extents, but not sufficient nor practical enough.[10]
In essence, the enabling frameworks (legal, contractual, and regulatory) for PPP implementation are formed. Improvements to these frameworks could focus on factors such as efficiency of implementation in specific areas of concern – like: Project Identification, Approval Process, ROW Acquisition, and

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[5] *Here, Pres. Aquino cited the Government's stance to protect investors against regulatory risks – explicitly excluding market or commercial risk.*
[6] *Cayetano Paderanga, Jr., "The PPP Framework and the PPP Center"*
[7] *BOT as defined under the law is substantially undertaken by the Private Sector with minimal Public Sector Participation.*
[8] *This was addressed by the Government by re-aligning the former BOT Center under the authority of NEDA vis-à-visDepartment of Trade and Industry.*
[9] *A new PPP Law is being discussed and its draft is being elaborated by the Government; addressing the need to improve the process for efficient ROW acquisition. This was also pointed out in: "Towards the Promotion of PPP Structure in the Philippines", Hirota Koki, JICA*
[10] *Although the Philippines rank high as being "in the advanced stage."*

additional Government financial support; as these emanate from policy directives. And vice-versa, its deficiencies, particularly in the areas of compliance to laws and enforcement of contractual obligations, would require identification of potential breaches and the corresponding imposition of penalties or due recourses.

The main inquiry of this review will focus on assessing the sufficiency of the enabling laws and frameworks and whether these appropriately places the Private Sector Investors in a legal comfort zone should their interests be caught to partner with the Government in its infrastructure program using the PPP implementation scheme. The analysis is carried out in the legal context of project development; rather than delve on issues of project viability.

1.3.3 Methodology of Legal Review

The proposition that there are enabling laws set the general objectives of this review. These are presented in the interrogative fashion:

Inquiry:

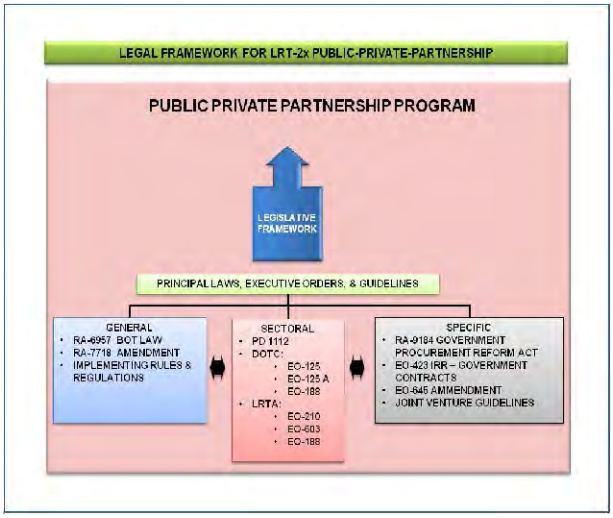
- Do the enabling frameworks allow and promote project implementations through PPP Programs?
- Are there existing Laws, the composition of which will permit PPP project implementation; and are these sufficient to cover legal requirements for entry of Private Sector into a partnership with the Government?

This report carried out the following:

- Review of the existing body of Laws (Legislations, Resolutions, Executive Orders, Charters, etc.) and its application to PPP program implementation. In other words, the laws that comprise the Legal Framework.
- Review the Institutional Structure for PPP and the interplay of relevant Laws.

1.3.4 The Laws Comprising the Legal Framework

The Enabling Laws: Republic Acts, Executive Orders, and the Implementing Rules & Regulations (IRR) are shown in **Figure 1.3-1**, below. These are: the (General) BOT Law (RA-6957, RA-7718, and its IRR), the (Sectoral) Charters of DOTC / LRTA, and the (Specific) Government Procurement Reform Act, RA-9184 with its attendant EO's.



Source: Study Team

Figure 1.3-1 The Enabling Laws comprising the Legal Framework

As a matter of note, there are, however, other laws that typically would have impact on a PPP project. While these are not the Enabling Laws forming the Legal Framework, the Private Sector proponent, in engaging in PPP needs to consider, examine, and comply with these laws. **Figure 1.3-2**, below, show typical PPP provisions and concern and the corresponding laws impacting PPP programs.

Source: Study Team

Figure 1.3-2 PPP Concerns & relevant Law impacting PPP

1) Discussion on the Enabling Laws

The Enabling Laws, as cited above, authorizes the Government to institutionally award concessions to private entities. The Philippine BOT Law is the legal vehicle in a pervasive fashion.

2) Discussion on Sector-specific (Sectoral) Laws

Sector-specific laws are laws that grant concessions wherein a Government Agency is created or identified who will be responsible for overseeing the bidding, construction, and operation of the projects and set the parameters for each, including granting the concessionaire or operator to collect fares for the use of the infrastructure. These are normally embodied in the Charters of the Government Agencies. Aside from Charters, an example of this type of sector specific law in the road sector is the Presidential Decree No. 1112 which created the Toll Regulatory Board (TRB) – (effectively the TRB charter) to grant franchises for toll roads, contract the construction of the expressways, and authorize the concessionaire or franchise holder to collect tolls from the expressway users. Similar authorities are provided in the Charters of DOTC and LRTA.

3) Discussion ont Impacting Laws related to PPP

A concession is composed of a suite of agreements starting off with the basic Concession Agreement (CA) between the Government (Public) and the Concessionaire (Private). The complexity of a concession agreement could best be appreciated by scanning the content normally incorporated into these agreements. It would be noted that recitations and provisions in the CA calls upon or refers to attendant

laws explicitly. It is apparent that the CA, in the enumeration of the roles, rights, and obligations of the parties, as cited in its provisions and articles, is derived out of interrelated Laws. A Concession Agreement will normally contain the following contractual provisions with the corresponding related legal basis for each provision, as shown in **Table 1.3-1**, below:

Table 1.3-1 Provisions on Toll Concession & Corresponding Related Laws

Contractual Substance	Related Legal Basis
• **Concession Period**	• BOT Law
• **Intent of both parties**	• BOT Law
• **Operative Law in the Grant**	• BOT Law
• **Recitals of Obligations**	• Contractual Agreement
• **Implementation of Construction**	• Contractual Agreement
• **Financing Agreement & Limits**	• BOT Law & Contractual Agreement
• **Bidding & Award Procedure**	• BOT Law
• **Provisions in Operating Agreement**	• BOT Law & Contractual Agreement
• **Right-of-Way Provisions**	• Property Laws
• **Dispute Resolutions**	• Laws on Disputes, Arbitration, and Mediation
• **Fare Rate Adjustment**	• Sector-specific Laws
• **Ownership of the Facilities**	• BOT Law
• **Taxes**	• Tax Laws
• **Default & Termination**	• Security & Insolvency Laws
• **Guarantees**	• BOT Law & Contractual Agreement
• **Incentives Derived**	• Omnibus Investment Code

Source: Study Team

1.3.5 The Enabling Law (General) – BOT Law

1) The BOT Law – Background and Formation

In the early 90's the Philippines took a quantum policy step in aggressively pursuing Build-Operate-&-Transfer Schemes with the promulgation of RA-6957[11]. In substance, RA-6957 is a policy statement authorizing the financing, construction, operation and maintenance of infrastructure projects by the private sector. And the scope of undertakings was wide: even covering, "…and for other purposes." The policy declaration acknowledges the 'indispensible' role of the private sector as the main engine for national growth. The policy statement is that the Government will provide favorable incentives as attraction for its immediate mobilization.

During this period, the economic pundits had predicted the infrastructure deficiency particularly in the power sector. The country started to experience rolling power blackouts. Its fiscal condition was constrained to undertake solutions to the deteriorating power supply capability. The Government, in the same breath, called upon the private sector for recourse and laid out the basic framework for investments in the country.[12] RA-6957 defined generally two (2) types of schemes, the Build-Operate-&-Transfer and the Build-Transfer Schemes. It gave the institutional guideline as to the authorized Government entities that the private sector can enter into contract with. RA-6957 stipulated on the process of determining the projects that could be undertaken by the private sector.[13]
Franchises were to be awarded based on public bidding to the lowest complying bidder based on design

[11] *This law was passed by the Congress in July 9, 1990.*
[12] *At this time the operative framework was concentrated in tollways; this being Presidential Decree-1112 (PD-1112), passed on March 31, 1977.*
[13] *Projects of national character must be in the medium-term programs of the government's infrastructure agencies, the list of which must be approved by Congress. For local projects, these must be confirmed and approved by the Regional Development Council.*

and performance specifications established by the corresponding infrastructure agency of the Government. Repayment schemes fall within the contractual framework in that it was left to the Government infrastructure agency to determine and approve the fairness and equity of the tolls and other fees to be charged by the private sector.[14]

A key provision of this RA-6957 is the assurance of just compensation to the private sector in the event of the Government's revocation, cancellation, or termination of the contract.[15] As to Government financial support, the Law provides "…that the financing of a foreign or foreign-controlled contractor[16] from Philippine government financing institution shall not exceed twenty (20%) of the total cost of the infrastructure facility of the project…" Also, no guarantees are to be provided by the Government if financing is from a foreign source.

However supple was RA-6957, the power outages were resolved with the intervention of private independent power producers (IPP). On the other hand, critics of the contracting administration point out the inordinate provision with the Government being obligated to purchase power on the basis of capacity-to-produce of the IPP's rather than consumed power from the IPP's.

2) RA-7718 (Amendment to BOT Law)

On April 27, 1994 an amendment, RA-7718 was enacted by Congress to further reinforce the policy direction for private sector investments into the Governments' infrastructure programs.

In essence, projects were identified in the form of a wide spectrum of infrastructure fields ranging from power plants, highways, telecommunication to information technology networks to educational facilities "…financed partly from direct government appropriations and/or from Official Development Assistance of foreign governments or institutions not exceeding fifty percent (50%) of the project cost." This amendment limited the project period when the facilities would be transferred back to the Government; this being after a period of fifty (50) years. And whenever a public utility franchise will be operated, the private sector proponent must register with the Securities and Exchange Commission; and the proponent entity must be sixty (60%) percent Filipino owned.

This provision somewhat paved way for public-private partnerships since it could be viewed that the Government could provide a portion of the financing requirement up to the limit not exceeding 50% of the project cost; and it is this direct government appropriation that will comprise its contribution / share in the partnership.

This amendment further provides other forms of private participation beyond the general BOT and BT Schemes under RA-6957. The private sector may also participate through the following schemes: Build-Own-&-Operate (BOO), Build-Lease-&-Transfer (BLT), Build-Transfer-&-Operate (BTO), Contract-Add-&-Operate (CAO), Develop-Operate-&-Transfer (DOT), Rehabilitate-Operate-&-Transfer (ROT), Rehabilitate-Own-&-&Operate (ROO).

This amending RA-7718 placed the burden of determining the appropriate returns-on-investment with the Investment Coordinating Council (ICC) of the National Economic Development Authority (NEDA).

This authority grant makes the NEDA-ICC essentially the clearinghouse for project approvals: from feasibility studies, project implementation plans, PPP Terms-of-Reference, to Toll Concession

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[14] *With the exception in the cases of national highways, roads, bridges and public thoroughfares which are approved by the Toll Regulatory Board (TRB).*

[15] *It is clear that this is based on the condition that it is through no fault of the private sector contracting party.*

[16] *'Contractors' was the wording used in this Law as it very much referred to Power-producer contractor vis-à-vis investor / concessionaire.*

Agreements by virtue of it being the principal entity that sanctions the rates-of-return.[17]

RA-7718 opened the Government's doors to Unsolicited Proposals. The Unsolicited Proposal route however does not lend well to PPP Schemes since the Government, under this scheme, does not provide direct government guarantee, subsidy or equity. There were, however, projects wherein Unsolicited Proposal were submitted, approved, and implemented.[18]

Other significant amendments to RA-6957 involved the procurement process relating to public bidding of projects and precedent conditions as to when direct negotiations are allowed. It was in this amendment where the Coordinating Council of the Philippine Assistance Program, together with other Government Agencies was tasked to craft and promulgate the Implementing Rules and Regulations relevant to RA-6957. The function of the Coordinating Council for Private Sector Participation (CCPSP) was to act as a one-stop-shop to support and promote private sector investments.

3) Implementing Rules & Regulations of the BOT Law

The supplementing Implementing Rules and Regulation (IRR) of RA-6957, as amended by RA-7718 were crafted with rules categorized falling along the following lines shown in **Table 1.3-2**.

From the **Table 1.3-2**, it would be noted that the IRR focused on the **Procurement** process relevant to the involvement of the private sector in implementing the Governments' infrastructure projects. Specific terms and conditions are laid out; from Prequalification to Contract Approval & Implementation.

Rule 1 – Preliminary Provisions. This IRR reiterated the policy of the Government with regard to encouraging the private sector to engage in or undertake its infrastructure projects. It reiterates in more precise manner the contractual arrangements these projects can be undertaken, e.g., BLT, DOT, etc.; as well as defining the linguistic terms stated in the BOT Law.

Table 1.3-2 IRR Rules & Corresponding Category / Theme

Rule	Description	Category / Theme
1	Preliminary Provisions	Definition of Terms
2	General Provisions	Process - Authorized Government Agencies, Eligible Projects, and Approval Process
3	Prequalification, Bids, & Awards Committee	Procurement – Committee Composition
4	Bid/Tender Documents	Procurement – Documents
5	Qualification of Bidders	Procurement – Bidders
6	Supplemental Notices & Pre-bid Conferences	Procurement – Process
7	Submission, Receipt and Opening of Bids	Procurement – Process
8	Evaluation of Bids	Procurement – Process
9	Negotiated Contract	Procurement – Process; qualifying conditions
10	Unsolicited Proposal	Procurement – Qualification for, and Process
11	Award & Signing	Procurement
12	Contract Approval & Implementation	Procurement
13	Investment Incentives	Government Participation and contributions
14	Coordinating & Monitoring of Projects	Establishment of BOT Center
15	Final Provisions	IRR Committee & Amendments to IRR

Source: Study Team

[17] *This is provided under Section 2 (o) of RA-7718. Short of any legislative or contractual bearing, it is within the context of this regulatory function wherein NEDA-ICC is called upon to assist, support, and sanction toll/fare adjustments as in the recent plan of the DOTC to increase the fares on its (LTRA) operations. It is notable that because of this authority, NEDA-ICC intervention in project aspects is pervasive.*

[18] *Projects such as the North Luzon Expressway and the South Luzon Expressway were undertaken through Unsolicited Proposals utilizing a joint venture arrangement between a private sector proponent and a franchise-holding Government-Owned-&-Controlled Corporation through the Presidential Decree-1112 route; with the Government having minority shares.*

Rule 2 – General Provisions. This rule allowed a whole range of Government Agencies / Units authorized to enter into contractual arrangements which includes: "..All concerned government agencies, including government-owned or controlled corporations…*and*.. Local Government Units authorized by Law…"[19] This rule identified eligible projects which were normally financed and undertaken by the Government[20] as well as the process of filtering which projects will be registered in the Governments' Priority List.

Being that the mode of implementation is through public bidding or direct negotiation, the process requires registration of project proponents who are interested in undertaking the projects in the Priority List. Under this rule, the Government implementing agency, e.g., DOTC, DPWH, etc. will secure the NEDA-ICC approval prior to public bidding; or in the case of Unsolicited Proposals, prior to the negotiations with the original proponent; to be all within the NEDA-ICC guidelines[21].

In short, a project menu is developed by the Government line / implementing agencies, and is submitted to NEDA-ICC for prioritization. The line agency would check out the viability of the project; and upon confirmation, develops the terms-of-reference for the public bidding for NEDA-ICC approval. The public tender process is administered by the line agency.

Rule 3 to 12 – Procurement of Private Sector Investor. Noticeable in this IRR is the promotion of succinct objectives of the BOT Law; and that is first, to ensure that the procurement process is conducted in a transparent manner. Secondly, the BOT Law, by detailing out the specifics of the process sends a clear message against speculative investors.[22]

Rule 13 – Government Financing. While it is clear that the private sector is expected to completely finance the project, the BOT Law allows the Government, in case the project encounters difficulties in sourcing funds, to partly finance the project from government appropriations and / or from ODA of foreign government or institution *but* not exceeding fifty percent (50%) of the project cost. As mentioned earlier, this rule is the open corridor for PPP scheme implementations. In fact, this rule further allows the Government, within specific conditions, to provide direct or indirect support or contribution even for Unsolicited Proposals in the form of: Cost Sharing, Credit Enhancements, Direct Government Subsidy, and Government Equity.

Rule 14 – Coordination and Monitoring of Projects. On November 2, 2002 CCPSP was reorganized into the BOT Center under the Department of Trade and Industry with expanded functions of marketing, coordinating and monitoring BOT programs - (Executive Order – 144). On September 9, 2010 the BOT Center was renamed to PPP Center; and placed under NEDA. Its functions continued with: facilitation and assistance to Government Agencies, providing advisory services and technical assistance, managing and administering project development, and facilitation of PPP Projects – (Executive Order -8) [23].

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[19] *Under Section 2.1 (a & b) of the IRR.*

[20] *Its coverage implies non-inclusion of projects involving those entailing national security.*

[21] *The NEDA-ICC guidelines for the review of proposals are provided as Annex-B in the IRR*

[22] *A case in point is where a private sector proponent would is awarded a concession with an agenda of turning around and peddling the project to others. This is major pitfall the Unsolicited Proposal is highly exposed to.*

[23] *With the fact that the PPP Center was placed under NEDA, the present Administration wants to strike a balance between the Government implementing agency's enthusiasm to undertake projects to the detriment of a thorough project audit with the introduction of this additional review layer (PPP Center) to complement the NEDA-ICC. This move could be viewed as the Government's efforts to positively reinforce its policy direction with regards to PPP project implementation with the PPP Center's role in: project packaging assistance and pre-fs appraisals. This was expounded by NEDA Director General Cayatano Paderanga, Jr., Infrastructure Philippines 2010.*

1.3.6 The Enabling Laws (*Sector-Specific*) – Decrees and Charters

1) PD-1112: The Toll Road Decree

PD-1112 was a decree issued by then President Ferdinand Marcos and was effective on March 31, 1977. It should be noted that this decree was declared when the Philippines was under Martial Law. Pres. Marcos had the constitutional power to issue decrees which carry the full force of the law. The decree title is: "Authorizing the establishment of toll facilities on public improvements, creating a Board for the Regulation thereof and for other purposes." This became known as the "Toll Road Decree."

PD-1112 was followed by PD-1113. PD-1113 created the Construction Development Corporation of the Philippines (CDCP) which was granted an all-encompassing franchise by the TRB. Some years later, the franchise was transferred to Philippine National construction Corporation (PNCC) through PD-1894.

Thereafter, Private Sector proponents interested in participating in toll road development were availing this franchise by forming a joint venture with PNCC, submit a Joint Investment Proposal (JIP) to the TRB for approval. Projects such as the North Luzon Expressway and the South Luzon Expressway were undertaken through this enabling / legal framework.

However, two (2) Executive Orders were issued that would pave the way for the participation of the Private Sector in railway projects. This was achieved by the creation of DOTC and LRTA with the specific mandates of, "… overseeing the effective implementation of the light rail transit project, including the construction and operation thereof.. " in their respective charters.[24]

These are Executive Order No. 603 (with its succeeding amendments) issued by Pres. Ferdinand Marcos on July 12, 1980 and Executive Order No. 125 (with its succeeding amendments) issued by Pres. Corazon Aquino.

2) EO-603 Creating the LRTA with authority to Construct & Operate the Light Rail Transit Project

The EO-603 was issued in preparation for the development of the Light Rail Transit – Line 1 by the Construction and Development Corporation of the Philippines, the Private Sector proponent closely allied with Pres. Marcos. The LRTA were given pervasive powers, among others to, "…..

- Contract any obligation or enter into, assign or accept assignment of, and vary or rescind any agreement, contract of obligation necessary or incidental to the proper management of the Authority…
- Carry on any business, either alone or in partnership with any other person or persons….
- Determine the fares payable by persons travelling on the light rail system, in consultation with the Board of Transportation…[25]
- Borrow or otherwise raise money and charge all or part of its properties as security therefor…

The LRTA was created as an attached agency under the supervision of DOTC. It is a contracting authority and was allowed to hold assets; but it could only recommend fare changes, the regulation of which was left to the Board of Transportation.

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[24] *Executive Order No. 603, Preamble.*
[25] *Executive Order No. 603, Article 2, Sections 4 & 5*

3) EO-125 Charter of the Department of Transportation & Communication

The government re-organization conducted in Yr-1987 created the Ministry of Transportation and Communication (MOTC), now Department of Transportation and Communication (DOTC) under Executive Order No. 125 (EO-125). Signed on January 30, 1987 by President Corazon Aquino, this EO-125 gave the mandate to DOTC to…"Establish and administer comprehensive and integrated programs for transportation and communications, and for this purpose, may call on any agency, corporation, or organization, whether public or private, whose development programs include transportation and communications as an integral part thereof, to participate and assist in the preparation and implementation of such programs."[26]

This EO allows the participation of the Private Sector with DOTC in undertaking rail development projects; essentially, this is the basis of the Institutional Structure for undertaking under a PPP implementation program. There is still, however, the necessary aspect of operating the facility beyond the development of the projects as given in this EO-125. The Private Sector would participate only provided that it will be allowed to operate (obtain revenues) in order to recover its investment.

4) EO-125A (Amendment to EO-125)

This EO-125A, the Amendment to EO-125 allows the DOTC to issue Certificates of Public Convenience (which is effectively an Operating Franchise) as stated: "Establish and prescribe rules and regulations for issuance of certificates of public convenience for public land transportation utilities, such as motor vehicles, tri-mobiles, and railways."[27] This EO-125A also grants the DOTC the authority to, "…determine, fix and/or prescribe charges and/or rates pertinent to the operation of public air and land transportation utility facilities and services…"[28] In essence, the DOTC has the regulatory function within itself to determine ticket fares on railroads; including fare adjustment as may be called for in the Parametric formula for Ticket Fares, as this is provided in Concession Agreements.

1.3.7 Specific Laws – Government Procurement Reform Act (GPRA) [29]

This RA-9184 principally places attention on procurement by the Government following the declared policy of promoting the ideals of good governance in all branches, departments, agencies, subdivisions, and instrumentalities, including government-owned and/or controlled corporations, and local government units.

RA-9184 reflects the constitutional principles of good governance of: transparency in the procurement process and the implementation of procurement contracts, competitiveness with equal opportunity for private parties to participate in public bidding, application of uniform procurement process, accountability for the decisions made by the authorities, and strict public monitoring of the procurement process.

RA-9184 is the applicable law for the Procurement of Infrastructure Projects, Goods, and Consulting Services, regardless of source of funds, whether local or foreign, by all branches and instrumentalities of government, its department, offices and agencies, including government-owned and/or controlled corporations and local government units. It was signed by President Gloria Macapagal-Arroyo on January 10, 2003 and took effect fifteen (15) days after its publication or on January 26, 2003.

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[26] *Executive Order No. 125, Section 5, Article B.*
[27] *EO-125A, Section 5, Article l.*
[28] *EO-125A, Section 5, Article P.*
[29] *The law was enacted on July 22, 2002 and promulgated on January 26, 2003. GPRA was generally defined as "An act providing for the modernization, standardization and regulation of the procurement activities of the Government and for other purposes.*

1.3.7.1 Implementing Rules and Regulations of RA-9184

The Implementing Rules and Regulations (IRR) of the GPRA was promulgated pursuant to Section 75 for the purpose of prescribing the necessary rules and regulations for the modernization, standardization, and regulation of the procurement activities of the government. The Government Procurement Policy Board (GPPB) through its Resolution 03- 2009, dated 22 July 2009, approved the Revised IRR and it took effect thirty (30) days after its publication or on 2 September 2009.

As a general rule, this IRR apply to all procurement of any branch, agency, department, bureau, office, or instrumentality of the Philippine Government, including government-owned and/or -controlled corporations (GOCCs), government financial institutions (GFIs), state universities and colleges (SUCs), and local government units (LGUs) except for the following activities:

- Procurement for goods, infrastructure projects, and consulting services funded from Foreign Grants
- Acquisition of real property; which is governed by R.A. 8974.
- Public-Private sector infrastructure or development projects and other procurement covered by R.A. 6957, as amended by R.A. 7718.

1.3.7.2 Executive Order No. 423

Executive Order 423 was issued to repeal Executive Order No. 109-A and to update the Rules and Procedures on the Review and Approval of all Government Contracts in order to conform with the GPRA. Specifically, this EO highlighted the following aspects/matters, among others, namely:

- Reiteration of the policy of this Administration that all Government contracts of Government Agencies shall be awarded through open and competitive public bidding, save in exceptional cases provided by law and applicable rules and regulations.
- Vesting authority to the Head of the Procuring Entity to give final approval and/or to enter into all Government contracts of their respective agencies awarded through public bidding, regardless of the amount involved.
- Requiring the Head of the Procuring Entity to obtain the opinion of the Government Procurement Policy Board (GPPB) and Approval of the Director-General of NEDA in order to proceed with alternative methods of procurement involving Government contracts required by law to be acted upon and/or approved by the President, with an amount of at least Five Hundred Million Pesos (P500 Million) and falls under any of the exceptions from public bidding.
- Instructing the National Economic Development Authority (NEDA), in consultation with the GPPB, to **issue guidelines regarding joint venture agreements with private entities** with the objective of promoting transparency, competitiveness, and accountability in government transactions, and, where applicable, complying with the requirements of an open and competitive public bidding.
- Prohibition on the Splitting or the division/breaking up of Government contracts into smaller quantities and amounts, or dividing contract implementation into artificial phases or sub-contracts for the purpose of evading or circumventing the requirements of law and this Executive Order, especially the necessity of public bidding of Government contracts, which entails.

1.3.7.3 Executive Order No. 645 – Amendment to Executive Order No 423

Executive Order 645 expressly amended section 4 of Executive Order 423 regarding approvals to be procured on government contracts entered into through Alternative Methods of Procurement. Beforehand, section 4 of Executive Order 423 required the approval of both the Government Procurement Policy Board (GPPB) and the Director-General of NEDA in order for the head of the procuring entity to proceed

with the alternative methods of procurement for Government contracts required by law to be acted upon and/or approved by the President, involving an amount of at least Five Hundred Million Pesos (P500 Million) and falls under any of the exceptions from public bidding described in Section 3 of EO 423. However, EO 625 now merely requires approval of the GPPB in order for the head of the procuring entity to proceed with government procurement under the same circumstances.

1.3.7.4 Guidelines to Joint Venture Agreements

These Guidelines were issued pursuant to Section 8 (Joint Venture Agreements) of Executive Order No. 423 dated 30 April 2005 that mandates the National Economic and Development Authority (NEDA), in consultation with the Government Procurement Policy Board (GPPB), to issue the necessary guidelines on Joint Ventures (JVs). The JV guidelines took effect on May 2, 2008.

The provisions of JV guidelines apply to all JVs to be entered unto by government-owned and/or controlled corporations (GOCCs), government corporate entities (GCEs), government instrumentalities with corporate powers (GICPs), government financial institutions (GFIs), state universities and colleges (SUCs), and which are expressly authorized by law or their respective charters to enter into JV Agreements. However, Local Government Units (LGUs) are not covered by these Guidelines.

Basically, JV agreements or projects are different from projects procured under Official Development Assistance (ODA), Build Operate and Transfer Law (BOT) and Government Procurement Reform Act (GPRA) where ownership of the asset/business will stay with the government. In contrast, JV agreements allow the private sector to take over the undertaking of the projects in its entirety after the government divests itself of any interest in the JV.

There are two modes for selecting a private entity-JV partner by the Government entity, namely; Competitive Selection and Negotiated Agreements. There are two modes for Implementing a JV agreement by the parties, namely: formation of a JV Company or a Contractual JV.

1.3.8 The Impact of RA-9184 and its attendant Executive Order's

As mentioned in Section 1.3.3, the current BOT law does not cover Joint Ventures and other variants in detail. Thus, the Legal Framework, with the BOT Law in its present form, need to be supplemented by RA-9184, EO-423, & EO-645 for those PPPs structured utilizing JVs.

To comprehensively constitute the BOT Law, the Government is proposing an Amendment to the IRR of RA-6957 / RA-7718 to include these variants. Until such time, the Legal Framework is embodied by the set of Laws shown in **Table 1.3.3**, below.

Table 1.3-3 Rationale' for Validity of Legal Framework through Precedence

LEGAL FRAMEWORK FOR LRT-2x PUBLIC-PRIVATE-PARTNERSHIP DEVELOPMENT, OPERATIONS, & OWNERSHIP			
Case No.	**Case**	**Applicable Law**	**Remarks**
1	• Private Sector to engage in railway Development and Construction	• Sec. 2 of RA-6957 • Sec. 2 of RA-7718 + IRR	• MRT3 as Precedence (BLT)
2	• Private Sector to Operate & Own	• LRTA: EO-603 + • BOT Law: Section-6	• Transfer of Authority to Operate granted
3	• Private Sector to Operate LRTA Facilities	• EO-125A	• Certificate of Public Convenience
4	• Private Sector JV to develop road project	• RA-9184 + EO-423 + EO-645	• PNCC-NDC JV Daang-Hari Project

Source: Study Team

Notes:

- *Case 1 – The fact is that the Metro Rail Transit – 3 Project (MRT-3) has been implemented by the Private Sector substantiates the BOT Law (with its amendments and IRR) as the enabling law. The LRT2 Extension Project can similarly cite the BOT Law in order to allow the Private Sector to develop the project.*

- *Case 2 –The implementation of MRT-3 project, with its operating component being undertaken by the Private Sector provides a sufficient precedence as basis for an O&M grant given to the Private Sector as part and parcel of the development of the entire project as provided in Section 6 of RA-6957. In the case of the LRT2 Extension Project, the O&M concession is granted to LRTA through EO-603. In this instance, considering that the operation of LRT-1 was given to LRTA under EO-603, LRTA can pass on the O&M grant to a Private Sector under PPP utilizing the provisions under Section 6 of BOT Law.30*

- *Case 3 – In the event where the Private Sector were to operate and maintain the facilities developed and owned by LRTA, the authority to operate and maintain can be granted to the Private Sector under (DOTC) EO-125A Section 5-g which stipulates that the selected Private Sector proponent can apply for a 'Certificate of Public Convenience.'*

- *Case 4 – In the event a PPP structure calls for LRTA and the Private Sector to form a Joint-Venture Company to construct and operate LRT-2 (or segments thereof), the joint-venture will be sanctioned under RA-9184 and its attendant Executive Order Nos. 423 and 645, with the supplemental Guidelines and Procedure for entering into Joint Venture Agreements between Government and Private Entities. The precedent case using this approach is the joint venture between Philippine National Construction Corporation (PNCC) a quasi government corporation and the National Development Corporation (NDC) a government investment agency for the development, operations and maintenance of the Daang Hari Project. A similar approach could be utilized for LRTA in joint venture with a Private Sector.*

1.3.9 Application of the Legal Framework to LRT2 Extension Project – PPP Scheme

Towards the implementation of LRT2 Extension Project under a PPP program, there are two (2) basic underlying aspects that must be addressed. These are:

- The law or laws that will govern in order to institute the partnership permitting the Private Sector to develop the project, and
- The law or laws that will allow the Private Sector to engage in the operations and maintenance of the developed / constructed facilities; whether wholly or partially owned.

Precedent cases are strong grounds in providing the legal rationale'. The logic is that if there are these laws forming the Legal Framework that have been earlier called in and applied that allowed Private Sector participation, it can be emulated for PPP implementation. Cases are presented below to prove this assertion.

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[30] *The Section 6 of RA-6957 is premised on the condition that the same Private Sector develops (constructs) the project.*

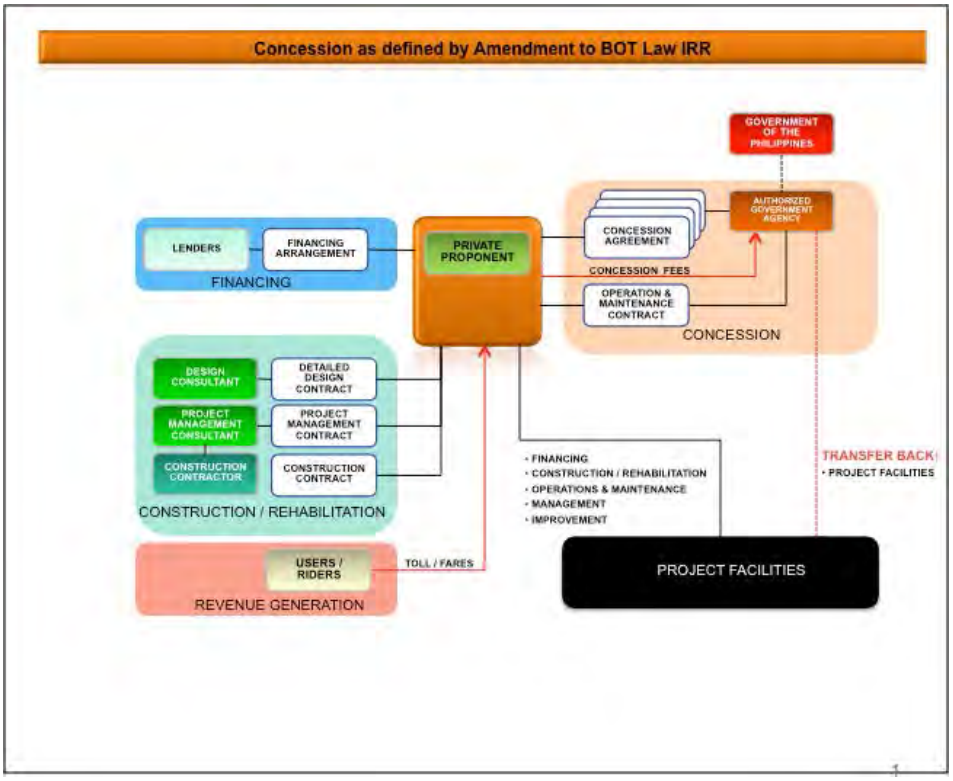
1.3.10 Amendment to the BOT Law

The Government, after a thorough review of the BOT Law, deemed that it is not a 'stand-alone' law that could form the foundation of the Legal Framework for PPP projects. It was found deficient in covering other PPP variants such as JV approach, Phased Approach, and the like. Thus, a proposed Amendment to the BOT Law is being pursued by the Government; with public hearings scheduled for a target of enactment prior to year-end 2011.

Significant in this Amendment, the Government introduced three (3) basic variants, i.e., Concession, Joint Venture, and Management Contracts over and above the BOT Law[31]. These schemes, and its dynamics are graphically shown in the Figures below. The following are the schemes:

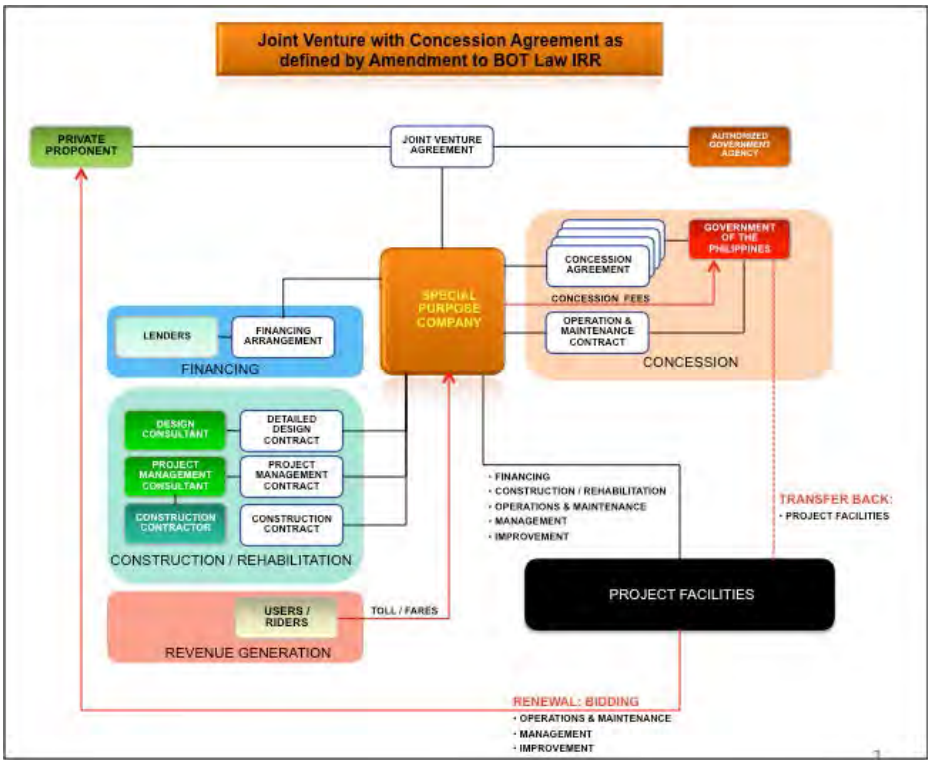
[31] *A review of the Amendment to this BOT Law could be found in: http://www.bworldonline.com/inside.php?title=Proposed BOT rule changes detailed by gov't&id=31176.*

1. Concession, 2-A. Joint Venture with a Concession
2-B. Joint Venture without a Concession, 3. Management



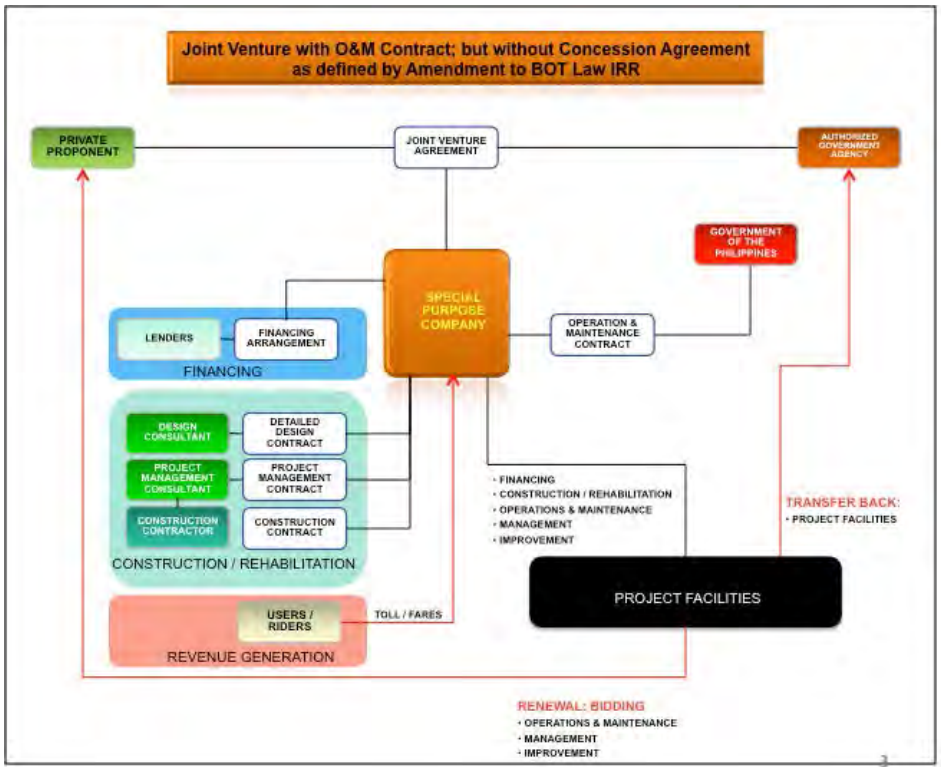
Source: Study Team

Figure 1.3-3 (1) Variant Schemes under Proposed Amendment to IRR ─Concession



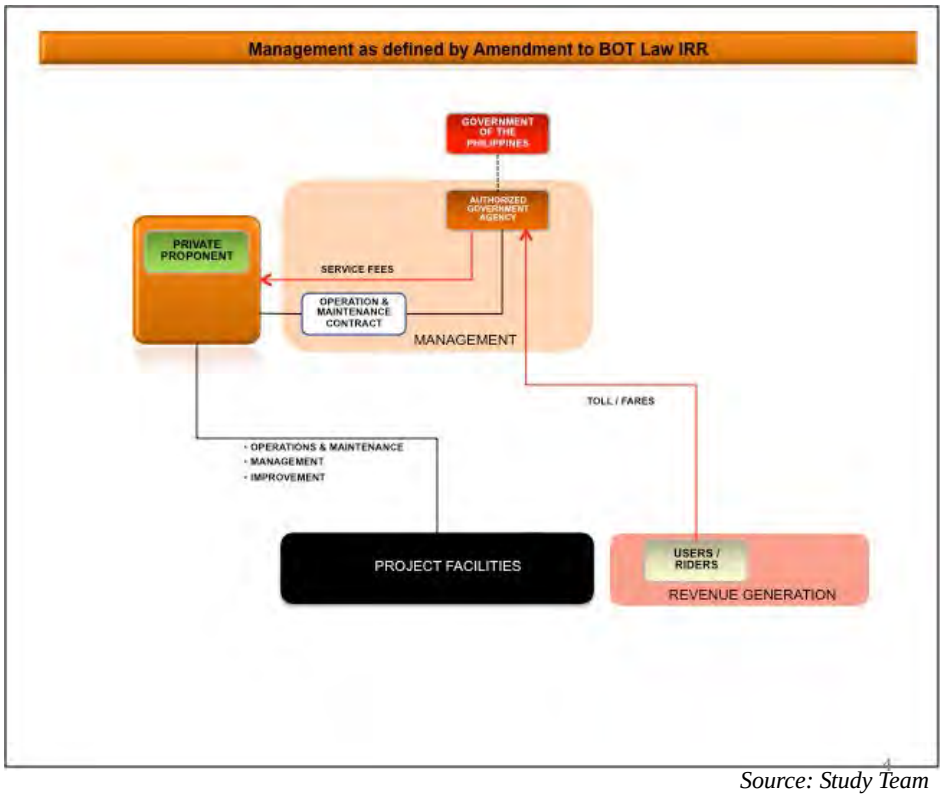
Source: Study Team

Figure 1.3-3 (2) Variant Schemes under Proposed Amendment to IRR ─Joint Venture with a Concession



Source: Study Team

Figure 1.3-3 (3) Variant Schemes under Proposed Amendment to IRR —Joint Venture without a Concession



Source: Study Team

Figure 1.3-3 (4) Variant Schemes under Proposed Amendment to IRR —Management

1.4 Review of Transportation Sector PPP Projects, Mobilization of Private Resources and Privatization in the Philippines

1.4.1 Rail Transport PPP Projects

1) Practical Example of PPP, Mobilization of Private Resources and Privatization

The past PPP project for the railway sector in the Philippines is the Metro Rail Transit (MRT) Line 3. The MRT 3 project is being implemented in accordance with the Buidl-Lease-and-Transfer (BLT) agreement between DOTC and Metro Rail Transit Corporation (MRTC). The **Table 1.4-1** shows a summary of the project.

Table 1.4-1 Project Summary of MRT 3

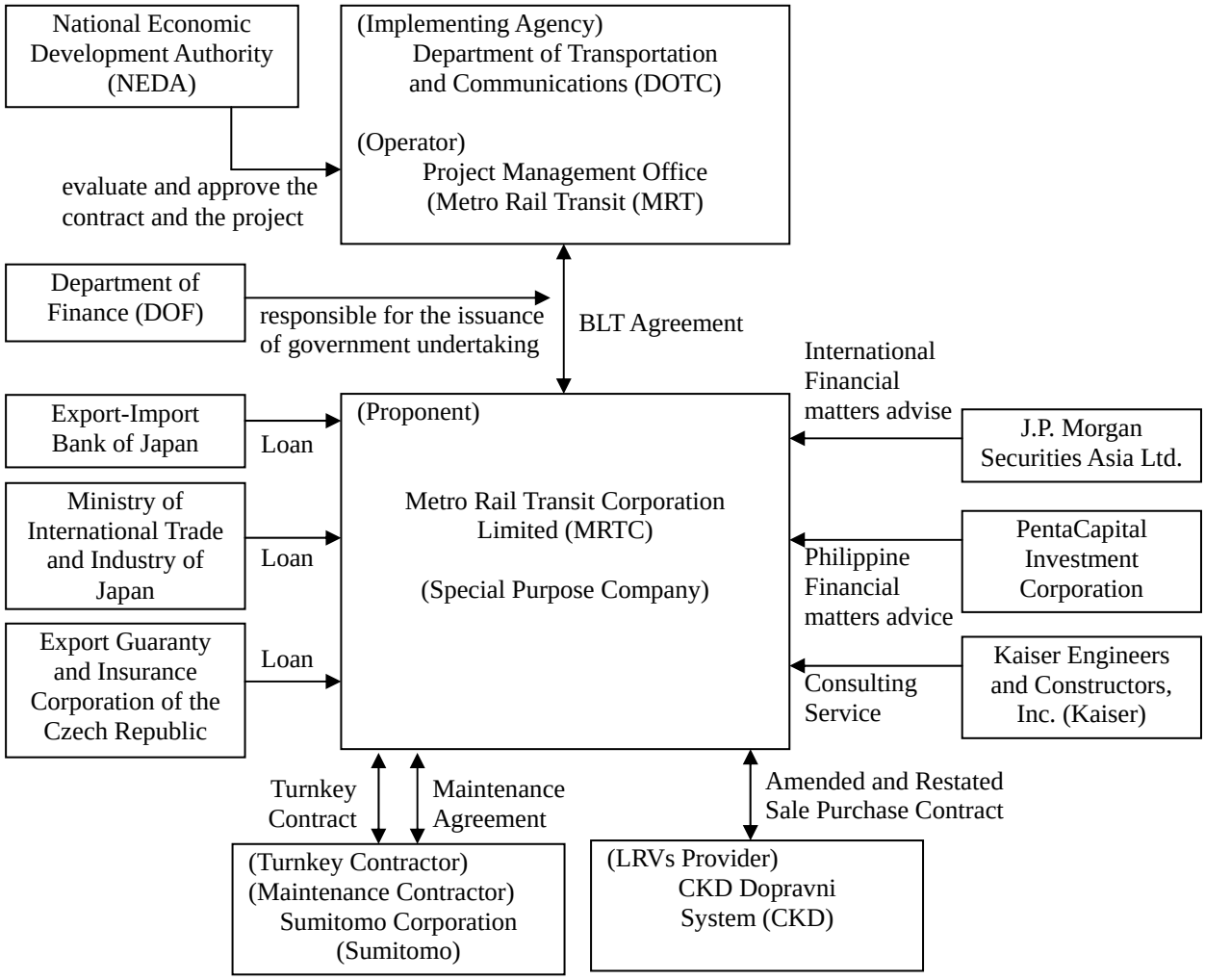
Project Name	Metro Rail Transit Line No.3 (MRT 3)
Project Location	National Capital Region
Objective/Description	The project aims to provide a Mass Transit System in Epifanio Delos Santos Avenue. The MRT 3 Project encompasses the design, construction, furnishing and equipping, testing and commissioning, and training of operations and maintenance personnel as necessary to operate Phase 1 of the EDSA Light Rail System. Phase 1 starts at the intersection of North Avenue and EDSA in Quezon City including the depot and depot access tracks and then proceeds generally along the median of EDSA continuously for approximately 17 kilometers to Taft Avenue in Pasay City.
Mode of Implementation	Solicited Mode
Scheme	Build-Lease Transfer (BLT)
Estimated Project Cost	US$655.0 Million
Status Updates	Operational
Legal Reference	The Philippine BOT Law (Republic Act No. 6957, as amended by Republic Act No. 7718)
Project Milestones	July 1991 ..... Execution of Build, Lease and Transfer Agreement between DOTC and EDSA LRT April 1992..... Execution of Revised and Restated Agreement May 1993..... Execution of Supplemental Agreement to the April 1992 Agreement July 1994 ..... Execution of Amendment No.1 to the Supplemental Agreement to the April 1992 Agreement May 1995..... Execution of Amendment No. 2 to the Supplemental Agreement to the April 1992 Agreement December 1995..... EDSA LRA changed its name to Metro Rail Transit Corporation Limited April 1996..... Metro Rail submitted proposal to DOTC for the construction and implementation of Phase II September 1996..... The NEDA Board approved the Phase I of the Project with the provision of 73 light rail vehicles October 1996 - July 2000 .. Construction Period December 1999..... Partial operation (North Avenue - Buendia) July 2000 ..... Full operation (North – Taft Avenue) July 2000 - July 2025 ..... Cooperation Period

Source: Build-Operate-and-Transfer (BOT) Center Website

Figure 1.4-1 shows the framework of the project and relations among stakeholders. The scheme required the DOTC to hold the franchise and run the system particularly the operation and the collection of fares. The MRTC built the system, maintained the same so as to guarantee the availability of the trains at specified headway at specified hours, as well as to procure the required spare parts. The DOTC pays MRTC monthly fees for a certain number of years. MRTC infused US$ 190 million in equity into the project, which is 28% of the total project cost.

The rental payment for the initial investment was based on a BLT agreement and is divided into the Debt Rental Payment allotted to repayment of the portion provided by borrowing from the financial institutions, and the Equity Rental Payment allotted to repayment of the portion provided by the investment in capital from the investors. Of these, payment of the portion provided by borrowing has been completed, and payment of the portion provided by the investment in capital is currently being made. This is the structure by which the share in the equity of MRTC transfers to DOTC according to the amount paid of the portion provided by the investment in capital.

The annual amounts of the BLT agreement payments are equity rental payment of 5,296 million pesos, debt guarantee payment of 1,157 million pesos, maintenance fee of 1,184 million pesos, insurance expenses of 207 million pesos, other fees and costs of 34 million pesos, for a total of 77,878 million pesos (2010).



Source: Study Team

Figure 1.4-1 Framework of the Project

The problems of the MRT Line 3 using a BLT scheme are as follows:

- MRTC is completely separated from the demand risk, therefore there is no incentive to increase the ridership.
- On the maintenance service which DOTC has commissioned to MRTC in accordance with a BLT agreement, there is no incentive for cost reduction or the replacement of facilities and equipment for the improvement in service, etc. The private sector has all the concessions, such as shops of a station yard, and DOTC cannot undertake an incidental business.
- Since operation by DOTC, and facilities ownership, maintenance and incidental business operation by MRTC are carried out by different entities, there is little flexibility in management and efficient and effective use of the management resources is difficult for DOTC.

2) Program of PPP, Mobilization of Private Resources and Privatization

The six projects are listed for the comprehensive Integrated Infrastructure program (CIIP) from 2009 to 2013 of NEDA as a PPP priority project of the rail transport subsector (**Table 1.4-2**).

- LRT Line 1 South Extension
- LRT Line 2 East Extension
- MRT 7
- MRT 8
- Common Ticketing System
- LRT Line 2 West Extension

Table 1.4-2 PPP Priority Projects in Rail Transport Subsector (CIIP)

PROJECT TITLE/DESCRIPTION	IMPLEMENTING AGENCY / INSTITUTION	TOTAL REMAINING PROJECT COST IN PHP MILLIONS	FINANCING SOURCE
URBAN LUZON SUPER REGION			
LRT Line 1 South Extension Project	LRTA	36,199.01	NG for Right of Way (ROW), Public-Private Partnership (PPP) for civil works
MRT Line 2 Phase 2 (Line 2 East Extension to Masinag)	LRTA	11,434.27	Public-Private Partnership (PPP)
MRT 7 Build Gradual Transfer Operate & Maintain (BGTOM) (Capacity Fee Payment)Unsolicited	DOTC	61,750.00	Build Gradual Transfer Operate & Maintain (BGTOM)
MRT 8 Build-Transfer/Build-Operate-Transfer (BT/BOT)	DOTC	51,464.00	Build-Transfer/Build-Operate-Transfer (BT/BOT)
Common Ticketing System	DOTC	357.30	Build-Operate-Transfer (BOT)
MRT Line 2 West Extension Project	LRTA	4,106.29	For ODA or Public-Private Financing

Source: NEDA Web-Site

The four following projects are listed as a PPP projects for the road transport subsector in the Philippines infrastructure held in 2010. Projects for 2011 rollout

- LRT Line 2 East Extension
- MRT/LRT Expansion Program: Privatization of LRT 1 Operation and Maintenance
- MRT/LRT Expansion Program: Privatization of MRT 3 Operation and Maintenance
- MRT/LRT Expansion Program: LRT 1 South Extension Project

Projects for the medium-term rollout and other PPP projects

- MRT/LRT Expansion Program: Common Ticketing System Project
- Privatization of Northrail Operation and Management

- Development of the Mindanao Railway System
- Main Line South Upgrading/Modernization

It is assumed that in the railroad sector, the government aims to transfer operation to the private sector based on the problems of the MRT Line 3 which is the only current PPP project, and the new construction, including the extension and O&M of the commuting lines of the Metro Manila which will cost a huge amount of money but can expect much demand are planned to be carried out by PPP.

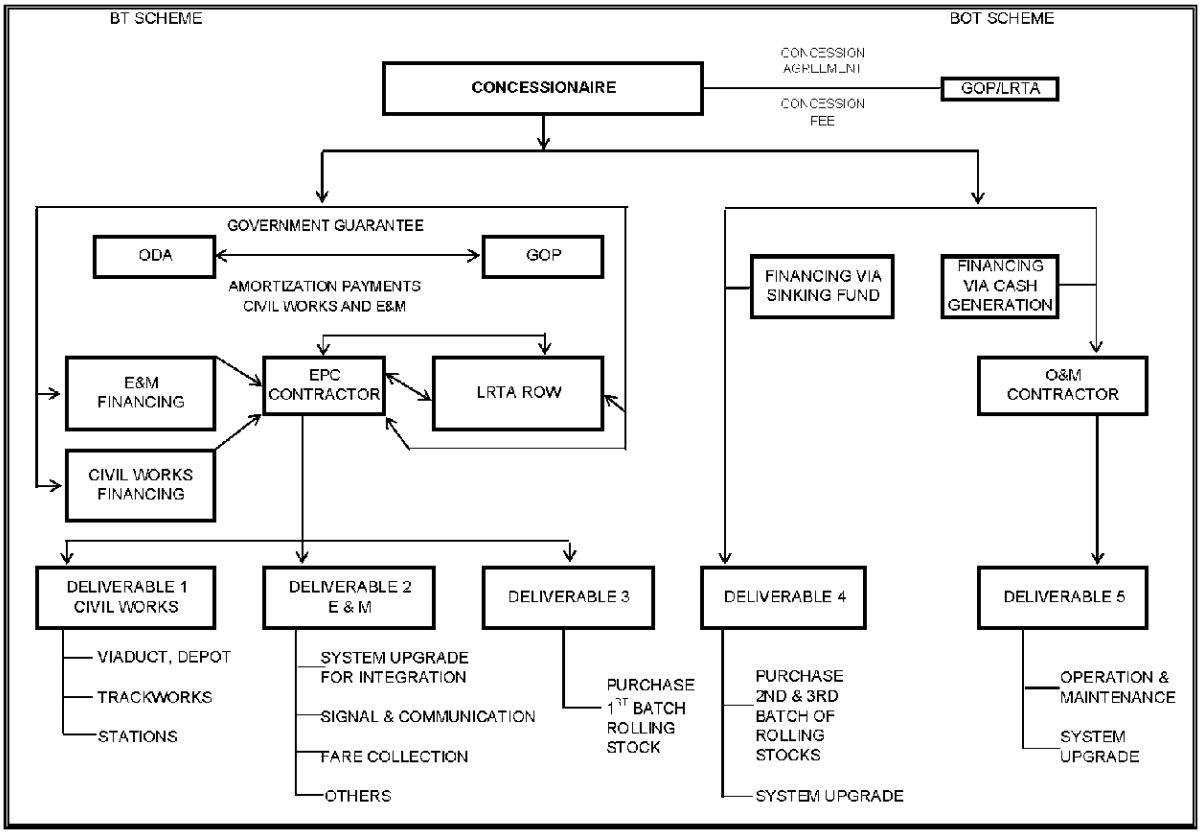
a) MRT/LRT Expansion Program: Privatization of LRT 1 O&M and MRT 3 O&M and LRT 1 South Extension Project

In these projects the overall strategy for the LRT-1 and MRT-3 Privatization and Extension Projects is as follows, (refer to **Fig. 1.4-2**), and details of the scheme are described on 1.7.1.1:

- Step 1 (2011-2016): Interim Operation & Maintenance for Lines 1 and 3 (excluding maintenance of AFC) to be bid out.
- Step 2 (2011-2021): Supply and Maintenance of Automatic Fare Collection System of Line 1, 2, and 3 to be bid out.
- Step 3 (2016-Onwards): Winning Line 1 Concessionaire to take over O&M of Lines 1 and 3 including ridership risk to secure procurement of Capital Costs (Rolling Stock).

b) Common Ticketing System Project

This project involves equipment and systems necessary to replace, upgrade and integrate the existing Automatic Fare Collection System of LRT 1, LRT 2 and MRT 3, with a standard architecture that it is capable of being expanded to other future transit lines (e.g., PNR commuter, North Rail, MRT 7) as well as providing low value payment services to non-transport businesses for profit. Included is an interoperable contactless technology that will also provide for transaction clearing and revenue apportionment services through centralized services, which include a ‘clearing house’.
The project is to be implemented on a PPP (Build-Lease to Own-Maintain-Transfer) basis. The chosen private entity shall install, finance and maintain the equipment and systems. After the development and installation period of the AFCS, the private entity, which owns the equipment, will lease to own the AFCS to the DOTC and maintain the system over a contract period which should not exceed 10 years. After the 10-year lease to own period, the AFC will be turned over to the DOTC.



Source: DOTC

Figure 1.4-2 Business Model of Line 1 Cavite Extension, Integration with Line 3 and their Operation and Maintenance

1.4.2 Road Transport PPP Projects

1) Practical Example of PPP, Mobilization of Private Resources and Privatization

The participation of the private sector in the road transport subsector began from implementing repair, extension and improvement of the road by the joint venture (JV) method between private-sector investors and the state-owned enterprise given the power to carry out construction, operation and maintenance of a highway in the 1990s. In accordance with the BOT law enacted in 1990, the private sector caries out construction, operation and maintenance, or operation and maintenance of a highway. On the case of road transport PPP projects completion of the prior land acquisition by the public sector has been a problem.

Table 1.4-3 Practical Example of PPP in the Road Transport Subsector

Project Name	System of Project
South Luzon Expressway (SLEx)	JV
Southern Tagalog Arterial Road (STAR)	Concession given to Private for O&M of Stage I and build and O&M for Stage II
Metro Manila Skyway	JV
Manila-Cavite Coastal Expressway (R-1)	JV
North Luzon Expressway (NLEx)	JV
Subic-Clark-Tarlac Expressway (SCTEx)	GRP built with ODA Funding O&M Contract: Lease Contract
Tarlac-Pangasinan-La Union Expressway (TPLEx)	Concession Contract (Under Construction)

Source: Preparatory Survey for PPP Infrastructure Development Projects in Philippines

2) Program of PPP, Mobilization of Private Resources and Privatization

The 17 projects of the comprehensive Integrated Infrastructure program (CIIP) from 2009 to 2013 of NEDA as PPP priority projects of the road transport subsector are listed. (**Table 1.4-4**).

Table 1.4-4 PPP Priority Projects in Road Transport Subsector (CIIP)

PROJECT TITLE/DESCRIPTION	IMPLEMENTING AGENCY / INSTITUTION	TOTAL REMAINING PROJECT COST IN PHP MILLIONS	FINANCING SOURCE
NORTH LUZON SUPER REGION			
San Fernando City Bypass Road (La Union)	DPWH	135.60	Public-Private Partnership (PPP)
URBAN LUZON SUPER REGION			
Cavite-Laguna (CALA) North-South Roads	DPWH	5,198.10	Proposed for BOT
Cavite-Laguna (CALA) Expressway	DPWH	8,749.60	Proposed for BOT
South Luzon Expressway Rehabilitation Project-Project Toll Road 4	DPWH	9,147.00	Proposed for BOT
Candelaria Bypass Road (Quezon)	DPWH	234.50	Proposed for BOT
Calamba-Los Baños Bypass Road, Laguna	DPWH	2,407.85	Proposed for BOT
Arterial Road Bypass Project Phase II (Cabanatuan, San Jose, Plaridel Bypass Road)	DPWH	5,604.90	Proposed for BOT
Alaminos-San Pablo City Bypass Road along Maharlika Highway	DPWH	605.16	Proposed for BOT
Tiaong Bypass	DPWH	102.90	Proposed for BOT
Batangas-Bauan Ring Road	DPWH	1,358.10	Proposed for BOT
CENTRAL PHILIPPINES SUPER REGION			
Palo East and West Bypass Road, Leyte	DPWH	269.18	Proposed for BOT
Bacolod City-Granada Section, Negros Occidental	DPWH	196.50	Proposed for BOT
Dumaguete City Diversion Road, Negros Oriental	DPWH	416.92	Proposed for BOT
MINDANAO SUPER REGION			
Panguil Bay Bridge	DPWH	1,406.25	Proposed for BOT
Ozamis City Coastal Bypass Road, Misamis Occidental	DPWH	450.00	Proposed for BOT
Zamboanga City Bypass Road, Zamboanga Del Sur	DPWH	1,100.00	Proposed for BOT
Second Magsaysay Bridge and Butuan City Bypass Road Phase II	DPWH	522.40	Proposed for BOT

Source: NEDA Web-Site

Moreover, the nine following projects are listed as PPP projects of the road transport subsector in the Philippines infrastructure held in 2010 (**Table 1.4-5)**. Projects for 2011 rollout:

- CALA Expressway－Cavite Side Section (27.5 km)
- NAIA Expressway (Phase II)

Projects for the medium-term rollout and other PPP projects

- C-5/FTI/Skyway Connector
- CALA Expressway－Laguna Side Section (14.3 km)
- C-6 Expressway (Global City Link)－South Section
- Central Luzon Expressway (CLEX)－Phase II, Cabanatuan－San Jose
- SLEX Extension (to Lucena City), 2-Lane
- Calamba－Los Banos Expressway
- R-7 Expressway

In DPWH, the Project Management Office – Build-Operate-Transfer (PMO-BOT) was constituted as a section for handling PPP projects, and has come up with a short and long list of priority PPP projects propose for implementation. The priority PPP projects are selected by screening on a quantitative criterion from the lists.

Table 1.4-5 PPP Priority Projects for 2011 Rollout in Road Transport Subsector

Project	Project Profiles	
CALA EXPRESSWAY -CAVITE SIDE SECTION (27.5 KM)	Description	The project will provide vital access between various economic zones in Cavite Province and NAIA, Manila Port and Batangas Port, and contribute to the economic development and decongestion of traffic along Cavite roads, particularly Aguinaldo Highway. This is the extension of the ongoing Manila-Cavite Coastal Expressway Extension and ends at Silang, Cavite Province. It is an at-grade expressway. L=27.5km No. of Lanes = 6 lanes
	Implementation Schedule	May 2012 to December 2015
	Project Cost	PHP 11,790 Million (US$ 262 Million)
	Sponsoring Agency	DPWH
	Project Status	- Detailed Feasibility Study will start in December 2010 and will be completed in August 2011 - Expected date of Bidding/Tendering Schedule － December 2011 - Detailed Design and Construction Schedule － May 2012 － December 2015
NAIA EXPRESSWAY (PHASE II)	Description	The project will link the Skyway and Manila-Cavite Coastal Expressway. It will provide vital access to NAIA Terminals 1, 2, and 3. Economic zones in Cavite Province will benefit through easier and faster transportation of products to NAIA as well as to Manila Port through this link and the NLEX-SLEX Link Expressway. L=4.9 km No.of Lanes =4 lanes
	Implementation Schedule	November 2011 to September 2015
	Project Cost	PHP 10,590 Million (US$ 235.33 Million)
	Sponsoring Agency	DPWH
	Project Status	- Feasibility Study completed in 2010 - Bidding/Tendering Schedule － May 2011 - Detailed Design and Construction Schedule － November 2011 to September 2015

Source: Public-Private Partnership Projects

1.4.3 Air Transport PPP Projects

1) Practical Example of PPP, Mobilization of Private Resources and Privatization

Participation of the private sector in construction and operation of the airport under the jurisdiction of the public sector is being carried out in various forms by many countries, including privatization of an airport operating company, outsourcing of various services, and PFI/BOT project from construction to operation by the private sector. In Asia, the airport PPP projects have been undertaken in Cambodia (Phnom Penh Airport, Siem Reap Airport), India (New Bangalore Airport, Indira Gandhi Airport), Japan (Haneda Airport), China (Beijing Capital International Airport), etc.

In the air transport subsector of the Philippines, "the Terminal 3 project of Ninoy Aquino International Airport" was undertaken as a project based on the BOT law. The BOT method, in which the selected private sector transferred the development it to the Government after they constructed the terminal for an international airline and operated it for 25 years, was adopted for this project.

In 1997, DOTC and the Manila International Airport office (MIAA) contracted a concession with the Philippine International Air Terminal Company (PIATCO) that has been established by the consortium which acquired the right of concession. Fraport, which was the largest stockholder of PIACTO and operated Frankfurt Airport was to take charge of operation of the terminal building after completion, the

Supreme Court repealed the concession contract just before the facilities completion and the Government requisitioned the facilities. The terminal began operation in 2008, and MIAA is carrying out operation and management.

2) Program for PPP, Mobilization of Private Resources and Privatization

The four following project are listed in the comprehensive Integrated Infrastructure program (CIIP) from 2009 to 2013 of NEDA as PPP priority project of the air transport subsector (**Table 1.4-6)**. Assitionally, nine projects are listed in the program as transportation priority projects of air transport subsector not based on PPP of air transport subsector.

- CEZA International Airport - development of an international airport within the freeport as a new airport for cargoes and passengers
- Diosdado Macapagal International Airport (DMIA) Passenger Terminal 2 Project
- San Jose Airport Development Project (Carabao Island)
- Balabac Airport, Palawan(to be funded either by Malampaya Funds or by the private sector) with Feasibility Study

Table 1.4-6 PPP Priority Projects in Air Transport Subsector (CIIP)

PROJECT TITLE/DESCRIPTION	IMPLEMENTING AGENCY / INSTITUTION	TOTAL REMAINING PROJECT COST IN PHP MILLIONS	FINANCING SOURCE
NORTH LUZON SUPER REGION			
CEZA International Airport - development of an international airport within the freeport as a new airport for cargo and passengers	CEZA - DOTC - Cagayan Land Property Development Corp. (CLPDC)	1,658.01	Joint Venture (JV)
URBAN LUZON SUPER REGION			
Diosdado Macapagal International Airport (DMIA) Passenger Terminal 2 Project	CIAC and Private Proponent	6,477.00	Joint Venture (JV) partner will provide full project financing of approximately Php 3 Billion with a gearing ratio of at least 70%-30% debt to equity.
CENTRAL PHILIPPINES SUPER REGION			
San Jose Airport Development Project (Carabao Island)	DOTC - Private Proponent	303.00	Public-Private Partnership (PPP) - Build-Operate-and-Transfer (BOT)
Balabac Airport, Palawan(to be funded either by Malampaya Funds or by the private sector) with Feasibility Study	DOTC - Private Proponent	1,145.00	Public-Private Partnership (PPP) - Build-Operate-and-Transfer (BOT)

Source: NEDA Web-Site

Next, the eight following projects are listed as PPP project of the air transport subsector in the Philippines infrastructure held in 2010 (**Table 1.4-7**). Projects for 2011 rollout:

- New Bohol Airport Development
- Puerto Princesa Airport Development
- New Legaspi (Daraga) Airport Development
- Privatization of Laguindingan Airport Operation and Maintenance

Projects for the medium-term rollout and other PPP projects

- Kalibo Airport Upgrading
- NAIA Terminal 3 Upgrading and Full Operationalization
- Privatization of NAIA and DMIA Development
- Balabac Airport Development

Table 1.4-7 PPP Priority Projects for 2011 Rollout in Air Transport Subsector

Project	Project Profiles	
NEW BOHOL AIRPORT DEVELOPMENT	Description	The project involves the construction of a new airport of international standards with 2,500m X 45m runway to replace the existing Tagbilaran Airport.
	Implementation Schedule	2012-2014
	Project Cost	PHP 7,600 Million (US$ 168,89 Million)
	Sponsoring Agency	DOTC/MIAA/CAAP
	Project Status	- Updating of FS to reconfigure the project into PPP and validate project scope, costs and structure - Preparation of bid documents under consideration for USTDA or Singapore assistance - PPP bid by 2nd quarter of 2011 with contract award by 4th quarter 2011
PUERTO PRINCESA AIRPORT DEVELOPMENT	Description	The Project involves the rehabilitation/improvement of the existing Puerto Princesa Airport to meet the standards of the International Civil Aviation Organization (ICAO) through the construction of new landside facilities on the north western side of the existing runway such as passenger terminal building, control tower, administration and operation building, cargo terminal building, rescue and fire fighting building and other support facilities, the construction of new apron and connecting taxiways, upgrading of the existing 2.6 km runway and its strip, and the provision of new navigational and traffic control equipment.
	Implementation Schedule	2012- 2014
	Project Cost	PHP 7,600 Million (US$ 168.89 Million)
	Sponsoring Agency	DOTC/MIAA/CAAP
	Project Status	- Updating of FS to reconfigure the project into PPP and validate project scope, costs and structure - Preparation of bid documents under consideration for USTDA or Singapore assistance - PPP bid by 2nd Quarter of 2011 with contract award by 4th Quarter 2011
NEW LEGASPI (DARAGA) AIRPORT DEVELOMENT	Description	The project involves the preparation of the detailed engineering design, and construction of airport facilities. It also includes land acquisition of about 180 hectares. Project components are the following: Landside – Passenger Terminal, Cargo Building, Control Tower, Administration Building, Vehicle Parking Area, and other site development.
	Implementation Schedule	2012-2014
	Project Cost	PHP 3,200 Million (US$ 71.11 Million)
	Sponsoring Agency	DOTC/CAAP
	Project Status	- Updating of FS to reconfigure the project into PPP and validate project scope, costs and structure - Preparation of bid documents under consideration for USTDA assistance - PPP bid by 1st quarter of 2011 with contract award by 4th quarter 2011
PRIVATIZATION OF LAGUINDINGAN AIRPORT OPERATION AND MAINTENANCE	Description	The project involves the privatization of the operation and maintenance of the Laguindingan Airport, Misamis Oriental to reduce government expenditure and increase current and future service levels of the airport. The O&M through concession covers the newly constructed airport on a 393-hectare property complete with facilities of international standards. The airport can accommodate 1.2 million passengers per year based on its Master Plan.
	Implementation Schedule	2011-2013
	Project Cost	PHP 1,500 Million (US$ 33.33 Million)
	Sponsoring Agency	DOTC/MIAA/CAAP
	Project Status	- Preparation of business case and tender documents for the privatization of the airport operation under consideration for USTDA assistance - PPP bid by 2nd quarter of 2011 with contract award by 4th quarter 2012

Source: Public-Private Partnership Projects

While the Terminal 3 project of Ninoy Aquino International Airport did not get off the ground as a PPP project, the Government shows the policy continues to promote mobilization of private resources for airport development and operation.

1.4.4 Sea Transport PPP Projects

1) Practical Example of PPP, Mobilization of Private Resources and Privatization

In the sea transport subsector, although there is no PPP example being carried out as a project based on the BOT law, the private sectors have been taking part in construction and operation of port facilities, and we can say that there is substantially an example of PPP. PPP port facilities projects have been carried out a method in which generally the government (Port Authority) basically built the container terminal, and the private sector entity that was given the concession operates the facilities. As typical cases, there are the Manila international container terminal (MICT) and the Manila South Harbor.

Since MICT was established as a harbor which handles international containerized cargo, it has been operated by International Container Terminal Service Inc. (ICTSI) who won the concession in 1988. ICTSI is an operator of 100% Philippines owners' equity, and it acquired the right of operation in the New Container Terminal-1 of Subic Bay Freeport, Bauan Terminal of Batangas, General Santos, Davao and Mindanao, it is developing projects in Brazil, Poland, Japan, Madagascar, Indonesia, Syria, China, etc. all over the world.

The Manila South Harbor was established in the beginning as a harbor which handles the miscellaneous goods and the bulk of foreign trade, and it has been operating by Philippines Port Authority (PPA). At the time of completion of the rehabilitation using an ADB loan in 1995, the operation was moved to Asian Terminals Inc. (ATI) a private operator under a concession contract. ATI also began handling containers with high profitability. Dubai Port World which bought out P&O Ports (one of the two major operators of Asia) owns the majority of the capital of ATI. ATI is operating Batangas Harbor, General Santos Harbor, etc. in addition to the Manila South Harbor in the country.

According to the profit and loss statement of the Philippines Port Authority in 2009, there is about 2,129 million-peso operating profit with operating expenses of about 4,840 million pesos to the operating revenue of about 6,969 million pesos, and the net profit is about 1,536 million pesos. Concession fees from MICT and South Harbor accounts for 48% of this operating revenue.

In the sea transport subsector, mobilization of private resources is already established, and it has a structure which commissions operation of the port facilities where profitability is high to a private sector operator, and promotes construction of the port facilities where profitability is low using the concession revenue earned by the public sector.

2) Program of PPP, Mobilization of Private Resources and Privatization

The following project is listed in the comprehensive Integrated Infrastructure program (CIIP) from 2009 to 2013 of NEDA as a PPP priority project of the sea transport subsector (**Table 1.4-8**). Additionally, 54 projects are listed in the program as sea transportation priority projects not based on PPP. Port Irene Rehabilitation and Development Project

Table 1.4-8 PPP Priority Projects in Sea Transport Subsector (CIIP)

PROJECT TITLE/DESCRIPTION	IMPLEMENTING AGENCY / INSTITUTION	TOTAL REMAINING PROJECT COST IN PHP MILLIONS	FINANCING SOURCE
NORTH LUZON SUPER REGION			
Port Irene Rehabilitation and Development Project	CEZA - Asia Pacific International Terminals (APIT)	4,000.00	Private Sector

Source: NEDA Web-Site

Next, four projects are listed as PPP projects in the of a sea transport subsector in the Philippines infrastructure held in 2010 (**Table 1.4-9**). Projects for the medium-term rollout and other PPP projects include:

- Development of new Cebu Port
- Driftwood Beach Marina and Terminal
- Guimaras-Iloilo Ferry Terminal Project
- Taal Lake Fish Port & Processing Complex

Table 1.4-9 PPP Priority Projects for the Medium-term Rollout in Sea Transport Subsector

Project	Project Profiles	
DEVELOPMENT OF NEW CEBU PORT	Description	The project aims to develop a new container and multipurpose terminal at a new site in Mandaue City to expand port capacity in handling container traffic.
	Implementation Schedule	2012-2015
	Sponsoring Agency	DOTC/CPA
	Project Status	Feasibility Study will be included in a request proposed to JICA for technical assistance. Preparation of the business case and PPP arrangement will be included in the FS scope of work.
DRIFTWOOD BEACH MARINA AND TERMINAL	Description	The project will adress transport needs of an increasing number of shipbuilding workers and employees, currently estimated to be around 20,000, who regularly use the strenuous Cawag － Subic Road. The project is a terminal port primarily for ferry boats traversing Subic Bay to Olongapo City and from the port of Hanjin Heavy Industries and Construction Company (HHICC). The project will cut down the transportation time by a minimum of 40 minutes providing workers and employees with more time for rest and other recreational activities. The terminal port will likewise have provision for commuters' amenities, communication services, porter services, fast food outlets, recreational, workers' assistance desk and medical emergency services.
	Implementation Schedule	1st Quarter 2012- 4th Quarter 2012
	Project Cost	PHP 100 Million (US$ 2.22 Million)
	Sponsoring Agency	City Government of Olongapo
	Project Status	City Government facilitated preparation of Project concept and detailed drawings
GUIMARAS-ILOILO FERRY TERMINAL PROJECT	Description	The project involves improvement of the port facilities in the Municipalities of Jordan and Buenavista in Guimaras Province and in Parolla, Iloilo City. The Parola Port improvement shall include the establishment of a terminal building that will house rentable commercial spaces and offices of the PCG and MARINA, an eco-park, public parking, docking facilities, commercial stalls and the future sites for the DENR and the PCG. The project will be undertaken through a Public-Private partnership scheme with the provincial government of Guimaras and the city government of Iloilo.
	Implementation Schedule	2011-2012
	Project Cost	PHP 406 Million (US$ 9.02 Million)
	Sponsoring Agency	City Government of Iloilo
	Project Status	Revised Memorandum of Agreement between the City Government of Iloilo, Provincial Government of Guimaras and the Philippine Coast Guard is ready for final signing by the signatories. Presidential Land Proclamation Application for the project site is now being finalized in the name of the City Government of Iloilo.
TAAL LAKE FISH PORT & PROCESSING COMPLEX	Description	The establishment of the Taal Lake Fish Port and Processing Complex is expected to accelerate growth of fishery activities in the city. It aims to make the City of Tanauan the transshipment point of the Taal Lake fish harvest and the agricultural products of the 11 lakeside towns. It is envisioned that with the fishing port and processing complex, there will be improvement in the quality and marketability of fish catch; efficiency of fishery unloading operations; adequacy of facilities and technology for processing, storing, and distributing fishery products; efficiency of product handling procedures; and availability and quality of shelter, maintenance, and repair facilities for fishing vessels.
	Implementation Schedule	2011-2012
	Sponsoring Agency	City Government of Tanauan
	Project Status	Development/structuring stage

Source: Public-Private Partnership Projects

While the port authority of the Philippines has not described the method in which the public sector builds and the private sector operates the facilities like MICT or Manila South Harbor as PPP, the authority is planning to leave operation or from construction to operation to the private sector in many projects under proposal according to the profitability of a project.

1.4.5 Realistic Eligibility and Requirements for participation in this project

Although concrete participating eligibility and requirements for the private sector regarding each project were not obtainable for the transportation sector PPP projects in the Philippines, the Study Team arranged the basic concept of the private sector participating eligibility and the requirements at the time of implementation this project as a PPP project as follows.

Participating qualification and requirements are set in order to secure the minimum quality of a participating company. As for participating qualifications and requirements, it is desirable to limit to regulations to a minimum and to evaluate the contents of each proposal, such as implementation organization of the service, so that the private ingenuity or creative proposals will not be obstructed.

Table 1.4-10 Basic Concept of the private sector participating eligibility and the requirements

Requirements for Group Formation	• In this project, several companies and organizations which carry out civil works, E&M system construction and supply, supply of the rolling stock, operation, and maintenance will form a group and participate. • In order to presuppose the project finance and insulate this project from other business risks of the participating companies, generally, DOTC/LRTA will contract with the special-purpose company (SPC or SPV). • In this project, since the railway business operation has been carried out over a long period of time, about 30 years, bearing most operation risks, an operation company will become the key member. • Although the local Philippine companies are guaranteed access to these projects by the 40% limitation for the ownership rate of foreign capital, the participation of the company which undertakes construction, operation and maintenance is controlled by the following requirements regarding the eligibility and the practical accomplishment of participating companies. • If the railway business operation over the long period of time of about 30 years is taken into consideration, it is important to give the local companies of the Philippines responsibility.
Requirements for the Eligibility of participating Companies	• The requirements for the eligibility of participating companies, such as business license and rating, are set as reference in the requirements for the eligibility assumed by the conventional mode in compliance with a related statute according to the contents and the size of this project.
Requirements regarding the Practical accomplishments of Participating companies	• The requirements for the practical accomplishments of participating companies are set as reference in the requirements for the practical accomplishments assumed by the conventional mode in compliance with a related statute according to the contents and the size of this project. • It is a basic requirement to have a contract track record of other projects of having contents and size equivalent to this project. • On establishment of the requirements for the practical accomplishments of a potential operation company, the number of companies which can participate will change dependant upon the exact experience required, which may include the country and the area in which the experience was accumulated, the track record of the number of years in operation, and operation form which are "contents equivalent to this project". These need to be circumspectly set up from the viewpoint of ensuring competitiveness and fairness, and a viewpoint of building the implementation framework of the railway business to which efficiency, sustainability, soundness, and safety are ensured. As criteria for "size equivalent to this project", the route length, the number of stations, and the number of passengers are included.

Source: Study Team

1.5 Overview of Implementing Agency

1.5.1 Outline of Implementing Agency

1.5.1.1 Organizational Structure

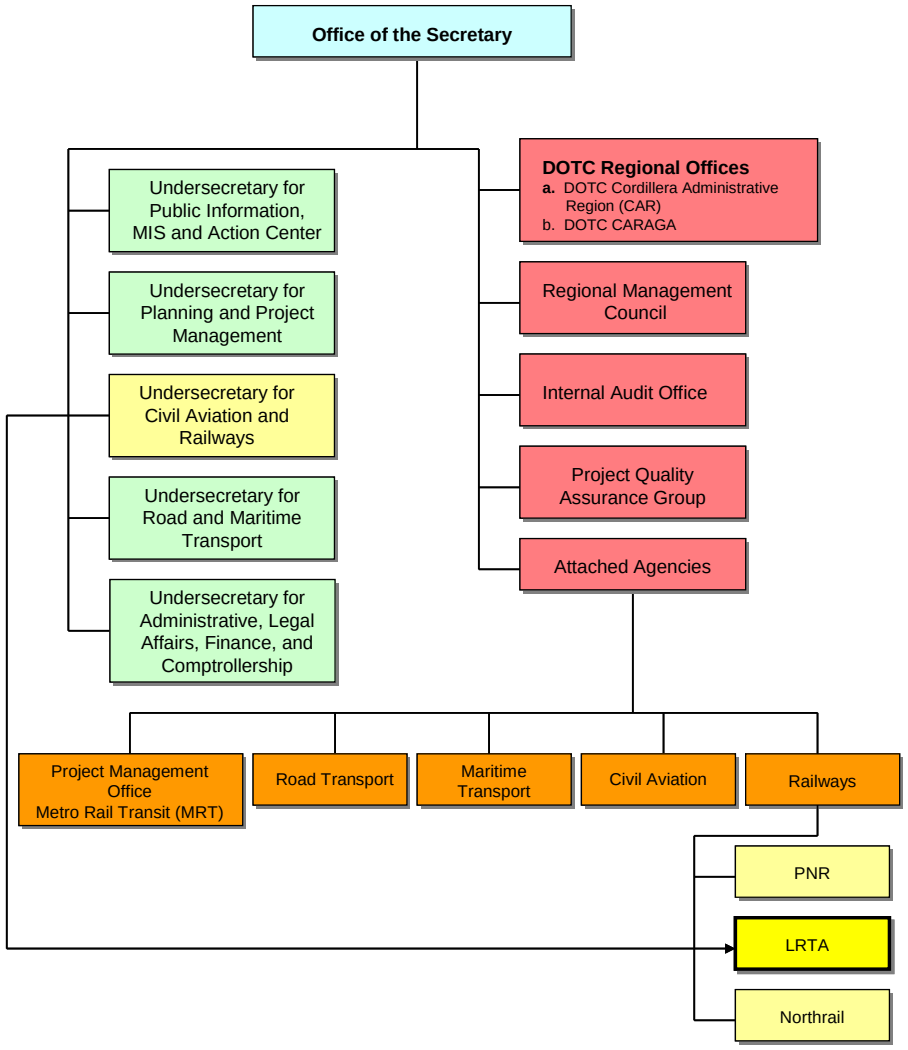
The Light Rail Transit Authority (LRTA) is a wholly government owned and controlled corporation attached to the Department of Transportation and Communications (DOTC). The linkage with DOTC is shown in **Figure 1.5-1**.

By virtue of Executive Order No. 603, as amended by EO No. 830 dated September 1982, and EO No. 210 dated July 7, 1987, the LRTA was created and mandated to be responsible primarily for the construction, operation, maintenance and/or lease of LRT systems in the Philippines. It has, therefore, the sole responsible of the operation and maintenance of all lines under its jurisdiction (Line 1 & 2), with no sharing of responsibility with DOTC. DOTC is the primary policy, planning, programming, coordinating, implementing and administrative entity of the executive branch of the government on the promotion, development and regulation of a dependable and coordinated network of transportation and communications systems, as well as in the fast, safe, efficient and reliable transportation and communications services[32].

LRTA owns the existing LRT Line 1 and LRT Line 2; and retains the power of prescribing the fares and planning of the network expansion/extension. The mission of LRTA is to provide safe, efficient, reliable and responsive mass transport services in the urbanized areas of the country, particularly in Metro Manila, and in conjunction with other existing modes of public transportation. **Figure 1.5-2** shows the organizational structure of LRTA.

The Board of Directors is composed of eight (8) ex-officio cabinet members such as the Secretary of the DOTC, as Chairman, the Secretaries of the DPWH, DBM, DOF and NEDA, the Chairman of the MMDA and the LTFRB, the Administrator of the LRTA and one (1) representative from the private sector. The Board is tasked to issue, prescribe, and adopt policies, programs, plans, standards, guidelines, procedures, rules, and regulations for implementation, enforcement, and application by the LRTA Management. The Board also convenes to resolve operations-related issues and concerns and other matters requiring immediate attention and resolution.

[32] *DOCT Official Website*



Source: Study Team

Figure 1.5-1 Organizational Structure of DOTC

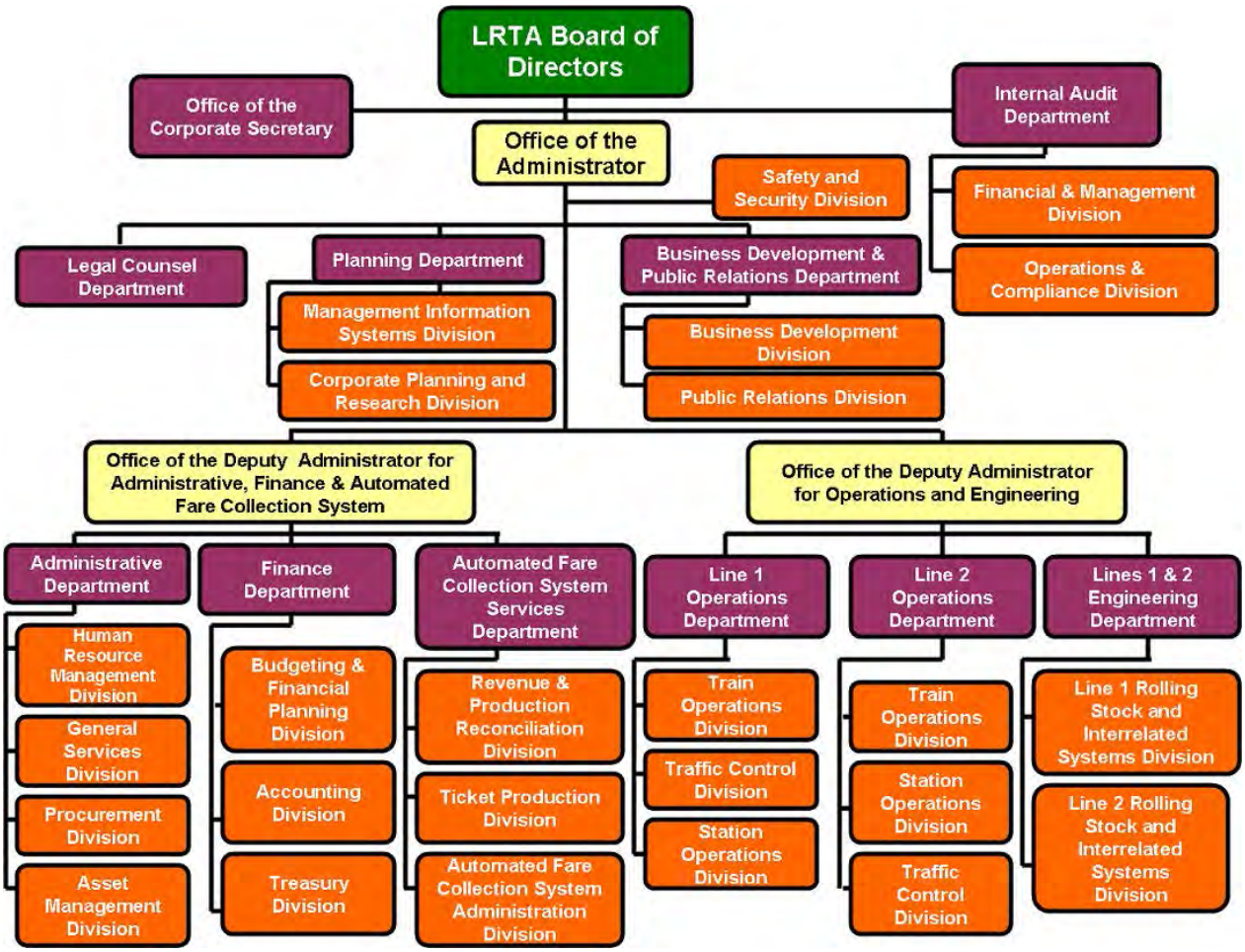
At the helm of the organization is the Administrator who is supported by two Deputy Administrators and ten regular Departments, namely, Planning, Legal, Finance, Administrative, Internal Audit, Line 1 Operations, Line 2 Operations, Line 1&2 Engineering, AFCS, and Public Relations and Business Development.

Office of the Administrator

- Formulates and recommends to the LRTA Board, plans and policies related to the administration/management and operation of the existing LRT Line 1 and Line 2 Systems and the future LRT/MRT Systems.
- Implements, enforces, and applies the policies, plans, standards, guidelines, procedures, decisions, rules and regulations issued, prescribed or adopted by the LRTA Board, the DOTC and the Office of the President.
- Manages the affairs of LRTA in accordance with applicable laws, orders, rules and regulations.
- Spearheads the conduct/execution of studies concerning the expansion of the LRT System's network and other related development requirements in consultation and coordination with appropriate agencies.
- Spearheads the conduct of periodic performance, operational and financial audits to ensure the

effective and efficient use of resources in the accomplishment of tasks and the achievement of the goals and objectives of the Authority.

- Oversees the enforcement and implementation of safety and security rules and regulations set by the Authority.
- Responsible for the planning, development and conduct of public relations programs and activities of the Authority.



Source: Study Team

Figure 1.5-2 Organizational Structure of LRTA

Planning Department

- Responsible for the conduct of feasibility and other related studies relative to the identification of projects, evaluation of the economic, financial, technical and operational acceptability of project proposals, and the funding/financing and approval of projects proposed by relevant government authorities.
- Formulates corporate goals/objectives, policies, short, medium and long term corporate plans and programs of the Authority.
- Directs all the IT activities of the LRTA including the application of computer-based information systems and related principles and techniques in all aspects of railway management and operation.
- Prepares periodic reports on operations and provides data, statistics and other relevant information on LRT system operation to the public and other concerned entities/agencies.

Finance Department

- Prepares and recommends financial policies, short-term and long-term financial plans and programs, systems and procedures and implements the same upon approval by the Board.
- Responsible for all financial transactions and advises the Administrator and the Board on all matters pertaining thereto.
- Undertakes studies on funding programs of the LRT system projects (Line 1 & 2 and future projects) in coordination with the appropriate agencies.
- Prepares and submits all financial reports required by various fiscal authorities and other government agencies requiring such reports.

Administrative Department

- Formulates and implements guidelines regarding personnel management and development, and general services for the LRTA.
- Maintains economic, efficient, and effective services relating to personnel, records, supplies, equipment, custodial works and related services.
- Handles and develops real estate properties, buildings and other ancillary structures and the efficient use of the same for income generation purposes.
- Formulates and implements long and short term administrative plans and programs in line with the objectives and policies of the Authority/Government.
- Maintains an efficient procurement and property management system.
- Takes charge of comprehensive insurance coverage for all LRTA assets, personal or real.

Operations and Engineering Department

- Takes charge of the day to day operation of the existing LRT Lines.
- Oversees the construction, expansion/extension of new LRT Lines and/or new projects.
- Conducts rehabilitation and maintenance of the existing and new LRT Lines.
- Supervises the activities of the Maintenance Contractor.
- Evaluates the operational feasibility of proposed projects in accordance with prescribed standards.
- Utilizes and controls equipment, spare parts, and other machineries essential for the efficient operation of the system.
- Provides operational inputs in the planning for new projects.
- Participates in detailed engineering and design of the various infrastructure projects of the Authority.

Internal Audit Department

- Advises the Board of Directors on all matters relating to management control and operations audit;
- Reviews and appraises systems and procedures/processes, organizational structure, assets management practices, financial and management records, reports and performance standards of the agency/units covered;
- Analyzes and evaluates management deficiencies and assists top management by recommending realistic courses of action; and
- Conducts management and operations audits of LRTA activities and determines the degree of compliance with their mandate, policies, government regulations, established objectives, systems and procedures and contractual obligations.
- Conducts separate evaluations of the effectiveness of the internal controls of management systems such as the human resource management system, financial management system, quality management system, risk management system and their sub-systems.
- Evaluates the effectiveness, efficiency, economy, and ethical conduct of operations, including the appraisal of the operating systems and their sub-systems.

Legal Department

- Acts as legal consultant/legal counsel and gives legal advice on official matters;
- Represents the Agency, the Administrator and other officials of the Authority in civil or criminal cases arising from the performance of official duties before the court/administrative bodies/tribunals;
- Conducts legal research work and studies on legal queries and renders opinions on such matters;
- Reviews and recommends approval of contracts entered into by the Authority; and
- Reviews/undertakes drafting of proposed rules, regulations, orders, circulars, and other regulatory measures regarding operational activities of the Authority

Business Development and Public Relations Department

Overall supervision of the conduct of research, feasibility studies, data gathering, and statistical analysis and the formulation/development of plans and programs for LRTA's non-rail revenue generated activities. Ensures the promotion of LRT system and the Authority.

a) Business Development Division

- Conducts research, feasibility studies, data gathering, statistical analysis and formulates/develops plans and programs for LRTA's non-rail revenue generated activities;
- Conducts assessments of current business development and concessions and recommends the trend most advantageous to LRTA;
- Prepares statistical projections and analysis on business of LRTA non-rail revenue generated transactions;
- Formulates, prepares, develops and/or recommends policies, rules, procedures and/or regulations for the evaluation, review and implementation of proposals;
- Oversees and initiates the proper implementation of approved non-rail revenue generated transactions for LRT Lines 1 & 2; and
- Identifies and prepares reports on available and potential LRTA assets, areas/spaces for allocation and evaluation of the highest/best use, for possible business opportunities.

b) Public Relation Division

- Formulates and implements an effective and efficient information program through mass media (print, radio and television) to achieve greater public awareness of the Authority's programs and projects;
- Ensures that complaints, requests and inquires pertaining to the services of the LRT are promptly attended to; and
- Handles all activities relating to media, press conferences, interviews etc.

Automated Fare Collection System Services (AFCS) Department

Supervises ticket sales and production, ticket sorting and encoding using Ticket Sorting and Issuing Equipment (TSIE) for Line 1 and Encoder Sorter for Line 2 (ES) machines.

a) Revenue and Production Reconciliation Division

- Maintains AFCS accounting records and other AFCS related documents, and updates and records ticket sales and production;
- Reconciles daily and monthly ticket sales/revenue in Line 1 Operations as against the Central Processing System (CPS) for Line 1 and Central Computer System (CCS) for Line 2 generated reports;
- Prepares accurate and timely financial reports/analysis, as well as preparation of non-financial reports for LRTA management use and guidance;
- Reconciles ticket production reports as against the CPS/CCS generated reports; and
- Reconciles ticket inventory against the actual physical count of tickets.

b) Ticket Production Division

- Sorts tickets and encodes them using Ticket Sorting and Issuing Equipment/Encoder-Sorter machines;
- Check, counts, seals and records processed tickets;
- Prepares daily ticket production reports;
- Releases magnetic tickets to Treasury Division/Line Operators;
- Receipts captured and returned tickets from the Treasury Division/Line Operators;
- Handles and stores ticket inventory; and
- Reconciles ticket production as against daily ticket balance records.

c) Automated Fare Collection System Administration Division

- Upgrades/develops software and monitors its performance;
- Maintains and monitors Automated Fare Collection computer system, and manages and monitors file server and database;
- Trains regarding AFCS application, analyses problems regarding ticketing procedures and manages E-Pass;
- Coordinates with the maintenance contractor for the maintenance/repair of AFCS equipment;
- Operates CPS Operator and Maintenance Consoles, and
- Identifies miscoded tickets and assists in reconciliation of ticket production by the Revenue and Production Reconciliation Division.

Contract Approval Procedure

- Preparation of draft contract: PMO thru the PMO's Legal Officer
- Review of draft contract:
  - PMO, LRTA/DOTC's Legal Dept. Consultant, if available [internal]
  - Office of the Solicitor General (OSG) if the signing party is DOTC - for the legal opinion [external]
  - OGCC, if LRTA is the signatory - for the legal opinion [external]
  - NEDA, for contracts P500M and above - [for "NO OBJECTION" clearance/confirmation]
- Approval:
  - LRTA Budget/Finance Dept. for the Certificate of Availability of Funds, if LRTA is the signatory and the Contract doesn't require multi-year funding.
  - LRTA is not authorized to approve a multi-year contract.
  - In case of a multi-year funding contract, the certificate of funds should be provided by a multi-year budget/financial plan approved by the LRTA Board or Multi-year Obligation Authority (MYOA) issued by the DBM, if DOTC is the signatory
  - Administrator by authority of the LRTA Board (if LRTA is the signatory to the contract)
  - Secretary of DOTC thru a signing authority granted by the Office of the President, (if DOTC is the signatory to the contract).

A pioneer of the urban railway industry since 1984, LRTA has become the country's prime mover in the rail transport sector serving the needs of millions of Filipinos by exploring avenues where the LRT system could continuously provide efficient transport services while promoting economy and efficiency of operations.

As of 2011, the LRTA has a total manpower complement of 1,715 of which 325 are permanent/regular employees and 1,390 are contractual personnel. A regular employee is a civil servant and is eligible for benefits. A contractual Employee is not a Civil Servant and has no eligibility. The breakdown of the LRTA personnel is as follows:

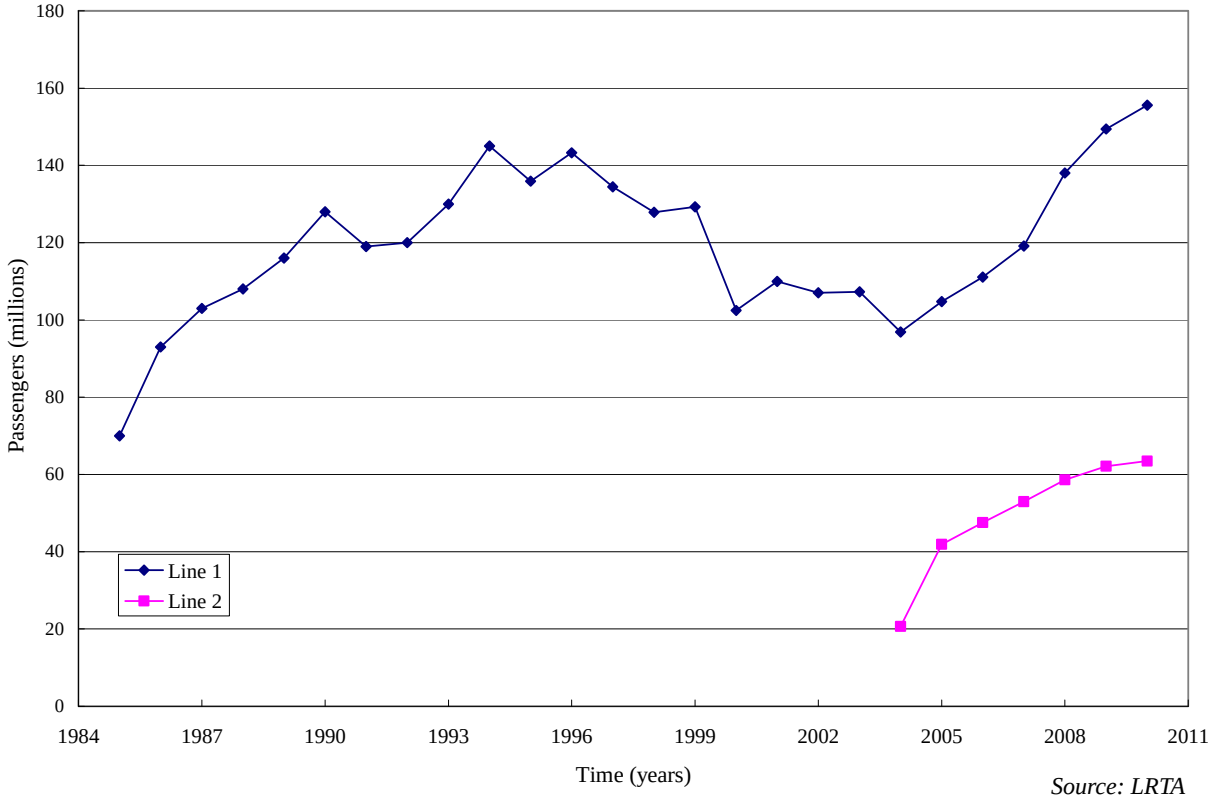
Table 1.5-1 LRTA Staffing

Section	Number of Staff		
	Regular	Contractual	**Total**
Administration	52	53	105
Finance	67	156	223
Engineering	38	28	66
Internal Audit	12	1	13
AFCS	21	60	81
BDU	6	4	10
planning	2	34	36
Operations	70	-	70
Office of Administrator	5	-	5
Office of Corporate Secretary	2	-	2
Safety & Security	10	-	10
Legal	6	-	6
MIS	20	-	20
Public Relations	6	-	6
Office of DA Finance	4	-	4
Office of DA Eng.	4	-	4
Station Teller			
Line 1	-	647	647
Line 2	-	123	123
Train Operators			
Line 1	-	187	187
Line 2	-	97	97
Total Filled Positions	325	1,390	1,715

Source: Study Team

1.5.1.2 Performance Accomplishment

The financial performance of LRTA is studied in detail in section 1.6 of this report. Ridership has been increasing dramatically in the last 7 years for Line 1. This increase has been especially remarkable after completion of CAPEX Package B (installation of ACU on 1st Generation fleet) in 2006, and even more when CAPEX Package A (new 48 LRVs) was completed in 2008. Line 2 has been increasing steadily, but seems to have reached a plateau unless a big modification in the catchment of the line is introduced (line extension). Please refer to **Figure 1.5-3**.



Source: LRTA

Figure 1.5-3 Ridership Historical Data for LRT Lines 1 & 2, 1985-2010

1.5.2 Project Implementing Organization

During the implementation of any project under the LRTA, a Project Management Office (PMO) is created as the organization to be in charge of the actual implementation of the project and liaison with the Consultant, Contractor, and other concerned stakeholders. For a project of the scope of the Line 2 Extension, a typical organization would be as shown in **Figure 1.5-4**.

The main scope of works of the PMO is summarized below:

- Reviews the Consultants design methods, standards and criteria used in the preparation of the design;
- Assures that the Contractor's work complies with the plans and specifications of the contract by conducting regular site inspections.
- Monitors work accomplishment of the contractors.
- Analyzes and interprets financial statements/reports;
- Responsible for all matters relating to taxes and BIR-related transactions;
- Responsible for the safekeeping of all project records and correspondence.
- Coordinates with LRTA Accounting Division and Commission on Audit regarding financial transactions of the PMO.
- Coordinates with the ODA Bank's Representatives regarding the PMO's disbursements financed from ODA loans, if any.
- Prepares all financial reports other than the PMO's financial statements as may be required by LRTA, NEDA and fiscal authorities/other agencies.
- Monitors and assists in the verifications of disbursement that are financed under the ODA loans (Foreign Currency).

The particular roles of some of the departments are mentioned below:

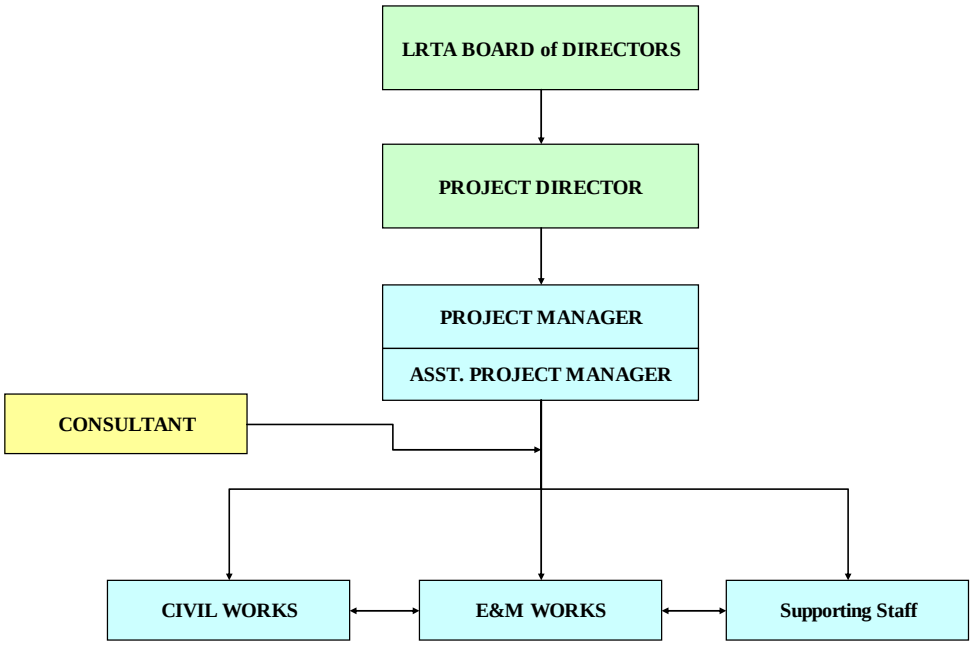
Office of the Project Manager
Shall be in charge of the supervision and management of all the functions of the LRT Line 2 Extension Project, Project Management Office. Shall be in charge of community relations during project implementation and setting-up of an efficient management operation system for the PMO.

Financial Services
Shall be in charge of the Budget, Accounting and Disbursement functions of the PMO. Generates the pertinent financial reports of the PMO.

Administrative Services
Shall be in charge of all Personnel, Legal, Property, Supplies and Liaison matters of the PMO. Generates inventory reports, personnel appraisals and other pertinent reports.

Civil / Structural Services
Shall be in charge of all the civil and structural aspects of the project to include review of design, supervision of excavation, foundation works, steel fabrications, structural works, trackworks, and pre-cast element fabrication. Generates pertinent reports.

Electro-Mechanical Services
Shall be in charge of the electrical, mechanical, signaling, telecom and fabrication works of the Project. Design review and supervision of the above mentioned works for the duration of the project. Generation of required reports.



Source: Study Team

Figure 1.5-4 Organizational Structure of PMO

1.5.3 Evaluation of Capacity of Implementing Agency and Necessary Measures for Capacity Enhancement

The experience and capability of the Implementing Agency to carry out a project of this magnitude rests on the more than 25 years of experience as an Operator of LRT systems, and on the experience of implementing similar or even larger projects.

LRTA also has the experience to implement projects funded by JBIC, European ODA, and National Government funds.

The main projects that this agency has implemented after the initial inauguration of Line 1 in 1985, and their funds' sources, are mentioned below:

- Line 1 Capacity Expansion Project, Phase I, JBIC
- Line 2 Construction Project, JBIC
- Line 1 Capacity Expansion Project, Phase II, JBIC
- Line 1 North Extension Project, Government of Philippines

The majority of the current management staff has been engaged with the LRTA since the start of operations 1985, and all of them have valuable experience in the implementation of the project mentioned above.

As a conclusion, it can be said that the capacity of the Implementing Agency has been proved during this past 25 years.

1.5.4 Overview of existing LRTA Infrastructure

1.5.4.1 Line 1

1) Rolling Stock

a) Status of First Generation LRVs (BN)

By end of December 2010, investigations were carried-out to update the current situation of the fleet of first-generation cars. On the basis of the daily report prepared by the Maintenance Contractor, the current situation is as follows:

- LRV 1002 down since 23/Dec/1998, due to lack of spare parts
- LRV 1006 down since 08/Aug/2000, due to lack of spare parts;
- LRV 1007 down since 15/Jun/1995, due to lack of spare parts;
- LRV 1054 down since 19/Jan/2000, due to lack of spare parts;
- LRV 1011 down since 25/Feb/2006, due to lack of spare parts;
- LRV 1061 down since 29/May/2009, due to lack of spare parts;
- LRV 1002 down since 23/Sep/2008, due to lack of spare parts;
- LRV 1037 down since 30/Dec/2000, due to bomb attack;
- LRV 1027 down since 24/Jun/2010, due to collision accident

The LRTA recognizes the importance of bringing those LRVs back into revenue operation, and it continues the efforts currently undertaken to return those LRVs to revenue operation by pursuing the ordering of the parts; resolving any issue with insurance and/or current investigations preventing the repair of the damages due to the collision of LRV 1027; and assessing from a legal and public-relation point of view whether the repair of LRV 1037 (Bombed LRV) is a feasible option.

b) Status of Second Generation LRVs (ADtranz)

By the middle of February 2011, investigations were carried-out to update the current situation of the fleet of second-generation cars. On the basis of the daily reports prepared by the Maintenance Contractor, the situation is described below.

- Train A5 is composed of Cars 1117 – 1118 – 1119 and 1128, due to lack of spare parts;
- Train A6 is composed of Cars 1121 – 1122 – 1126 and 1125, due to lack of spare parts;
- Train A7 is composed of Cars 1107 – 1120 – 1124 and 1127 (not coupled), due to lack of spare parts and derailed car (1107).

As mentioned before, the LRTA recognizes the importance of bringing back into revenue operation those LRVs, and it is currently pursuing orders of the parts (including additional parts to prevent further cannibalization) pertaining to those LRVs, to have them installed and then being tested prior to return to revenue operation.

c) Status of Third Generation LRVs (Kinki Sharyo)

One LRV (1236) was damaged during a collision accident early this year (February 18, 2011). The car is currently down waiting for evaluation and repair.

2) Operation & Maintenance

It should be mentioned that the maintenance of the rolling stock, and the also the operation of the system, is more complex than for a usual railway system due to the variety of types of rolling stock and associated subsystems. The LRTA, however, is doing its best to maintain a required level of service by outsourcing the maintenance activities of all subsystems.

3) Civil Infrastructure

Since the opening of the Manila Light Rail Transit System Line 1 for public operation more than 26 years ago, the varying tropical weather conditions, strong earthquakes and poor maintenance led to the progressive deterioration of the Line 1 viaduct structure.

In September 2005, a segment of the pre-cast parapet detached and fell onto the street below. This parapet section measured three meters long and about two meters high and weighed more than two tons. A survey showed that the main cause of the incident was the total corrosion of the steel reinforcing bars joining the parapet and the superstructure. Moreover, there were other contributing factors such as unanticipated loading, poor reinforcement detailing in the original design, substandard workmanship, excessive vibration, and defective construction materials that need to be considered to ensure the integrity of the aging structure. As an emergency measure, tie rods were installed in the obviously distressed parapets.

In recognition of the critical condition of the viaduct structure, an overall checking/diagnosis of the Structural Soundness of Line 1 was carried out in 2008. With that purpose, a visual inspection of the entire viaduct and special non-destructive tests were carried out. The result of this Structural Soundness study confirmed that the viaduct parapet walls are structurally compromised, and only the emergency tie rods are holding them in place. It was also found that there are other structural damages, to wit: cracks at the end of girders along their lower flange; split and exposed reinforcement bars; water leaks and efflorescence. It was recommended to apply surface coating, concrete patching, and painting, among other countermeasures to delay and resolve the damage.

1.5.4.2 Line 2

1) Rolling Stock

According to recent monthly reports of the Maintenance Contractor, of the original fleet of 18 train sets, only 14 are currently available for revenue operation. The main reason for such number of trains down is the unavailability of spare parts. There is a high ratio of use of spare parts due to higher than usual

wear of the wheels. Thus, the wheels have to be re-profiled often. To make matters worse, the Wheel Truing Machine has been broken down and also its repair has not been possible due to lack of spare parts. Moreover, the wear of the wheels can not be compensated for by changing the direction of the rolling stock due to the lack of a circulation track in the depot area, unlike in Line 1, where the train can easily change direction thru the circulating track.

The board of the compressor motor was another part that is very susceptible to burnout. However, this problem has been solved by modifying the original compressor motor.

2) Signaling and Telecommunications

The following are issues in signaling and telecommunication systems that were mentioned by Maintenance personnel that could have been better designed, and therefore, they should be taken into consideration when designing the future extension:

- The separation of the signaling and telecommunication system networks should be considered as an improvement for the existing line and future extensions. Every time there is a failure on the SDH (Synchronous Digital Hierarchy) both signaling and telecom systems are affected.
- Spare parts availability – one of the most neglected spares in line 2 after its completion, is the spare electronic cards and software. Repair works would be much easier if all the needed cards and diagnostic software are readily available.
- Controlled Circuit Television (CCTV) modules are already obsolete.
- Need of additional PABX (Private Automatic Brand Exchange) – the existing is insufficient in Line 2.
- Separation of UPS (Uninterrupted Power Supply) for signaling and electrical room's auxiliary loads. Any failure of the UPS will affect both the signaling system and other electrical loads in the station.
- Study the possibility of replacing the TAIT system with a TETRA system so that it will be compatible with the future implementation of the unified radio system in other railway lines, and to provide a more user friendly system, adaptable to new frequency sets by the National Telecommunication Commission.
- Consider upgrading of existing Line 2 AFC system in consideration of future Unified Ticketing System for entire railway network. Most probably, this system will be of contactless basis.

3) Infrastructure, Stations and Track Works

As with the previous systems, there are some issues with the infrastructure and track works that should be taken into consideration when designing the future extension.

Cracks have been found in more than 100 concrete plinths of the track system. The cracks are at the base of the plinth due to excessive vibration caused by the rigidity of the interface between the track work system and the civil superstructure. The LRTA has identified this problem and has already rectified the said concrete plinths. This study should consider this matter and avoid similar problems by proposing a better track design. In general, this study, or the detailed design, should propose a better track that is compatible with existing and future rolling stock that will reduce current problems such as severe squeal in curves and excessive wear of the running rails. Corrugation and uneven head of rails are main contributory factors causing the uneven and flatness of the flange on the train's wheels, and this could be improved by acquiring a grinding machine. LRT Line 2 must have its own grinding machine that will grind a wide surface and is capable of continuous operation during the maintenance period.

Although the current slim viaduct design is, from the aesthetic viewpoint, attractive, the lack of parapet wall does not provide any additional protection during possible derailment. Additionally, a fatal accidental could occur if external train doors are opened by accident if the train stops between passenger

stations. Moreover, the maintenance could be easier and safer if the cable channels/ walkways are outside and not between the tracks. However, due to the difficulty, a change in the viaduct design will not be considered at this stage. Accessibility for maintenance and emergency cases should be considered in designing the viaduct.

Other matters to be considered are the installation of separate provisions for utilities for commercial stalls at the passenger stations to prevent frequent tripping of circuit breakers by the overloading from the commercial stalls affecting the electromechanical equipment such as UPS, signaling system, AFC, etc. The stalls should obtain their own power supply from Meralco; and study the possibility of a different roof design, because the current design is hard to maintain.

4) Power Supply & OCS

Finally, the items that should be considered for better design for the power supply and OCS are:

- OCS - Contact Wire stagger (zigzag arrangement) needs modification in order to increase the usage of the carbon strip up to 80-90%, the present design uses 50-60% of the carbon strip.
- Substation Lighting Design – Auxiliary lighting inside the substation must have a separate power supply and should not be directly connected to the high voltage switchgear. This interconnection means that every time the high voltage switchgear fails, the lights inside the substation also fail
- Power supply cable from the pantograph should not be inserted inside a rigid stainless pipe. It's better that the cable to be exposed to easily determine the outer sheath condition during inspection. The cable must be designed with high temperature all weather insulation – this issue should be incorporated in rolling stock.
- Propose proper design of new RSS structures to avoid water ingress into the substations. New substations should have proper waterproofing, ventilation, and they should be at ground level for easy maintenance.

1.6 Financial Analysis of Executing Agency

1.6.1 Executing Agency

LRT Line 2 began its operation of 13.8km between Santolan and Recto in October 2004 and the Light Rail Transit Authority (LRTA), the executing agency of this existing line, has been engaged in planning, construction, operations and management. With this experience, LRTA is considered the most appropriate Executing agency for the planned extension line, to construct and operate it in a comprehensive manner for both existing and extended Line 2.

LRTA is legally endorsed to be the executing agency under the Executive Order No. 603 determining the LRTA's establishment, role and power, and thus is considered as a lawful Executing agency.

When the Project is implemented with its whole or a part of its operations under PPP, LRTA can also assume roles as the contractor within the public administration, on the public tender, appraisal, evaluation, specifications and contractual agreements.

1.6.2 Financial System of Executing Agency

LRTA was established in 1980 as a public corporation with 100% ownership by the government under the Executive Order (E.O.) No.603 with initial capital of 500 million Peso, and later its capital was increased to 3 billion Peso with E.O. No830 in 1982.

The annual budget for LRTA operations is proposed to the Department of Budget Management (DBM)

during the preceding year, then proposed to the Parliament, signed by the President, and allocated to LRTA.

A public corporation should seek approvals of NEDA/DOF and to secure its financial requirements based on its needs, as a tradition of the country's budget policy. LRTA has also been arranging finance in the form of loans and subsidies from the government by itself.

LRTA's accounting is operated under the NGAS Manual for National Government Agencies regulated by the Commission on Audit, and also follows the Philippine Accounting Standard.

1.6.3 Financial Situation of Executing Agency

1.6.3.1 Financial Situation Trend of Executing Agency

1) Profit and Loss Statement

The Profit and Loss Statement of LRTA for the year ended December 31, 2010 registered 3,079 million Peso for Operating Revenue and 2,935 million Peso Operating Expense with 144 million Peso Operating Profit. The Operating Profit only includes passenger fare revenue and the associated business revenue is not included.

The Current Account, including Non-Operating revenue and expense on top of Operating Profit, marked a deficit of 5,932 million Peso. When considering LRTA's Non-Operating Accounts, such as revenues from Rent, Dividends, Interest, and Miscellaneous operations, Non-Operating Revenue stayed at 211 million Peso whereas Non-Operating Expense registered 2,290 million Peso for a Foreign Exchange Loss, 2,073 million Peso for Interest Payment, 1,923 million Peso of Depreciation, and 1.4 million Peso for Bad Debts.

Comparing the situation of 2010 with that of 2007, Operating Revenue increased just 26% during the period with a 52% increase of Operating Expenses that resulted in a 72% decrease at Operating Profit level. As for Operating Expense, the impact of LRT System maintenance charge (increased by 164%) largely contributed. The Net Profit showed 1,058 million Peso in 2007 but since 2008, it continuously registers negative figures. The main reasons are attributed to the increase of Interest Paid (45% increase) as one reason, but more importantly it has been caused by Foreign Exchange Profit/Loss related to the Long-term Debt in foreign currency.

Table 1.6-1 Profit and Loss Statement of LRTA

pesos in thousands	2007	2008	2009	2010
REVENUE				
Sales	2,456,828	2,778,250	2,951,088	3,088,901
Sales Discount	-4,393	-5,565	-6,214	-7,562
Sales Refund	-2,858	-2,884	-4,093	-2,178
SMART	3	0	0	0
Total	2,449,580	2,769,801	2,940,780	3,079,161
OPERATING EXPENSES				
Materials	178,900	205,731	241,239	363,322
Overhead	304,027	298,228	305,779	343,099
Power	507,464	488,814	403,651	653,838
Maintenance of LRT System	238,224	351,636	612,513	628,458
Personal Services	398,582	391,614	432,376	549,121
Maintenance & other operating expenses	308,180	346,648	329,313	396,750
Total	1,935,377	2,082,671	2,324,871	2,934,588
OPERATING GAIN	514,203	687,130	615,909	144,573
OTHER INCOME AND EXPENSES				
Depreciation	-1,825,653	-1,332,029	-1,079,524	-1,923,223
Bad debts	-1,176	-13,023	-12,072	-1,421
Loss on impairment of assets	-14,500	0	0	0
Foreign exchange gain/loss	2,746,627	-10,257,527	1,002,979	-2,289,762
Sale of Disposed Assets	0	0	2,111	0
Interest/bank charges	-1,429,342	-1,621,044	-1,758,240	-2,073,074
Subsidy from National Government	1,033,795	559,911	223,778	
Rental	37,504	55,639	60,110	104,318
Interest income	4,415	30,247	32,283	100,699
Miscellaneous	3,749	8,393	5,910	5,498
Total	555,419	-12,569,434	-1,522,665	-6,076,965
NET INCOME(LOSS)	1,058,157	-11,882,304	-906,756	-5,932,393

Source: LRTA Accounting

Looking into Line 1 and Line 2 operations (2010) separately, Line 1 has 2,224 million Peso for Operating Revenue and 1,841 million Peso for Operating Expense, whereas Line 2 has 855 million Peso for Operating Revenue and 1,094 million Peso for Operating Expense. The Fare Box Ratios by dividing Operating Revenue with Operating Expense are calculated as 1.05 for the entire LRT, 1.21 for Line 1, both showing over 1, but Line 2 FB Ratio returns 0.78 indicating expenses incurred cannot be covered by revenue from the operations.

Moreover, LRT 2 Long-term Debt has a larger balance than that of Line 1. The impact from the L/T debt interest payment and the foreign exchange loss affected the Line 2 operations to the extent that it produced 62% of the LRTA's Net Loss.

2) Balance Sheet

The Balance Sheet of LRTA on December 31, 2010 shows 5,377 million Peso of Current Assets, 50,454 million Peso of Fixed Assets, 6,421 million Peso of Current Liabilities, 62,947 million Peso of Fixed Liabilities (Long Term Liabilities) and 17,059 million Peso of Capital.

The Current Ratio calculated on Current Assets to Current Liabilities stays as low as 84%. That came down from 107% in 2009. This may generate issues on the stability of the financial situation and also the payment ability. In addition, the Net Assets including the accumulated losses in the past years ends up 17,059 million Peso in the negative, and that was 50% worse than the 2009 figure of negative 11,123 million Peso. Thus, the current financial situation and balance situation is quite unstable.

Table 1.6-2 Balance Sheet of LRTA

(Million Pesos)

	December 2010			December 2009			December 2008
	LINE 1	LINE 2		LINE 1	LINE 2		
ASSETS							
Non-Current Assets	26,970	23,484	50,454	26,919	24,126	51,045	48,419
Current Assets	4,503	874	5,377	4,628	787	5,414	2,758
Total	31,473	24,358	55,831	31,546	24,912	56,459	51,176
LIABILITIES							
Non-Current Liabilities	24,239	38,709	62,947	23,471	35,915	59,385	58,173
Current Liabilities	6,254	3,689	6,421	4,856	3,341	5,037	2,654
Total	30,493	42,398	69,368	28,327	39,255	64,422	60,827
CAPITAL							
Total	980	-18,040	-17,059	3,220	-14,343	-11,123	-97

Source: LRTA Accounting

3) Long-term Borrowings

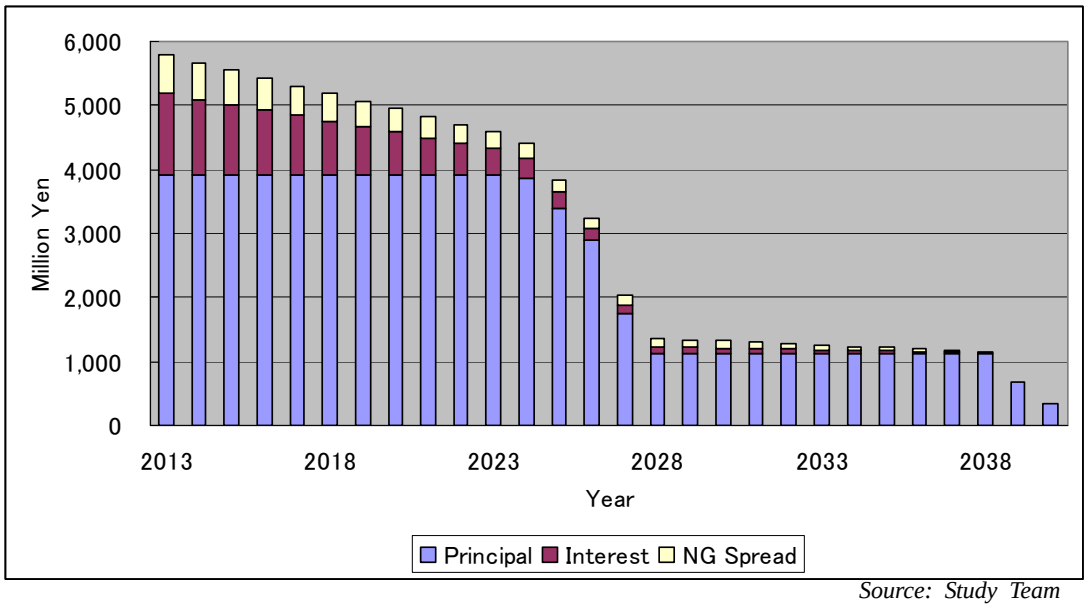
LRTA has, as at December 31, 2010, 42,450 million Peso equivalent foreign borrowing balance. The purpose of the financing is divided into 40% for Line 1 construction, repair and reinforcement and 60% for Line 2 construction.

A Yen Loan represents about 96% of the borrowing with 40.8 billion Peso value. The principal repayment in 2010 was 2,136 million Peso equivalent originally but was increased due to a 2,198 million Peso of Foreign Exchange Loss (Foreign Exchange Evaluation Adjustment), which is larger than the principal amount itself.

1.6.3.2 Future of the Executing Agency Financial Situation

1) Long-term Borrowing Repayment Schedule

The Yen Loan representing 96% of the Long-term Debt is shown in **Figure 1.6-1**, and the repayment will be completed in 2040. LRTA should pay nearly 6 billion Yen to the Philippine government including principal, interest and the spread to the government for the next five years, and further 4 billion Yen / year till 2024.



Source: Study Team

Figure 1.6-1 Repayment Schedule of Yen Loan

2) Future Trend of LRTA's Financial Situation

LRTA plans and expects four more projects, on top of the Line 2 Extension, to be implemented under PPP Schemes. The Line 1 South Extension is to be consolidated with MRT Line 3. When implementing those projects, LRTA, as the public sector side of the contractor and the type of arrangement / payment to the private sector will affect the financial situation of LRTA. Thus a quantitative forecast at this stage is rather difficult.

- LRT Line 1 Operations and Maintenance Privatization
- Common Ticketing System
- LRT Line 1 South Extension
- Ninoy Aquino International Airport Rail Link Project

Without considering those projects stated above, LRTA's financial forecast is presented here by only taking the trend and present financial situation and the scheduled Long-term debt repayment into consideration.

T Operational Revenue has steadily increased but a fare rise is not easy to implement. LRTA is expected make an effort to increase the associated business revenue such as unused space rental revenue in the LRTA's own land and property, advertisement revenue and so on. However, it is rather difficult to anticipate a big jump in revenue without having large scale externally impacting factors such as the connection with other new lines, large scale property development or a review of the competing public transport as it impacts LRTA.

Regarding the Operational Expense, the Interest Payment will decrease in the years to come. The foreign exchange fluctuation is rather difficult to predict but the adverse impact of Peso depreciation should be seriously considered. Furthermore, in addition to the regular maintenance and management, it is anticipated that large scale repair and renewal of rolling stock will be undertaken in the mid- and long-term. The expenditure for large scale repair and renewal of LRT Line 1 and 2 is estimated to total 2,712 million Peso; 2,138 million Peso for LRT Line 1 and 574 million Peso for LRT Line 2, although the payments will be dispersible.

Table 1.6-3 Large Scale Repair and Renewal in the mid- and long-term

	LRT Line 1	LRT Line 2
1. Civil	1,681,000,000	0
2. Track	232,560,000	1,810,000
3. Depot Equipment	43,500,000	15,000,000
4. System	0	183,000,000
5. Rolling Stock	181,050,000	174,000,000
6. Automatic Fare Collection (AFC)	0	200,000,000
Total	2,138,110,000	573,810,000

Source: Study Team

Due to those factors, it is estimated that the LRTA's operations would stay with a low net profit level as well an unstable profit situation in the near foreseeable future.

1.6.4 LRTA Financial Restructuring

LRTA has been steadily working on restructuring its financial situation particularly since this was

recommended by JBIC[33] in 2007 by a JBIC Study on LRTA Financial Restructuring Plan ("JBIC Plan").

JBIC pointed out the low fare revenue level and the highly indebted situation. According to the JBIC Plan, LRTA debt will need over 65 years to pay back its PHP 80 billion debt, most of which are loans from JBIC in Yen. JBIC recommended the following actions to be taken by LRTA, together with DOTC and other key related ministries, and since then some progress has been made.

1) Create an LRTA Financial Restructuring Committee

JBIC recommended, as a direction for LRTA to take, to create a Financial Restructuring Committee to be mandated to implement restructuring. In fact, LRTA formed a Financial Restructuring Committee in 2007 together with its Working Level Committee. They have been integrated into the Regional Transport Committee and its Technical Working Group.

2) Raise Fares and Seek Higher Operational Revenue

JBIC suggested the poor performance that is shown by the farebox ratio being below 1, has always been the concern on Line 2 Operation. LRTA well recognized the need to bring the farebox ratio of Line 2 to over 1, and attempted a fare rise in early 2011 but due to the strong negative reaction from the general public, it reversed the proposal.

3) Raise Non-Railway Operations Revenue

JBIC indicated that the Non-Railway revenue is an important part of the urban public transport by citing examples of HK MTR, Singapore MRT etc. especially the case of HK MTR where the Non-Railway revenue reached 27% whereas LRTA was only 2.6% in 2006. Non-Railway operations include a) advertisement, b) space rental, c) access charges to feeder transports, d) access rights to retail and residential property and sometimes d) property and regional development. LRTA has been making some efforts in increasing its advertisement and space rental activities within stations.

Under the upcoming PPP project implementation, LRTA and private sector partners will need to enter into more business oriented discussions on how to effectively used tangible and intangible assets of LRTA without sacrificing the public transport objectives and mission. From the legal point of view, LRTA views that it is possible to mobilize and develop new non-railway activities on its own land as its LRTA Charter (E.O. No. 603) stipulates at Section 4. (8) "To improve, develop or alter any property held by it".

4) Restructure Debt – Debt/Equity Swap

JBIC suggested a few options to LRTA such as a) Debt transfer to the government, b) Debt / Equity Swap, c) subsidy and d) Debt and Asset Transfer. LRTA, DOF and DBM have been addressing the subject by continuing its re-filings of GOCC capital increase including LRTA by which LRTA capital would be amended to PHP100 billion. If the capital increase bill is approved, LRTA will enjoy a Debt Equity Swap to drastically improve its financial situation and structure.

Because it is anticipating this capital increase bill to pass parliament, DOF has been providing a subsidy to cover losses incurred by the capital investment and the associated foreign exchange loss. This subsidy provision is considered as a transitory solution until the capital increase is approved.

The following are activities that LRTA has been taking on its own initiative to improve its financial situation.

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[33] *JBIC was merged with JICA in October 2010 under the objectives to unify Japanese Official Development Assistance.*

5) Re-Evaluate Assets

The assets of LRTA have been registered on a historical cost basis following the Philippine Accounting Standards. Assets can also be adjusted in accordance with the market level. LRTA has begun the process to hire a property appraiser to review and adjust its key assets. LRTA has its own land alongside its Line 1 and Line 2. Most of the stations are built on the public roads where DPWH has the ownership whereas some stations and the two depots are owned by LRTA. LRTA hopes the asset evaluation will improve its financial status by reflecting the current situation.

Finally, LRTA has been elaborating its Medium-Term Development Plan 2011 – 2016 ("MTDP") and according to the draft document, one of the vision statements is that "LRTA achieves financial independence with a strong asset base".

1.6.5 Issues and Matters for the Executing Agency in terms of Project Implementation Capacity

This part will review and present issues and matters of the project implementation capacity from viewpoints such as the repayment ability, direction of public assistance from the government, viability of railway businesses and operations, and the budgetary system of the executing agency.

1) Repayment Ability and Project implementation capacity

The financial status of LRTA showing a low current ratio and negative net assets presents fundamental issues on its stability and repayment ability. For the coming 10 years, the low level of the current account, as well as the unstable profit, will continue. Without drastic measures, the current situation will not improve in the short term. In addition, the general operational budget is allocated from the government each year, but there is no guarantee that LRTA will receive sufficient funding from the government for its new capital investment.

Bearing the above in mind, LRTA does not have sufficient repayment ability to undertake a new large investment as an executing agency.

2) Viability of railway businesses and operations

The railway operations, in general, require a large amount for the initial investment , but the fare is usually set at a low level, and it will be difficult to secure returns covering the initial investment. However, if such initial investment is excluded, the minimum requirement as a railway company is to achieve its fare-box ratio over one, i.e. railway operation revenue covers the railway operation expense.

As stated above, the Fare-box Ratio of LRTA registered 1.05 for the entire LRTA, 1.21 for Line 1 and 0.78 for Line 2 in 2010, whereas those figures in 2009 are 1.27, 1.39 and 1.05 respectively. That the Line 2 fare-box ratio in 2010 was below 1 should be noted. The main reason is higher operational expenses than the operational revenue although they increase their amount each year.

To improve this low profitability, the first thing envisaged is to raise the fares, but the announcement made by LRTA in January 2011 on the LRT Line 1, LRT Line 2 and MRT Line 3 was faced with difficulties in receiving a favorable understanding from the general public. LRTA, postponed, as a result, its submission on the fare raise to the Land Transportation Franchising and Regulatory Board (LTFRB) in February 2011.

Under this circumstance regarding raising the fares, the next option will be to increase the railway operational revenue by increasing the number of passengers, and also make efforts to raise revenue from the associated operations, and also to make an effort to reduce the operational and maintenance expenses. LRTA, different from a private sector company, cannot expect a drastic improvement without having

strong incentives in driving itself to a further revenue increase and also to a cost reduction under the government budget allocation structure.

Viewing the above, the viability and profitability of the execution agency may need to conclude that LRTA has a structurally low profitability and a swift remedy will require drastic measures to be implemented.

3) Government's supportive policy orientation

The Project Implementation Capacity of the Executing Agency from the Viewpoint of Pubic Assistance: LRTA's role and its financial situation are expected to be largely changed by the four planned projects in addition to the LRT Line 2 Extension. DOTC plans to take initiative on the privatization of LRT Line1 operations and maintenance, the common ticketing system introduction, and the LRT Line 1 South extension. It also plans to consolidate those projects with MRT Line 3. On the other hand, LRTA sets out a policy for LRTA to build, operate and maintain its operations except its rolling stock, and thus LRTA is not expected to reduce its role dramatically.

The government fully recognizes the necessity and importance of the public transportation, and at the same time, it fully admits the current low profitability of LRTA, the vulnerability of its financial status and the difficulties in raising fares. The government is supportive of the mass rail projects in providing funds.

LRT Line 1 South Extension is planned to introduce a Build and Transfer Installment Payment scheme[34], and the government continues to show its strong policy orientation to implement PPP. Those developments will assure the government support will continue for LRTA being an urban railway operator, to make its necessary investments and increase its operational capability.

1.6.6 Description of Risks

This is to review possible general risks associated with each stage of the project, i.e. the tendering, construction, operation and maintenance stages by considering financial issues and seeking an efficient and sustainable operation of the railway business.
When assessing risks, two approaches are reviewed; the one is to assess risks in operations and maintenance of the entire LRTA including Line 1, and the other is to review risks limited only to Line 2 existing lines and its extension.

1.6.6.1 Risks during the Tendering Stage

The tendering stage is defined as the period starting from the public tender notice till the contractual agreement is concluded with the winning bidder. The risks during this stage will be the project content changes, tender document mistakes and changes of the contents, delay or the non-execution of the contract, legal and system changes such as tax regulations, interest fluctuations, price fluctuations, foreign exchange, etc. It should be noted that the risk sharing or response to risks should be carefully determined when those risks appear or occur after the proposal submission during the tender process.

When considering those risks from the viewpoint of efficient and sustainable operations of railway businesses based on the issues of the financial situation at LRTA pointed out at 1.6.4 above, it should be pointed out that if the executing agency is not able to implement planned financial arrangements, the following risks such as the project content change, the case where no private sector company applies, fluctuations in interest rates, prices and foreign exchange for the duration between the proposal submission and tender till the contract agreement is concluded will be crucial.

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[34] *"Project Brief: LRT1 and MRT3 Privatization and Expansion Program" (DOTC)*

1.6.6.2 Risks during Design and Construction Stage

The Design and Construction Stage starts from the contract signing with the bidding winner till the facility begins its operating services. The risks during this stage are, in the same manner as those in the tendering stage, the project content changes, tender document mistakes and changes of the contents, legal and system changes such as tax regulations, interest fluctuations, price fluctuations, foreign exchange, etc. In addition, other common risks applied from tendering and construction stage till the operations and maintenance stage are damage to the facilities, third party indemnity, hidden defects in the facilities and force majeure. As for the tendering and construction stage risks, non-approval of the project, securing the construction sites and warehousing of materials, errors and mistakes in the geological survey, change in construction cost, construction delays, non-achievement of the required quality of the facility, financing, etc. Risks applied for this Project in particular are the existing route and facilities, and work at the connecting point between the existing and the extended part that may interfere with the smooth operations of the trains.

Looking into the risks with a view point of efficient and sustainable railway operations based on the issues pointed out in the LRTA financials at 1.6.4., in the same manner as the tendering stage the risks include the financing by the executing agency, project content change, construction delay. Risks during the period between the contract agreement till the facility operation start are those related to interest, price and foreign exchange.

1.6.6.3 Risks during Operations and Maintenance Stage

The Operations and Maintenance Stage starts from the facility service beginning until the end of the facility life or the end of the PPP contract. Risks during this stage are the same as the other stages, project content change, legal framework change including taxation, interest fluctuations, price fluctuations, foreign exchange, facility damage, third party indemnity, hidden defects, and force majeure.

Risks specific during the operations and maintenance stage are facility service delays, non-achievement of the required quality of the facilities, required specification change, demand fluctuations associated with fare rises, repair and rehabilitation, and the project closing process. The specific risks related to this Project are mal-function of the AFC system, and hidden problems or necessary repair on the existing route. Risks from the viewpoint of efficient and sustainable railway operation include the demand risk, which is crucially important as the basis not only for the railway operations revenue but also the initial and renewal investments and operations and maintenance expenses.
When the actual demand goes below the demand forecast figures and the expected railway business revenue does not achieve the target, or the demand does not cover the minimum level of operations and maintenance cost, the total profitability of the executing agency could move lower. On the contrary , when demand is over the demand forecast figures, that may also cause the increase of the operations and maintenance expense and acceleration of the renewal timing of the facilities. If those increased costs go over the revenue increase, or the executing agency receives a fixed service payment without receiving the fare revenue, the profitability of the executing agency may be lowered.

1.7 Clarification of Issues and review of development/business plans of other implementing institutions in Manila metropolitan area

1.7.1 Review of development/business plans of other implementing institutions

There are railway operators other than LRTA in Manila metropolitan area (refer to **Table 1.7-1**,). Their development plans, business plans and management plans of the other railway operators will be reviewed. Again, if there is new line construction by other implementing institutions planned, such development plans and operational forms will be clarified.

Table 1.7-1 Railway Transportation in Manila Metropolitan Area and Operators

Railway transportation route	Operator
LRT Lines 1 and 2	LRTA
MRT Line 3	DOTC (MRT 3 Project Management Office)
Manila Metropolitan Area Commuter Line	Philippine National Railways (PNR)

Source: Study Team

1.7.1.1 DOTC (MRT Line 3 Project Management Office)

1) Financial Condition

The DOTC awarded a contract to Metro Rail Transit Corporation (MRTC) to build, lease and transfer the Metro Rail Transit System, under the BOT laws of the Republic of the Philippines. The scheme required the DOTC to hold the franchise and run the system, particularly the operation and the collection of fares. Therefore, MRT Line 3 Project Management Office was newly established in DOTC as a section which implements operation of the MRT Line 3 system.

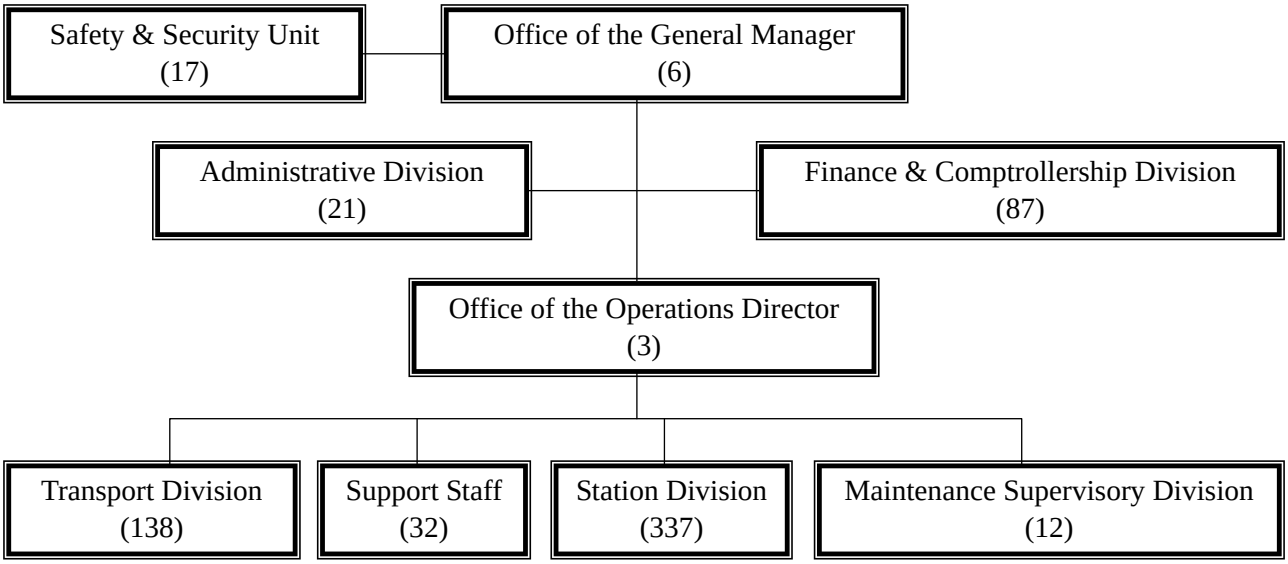
The MRT Line 3 Project Management Office which actually operates the MRT Line 3 in the DOTC has the following mission and vision.

Mission
To provide an adequate, regular and faster mode of transport service along the 16.9-km stretch of EDSA by operating a safe, efficient and reliable light rail transit system designed to satisfy the standards of service, quality and customer satisfaction; create opportunities for community development; and attain fiscal independence and economic growth in order to contribute to national stability and prosperity.

Vision
A Progressive Rail Transport System Anchored On:

- Service Excellence
- Community Development
- Economic Stability

The organizational chart of the MRT Line 3 project management office is as shown in **Figure 1.7-1**, and the total number of staff is 653 persons.



Source: DOTC

Figure 1.7-2 Organization Chart of MRT Line 3 Project Management Office

MRT Line 3 is a route of 17 km of route length who travels through the east side of the Metro Manila, and has a total of 13 stations from North Avenue to Taft Avenue. In December 1999, the section from North Avenue Station to Bendia Station started business partially, and the whole line started business in July 2000.

Table 1.7-2 shows the ridership of MRT Line 3. MRT Line 3 has 153 million passengers in 2010. The ridership of MRT Line 3 has increased steadily after commencement of business, but the growth in recent years is becoming slow.

Table 1.7-2 MRT Line 3 Comparative Ridership Report 2000-2010

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
January	659,116	6,850,686	8,160,724	9,463,295	10,051,192	10,767,535	11,538,453	12,003,233	12,760,261	12,891,166	12,736,012
February	1,459,552	6,546,431	7,567,509	8,949,173	9,837,601	9,941,404	10,769,229	11,102,544	12,140,166	12,226,451	12,281,050
March	1,546,787	7,476,868	7,354,889	9,417,472	10,681,316	10,077,543	11,943,464	12,186,469	11,182,082	13,118,143	13,355,286
April	1,275,710	6,251,491	7,856,958	7,654,948	8,600,102	10,485,899	9,907,209	9,847,325	12,547,164	10,880,246	11,183,852
May	1,675,700	7,118,796	8,090,636	8,579,208	9,651,535	10,587,855	11,603,446	11,835,248	12,770,914	12,636,363	12,463,385
June	1,623,976	7,416,309	8,215,791	9,082,575	10,193,104	10,622,520	11,167,889	11,726,919	11,853,520	12,402,647	12,376,655
July	2,692,054	8,059,856	8,603,687	9,474,239	10,951,598	10,914,817	11,242,020	12,545,080	13,197,729	13,436,322	13,162,287
August	5,171,524	8,329,166	9,635,311	9,537,719	10,553,073	11,527,030	11,674,178	12,163,511	12,621,770	12,681,458	13,198,381
September	5,211,402	7,947,605	9,247,382	10,036,791	10,643,026	11,299,545	10,623,740	12,349,352	12,849,217	12,694,556	13,236,251
October	5,495,845	8,613,773	9,585,241	10,408,300	10,572,978	10,861,787	11,521,535	12,748,860	13,103,909	13,335,114	13,185,631
November	5,627,182	7,606,151	9,034,544	9,748,272	10,293,693	10,393,540	11,684,497	12,015,027	12,429,646	12,695,041	13,123,320
December	6,962,617	8,045,016	9,090,892	10,295,482	10,472,951	10,921,847	11,495,727	12,362,489	12,129,185	12,698,883	13,174,013
TOTAL	**39,401,465**	**90,262,148**	**102,443,564**	**112,647,474**	**122,502,169**	**128,401,322**	**135,171,387**	**142,886,057**	**149,585,563**	**151,696,390**	**153,476,123**
INCREASE		**129.08%**	**13.50%**	**9.96%**	**8.75%**	**4.82%**	**5.27%**	**5.71%**	**4.69%**	**1.41%**	**1.17%**

Source: Metro Rail Transit Line 3 - Metrostar Express Website

The profit and loss in 2010 of the MRT Line 3 Project Management Office are as shown in Table 1.7-3, and operating profit or loss is 153 million-peso loss, and the Farebox Ratio is 0.93, which is less than 1. It is guessed that this is because the system maintenance management expenses paid to MRTC which owns the facilities are large sums. Revenue other than fare revenue is only 0.6% of fare revenue. This is because there is almost no room to undertake the incidental business from which DOTC is gotten by a contract with MRTC.

The rental payment (Equity Rental Payment and Debt Guarantee Payment) paid to MRTC is 6,453 million pesos per year, and the balance which cannot be provided with funds from operations is covered by the governmental subsidy.

Table 1.7-3 Profit and Loss of MRT Line 3 in 2010

	(Php thousand)
Gross Income	1,916,564
Farebox Collections	1,904,585
Other Income	11,979
Operating Expenses	2,070,171
Salaries & MOOE	645,006
System Maintenance	1,184,437
Insurance	206,807
Other Expenses	34,640
Net Operation Deficit	-153,608
Less: Financial Charges (Equity Payments)	6,453,376
Total Financial Deficit	-6,606,984

Source：DOTC Distribution materials in fare raising public consultation

2) Development Plans and Business Plans

a) LRT Line 1 Cavite Extension Project as Integrated with MRT Line 3

DOTC is presupposing that the Cavite extension and O&M of LRT Line 1 are to be carried out by a PPP scheme after integrating with MRT Line 3. The objects of this project are the five following items.

- (i) Construction of the 11.7km Line 1 south extension including: the construction of eight stations of which three would have intermodal facilities, expansion of the existing depot and construction of a new satellite depot, installation of eight traction power substations, and other civil and electro-mechanical works
- (ii) Integration of Lines 1 and 3 to permit through train operations by undertaking adjustment work (to the signaling, telecommunications, rolling stock, operations centers, etc.) to make the individual system components of Lines 1 and 3 compatible with each other.
- (iii) Acquisition of additional rolling stock (termed the first batch rolling stock) for the current Lines 1 and 3 fleets (especially the latter) to address the additional capacity requirements. Depending on the results of the technical audits currently being undertaken, some or all of the first generation trains of Line 1 may have to be retired and replaced.
- (iv) Refurbishment and gradual replacement of the LRTA's and MRT3's aging first, second and third generation rolling stock in future years depending on the life cycles of the rolling stock.
- (v) Operations and Maintenance (O&M) of the integrated Lines 1 and 3 for the remaining concession period of 30 years including asset replacements of components that will be retired within the concession period.

As for a PPP scheme, above (i) and (ii) are a BT portion, and (iv) and (v) are BOT portion. Furthermore, it is being studied currently whether to implement in either a single bid, 2 bids or other schemes. As an implementing schedule, to secure ICC approval of the project, to complete ROW acquisition by LRTA and to start of bidding are all planned by the end of 2011.

b) Contract of services for the operation and maintenance of LRT Line 1 and MRT Line 3 systems

DOTC published an invitation to submit expressions of interest and to apply for eligibility and to bid for the contract of services for the O&M of LRT Line 1 and MRT Line 3 systems for a four year period, extendable by one year on March 28, 2011. The bid is scheduled for July and the approved budget for the contract is 14 billion pesos.

This contract is positioned as an interim contract on a period until O&M of LRT Line 1 and MRT Line 3 start after the Cavite extension as above. The winning bidder shall temporarily absorb personnel currently

working for the operation and maintenance of the two lines for six months, beyond which the winning bidder may reduce the workforce on an as-needed basis and in accordance with its work plan.

1.7.1.2 Philippine National Railways (PNR)

1) Financial Condition

Manila Railroad Company is a predecessor of Philippine National Railways (PNR), and was opened in 1892. In 1964, it was nationalized by the republic Act No. 4156 and changed its name to PNR. The PNR is carrying out the long-distance transportation connecting southern Luzon to the Metro Manila, and commuting transportation in the Metro Manila.

The profit and loss in 2009 of the PNR was a large operating loss, and the Farebox Ratio is 0.09 and is much less than 1. Revenue other than fares is 873.1% of fare revenue with the rental of the land to own. Although rail business revenue and non-rail business revenue are increasing, the large loss in operating profit and net profit continues.

According to the balance sheet at the end of 2009, the current ratio was very low at 5%, and net assets were in the red by about 10,889 million pesos, therefore, the stability of the financial situation is low.

Table 1.7-4 Financial situations of PNR (2003-2009)

INCOME STATEMENT							(In Thousand Pesos)
	2003	2004	2005	2006	2007	2008	2009
Operating Revenues	90,279	83,496	43,300	57,825	21,593	15,438	17,435
Operating Expenses	419,838	416,988	376,880	388,475	316,952	517,994	204,915
Net Income (Loss) from Operations	-329,559	-333,492	-333,580	-330,650	-295,359	-502,556	-187,480
Non-Operating Revenue	91,719	98,014	142,572	109,968	113,670	115,173	160,986
Non-Operating Expense	620,060	1,087,938	104,728	542,338	62,741	1,501,486	485,402
Net Income (Loss) before Subsidy	-857,900	-1,323,416	-295,736	-763,020	-244,430	-1,888,869	-511,896
Subsidy	213,914	198,718	181,040	225,000	1,402,564	426,798	1,326,464
Net Income (Loss) During the Period	-643,986	-1,124,698	-114,696	-538,020	1,158,134	-1,462,071	814,568

BALANCE SHEET						(In Million Peso)
	2004	2005	2006	2007	2008	2009
ASSETS						
Non-Current Assets	11,499	11,444	11,401	11,338	11,036	12,002
Current Assets	860	1,052	1,045	1,095	1,206	1,049
TOTAL ASSETS	12,359	12,496	12,446	12,433	12,242	13,051
LIABILITIES AND EQUITY						
Current Liabilities	13,599	15,160	16,434	17,365	18,748	19,358
Long-Term Liabilities	6,401	5,082	4,334	4,125	4,195	4,412
Deffered Credits	137	139	142	150	159	169
Capital Deficiency	-7,777	-7,885	-8,464	-9,207	-10,860	-10,889
TOTAL LIABILITIES, NET OF CAPITAL DEFICIENCY	12,359	12,496	12,446	12,433	12,242	13,051

Source: Philippine National Railways

2) Development Plans and Business Plans

In addition to multiple other projects the PNR is carrying out the following three projects.

a) SouthRail Project (Reopening of Bicol Line Project)

This project involves the rehabilitation of the damaged rail tracks, bridges and culverts from Calamba to Naga in Bicol which were damaged by Typhoons in 2006 to enable the resumption of train services from Manila to Bicol. The PNR is the implementing agency for this project and it is locally funded with a project cost of Php 1.875 Million.

b) NorthRail-SouthRail Linkage Project Phase I (Caloocan to Alabang)

This project involves the rehabilitation of the existing PNR commuter service in Metro Manila from Caloocan/Tutuban to Alabang, which includes the track renewal of the section between Caloocan-Tayuman-Espana, strengthening of the track from Espana to Alabang in Laguna, double-tracking from Sucat to Alabang, improvement of some stations and flagstops, fencing of station premises, improvement of depot and maintenance facilities, installation of signaling and communications equipment, provision of protective devices in all level crossings, and supply of 21 diesel multiple units. The implementing agency is the PNR. Its implementation mode is ODA from the Republic of Korea. The total project cost is US$50.42 Million with construction date from 2007 to 2010.

c) Northrail Southrail Linkage Project Phase II (Alabang to Calamba)

This project involves the rehabilitation and double tracking of the 27-km Alabang to Calamba section of the PNR South Commuter Line. The project includes five train sets of three cars each. It is the continuation of the ongoing NorthRail Southrail Linkage Project Phase I. The implementing agency is the PNR. The original timetable for its completion was from 2007 to 2009, however, it was revised to run from 2010 up to 2012. The Republic of Korea has approved its supplemental loan in the amount of US$95,993,000 from the Economic Development Cooperation Fund (EDCF). There is an ongoing relocation of informal settlers along the PNR right-of-way with about 7,000 households already relocated. However, there are still some 14,000 households to be relocated.

In addition PNR's proposing the Mainline South Railway Project (Southrail) Phase IA (Calamba-Lucena) and NorthRail Project Phase 1 Section 2 (Malolos to Clark). The system for the projects under implementation and the proposed projects is the conventional system which not PPP but a public sector carries out.

1.7.2 Establishing challenges of the implementing institution

Like the MRT Line 3, although the passenger growth for LRTA in the recent years has been slow, the number of passengers is increasing steadily, and considering only the railway business, it is raising its operating revenue which exceeds operating expenses.

However, the repayment burden of the long-term debt accompanying the borrowing for construction investment expense is heavy, and its financial structure is supported by the subsidy from the government. Not only LRTA but MRT Line 3 with a heavy payment burden for the Equity Rental Payment and PNR with a heavy repayment burden for long-term debts have their financial structures supported by the subsidies from the government.
On the other hand, although there is much non-railway business revenue for LRTA compared with MRT Line 3 which cannot rent the space of a station yard, there is little compared with PNR which owns a great deal of land.

While it is assumed that LRTA will see a considerable increase in the future number of passengers due to its extension to the southern and eastern parts of the Metro Manila, the private sector will generally get freight receipts and non-railroad enterprise revenue by introducing PPP in the future.

Therefore, in order to improve the financial condition which carries a heavy burden due to the long-term debt and depends on the subsidy from the government, it is important to create incentives which increase the profit from the railway business and a non-railway business for the private sector, and to distribute the profit increase mutually with the private sector participants in the PPP project scheme.

Table 1.7-5 Comparison of existing railway operators

	LRTA (LRT Line 1, Line 2)	DOTC/PMO (MRT Line 3)	PNR (All the Routes of PNR)
Railway Business			
Route Length	27.42km	16.9km	Commuter Line South (Manila-Carmona) 40km Main Line South (Manila-Legaspi) 474km
Number of Passengers	(2010)219.27Million Pax/Year	(2010)153.48Million Pax/Year	(2010) 9.15Million Pax/Year
Farebox Revenue	(2010) PhP3,079.16Million	(2010) PhP1,904.59Million	(2009) PhP17.43Million
Farebox Ratio	(2010) 1.05	(2010) 0.93	(2009) 0.25
Present Fare	PhP12 - PhP15	PhP10 - PhP15	PhP10 -
Project/Program of New Line	-Line1:North Extension, -Cavite Extension -Line2:East/West Extension -NAIA Rail Link	None	
Non-Railway Business			
Kind of Non-Railway Business	-Advertisement -Access Charge to Stations -Rental Fee from Shops at Stations	-Advertisements -Other Income	-Rental Income -Hospital Services -Miscellaneous Income
Non-Rail Revenue	(2010) PhP109.82Million	(2010) PhP11.98Million	(2009) PhP152.22Million
Non-Rail Revenue / Farebox Revenue	(2010) 3.6%	(2010) 0.6%	(2009) 873.1%
Financial Condition			
Long-term Debts	(2010) PhP62,947.21Million		(2009) PhP4,363.94Million
Subsidy			

Source: Study Team

1.8 Confirming Assistance Policies and Programs of other Donors for Transport Sector

The international donors have been closely collaborating with the Philippine government. It has been further strengthened through the Philippine Development Forum (PDF) since 2004. The key players in the transport sector assistance to the Philippines are the World Bank, ADB among multi-national agencies and JICA and AusAID among the bilateral development agencies.

The World Bank has been taking a strong initiative in leading a wide scope of developmental subjects through PDF and also focusing on the infrastructure development. AusAID has been recently assisting a National Transport Policy and Plan whereas JICA has been leading the infrastructure Working Group with its particular coordination on the water and the transport sector.

1.8.1 PDF and International Development Community

The **Philippines Development Forum (PDF)** is the primary mechanism of the Government for facilitating substantive policy dialogue with the international development community on its development issues and agenda. It also serves as a developmental framework for developing and achieving consensus among different stakeholders on the reform agenda of the Philippine government.

The PDF process was launched in 2004 with an agreement between the Government and the World Bank to seek more benefit by widening the participation and bringing other stakeholders such as civil society, academe, the private sector, and legislative representatives into the dialogue. Within PDF, eight Working

Groups (WGs) were formed and one of them is the Infrastructure WG comprising three Sub-Working Groups on Water, Transport and Energy. The last PDF was held in February 2011.

Each of the WG facilitates wide consultations across a broad range of stakeholders on specific themes; each is led by a Government agency as the lead convener represented by the head of that agency, with a development partner as co-lead convener. The Infrastructure Working Group comprises NEDA as the lead Convener, and the Philippine members are DOF, DBM, PMS, DPWH and DOTC. The **Sub-Working Group on Transportation** is co-chaired by DOTC and DPWH and WB and JICA as the co-lead conveners.

Infrastructure Working Group (IWG) has been addressing agenda items in 2008 PDF meetings such as;

- Widen private sector participation
- Push for separation of operations and regulation
- Improve incentives for private sector participation
- Ensure independence of regulatory bodies
- Formulate a multi-modal transport plan and policy framework.

During the latest PDF 2011 Meeting, the Philippine government presented its new **Philippine Development Plan (PDP) 2011 – 2016** and addressed its broad strategy of a) High and sustained economic growth, b) Equal access to development opportunities, and c) Effective and Responsive social safety nets.

On the Infrastructure agenda, it stressed i) the vital importance of infrastructure and expansion of logistic chains, ii) development of integrated and multi-modal national transport and logistic systems, iii) presented its intended massive investment under PPP and iv) need for transparent and responsive governance leading to procurement reform and anti-corruption. Around the same time, a few policy supports and assistance were announced by the international donor community.

1.8.2 The World Bank

At PDF 2011, the World Bank (WB) endorsed the policy direction of the Social Contract approach with its **inclusive PDP approac**h led by the new Aquino Administration. WB pointed out the poor infrastructure is “a critical bottle-neck for growth and competitiveness”. They commented that to promote further transparent processes, providing bankable PPP projects in pipeline, strengthening transaction advisory capacity of the Government to properly manage those efforts as well as addressing the financing gap to be filled in are all essential.

Prior to this, WB presented a Policy Paper on “**Transport for Growth**” in 2009. WB pointed out that the quality of urban rail and train operation and their capacity need to be improved with increasing demand while the main expenditure of DOTC have been railway, airports and air navigation projects, and further WB assessed the financial burden that still remains in the railway sectors whereas many other GOCCs have become solvent and no longer require any subsidy from the government.

In particular, WB assessed that LRTA's debt burden has grown beyond its financial capacity due mainly to the high construction costs and low revenue from its fare and recommends a swift restructuring of its debt as well as re-establishing the governance of LRTA. Further, WB indicates outsourcing of O&M might improve and solve the financial situation in a sustainable manner, i.e. pushing towards some form of PPP for LRTA.

The **WB current and past lending projects portfolio** in the transport sector has two projects, the one, National Roads Improvement and Management (APL) Phase 2, an active project approved in May 2008, and the other closed project of Metro Manila Urban Transport Integration Project (MMUTIP) approved in June 2001.

World Bank Project Name

- Light Rail Transit Line 1 (South Extension) : Planned (n.a).
- National Roads Improvement and Management (APL) Phase 2 : Active (May-2008)
- Metro Manila Urban Transport Integration Project : Closed (Jun-2001)

Under the new **World Bank CAS 2010-2012**, presented to its Board in April 2009, the Bank set up five strategic objectives, one of which is "Strategic Objective 2: Improved Investment Climate in sharing the objectives with other donors such as from ADB, Japan, Australia, China, France and Korea which support relatively large transport infrastructure projects such as national roads/highways, railways, airports, fish ports, rural roads, bridges and so on.

Reflecting the country PDP goals, in the area of Investment Climate, it stressed encouraging the private sector to improve productivity, strengthen trade and investment and attain national investment rates of about 25-28 percent of GDP, and continuing with the integration of the transport system, and developing and diversify the energy mix, and finally ensuring smooth financing for entrepreneurs.

One of the Results Areas is "2.1 Enabling an environment for competitiveness, productivity, and employment". As its "Outcome 1: Increased and improved delivery of infrastructure", The World Bank Group will help deliver more tangible transport results linked to improvements in governance through the ongoing **Second National Roads Improvement and Management Program (NRIMP2)**, and will support expansion of this approach to the management of secondary and rural roads.

In order to operationalize the framework for Public-Private Partnerships with better risk-sharing between the public and private sector, the World Bank Group will support one model PPP for a national toll road and one for a Light Rail project. The CAS includes the Light Rail Transit Line 1 (South Extension) with Public-Private Partnership; Metro Manila and other major cities transport integration as a follow-up to MMUTRIP; and Cavite-Laguna toll road project in a growing urban community as a model PPP.

In response to a possible reduction in the availability of **private financing** due to the current global downturn, the Bank Group could provide risk mitigation products and assistance in preparing financing and implementation packages for public investments.

1.8.3 Asian Development Bank

The Asian Development Bank (ADB), in consultation with the Philippine government and other relevant stakeholders, is formulating its **Country Partnership Strategy (CPS) 2011–2016** along with the Country Operations Business Plan (COBP) 2011–2013. ADB's upcoming CPS is expected soon and will be strategically aligned with the government's PDP 2011–2016 but not it has not been launched at the time of writing of this report.
According to its **Country Operations Business Plan (COBP)** 2010-2012 approved in October 2009, it is confirmed that the infrastructure development of ADB focus substantially on power generation and transmission, and improvement of energy efficiencies. ADB's strategy on the transport sector is rather limited to the toll road construction and operation projects and the urban transport systems such as light rail transit and bus rapid transit, and construction, modernization and operations of port facilities.

ADB Project Name

- Road Sector Institutional Development and Investment Program, (former Road Sector Improvement Project) : Firm (2011(Standby 2010))
- Road Sector Improvement : Active (2008)

ADB issued its "Sustainable Transport Initiative Operational Plan" in July 2010. Some of the reasons behind ADB's relatively limited project operations for the transport sector in the Philippines could be attributed to two reasons. The first reason is ADB policy in the railway sector is limited to a small number

of countries such as China to which a substantial amount of lending finance has been concentrated. Secondly, the Plan also states that the major factor to limit its scale of lending is due to the railway administration bodies failure to reform and modernize. Due to these factors, ADB has had difficulty in justifying large scale investment projects. However, ADB indicated that there are some signs of willingness to proactively move forward.

1.8.4 AusAID on National Transport Plan

The Australian Agency for International Development (AusAID) in close coordination with DOTC, formulated a National Transport Plan (NTP) in March 2011. The policy framework covers the areas such as Resources generation and allocation, Criteria for the preparation of agency plans, programs, and projects, Cost recovery, Urban transport, Governance, and others. The objectives were to a) provide the basis for the formulation of the National Transport Plan based on NEDA's CIIP; and b) support the establishment of a process for strategy development and monitoring. Such a process will facilitate inter-agency coordination and eliminate conflicts among modal agencies, strengthen regulatory oversight within the transport modes, and ensure efficient use of limited government resources

As for the urban transport, the main policy statements are;
public transportation in urban areas provided by the government and/or under PSP arrangements shall be given priority over private transportation to ensure accessibility, comfort, convenience, reliability, safety, security and affordability to the majority of urban travelers.

Taking into consideration the criteria for evaluating and selecting transport projects, **high capacity public transport systems** shall be the preferred mode in high passenger density corridors in order to maximize the use of travel space by servicing the largest number of passengers with the least delay possible

Interconnectivity among public transport modes shall be of prime consideration for the development of the urban public transport system through the provision of modal interchange areas where transfer of passengers from one mode to another will be safe and convenient and vehicle movements will not disrupt traffic flow in the surrounding areas

On the private sector role, the government shall **provide scope for PPP** where such potential exists and shall withdraw from transport activities and areas where the private sector is strong and competition exists or can likely emerge. The government shall concentrate on direction-setting, technical regulation and economic regulation.

In PPP, **no unsolicited proposal** shall be entertained, except when the project can pay for itself entirely from user revenues such as in BOO, BOT and similar schemes. Accordingly, any development based on an appropriate feasibility study shall first be offered for PPP through public bidding. The feasibility study shall be made available to any interested private party. The planning and implementation of PSP and PPP projects shall adhere to the guidelines.

AusAID recommendations are based on the latest PDF in the transport sector for the PDP period 2011 - 2016 such as a) fast-track implementation of infrastructure projects, b) implement clear competition policies in infrastructure provision, c) undertake capacity building in infrastructure development, d) improve the linkage between planning, budgeting and funding processes, and e) pursue the triple bottom line (economic, social and environmental) in infrastructure development.

1.8.5 Necessity of the Project by Reviewing Other Donors' Projects and Assistance

The Philippines Development Forum (PDF) has been providing an integrated developmental assistance and **policy framework and processes** among the international development community for the Philippines. Japan's undertaking of the key position in Transport Sub-Working Group in PDF has been

creating good opportunities to stress the importance of the transport sector development to achieve both economic and social development objectives. AusAID's National Transport Policy Framework and Plan has been formulating necessary policy, legislative and institutional capacity building for the sector.

On the **urban transport development**, the World Bank (WB) has been putting its focus on the macro-economic development and enabling environment improvement. Due to its wide coverage of administrative, economic and social development agenda, the transport sector allocation has been inevitably restrained. So far the World Bank has been providing nation-wide support through the Second National Roads Improvement and Management Program (NRIMP2), and plans its financing for Light Rail Transit Line 1 (South Extension). ADB, on the other hand, due to past experience in the railway sector, does not seem to have a strong interest whereas they focus more substantially on the energy sector. Through this Study, Japan will be able to show that it is one of the few countries successfully dealing with urban transport and traffic management issues by developing its own engineering technology in an efficient manner for application of a PPP scheme.

A PPP scheme has been discussed among all the stakeholders. The LRTA has a few PPP projects to be implemented. So far, the World Bank has LRT Line 1 South Extension as a PPP project in the pipeline whereas other donors are rather oriented to the policy, legislative and capacity building issues of administration whereas this Study would be able to bring an implementable and feasible concrete case that could be a benchmark project and operation.

WB pointed out that the **financial burden of LRTA** remains at railway sectors among GOCCs and requires continuing subsidy support from the government. The former JBIC ODA Yen Loans seem to have been one of the main reasons. This Study looks carefully into the poorly performing financials of Line 2 and PPP scheme recommendations may provide a substantial improvement of its financial situation.

1.9 Confirming Necessity of Project

1) Positioning of this project in Metro Manila

As a result of having reviewed 1.1-1.8, positioning of this project in Metro Manila is defined as follows:

a) Manila Transport Sector Condition

- The urban transport of the Metro Manila in which population and industry are concentrated is greatly dependent on vehicle traffic including public transport by bus, jeepney, etc., and aggravation of the inconveniencies of travel and influence on the environment are issues.
- Expansion of the public transport network by extension and establishment of the urban rail transport including extension of LRT Line 2 has been a preferential subject of the Metro Manila transport sector.

b) Confirming Transportation Sector’s Policies and High-priority Projects

- In MMUTIS, the east extension to Antipolo and the west extension to the port area of LRT Line 2 were proposed as an urban rail transport network, and the section to Masinag within the east extensions was further mentioned as a core project.
- In CIIP, the east extension (up to Masinag) and the west extension of LRT Line 2 are selected as the priority project of the rail traffic sector and PPP priority project.
- In November 2011, the government announced ten projects to tender by the end of 2011, and LRT Line 2 east extension is included in them.

c) Review of Legal Framework

- When undertaking this project by PPP, it is necessary to follow the BOT laws, such as requirements the maximum government burden and nationality of a shareholding company, and a process for getting approval of NEDA-ICC.
- In order to eliminate the barrier to the private sector participation in a PPP project, legislative financial and contractual correspondence is needed.

d) Review of Transportation Sector PPP Projects, Mobilization of Private Resources and Privatization in the Philippines

- In the rail transport sector, MRT Line 3 is to be carried out as a PPP project and, carrying out the south extension of LRT Line 1, the east and west extensions of LRT Line 2, MRT Line 7, and MRT Line 8 as PPP projects was announced by the government in the planning stage for the new railway.
- In the road transport sector, PPP projects have been undertaken from the 1990s by the joint venture (JV) system of a state-owned firm and a private-sector investor, and the system is based on the BOT law.
- In the sea transport sector, although there is nothing that was carried out as a PPP project in the past, there are cases currently carried out by which the public sector builds port facilities and leaves the operation to the private sector.
- In the air transport sector, although the air terminal building project was started as a PPP project, the public sector acquired the completed facilities and is managing them because of a dispute between a public sector entity and a concessionaire.
- Introduction of PPP is expected in some projects that are in the planning stage in any sector.

e) Overview of Implementing Agency

- Although the passengers carried on LRT Line 2 is increasing in number steadily, as long as there are no big projects such as an extension, a large increase will not be expected in the future.
- The existing LRT Line 2 has various issues in the rolling stock, signal and communication, civil works, station facilities, track, electric power, and OCS, and there are some that need to be repaired immediately and the design of the extension should be considered.

f) Financing Analysis of Executing Agency

- The profit and loss in 2010 of LRTA registered 144 million Peso operating profit and about 6 billion-peso net loss. Due to the increase in interest due and fluctuations in the profit or loss on foreign exchange accompanying repayment of the long-term loans in foreign currency, the situation where net profit is a deficit continues from 2008 and afterwards.
- The LRTA balance sheet at the end of 2010 of shows net capital of minus 17,100 million pesos, and illuminates the problem of the stability of the financial situation and repayment capacity.
- The profit and loss of LRT Line 2 registered an operating loss. The Farebox Ratios by dividing Operating Revenue with Operating Expense are calculated as 1.05 for the entire LRT, 1.21 for Line 1, both showing over 1, but Line 2 FB Ratio returns 0.78 indicating expenses incurred cannot be covered by revenue from the operations.
- Since fare increases are difficult, the increase of revenue is difficult in a situation where there is little profits from non-rail business, the repayment burden of the long-term loan being heavy, and repair and renewal expense expenditures are expected, the financial situation of LRTA with the net loss and fund balance with low stability is expected to continue for a while.
- When O&M of LRT Lines 1 and 2 are left to the private sector by introduction of PPP, it is assumed that the role and financial situation of LRTA will change a lot.

g) Clarification of Issues and Review of Development/Business Plans of Other Implementing Institutions in Metro Manila

- The profit and loss in 2010 of the DOTC Project Management Office that operates MRT Line 3 registered an operating loss and net loss, because the equity rental payment and maintenance costs which DOTC pays to MRTC are very high. The Farebox Ratio of MRT Line 3 is 0.93, and revenue other than fare revenue is only 0.6% of fare revenue.
- The profit and loss in 2009 of PNR was a large operating loss, and the Farebox Ratio is 0.25 which is much less than 1. Revenue other than fare revenue reaches 873.1% of fare revenue with the rental fee of the land.
- Each urban railway operating agency (LRTA, the DOTC project management office, and PNR) of Metro Manila has a heavy payment burden for the large amount of initial investment expenses, and has a financial structure depending on the central government's subsidy.

h) Confirming Assistance Policies and Programs of other Donor's for Transport Sector

- WB has been putting its focus on the macro-economic development and enabling environmental improvement. Due to its wide coverage of administrative, economic and social development agenda, the transport sector allocation has been inevitably restrained.
- So far WB has been providing nation-wide support through the Second National Roads Improvement and Management Program (NRIMP2), and plans its financing on Light Rail Transit Line 1 (South Extension).
- ADB, due to past experience in the railway sector, does not seem to have a strong interest whereas they focus more substantially on the energy sector.
- AusAID in close coordination with DOTC, formulated a National Transport Plan (NTP) in March 2011.

2) Confirming necessity, effectiveness and validity of JICA assistance for this project

Based on the positioning of this project in the Manila metropolitan area, the necessity, effectiveness, and the validity of the assistance of JICA for this project are confirmed as follows:

a) Manila Transport Sector Condition

In order to expand the public transport network and to correct the excessive dependence on the vehicular traffic in Metro Manila, the LRT Line 2 extension project has high necessity, and implementation of the assistance for this also has high necessity.

b) Confirming Transportation Sector's Policies and High-priority Projects

This project has been positioned as a high priority in the transport sector in Metro Manila, and it has been selected as a governmental PPP priority project. This makes it clear that the intention of the government is to implement this project and that the government will give it all possible assistance.

c) Review of Legal Framework

Since it is thought that participation of the private sector is promoted by the fiscal measures of the government including assistance when undertaking this project as PPP, the effectiveness of assistance is expected to be high.

d) Review of Transportation Sector PPP Projects, Mobilization of Private Resources and Privatization in the Philippines

Compared with the PPP introduction situation of other transport sectors, in the rail transport sector, PPP introduction is behind the road transport sector. The policy of the government is clearly to aim at introduction of PPP. Infrastructure construction in the transport sector requires a large amount of funding, and since the framework development of PPP combining public funds containing ODA with privat.

e) Overview of Implementing Agency

Immediate repair works on the existing sections are required in addition to the extension of LRT Line 2, therefore, the demand for funding as a package for LRT Line 2 including these is large, and its necessity for assistance is high.

f) Financing Analysis of Executing Agency

In order to hand O&M of LRT Lines 1 and 2 over to the private sector through a PPP scheme, it will be necessary to improve the profitability of LRT Line 2 and improve the financial condition of LRTA radically through large-scale governmental financial support. Supporting the LRT Line 2 extension project will be highly effective.

g) Clarification of Issues and Review of Development/Business Plans of Other Implementing Institutions in Metro Manila

Each urban railway operating agency of Metro Manila has a heavy payment burden for the large amount of initial investment expense, and they each have a financial structure dependant on the central government's subsidy.
While expansion of the public transport network by extension and establishment of urban rail transport is required, in order to carry out these projects while controlling the governmental fiscal burden, assistance is indispensable in the form of introduction of PPP.

h) Confirming Assistance Policies and Programs of other Donor’s for Transport Sector

The assistance for the transport sector of other donors, such as WB, ADB, and ausAID, does not overlap with the assistance which JICA is going to carry out for this project, but complements the assistance. JICA assistance for the project has validity.

CHAPTER 2

DEMAND FORECAST

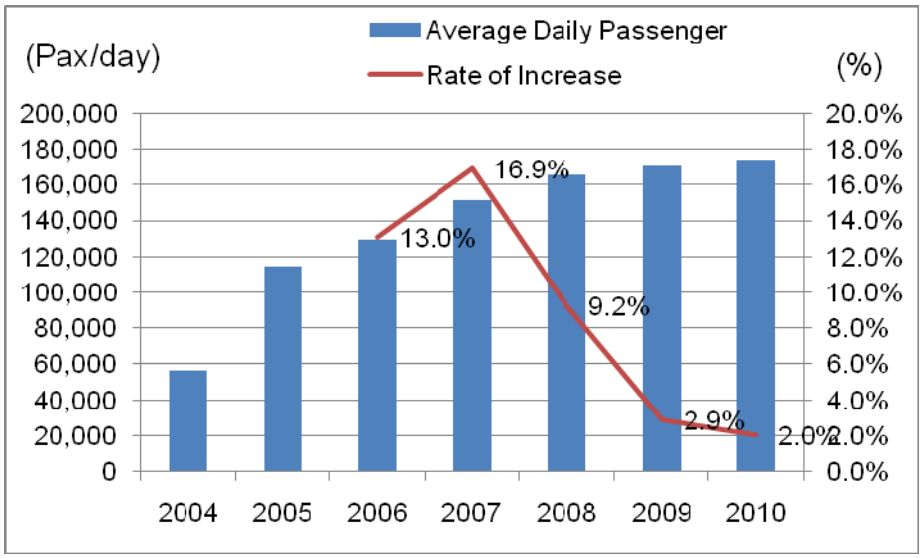
CHAPTER 2 DEMAND FORECAST

2.1 Review of passenger count in LRT line 2

2.1.1 Average daily passenger

LRTA records number of passengers passing through ticket gates of each station by boarding and alighting. The record is hourly basis and accumulated into daily passengers. It is also calculated and reported average weekday/ Saturday/ Holiday & Sunday Passengers by month.

Average Daily Passenger has been growing since the beginning of the operation; however the yearly growth ratio is dropping in recent years. Latest growth ratio from 2009 to 2010 is 2.0%.



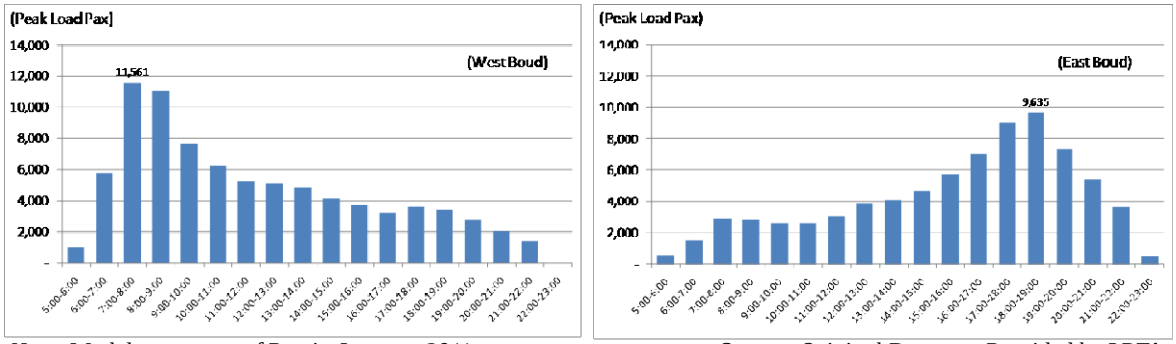
Note: Number shows Entry to Stations

Source : Original Data was Provided by LRTA and Study Team Calculated.

Figure 2.1-1 Average Daily Passenger of LRT Line 2

2.1.2 Hourly Peak Load Passengers on Board

Hourly Peak Load Passengers by direction are shown in **Figure 2.1-2**. The figure shows the biggest number of passengers between stations in an hour. The peak shows at 7am – 8am in West Bound, Santolan to Recto. West bound is busy in the morning; on the contrary east bound is busy in the evening. It is obvious that only one side is busy in peak hours and shapes of passenger volume pattern are symmetric. So that commuter seems to be major purpose of users.



Note: Weekday average of Pax in January, 2011

Source: Original Data was Provided by LRTA

Figure 2.1-2 Hourly Peak Load Pax on Board of LRT Line 2

2.1.3 Fare revenue

1) Ticket type

LRT tickets are not common in use between LRT line 1, line 2 and MRT line 3. LRT line 2 tickets consist from 3 types as follows:

- Single Journey Ticket
  - Ticket for one way trip.
  - Valid only on the date of purchase.
- Stored Value Ticket
  - Kind of prepaid card value of PhP 100. Remaining value is stored in the Ticket with subtraction of each fare of ride.
  - Last Ride Bonus is privilege. Ticket is still valid for one more ride even if stored value is less than the regular fare.
  - Valid Six months from date of first use.
- Discount Ticket
  - 20% discounted.
  - Available only to Senior Citizens and Disabled Passengers.

In 2010, 58% of passenger used Single Journey Ticket whereas 39% of passenger used Stored Value Ticket. It seems that Single Ticket is enough cheap and Stored Value Ticket cannot to be attractive.

2) Fare system

Present fare system is shown as follows:

- PhP 12.0: 1 to 3 intersections
- PhP 13.0: 4 to 6 intersections
- PhP 14.0: 7 to 9 intersections
- PhP 15.0: 10 intersections

DOTC announced fare hike of LRT from March 2011 in January 2011. However, it was suspended by public protest. In May, the Land Transport Franchising and Regulatory Board (LTFRB) has agreed to the proposed increase in the fares for the LRT, but the government postponed indefinitely their implementation. The proposed fare is maximum 9 and 11 pesos increase for store and single journey, respectively, as shown in **Table 2.1.-1**.

Table 2.1-1 Comparison of Proposed New Ticket Fare and Present Fare from Recto St.

To/From:	Stored Value		Single Journey	
	Old	New	Old	New
Legarda	12	12	12	15
Pureza	12	14	12	15
V. Mapa	12	15	12	15
J. Ruiz	13	16	13	20
Gilmore	13	17	13	20
Belmonte	13	18	13	20
Cubao	14	19	14	20
Anonas	14	21	14	25
Katipunan	14	22	14	25
Santolan	15	24	15	25

Source : Basic Data is provided by DOTC

3) Fare revenue

Annual Fare Revenue in 2010 was 855 million Pesos, 2.4% increased from 2009.

Table 2.1-2 Annual Passenger Counts and Annual Fare Revenues

	2004	2005	2006	2007	2008	2009	2010
Annual passenger count :millions (Rate of Increase: %)	20.6	41.8 (103%)	47.4 (13.3%)	55.2 (16.5%)	60.5 (9.6%)	62.1 (2.6%)	63.4 (2.0%)
Annual fare revenue :mil. PhP (Rate of Increase: %)				749	816 (8.9%)	835 (2.3%)	855 (2.4%)
Average Trip Fare: PhP				13.5	13.5	13.4	13.5

Source: Basic Data is provided by LRTA

2.1.4 Passenger count target

Line 2 Operation Department of LRTA projects target number of passengers. The target numbers are set for Weekday, Saturday and Sunday & Holiday by each month. Firstly rate of increase of previous year is calculated and multiply to average volume of fore mentioned classified volume of the previous month.

For example, the number of weekday passengers in April 2010 is estimated to 178,800 pax/day and actual number was 182,335 pax/day.

Table 2.1-3 Passenger Count Target and Actual Number in April 2010

Average Daily Ridership	Target (pax/day)	Actual (pax/day)	Actual / Target (%)
Weekday	178,800	182,335	102
Saturday	140,800	130,798	93
Sunday / Holiday	96,900	94,950	98

Source : LRTA

LRTA projects its target ridership through historical data and compares to actual number. The target numbers are used to project the number of trains to be utilized for revenue operations. Ridership statistics are then prepared by the Central and Traffic Control Division (CCH) for the reference of the Planning Department.

2.2 Examination of extension routes

The extension routes examined in this study are based on the recommendations put forward in the results of the METI Study on LRT line 2 East-West Extension Project in 2009. The METI Study examined extension section from Divisoria to North Harbor as case 1 and case 3. However both cases are regarded to be “Not feasible” because the FIRR is less than zero. In addition to this, North Harbor is a cargo Port and it is hardly expected highly increase in passenger transport by LRT from the port. The extension sections (about 4km east to Masinag and about 2km to Divisoria) are the two cases shown in **Table 2.2-4** as the comparative alternatives. The alignment is studied as the center of existing road with elevated viaduct, which is same as METI Study. Further detail is studied in Section 3.3.

Table 2.2-1 Comparable Alternatives of Extension Routes in METI Study

Case	Description	Length(km)
1	East extension (to Masinag) + West extension (to Manila North Harbor, Pier 14)	7.96
2	East extension (to Masinag) only	4.14
3	East extension (to Masinag) + West extension (to Manila North Harbor, Pier 4)	7.12
4	East extension (to Masinag) + West extension (to Manila Divisoria)	5.77

Source : Study on Manila LRT Line-2 East-West Extension Project in Philippines, METI, 2009

Table 2.2-2 Evaluation of Alternatives of Extension Routes in METI Study

Case	Financial analysis and evaluation		Economic analysis and evaluation				Evaluation of impacts on environment and society
	FIRR	Result	EIRR	B/C	NPV (mil. peso)	Result	
1	- 1.82%						Great impact
2	4.22%	Feasible	15.97%	1.35	1,609.11	Feasible	Limited impact
3	-0.09%						Great impact
4	1.50%	Feasible	12.06%	1.00	36.76	Feasible	Limited impact

Source : Study on Manila LRT Line-2 East-West Extension Project in Philippines, METI, 2009

Table 2.2-3 Recommended Proposal and Reasons Presented in METI Study

Recommended Proposal	Reasons for the Recommendation
Case 4	・ Possibility of grant of yen loan by STEP from Japan ・ Indirect influence on development of Recto Avenue in Divisoria, the commercial center of the western extension ・ Advantages in terms of environmental aspects

Source : Study on Manila LRT Line-2 East-West Extension Project in Philippines, METI, 2009

Table 2.2-4 Comparison of Alternative Extension Routes in This Study

Case	Description
New case 1	East extension only (to Masinag)
New case 2	East extension (to Masinag) + West extension (to Manila Divisoria)

Source : Study Team

2.3 Creation of modal split models

2.3.1 Previous modal split model in Metro Manila

From 1996 to 1999, JICA-supported Metro Manila Urban Transportation Integration Study (MMUTIS) was conducted. In MMUTIS, several steps were set as procedure for demand forecast considering trip modes; Public or Private, in network and OD matrixes. For traffic assignment, two types of models; (i) Highway-type assignment for private and public mode, and (ii) Transit assignment for public mode and highway-type assignment for private mode, were adopted. Analysis of MMUTIS was mainly based on the first model which was conventional incremental assignment model.

Before conducting traffic assignment, demand shift from private to public was considered using Demand shift model, which was based on "willingness-to-pay" survey and taking into consideration if reliable and comfortable railway services were provided. Created model of Demand shift is shown in **Figure 2.3-1**.

$$P = \frac{1}{1+Exp(\alpha\Delta t+\beta\Delta C+\gamma)}$$

Where,

Δt : Travel time differences in minutes (public mode - private mode)
ΔC : Travel cost differences in pesos (public mode - private mode)
α, β, γ : Parameters

Parameter	Coefficient
α	0.0408
β	0.0392
γ	2.35

Source: MMUTIS (JICA, 1999)

Figure 2.3-1 Modal Split Model (Demand Shift Model from Private to Public) on MMUTIS

The studies developed Transport Demand Model in Metro Manila are recently conducted. LRTA and World Bank conducted studies on LRT line 1 North extension and South extension respectively. World Bank Study calibrated JICA STRADA based Metro Manila Transport Demand Model up to 2007.In 2010, METI Study was conducted. Ridership estimation was based on MMUTIS network with updating and updated public transport OD by MMPTS.

Several LRT 2 ridership estimations are conducted before this study as shown in **Table 2.3-1**.

Table 2.3-1 Result of LRT 2 Ridership with East Extension

Project (Agency)	MMUTIS (JICA)	LRT 1 North FS (LRTA)	LRT 1 South FS (WB)	LRT2 East West Ext (METI)
Year	1999	July 2007	July 2008	March 2010
Fare Level	No Detailed Information	PhP12 for first 3 km + PhP0.36/km	PhP9 (boarding) + PhP0.9/km (2005 prices)	PhP 8 (boarding) + PhP0.8/km (2008 prices)
Base Year	1996	2006	2007	2008
Ridership Projections (pax/day)				
2010	-	161,381	-	-
2015	830,000	194,054	219,102	376,977
2020	-	212,665	253,966	416,213
2025	-	-	294,390	482,505
2030	-	-	341,254	559,356
2035	-	-	387,152	648,446
2040	-	-	448,861	-

Source : Study Team

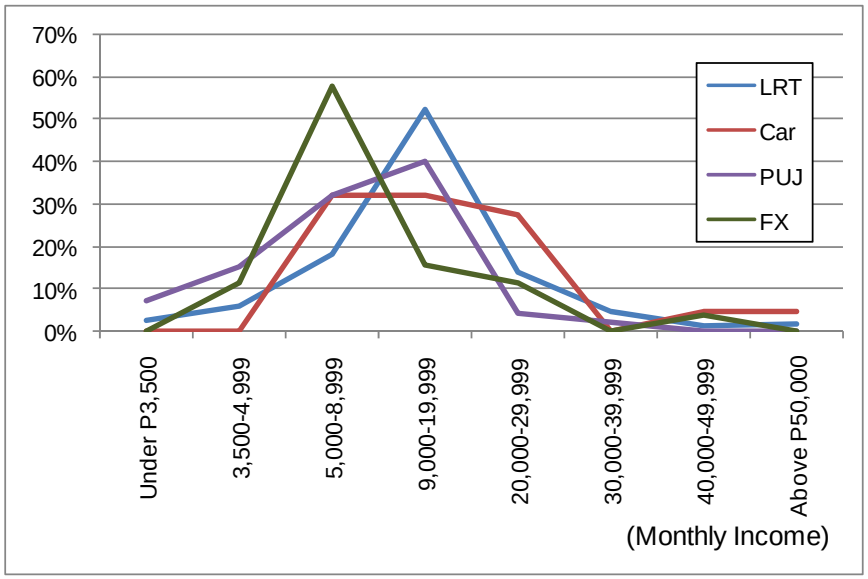
2.3.2 SP survey

In this study, Stated Preference (SP) Survey was conducted. The purpose was to provide basic data for demand forecasting of LRT line 2 extensions, and to grasp the present characteristics of LRT line 2 users and possible users.

Survey was conducted from 3rd to 5th March, 2011 at existing LRT line 2 stations and Jeepney/Bus/FX stations.

1) Income Distribution of each mode

SP survey revealed income distribution of each mode as shown in **Figure 2.3-2** and average income of each mode is shown in **Table 2.3-2**.



Source : Study Team

Figure 2.3-2 Income Distribution of each mode

Table 2.3-2 Average Income of each mode

Mode	LRT	CAR	PUJ	FX
Monthly Income (PhP/month)	15,645	17,977	10,623	11,375
Income by Minutes(PhP/min)	1.55	1.78	1.05	1.13

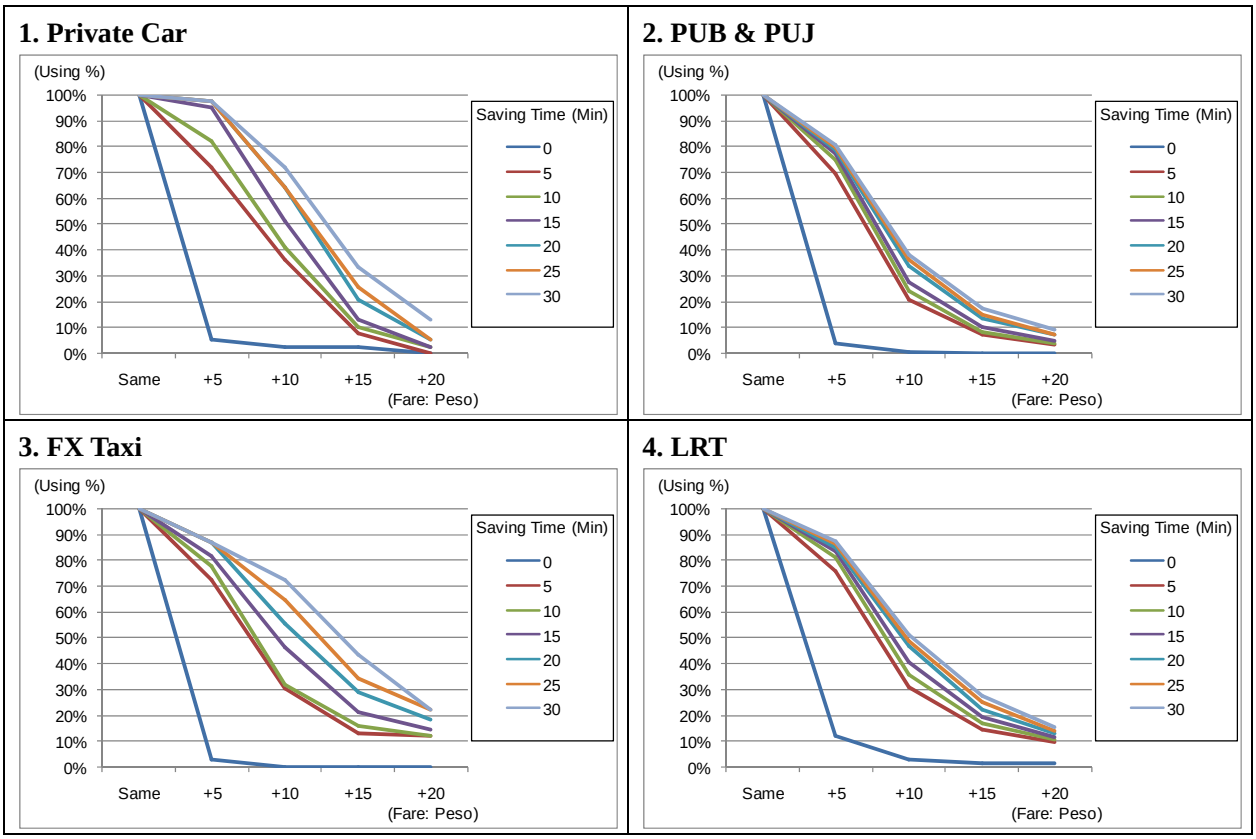
Note: Income by Minutes is calculated on the assumption of 21 working day per month and 8 working hours per day.

Source : Study Team

2) Willingness to Pay survey result

SP survey that interviewed with users, how much they are willing to pay for LRT line 2 extension with certain time savings, was conducted. Results of each mode are shown in **Figure 2.3-3**. Because Public Bus (PUB) is minor on the Marcos Highway, only 7 samples could be interviewed, so that following figure shows PUB and Public Usage Jeepney (PUJ) as integrated mode, PUB & PUJ.

As the figure indicates, strong rejection of fare hike without time savings was shown. Comparing the sensitivity of Cost and Time, it seems that Fare Escalation is more sensitive than Saving Time. Private car and FX users seems considering Time savings rather important than PUB & PUJ and LRT users.



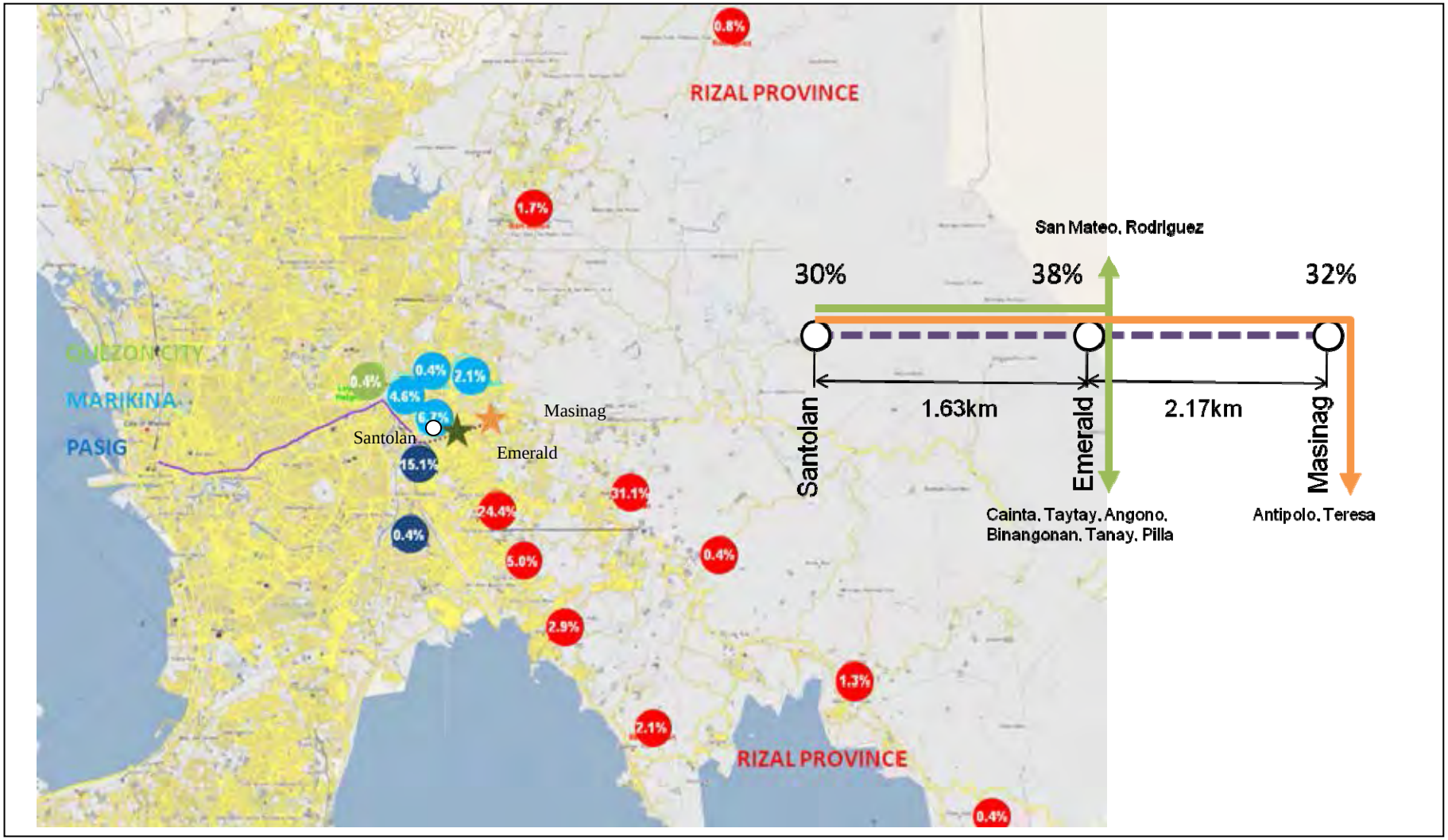
Note: Number of Samples are; Car is 39, PUB& PUJ is 230, FX is 76, and LRT is 723

Source : Study Team

Figure 2.3-3 Willingness- to-pay Survey Result by each mode

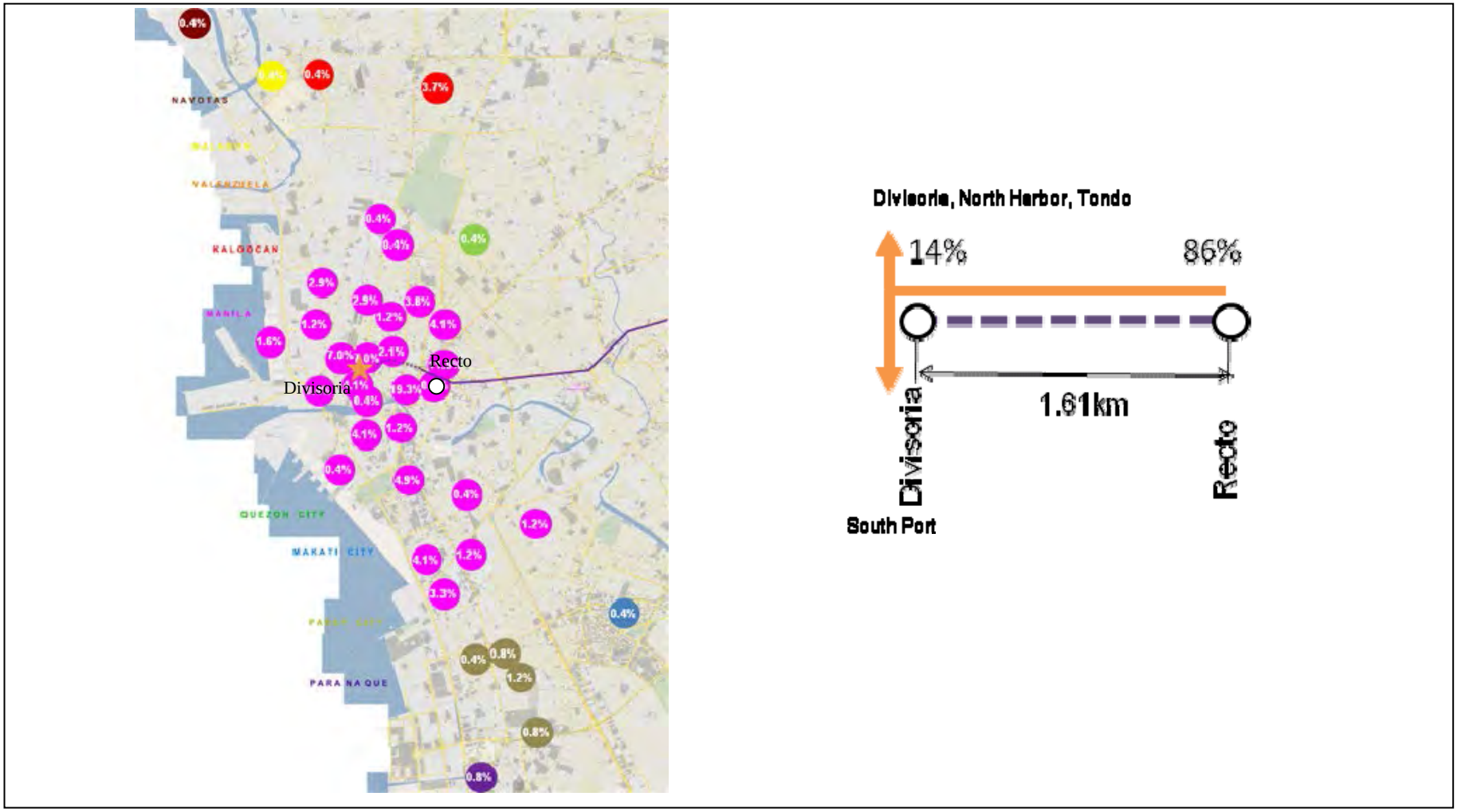
3) Catchment area of existing terminals

With SP survey, Origin and Destination of the trip was interviewed. The survey revealed catchment area of existing terminals; Santolan and Recto, and assumed shift to new constructing stations as shown in **Figures 2.3-4** and **2.3-5.**



Source : SP Survey at Santolan St.(3-5 March,2011)

Figure 2.3-4 Present Catchment Area of Santolan Station and Assumed Shift to New Constructing Stations (Emerald and Masinag)



Source : SP Survey at Recto St.(3-5 March,2011)

Figure 2.3-5 Present Catchment Area of Recto Station and Assumed Shift to New Constructing Station (Divisoria)

2.3.3 Modal split model

Based on the willingness-to-pay survey result, Modal split model for Private car to LRT was created as shown in **Figure 2.3-6**. This model was developed in the same manner as MMUTIS did. Demand shift prom private traffic to LRT was given from the differences of travel time and that of time. Coefficient for travel cost was about five times larger than that of time.

$$P = \frac{1}{1+\mathrm{Exp}(\alpha\Delta t+\beta\Delta C+\gamma)}$$

Where,

Δt : Travel time differences in minutes (LRT – Car travel)
ΔC : Travel cost differences in pesos (LRT – Car travel)
α, β, γ : Parameters

Parameter	Coefficient
α	0.0482
β	0.2660
γ	-1.988

Source: Study Team

Figure 2.3-6 Modal Split Model for Private Car to LRT

2.4 Demand forecast for the extended routes

1) Methodology

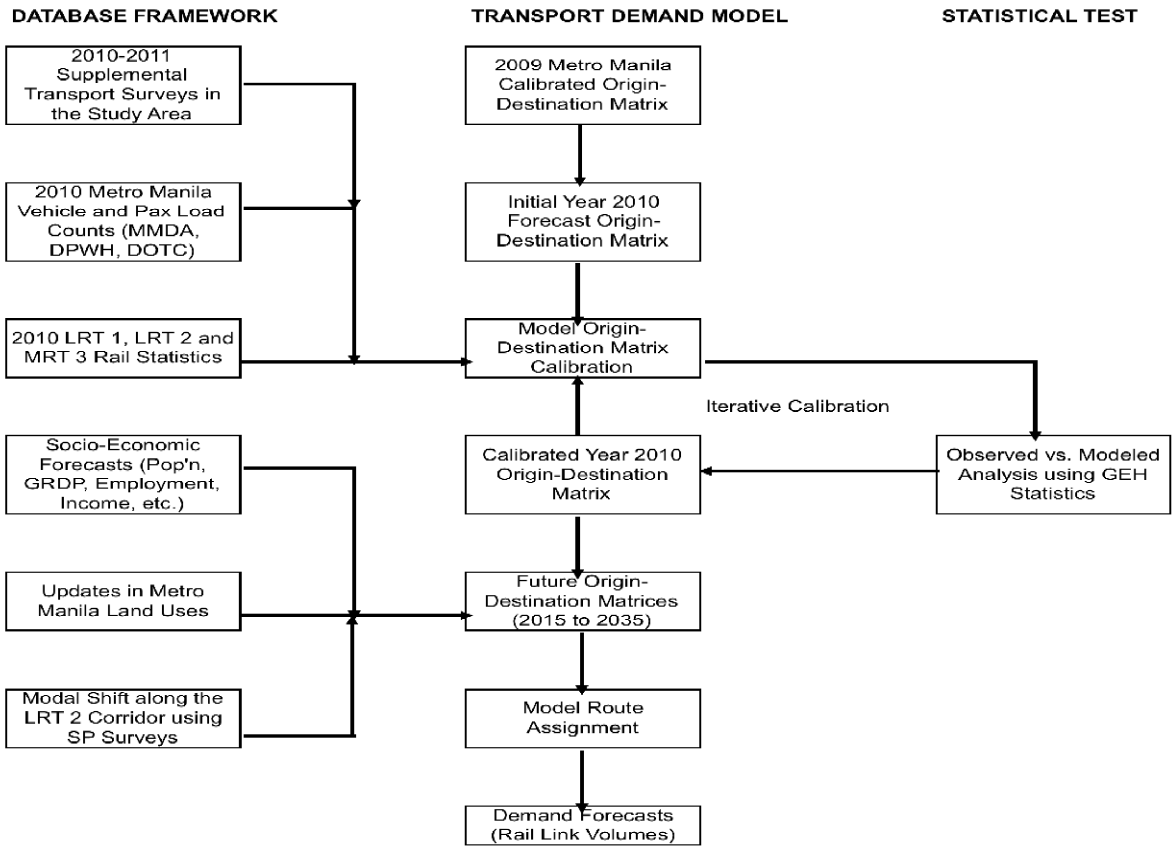
The traffic demand forecast model was based on the result of the Person Trip (PT) survey and models studied in MMUTIS with updating population growth, changes in land use, and traffic survey result.

For general land use for Metro Manila, the updated GIS model for Metro Manila was utilized, which was the recent revisions developed by the Metropolitan Manila Development Authority (MMDA) and the Department of Transportation and Communications (DOTC) in 2003 under the JICA Earthquake Impact Reduction Study of Metro Manila (MMEIRS).

For the traffic demand forecast, the JICA STRADA-based Metro Manila Transport Demand Model was used, which was developed by MMUTIS and first calibrated for base year 2007 by LRT 1 Extensions Study and recent ridership studies on MRT 3 and LRT 1 South Extension and METI LRT 2 East-West Extension Study. **Figure 2.4-1** shows the transport demand forecast modeling process.

This Ridership Study to estimate future LRT 2 passenger volumes and revenue impacts were based on the following scenarios:

- Base Year 2010 and forecast years of 2015, 2020, 2025, 2030 and 2035;
- Case 0: No LRT 2 Extension
- Case 1: With LRT 2 East Extension to Masinag Station, and
- Case 2: With LRT 2 East Extension and West Extension to Divisoria.



Source: Study Team

Figure 2.4-1 Transport Demand Forecast Modeling Process

2) Conversion Factors

The transport demand forecasted average weekday daily traffic. However, annual traffic volume was required for environmental and financial analysis. To fulfill this requirement, ridership statistics was analyzed.

Table 2.4-1 shows weekday-to annual factors, which were derived from the LRTA and DOTC/Metrostar Express rail passenger statistics in 2010.

Table 2.4-1 Basic Railway Ridership Parameters, 2010

	LRT 1	LRT 2	MRT 3
Ave. Week Day Pax, 2010	497,279	194,456	487,668
Weekday-to-Annual Factor, 2010	313.5	325.8	314.0
Weekday-to-Annual Factor, Model Assumption	320		

Source: LRTA and DOTC/Metrostar Express

3) OD Matrix

Present OD matrix was updated to the year of 2010, considering growth of population, employment and student population of MMUTIS study area. **Table 2.4-2** shows socio economic indicators of study area.

Table 2.4-2 Growth Rate of Socio Economic Indicators

Indicators	Period	Annual Growth Rate
Population	1996-2007	Metro Manila: 2.41% Adjoining Area: 3.77%
Employment	1996-2007	2.92%
Student Population	2002-2007	-0.54%

Source: Study Team

4) Validation of Present Transport Demand Forecast

To test the reliability of transport demand forecast model, present passengers of LRT and other public transport are estimated and compared to actual passengers. The calibration was conducted on both OD matrix and parameters for traffic assignment, to be acceptable comparing to observed value. The GEH[1] statistics were applied for measurement of distance between estimated value and observed value. The GEH statistics is given as:

$$GEH = \sqrt{\frac{2(M-C)^2}{M+C}}$$

Where: M = modeled hourly traffic volume; and
C = observed hourly traffic volume.

For individual link flow, GEH values less than five (5) are considered to be good fit, while those between 5 and 10 are considered acceptable.

Table 2.4-3 shows observed passenger volume (OBS) and model calculated passenger volume (MOD) in 2010, and GEH statistics. GEHs indicate that transport demand forecast model is acceptable. **Figure 2.4-2** shows comparison OBS and MOD, which also shows model was adequate.

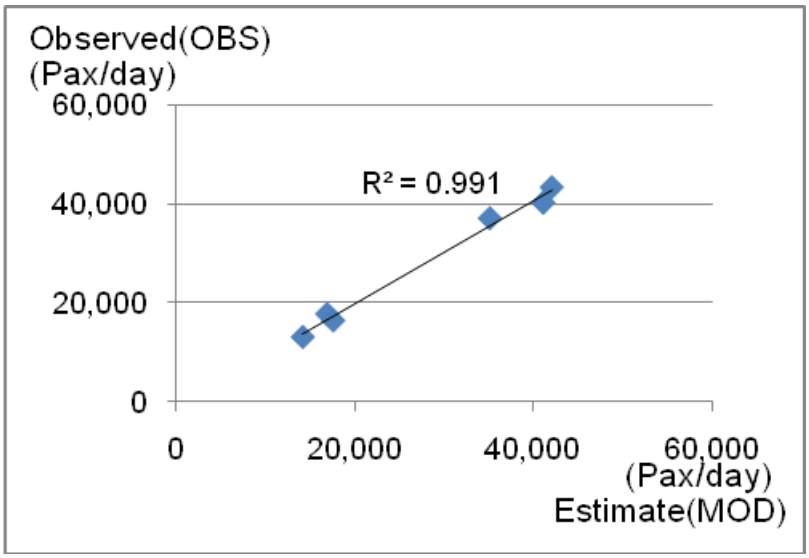
Table 2.4-3 Model Validation

	Daily Passenger Volume		Peak-Hour Factor	Hourly Passenger Volume		GEH
	MOD	OBS		MOD	OBS	
LRT						
LRT 1	508,038	497,279	0.081	41,151	40,280	4.1
LRT 2	185,614	194,456	0.091	16,891	17,695	5.9
MRT 3	473,194	487,668	0.089	42,114	43,402	6.3
Road Public Trasnport						
Taft Avenue (PGH)	224,728	206,405	0.063	14,158	13,004	9.1
R Magsaysay Blvd (Pureza)	247,499	230,353	0.071	17,572	16,355	8.6

MOD: Modeled Passenger Volume, OBS: Observed Passenger Volume

Source: Observed data based on LRT/MRT Ridership Statistics, 2010

[1] *GEH statistic is a formula used in traffic engineering, traffic forecasting, and traffic modeling to compare two sets of hourly traffic volumes. It is an empirical formula that has proven useful for a variety of traffic and transport planning analysis purposes. The use of GEH as an acceptance criterion for travel demand forecasting models is recognized in the UK Highways Agency's Design Manual for Roads and Bridges (DMRB) and other references.*

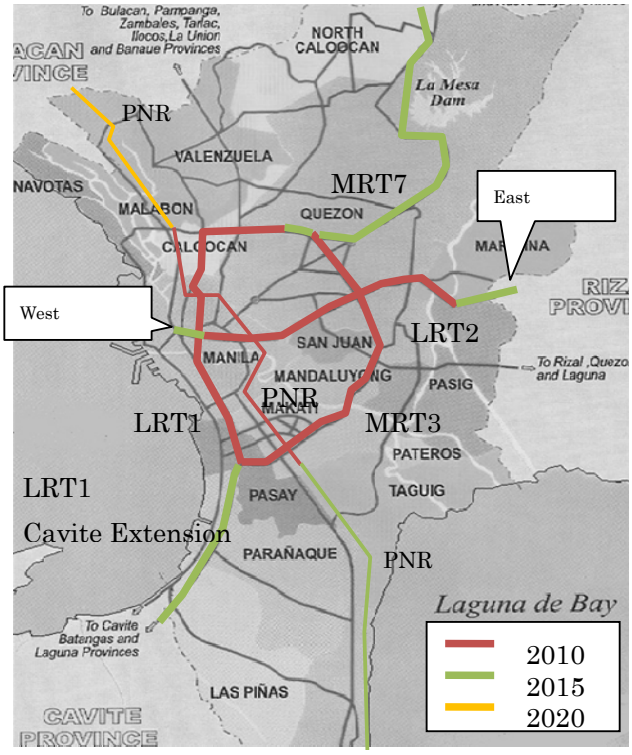


Source: Study Team

Figure 2.4-2 Comparison between Observed and Estimated Passenger Volume

5) Future Network

The Metro Manila transport infrastructure development plan was taken from the NEDA Board-approved Comprehensive Integrated Infrastructure Program (2009-2013), with the likely completion dates of major mass transit and highway projects confirmed through discussions with NEDA, DOTC and LRTA. The future public transit network is indicated as shown in **Figure 2.4-3**. MRT 8 which was in the list of PPP projects in transportation of CIIP, was not included in the future network for traffic forecast because it is not clear the implementation direction of DOTC.



Year	Transit Network	Status	Supposed Opening Year
2015	LRT North Extension	Ongoing	2011
	LRT Line 1 Cavite Extension	Ongoing	2015
	LRT Line 2 East Extension	Case 1	2015
	LRT Line 2 West Extension	Case 1&2	2015
	MRT Line 7	Ongoing	2014
	PNR Northrail-Southrail Linkage, Phase 1 (Caloocan to Alabang)	Ongoing	2011
	PNR Northrail-Southrail Linkage, Phase 2 (Alabang to Calamba)	Ongoing	2014
2020	Northrail Phase 1, Sections 1 and up to Clark International Airport)	Planning	2020

Source: Study Team

Figure 2.4-3 Present and Future Network for Demand Forecast

6) Model Parameters

a) Value of Time

The value of time was estimated on the basis of the "living wage" for Metro Manila residents of PhP114.62 per hour and 1.91 pesos/min. Living wage is the amount of family income needed to provide the family's food and non-food expenditures.

b) Fare Structure

For the required model runs, the recently approved common fare for LRT lines of PhP 11 boarding + 1.0 per kilometer (2010 price level) was used. Other public transport fares were based on current 2010 levels, at constant prices.

7) Result of Demand Forecast

The results of demand forecast are shown in **Tables 2.4-4** and **2.4-5** and **Figures 2.4-4** and **2.4-5.**

Table 2.4-4 Demand Forecast Result of LRT Line 2 Extension

Year 2015	Case 0 Without	Case 1 East	Incremental (W-WO)	Case 2 East & West	Incremental (W-WO)
Ave. Peak Hour Pax (2-way)	17,706	27,186		28,726	
Ave. Week-Day Pax	218,593	335,625	117,032	354,640	136,047
Total Pax-Km/Day	1,525,778	2,752,123	1,226,346	3,010,892	1,485,114
Pax Trip Length, km	6.98	8.2	1.22	8.49	1.51
Ave. Fare/Pax, PhP	17.98	19.2		19.49	
Daily Fare Revenue, PhP	3,930,299	6,443,996	2,513,698	6,911,930	2,981,631
Annual Fare Revenue, PhP	1,257,695,578	2,062,078,818	804,383,240	2,211,817,505	954,121,927

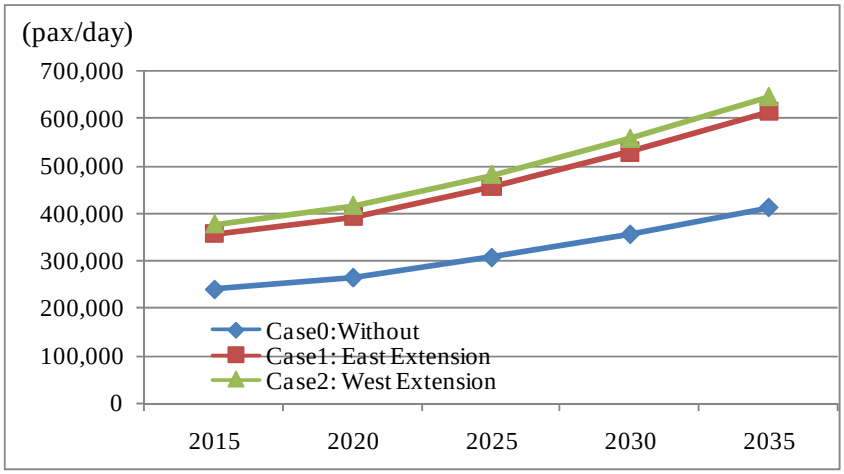
Year 2020	Case 0 Without	Case 1 East	Incremental (W-WO)	Case 2 East & West	Incremental (W-WO)
Ave. Peak Hour Pax (2-way)	19,549	30,015		31,716	
Ave. Week-Day Pax	241,344	370,557	129,213	391,551	150,207
Total Pax-Km/Day	1,684,582	3,038,567	1,353,985	3,324,268	1,639,686
Pax Trip Length, km	6.98	8.2	1.22	8.49	1.51
Ave. Fare/Pax, PhP	17.98	19.2		19.49	
Daily Fare Revenue, PhP	4,339,367	7,114,693	2,775,325	7,631,329	3,291,962
Annual Fare Revenue, PhP	1,388,597,544	2,276,701,637	888,104,094	2,442,025,247	1,053,427,704

Year 2025	Case 0 Without	Case 1 East	Incremental (W-WO)	Case 2 East & West	Incremental (W-WO)
Ave. Peak Hour Pax (2-way)	22,663	34,796		36,767	
Ave. Week-Day Pax	279,784	429,577	149,793	453,915	174,131
Total Pax-Km/Day	1,952,892	3,522,532	1,569,639	3,853,738	1,900,845
Pax Trip Length, km	6.98	8.2	1.22	8.49	1.51
Ave. Fare/Pax, PhP	17.98	19.2		19.49	
Daily Fare Revenue, PhP	5,030,516	8,247,879	3,217,363	8,846,802	3,816,286
Annual Fare Revenue, PhP	1,609,765,132	2,639,321,183	1,029,556,051	2,830,976,558	1,221,211,426

Year 2030	Case 0 Without	Case 1 East	Incremental (W-WO)	Case 2 East & West	Incremental (W-WO)
Ave. Peak Hour Pax (2-way)	26,272	40,338		42,623	
Ave. Week-Day Pax	324,346	497,997	173,651	526,212	201,865
Total Pax-Km/Day	2,263,937	4,083,579	1,819,642	4,467,538	2,203,601
Pax Trip Length, km	6.98	8.2	1.22	8.49	1.51
Ave. Fare/Pax, PhP	17.98	19.2		19.49	
Daily Fare Revenue, PhP	5,831,747	9,561,552	3,729,805	10,255,868	4,424,121
Annual Fare Revenue, PhP	1,866,158,983	3,059,696,621	1,193,537,638	3,281,877,728	1,415,718,745

Year 2030	Case 0 Without	Case 1 East	Incremental (W-WO)	Case 2 East & West	Incremental (W-WO)
Ave. Peak Hour Pax (2-way)	30,457	46,763		49,412	
Ave. Week-Day Pax	376,006	577,316	201,309	610,024	234,017
Total Pax-Km/Day	2,624,524	4,733,988	2,109,464	5,179,101	2,554,577
Pax Trip Length, km	6.98	8.2	1.22	8.49	1.51
Ave. Fare/Pax, PhP	17.98	19.2		19.49	
Daily Fare Revenue, PhP	6,760,593	11,084,459	4,323,866	11,889,362	5,128,769
Annual Fare Revenue, PhP	2,163,389,728	3,547,026,968	1,383,637,241	3,804,595,765	1,641,206,038

Source: Study Team



Source: Study Team

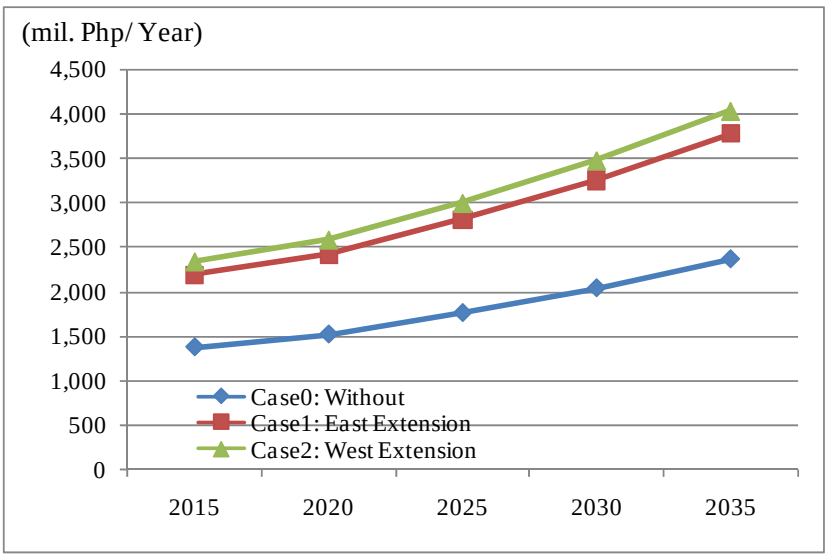
Figure 2.4-4 Average Week Day Demand per Year

Table 2.4-5 Average Week Day Demand per Year of Entire Line 2

Total Passengers/day

Year	Case 0 Without	Case 1 East	Case 2 East & West
2015	218,593	335,625	354,640
2016	222,965	342,337	361,733
2017	227,424	349,184	368,967
2018	231,972	356,168	376,347
2019	236,612	363,291	383,874
2020	241,344	370,557	391,551
2021	248,584	381,674	403,298
2022	256,042	393,124	415,396
2023	263,723	404,918	427,858
2024	271,635	417,065	440,694
2025	279,784	429,577	453,915
2026	288,178	442,464	467,532
2027	296,823	455,738	481,558
2028	305,728	469,410	496,005
2029	314,899	483,493	510,885
2030	324,346	497,997	526,212
2031	334,077	512,937	541,998
2032	344,099	528,326	558,258
2033	354,422	544,175	575,006
2034	365,055	560,501	592,256
2035	376,006	577,316	610,024

Source: Study Team



Source: Study Team

Figure 2.4-5 Annual Revenue for Line 2

CHAPTER 3

DEVELOPMENT OF PROJECT PLAN

CHAPTER 3 DEVELOPMENT OF PROJECT PLAN

3.1 Review of Standards and Specifications of Existing Railway Facilities and Systems

3.1.1 Railway Civil Engineering and Facilities

1) Existing Design and Construction Standards

Railway civil engineering facilities under LRTA are designed and constructed in accordance with international standards and applicable local codes, regulations, standards and requirements of local statutory authorities and agencies. The LRTA does not have a policy of enforcing particular international standards and such standards are set on a project by project basis.

For the most recent project implemented by the LRTA, the LRT Line 1 North Extension Project, the standards referenced in the Bidding Documents for the Viaduct and Stations are presented in **Table 3.1-1**.

The American Railway Engineering and Maintenance-of-Way Association (AREMA) was formed on October 1, 1997, as the result of a merger of three engineering support associations, namely the American Railway Bridge and Building Association, the American Railway Engineering Association (AREA) and the Roadmaster's and Maintenance of Way Association, along with functions of the Communications and Signals Division of the Association of American Railroads. The AREMA Manual for Railway Engineering contains principles, data, specifications, plans and economics pertaining to the engineering, design and construction of the fixed plant of railways (except signals and communications) and allied services and facilities. The AREMA Manual recommended practices for the design, construction and maintenance of railway infrastructure are requirements in the United States and Canada. The AREMA Manual is divided into four volumes namely: Volume 1 Track, Volume 2 Structures, Volume 3 Infrastructure and Passenger, and Volume 4 Systems Management.

The U.S. Naval Facilities Engineering Command (NAVFAC), Design Manual (DM-7) is published in two parts, namely DM-7.01, Soil Mechanics, and DM-7.02, Foundations and Earth Structures. The NAVFAC DM-7 is an international reference for geotechnical engineering.

The Structural Engineers of California (SEAOC) developed the Recommended Lateral Force Requirements, also known as the Blue Book, to recommend seismic provisions for incorporation into building code regulations, including the Uniform Building Code (UBC). The Blue Book and the UBC seismic provisions have been recognized throughout the world as leading references for the design of earthquake resistant buildings.

The National Structural Code of the Philippines (NSCP), Vol. II, 1997 Edition is for the design of bridges and is published by the Association of Structural Engineers of the Philippines (ASEP). The NCSP, Vol. II, is based on the AASHTO Standard Specifications for Highway Bridges and the AASHTO Seismic Design Guidelines for Highway Bridges.

The DPWH Design Guidelines, Criteria and Standards, Vol. I-III, are based primarily on (i) A Policy on Geometric Design of Highways and Streets, AASHTO, 1994, (ii) Highway Drainage Guidelines, AASHTO, 1992 and (iii) AASHTO Interim Guide for Design of Pavement Structures.

The DPWH Standard Specifications, Vol. I-II, are based on the equivalent AASHTO specifications for highway and bridge construction.

The International Electrotechnical Commission (IEC) is a non-profit, non-governmental international standards organization that prepares and publishes International Standards for all electrical, electronic and related technologies. The IEC cooperates closely with the International Organization for

Standardization (ISO) and the International Telecommunication Union (ITU). IEC standards are being adopted as harmonized standards by several certifying bodies internationally.

Table 3.1-1 Railway Civil Engineering and Facilities – Standards Imposed by LRTA

1.	AASHTO, Standard Specification for Highway Bridges
2.	AASHTO, Guide specification for Design and Construction of Segmental Bridges
3.	AASHTO, LRFD Bridge Design Specifications and its Interim
4.	ACI 358 IR – (Latest Edition) – Analysis and Design of Reinforced and Prestressed Concrete Guideway Structures
5.	ACI, Analysis and Design of Reinforced Concrete Bridge Structures
6.	ACI 318, Building Code Requirements for Reinforced Concrete and Commentary
7.	ACI, Specifications for Structural Concrete for Buildings
8.	AISC, Manual of Steel Construction
9.	AREMA, American Railway Engineering and Maintenance of Way Association Manual for Railway Engineering
10.	ASCE, American National Standards
11.	ASTM, American Society for Testing and Materials Standards
12.	AWS, Bridge Welding Code
13.	AWS, Structural Welding Code
14.	AWS, Structural Welding Code – Reinforcing Steel
15.	Uniform Building Code (Latest Edition) Vol. I, II and III
16.	International Union of Railways, UIC Code
17.	U.S. Naval Facilities Engineering Command, Design Manual (DM-7)
18.	SEAOC, "Recommended Lateral Force Requirements and Tentative Commentary"
19.	The National Building Code of the Philippines
20.	The National Structural Code of the Philippines, Vol. II, 1997 Edition
21.	The DPWH Design Guidelines, Criteria and Standards, Vol. I-III
22.	The DPWH Standard Specifications, Vol. I-II.
23.	IEC Standards for indoor and outdoor electrical installations
24.	National Plumbing Code of the Philippines
25.	Code on Sanitation of the Philippines
26.	Fire Code of the Philippines
27.	NFPA 130, Standard for Fixed Guideway Transit and Passenger Rail Systems

Notes: *AASHTO: American Association of State Highway and Transportation Officials*
ACI: American Concrete Institute
AISC: American Institute of Steel Construction
AREMA: American Railway Engineering and Maintenance of Way Association
ASCE: American Society of Civil Engineers
ASTM: American Society for Testing and Materials
AWS: American Welding Society
SEAOC: Structural Engineers Association of California
DPWH: Department of Public Works and Highways
IEC: International Electrotechnical Commission
NFPA: National Fire Protection Association (US)

Source: LRT Line 1 North Extension Project, Bidding Documents, LRTA

The National Fire Protection Association (NFPA) is a U.S. organization charged with creating and maintaining minimum standards and requirements for fire prevention and suppression activities, training, and equipment, as well as other life-safety codes and standards. The NFPA Standard for Fixed Guideway Transit and Passenger Rail Systems (NFPA 130) was first adopted in the USA in 1983 to establish fire safety standards specifically tailored for transit systems. The NFPA 130 Standard was developed to apply to all fixed guideway transit systems, including those that are automated, and covers at-grade, elevated, and underground systems. The NFPA 130 Standard governs facility design as well as operating equipment, hardware, and procedures. Prominent among the NFPA 130 requirements is the emergency egress element, which establishes emergency evacuation requirements for transit stations (passengers must be able to clear station platforms within 4 minutes and reach a point of safety within 6 minutes). Unlike the generally prescriptive egress provisions of model building codes, the NFPA 130

egress element offers a performance-based approach for determining egress requirements at transit stations. Additional requirements exist for the evacuation of trainways. With increasingly widespread application of the NFPA 130 Standard, its emergency egress provisions have become an important consideration in the planning and design of fixed guideway transit systems—particularly passenger stations. The NFPA 130 Standard is finding increasing application outside of North America. In Singapore, for instance, the Standard has been formally adopted as part of the building code. Cities where the NFPA 130 Standard was used as a guide in the design of transit systems include Hong Kong, China; Izmir, Turkey; Caracas, Venezuela; London, England; and Taipei, Taiwan.

2) Existing Line 2 Track Geometry Standards

The existing Line 2 track geometry standards were derived from the now superseded AREA (American Railway Engineering Association) Manual current at the time of the detailed design. The AREA Manual has now been replaced by the AREMA Manual. The track geometry standards of the existing Line 2 are presented in **Table 3.1-2**.

The minimum horizontal curve radius is determined by the physical characteristics of the vehicle and the operating speed of the track. The minimum radius is more severely affected by the distance between vehicle truck centers and truck axle spacing. On the existing LRT Line 2 project a minimum radius of 175m was adopted. Smaller radius curves have been used on other LRTA lines where track alignment is constrained by existing conditions. The curve radius of the newly constructed Line 1 NEP at the connection point with MRT Line 3 is 100m. The Track Design Handbook for Light Rail Transit, Transit Cooperative Research Program (TCRP) in the US, specifies a desirable minimum of 150m and an absolute minimum of 90m for LRT revenue track.

LRT alignment geometry differs from freight railroad (AREMA) design in that curves are generally defined by their radius rather than by degree of curvature. The minimum radius of 175m adopted on the existing LRT Line 2 project corresponds to a degree of curvature of 10 degrees.

The superelevation design of the existing LRT Line 2 trackwork is in accordance with established international standards. Main line tracks are designed with superelevations that permit desired design speeds to be achieved without resorting to excessively large curve radii. In practice, full equilibrium superelevation (Eq) is rarely installed in track. This would require excessively long spiral transition curves. It could also produce passenger discomfort on a train that is moving much slower than the design speed or stopped in the middle of a steeply superelevated curve. Therefore, only a portion of the calculated equilibrium superelevation (Eq) is commonly installed as actual superelevation (Ea). The difference between the equilibrium and actual superelevation is called superelevation unbalance or deficiency (Eu). Curves are therefore designed with some combination of actual and unbalanced superelevation.

Table 3.1-2 Existing Line 2 Track Geometry

Track Geometry Item	Criteria	Comment
Vertical Grade on Viaduct	Maximum 5%	Applied on section between Anonas and Katipunan Stations AREMA specifies for LRT a range of between 4% and 7% with a typical desirable maximum of 4%.
Vertical Grade in Elevated Stations	Maximum 0.35%	This is preferred maximum value. Applied only at Anonas and J. Ruiz Stations. All other elevated stations have 0% grade.
Vertical Grade in Underground Stations	Maximum 0.50%	This is absolute maximum value. Applied only at Katipunan Station.
Horizontal alignment – circular curve radius	R = 175m absolute minimum R = 250m desirable minimum	Absolute minimum value applied on the Recto – Legarda - Pureza section only. Elsewhere the desirable minimum value has been applied. The threshold circular curve radius for installation of check rail (restraining rail) is 300m.
Maximum superelevation	Eq=175mm (equilibrium) Ea=100mm (actual) Eu=75mm (unbalanced/deficiency)	These are maximum desirable values applicable to LRT systems. Absolute maximum values may be as high as 150mm for actual superelevation (Ea). The Federal Railroad Administration (FRA) in the USA mandates that unbalanced (deficiency) superelevation (Eu) shall not exceed 100mm.
Track Centers	4.4m on tangent and R $\geq$ 250m 4.5m for R = 210m 4.8m (max) for R = 175m	The track center spacing allows for catenary posts to be located centrally between the tracks. The larger track center values allow for mid car in-swing and end-of-car outswing on curves.
Design Speed (Maximum operating speed)	80kph on tangent 60kph for R = 250m 45kph for R = 175m	Scheduled speed on the existing line is 30kph based on the following speed regulations: 0 = 80kph maximum (tangent track) 1 = 60kph maximum (curved track R = 250m) 2 = 45kph maximum (curved track R = 175m) 3 = 30kph maximum (approach to stations)

Source : LRT Line 2, Final As-Built Drawings, Trackworks, March 2005, LRTA

3) Maintenance Standards

The LRTA have in place a regime of daily ocular inspections and foot patrols along the track, and have undertaken repairs on a case by case basis in the past. However, there is no formalized inspection and maintenance manual for LRTA civil infrastructure.

A Maintenance Plan for civil infrastructure has been prepared by the LRTA consultants undertaking the Line 1 Capacity Expansion Project and was issued in January 2009. Reference should be made to this Maintenance Plan and other suitable references in formalizing the LRTA infrastructure inspection and maintenance standards going forward.

3.1.2 The Issue of Existing Civil Structure

1) Lack of Parapet Railing on Viaduct

The existing Line 2 viaduct sections do not feature parapet rails on the external side of the viaduct.

The lack of guard rail on the external edge of the viaduct is not a derailment protection issue, rather an issue of passenger safety should the doors of a train be opened accidentally on the external side on the viaduct. LRTA have advised that this was not possible with the train in Automatic Train Operation (ATO) on the viaduct. However, accidental opening of train doors on the wrong side doors is possible while the train is in ATP (Automatic Train Protection) mode in the stations and has actually occurred at Santolan

but without incident. The incident was later managed by LRTA with a Public Relations exercise. At Santolan the island platform design means the outward facing doors on the train can open above the viaduct edge without any guardrail to prevent passenger falls. LRTA have already retrofitted protective caps over the buttons in the driver cab controlling door operation. Such caps will force a delayed action in the button press thereby giving the driver pause to press the correct button. It was noted that there should be no passengers on board the train in ATP mode.

With regard to passengers being able to manually open the doors themselves, for instance while the train is stalled on the viaduct as a result of power outage, remedial measures should be planned. Installation of parapet railing, or other suitable form of protection, should be considered in the design of the viaduct for the extension works. External railing protection, or other suitable form of protection, should not only be provided for the extension but also consideration should be given to retrofit railings, or effect other remedial measures, on the existing Line 2 viaduct structure.

2) Location of Cable Tray on Viaduct

The cable trays carrying power and communication cables are located in the central space between the Line 2 viaduct girders, hung beneath the central walkway panels. There are actually no major inspection or maintenance problems with the central location of the cable trays. The cables can only be inspected out of revenue hours since power has to be cut. Therefore, the central location of the trays is not a major issue. The only problem encountered has been, because the cables are relatively exposed on the cable trays, there has been a case where the cables were shot at from below with firearms by persons unknown.

3) Central Walkway on Viaduct

The central walkway on the Line 2 viaduct sections is relatively narrow (1500mm) and therefore, according to LRTA, during the foot patrols of maintenance staff along the viaduct (undertaking ocular inspections of the track and catenary) speed restrictions of 25kph have to be imposed on the train operations. Sufficient access/ walkway for maintenance personnel and for passenger egress in case of emergency should be considered in the design of the viaduct for the extensions.

4) Station Elevator and Escalator Issue

Many of the existing escalators in the Line 2 stations are currently out of service. The maintenance contracts on both the escalators and elevators have expired.

Of the total fifty eight (58) escalators, thirty eight (38) have been put under a repair contract under a special supplementary agreement. LRTA have prepared a TOR and have recently bid out the contract for the repair of the remaining twenty (20) escalators out of service and for the maintenance of all escalators. It is intended that a repair and maintenance contract for the escalators will be in place not later than the 3RD quarter of 2011.

Separate negotiations are taking place for the maintenance of the elevators with the elevator manufacturer, formerly LG, now taken over by OTIS.

An issue raised by LRTA is the ventilation of the equipment rooms for the escalators/elevators. These rooms have exhaust ventilation fans only, leading to high temperatures and burnt out motors. LRTA suggest that air-conditioning units should be installed in the machine rooms to control temperatures.

5) Flooding at Substations

The Line 2 Sub-station located at Betty Go is prone to flooding. LRTA have advised that due consideration should be given to flooding along Marcos Highway in locating any sub-stations.

6) Station Roof Design

The arched truss girders supporting the roofing at the Line 2 stations are difficult to clean and encourage bird nesting. LRTA have advised that alternative roof support systems should be investigated for the extensions. It was suggested to compare the roofing supports installed on Line 1 NEP as a good reference for an alternative configuration.

7) Station Lighting

The Manager, Line 2 Operations Department of the LRTA advised the Study Team that the lighting system at the Line 2 stations is problematic.

The current problem with the lighting is that all station areas are lit with only one switch at each station. Perimeter areas that could remain unlit during revenue operation have to be lit. There are no separate switches serving different station areas.

8) Waste Management Facility at the Depot

The Line 2 Depot does not feature a Waste Management Facility to separate and store hazardous waste materials and scrap materials for disposal, or materials with some residual value for sale. LRTA have requested that a study on a Waste Management Facility at the Depot should be made as part of this study.

In establishing the types of waste materials produced by the Line 2 operations the Study Team met with the Deputy Administrator for Administrative, Finance and AFCS, who acts as Head of the Waste Disposal Committee, the OIC of the Administrative Department, who acts as Vice Chairman of the Waste Disposal Committee and the Manager of the General Services Division at the Line 2 Depot.

The Study Team was taken on a tour of the waste products stockpiled at the Line 2 Depot. The waste products are stockpiled at various locations scattered across the Depot lot, including in the warehouse, in portable cabins and skips, and on unused ground uncovered and unprotected from the elements. The types of waste materials inspected are illustrated in **Photo 3.1-1**.

The type of Waste Disposal Facility required, according to the Manager of the General Services Division, is a large covered building, at least 300 sqm, with individual storage areas, separated by walls, featuring bins or skips that each can be dedicated to a particular form of waste, including hazardous waste for controlled disposal, waste products for re-sale, and other general waste products. The area reserved for the Waste Disposal Facility is located on hard standing located south and west of the wheel truing machine house close to the perimeter wall. Refer to **Photo 3.1-2** for a picture of the proposed site.

Batteries

Tires

Electrical Cables

Wheel Turning Metal Shavings

Empty Hydraulic Fluid Containers

Empty Aircon. Refrigerant Canisters

Broken Computer Equipment

Assorted Empty Bottles, Canisters and Cans

Source: Study Team

Photo 3.1-1 Waste Products Stored at LRT Line 2 Depot

Source: Study Team

Photo 3.1-2 Waste Products Stored at LRT Line 2 Depot

3.1.3 The Issue of Railway System

Throughout review of existing design documents and maintenance reports, and also through interviews with LRTA operation personnel and maintenance contractor personnel, the Study Team identified the following issues on the Line 2 system. Some of these issues are beyond the scope of work of this study but they should be taken into consideration when designing the new extension line in order to not repeat the same problems. Some other items are for reference only.

1) Abrasion of Rolling Stock Flange

The existing LRT Line 2 rolling stock is suffering from uneven wear or abrasion of the train wheel flanges. The uneven wearing of the wheel flanges is mainly attributed to the fact that the trains cannot be turned around on Line 2 and must run back and forth wearing the wheels on one side more than the other. This is because the depot design was changed during implementation because of ROW issues thereby preventing train turn around on a turning loop.

The impact of the lack of a turning loop on the uneven wear of the train wheel flanges should be verified and considered in the design of the extensions. All other factors affecting the uneven and rapid wearing of the wheel flanges should also be identified and considered.

2) Re-railing Machine

The re-railing machine supplied under the P1 Depot contract for LRT Line 2 serves to reset derailed train cars back onto the rails in the case of minor derailments. LRTA have never tried to use this machine on the viaduct (only used during a trial in the Depot) but it is considered that the apparatus will not fit between the parapet upstands of the box girder section.

The re-railing machine consists of a motorized track vehicle and a flat car carrying bridge rails and jack. According the to the Section Head of the General Repair and Maintenance Section (GRMS) of the Line 2 Depot, the bridge rails are too wide to fit within the space allowed on the viaduct between the parapet upstands and the jack is too heavy to transport other than on the flat car. The Section Head request has been for the supply of two portable hydraulic jacks with capacity of 60-90tonnes, a 20 liter hydraulic

pump and bridge rails with length to fit on the viaduct. This equipment could be more easily transported to a de-railed train on the viaduct.

3) Trackwork Support Plinths

The existing LRT Line 2 trackwork is mounted on direct fixation fasteners that are attached to concrete plinths. The rectilinear plinths allow the support of several direct fixation fasteners under a single rail. Periodic interruptions of the plinths allow cross track drainage. Short plinths are located over the piers, intermediate length plinths are located at each viaduct girder end, and longer plinths are distributed over the remaining length of the viaduct girders. Direct fixation is the standard method of construction for tracks on aerial structures and in tunnels.

An investigation of the trackwork support plinths was undertaken for LRTA in 2008. The investigating entity was the Consultant undertaking the LRT Line 1 Capacity Expansion Project (Capex) Phase II. LRTA requested the Capex Consultant to include a Line 2 track investigation in addition to the Line 1 Track investigation.

The plinth investigation found that the short and intermediate plinths located on sharp curve sections (R=175m) have become detached from the viaduct structure. Vibration measurements confirmed that the track support is stiffer at the short plinths over the piers than at the longer plinths located in span. In addition impacts due to train passages over the pier plinths are increased at curve sections. The investigation report, Report No. 1 LRT Line 2 Track Investigation, August 2008, recommended the replacement of all short plinths at piers and the repair of all intermediate plinths by applying epoxy injection. The report also recommended the installation of a resilient layer underneath the short plinths to reduce impact at each short plinth.

As of 2010 LRTA have repaired 100 plinths. The LRTA intend to undertake repairs of a further 43 damaged plinths, 26 short plinths and 17 intermediate plinths, commencing from this year 2011.

For the Line 2 Extension sections it may be necessary to review conventional design methods, and examine new methods of support to the plinths over the piers to provide a more gradual transition in track support stiffness, particularly for sharp curve sections.

4) Separation of Signaling and Telecommunication System

The transmission network of the signaling system between an Operation Control Center (OCC) and equipment at the site of the signaling system of LRT line 2 shares the fiber optical transmission line with the telecommunication systems such as telephone, clock and train radio systems. Therefore, the signaling information from OCC to the signaling equipment transfers by the synchronous digital hierarchy (SDH) of the telecommunication equipment room (TER).

In recent years, the signal trouble occurred frequently by failure of SDH and UPS (uninterruptible power-supply system). Although the cause of the troubles was not clarified, the troubles were solved by replacing of SDH and UPS. From now, in order to secure safe operation, the signaling system should be separated from the portion currently shared with the telecommunication system as a radical measure.

Furthermore, as for the emergency power source of the signaling system, it should be considered to adopt the Uninterruptible Power-supply System (UPS) which is exclusively used for the signaling system.

For these reasons, when LRT line 2 is extended, SDH and UPS which are exclusively used for the signaling system shall be installed in each signaling equipment rooms (SER) in whole section including existing and extension lines. The signaling system shall be completely separated from the telecommunication system. Also, the transmission network of the signaling system shall be separated

from the telecommunication system, and a new fiber optical transmission line will be installed.

5) Closed Circuit Television (CCTV)

Closed Circuit Television (CCTV) transmit the images to OCC in order to see the picture of each station and contribute to ensure safe train operation and passenger safety, etc. However, the transmissions from three stations under operation are aborted and the cause of this trouble is not clarified. It is said that the trouble was caused by poor power supply. Moreover, because of using VHS video recorder, the recording in OCC takes time and it is difficult to play back instantly. Meanwhile, relevant technologies such as DVD digital recorder, an instant replay and a multi display switch are advanced and more prolonged time recording can be performed by arranging the number of images per seconds and deleting the old images nowadays.

The latest CCTV system will be introduced for new stations and existing three stations of which transmission are failed. The CCTV of other stations will be renewed as needed such as deterioration, etc.

The existing fiber optical transmission line does not have excess line capacity to cover new stations. And the amount of information of image data compressed by MPEG4 format is heavy. Therefore, the fiber optical transmission line for new CCTV shall be newly installed as well as the signaling system.

6) Automatic fare collection system (AFC)

The existing fare collection system of LRT Line 2 is adopting magnetic tickets which can be purchased at ticket offices or at ticket vending machines and the system is compatible with LRT Line 1. The magnetic tickets can be repeatedly used 1000 times or for 6 to 12 months because the data on magnetic tickets can be rewrote by the encoder. However, as for the present AFC systems in the station of LRT line 2, a lot of ticket vending machines and automatic gates which are out of service because of failure can be seen.

Department of Transportation and Communications (DOTC) is now promoting the plan of the common ticketing system (CTS) in Metro Manila. According to the plan, CTS will be introduced under the BOT scheme of which private sector participate. Therefore, the contact-less smart card should be introduced for the line to realize smooth transfer to other lines. In an initial stage, the smart card will be used only for the railway but it will be able to use for multipurpose use in future. In addition, the operation and maintenance of AFC will be transferred to and handled by the provider of CTS.

The bidding for the implementation of the Common Ticketing system for all lines in Metro Manila is scheduled for late 2011. Therefore, CTS shall be gradually introduced by reusing the existing automatic gates with new contactless card read-write module and turnstile interface. Accordingly, the cost of introducing AFC in the new LRT line 2 extension will be discarded from our study, as well as the maintenance cost.

7) Fiber Optical Transmission Line

The existing fiber optical transmission pass is divided broadly into that of telecommunication system and that of CCTV. The capacities of the transmission line of CCTV has reached maximum mostly. From now, new fiber optical transmission pass will be required because increasing of the amount of transferring data is estimated by addition of new stations and the conversion from analog to digital.

Furthermore, when the signaling and the telecommunication system are separated as mentioned above, a fiber optical transmissions line for exclusive use for the signaling system shall be newly installed.

8) Electronics card and Software

Unavailable cards and software have not been identified by interview survey. Therefore, as for the electronics card and software, which are newly installed when LRT line 2 is extended, the contract agreement with the manufacturers should be included the condition that the software can be utilized all the time when necessary.

9) Telephone System

In an interview with the operation staffs of LRTA, it was reported that the number of telephone sets in each station is currently satisfied.

The telephone systems for new stations are planned based on the existing specification. With regard to the capacity of the private branch automatic exchange equipment (PABX), expansion is taken into account since the increasing of future demand is being proposed.

10) Train Radio System

Existing train radio system uses TAIT's analog radio system. LRTA is planning the replacement to TETRA system to satisfy the unified radio system future implementation of this system in other lines, and more user friendly system from TAIT system in the future. While the existing system will be replaced by new system, the existing facilities have to be used under the existing systems for the time being.

11) Overhead contact system (OCS)

In the previous METI study, uneven wear on the contact strip of pantograph was pointed out from LRTA. The deviation of zigzag arrangement should be calculated again and be modified by adjustment of the contact wire stagger. On the design of the extension line, the deviation limit and the uniform contact of pantograph should be fully considered.

3.2 Geotechnical Survey

3.2.1 Geology in Metro Manila

Metropolitan Manila is located in the Central Valley in Luzon Island which is sandwiched between the Zambales range in the east and the Sierra Madre range in the west. The topography of Metro Manila can be classified into three zones namely; (1) the Coastal Lowland along Manila Bay, (2) the Central Plateau and (3) Marikina Plain. The surface geology of the Central Plateau consists of Tertiary deposits of the Guadeloupe Tuff formation. On the other hand, the Coastal Lowland and the Marikina Plain mainly consist of Quaternary alluvium deposits. The Marikina Plain is a pull-apart basin, and is delineated by the East Valley fault and the West Valley fault. The surface geology and active faults in Metropolitan Manila are presented in **Figure 3.2-1.**

The East Extension is located in the Marikina Plain and the West Extension is located in the Coastal Lowland.

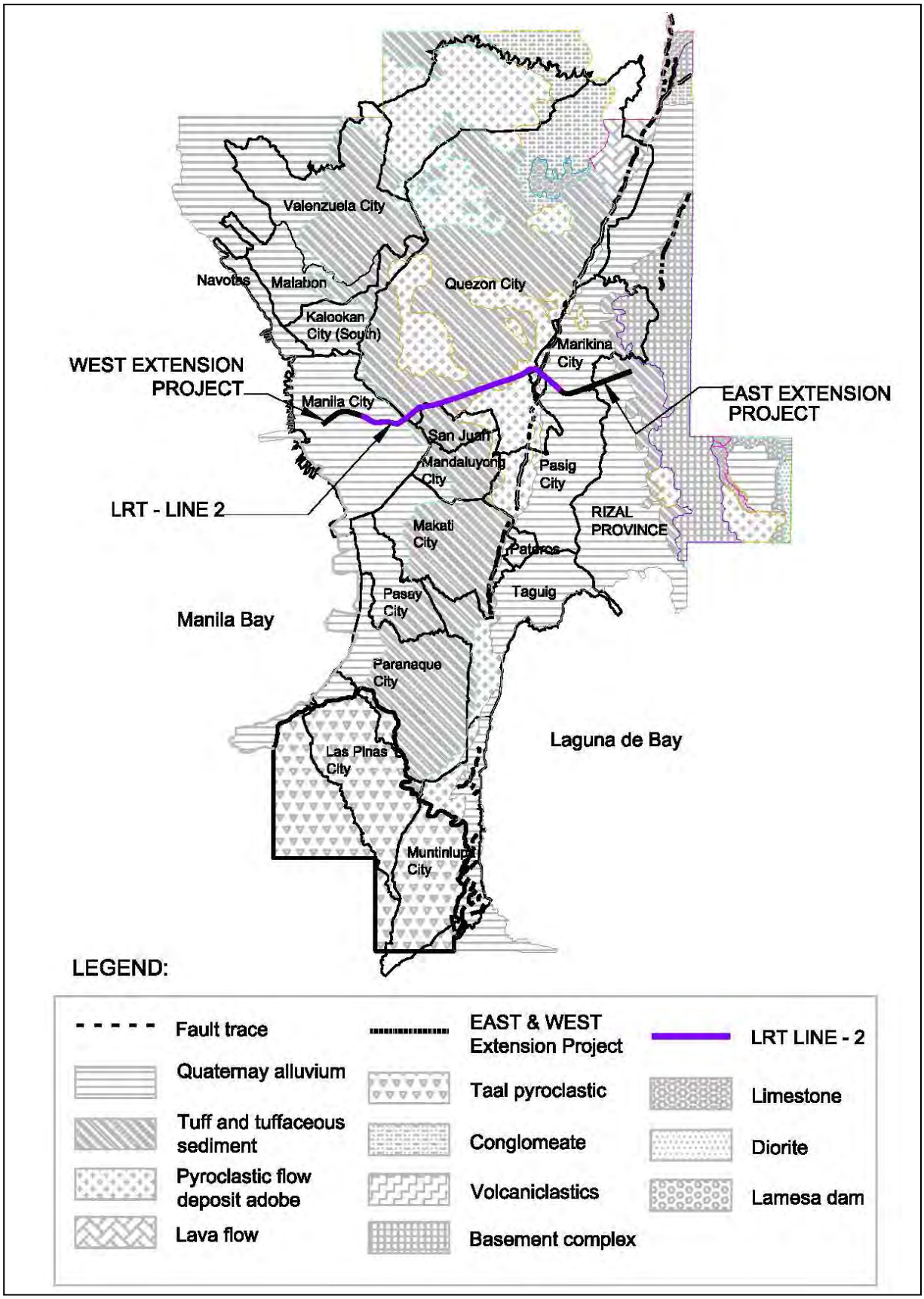
Numerous earthquake generators, such as the Valley Fault System, Philippine Fault, Lubang Fault, Manila Trench, and Casiguran Fault, are located in and around Metropolitan Manila. Among these faults, the Valley Fault System is considered to potentially cause the largest impact to the Metropolitan Manila area should it generate a large maximum earthquake.

Recent studies show that the West Valley Fault has moved at least 4 times and generated strong

earthquakes within the last 1,400 years. The approximate return period of these earthquakes is less than 500 years and no event along the West Valley Fault is known after 17th century. This means that the active phases of the Valley Fault are approaching. Many research studies indicate that the estimated magnitude will be around 7 or more.

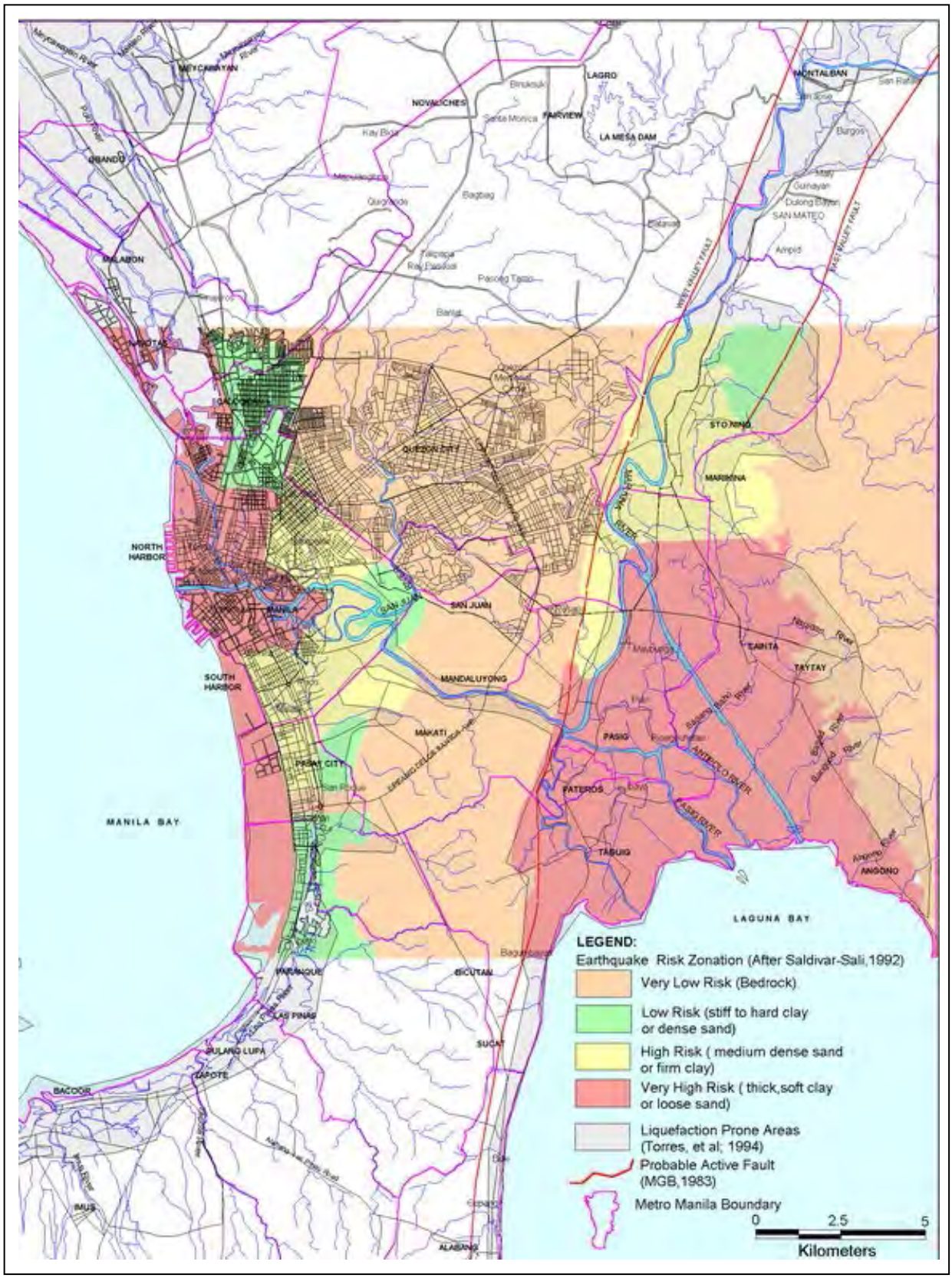
A Study for Earthquake Impact Reduction for Metropolitan Manila (MMEIRS) was undertaken in 2004 with JICA as the Implementation Agency and both Metropolitan Manila Development Authority (MMDA) and Philippine Institute of Volcanology and Seismology (PHIVOLCS) as Counterpart Agencies. The aim of the study among others was to develop a national system resistant to earthquake impact and to improve Metropolitan Manila's urban structure to be resistant to earthquakes. The West Valley fault earthquake scenario postulated in the study indicated that there would be severe damage in Metropolitan Manila as a result of a magnitude 7 earthquake. Refer to **Figure 3.2-2** for an Earthquake Risk Map of Metro Manila prepared by the MMEIRS study. According to the risk map, both the East Extension and the West Extension are in High Risk to Very High Risk areas.

Refer to **Figure 3.2-3** for a location map of the West Valley Fault in the vicinity of the East Extension site.



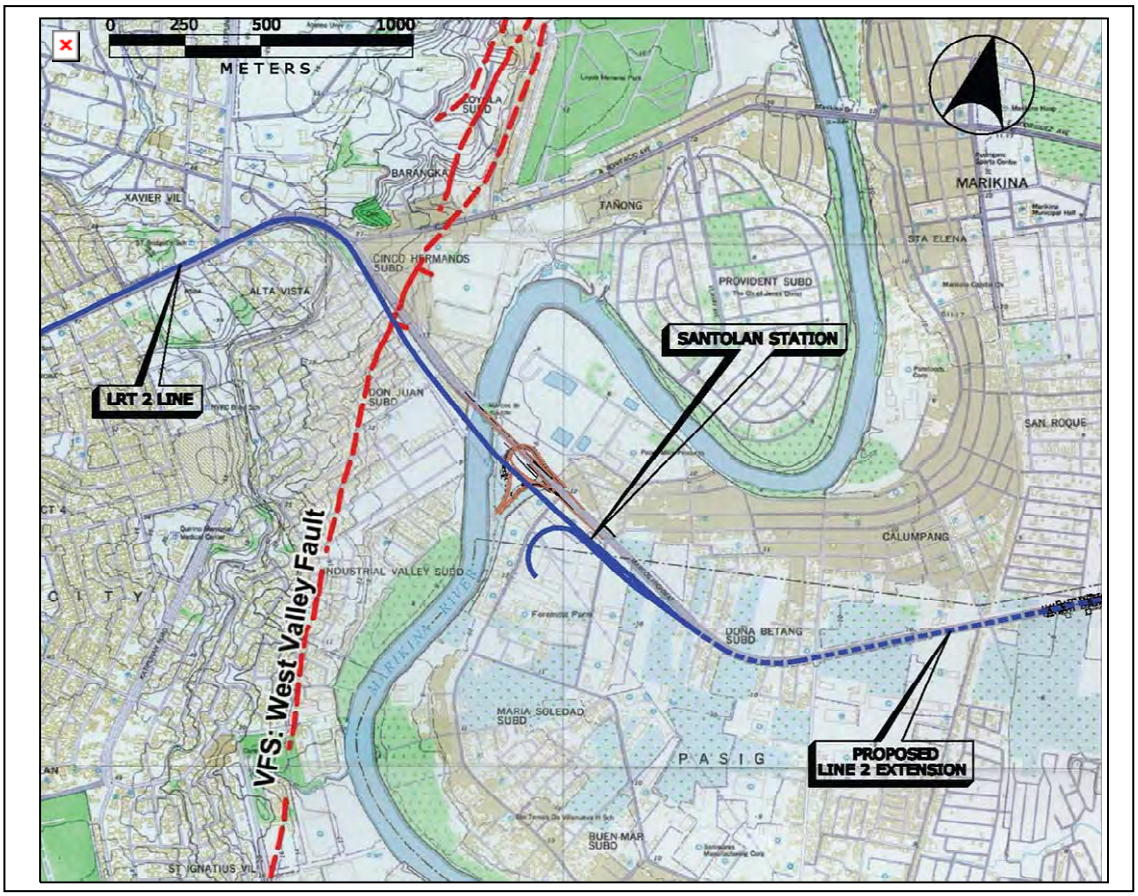
Source for surface geology and active faults: PHIVOLCS, DOST

Figure 3.2-1 Surface Geology and Active Faults in Metropolitan Manila



Source: MMEIRS

Figure 3.2-2 Metro Manila Earthquake Risk Map



Source: METI Study 2009

Figure 3.2-3 West Valley Fault - Marikina

3.2.2 Geology in Metro Manila

A geotechnical investigation was undertaken in 2004 along Marcos Highway. The investigation comprised the drilling of twenty (20) boreholes with SPT's and laboratory tests on disturbed and undisturbed soil samples. The boreholes were located mostly along the centerline of Marcos Highway from the end of the existing LRT Line 2 guideway to Masinag.

The Study Team obtained permission, from the drilling company who undertook the geotechnical investigation, to make use of the results of the soil survey in this Study.

For the East Extension, soil conditions comprise sediments overlying the Guadalupe Tuff formation (GTF). The Guadalupe Tuff formation consists of beds of tuffaceous sandstone, siltstone and shale. The sediments comprise medium dense to very dense sand and soft to stiff clay. Bedrock is encountered at depths ranging from 30m near Emerald Station to as shallow as 10m at Masinag. The soil conditions encountered along the proposed route of the LRT Line 2 East Extension are presented in **Figure 3.2-4**. Deep foundations comprised of bored piles will be required for the East Extension. The liquefaction potential along the site is assumed to be not significant.

Design Ground Acceleration and Soil Profile

To take account of the proximity of the West Valley Fault to the project site, a ground motion attenuation relation was assumed, after Fukishima and Tanaka, namely:

$$log_{10}A = 0.42 \times M_W - \log_{10}\left(R + 0.025 \times 10^{0.42 M_W}\right) - 0.0033 \times R + 1.22$$

(*Source: Yoshimitsu Fukushima and Teiji Tanaka, 1990, A New Attenuation Relation for Peak Horizontal Acceleration of Strong Earthquake Ground Motion in Japan, Bull. Seism. Soc. Am., Vol. 80, No. 4, 757-783.*)

Where:

A = the mean of the peak ground acceleration (cm/s^2)
M_W = Moment Magnitude
R = shortest distance between the site and fault rupture (km)

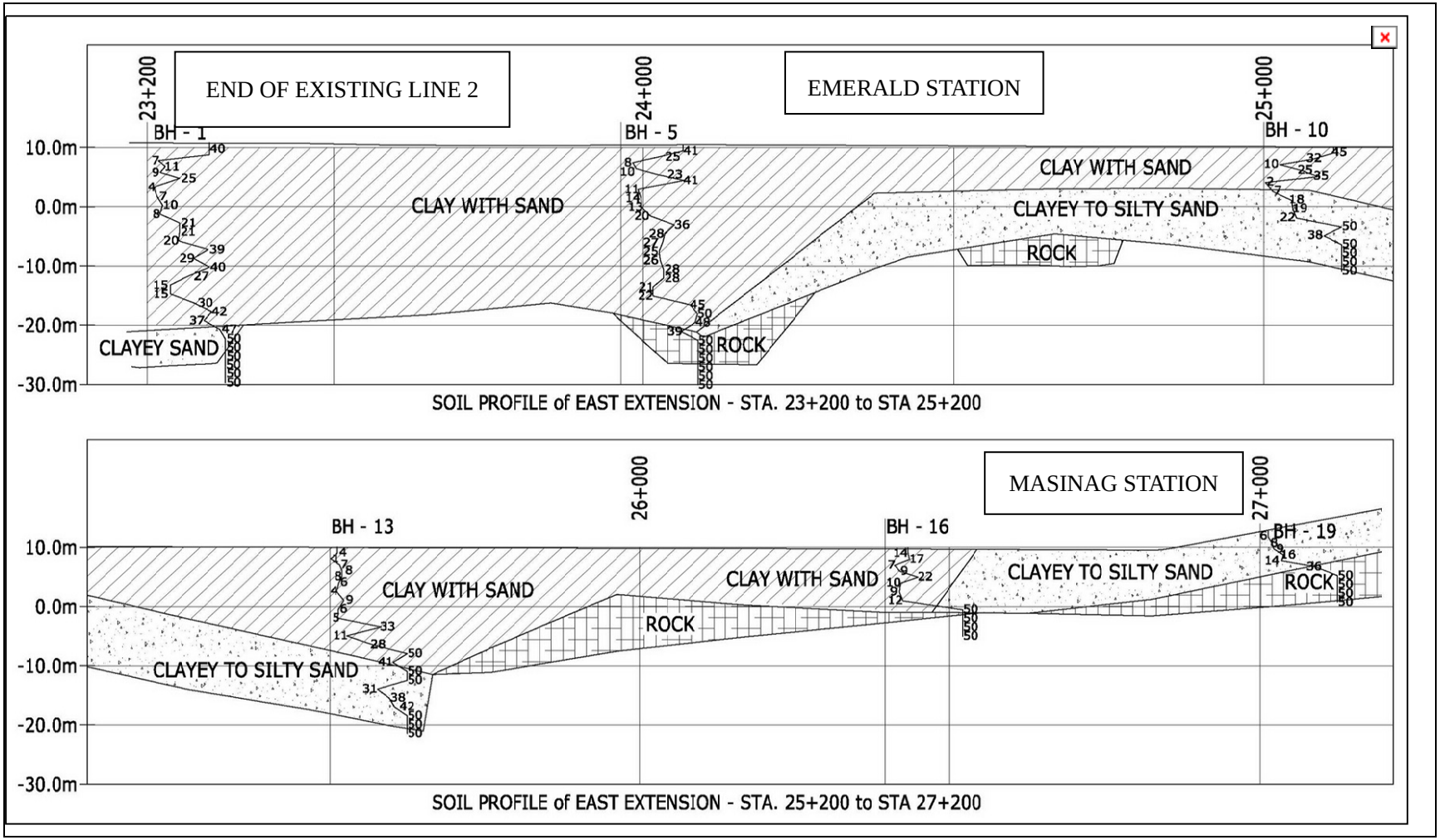
Assuming a magnitude 7 earthquake, the mean peak acceleration at varying distances from the West Valley Fault , derived using the Fukushima and Tanaka attenuation formula, is given below:

Distance from fault rupture, R	1km	2km	4km	10km
Mean Peak Ground Acceleration, A	0.64g	0.61g	0.55g	0.43g

The effects of site condition on structure response is determined from the use of a site coefficient, based on soil profile type, per the requirements of the National Structural Code of the Philippines (NSCP), Vol II – Bridges. The soil conditions along the East Extension correspond to Soil Profile Type I (stiff soil conditions where the soil depth is less than 60m).

The following are therefore recommended in undertaking an outline design of the East Extension:

- Acceleration Coefficient (A/g) = 0.5 to 0.6 (depending on distance from the fault)
- Site Coefficient, S = 1.0 (based on NSCP provisions for Soil Profile Type I)



Source: METI Study 2009

Figure 3.2-4 Soil Profile - East Extension

3.2.3 Geotechnical Investigation for the LRT Line 2 West Extension Project

A geotechnical investigation was undertaken for this Study along Recto Avenue. The investigation comprised the drilling of six (6) boreholes with SPT's and laboratory tests on disturbed and undisturbed soil samples. The boreholes were located mostly along the centerline of Recto Avenue from the end of the existing LRT Line 2 guideway to Divisoria.

For the West Extension, soil conditions comprise sediments overlying the Guadalupe Tuff formation (GTF). The sediments comprise shallow deposits of loose to very dense silty sand overlying deep deposits of mostly very soft to soft silty clay, with lower lenses of stiff to hard clayey silt. Hard or very dense bearing layers are encountered at depths ranging from 33m near Divisoria Station to 25m along Recto Avenue at the location of the existing Line 2 structure. The soil conditions encountered along the proposed route of the LRT Line 2 West Extension are presented in **Figure 3.2-5**.

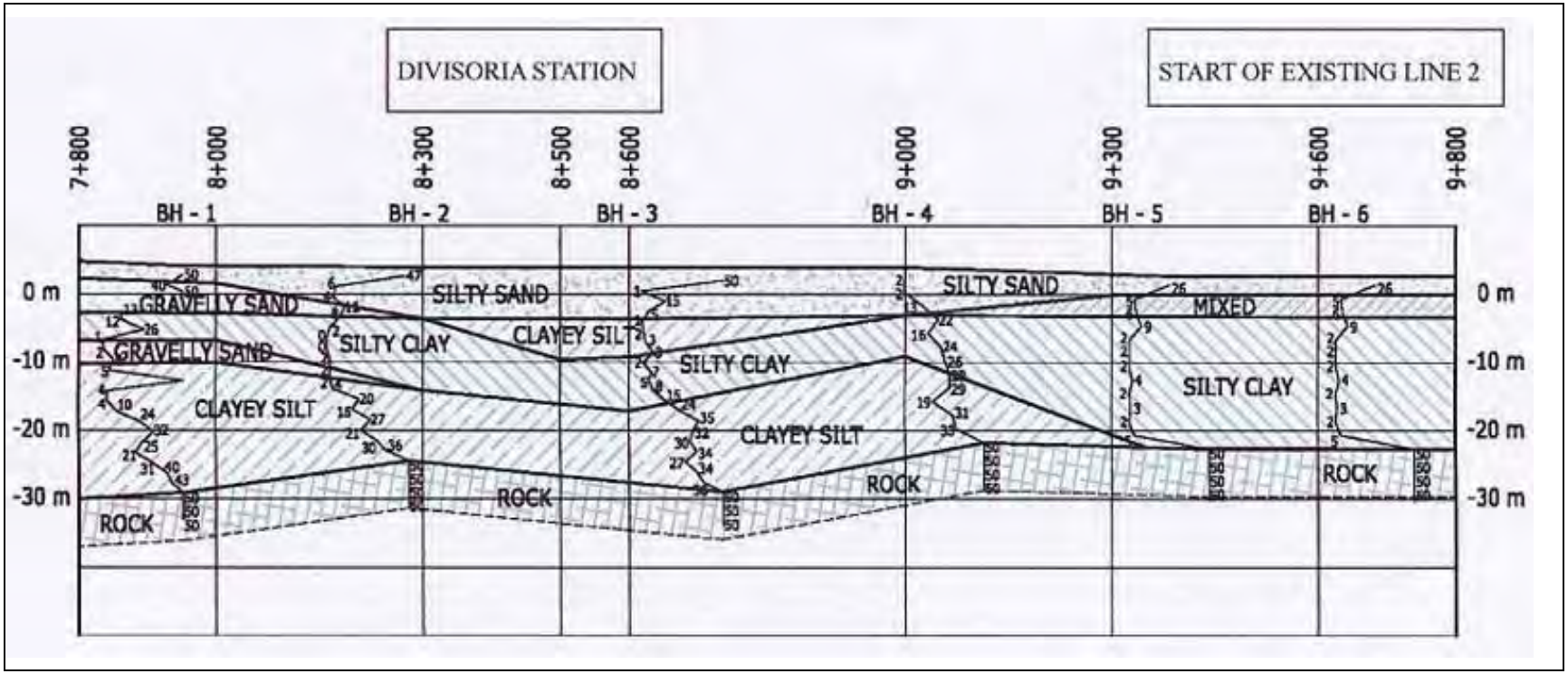
Deep foundations comprised of bored piles will be required for the West Extension. Given the presence of loose sand the Study team undertook an analysis of the liquefaction potential for the top 20m depth of the soils encountered in the investigation. It was found that liquefaction does occur at shallow depth in the narrow bands of loose sands under design earthquake conditions. The foundation design adopted for the West extension, pile caps supported on pile groups, is however very robust in transmitting forces into the sub-soils, even with complete loss of strength in the loose sands just beneath the pile cap base. The liquefaction potential along the site is therefore not considered to be significant for the foundation design.

Design Ground Acceleration and Soil Profile
The site is located more than 10km from the West Valley Fault. At such distance from the fault the ground accelerations in rock from a magnitude 7 earthquake, based on the Fukushima and Tanaka attenuation formula, will have subsided to below the minimum value required to be applied by the NSCP.

The soil conditions along the West Extension correspond to Soil Profile Type III (soft to medium stiff soils more than 10 deep).

The following are therefore recommended in undertaking an outline design of the West Extension:

- Acceleration Coefficient (A/g) = 0.4 (minimum value allowed based on NSCP provisions)
- Site Coefficient, S = 1.5 (based on NSCP provisions for Soil Profile Type III)

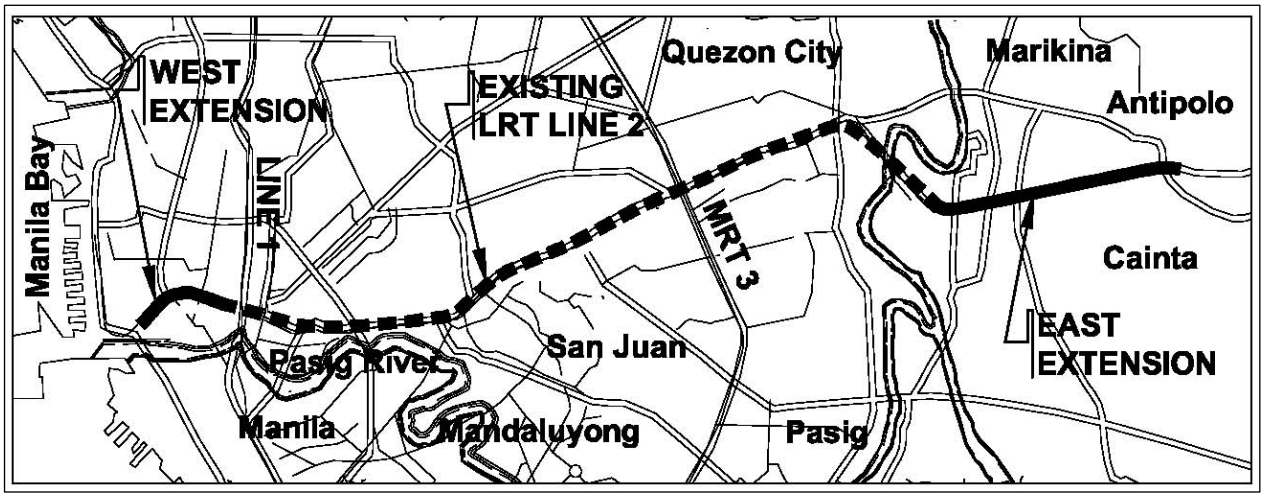


Source: Study Team

Figure 3.2-5 Soil Profile - East Extension

3.3 Route Planning

The existing route of LRT Line 2 primarily occupies the existing road center line reserves with elevated viaduct. The existing route is 13.8km long and features 11 stations. The route runs from Recto Avenue in Manila City, passing along Legarda, Ramon Magsaysay Boulevard and Aurora Boulevard, before turning onto Marcos Highway in Marikina City to terminate at Santolan. The route passes above the LRT Line 1 at Recto and the MRT Line 3 at Cubao. The route goes underground for a short section and features one (1) underground station at Katipunan. The existing elevated terminal tracks at both Recto Avenue and Marcos Highway occupy the road central reserve and are supported on viaduct. The existing route of the LRT Line 2, together with the proposed extensions, is shown in **Figure 3.3-1**. For a layout plan of the proposed routes of the East and West extensions, refer to **Figure 3.3-2**.



Source: Study Team

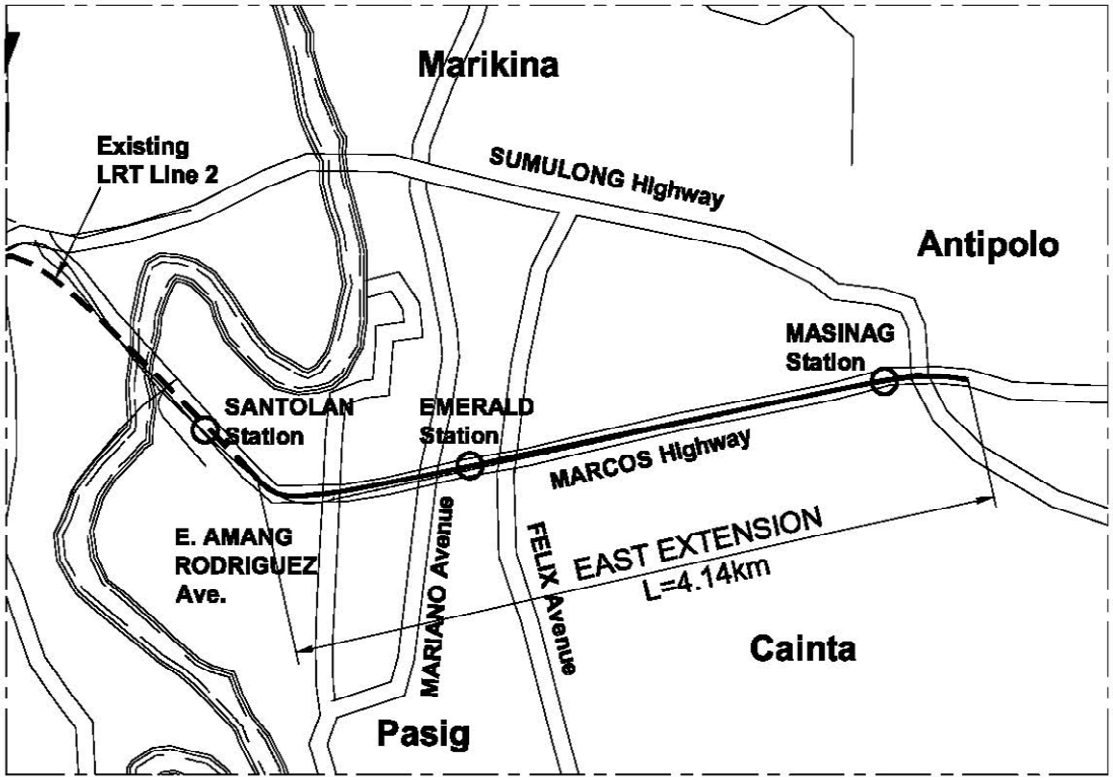
Figure 3.3-1 Location Plan of the LRT Line 2 East & West Extension Project

The selection of the route for both the East and West extensions was controlled by the location of the existing LRT Line 2 terminal tracks and the selected destinations of both the extensions. The alignment conditions of the East and West extensions are similar in that the elevated guideway for each extension will be constructed such that it follows the center line of the existing road.

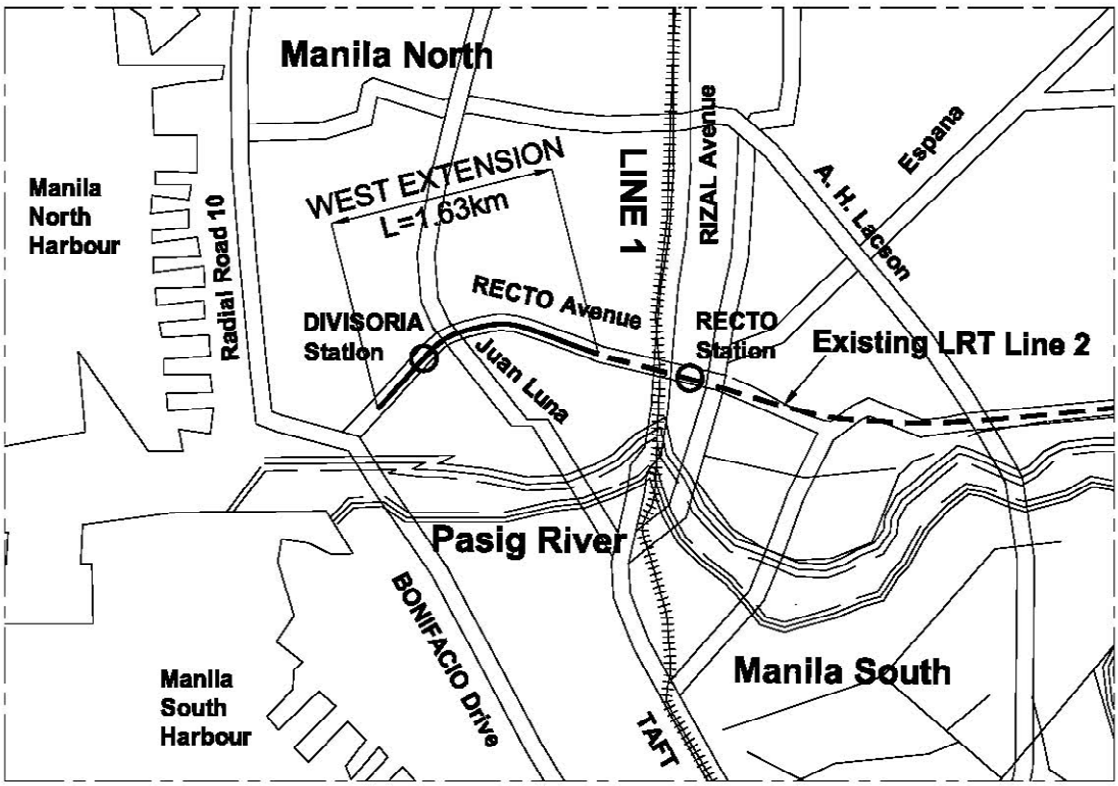
For the East extension the selected route extends from the termination point of the existing LRT Line 2 structure at Santolan in Marikina City on Marcos Highway to Masinag, Cainta Municipality, Rizal Province, also located on Marcos Highway. The route occupies the central reserve of Marcos Highway for the full length of the extension and the elevated track is supported on viaduct. The route is 4.14km long including the back track. Between Santolan and Masinag, Marcos Highway is a wide divided road occupying a road right of way of 50m.

The Department of Public Works and Highways (DPWH) are currently having Marcos Highway improved, including pavement widening and new drainage works, under a World Bank loan as part of the National Road Improvement Project Phase 2 (NRIMP2). The road improvement works extend over the length of the proposed East Extension and will provide five (5) lanes in each direction with a 4m central reserve. The NRIMP2 project is due to be completed in January 2012.

In following the existing road alignment of Marcos Highway the East Extension will encounter only one curve on the service route requiring a radius in the order of 350m, comfortably above typical minimum radius requirements. A minimum radius curve will be required only on the East Extension backtrack as it negotiates the bend in the road alignment at Masinag at the junction with Sumulong Highway.



a) East Extension



b) West Extension

Source: Study Team

Figure 3.3-2 Route Plans

With regard to vertical alignment, the East Extension will follow a relatively flat profile until just before the approach to Masinag where it will be required to climb to provide clearance to the existing road. Marcos Highway gains approximately 13m in elevation over a distance of approximately 500m on the approach to the road intersection with Sumulong Highway before climbing further as it extends east to Cogeo.

For the West extension the selected route for Case 2 extends back from the termination point of the existing LRT Line 2 structure along Recto Avenue and will terminate on Recto Avenue in Divisoria. For most of the length of the West Extension, Recto Avenue is a divided highway with three (3) traffic lanes in each direction. The width between building faces is typically between 26 to 27m. In Divisoria however Recto Avenue becomes wider, with more than 40m between building faces and the road accommodates up to four (4) traffic lanes in each direction. The roadway space in Divisoria is however mostly occupied by unlicensed vendors, with only one or two lanes available for traffic in each direction.

In following the center line of Recto Avenue the West Extension will be required to adopt minimum radius curves at two (2) locations on the service route. The back track can adopt a relatively straight alignment beyond the station at Divisoria.

The West Extension will follow a relatively flat profile with no major changes in road elevation encountered along the route.

In establishing track geometry reference has been made to the Project Design Standards established in Section 3.5 of this report. These standards have been established with reference to approved international standards and to ensure consistency with the existing system. Features of the existing Line 2 track geometry are presented in **Table 3.1-2**.

3.4 Train Operation Plan

3.4.1 Current situation

1) Transport volume

In 2010, average daily transport volume was 175,000 passengers while the maximum number was about 249,000 passengers, (July 2, 2010).

A glance at annual transport data reveals that the most crowded period is the interval between the early June and the end of the next March.

The **Table 3.4-3** illustrates the real passenger volume at each station for one hour during the rush hour in the morning (from a survey on November 15, 2010).

Table 3.4-1 LRTA Line-2 Transport Volume by month (2010)

2010		Transport volume (person)	Percentage (%)	Percentage of monthly average
1	January	5,530,622	8.9	106.9
2	February	5,193,329	8.4	100.4
3	March	5,545,579	8.9	107.2
4	April	4,053,921	6.5	78.3
5	May	4,577,954	7.4	88.5
6	June	5,133,566	8.3	99.2
7	July	5,876,060	9.5	113.6
8	August	5,747,650	9.3	111.1
9	September	5,746,636	9.3	111.1
10	October	5,229,845	8.4	101.1
11	November	5,306,291	8.5	102.6
12	December	5,414,144	8.7	104.6
	Total	63,355,597	100%	
	Average	5,279,633		100%

Source: Study LRTA

Table 3.4-2 Average transport volume per day (2010)

Daily Average	175,778	
Weekdays	198,693	
Saturdays	162,535	
Sundays/Holidays	101,297	
Highest Ridership	249,085	Jul. 2 Fri

Source: Study LRTA

Table 3.4-3 Peak Hour Ridership Based on Entry/Exit Traffic Per Station

(Date Nov 15 2010 7:00-8:00)

	Station	Entry	Exit	Total
1	Rect	2,088	6,047	8,135
2	Lagarda	344	4,958	5,302
3	Pureza	1,010	1,770	2,780
4	V.Mapa	1,233	677	1,910
5	J.Ruiz	373	624	997
6	Gilmore	327	687	1,014
7	Betty-Go	405	320	725
8	Araneta-Cubao	2,057	1,834	3,891
9	Anonas	1,546	445	1,991
10	Katipunan	3,871	879	4,750
11	Santolan	5,466	738	6,204
		18,720	18,979	

Source: Study LRTA

2) Current Train Operation

Table 3.4-4 shows the departure timetable at Santolan Station. There are three separate timetables for Weekdays, Saturdays and Sundays & Holidays. Due to the comparatively smaller volume of passengers during the interval between late March and early June, the regular Sunday timetable is used for weekdays in this period.

On weekdays, train frequency is 12 trains/hour (5-minute headway) during the morning rush hours and 10 trains/hour (6-minute headway) at during other hours in the day time. The daily number is 342 trips, 286 trips and 270 trips respectively for Weekdays, Saturdays, and Sundays& Holidays.

The travel time between Santolan and Recto (12.6km) is 23 minutes. Regardless of train headway, time for train turn-back at two terminals is 7 minutes. Therefore, a round trip for one train takes 60 minutes.

Table 3.4-4 Santolan Station Departure Timetable

	WEEKDAY													SATURDAY													SUNDAY & HOLIDAY												
5	5	15	25	35	45	55								5	5	15	25	35	45	55								5	5	15	25	35	45	55						
6	0	5	10	15	20	25	30	35	40	45	50	55		6	7	13	19	25	31	37	43	49	55					6	5	15	25	35	42	49	56						
7	0	5	10	15	20	25	30	35	40	45	50	55		7	1	7	13	19	25	31	37	43	49	55				7	3	10	17	24	31	38	45	52	59				
8	0	5	10	15	20	25	30	35	40	45	50	55		8	1	7	13	19	25	31	37	43	49	55				8	6	13	20	27	34	41	48	55					
9	0	6	12	18	24	30	36	42	48	54				9	1	8	15	22	29	36	43	50	57					9	2	9	16	23	30	37	44	51	58				
10	0	6	12	28	24	30	36	42	48	54				10	4	11	18	25	32	39	46	53						10	5	12	19	26	33	40	47	54					
11	0	6	12	18	24	30	36	42	48	54				11	0	7	14	21	28	35	42	49	56					11	1	8	15	22	29	36	43	50	57				
12	0	6	12	18	24	30	36	42	48	54				12	3	10	17	24	31	38	45	52	59					12	4	11	18	25	32	36	46	53					
13	0	6	12	18	24	30	36	42	48	54				13	6	13	20	27	34	41	48	55						13	0	7	14	21	28	35	42	49	56				
14	0	6	12	18	24	30	36	42	48	54				14	2	9	16	23	30	37	44	51	58					14	3	10	17	24	32	38	45	52	59				
15	0	6	12	18	24	30	35	40	45	50	55			15	5	12	19	26	32	38	44	50	56					15	6	13	20	27	34	41	48	55					
16	0	5	10	15	20	25	30	35	40	45	50	55		16	2	8	14	20	26	32	38	44	50	56				16	2	9	16	23	30	37	44	51	58				
17	0	5	10	15	20	25	30	35	40	45	50	55		17	2	8	14	20	26	32	38	44	50	56				17	5	12	19	26	33	40	47	54					
18	0	5	10	15	20	25	31	37	43	49	55			18	2	8	14	20	26	32	39	46	53					18	1	8	15	22	29	36	43	50	57				
19	1	7	13	19	25	32	39	46	53					19	0	7	14	21	28	35	44	53						19	4	11	18	25	32	40	50					
20	0	7	14	21	28	35	42	50						20	2	10	20	30	40	50								20	0	10	20	30	40	50						
21	0	10	20	30										21	0	10	20	30										21	0	10	20	30							
22														22														22											
23														23														23											
0														0														0											

Sunday timetable is applied on weekdays during the period March 28 to June 3, 2011 Source: Study Team

Table 3.4-5 Number of trains in operation (Year of 2011)

(Unit: Trains/day)

	Weekday	Saturday	Sunday/holiday
Rect → Santolan	169	143	133
Rect ← Santolan	173	143	137
Total	342	286	270

Source: Study LRTA

Table 3.4-6 Train kilometers and power consumption (Year of 2010)

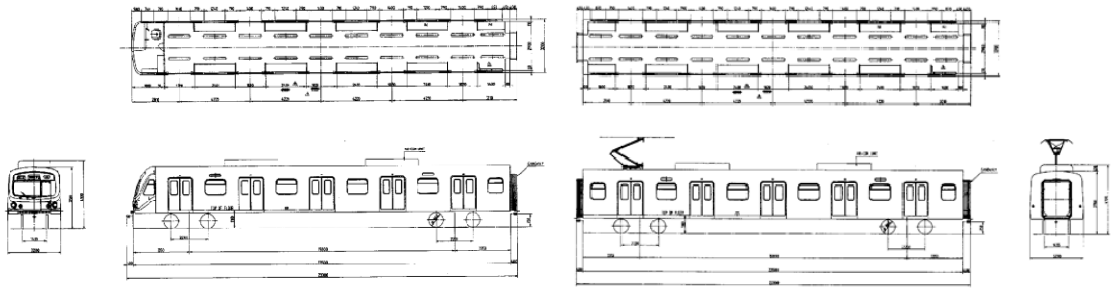
Train kilometer	1,472,212	Train-km
Power consumption	27,600,237	kwh

Source: Study LRTA

3) Transport Capacity

- Car size of LRTA Line-2 rolling stock: 23.5m(length)×3.2m (width)
- Train formation: 4 cars (4M)
- Train axle load and transport capacity is categorized according to the following types of load:
  - ✧ AW0 (empty car),
  - ✧ AW1 (car with only seated passengers)
  - ✧ AW2 (AW1+standing capacity of 4 persons/m^2)
  - ✧ AW3 (AW1+ standing capacity of 7 persons/m^2).
- Load with AW1+standing capacity 3 persons/m^2, which is standard nominal riding density in Japan, is equal to transport capacity of 826 passengers. Supposing this number implies100% congestion rate, AW2 and AW3 are, respectively, equivalent to 124% and 196% congestion rate.
- In relation to operation planning, train interval is computed based on the assumption that transport capacity at peak hour is AW1+standing capacity 6 persons/m^2.

Head cars（MC1,MC2） **Middle cars（M1,M2）**



Source: Study LRTA

Figure 3.4-1 General Arrangement of Rolling Stock

Table 3.4-7 Seating and standing capacity of a vehicle (AW1+standing capacity 3 persons/m^2)

Items	Seating	Standing area	Standing capacity	Total
Head car（MC1,MC2)	54	48.25	144	198
Middle car （M1,M2)	62	50.98	153	215
A 4-car train	232	198.46	594	826
Remarks		Assuming AW2	3.0persons/ m^2	

Source: Study LRTA

Table 3.4-8 Riding capacity per train and riding percentage of different loads

Type		Definition	Number of passenger(s)			Riding percentage（%）
			Seating	Standing	Total	
1	AW0	Empty car	0	0	0	0
2	AW1	AW0＋seating capacity	232	0	232	28
3	Standard	AW1＋3.0p/ m^2（standing）	232	594	826	100
4	AW2	AW1＋4.0p/ m^2（standing）	232	794	1,026	124
5		AW1＋5.0p/ m^2（standing）	232	995	1,227	147
6		AW1＋6.0p/ m^2（standing）	232	1,190	1,422	172
7	AW3	AW1＋7.0p/ m^2（standing）	232	1,396	1,628	197

Source: LRTA+Study Team

The table below shows the transport capacity per hour with different headways.

Table 3.4-9 Number of trains and passenger capacity per hour

Train interval (min)	Number of trains per hour	Passenger capacity per hour				
		AW1＋ 3.0p/m^2 （standing）	AW2 4.0p／m^2 （standing）	AW1＋ 5.0p/ m^2 （standing）	AW1＋ 6.0p/ m^2 （standing）	AW3 7.0p／m^2 （standing）
5	12	9,912	12,360	14,724	17,064	19,536
4	15	12,390	15,450	18,405	21,330	24,420
3.5	17	14,042	17,510	20,859	24,174	27,676
3	20	16,520	20,600	24,540	28,440	32,560
Congestion rate		100%	124%	148%	172%	196%

Source: Study Team

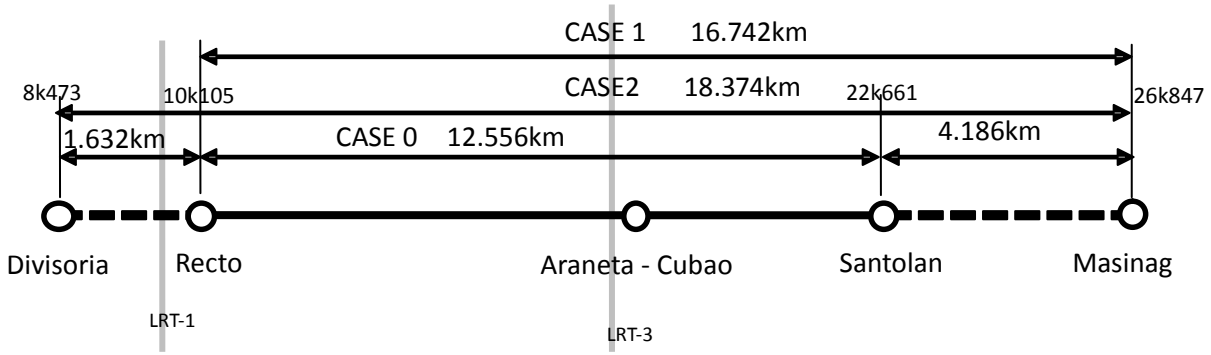
3.4.2 Train Operation Plan after line extension

1) Operation headway and travel time for each extension case

Two extension cases are considered. In Case-1, the current section (12.56 km) between Recto and Santolan is extended to the east (16.75 km), while in Case-2 it is extended in both directions (18.36 km).

Currently, the scheduled speed in the section between Recto-Santolan is 32.8 km/h. It is presumed that the scheduled speed will remain the same in both extension cases.

After extension, train turn-back at the terminal is planned to use the lead track which is the same as present practice. The required time for turn-back shall be based on current turn-back time of 7 minutes with regard to operation headway.



Source: Study Team

Figure 3.4-2 Distance between stations by case

Table 3.4-10 Operation distance and travel time (one direction)

CASE	Distance (km)	Number of stations	Distance interval (km)	Scheduled speed (km/h)	Running time (minute)	Remarks
CASE 0	12.556	11	1.256	32.8	23	Data by LRTA
CASE 1	16.742	13	1.396	32.8	30	Scheduled speed is presumed to be the same as present
CASE 2	18.374	14	1.413	32.8	33	Scheduled speed is presumed to be the same as present

Source: Study Team

2) Operation plan corresponding to future demand

Estimated future demand from a study conducted by METI is shown in **Table-3.4-11**. The required operation headway for the both cases is 4 minutes in order to meet the estimated demand in the year 2035.

In response to 4-minute headway (15 trains/ hour), the necessary number of train sets including operation reserve trains and maintenance reserve trains, is 21 train sets in Case-1 and 23 train sets in Case-2.

Table 3.4-11 Future peak hour traffic demand survey by METI (passengers/hour/direction)

Case	2015	2020	2025	2030	2035
Case 0（No extension）	8,387	9,260	10,735	12,444	14,426
Case 1（East Extension）	11,747	12,969	15,035	17,430	20,206
Case 2（East-West Extension）	12,412	13,704	15,887	18,417	21,351

Source: Study Team

Table 3.4-12 Case-1: Required number of train sets

Items		Current headway at peak hour	CASE 1: Headway at peak hours (minutes)				Remarks
		5.00	5.00	4.00	3.50	3.00	
Transport Capacity（passengers/hour）	AW1＋3.0p/㎡（standing）	9,912	9,912	12,390	14,042	16,520	100%
	AW2：AW1＋4.0p/ m^2（standing）	12,360	12,360	15,450	18,360	17,510	124%
	AW1＋5.0p/ m^2（standing）	14,724	14,724	18,405	20,859	24,540	148%
	AW1＋6.0p/ m^2（standing）	17,064	17,064	21,330	24,174	28,440	172%
	AW2：AW1＋7.0p/ m^2（standing）	19,536	19,536	24,420	27,676	32,560	196%
Travel time per direction (minute)		23	30	30	30	30	
Turn-back time at terminal (minute)		7	7	6	6	6	
Round-trip time (minute)		60	74	72	72	72	
Required number of train sets at peak hours		12.0 ↓ 12	14.8 ↓ 15	18.0 ↓ 18	20.6 ↓ 21	24.0 ↓ 24	
Operation reserve (one train set)		1	1	1	1	1	
Maintenance reserve (10%)		1	2	2	2	3	
Total required number of train sets		14	18	21	24	28	

Source: Study Team

Table 3.4-13 Case-2: Required number of train sets

Items		Current headway at peak hour	CASE 2: Headway at peak hours (minutes)				Remarks
		5.00	5.00	4.00	3.50	3.00	
Transport Capacity（passengers/hour）	AW1＋3.0p/㎡（standing）	9,912	9,912	12,390	14,042	16,520	100%
	AW2：AW1＋4.0p/ m^2（standing）	12,360	12,360	15,450	18,360	17,510	124%
	AW1＋5.0p/ m^2（standing）	14,724	14,724	18,405	20,859	24,540	148%
	AW1＋6.0p/ m^2（standing）	17,064	17,064	21,330	24,174	28,440	172%
	AW2：AW1＋7.0p/ m^2（standing）	19,536	19,536	24,420	27,676	32,560	196%
Travel time per direction (minute)		23	33	33	33	33	

Turn-back time at terminal (minute)	7	7	6	6	6	
Round-trip time (minute)	60	80	78	78	78	
Required number of train sets at peak hours	12.0 ↓ 12	16.0 ↓ 16	19.5 ↓ 20	22.3 ↓ 23	26.0 ↓ 26	
Operation reserve (one train set)	1	1	1	1	1	
Maintenance reserve (10%)	1	2	2	2	3	
Total required number of train sets	14	19	23	26	30	

Source: Study Team

3.4.3 Operation plan and required number of trains by year after extension

The operation plan and required number of trains by year in the future is calculated based on future demand estimated from the result of this study.

The train kilometers by year in the future are computed using the current daily train kilometers and annual train kilometers.

Table 3.4-14 Case-1: Train Operation Plan (2015-2035)

Year	Peak hour volume	Number of trains at peak-hour	Transport capacity at peak-hour	Congestion rate at peak-hour	Required number of train sets	Annual train-kilometer
	person/hour	train/hour	person/hour (100%)	%	train set	thousand-km
2015	11,747	12	9,912	119	18	1,844
2016	11,982	12	9,912	121	18	1,844
2017	12,221	12	9,912	123	18	1,844
2018	12,466	12	9,912	126	18	1,844
2019	12,715	12	9,912	128	18	1,844
2020	12,969	12	9,912	131	18	1,844
2021	13,359	12	9,912	135	18	1,844
2022	13,759	12	9,912	139	18	1,844
2023	14,172	12	9,912	143	18	1,844
2024	14,597	12	9,912	147	18	1,844
2025	15,035	12	9,912	152	18	1,844
2026	15,486	12	9,912	156	18	1,844
2027	15,951	12	9,912	201	18	1,844
2028	16,429	12	9,912	166	18	1,844
2029	16,922	12	9,912	171	18	1,844
2030	17,430	15	12,390	141	21 （adding 3 train sets）	2,305
2031	17,953	15	12,390	145	21	2,305
2032	18,491	15	12,390	149	21	2,305
2033	19,046	15	12,390	154	21	2,305
2034	19,618	15	12,390	158	21	2,305
2035	20,206	15	12,390	163	21	2,305

- Peak hour volume does not exceed AW1+standing capacity 6p/m^2

Source: Study Team

Table 3.4-15 Case-2: Train Operation Plan (2015-2035)

Year	Peak hour volume	Number of trains at peak-hour	Transport capacity at peak-hour	Congestion rate at peak-hour	Required number of train sets	Annual train-kilometer
	person/hour	train/hour	person/hour (100%)	%	train set	thousand-km
2015	12,412	12	9,912	125	19 (adding 1 train sets)	2,025
2016	12,661	12	9,912	128	19	2,025
2017	12,914	12	9,912	130	19	2,025
2018	13,172	12	9,912	133	19	2,025
2019	13,436	12	9,912	136	19	2,025
2020	13,704	12	9,912	138	19	2,025
2021	14,115	12	9,912	142	19	2,025
2022	14,539	12	9,912	147	19	2,025
2023	14,975	12	9,912	151	19	2,025
2024	15,424	12	9,912	156	19	2,025
2025	15,887	12	9,912	160	19	2,025
2026	16,364	12	9,912	165	19	2,025
2027	16,855	12	9,912	170	19	2,025
2028	17,360	15	12,390	140	23 (adding 4 train sets)	2,531
2029	17,881	15	12,390	144	23	2,531
2030	18,417	15	12,390	149	23	2,531
2031	18,970	15	12,390	153	23	2,531
2032	19,539	15	12,390	158	23	2,531
2033	20,125	15	12,390	162	23	2,531
2034	20,729	15	12,390	167	23	2,531
2035	21,351	15	12,390	172	23	2,531

- Peak hour volume does not exceed AW1+standing capacity 6p/m^2

Source: Study Team

3.5 Project Design Standards

3.5.1 Civil

The railway civil engineering facilities shall be designed and constructed in accordance with international standards and applicable local codes, regulations, standards and requirements of local statutory authorities and agencies. The standards imposed by LRTA on the design of Line 1 NEP are directly applicable to the design of the Line 2 Extension Project. Refer to **Table 3.1-1** for a detailed listing of specified standards.

The design of elevated structures for light rail transit systems involves choosing a design code, determining light rail vehicle forces, confirming track configuration requirements, and applying rail/structure interaction forces. This interaction is affected by such factors as the bearing arrangement, trackwork terminations, type of guideway construction, and type of rail fasteners. The structural engineer must coordinate with the trackwork engineer to fully understand the issues that affect the design of an elevated structure. The details of the trackwork design significantly affect the magnitude of the forces that must be resisted by the structure.

Currently there is no internationally accepted design code that has been developed specifically for light rail transit elevated structures. In addition to local design codes, designers may choose between the Standard Specifications for Highway Bridges, published by the American Association of State Highway and Transportation Officials (AASHTO) and the Manual for Railway Engineering issued by the American Railway Engineering and Maintenance of Way Association (AREMA). However neither the AASHTO nor AREMA code accurately defines the requirements of an elevated structure to resist light rail transit loads, although the AASHTO code is probably more applicable. Most light rail loads are greater than the HS20 truck load used by AASHTO, but they are much less than the Cooper E80 railroad loading cited in the AREMA code.

A strong similarity exists between light rail transit design requirements and the AASHTO code. For light rail transit aerial structures, the ratio of live load to dead load more closely approximates that of highway loadings than freight railroad loadings. In addition, since the magnitude of the transit live load can be more accurately predicted, the conservatism inherent in the AREMA code is not required in light rail transit structures. Although there is no current bridge design code that is completely applicable to light rail transit bridges, the use of the AASHTO code will result in a conservative design that is not overly restrictive or uneconomical. The use of the AASHTO code is therefore recommended as the primary standard for the design of the viaduct structure.

The primary standard for the structural design of the stations will be the International Building Code (IBC) published by the International Code Council (ICC), this was formerly the Uniform Building Code in the USA, and the National Building Code of the Philippines.

3.5.1.1 Design Load

The following design loads have been considered in the outline design of the LRT Line 2 Extension:

1) Live Loading

Live loading is based on a 4-car train formation or a 6-car train formation to determine which loading will produce the maximum stresses on the members. The design loading consists of sixteen (16) axle loads distributed over a 4-car train configuration as given in **Figure 3.5-1**. One axle load is equal to W = 16,600kg (163.0kN). This is the axle load configuration adopted for the existing Line 2.

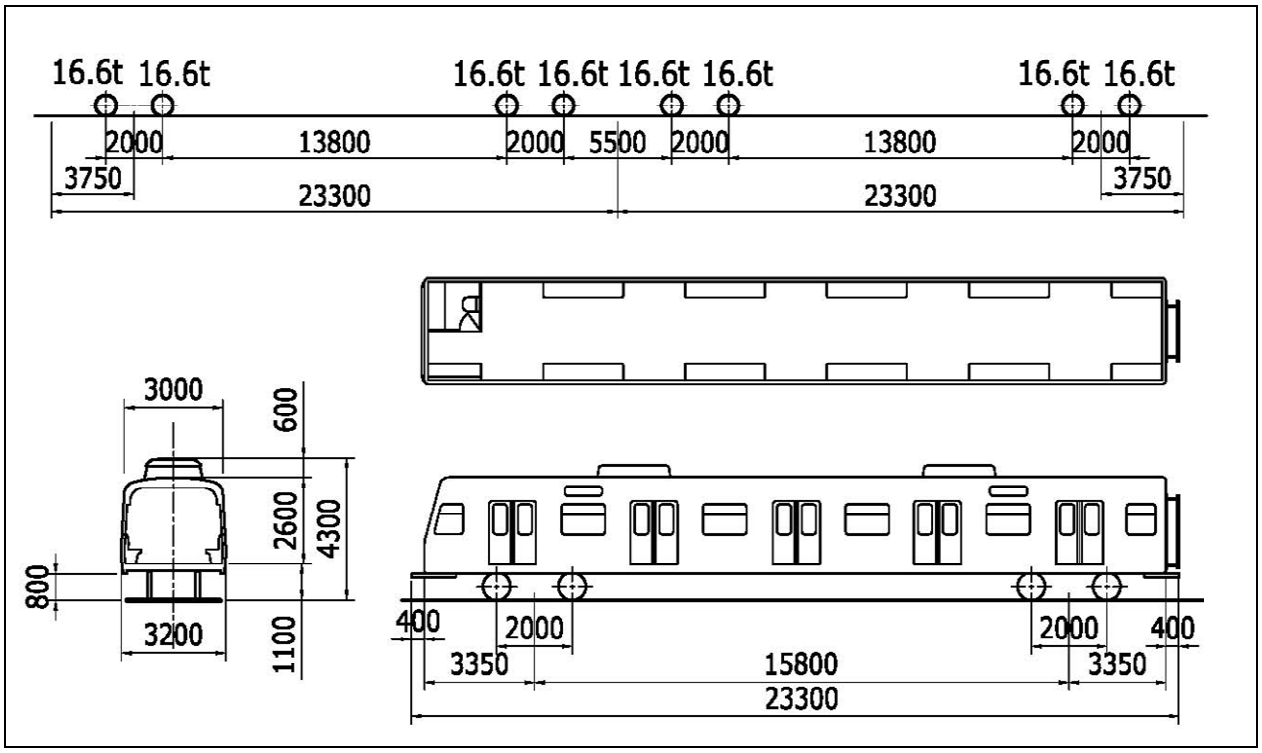
Dynamic load allowance, or impact factor, shall be calculated in accordance with UIC Leaflet 776-1R, “Loads to be Considered in Railway Bridge Design”.

2) Longitudinal Force

The longitudinal force shall be taken as 15% of the live load without impact for normal breaking and 30% of the live load for emergency braking. The longitudinal force acts simultaneously with the vertical live load of a standard vehicle on all wheels. It may be applied in either direction with either a single track loaded or both tracks loaded.

3) Rolling Load

A force equal to 10% of the train loading per track without impact shall be applied downwards on one rail and upwards on the other for all tracks.



Source: Study Team

Figure 3.5-1 Static Axle Load of 4-Car Design Train

4) Centrifugal Loads

Structure on curves shall be designed for a horizontal radial force equal to the following percentage of the live load, without impact, in all tracks:

$$C = 0.00117 \times S^2 \times D = \frac{6.68 \times S^2}{R}$$

Where:

C = the centrifugal force in percent of the live load, without impact
S = the design speed in miles per hour
D = degree of curve
R = radius of the curve in feet
The centrifugal force shall be applied 1.8m above the top of rail.

5) Derailment Loads

The vertical derailment load of the design vehicle shall consist of the maximum load multiplied by an impact factor of 100% for design of deck slab (multiply wheel load by 2.0). For other parts of the superstructure, the impact factor shall be 30% (multiply wheel load by 1.3). All elements of a structure shall be checked assuming simultaneous application of all derailed wheel loads. Only one train on one track shall be considered to have derailed, with the other track being loaded with a stationary train.

6) Earthquake Force

Seismic considerations to determine the earthquake loading will be based on the Structural Code of the

Philippines, Volume II Bridges. The design earthquake motions and forces specified in these provisions are based on a low probability of their being exceeded during the normal life expectancy of a bridge. Structures are allowed to respond into the inelastic range with a limited ductile response.

The elastic seismic response coefficient for a particular mode is defined as:

$$C_{SM} = \frac{1.2 \times A \times S}{T_M^{2/3}}$$

Where:

A = Acceleration Coefficient (typically 0.40g in Luzon with a need for review near active faults)

S = dimensionless coefficient for the soil profile characteristic of the site

T = period of the structure for a particular mode

The value CSM need not be taken greater than 2.5A.

3.5.1.2 Track Geometry Standards

The track geometry standards shall be established with reference to approved international standards and to ensure consistency with the existing system. Features of the existing Line 2 track geometry are presented in **Table 3.1-2**.

1) Horizontal Alignment

The horizontal alignment of track consists of a series of tangents joined to circular curves and spiral transition curves. In the depot yards and other non-revenue tracks, the requirement for spiral transition curve is frequently deleted. Track superelevation in curves is used to maximize vehicle operating speeds wherever practicable.

In determining horizontal alignment, three (3) levels of criteria are usually considered.

1. **Main Line Desired Minimum** -This criterion is based on an evaluation of maximum passenger comfort, initial construction cost, and maintenance considerations on main line ballasted and direct fixation track. It is used where no physical restrictions or significant construction cost differences are encountered.
2. **Main Line Absolute Minimum** -Where physical restrictions prevent the use of the main line desired minimum criterion, a main line absolute minimum criterion is specified. This criterion is determined primarily by the vehicle design, with passenger comfort a secondary consideration.
3. **Depot Yard and Non-Revenue Track**-This criterion is generally less than main line track, covering low-speed and low-volume non-revenue service. The minimum criterion is determined primarily by the vehicle design, with little or no consideration of passenger comfort.

a) Minimum Tangent Length Between Curves

The minimum length of tangent between curves is equal to the longest car that will traverse the system. This usually translates into a desired minimum criterion of 30 meters as a minimum desirable length.

b) Circular Curves

Intersections of horizontal alignment tangents are connected by circular curves. The curves may be simple curves or spiraled curves, depending on the curve location, curve radius, and required superelevation.

As a guideline for LRT design, curves should be specified by their radius. Degree of curvature, where

required for calculation purposes, should be defined by the arc definition of curvature as determined by the following formula:

$$D = \frac{1763.79}{R}$$

Where:
D = Degree of curvature in decimal degrees
R = Radius of curvature in meters

The minimum radius curve used for the preliminary design of the Line 2 Extensions (R=175m) is the same as used on the existing Line 2. This gives a maximum degree of curvature of approximately 10 degrees.

c) Superelevation

Main line tracks are designed with superelevations that permit desired design speeds to be achieved without resorting to excessively large curve radii.

The superelevation criteria established for the existing Line 2 track will be adopted for the Line 2 Extensions. Refer to **Table 3.1-1** for details.

d) Spiral Transition Curves

Spiral transition curves are used to gradually build into the superelevation of the track and limit lateral acceleration during the horizontal transition of the light rail vehicle as it enters the curve. Horizontal spiral curves are broadly defined as curves with a constantly decreasing or increasing radius proportional between either a tangent and curve (simple spiral) or between two curves (compound spiral).

For LRT design, it is recommended that spiral transition curves should be clothoid. Spirals are typically used on all main line track horizontal curves with radii less than 3,000 meters wherever practicable.

The design of spiral transition curves for the Line 2 Extensions will be consistent with the existing Line 2 design and will be a task for the detailed design stage.

2) Vertical Alignment

The vertical alignment of an LRT alignment is composed of constant grade tangent segments connected at their intersection by parabolic curves having a constant rate of change in grade.

a) Vertical Tangents

The minimum length of constant profile grade between vertical curves should be 30m as a desirable minimum.

b) Vertical Grades

Maximum grades in track are controlled by vehicle braking and tractive efforts. The maximum grades to be adopted for the Line 2 Extension will be consistent with the existing Line 2 design. Refer to **Table 3.1-1** for details.

c) Length of Vertical Curves

The minimum length of vertical curve applicable to LRT systems shall be determined from AREMA as follows:

$$L = \frac{2.15 \times D \times V^2}{A}$$

Where:
- L = Length of vertical curve (in feet)
- D = Algebraic difference in grades (expressed as a decimal)
- V = Design velocity (in miles per hour)
- A = Vertical acceleration (0.6ft/sec2 for passenger rail)

The vertical acceleration limit for passenger services was set by AREMA Sub-Committee 8, Track Geometry, in 1994. The limit on vertical acceleration results in vertical curves for passenger and transit systems that, for the same gradient and speed, are six (6) times shorter than those for freight operations.

3.5.1.3 Electro-Mechanical Standards

The Electro-Mechanical Standards for the station installations shall be in accordance with international standards and applicable local codes, regulations, standards and requirements of local statutory authorities and agencies.

Elevators and escalators shall be designed to satisfy ASME A17.1-2004, Safety Code for Elevators and Escalators.

3.5.1.4 Maintenance Standards

Going forward LRTA should formalize their inspection and maintenance standards for the civil infrastructure facilities making reference to:

- Maintenance Plan, Line 1 Capacity Expansion Project, January 2009, LRTA
- AREMA Manual for Railway Engineering (2010)
- AREMA Bridge Inspection Handbook (2010)
- AASHTO Manual for Condition Evaluation of Bridges, 2nd Edition (2003)
- FHWA Bridge Inspector's Reference Manual (2006)
- The American Public Transportation Association (APTA) Standard for Rail Transit Structure Inspection and Maintenance (2002)
- International Property Maintenance Code (2003)

3.5.2 Railway System Standards

The Railway Systems Standards for the LRT Line 2 Extension shall be in accordance with international standards and applicable local codes, regulations and standards.

1) Signaling

- International Organization for Standardization
- International Electro technical Commission
- International Union of Railways Standards
- Philippines Electric Code

2) Telecommunication

- Accessibility Law BPB 344
- American National Standards Institute
- British Standards Institution
- Building Telephone Facilities Vol 2, Philippines
- International Telecommunications Union
- Electronics Industries Association
- Federal Communications Commissions
- International Electro technical Commission
- Institute of Electrical and Electronic Engineers
- National Electrical manufactures Association
- National Telecommunications Commission
- Philippines Electric Code Safety Code Vol.1

3) Track works

- UIC Leaflet 860.0 Technical Specifications for flat-bottom rails
- UIC Leaflet 864/1.0 Technical specifications for the supply of coach screws
- UIC Leaflet 864/2.0 Technical specifications for the supply of steel track bolts
- UIC Leaflet 864/3.0 Technical specifications for the supply of spring washers
- UIC Leaflet 864/4.0 Technical specifications for the supply of fish plates
- American Society of Testing and Materials
- American Welding Society
- American Railway Engineering Association
- British Standards

4) Basic Electrical Materials & Methods

- ANSI C80.1 Rigid Conduit – Zinc Coated
- ASTM A123 Specification for Zing (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- ASTM A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- ASTM D149 Test Methods for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
- ASTM D570 Test Method for water Absorption of Plastics
- ASTM D638 Test Method for Tensile Properties of Plastics
- ASTM D695 Test Method for Compressive properties of Rigid Plastics
- ASTM D790 Test methods for Flexural Properties of Unreinforced and Electrical Insulating Materials
- ASTM D1000 Method of Testing Pressure-Sensitive Adhesive Coated Tapes Used for Electrical Insulation
- ASTM D1518 Test Method for Thermal Transmittance of Textile Materials
- ASTM D1682 Test Methods for Braking Load and Elongation of Textiles Fabrics
- ASTM D2240 Test Method for Rubber Property – Durometer Hardness
- ASTM D3005 Specification for Low-Temperature Resistant

5) Wires and Cables

- ANSI MC96.1 Temperature Measurement Thermocouples
- ASTM B3 Specification Copper Wire
- ICEA

- IEEE 48 Test Procedures and Requirements for High Voltage Cable Terminations
- IEEE 383 Type Test of Class 1E Electrical Cables, Field Splices, and Connections for Nuclear Power Generating Stations
- NEMA WC5 Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
- NFPA 70 National Electrical Code

6) Grounding and Bounding

- ASTM B3 Specification for Soft or Annealed Copper Wire
- ASTM B187 Specification for Copper Bus Bar, Rod and Shapes
- NFPA 60 National Electrical Code
- UL 467 Grounding and Bounding Equipment
- Philippines Electric Code

3.5.3 Rolling Stock Standards

3.5.3.1 Standards

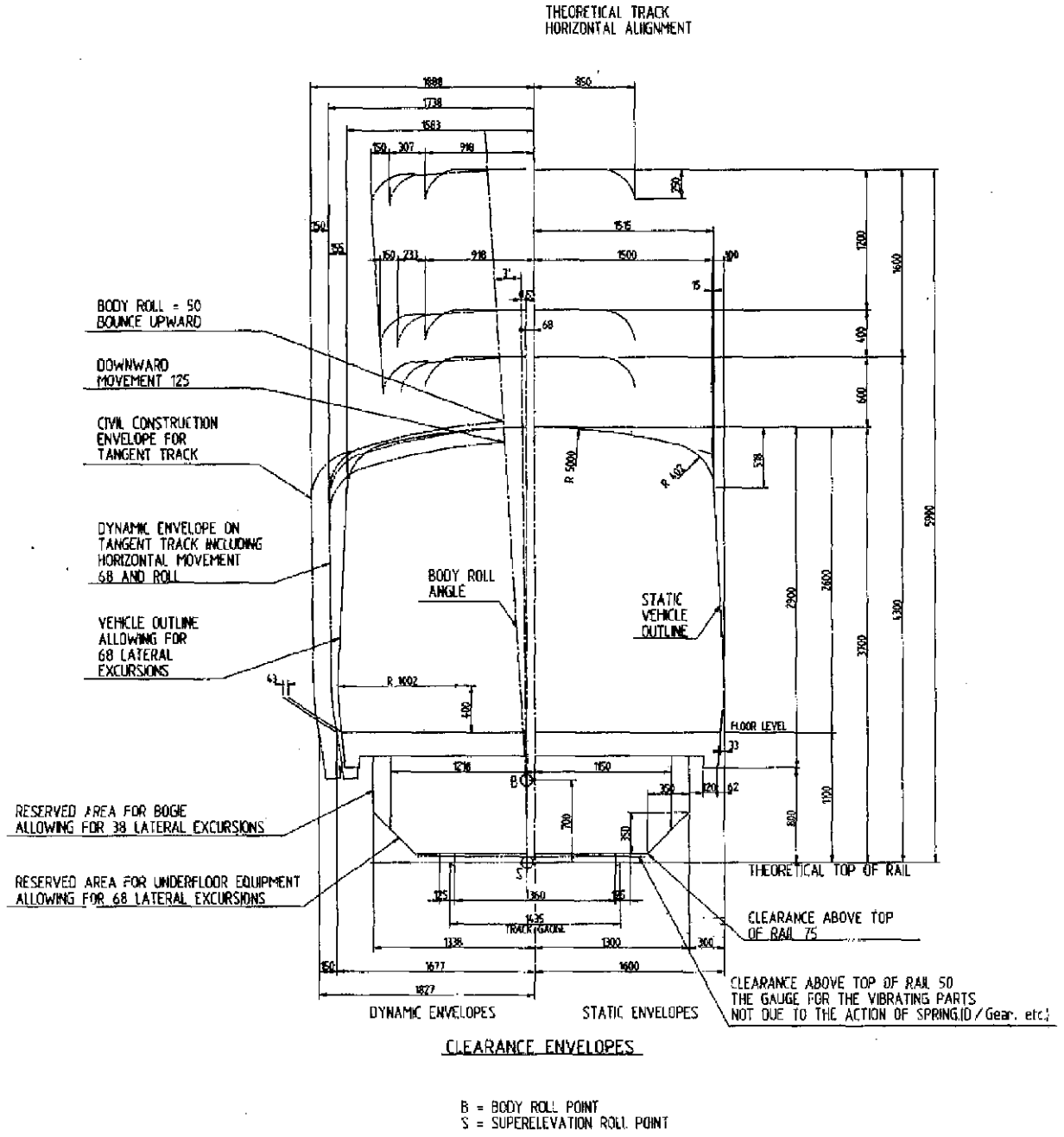
1) General

- Association of American Railroads
- American Iron and Steel Institute
- American National Standards Institute
- American Railway Engineering Association
- Australian Standards
- Standards Australia
- British Standards
- British Standards Institution
- National Standards of Canada
- Deutsches Institut fur Normung
- Japanese Industrial Standards
- Rolling Stock Industrial Standard
- Philippine National Standard
- Bureau of Product Standards
- International Organization for Standardization
- International Union of Railways Standards
- International Electro technical Commission

2) Railway Operations Safety

- Federal Transport Authority (FTA) Rail Transit System Safety Programs
- Federal Railroad Administration (FRA) Track Safety Standards and Safety Advisories
- The American Public Transportation Association (APTA) Operating Practices

3.5.3.2 Rolling Stock Envelop



Source: LRTA Study

Figure 3.5-2 Rolling Stock Clearance Envelop

3.6 Rolling Stock Procurement Plan

3.6.1 Current Rolling Stock

1) Car size and structure

The current rolling stock of LRT-Line 2 has a large car size of 22.5m length and 3.2m width with 5 doors of 1.4m width on each side. The length of a 4-car train is 93.2 m. This has been the standard car length for the planning of stations and facilities. In Japan, for standard commuter trains, the specifications are as follows: car length 19.5m, car width 2.80~ 2.95m, side door width 1.3m, train formation: maximum 15 cars)

The main reason for such a large car size is that the maximum cross-sectional peak hour volume was estimated at 40,000 passengers per hour, which requires a train interval of 2.5 minutes (24 trains/hour). In general, adding more cars can respond to the increasing demand, however, in the case of Line 2, because the elevated track is constructed over urban roads, the length of the stations is therefore restricted. In the original plan, at peak hour per train capacity was AW3: 1628 passengers (standing capacity of 7 passengers/m^2), which means an hourly transport capacity of 39,072 passengers (1628 passengers × 24trains/hour). Regarding the fact that in Japan, 100% congestion rate corresponds with standing density of 3 passengers/m^2, AW3 is effectively equal to 197% congestion rate.

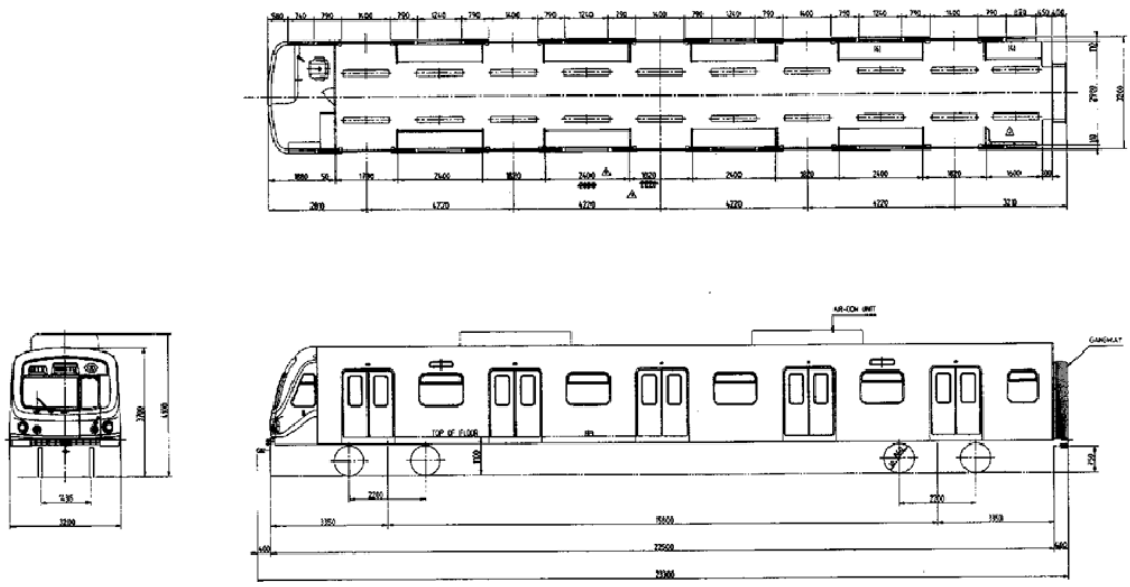
The body structure is made of stainless steel. Glass window between passenger doors are of the hinged door type with a fixed lower part and inwards opening upper part. End panel of each car is 1.4m in width and is equipped with sliding door or gangway. LRT Line 2 is an elevated line constructed over the center of roads, the only underground section of the existing 12.6km line is located near Katipunan Station. The extension section will also be elevated. Because evacuating from side doors is difficult, emergency door are provided at the end of every head car.

Reinforced plastic long-benched seats are installed longitudinally with capacity of 6 persons per seat. In order to separate the standing area from the seating area, partition board are installed at the seat end. Distance between two opposite seats is 1.96m which is over 40 cm wider than the Japanese standard of 1.53m for a 2.85m-width rolling stock. Two stanchion poles are provided between the two side doors. Three rows of straps are installed in front of the seating area. There are 8 triangle-shaped straps in the central row. Straps of the two side rows are distributed unevenly and limited in number. Air-conditioning equipments consists of unit coolers installed above the car roof. There are two units on each car.

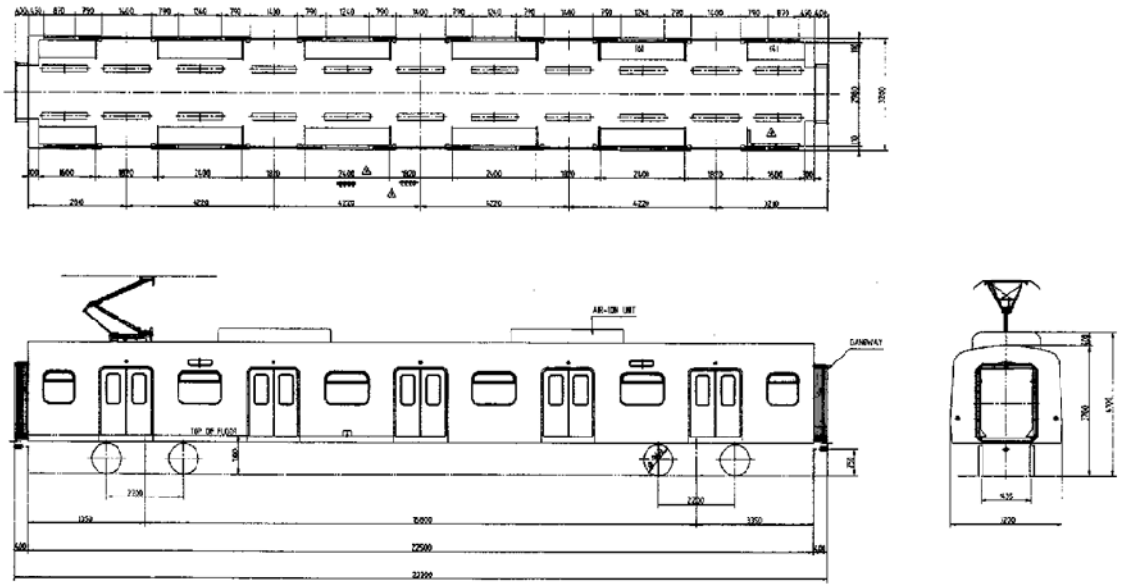
Source: Study Team

Photo 3.6-1 View of Rolling Stock

MC1 **MC2**

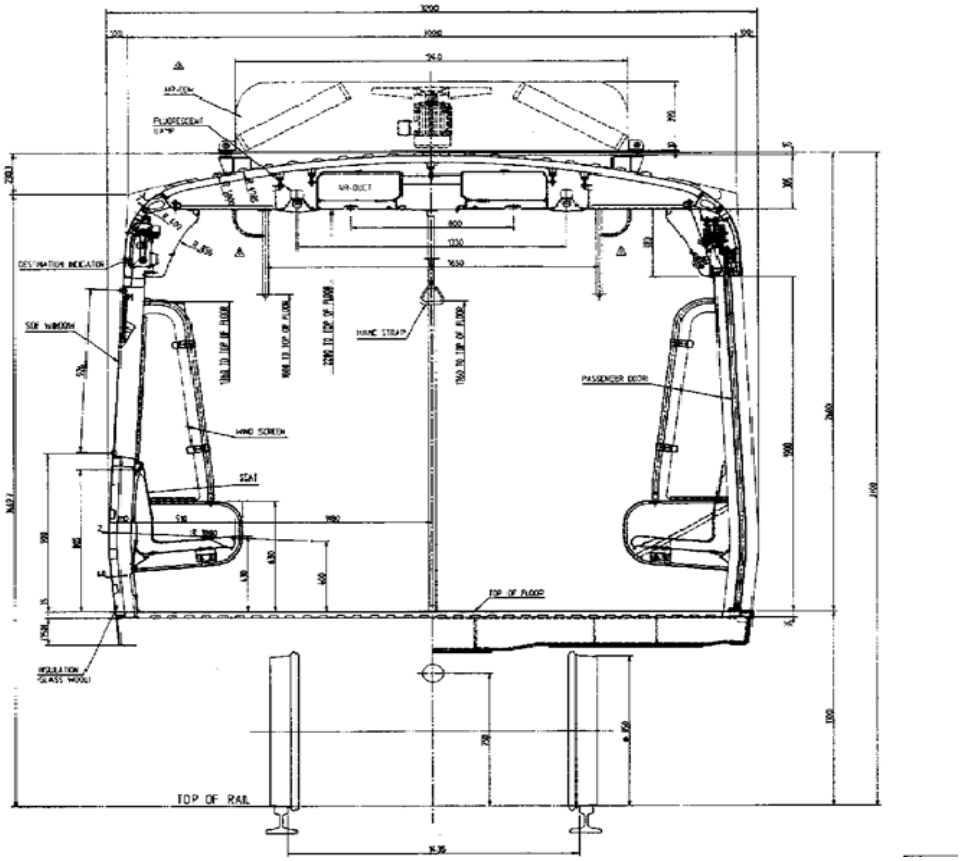


M1 **M2**



Source: LRTA Study

Figure 3.6-1 General Arrangement of Rolling Stock



Source: LRTA Study

Figure 3.6-2 Section of Car Body

Source: Study Team

Photo 3.6-2 Interior of Passenger Car

2) Power and Traction System

The power supply for trains is DC 1500V from an overhead catenary system. Single-armed pantographs are equipped on each of the two middle cars of the 4-car trains. An IGBT-VVVF inverter is used for the traction control system. All the four main motors are controlled by one set of inverter equipment. All the 4 cars of the trains are motor cars (4M). The main traction motors are squirrel cage induction motor with self-ventilation cooling system.

The bogies are of the bolsterless type. Bogie axle length of is 2.2m; and bogie center distance is 15.8m. Primary suspension consists of conical rubber suspension and secondary suspension consists of diaphragm air springs. The brake system is of the electric type with auxiliary pneumatic and regenerative brakes.

Relating to the safety equipment system, ATC (Automatic Train Control), ATP (Automatic Train Protection), ATO (Automatic Train Operation), and ATS (Automatic Train Supervision) system are provided. These systems can ensure the minimum headway of 2.5 minutes at peak hour which was calculated in the original future transport plan.

The tare weight of the head car is 41.0 tons and that of middle cars is 39.05 tons, therefore weight of an empty 4-car train is 160.1 tons. The train weight and transport capacity for various load types are described in the **Table 3.6-1**. It is assumed that weight of a passenger is 65kg.

Table 3.6-1 Train weight and passenger capacity

		TRAIN WEIGHT AND PASSENGER CAPACITY				
		MC 1	M 1	M 2	MC 2	TOTAL
1	AW0 Tare weight	41.00	39.05	39.05	41.00	160.10
2	AW1	54	62	62	54	232
	AW0 + seated passengers	44.51	43.08	43.08	44.51	175.18
3	AW2	247	266	266	247	1,030
	AW1 + 4.0p/㎡ standing passengers	57.06	56.47	56.47	57.06	227.05
4	AW3	392	422	422	392	1,628
	AW1 + 7.0p/㎡ standing passengers	66.48	66.48	66.48	66.48	265.92
5	AW4 AW3 + 0.25g dynamic load	83.10	83.10	83.10	83.10	332.40
		198	215	215	198	826
	AW1 + 3.0p/㎡ standing passengers	53.87	53.03	53.03	53.87	213.79

Source: LRTA Study+Study Team

Table 3.6-2 Specification of Rolling Stock

		SPECIFICATION				
Gauge	mm	1,435				
Traction energy supply		D.C. 1,500V, Overhead wire				
Length (Coupler faces)	mm	23,800				
Length (Car body)	mm	22,500				
Width	mm	3,200				
Height (pantograph lock down)	mm	4,100				
Car body structure		Stainless steel				
Train formation		4 Cars（MC1-M1-M2-MC2））				
Maximum axle load	t	16.6				
AW1 Seating	persons	MC1	M1	M2	MC2	TRAIN
		54	62	62	54	232
AW2 Standing Passenger (standing 4.0p/m^2)	persons	193	206	206	193	794
AW2 Total Passenger capacity (standing 4.0p/m^2)	persons	247	268	268	247	1,026
AW3 Maximum Passenger capacity (standing 7p/m^2)	persons	392	422	422	392	1,628
Maximum Speed	km/h	80				
Acceleration (Average)	km/h/s	4.68				
Acceleration (Maximum）	km/h/s	4.68				
Deceleration (Average)	km/h/s	4.68				
Deceleration (Emergency)	km/h/s	5.4				
Bogie truck	Type	Bolsterless bogie truck				
	Primary suspension	Conical rubber suspension				
	Secondary suspension	Air suspension				
Bogie Center Length	mm	15,800				
Axle Length	mm	2,200				
Traction Motor		Three-phase A.C. Motor				
	kw	120				
Diameter of wheel	mm	New 850　Worm 790				
Traction system		Gear coupling(WN) type				
Traction Controller		VVVF inverter (IGBT)				
Brake systems		Electric type with auxiliary pneumatic, regenerative brake				
Signaling　system		ATC, ATP, ATO, ATS				
Train integrated management equipment		Monitors and records of the control equipment, the motor, and the operation condition, etc.				

Source: Study Team

3.6.2 Maintenance of Rolling Stock

Six types of inspection with specific inspection period are described in **Table 3.6-3**. Japanese standard for inspection types and periods are also shown for reference.

Table 3.6-3 Rolling Stock Maintenance Plan

LRTA LRT-2 （Workshop Manual）		STANDARDS OF JAPAN（Bulletin of MLIT）	
NAME	Inspection periods	NAME	Inspection periods
Normal Maintenance Examination	30+7 days or 10,000km	Train inspection	≦ 10days
Limited Inspection	90+7 days or 30,000km	Monthly Inspection	≦ 90days
General Inspection 1	180+7 days or 60,000km		
General Inspection 2	360+7 days or 120,000km		
Car Overhaul 1	3 years or 360,000km	Important parts Inspection	4 years or 600,000km
Car Overhaul 2	6 years or 720,000km	General Inspection	8 years

Source: Study Team

3.6.3 Issues of the current rolling stock and specifications corresponding to the future extension

1) Issues of the current rolling stocks

In total, 72 cars of 18 train sets are usually operating at LRT Line 2. However, as of March 2011, three of the train sets are out of service due to difficulty in procurement of spare parts. Normally, one train is rotationally in maintenance; thus there are substantially maximum 14 train sets in revenue service.

At present during rush hour, 12 train sets are required to ensure train interval of 5 minutes. Because two reserve train sets are secured for operation and maintenance at all times, no impediment to train operation is expected. However, if more train sets are out of service, there is concern about negative impacts on train operation during rush hours.

The condition of out-of-service rolling stocks, along with an overview of the breakdown and repair cost are described in the **Table 3.6-4.** Total repair cost for the 3 train sets is estimated at PHP174 million, and maintenance cost for a wheel-tread cutting machine is approximately PHP 15 million.

Table 3.6-4 Rolling Stock Condition and Repair Cost

ITEMS	ACTION	REPAIR COST
Number of train sets, not in operation now.	15 out of 18 train sets are in operating condition. Total of 3 train sets are not operating with one set under repair while the three train sets are down.	Each train set is approximately PHP 58M
Causes of failure of each train set above in detail.	The causes of failure for rolling stock are as follows: 1. Tear & Wear 2. Unavailability of spare parts 3. Obsolete parts 4. Difficulty in procurement of spare parts usually it takes six months for local and one year for foreign components	
Wheel Turning Machine.	Wheel Turning Machine as follows: 1. Hydraulic seal 2. Software & Hardware 3. Wheel Profile Recalibration	Approximately PHP 15M

Source: Study Team

2) Car specifications corresponding to the future extension

In reference to the future traffic demand, the required number of train sets after the extension is computed in a separate part in this report. Even if train interval is the same as present (12 trains/hour or 5-minute headway), 18-19 train sets inclusive of those withdrawn for maintenance are required. In response to increasing demand in the future, 24 to 26 train sets are essential to ensure a shorter headway; accordingly additional 6 to 8 cars will be needed.

Compared to the general standards of urban railway cars, specifications of LRT-Line 2 rolling stock such as car body, car structure, control devices, brake system are basically higher. However, it is necessary to replace or repair train radio subsystems or public address systems in case of line extension.

As explained above, in case of line extension, there will be no change in basic specifications of the current rolling stocks. However, in order to simplify the maintenance work, a partial change of subsystems is required.

3.7 Civil Engineering Facilities Plan

3.7.1 General

The choice of structural solutions, appropriate for the congested urban setting of Metro Manila, is in general governed by the following conditions:

- Structural system and construction methodology that is easier to implement and will minimize impact to traffic, right-of-way and urban environment,
- Structure type that is cost-effective and faster to construct (shorter construction period),
- Structural system that is resistant and reliable against expected loads (including earthquake),
- Structural type that is easy to maintain,
- Minimal environmental impact, and
- Aesthetically pleasing.

For LRT viaduct structures carrying frequent loads through urban areas, the following considerations must also be addressed:

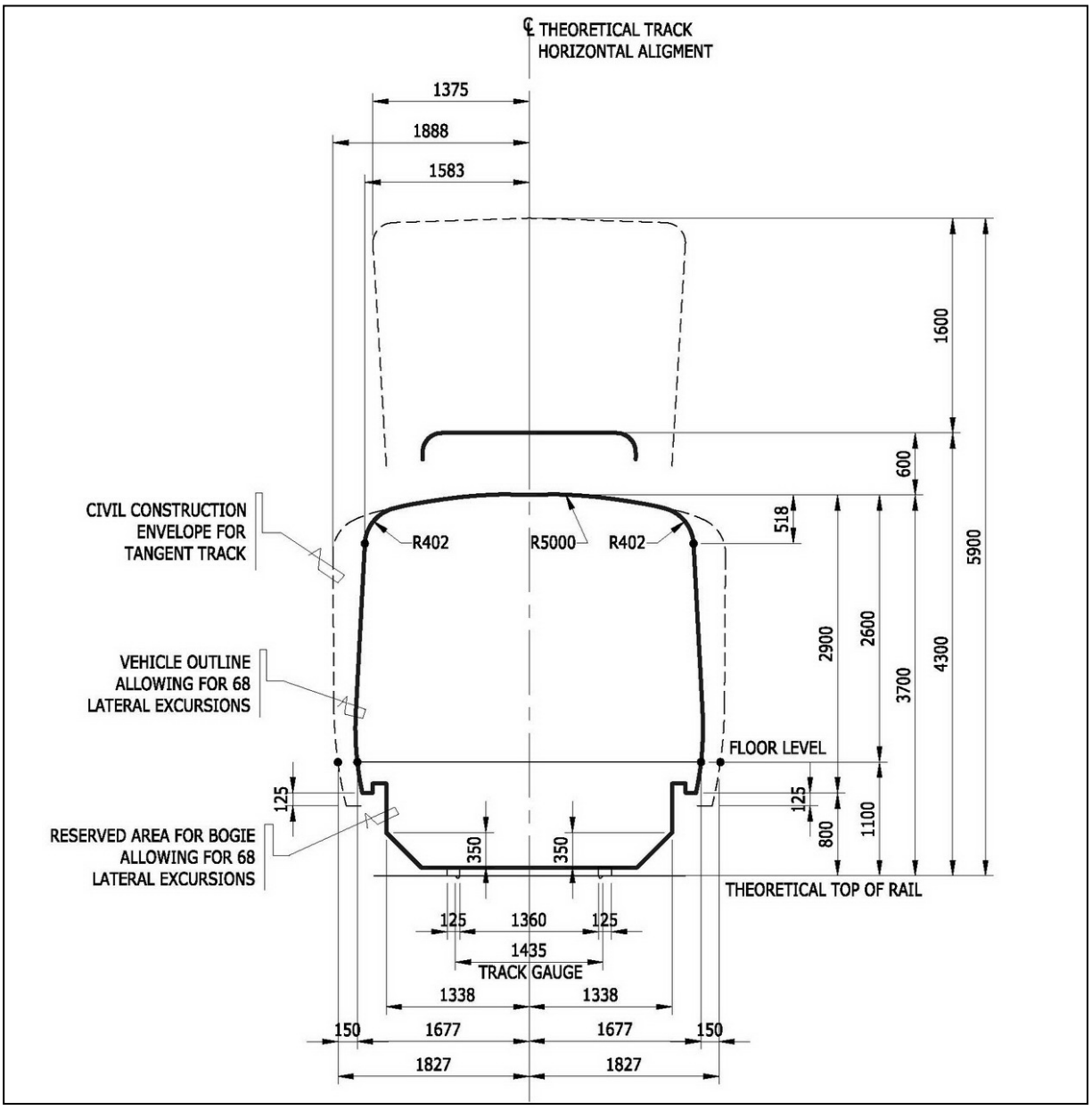
- Guidance of LRT trains includes the ability to switch trains between viaduct tracks.
- The viaducts must generally satisfy additional requirements, such as providing emergency evacuation and supporting wayside power distribution services.
- Rail/structure interaction forces – for LRT viaducts the rails are typically continuously connected to the bridge deck, resulting in differential expansion and contraction effects between the different materials.
- Vibrations and deflections criteria – the limitations established for vibrations and deflections for rail structures are more stringent than typical highway loading due to the sensitivity of the train operations to structure movements
- Structure/vehicle interaction – vehicle interaction with the viaduct structure can affect its performance as related to support, steering, power distribution and traction components of the system.
- Ride quality. System specifications usually present ride quality criteria as lateral, vertical and longitudinal acceleration and jerk rates (change in rate of acceleration) as measured inside the vehicle.
- Noise control – the noise level created by trains is often a concern in areas where the alignment passes residential areas or parks

3.7.2 Civil Construction Envelope, Rolling Stock Envelope and Track Center Spacing

The civil construction envelope and rolling stock envelope, also known as *static* and *kinematic gauge*, for the proposed train are given in **Figure 3.7-1**. The civil construction envelope is given by providing a horizontal margin, 0.15 m for right and left side respectively, to the dynamic rolling stock envelope.

For curved sections it is necessary to recalculate the horizontal and vertical deflection of the rolling stock gauge and modify the gauge value.

Track center spacing shall be 4.4m on tangent for the twin box girder concept with central catenary pole. The track center spacing can increase up to 4.8m for curved alignment with the minimum track radius of 175m. Track center spacing may be reduced on tangent to be 3.6m on tangent for side catenary pole arrangements.



Source: METI Study2009

Figure 3.7-1 Civil Construction and Rolling Stock Envelopes

3.7.3 Viaduct

3.7.3.1 Foundations and Substructure

1) Foundations

Deep foundations are required for both the East and West Extensions. Refer to Section 3.2 Geotechnical Survey. The following deep foundation concepts are proposed:

- Conventional pile caps with multiple smaller diameter bored piles for the West Extension (supporting single column piers)
- Single large diameter bored piles for the East Extension (supporting single column piers)

Pile caps are structurally the most efficient particularly for transferring large lateral forces into the supporting ground in the case where the overlying soils are soft or loose. The soil conditions along the West Extension, with varying overlying depths of very soft clays and silts, therefore militate in favor of conventional pile caps. The proposed pile cap concept is similar to that adopted for the piled foundations of the existing Line 2.

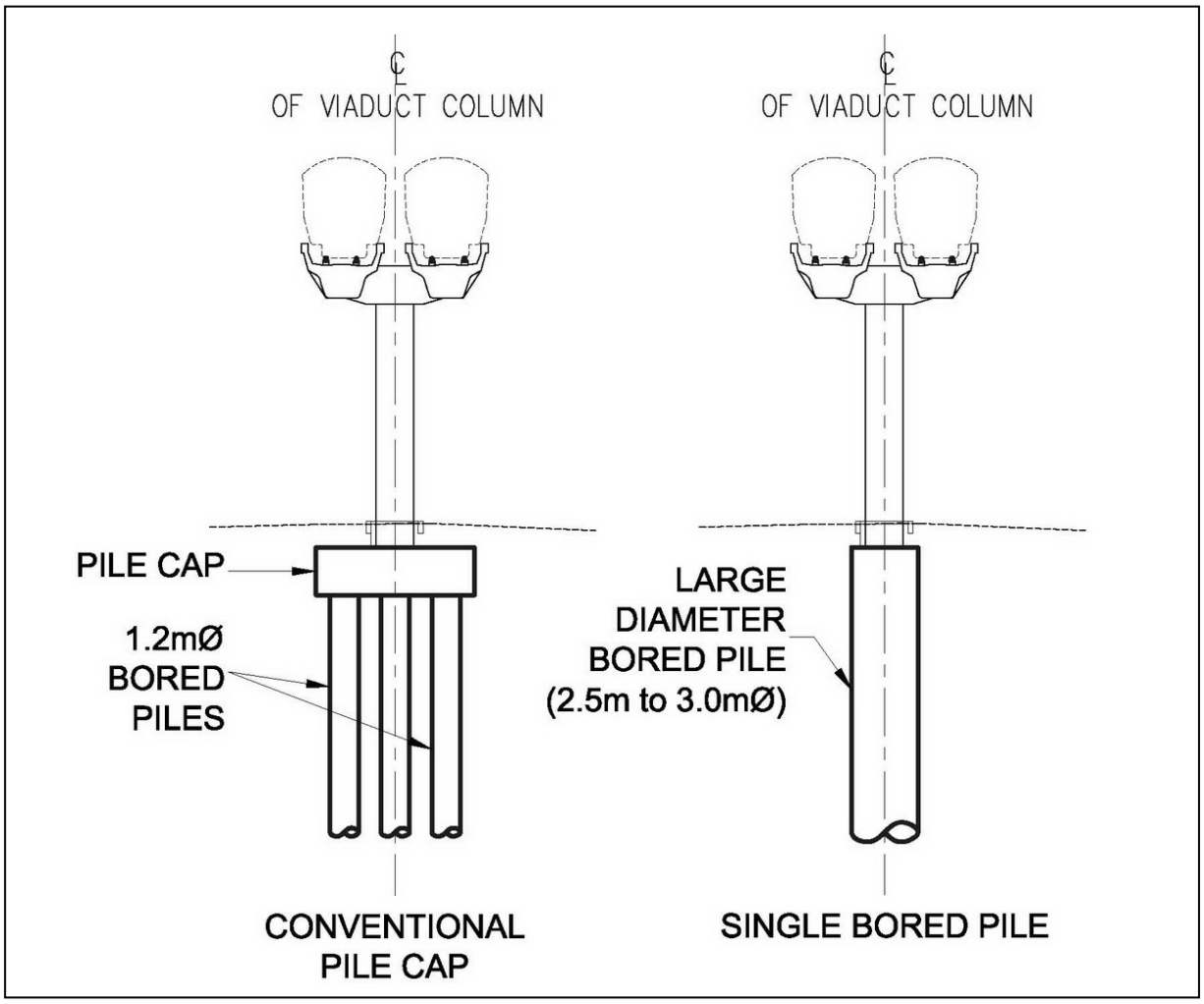
For the West Extension bored pile diameters of 1.2m and 1.5m are proposed, with lengths varying from 30m to 45m. Ultimate axial bearing capacities range from 550t for the 1.2m diameter pile to 750t for the 1.5m diameter pile. In establishing preliminary designs and estimating quantities, the design ground accelerations and soil factors proposed in Section 3.2 have been adopted.

The use of multiple piles and pile caps presents a relatively large footprint that may conflict with utilities and will require a relatively wide temporary construction area. Pile caps also require multiple construction phases including excavation and shoring of the pile cap foundation, construction of the pile group followed by the setting formwork, installing rebar cages and concreting of the pile cap and then filling and compacting operations. Single large diameter bored piles supporting single column piers offer substantial advantages in that the footprint of the foundation is minimized and a pile cap is not required. The impact of the foundation construction on the existing facilities, such as underground utilities, is therefore kept to a minimum and construction time is much reduced. Competent overlying soil conditions are required for single large diameter bored piles in order to provide lateral support to the pile, critical during an earthquake event.

The soil conditions encountered along the East Extension, mostly medium dense to very dense sand, overlying rock, allow the use of single large diameter bored piles. It is noted that single large diameter bored piles were also adopted for the pier foundations for LRT Line 1 North Extension Project (NEP) and for the MRT Line 3 where competent soil conditions occur.

For the East Extension large single diameter bored piles with a diameter of 3.0m are proposed, with lengths varying from 14m to 28m. Ultimate axial bearing capacities range from 1000t to 1300t depending on length and location.

Refer to **Figure 3.7-2** for an illustration of a conventional pile cap foundation and a single large diameter bored pile foundation.



Source: METI Study2009

Figure 3.7-2 Civil Construction and Rolling Stock Envelopes

2) Substructure

Single column piers are proposed for both the East and West Extensions. Single column piers located in the central road reserve do not obstruct the existing at-grade traffic lanes or sidewalks, allow minimum footprint area foundations, require the least construction stages and provide an unobstructed view for road traffic. The existing LRT Line 2 viaduct also typically features symmetrical single column pier supports located in the central reserve of the existing roads along the route.

The piers are formed in reinforced concrete cast-in-place given the design and construction flexibility afforded by in-situ construction. Pier heads will incorporate pre-stressing to minimize construction thickness and to afford a slender, sculpted impact.

For the West Extension, where the viaduct negotiates relatively small radius curves at Divisoria, symmetrical single column pier support sometimes will not be possible, given the constraints imposed on the guideway alignment and required location of the pier column in the central road reserve. At this location, asymmetrical pier columns will be adopted.

For both the East and West Extension, typical size of column is proposed at 2.0m x 2.0m to be sympathetic with the existing Line 2 structure. Maximum pier height is typically 12m to bearing level. However pier heights increase to 16m at the connection to the existing guideway for the West Extension

and increase up to 20m at the approach to Masinag Station for the East Extension. Tall pier heights on the approach to Masinag are unavoidable given the location of the station, the sharply rising existing road profile and the need to maintain clearance for road traffic both on Marcos Highway beneath the station structure and along Sumulong Highway at the intersection. Larger section size columns are proposed for the tall piers at the approach to Masinag Station supported on conventional pile cap foundations to limit design deflections under earthquake loading.

In establishing preliminary designs and estimating quantities, the design ground accelerations and soil factors proposed in Section 3.2 have been adopted.

3.7.3.2 Superstructure

1) Structure Alternatives

The choice of LRT viaduct superstructure alternatives is typically limited to forms constructed in pre-stressed concrete, either cast-in-place or precast. Concrete is a natural damper for both noise and vibration. Concrete construction is therefore recommended for LRT viaduct structures, where both noise and vibration criteria are to be taken into consideration. Shallower beams and girders can be constructed using pre-stressed concrete, bringing advantages both in terms of reduced visual impact and, in congested urban settings where vertical controls are a factor for the design, in minimizing construction depth. The urban settings of LRT structures typically do not allow the use of such extensive shoring works and consequently cast-in-place concrete construction has not been used extensively in modern LRT structures.

The advantages of precast concrete construction are well established. These include:

- Rapid construction on site with minimal impact on traffic, units can be delivered during night time work shifts
- Quality can be controlled and monitored much more easily in the pre-cast yard making it easier to control the mix, placement, steam curing and formed finish
- Weather is eliminated as a factor in the pre-casting process with covered and protected casting beds in the casting yard
- Less labor is required
- On site, precast elements can be installed immediately, there is no waiting for elements to gain strength
- Repeatability—multiple units of the same precast element can be made; and by maximizing repetition, the contractor can maximize the value from a mold and a pre-casting set-up

The forms of pre-cast concrete construction used for LRT viaduct superstructures are:

a) Precast segmental, span-by-span

- BOX Girder
  - Closed trapezoidal section has high torsional stiffness
  - Visually attractive structural form
  - Typically requires specialized erection gantries to erect
  - Can have integrated sound protection
  - Cost effective for sufficiently long routes

- U-Shaped Girder
  - Proprietary system developed and patented by SYSTRA (used in Tapei, Dubai and Delhi)
  - Reduction of visual impact in the urban environment,
  - Integrated sound protection
  - Torsional stiffness improved with design of widened top flanges

- Requires specialized erection gantries or large capacity truck cranes to erect
- Cost effective for sufficiently long routes

b) Composite pre-cast beam and in-situ slab

- AASHTO Girder
  - Cost effective irrespective of length of route
  - Poor torsional stiffness requires transverse diaphragms
  - Requires in-situ concrete deck slab
  - Can be erected using conventional cranes
  - Poor aesthetic impact

The existing LRT Line 2 adopted a twin box girder superstructure type, whereas the LRT Line 1 NEP and MRT Line 3 adopted AASHTO girder type construction. Refer to **Photos 3.7-1** to **3.7-3**.

Source: Study Team

Photo 3.7-1 PC Box Girder - Existing LRT Line 2 Girder – Manila

Source: Study Team

Photo 3.7-2 AASHTO Girder - LRT Line 1 NEP Girder – Manila

Source: Study Team

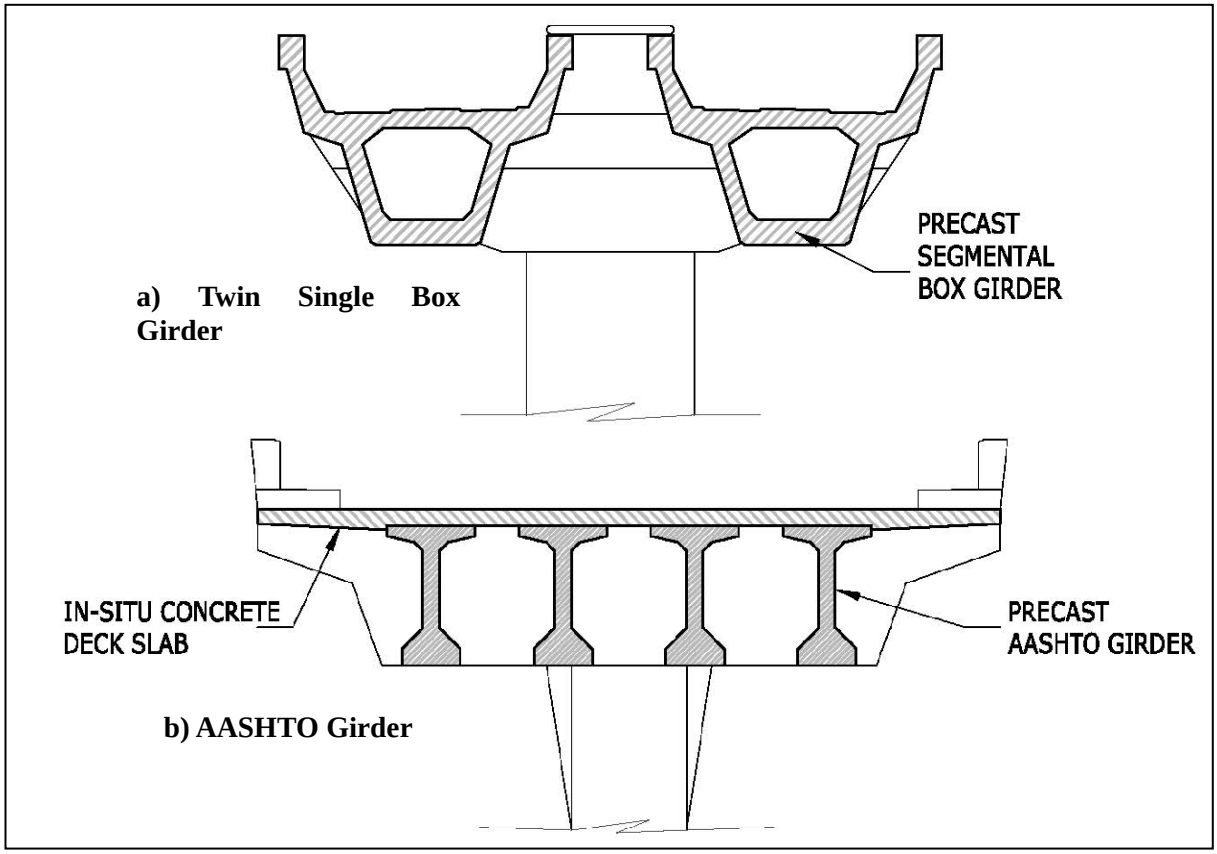
Photo 3.7-3 AASHTO Girder - MRT Line 3 – Manila

The twin single box girder concept adopted for the existing LRT Line 2 has advantages in that the parapet upstands of each girder form part of the deck structure above rail level, thereby allowing a reduced construction depth below rail level and the upstands also provide integrated sound protection. In addition the separated structures allowed the alignment of each track to take different routes at specific congested areas along the existing Line 2 alignment.

The space between the twin box girders is occupied by a centrally located overhead catenary system supported from the pier heads and also affords space to accommodate power and telecommunication cables in a cable tray located below a central walkway. The centrally located walkway does not require railing protection at the exterior of the girders for regular operation and maintenance activities.

The AASHTO deck concept lends itself to side mounted overhead catenary systems, again supported from the pier heads (refer Photo 3.7-3) with cable trays and walkway space also accommodate at each side on the deck slab. The walkways require continuous railings at the deck edge each side.

Refer to **Figure 3.7-3** for illustrations of both the twin box girder type and AASHTO girder type of viaduct deck.



Source: Study Team

Figure 3.7-3 Viaduct Superstructure Types

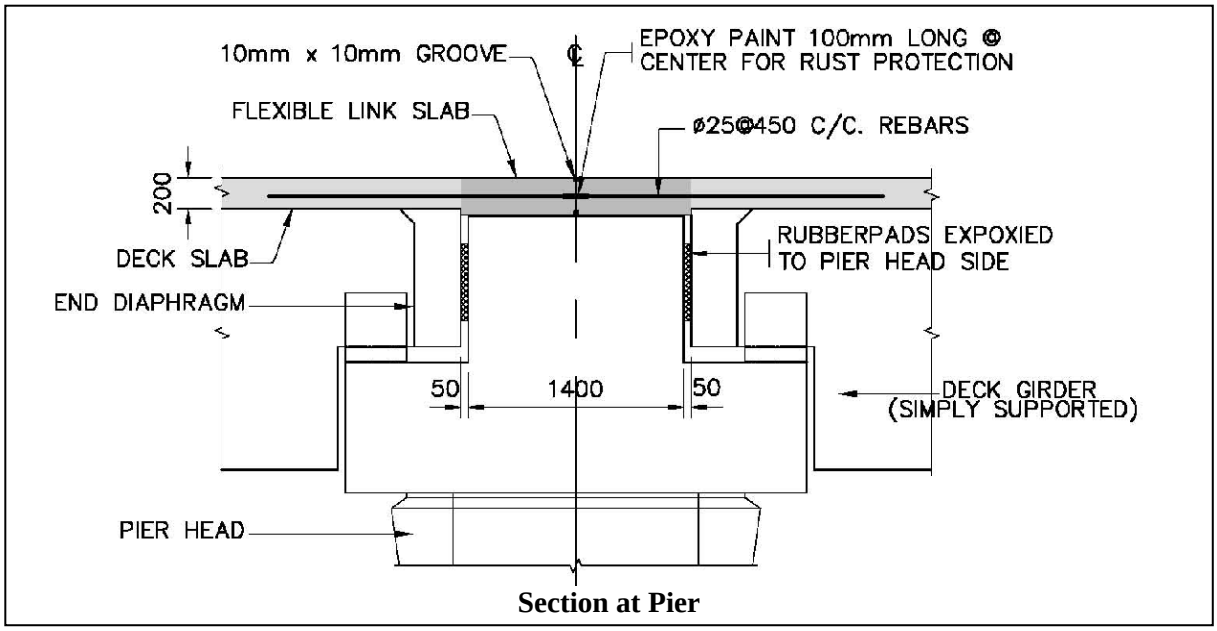
Construction cost data for the Line 1 NEP project was obtained from LRTA and a comparison made between the cost of the AASHTO girder deck and the updated cost estimate for the twin single box girder deck. The cost difference between the two forms of construction was found to be marginal. For the purposes of this Study, both the twin single box girder and the AASHTO girder deck therefore can be considered. The twin single box girder is however recommended from the viewpoint of consistency and aesthetic compatibility with the existing Line 2 structure. The U-Shaped girder option is not recommended under Japanese ODA as it is a proprietary patented system available from a non-Japanese source.

A span length study was undertaken for the previous METI study to verify that the 25m typical span adopted for the existing LRT Line 2. The structure spanning established for the METI study have therefore been retained and adopted in this Study.

2) Continuity at Pier Supports

The viaduct decks are simply supported at the piers, with dapped girder ends formed to conceal the pier head within the deck outline. In order to control relative displacements between adjacent decks and distribute deck rotations at the support, flexible link slabs are proposed at the piers. The flexible slabs also provide a direct link between adjacent deck structures, thereby promoting a more robust structural arrangement in responding to earthquake forces and preventing spans dropping off bearings.

Flexible link slabs will be installed over a frame of five to six spans with expansion joints between frames. The trackwork system to be adopted is compatible with the link slab design, as this system and flexible slab combination has already been adopted for the Line 1 NEP project. The link slab concept can be applied to any simple supported viaduct deck arrangement, including the single box girder. Refer to **Figure 3.7-4** for an illustration of the flexible slab detail used for the LRT Line 1 NEP.



Source:LRTA Study

Figure 3.7-4 Flexible Link Slab Detail

3) Facilities for Access, Emergency Egress and Inspection

The existing LRT Line 2 viaduct provides a central walkway space for foot patrols undertaking inspection

and maintenance of the railway system. The central walkway also serves as an emergency exit way for passengers evacuated from a disabled train.

The Manager of the LRTA Line 2 Operations Department informed the Study Team that the existing central walkway space for access along the viaduct is not wide enough to allow unrestricted operation when patrls are walking the line. The central walkway on the viaduct sections is relatively narrow (1500mm) and therefore during the foot patrols along the viaduct speed restrictions of 25kph have to be imposed on the train operations.

The viaduct arrangement for the LRT Line 2 Extension should therefore provide additional or improved facilities for walkway access. In the case of the twin single box girder concept additional walkways at each side are proposed together with an exterior railing. The walkway and railing can also serve both to evacuate passengers from disabled trains and prevent falls from the viaduct.

In the case of the AASHTO girder concept, walkways and railing located at side of the deck slab are proposed, similar to the concept adopted for LRT Line 1 NEP and MRT line 3.

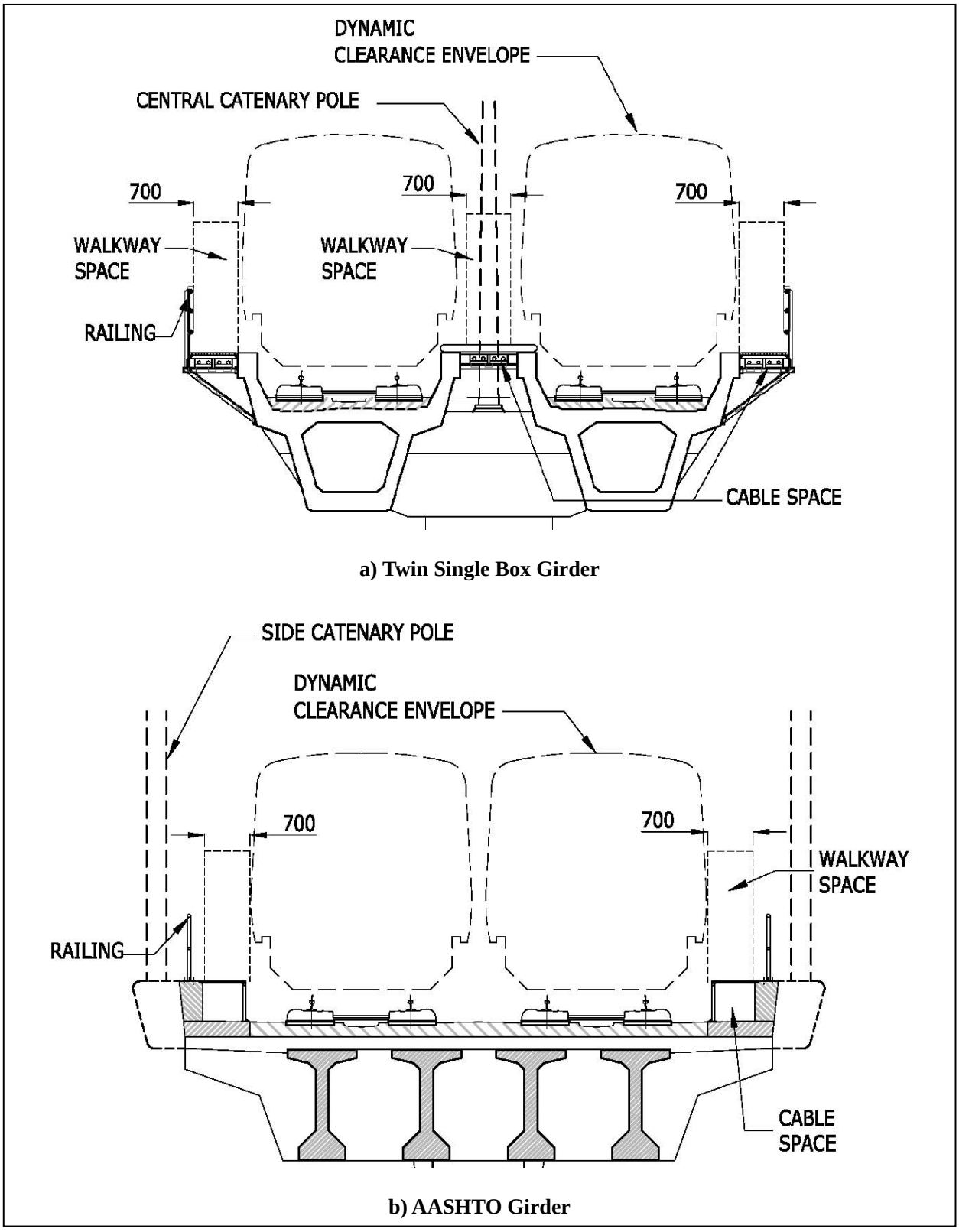
Refer to **Figure 3.7-5** for an illustration of the access walkway and railing facilities proposed for the Line 2 Extension.

4) Backtrack

Backtracks are proposed at each terminal station for the LRT Line 2 Extension, namely at Masinag Station for the East Extension and at Divisoria Station at the West extension.

Back tracks, or reversing tracks, allow trains, not in revenue service, to reverse along an extended viaduct section beyond the terminal station and to switch to the other track at double crossovers. The reversing and switching, out of revenue operation, provides more operational flexibility and allows a temporary storage facility for trains not in operation.

The backtrack length established by the METI study will be adopted: Back Track Length > 270m (= 25m tangent + 55m double cross over + 190m storage and buffer terminal).



Source: Study Team

Figure 3.7-5 Viaduct Walkway and Railing Layouts

3.7.4 Stations

3.7.4.1 Station Function, Type and Location

1) Basic Function

In order for stations to be functional, the planning of station buildings and facilities must assure passenger safety and comfort while making provisions for passenger convenience with user-friendly facilities. The stations must be designed to make adequate provision for disabled passengers and the station access ways must satisfy emergency egress requirements in the event of a fire.

2) Platform Type

A comparative study on platform type was undertaken for the METI study in 2009. The typical platforms types investigated were (i) island platform type and (ii) separate platform type.

The island type platform was recommended at terminal stations given the increased passenger convenience offered by this type, and the separate platform type was recommended for intermediate stations given that this has minimal impact on the track alignment. These recommendations have been adopted for this JICA Study. The terminal stations at Masinag, for the East Extension, and Divisoria, for the West Extension, are therefore recommended to be island platform type stations. Emerald Station, for the East Extension, is recommended to be separate platform type.

The effective length of an intermediate station platform is planned as 100m which is composed of 23.3m (one vehicle length) x 4 vehicles (the number of vehicles per train) +3.4m (margin at each platform end). The platform length for a terminal station is extended to 125m given the additional length required to accommodate the facilities for access/egress on the platform. These platform lengths are consistent with the lengths of the existing LRT Line 2 station platforms.

Minimum platform width, based on typical LRT design guidelines, should be no less than 3m (10ft) for separate platforms and 7m (15ft) for island platforms.

3) Station Location

A comparative study on station location was undertaken for the METI study. Alternative locations were investigated for Emerald Station, for the East Extension, and Divisoria, for the West Extension. Evaluation criteria adopted in the comparative study included: ridership, passenger convenience, access to other transport modes, landing locations, available road traffic lanes and ROW.

The location of Masinag Station was not subject to a comparative study at METI stage. The location of the station, identified during the METI Study, is sufficiently set back from the junction of Marcos Highway with Sumulong Highway, and is at the location of the proposed DPWH jeepney loading/ un-loading bay opposite an undeveloped plot. This location is understood to be the most recommendable and is therefore adopted in this JICA Study.

a) Emerald Station, East Extension

In the METI study, Emerald Station was recommended to be set sufficiently back from the intersection of Marcos Highway with Felix Avenue, in order to ensure that the public utility vehicles, stopping to load/unload passengers would not block the intersection. Emerald Station is located close to two adjacent malls, namely Robinsons Place Metro East and Sta. Lucia East Shopping Mall. The position recommended in the METI study places the station at a location facing the Robinsons mall. The owners of both of the adjacent malls, according to scoping meetings held during the METI study, both desire for

Emerald Station to be located at a position facing their respective mall. Robinsons Land are proposing to construct at their own cost an elevated access way from the station landing to connect directly with their mall, confirmed at a meeting held as part of the Environmental and Social Study for this JICA study.

The final position of the station, either opposite Robinsons Place Metro East or Sta. Lucia East Shopping Mall, will not have a quantifiable impact on ridership or passenger convenience, and will not affect project costs. For the purposes of this JICA Study, the location recommended by the METI Study is adopted.

In April 2011 a formal written proposal from a private developer was made to the DOTC to develop land areas in a subdivision located each side of Marcos Highway into a bus and jeepney parking/loading facility. The proposed site is located approximately 300m east from the junction of Marcos Highway and Feliz Avenue, approximately 500m from the proposed site of Emerald Station. The proposal was made with the purpose of proposing that Emerald Station should be re-located to this proposed site. This issue was taken up by the Study Team with DOTC Assistant Secretary for Planning at a meeting arranged by the Study Team. According to the Assistant Secretary the proposal of the private developer will not be pursued since it will provide a bias to a particular private developer that may not best meet the aspirations of the project implementation in terms of PPP.

b) Divisoria Station, West Extension

The METI study identified two (2) locations on Recto Avenue for Divisoria Station. One location was facing the Tutuban Mall, a large wholesale and retail shopping center, and the other location, approximately 400m further west, at a position where Recto Avenue becomes significantly wider.

Notwithstanding that a station location adjacent to Tutuban Mall would provide direct pedestrian access to the shopping center, the station location recommended by the METI Study was the position further west where Recto Avenue widens out. The following justifications were given:

- Available width between buildings at the recommended location is more than 40m. The location is therefore sufficiently wide to be able to accommodate the station and landings without the need for ROW acquisition.
- More available space at the recommended position for passenger transfer to other transportation modes.
- Available width at the Tutuban location is approximately 27m. This is wide enough to accommodate the station but the landings, at least on the south side, will require ROW acquisition.
- The available lanes will be reduced by station foundations at the Tutuban Mall site at a location where large volumes of jeepney traffic are turning.

Tutuban Mall occupies the site of the former Tutuban Station, the first main railway station in the Philippines. PNR leases out the Tutuban property, extending over 22-hectares, to Tutuban Properties Inc. (TPI), the developers of Tutuban Mall. The lease was renewed in December 2009 for another twenty five years. TPI have made a written request to LRTA for the station at Divisoria to be located adjacent to Tutuban Mall. The request also included location plan, sections and elevations of the proposed station. This TPI Study has been forwarded to the Study Team by the Administrator of LRTA with a request for the proposal to be included in the JICA Study.

The JICA Study Team has re-examined the Divisoria Station location issue, in the light of the TPI Study and in view of the fact that the station substructure and landing concepts have been revised/updated (refer Section 3.7.4.3). The following are the findings of the re-examination:

1. The TPI study shows the south landing occupying the footprint of a substantial 3-storey RC

frame building, referred to as the Roman Square Building. The plan shows the footprint only occupying the arcade walkway at ground level. However the building extends over the footprint of the arcade from the 1st-floor. Since the stair landing height is in the order of 13m above road level, the building will require partial demolition to accommodate the south stair landing.

2. The TPI proposed north stair landing at Tutuban Mall is located in an open area between mall building close to the Bonifacio monument. The space available is significant (9.7mx19.6m) and would likely be adequate for a main stair landing and elevator, together with the pump rooms and underground cisterns required to serve the station building if required.
3. The revised station concept could be accommodated at the Tutuban Mall location.
4. The width of the revised station concept at 23m is slightly less wide than the previous station concept. However given the relatively narrow space between buildings at the Tutuban Mall location, the available air gap between station building and adjacent properties will be in the order of 1.0 to 1.5m. This is too narrow for fire fighting access to the facing properties.
5. The TPI plan shows the wider station footprint proposed by the METI Study (taken from the existing LRT Line 2 design) overlapping with the Ramon Square building. A lateral displacement of this station design, to avoid demolition to accommodate the station itself, will bring the station building into close proximity with the Tutuban Center Prime Block Building on the North side. The space available for fire fighting access in this case is almost non-existent.

Given the above findings, the JICA Study team recommends that the proposed location of Divisoria Station should be retained at the position identified by the METI Study i.e. at a point some 400m west of the Tutuban Mall.

For the location and specific details of each station refer to Drawings E-14 to E-17, for Emerald Station and Masinag Station, and Drawings W-8 to W-9, for Divisoria Station.

3.7.4.2 Station Facilities

Requirements for station facilities are as follows:

- Two levels to be provided, a mezzanine concourse level and platforms at the upper level
- Transfer between the different levels will be made by using stairs, escalators and elevators.
- Emergency stairs shall be provided allowing emergency egress from the platform level and concourse level to ground level
- The non-paid area in the stations should be spacious enough to allow development of commercial activities
- Ticket booths should be located centrally and shall house all commands for the station mastering activities such as lighting, access and operations supervision
- Sufficient gates should be provided to allow passengers to access the paid area and should offer enough room for emergency evacuation
- Station Services
  - Water Supply system
  - Drainage, Sanitary and Sewerage System
  - Lighting and Electrical Power
- Fire Protection System
  - Fire Detection and Alarm System
  - Fire Protection System and Equipment
- Signage and graphic system (identification, directional, information and prohibition signs)
- Technical and service rooms, equipped with utilities for fire protection, ventilation and air-conditioning, should be provided to house:
  - Substations
  - Electrical distribution boards
  - Telecommunications equipment

  - Signaling connection boards
  - Elevator machine rooms
- Water tank for fire-fighting, water tank pump and septic tanks should be provided beneath the station.
- Male and female toilet facilities

The Manager of the LRTA Line 2 Operations Department informed the Study Team that the existing station lighting system should be improved. The current problem with the lighting is that all station areas are lit with only one switch. Perimeter areas that could remain unlit during revenue operation have to be lit when revenue areas are lit. There are no separate switches serving different station areas. Particular attention should be paid in specifying the performance requirements of the lighting system for the Line 2 Extension stations to allow areas within the station to be separately lit.

In addition the Manager of the LRTA Line 2 Operations Department informed the Study Team that the equipment rooms of the stations for the extension should be properly ventilated to prevent overheating and burn-out of motors. Equipment rooms therefore should be air-conditioned.

3.7.4.3 Station Structure Concept

The station structures comprise of reinforced and pre-stressed concrete substructures, supporting the concourse and platform levels, with a structural steel superstructure frame supporting the station roof.

1) Substructure

The existing LRT Line 2 stations are supported on a substructure that is comprised of a 3 leg concrete frame straddling the traffic lanes. This concept was also adopted for the outline station design established in the METI Study.

The current lane arrangement along Marcos Highway provides for four (4) lanes in each direction. This arrangement was accommodated with the previous substructure concept for the stations. Marcos Highway is currently being improved by DPWH under a World Bank funded National Road Improvement Project Phase 2 (NRIMP2). The Study Team obtained plans of the ongoing improvement from the DPWH project manager and were advised that the design of the improvement had been changed from the existing four (4) lane layout to a five (5) lane arrangement in each direction. The required width of the roadway in each direction is 18m.

With this revised arrangement, the previous framed station substructure concept can no longer be accommodated, as there is no available space for the exterior legs of the frame.

The station substructure concept has therefore now been revised such that support to the station is provided only from single central pier supports. The central piers are relatively wide, occupying the width of the 4m central reserve, and support the station structure on wide cantilever pier heads. This concept was used for the LRT Line 1 NEP stations along EDSA. Refer to **Figure 3.7-6** for a comparison of the station concepts.

A typical station of LRT Line 1 NEP is shown in **Photo 3.7-4**, illustrating the single central pier concept proposed for the Line 2 Extension.

Another component of the NRIMP2 project is the installation of substantial drainage works along the full length of Marcos Highway. Marcos Highway suffers from periodic flooding and this was particularly devastating during the onslaught of Typhoon Ondoy in 2009. The proposed drainage works, large size box culverts and pipe culverts, are intended to mitigate the effects of flooding along Marco Highway. The relative size and location of the proposed drainage works are shown in **Figure 3.7-6b**.

The proposed central pier support concept for the stations along Marcos Highway will not affect the proposed flood mitigation works.

The available width of the central road reserve at Divisoria Station is also sufficiently wide to accommodate the revised station concept. In the interest of uniformity, the single central pier support concept will also be adopted for Divisoria in the West Extension.

Source: LRTA Library Photo

Photo 3.7-4 Balintawak Station – LRT Line 1 NEP

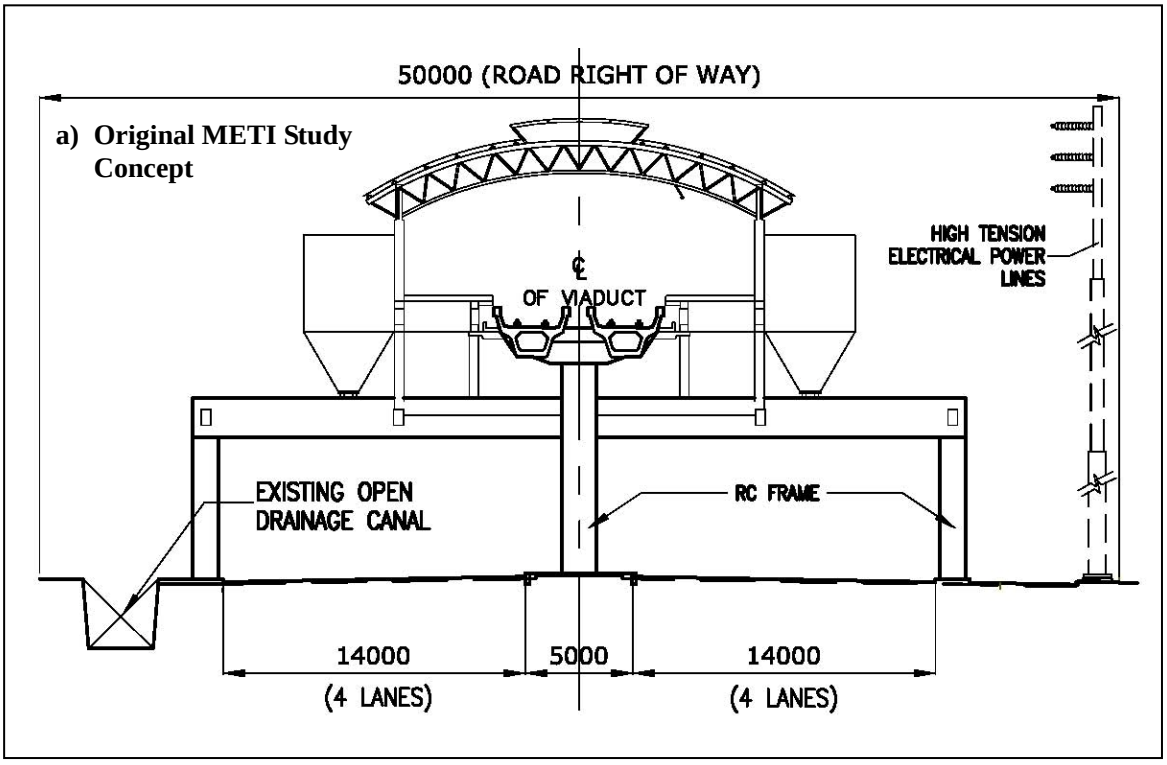
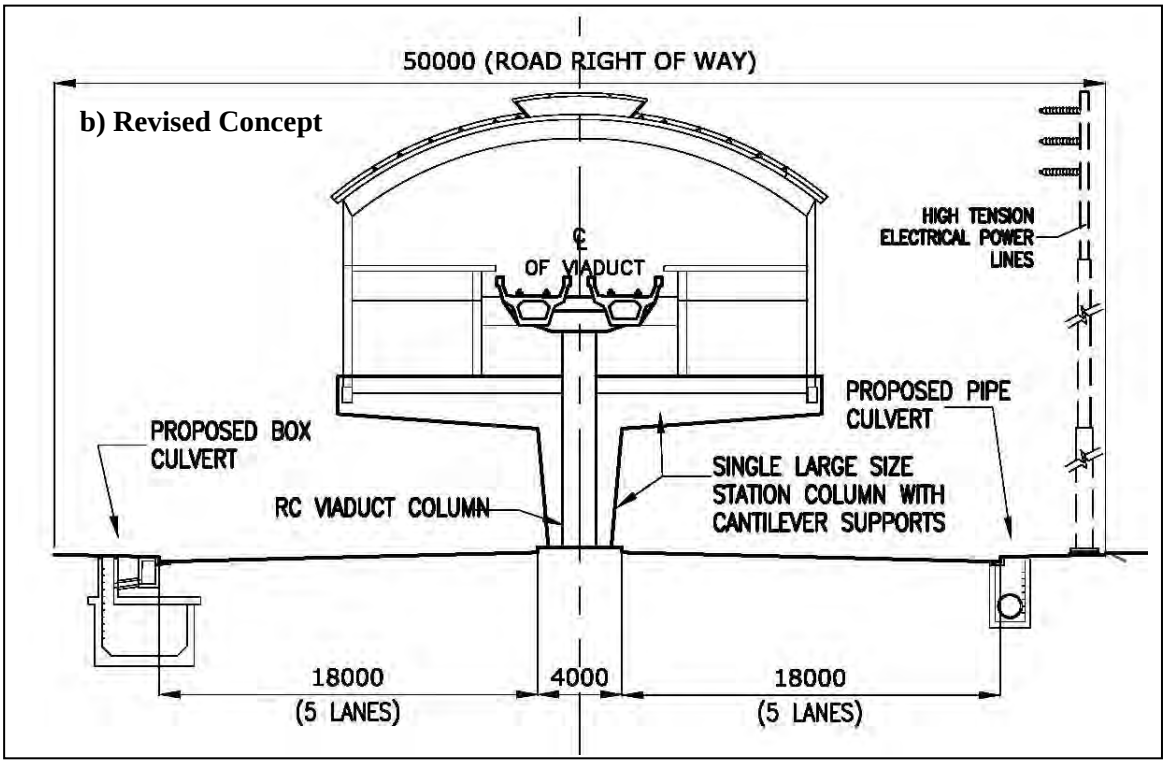


Figure 3.7-6a Station Concept along Marcos Highway



Source: Study Team

Figure 3.7-6b Station Concept along Marcos Highway

2) Viaduct Continuity

The existing LRT Line 2 stations support the trackwork on composite slabs supported on transverse steel stringers. The twin single box girder viaduct terminates at each end of the station and does not continue through the length of the station. The advantage of this form of construction is that the depth of construction of the track slab can be minimized and the height between concourse floor and platform can be kept to a minimum while still maintaining sufficient headroom in the concourse area.

The LRT Line 1 NEP viaduct is continuous through the stations, supported independently from the station structure on regular piers. The advantage of this configuration is that the viaduct construction can proceed without any need to interface with station structure support and construction can therefore proceed ahead of the station works. However in order to maintain headroom beneath the viaduct girder in the concourse, the height between concourse floor and platform must be correspondingly increased.

Both viaduct support methods in the stations have advantages and disadvantages. The choice of final configuration will be a matter for the final design.

3) Landings and Emergency Exits

The existing LRT Line 2 station main landings occupy a substantial footprint given that, in addition to providing stair and elevator access, the landings also accommodate the pump rooms and cisterns to serve the station buildings. The narrow space available along the existing route precluded the construction of water cisterns, pump rooms and septic tanks beneath the roadway.

For the Line 2 Extensions, the relatively wide space available for the construction allows the location of water tanks, pump rooms and septic tanks underground in the wide central reserve. As a result the proposed station landings can be relatively simple in design in that they only need to feature stairs, elevators and escalators, as necessary. There will be no requirement to find additional space at landing locations for other facilities.

The landing design is therefore proposed to be similar to the concept adopted for the LRT Line 1 NEP, with stairs, elevators and escalators, as required, occupying positions parallel with the road and located in the road ROW. Refer to **Figure 3.7-8** for an illustration of the station landing concept.

According to NFPA 130, Standard for Fixed Guideway Transit and Passenger Rail Systems, the combined egress capacity of the proposed main stairs and emergency stairs is 640 person per minute (ppm) or 3840 persons in the 6 minute period prescribed to evacuate the station trains and platform in the event of a fire. This is based on 2 main stairs and 2 emergency stairs each providing 4 pedestrian flow lanes (0.559m per lane). This capacity will require to be checked against the final estimates of peak hour traffic prior to the final design.

4) Station Roof

The existing LRT Line 2 stations feature a steel lattice type frame supporting the station roof. The Manager of the LRTA Line 2 Operations Department informed the Study Team that this type of roof structure support is difficult to keep clean and attracts bird nesting.

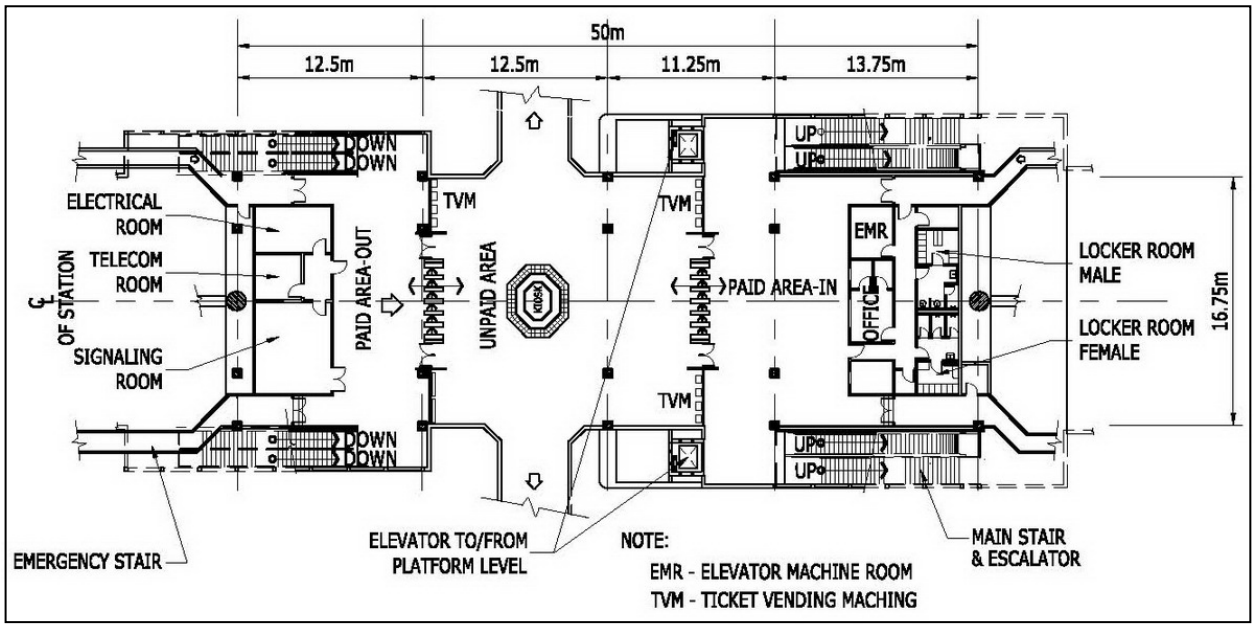
It is proposed to use curved rolled steel beam sections to support the station roof for the Line 2 extension structures, given that this will be easier to clean and maintain and may not be as attractive for bird nesting.

Refer to **Figure 3.7-6** for a comparison of the roof concepts and **Photo 3.7-4** for an illustration of the curved rolled steel beam support proposed.

3.7.4.4 Development of Commercial Area within the Station for Non-Rail Revenue Generation

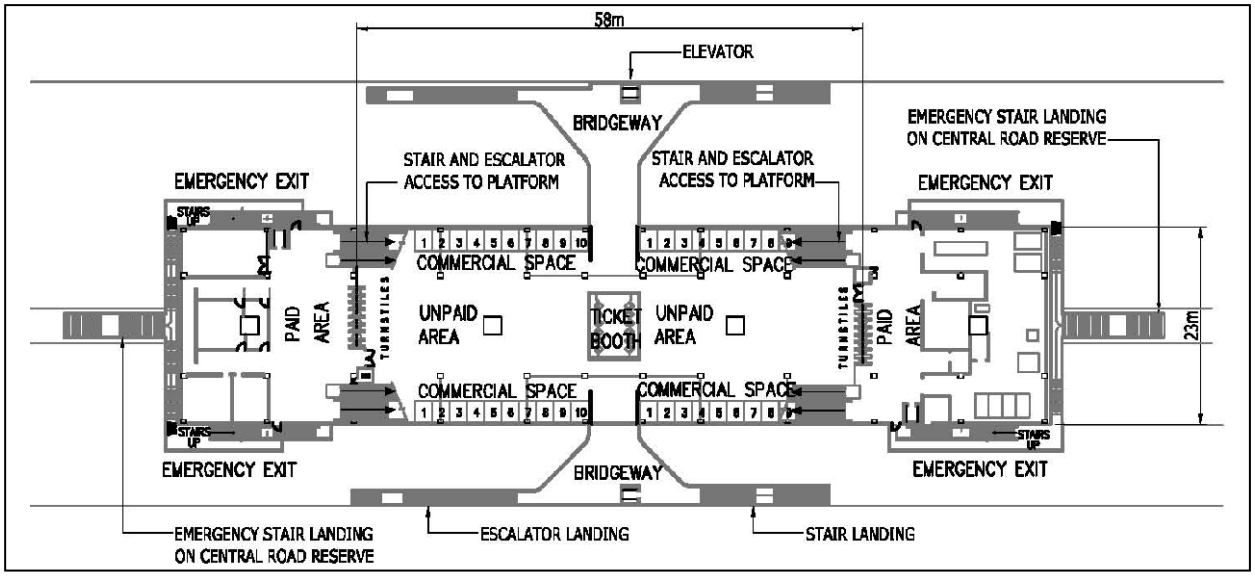
The Manager of the LRTA Line 2 Operations Department informed the Study Team that the un-paid passenger areas in the stations of the existing LRT Line 2 are too small to develop commercial space for non-rail revenue generation.

The main reason for this is that the emergency stairs from the paid areas of the existing stations are directed back to the central area of the station concourse, in order to find exits through the regular stair landings. With this configuration the regular stair and escalator access to the platforms in the paid area also have to follow the same parallel orientation thereby restricting the un-paid area to a small space in the central area of the concourse. For the existing Line 2 the relatively narrow road space available along the route precluded landing the emergency stairs independently on the narrow central road reserve. **Figure 3.7-7** for an illustration of the station concourse un-paid area concept for the existing LRT Line 2.



Source: METI Study2009

Figure 3.7-7 Existing LRT Line 2 Station Concourse Layout



Source: Study Team

Figure 3.7-8 Existing LRT Line 2 Station Concourse Layout

For the Line 2 Extension, the proposed un-paid areas in the station concourses will be made larger to facilitate development of commercial areas. Directing the emergency stairs from the platform and concourse paid areas to the ends of each station to find landings on the road central reserve provides more flexibility in arranging the regular stair and escalator orientation in the paid areas, to create a larger un-paid space in the central concourse area. Refer to **Figure 3.7-8** for an illustration of the proposed station concourse un-paid area concept.

3.7.5 Intermodal Facilities

An intermodal facility can be defined as a place where interface occurs between transportation modes. The term "intermodal" implies not only multiple transit modes but also a high degree of connectivity and interchange between modes.

The American Public Transit Association offers the following definition: "Intermodal (multimodal) are those issues or activities, which involve or affect more than one mode of transportation, including transportation connections, choices, cooperation and coordination of various modes."

Successful intermodal facilities can provide numerous benefits, such as:

- Supporting and enhancing transit usage
- Facilitating transfer between transit modes
- Increasing transportation options
- Consolidating transit services
- Supports economic and urban development.

The challenges faced by the successful implementation of intermodal facilities are:

- Institutional issues raised by competing services or by the use of the intermodal facility space by unlicensed vendors, etc.
- Physical engineering challenges
- Traffic impacts
- Cost.

Intermodal facilities can take several forms depending on their location, types of transit services offered and passenger characteristics. Within the context of the Line 2 Extension Project, intermodal facilities can be considered to be of the following types:

- On-street Transit Facilities/Transit Mall Facilities
- Park and Ride

On-street Transit Facilities/Transit Mall Facilities are applicable to all the proposed stations of the Line 2 Extension Project. Given the particular characteristics of Park and Ride Facilities, described below, the only applicable station to consider developing such a facility is Masinag Station on the East Extension.

3.7.5.1 On-street Transit Facilities/Transit Mall

Within the context of the Line 2 Extension, on-street transit facilities at the station areas will comprise, where space allows, additional at grade service lanes to accommodate licensed public utility vehicles and private cars to pick-up/drop-off passengers, short-term parking areas for waiting vehicles and waiting sheds.

The successful implementation of such facilities will depend fundamentally on the following aspects:

- the interaction between the general traffic and public transport modes running on the streets
- proper planning of at grade facilities to support interconnection with other transport modes.

The interaction between the general traffic and public transport modes in practice covers most public transport services. Both operating costs and quality of service of street-based public transport modes are strongly dependent on the characteristics of the traffic flow. This calls for:

- continuing attention to traffic management to improve the performance and maximize the use of the existing urban road infrastructure;
- selectively giving public transport vehicles the priority of use, ranging from the right of quick passage at intersections to exclusive-use lanes for high-volume service corridors; and
- judicious improvements to the road network, with designs anticipating the priority for passenger transport modes.

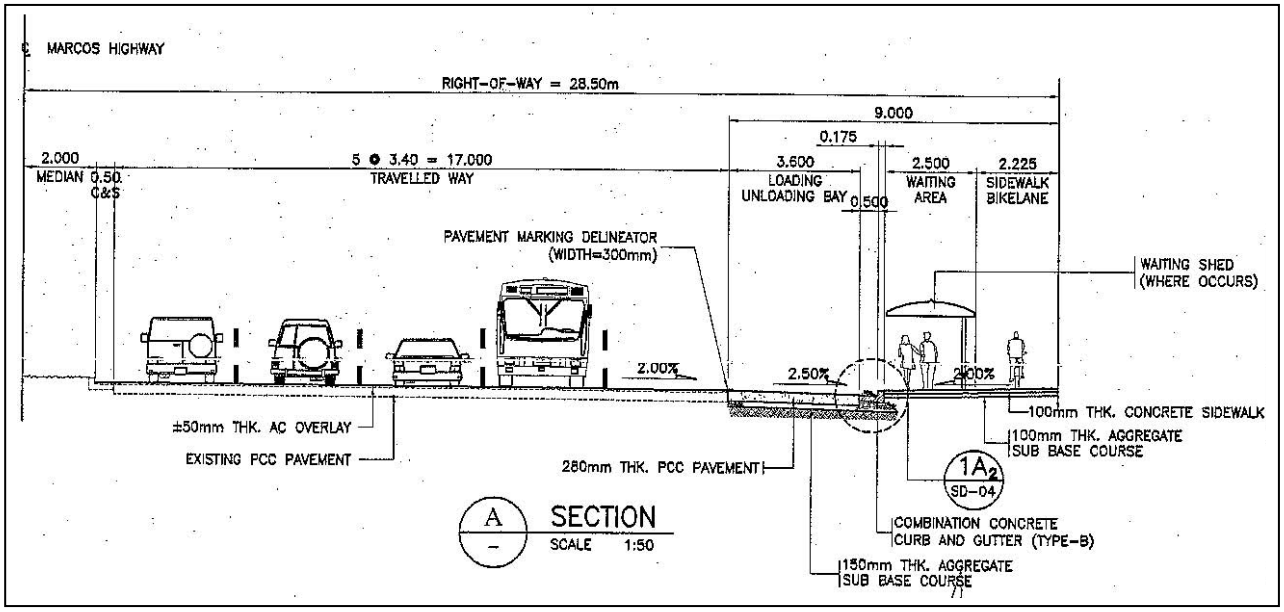
Station locations where space is available for on-street transit facilities are Masinag Station on the East Extension and Divisoria on the West Extension. Transit mall facilities could be developed at all station locations.

1) On-Street Facility at Masinag Station

Masinag Station is to be situated at the location where DPWH intends to build a jeepney bay on Marcos Highway, at least for the westbound traffic, as part of the NRIMP2 project.

According to typical drawings obtained through the DPWH project manager, the jeepney bay will be 70m in length and 9m wide, including a 3.6m wide jeepney bay, 2.5m waiting area with waitng shed and 2.225m sidewalk. Refer to **Figure 3.7-9** for a typical section through the proposed jeepney bay.

Given that the landings for Masinag Station are to be located at the same position, within the sidewalk space, the jeepney bay will also serve as an on-street facility for the station.



Source: DPWH NRIMP2 Project Plan

Figure 3.7-9 Proposed Jeepney Bay on Marcos Highway

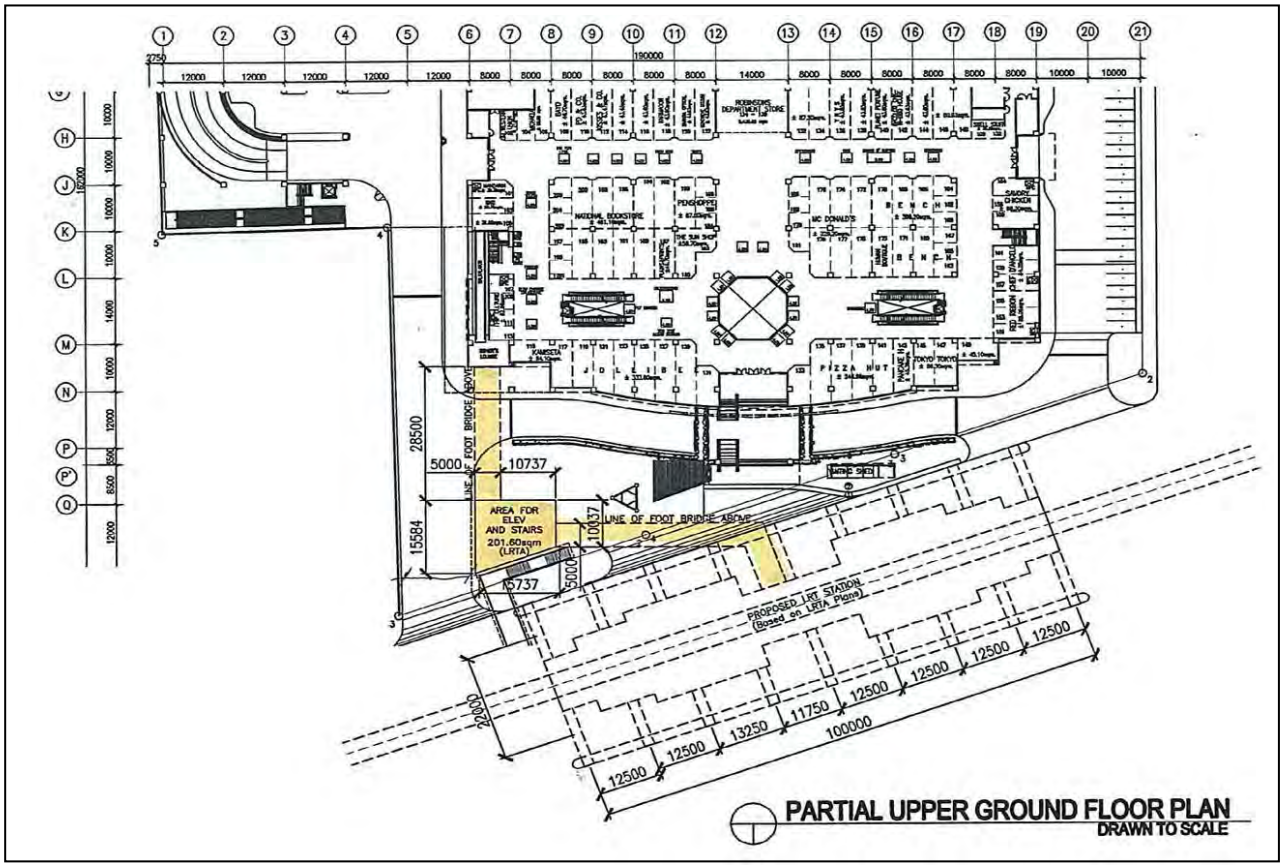
2) On-Street Facility at Divisoria Station

Divisoria Station is located where Recto Avenue widens out to more than 40m between building lines. In order to connect to Radial Road 10 to the west, there is a need to provided only 2 lanes in each direction on Recto Avenue west beyond the station location, occupying a width of 20m. This is because the connecting road to R10 is only 4 lanes in width. The remaining width could be developed into a public utility vehicle loading area, with adequate provision made for pedestrian waiting areas and sidewalks. The available length along Recto Avenue for development is around 150m, from Carmen Planas Street to El Cano Street.

3) Transit Mall Facilities

Although, strictly speaking, direct dedicated pedestrian links to malls located in the vicinity of the proposed Line 2 Extension stations are not themselves intermodal, such links provide access to the on-street vehicle loading/unloading and parking facilities already established at each mall location. Direct pedestrian links to adjacent malls will also promote patronage of both the mall and LRT line 2.

Malls are located either adjacent to or in the vicinity of all proposed stations of the Line 2 Extension Stations. Robinsons Land Corporation, the owners of Robinsons Metro East Mall located adjacent to the proposed Emerald Station, have already drawn up plans for a direct footbridge connection, connecting the mall with the landing of Emerald Station. Refer to **Figure 3.7-10** showing a plan on the upper ground floor of the mall and the footbridge connection, to be constructed at no cost to LRTA.



Source: Robinsons Land Architectural Plan

Figure 3.7-10 Proposed Elevated Footbridge from Emerald Station to Robinsons Metro East Mall

At other station locations, elevated pedestrian access ways directly linking stations with mall buildings could be erected to promote safe passenger transfers above street level. Such an elevated pedestrian access way has been erected to connect the SM Marikina Mall to Santolan Station on the existing Line 2, a footbridge in the order of 350m in length. Similar footbridges could be constructed to connect Masinag Station to the newly constructed SM Masinag (a distance of approximately 250m) on the East Extension and to connect Divisoria Station to Tutuban Mall (a distance of also approximately 250m) on the West Extension. It is noted that the maximum desirable walking distance for such facilities is in the order of 250m.

3.7.5.2 Park and Ride Facility

Park-and-ride lots can be classified as intermodal transfer facilities. They provide a staging location for travellers to transfer between their cars and the LRT. If carefully planned and integrated into the transportation system park-and-ride facilities can encourage a shift from the single occupancy vehicle to the LRT, meeting efficiency needs of the transportation network.

Within the context of the LRT Line 2, the functional characteristic of a proposed park-and-ride facility will be suburban. Suburban park-and-ride lots are typically located at the outer edges of urban developments. The chief function of such a facility is to collect potential transit patrons as close to their place of origin as possible (their homes) and provide a transfer point to the long-haul LRT service.

Suburban park-and-ride lots are typically funded by public investment, but in some cases sustain private ownership. Opportunities for joint development and multi-use facilities can be high, depending on location.

The park-and-ride facility should be located with regard to the following criteria:

- along a major transportation corridor
- in advance of the point where intense traffic congestion routinely occurs
- 6 to 8.0 kilometers from the downtown area served by the transit way and at least 6 to 8.0 kilometers from another park and ride facility
- downstream from, but in the immediate area of, sufficient demand for travel to the downtown area being served.

These criteria are met along only at Masinag. Therefore, should park-and-ride facilities be considered for the Line 2 Extension, they should be considered only for Masinag Station on the East Extension.

To encourage use of the park-and-ride facility, they should be located typically no more than 250m from the station. An inspection of the area within a 250m radius of the proposed Masinag Station indicates that the only likely site for the park-and-ride facility would be the undeveloped lot/lots fronting onto Marcos Highway on the north side and directly adjacent to the proposed station location. This area is approximately 200mx75m in size.

The size of the park-and-ride facility is influenced by the estimated demand, using a “commutershed” concept. The commutershed concept is used to determine the primary catchment area for estimating the demand for park-and-ride. The commutershed is roughly a parabolic-shaped area, and for a terminal station is usually taken to be 8km long and 10km wide, with the park-and-ride facilities at the focus of the parabola. In the case of Masinag the commutershed would extend from Masinag along Marcos Highway to beyond Cogeo and along Sumulong Highway to Antipolo City.

The basic steps in estimating the demand for park and-ride facilities are as follows:

1. Define the catchment area for the station

2. Determine the primary market (the downtown Manila employees/students residing in the catchment area)
3. Determine the primary demand, which is based upon the observed and expected modal split for home-based work/study trips to Manila downtown.
4. Estimate the proportion of primary demand attracted to the park-and ride facility.

The estimation of the demand for a proposed park-and-ride facility at Masinag is beyond the scope of this Study.

3.8 Plans for Power Distribution, Machinery, Signaling, and Telecommunication Facilities

3.8.1 Preliminary Design

The preliminary design (Sheet No: EM1001~EM1022) shows changes due to the extension in LRT Line 2, including power distribution, machinery, signaling and telecommunication systems. As-built drawings belonging to LRTA were applied to these preliminary designs (Preliminary Design: See Appendix A "Drawings of E&M System").

1) Power Distribution System

As for changes to the power distribution system due to the extension, the location of a new rectifier substation (RSS#7), station electric rooms, and enhanced existing facilities are indicated in Sheet No: EM-1001 (DWG No: PWS-1). Standard single line diagrams for the existing rectifier substation and station electric room are shown in EM-1002 (PWS-2) and EM-1003 (PWS-3).

The most suitable location for the new RSS#7 for power distribution in the east extension is midway between Emerald Station and Masinag Station. The location will be around 1.4 km east of Emerald Station. This is a location similar to the existing RSS#4 between Betty Go Station and Cubao Station.

The overhead contact system consists of center poles and cantilever beams. EM-1004 (OCS-1) shows the principal arrangement of the tangent track in the main line. Simple catenary systems (with automatic tension balancer) are used for the existing overhead contact system. The main materials for the electric circuits are tin coated hard-drawn grooved trolley wires ($137mm^2$) for contact wires and 19/2.8mm hard-drawn copper stranded conductor ($117mm^2$) for messenger wires.

Table 3.8-1(1) Description of E&M system construction work

System	classification	Equipment	Description of work	Scale
Power distribution	Extension	Rectifier substation	Power supply for east extension	1 location near Emerald station (RSS#7)
		Station electrical room	Power supply for equipment in new stations	2 stations in east extension and 1 station in west extension
		Power distribution facilities along main line	High voltage and low voltage power distribution	4.14km in east extension and 1.63km in west extension
		Catenary equipment for the main line	Installation of catenary and center poles	Ditto
	Function Reinforcement	4000KW rectifier	Additional rectifier for increased power demand	RSS #1,3,4,5 (Number of locations depends on the size of the demand)
Signaling	Extension	Signaling equipment rooms, railway equipment, wiring	Signaling equipment rooms at new stations, wayside railway equipment in extension section and wiring of sigaling cables	2 stations and 4.14km in east extension and 1 station and 1.63km in west extension
		Onboard signaling equipment for new rolling stock	Onboard signaling equipment mounted on new trains	Number of mounted equipment depends on the number of train sets
		Switch machine for the main line	Switch machine for train turn-back	Divisoria station, Masinag station
		Passenger information displays	Installation at the platform of new stations	2 stations in east extension and 1 station in west extension
	Upgrading	Train supervisor control equipment	Replacement of whole OCC equipment due to extension	OCC 1 set
		Central control equipment	Replacement of whole OCC equipment due to extension	OCC 1 set
Telecommunication	Extension	Telecommunication facilities for the stations	Installation of telecommunication equipment at new stations	2 stations in east extension and 1 station in west extension
		Clock facilities	Installation of clock facilities at new stations	Ditto
		SCADA facilities	Installation of remote control terminals for new stations and substation	Ditto, RSS#7
		Telephone facilities	Installation of telephone facilities for new stations	2 stations in east extension and 1 station in west extension
		APS announcement facilities	Installation of APS facilities for new stations	Ditto
		Train radio facilities	Installation of new radio stations	Divisoria station, Masinag station
		Fiber optical transmission line for telecommunication	Extension of fiber optical transmission line	4.14km in east extension and 1.63km in west extension
		UPS power source facilities for telecommunication	Installation of UPS power source facilities for telecommunication facilities for new stations	2 stations in east extension and 1 station in west extension
	Upgrading	CCTV	Installation of CCTVs at new stations and 3 operating stations which have become unable to transmit	stations in east extension, 1 station in west extension and 3 stations in need of repair
		Fiber optical transmission line for telecommunication	Installation of dedicated fiber optical transmission line for signaling and CCTVs	Case1: 17.66km, Case2 19.29km

Source: Study Team

Table 3.8-1(2) Description of E&M system construction work

System	classification	Equipment	Description of work	Scale
Telecommunication	Upgrading	CCTV	Installation of CCTVs at new stations and 3 operating stations which have become unable to transmit	stations in east extension, 1 station in west extension and 3 stations in need of repair
		Fiber optical transmission line for telecommunication	Installation of dedicated fiber optical transmission line for signaling and CCTVs	Case1: 17.66km, Case2 19.29km
		Central control equipment	Replacement of whole OCC equipment due to extension	OCC 1 set
		Management information system	Replacement of whole OCC equipment due to extension	OCC 1 set
	Repair	SCADA	Early restoration of required system for safe management of power supply	Entire area of existing section
		APS	Early restoration of required broadcasting facilities for operation	In Depot
AFC	Upgrading	AFC	Installation of AFC facilities at new stations, and upgrading of some AFCs at existing stations	2 stations in east extension, 1 station in west extension and 11 existing stations
Track works	Extension	Direct fixation concrete tracks for the main line	Construction of direct fixation concrete track structures including rail and rail fastening device	4.14km in east extension and 1.63km in west extension
		No.8 diamond double crossover	Installation of switch machine for train turn-back	Divisoria station, Masinag station
		Rail joints for main line, etc.	Seamless rail welding, etc.	4.14km in east extension and 1.63km in west extension
	Repair	Concrete plinth	Plinth repair for safe train operation	43 points in existing section
Maintenance facilities	Repair	Under-floor wheel truing machine	Early restoration of necessary equipment for train maintenance	1 set at wheel truing line in Depot

Source: Study Team

2) Signaling system

Control points for the signaling system were additionally built at Divisoria Station in the west extension and Masinag Station in the east extension; the outline of this change is shown on EM-1005 (SIG-1). WESTRACE made by DEMETRONIC is used for the interlocking in the existing line, where signal information is transmitted to signal equipment installed along the main line via the fiber optical transmission line of the telecommunication system and the SDH in the telecommunication equipment room (TER).

The signaling system was changed so that it would not be affected by the telecommunication system, and the outline of such change is shown on EM-1006 (SIG-2) and EM-1007 (SIG-3). This involves the installation of new SDH in the signal equipment room (SER) and the fiber optical transmission line dedicated to signaling, making the signaling system independent of the telecommunication system.

EM-1008 (SIG-4) shows the single line diagram from the SER to the ATO loop on the track that controls the automatic operation; EM-1009 (SIG-5) shows the single line diagram of the passenger information display system connecting the centralized traffic control (CTC) with each station.

3) Telecommunication System

The existing telecommunication system transmits signals for telephones, clocks, train radios, SCADA (Supervisory Control and Data Acquisition System), APS (Audio Paging System), AFC (Automatic Fare Collection), BMS (Building Management System), signaling, and PIS (Passenger Information System) information, using single-mode fiber optical transmission line of 2 x 24 cores. The same fiber optical transmission line is also installed in the CCTV system.

As for changes made to the signaling system due to the extension, EM-1010 (COM-1) shows the fiber optical transmission line for the new telecommunication system that separates the signaling.

Remote Terminal Unit (RTU) for SCADA are installed at the existing substations and stations; the layout of the new SCADA system including the added substations (RSS#7) and stations is shown in EM-1011 (COM-2).

Regarding the telephone system, a single line diagram for the existing standard stations is shown in EM-1012 (COM-3) for reference.

The existing train radio system uses TAIT's analog radio system. While it is projected that the analog system will be digitalized in the future, the existing facilities will continue to be used with the existing systems at this point. Currently, four base stations are in operation. While the east extension is expected to go beyond the range of the existing base stations, radio disturbance is expected to occur in the west extension due to buildings along the main line. Therefore, new base stations will be built at the terminal stations, Masinag Station and Divisoria Station, with antennas installed on the rooftops of the respective station buildings. The overview of this train radio system is shown in EM-1013 (COM-4).

Single line diagrams for APS, clocks and CCTV systems at the existing standard stations are shown in EM-1014 (COM-5), EM-1015 (COM-6), and EM-1016 (COM-7), respectively. Management Information System (MIS) within OCC assumes an update to the latest system. The single line diagram for the existing systems is shown in EM-1017 (COM-8) for reference.

EM-1018 (COM-9) shows the outline of each system's circuits and link status for the fiber optical transmission line of the telecommunication system, as modified due to the extension. Transmission links of the signaling system in this drawing will be shifted to the new independent transmission network, as mentioned above.

4) AFC

As for the allocation of AFC equipments at new stations, the allocations at the existing standard stations are shown in EM-1019 (AFC-1) for reference. The variety and quantity of AFC at the new stations shall use the specification of the existing stations.

5) Track Works

Direct fixation concrete track structure, which is equivalent to the track structure used for the existing line, will be used for the extension line and will be shown in EM-1020 (TWK-1) for reference. However, terminal joints of track beams shall be joined in a manner that prevents causing cracks, as much as possible, between the concrete plinth and the concrete on track beams.

6) Depot Facilities

Track layout in the existing depot is as shown in EM-1021 (DPO-1). The number of train sets owned is currently 18 train sets (4 cars per train set). A total of 14 train sets are held on stabling tracks (7 tracks),

and 4 train sets are held on manual car washing tracks (4 tracks). By using a part of the manual car washing tracks, the car washing machine tracks, wheel turning tracks, heavy maintenance tracks, and light maintenance tracks, it would be possible to store 4, 2, 1, 1 and 2 train sets, respectively, with the maximum capacity of 28 train sets.

Layout of inspection and repair facilities in the existing workshops is as shown in EM-1022 (DPO-2). Heavy maintenance tracks (2 tracks) and light maintenance tracks (4 tracks) are allocated as inspection and repair tracks, which would allow inspections and repairs of approximately 40 train sets based on an estimate from the standard inspection days and intervals. Therefore, if rolling stock to be added due to the extension are in specification equivalent to the inspection and repair of the existing rolling stock, the inspection and repair facilities need no significant improvement because the current facilities will suffice.

3.8.2 Data for Cost Estimates

In order to implement the extension of LRT Line 2, construction estimates were made by the following construction types, including the extension line.

- Costs to revise the existing system specifications, to upgrade the facilities in the existing line due to obsolescence, and to install facilities of the same specifications in the extension;
- Costs to install facilities for the extension of the same specification as the existing systems;
- Costs to reinforce functions of the existing facilities due to the extension; and
- Repair costs for the existing facilities.

Specific descriptions of the categories are as follows:

1) Upgrading the Existing Systems

As mentioned in subsection 3.1 “Reviewing the Existing Railway Facilities and System Specifications,” the upgrade of the existing systems is summarized as follows:

- To install new SDHs and UPS in signal equipment rooms in the existing and extension line, and to separate the transmission portions of the signaling systems from the telecommunication systems;
- To install new CCTVs at new stations and the operating stations which have become unable to transmit;
- To install dedicated fiber optical transmission line for signaling and CCTV; and
- The ongoing project. “Upgrading and Integration of the Automatic Fare Collection Systems of the LRT1, LRT2, and MRT3 railway Systems”

The quantities for the above upgraded systems are shown in **Table 3.8-2** Estimates for System Upgrades.

2) Construction of the Extension

The quantities for the construction of the extensions with the existing specification are shown in **Table 3.8-3** Estimates for the Extension.

3) Function Reinforcement of the Existing Equipment

Demand for power supply will increase upon extension as the number of operating trains increases. Each of the four existing rectifier substations (RSS#1, RSS#3, RSS#4, and RSS #6) has an empty space where one 4000kW-class rectifier can be installed. One rectifier per substation will be allocated for reinforcement in order to cope with the demand increase.

The expected quantity due to function reinforcement is shown in Table 3.8-4 for Function Reinforcement of the Existing Equipment.

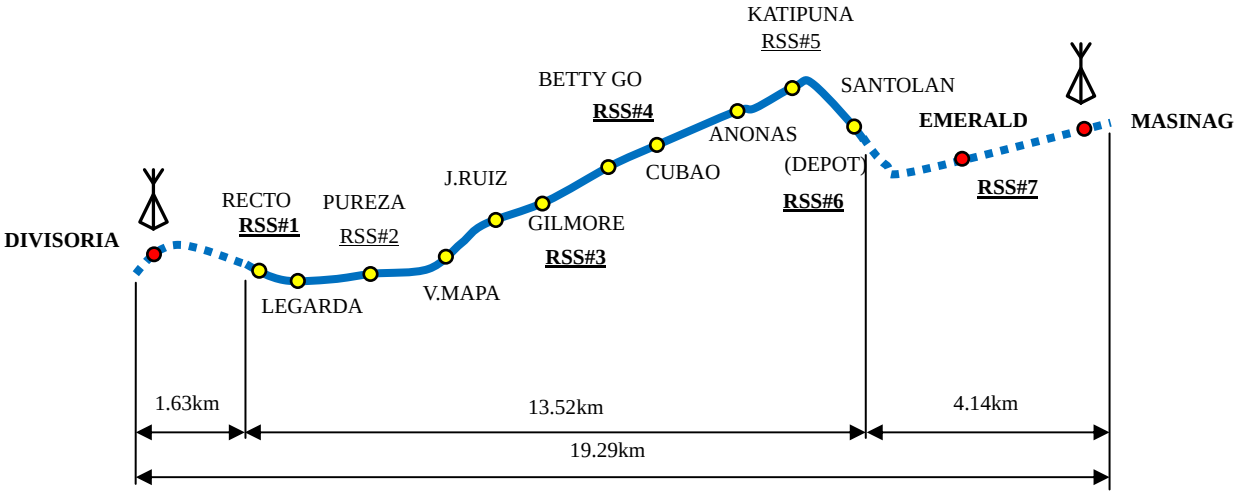
4) Repair of the Existing facilities

The answers obtained from LRTA regarding the repair items for the existing facilities and their costs are shown in Table 5.5 -1. The estimated extensive repair cost of line 2.

5) Quantities

Route layout is as shown in **Figure 3.8-1** LRT Line 2 Route Layout for the purpose of cost estimates.

The results of the cost estimates are as shown in **Tables 3.8-2~4** below. The quantities indicated in **Tables 3.8-2~3** represent 2 cases: one for the east extension only and the other for both the east and west extensions. The distribution ratio of foreign and local costs was set with reference to the contract records for the construction of LRT Line 2. Cost of these items will be included in Section 5.5 of the Final Report.



Source: Study Team

Figure 3.8-1 LRT Line 2 Route Layout

Table 3.8-2 Estimates for System Upgrades

Item	Unit	Quantity		Distribution ratio	
		East only	East&West	Foreign	Local
Control center equipment for signaling	set	1	1	90%	10%
New CCTV (incl. existing parts)	station	New 2 Repair 3	New 2 Repair 3	95%	5%
New fiber optical transmission line (signaling, CCTV), including the installation of new SDHs	km	17.66	19.29	95%	5%
Control center equipment for telecommunication	set	1	1	95%	5%
Train supervisor control equipment (OCC)	set	1	1	95%	5%
New management information system (MIS)	set	1	1	95%	5%

Source: Study Team

"Upgrading and Integration of the Automatic Fare Collection Systems of the LRT1, LRT2, and MRT3 railway Systems" is ongoing.

Table 3.8-3 Estimates for the Extension

Item	Unit	Quantity		Distribution ratio	
		East only	East&West	Foreign	Local
Rectifier substation (RSS#7)	location	1	1	90%	10%
Station electrical room	station	2	3	90%	10%
Power distribution facilities along main line	double-track km	4.14	5.77	90%	10%
Catenary equipment for the main line	single-track km	8.28	11.54	80%	20%
Signaling equipment rooms, railway equipment, wiring	station	2	3	90%	10%
Onboard signaling equipment for new rolling stock	train set	Depending on the number of required rolling stock		90%	10%
Switch machine for the main line	unit	4	8	90%	10%
Passenger information displays	station	2	3	90%	10%
Telecommunication facilities for the stations	station	2	3	95%	5%
Clock facilities	station	2	3	95%	5%
SCADA facilities	RTU	3	4	95%	5%
Telephone facilities	station	2	3	95%	5%
APS announcement facilities	station	2	3	95%	5%
Train radio facilities	base station	1	2	95%	5%
Fiber optical transmission line for telecommunication	km	4.14	5.77	95%	5%
UPS power source facilities for telecommunication	station	2	3	95%	5%
Direct fixation concrete tracks for the main line	Single-track km	8.28	11.54	85%	15%
No. 8 diamond double crossover	set	1	2	85%	15%
Rail joints for the main line, etc.	km	8.28	11.54	85%	15%

Source: Study Team

Table 3.8-4 Function Reinforcement of the Existing Equipment

Item	Unit	Quantity	Distribution ratio	
		Existing line	Foreign	Local
4000kW rectifier assembly (RSS#1,3,4,6)	set	4	90%	10%

Source: Study Team

3.8.3 Technical Consideration regarding the Function Reinforcement of the Existing Systems

Table 3.8-5 "Points of Technical Consideration upon Function Reinforcement" below lists additional specifications to be taken into consideration upon reinforcing the functions of the existing systems:

Table 3.8-5 Points of Technical Consideration upon Function Reinforcement

System	Points of Consideration
Power Supply	• An approximately 300m^2 (20 x 15m) lot to the east of EMERALD Station needs to be obtained to build a new rectifier substation (RSS#7). • Standard height for installing substation facilities and building structure standards should be established considering possible floods evidenced by Tropical Storm Ondoy. • A possible voltage drop should be examined in detail, and high output of the substation facilities to be reinforced should be considered at the time of designing as necessary. • Installation of emergency lighting systems and ventilation equipment at substations and stations' electric rooms should be considered to improve the work environment.
Overhead contact system	• Lightning arrestors should be installed on the rooftops of new station buildings and on the center poles in the extension for lighting measures.
Track works	• Continuous slab structures are preferable for expansion gaps between beams (upper piers), which does not affect the shape of direct fixation concrete track structures.
Fiber optical transmission line	• Transmission line for signaling and CCTV should be integrated as a single cable.
Telephones	• Investigate how many additional telephones are needed at the existing stations and facilities, and examine the number of additional racks that can be installed.
Train radios	• A radio wave sensitivity test should be conducted prior to setting up radio stations at each terminal station in the extended zones, and the test results should be reflected in the design of the stations.
AFC	• As part of the phased transition to the common ticketing system, it is planned to retain the exterior of automatic ticket gates and replace the interior with the contactless system successively. Thus, the specifications should be thoroughly examined upon converting the AFC system.
UPS	• Telecommunication system failures have occurred in the past due to UPS malfunction. The cause of these failures should be summarized to take measures to prevent recurrence of such failures.
CCTV	• Since the existing operational systems and new systems will be used in combination to operate CCTV for the moment, the specifications of connection areas, etc. need to be designed assuming a complete update to new systems in the future.
OCC	• Connecting between the extension and the existing lines should be done outside the hours of operation and within a short time. Therefore, the new system shall be built with other systems that will not affect the existing systems; comprehensive tests should also be conducted. • OCC facilities have already begun deteriorating; equipment including Train supervisor control equipment, control center equipment for signaling and telecommunication, and MIS, also need to be updated. • For the large operation display panel, which is currently out of service, a monitor display type is recommended.

Source: Study Team

3.8.4 Consideration of Barrier-free, Universal Design

Barrier-free concepts in railway aim at eliminating obstacles for people with disabilities who access train stations and use trains, while universal design expands further the barrier-free concepts and refers to facilities that are designed in a way that especially elderly people and people with disabilities have easier access. In the area of power distribution, machinery, signaling, and telecommunication in the railway system, ticket gates and information systems at train stations are the examples of facilities that are directly used by passengers.

In terms of universal design, it is important to ensure that automatic ticket gates and automatic ticket vending machine can be easily used by anybody and that automatic fare adjustment machine can be easily located. Such designs include wheel-chair accessibility of to automatic ticket gates (to ensure enough width so that wheel-chairs can easily pass through the gates), Braille signs, voice response system and route/fare display functions of automatic ticket vending machines. It would also be necessary to install 2-tiered counters at passenger counters which are wheel-chair accessible and guiding blocks at ticket gates for visually impaired persons.

Currently, automatic ticket gates for LRT Line 2 are using turnstiles and are not wheel-chair accessible. As people with wheel-chair now need to use gates where they can be attended by station staff, installation of automatic ticket gates with a flap type barrier may be considered in the future, in terms of improving passenger service.

For information systems designed for visually impaired persons, it would be better to use voice information boards, call buzzers, and interphones (with Braille signs), as well as something more contrasting for station signs which are easier to read for the weak-sighted.

3.9 Technical Review of Compatibility with Existing Railway System

In order to implement the extension, the study reviewed the system specifications as regards the construction of LRT Line 2 and conducted a technical examination, taking the upgrade of the existing railway facilities and systems into consideration.

This section will examine the technical aspects of ensuring consistency and compatibility between this study's proposals and the existing railway facilities and systems, and describes the ensuring of safety, maintenance, unification of spare parts, and management of drawings in terms of the operation after inauguration.

3.9.1 Technical Comparison to Ensure Consistency and Compatibility

1) Rolling Stock

The basic specifications of the rolling stocks of LRT Line 2 are at the required level for a standard urban railway system. However, in recent cases, in order to decrease the number of motors and control equipment, motors with higher output and VVVF inverters for controlling multiple motors have been introduced. Modifications of basic specifications such as reducing M/T ratio must be implemented on all rolling stock inclusive of the current rolling stock. Otherwise, maintenance shall become complicated due to existence of different specifications.

As spare parts are not manufactured, in case compatible items can not be found, it is essential to correspond to new specifications. When switching to spare parts with new specifications, service life and number of parts and equipment must be taken into account in order to decide whether only parts with new specifications should be modified or all parts should be replaced.

2) Power Distribution, Machines, Signals, and Communication Equipment

Table 3.9.1-1 shows the results of the technical review regarding the upgrades of power distribution, machines, signaling, and telecommunication facilities:

Table 3.9-1 Result of Technical review of adjustment and compatibility with the existing equipment

System	Reexamination of the technical function	Adjustment and compatibility with the existing equipment
Signaling	Separation of the transmission line from the telecommunication system	The specification of fiber optical transmission line is changed. The current specifications for signal equipment will be applied for the extension line.
AFC	Replacement of broken equipment, Upgrading	Nearly half of the automatic ticket gates including broken equipment are converted to upgrade the function. Because the existing equipment is used in combination, AFC data transmission will use the specification equivalent of the existing equipment for the existing system and no major update will be made.

CCTV	Replacement of broken equipment, Upgrading, Installation of dedicated fiber optical transmission lines	The existing system and the new CCTV system will be used in combination for the moment. Newly dedicated fiber optical transmission line will be installed and 2 CCTV systems are to be installed so that no mutual interface will occur.
Track works	Mitigation of the squeal sound and the wear of rails and wheels	Check rails are not adopted. By applying the alternative countermeasures or reduced running speed in the curves, it is expected that the squeal sounds and the wear of rails and wheels will be mitigated.
	Deterrence of track deformation	Tracks using anti-vibration sleepers absorb vibration compared with the tracks laid by the concrete plinth method and are expected to reduce track deformation.
Maintenance facilities	Common use of maintenance facilities	By accommodating the basic specifications of additional rolling stock to the existing specification, the maintenance facilities can be shared with existing rolling stock.
Power distribution, Overhead contact system, Telephone, Clocks, Train radio, SCADA, APS, PIS	Follow the existing functions	Since the functions of these systems are satisfactory, the standards and specifications adopted in the existing line will apply to the extension line.

Source: Study Team

3.9.2 Technical Review Viewing Operation after Inauguration

1) Rolling Stock

In respect to rolling stock specifications corresponding to the line extension and renewal of current facilities, modification of the basic specifications is not required. Only minor modifications of subsystems and parts specifications are to be implemented in order to ensure functional reliability of the rolling stock and facilities as well as to simplify the maintenance process.

Subsystems with functions integrated with way-side facilities such as train radio and public address system should be modified in regard to comparison between parts replacement and repair, number of rolling stock required after the line extension, and timing for replacement of the existing rolling stock.

For items corresponding to parts with new specifications, it is necessary to modify the maintenance manuals for the rolling stock.

2) Power Distribution, Machines, Signals, and Communication Equipment

a) Ensuring safety

Deformation of the concrete plinth for the tracks could reduce the safety of the running trains and appropriate train operation. Detailed inspection will be required where track deformation is expected to occur.
High voltage cables are installed right under the inspection passage for workers in the existing lines, and power is supplied through the center pole to the overhead catenaries. In the extension lines, it is desirable to install high voltage cables at a sufficient distance from the inspection passage considering the safety of the workers.

b) Maintenance

Although the existing AFC system equipment is currently being repaired by LRTA, it is desirable to

outsource it in terms of operational efficiency in compliance with the common ticketing system concepts.
Since the existing power and telecommunication cables are installed under the inspection passage between the track beams of the up and down lines, it is not easy to inspect them due to the need to open the inspection passage which is covering the duct. It is desirable to install cable troughs on the same surface as tracks and at distance from the inspection passage.
Maintaining the correct shape of the wheel treads helps to improve the ride quality and reduce wheel and rail noise and abrasion. It is important to repair and maintain an under-floor type wheel turning machine, which is currently out of service, so that it is available for use at all times.

c) Unification of spare parts

Expendables and spare parts (e.g. parts, materials, tools) for track works and power distribution should be standardized with the same items as or equivalent to those used in the existing systems, so that they can be used in the main line including the extension.
It is often difficult to standardize electronic parts, which are redesigned at a rapid pace. Especially in the CCTV system, parts management will be required so that parts will not be mixed when old and new systems are used at the same time.

d) Management of drawings of old and new systems

Completion drawings regarding the extension construction and the improvement construction of the existing line should be submitted to the client prior to the beginning of the construction. The contractor should delete the old completion drawings for the existing line upon system updates, replace them with post-improvement drawings, edit them by adding post-extension drawings, etc., and obtain approval from the client.

CHAPTER 4

SUSTAINABLE RAILWAY BUSINESS OPERATIONS

CHAPTER 4 SUSTAINABLE RAILWAY BUSINESS OPERATIONS

4.1 Review of the ex-post evaluation of Metro Manila railway sector projects

Until now, many projects in the rail transport sector in Metro Manila have been undertaken with the support of yen loans. Some lessons and recommendations (issues) were mentioned by the ex-post evaluation to the support. In summary, the following three solutions were recommended for sustainable railway business operations.

- Importance of change of the fare level and necessity for continuous financial support from the government
- Necessity of procurement of spare parts, delivery program and maintenance system
- Security of the design renewal and replacement program for facilities/system and the assurance of readily available funds to cover required expenses

4.1.1 Ex-post evaluation report of LRT Line 1 capacity expansion project

In the ex-post evaluation report of the LRT Line 1 capacity expansion project in which the fact-finding was carried out in September 2004, recommendations were made as shown in **Table 4.1-1 and** as follows:

- In order to secure the sustainability of railway business operations, it is necessary to improve the financial situation of LRTA, which is in a severe condition
- As a measure for that, while continuously aiming at improvement of the profitability of the railway business operation, it is necessary to aim at expansion of non-railway business, and
- In order for the government to support the railway financially, a capital increase Bill needs to be approved.

Moreover, since the procurement procedure for spare parts was inefficient, the rolling stock operating ratio has been falling, but it is assumed that the improvement of procurement procedure was achieved as recommended by the 2004 study of Japan Bank for International Cooperation (JBIC).

4.1.2 Ex-post evaluation report of LRT Line 2 construction project

The ex-post evaluation of Metro Manila Strategic Mass Rail Transit Development (LRT Line 2) Project was conducted from September 2008 to August 2009, and its report described the lessons and recommendations as shown in **Table 4.1-2 and** as follows:

- First, like the LRT Line 1 ex-post evaluation, in order to secure the sustainability of railway business operations, LRTA needs to improve its severe financial condition, and to change its fare level or to continue the governmental financial support.
- On the spare parts issue, the local availability should be reviewed carefully during the planning stage, and when it is judged difficult, detailed maintenance articles should be incorporated in the implementation contract on the issue such as a) advanced procurement of those spare parts as a part of the initial implementation or b) a maintenance article describing the manners and ways to procure spare parts.
- In order to make train operations efficient, safe and economical, large-scale repair work cost should be budgeted as a component in the economic and financial analyses.

Table 4.1-1 Ex-post valuation of LRT Line 1 Capacity Expansion Project

Importance of change of a fare level and necessity for continuous governmental continuous financial support	
Background and Circumstances	LRTA has its excessive liabilities, but the financial sustainability of LRTA has been secured. 1) Financial situation of LRTA ・(Before the project implementation) Since LRTA which had fixed liabilities of 5,200 million pesos in end of 1992 was in the situation of excessive liabilities, profitability was pressed by the refund and interest burden. At the time of examination, the Bill which increases authorized capital to 12 billion pesos for the purpose of support of this debt was deliberated in congress. ・(After the project implementation) LRTA which had fixed liabilities of 11,800 million pesos also in 2003 is still in the situation of excessive liabilities, and profitability is pressed by the interest burden of 870 million pesos and the exchange loss of 2,750 million pesos. The Bill which increases authorized capital has not been approved in Parliament. Although the capital-increase Bill was deliberated by the Chamber, it has not been approved by the Senate. 2) LRTA's profitability from its railway business and non-railway business ・Although the farebox ratio of LRTA has decreased when compared with the time of examination, it has increased in recent years, therefore, there is no special issue in the profitability of the primary railway business. ・LRTA intends to expand its non-railway business (a real estate enterprise, an advertising enterprise) for the purpose of profitability strengthening from now on. 3) Governmental policy and action ・The government has taken the action which covers the worsening profitability of LRTA due to its interest burden by means of a subsidy injection of 830 million peso in 2002 and 7,600 million pesos in 2003. ・In view of the fact that LRTA has played a major role (public nature) for traffic congestion mitigation of Metro Manila, DOTC reveals its idea that since a capital-increase Bill was not approved, LRTA can depend on a government guarantee for the incurrence of obligations. ・In April 2005, LRTA again requested adoption of a capital-increase Bill by the railroad committee of the Chamber.
Recommendations	（To executing agency） In order to prevent the financial characteristics of LRTA which is still in a severe situation from reducing its effectiveness as a railway, it is necessary to improve the ongoing profitability of the railway business and expand the non-railway business. However, the financial assistance from the Government by enactment of a capital-increase Bill is indispensable.
Procurement of spare parts, delivery program and maintenance system	
Valuation	Maintenance is evaluated as follows. ・Since the procurement procedure for required spare parts for maintenance of rolling stock was inefficient after 2001, the rolling stock operating ratio is falling, and the number of rolling stock operations is also in a downward tendency. ・It is supposed that as the improvement of procurement procedure was achieved by the study (2004) of the Japan Bank for International Cooperation, normal operation of the rolling stock will be resumed.

Source：Ex-post valuation report of LRT Line 1 capacity expansion project

Table 4.1-2 Ex-post valuation of LRT Line 2 Construction project

Importance of change of a fare level and necessity for continuous governmental financial support	
Background and Circumstances	1) Financial situation of LRTA ・ At present, the fare revenue can cover operation expense with difficulty. ・ LRTA had a 44,100 million-peso debt and equity capital of only 2,200 million pesos at the end of December 2007, and 90 percent of the debts are long-term loans (yen loans). ・ About 1 billion pesos will be necessary from now on to cover repair work expense which is required within 10 years (2012) after starting the operation. In addition, although payment of the yen loan also started in 2006, the amount repaid from the 2009 fiscal year amounts to about 3,300 million yen every year. 2) The fare level of LRTA ・ At the time of examination, the fare was set as the fixed 11-peso amount. ・ The current fare of 12-15 pesos (an average of 13.5 pesos) has been deferred since the 2003 commencement of operation. ・ As compared with the fare of a bus and a jeepney, the fare of the LRT Line 2 is considerably lower. ・ Although governmental approval is required for a fare change, at least a 2-5 peso price increase should be considered. 3) LRTA's profitability from its railway business and non-railway business ・ The operating profit of LRT operation is chronically in the red. The reasons net profit in black figures from year to year are exchange gain and subsidy injection by the government. 4) Governmental policy and action ・ The subsidy injection from the government is planned for the payment of repair work expense and the repayment expense of yen loan. ・ The fare level is set very low by decision of the government. ・ The capital-increase Bill which was under deliberation in the Congress at the time of examination is not approved this time.
Lessons	Support from the capital injection and subsidy from the government is indispensable. After developing a detailed financial analysis and a fiscal plan which includes early dissolution of excessive liabilities, a well-planned repayment method of the debt, and strengthening of the management framework, etc. in the stage of project formation, it is necessary to develop an action plan for government support and to manage the project in order to carry it out with certainty.
Recommendations	The fare level is maintained so low by decision of the government that running cost is covered with difficulty. For the purpose of securing the sustainability of the project, as part of project supervision JICA needs to present the importance of a change in fare level to the government as needed, or (while the above-mentioned decision is maintained) needs to present the necessity for continuous financial support by the government as needed.
Procurement of spare parts, delivery program and maintenance system	
Background and Circumstances	・ Only 14 trains are used for operation from among the existing 18 trains, and four remaining trains are not working because of the procurement difficulty of spare parts and the shortage of eligible repair companies etc. ・ Since many spare parts are custom-made items, the number of suppliers is limited. As countermeasures for this problem LRTA created a database which listed the economical spare parts suppliers, re-classified change and improvement of parts so that it may further reduce costs, searched for substitutes for outdated spare parts, and founded a research-and-development division, and it is advancing local production of the present parts.
Lessons	The propriety of the spare parts procurement in the country and the procurement method in the case of this being difficult (the existence of an agency, the storage place of parts, etc.) should be clarified in the project planning stage. If procurement/arrangements are judged to be difficult, it is necessary to include simultaneously purchasing enough spare parts) in the contract at the time of main part procurement purchase (for example, is the quantity of important parts required over five years.
Recommendations	In a railroad project, it is usual that special specifications are used for some rolling stock and equipment, and it is desirable to consider the procurement of the spare parts at the time of maintenance before project implementation. It is necessary to also consider including the maintenance provision which includes the delivery and plan of spare parts at the time of writing the main contract.
Design renewal and replacement program for facilities/systems and securing of funds to cover required expenses	
Background and Circumstances	・ About 1 billion pesos will be necessary from now on to cover repair work expense which is required within 10 years (2012) after starting the operation.
Recommendations	Although the annual operational and maintenance expense after construction completion is added as expense, the cost of the required large-scale repair work once in several years is not added in the stage of economic and financial analyses. In order to operate the trains economically, safely and efficiently, it is necessary to add all of the required expenses.

Source : Ex-post valuation report of Metro Manila Strategic Mass Rail Transit Development project

4.2 Review of solutions pertaining to the lessons and recommendations

4.2.1 Measures to improve financial structure of executing agency

4.2.1.1 Introduction

As reviewed in Chapter 1.6, judging from its current financial situation and future prospects, LRTA does not have sufficient repayment capacity for a new and large investment, and its low profitability is rather structural and fast track solutions seem to be difficult. On the other hand, LRTA has to continue to make necessary investment as an urban railway entity, but this would require sufficient support from the government. Consequently, with a view to improve its repayment ability for large scale investments, the financial situation of LRTA is expected to be improved through budgetary measures by the central government.

1) Measures in alignment with future direction of LRTA

When considering improvement of the financial character of LRTA, one needs to adopt policies in line with the future direction of LRTA.

According to the draft proposal of the LRTA medium-term development plan (2011-2016) drawn up first in 2011, it is assumed that LRTA is financially-independent, fully-owning its assets, and the sole government institution, in partnership with the Private Sector, that is responsible for the construction, management and operation of urban mass transit system in the country. It is understood that LRTA will contract the Line 1 and MRT Line 3 temporary O&M and then, under the PPP scheme, the Line 1 Cavite Extension and its integration with Line 3 and their O&M are expected to be operated by the private sector. It is possible that the Line 2 Extension will also be constructed, operated and maintained the private sector.

Based on those facts, LRTA would not build, operate or maintain its lines by itself, but it will own the existing lines and also the extended and new lines to be built by the private sector and receive concession fees by contracting with the private sector for the operation and maintenance, and thus LRTA is oriented to assume a role as administer and supervise the whole railway operations that would be built, operated and maintained by the private sector.

As for the projects such as the Line 1 Cavite Extension, Ninoy Aquino International Airport Rail Link, and the LRT Line 2 East-West Extension, since ODA financial assistance for those projects would be possibly envisaged, LRTA may also function as an executing agency for the ODA financial assistance.

2) Menu of improvement measures for financial characteristics

In the ex-post evaluation report of the LRT Line 1 capacity expansion project and LRT Line 2 construction project, the improvement of the financial situation of LRTA which is in a severe condition is mentioned as an issue in order to secure the sustainability of railway business operations, and the solutions are proposed as follows:

- Necessity to continuously improve the profitability of the railway business operation and to expand the non-railway business
- Importance of change of the fare level and necessity for continuous financial support from the government
- Governmental financial support by approving a Capital-Increase Bill

The JBIC Study proposed the following four measures as stated as reviewed in Chapter 1.6.

- Debt Transfer to GOP
- Debt & Asset Transfer to GOP
- Subsidy (including write-off of BTR advances)
- Debt-Equity Swap

The "Study Report on Manila LRT Line-2 East-West Extension Project in Philippines" (METI Study) proposed three ways to improve LRTA's financial issues as follows and it further recommended that the measures should be adopted.

- Establishing accounting separation of the long-term debt from the operational cash-flow and the former to be funded from the national account.
- Strategic subsidy allocation by the national government,
- Substantial increase in LRTA capital.

The Study Team is proposing the following measures for improving the financial condition of LRTA:

- Change of fare level
- Improvement of profitability with expansion of non-railway business
- Debt Repayment Obligation Transfer to the National Treasury
- Strategic subsidy or assistance from the government
- Capital increase of LRTA

4.2.1.2 Improvement measures for the financial condition/situation

1) Change of a fare level

In order to improve the low level of profitability of LRTA as stated to Chapter 1, a fare increase is required in the first place.

In January 2011, LRTA and DOTC proposed the fare hikes for LRT Line 1, LRT Line 2, and MRT Line 3. The proposed new fare system is according to transportation distance, and 1 peso per km is added to a basic 11-peso boarding fare. An average new fare of LRT Line 1 and Line 2 is said to be 19 pesos (8 km of average trip length). Public consultations were held twice, on February 4 (student organizations), 2011, and on February 5 (a variety of mixed groups). However, since citizens' sufficient understanding was not obtained, LRTA announced that it would delay its presentation of the new fare proposal to Land Transportation Franchising and Regulatory Board (LTFRB) on February 23. The fare increase was ultimately approved by LRTA Board and LTFRB in May, however, it has not yet been implemented due to instructions from Central Government.

Although the fare increase is supported by DOTC DBM and DOF, the situation where implementation is delayed so that it may not become a political point at issue continues.

2) Improvement of profitability with expansion of non-railway business

Although LRTA is expanding non-railway business, such as advertisement, access charge to stations, and rental fee from shops at stations, such non-railway revenue is only 3.6% of farebox revenue (2010), but it is expected that it would grow further in the future.

To use its land more effectively, LRTA has been planning to evaluate its land assets, mainly at Line 1 and Line 2 depot areas.

Further, legal comments are provided that the interpretation of LRTA Charter (E.O. 603) indicates that

LRTA can be engaged in mobilizing its assets including property development on and above its land. LRTA is promoting measures towards the further expansion of non-railway business.

3) Debt Repayment Obligation Transfer to National Treasury

LRTA had a 42,450 million Pesos foreign debt balance as at December 31, 2010, of which LRT Line 2 borrowing occupies about 60%, around 26,300 million Pesos. This borrowing has a matched asset and the asset in question is being used currently for public transportation purposes and is not easily disposed of. The debt repayment transfer to the Treasury (the general budget) will mean both the Asset and the corresponding Debt should be assumed by the government, and the Asset and Debt will be separated from the LRTA operations and maintenance.
LRTA will have a great advantage with a more stabilized financial situation by receiving benefits of improving the quality of its balance sheet, as well as no risks associated with the foreign exchange by transferring both the Asset and Debt above. The debt transfer to Treasury, however, is considered as a substantial measure under the application of the relevant laws and regulations. With a view to have support from the public, LRTA would, in parallel, need to make efforts in raising revenues such as from the non-railway operations, disposals of assets with low necessity, effective use of the assets, and measures to secure the sound management in the future. Furthermore, the government will possibly to set conditions that the government will not compensate any losses in the form of subsidies.

4) Strategic subsidy or assistance from the government

The subsidy by the central government (Treasury) will increase LRTA's current asset (Cash). That will achieve a higher Current Ratio and contribute to the stability of the financial situation. The subsidy or financial assistance from the central government will not mean a legal consolidation procedure like the case 3) Debt Repayment Obligation Transfer below, and will be relatively easily implemented. This subsidy methodology to reinforce debt repayment ability by improving the Current Ratio will suit the future role of LRTA as the executing agency of ODA responsible for the debt repayment obligation for new debts.

However, since there is currently no subsidy for such operation in the existing institution, the Study Team deems that implementation would not be easy. Furthermore, it is not possible to drastically improve the LRTA's financial situation and thus it is essential to combine it with other measures.

5) Capital Increase for LRTA

LRTA was established with its capital of 500 million Pesos in 1980, and raised its capital to 3 billion Pesos in 1982 for the implementation of the LRT Line 1 construction project. The Net Asset at the end of 2010 shows a negative 17,059 million Pesos, LRTA needs to continue principal payment of 4 billion yen every year till 2024 Yen loan occupies 96% of funded debts, and it is expected that net assets will decrease further.

As stated in the ex-post evaluation report of LRT Line 1 capacity expansion project and LRT Line 2 construction project, in order to support LRTA in the situation of excessive liabilities for repayment of long-term liabilities, a bill to increase the capital to 12 billion pesos in the first half of the 1990s was submitted to the Congress, but not approved. Now LRTA has a plan to increase its capital to 100 billion Pesos, and once again is going to submit the request to Congress.

LRTA receives the funds from the government that are appropriated for repayment of the long-term debt in the form of a subsidy. Although timing is specified, this subsidy is to be changed to capital increase. That is, the government will invest and the investment will be appropriated for discharge of the debt (Debt Equity Swap).

If this capital increase is realized, LRTA can compress the debt and improve its financial characteristics. The reasons for this low level of stability of its capital balance are mainly attributed to the new and extension of LRT lines and also its train capacity increase operations. In addition, its low profit level comes from difficulties in raising its fares, increasing payment of interest, and losses caused by foreign exchange. Taking those factors into consideration, the capital increase is considered as a possible measure to be taken to improve the financial situation. It will also match LRTA's future role as the asset owner as well as the executing agency of ODA debt with undertaking of debt repayment.

The capital increase procedures would require, in the same manner as the previous capital increase was done in 1982, an Executive Order. It would be considered in the same context as the debt repayment transfer to the Treasury above as a substantial measure. LRTA will be required to make efforts in raising revenues such as from the non-railway operations, disposals of assets with low necessity, effective use of the assets, and measures secure the sound management in the future.

4.2.2 Measures to secure spare parts

Currently, LRTA is outsourcing the maintenance services of both Lines 1 & 2, but the services are mainly for man-power and implementation of light and heavy maintenance. Special repairs are secured on separate contracts on need basis, and the Maintenance Contracts include the purchase of consumable spare parts. The purchase of Capital spare parts is kept under the control and regulations of the LRTA.

For each line there is a *Master List* of capital spare parts, and whatever part not included in that list is considered a *consumable* spare part. A usual definition of Capital Spare parts are the parts within inventory that are purchased as spare parts for depreciable assets (e.g., capital equipment), while consumables are any part, component, or subassembly kept in reserve for the maintenance and repair of major items of equipment. As such, consumables are moving parts of a whole assembly (or capital part), and they are usually easy to obtain in the local market without proprietarily issues, and with a wide range and variety of offers, which make them price competitive.

ON the other hand, capital spare parts are usually limited in offer, sometimes with a single supplier (OEM), many times foreign only supply, and usually with a long lead time for delivery.

The procedure for acquisition of Capital spare parts is as follows:

- Maintenance Contractor issue a Material Request (MR) to LRTA for a given spare part as per needed or as per maintenance schedule requirements,
- LRTA processes the MR internally, canvasses, sometimes bid, and purchases, all regulated by Law RA 9184,
- Material is delivered to Maintenance Contractor for usage.

The timely delivery of these spare parts is critical to preventive and corrective maintenance of all equipment of LRTA. Unavailability of these spare parts will further affect the scheduled maintenance activities and can cause slow down of revenue lines.

Unfortunately, the efficiency of timely purchasing capital spare parts is wanting, mainly due to bureaucratic procedures, or red tape. This is not a unique problem for LRTA, but it is common to many governmental agencies in the Philippines and around the world.

It is clear that LRTA should improve the procedure for acquisition of capital spare parts, or include this task within the scope of works of the maintenance contractor. Outsourcing the entire maintenance activity, including acquisition of capital spare parts would improve the availability of such parts for the timely and correct maintenance of the system's equipment. If this is done, warehousing and supply chain management will improve. Procurement of needed spare parts and equipment will be faster by

employing technical experts for doing the canvassing, evaluating, and testing up to acceptance of delivered spare parts, besides reducing the effect of red tape and bureaucratic procedures.

4.2.3 Security of the investment expense for repair and replacement

While, generally in the economic and financial evaluation process of studies/planning stage, initial investment expense, operation/maintenance expense, railway business revenue, etc. are estimated, and the financial analysis over a long-term project period is conducted. In railroad construction, only the replacement expense of the rolling stock is included in the estimate, and other large-scale repair or replacement expenses are not included. This is considered to be based on the following reasons.

- In order to estimate the expense of large-scale repair or replacement, development of the long-term repair plan according to the contents of initial construction is needed, but no engineer is posted to takes charge of the preparation and estimate of a long-term repair plan in the basic design stage.
- Since railroad facilities do not make many large scale repairs compared with civil structures, such as buildings, roads, port facilities, or airports, and there are numerous management entities which carry out large-scale repair, and the items which are the object of large-scale repairs, such as civil works facilities, E&M systems, and the rolling stock, are various, the large-scale repair carried out in the past is hard to be unified as a database, and the estimate of the large-scale repair works over a long period of time is difficult.
- Due to appropriating the expense of large-scale repair or replacement as required expense from the economic and a financial-analysis process, the budget security at the time of actually carrying out large-scale repair etc. is not easy.

In order for LRTA as an implementing agency to ensure coverage of the expense required at the proper time in the future and to steadily carry out large-scale repair of the existing section and the extension section of LRT Line 2, it is necessary to implement the following solution.

1) Large-scale repair of existing sections before the completion of extension sections

If construction of the extension sections is carried out by the conventional mode, it would be efficient to carry out large-scale repairs of the existing sections together with construction of the extension section, considering both time and cost. It is assumed that the expense at this time can be included in the total investment expenses which are subject to the loan ratio of ODA although it cannot be directly considered as the object of ODA. Therefore, a financing resource other than ODA must be provided, which will be in addition to the loan for the extension section.

It is desirable for LRTA to carry out large-scale repair of the existing section along with completion of the extension section as shown in "4.4.1.4 Allocation of the Roles and Risks of the Public Sector and Private Sector 1) Rehabilitation of the Existing Portion of Line 2", if construction of the extension section is carried out by the private sector in PPP mode. In this case, LRTA needs to cover provide the expense of large-scale from other resources.

2) Large-scale repair after the completion of the extension section

It is desirable for large-scale repair after extension section completion to be carried out by LRTA as it is shown in "4.4.1.4 Allocation of the Roles and Risks of the Public Sector and Private Sector 3) Replacement, Renewal and Large Scale Repair Work after the Extension Operation Starts".
In this case, the expenses of large-scale repair should always be covered by LRTA as well as the large-scale repair before extension section completion.

It is desirable for LRTA to reserve a fixed amount of money as a reserve fund for repairs every year in

order to prepare for future large-scale repair. It is efficient for the reserve to be adequate to cover the whole route which LRTA will own and manage in the future including LRT Line 1 Line 2 and MRT Line 3.

And, when premised on operation and maintenance of the existing section and the extension section being carried out by a project company (SPC), it is desirable to carry out large-scale repair appropriately by the following ways.

- After making the project company concerned prepare the draft proposal for a long-term repair plan before extension section completion and getting approval of LRTA, LRTA and the project company share the long-term repair plan. Estimated costs are included in the long-term repair plan as reference information.
- Based on the long-term repair plan, the project company carries out repairs other than large-scale repair, and LRTA carries out large-scale repair and replacement.
- The project company keeps the history and record of all the repairs including large-scale repair, and updates a construction drawing.
- The project company revises and updates the long-term repair plan periodically, and acquires approval of LRTA.
- It is better for LRTA to take into consideration giving the project company some incentive so that the prolongation of life of facilities and equipment may be achieved by implementation of the appropriate maintenance by the project company and a large-scale repair implementation schedule can be postponed.

4.3 Adequacy Evaluation of solutions and recommendations for direction

4.3.1 Adequacy of financial improvement measures of the executing agency

This subsection will review adequacy of improvement measures of LRTA's financial characteristics shown in subsection 4.2.1 from the point of view of LRTA management.

1) Change of a fare level

- In consultation with LRTA, LRTA stated they have been exploring, adjusting with the government.
- LRTA and DOTC are going to implement the fare hikes for LRT Line 1, Line 2 and MRT Line 3 simultaneously. This is appropriate.
- Implementing the required fare hike before the O&M contract with a private sector entity by introducing PPP makes it possible to reduce the demand and revenue fluctuation risk to the public sector and fare determination/change risk to the public sector or private sector. And, the automatic fare collection system is to be introduced into LRT Line 1, Line 2, and MRT Line 3 collectively. Even from the viewpoint of introductory time, there is advantage in an early fare hike.

2) Improvement of profitability with expansion of non-railway business

- Although expansion of non-railway business, such as advertisement charge revenue, access charge revenue to a station, and rental charge revenue from shops of a station yard, were all increased, discussions with LRTA indicate that they recognize it is still not enough.
- Due to LRTA's lack of operation capability (planning, implementation, and operating capability of a real estate development), it can not be assumed with confidence that it will be able to profitably use the rail yard which it holds among its non-railway businesses.
- On the other hand considering that O&M of LRT Line 1 is supposed to be transferred to a private sector entity, and O&M of LRT Line 2 is also likely to be transferred to a private sector entity by

PPP, transferred the implementation of a non-railway business to a private sector entity is also to be considered.

- From the viewpoint of the improvement of the financial standing of LRTA, it is necessary to build a structure which can divide the development profit mutually between the private sector and LRTA, without entitling simply a private sector entity to develop upper space of a depot.

3) Debt Repayment Obligation Transfer to National Treasury

- Since transferring not only the debt but also the property to the central government conflicts with the future vision of LRTA which is that LRTA continues holding the property, LRTA indicated that this plan is not desirable.
- The view that the measure was not suitable was shown by DOF, because it didn't come into line with the policy of the government in which the government agency should take the responsibility for its activity and operation and LRTA should hold property itself
- At present, project formulation under a PPP scheme is envisaged for Lines 1 and 2, and would change the LRTA revenue structure depending upon the bidding results by the private sector, and further, LRTA may also assume new debt. In addition, as stated above, the future role of LRTA is oriented towards the overall management and supervision role and not in building, operating and maintaining the facilities by itself. This direction does not match with this approach in separating its asset ownership and the railway operations and maintenance. Consequently, this debt repayment transfer option is not a recommendable measure to be taken as of now.

4) Strategic subsidy or assistance from the government

- In consultation with LRTA, LRTA stated that the view of LRTA that the government is supporting with a fare hike and charging O&M to a private sector by PPP in the operation side, and expenditure of a direct subsidy is not realistic.
- From DOF stated having already distributed as a subsidy the fund which LRTA appropriates for repayment of a long-term debt.
- If such a situation is taken into consideration, it is not appropriate to offer new assistance in the form of a large sum which would sharply compress the debt.

5) Capital increase of LRTA

- LRTA indicates that they would like to increase the capital to 100 billion pesos and submit such a request to Congress for approval. Also DOF showed that they had already carried out converting the BTR advance into a subsidy as a first step on the assumption that a capital-increase bill would be approved, and the subsidy would probably be converted into capital. Considering the policies of the government and LRTA, this measure is appropriate.
- The reduction of the debt and the increase of capital are very appropriate as an action for it not only corrects the excessive liabilities of LRTA, but secures the soundness and continuity of LRTA operations corresponding to the future vision of LRTA by introduction of PPP.
- It would be possible for LRTA to appropriately manage the property which it holds after the capital-increase implementation, and to advance cost reduction, information disclosure, etc. Therefore, this measure is appropriate.

4.3.2 Risks of the financial improvement measures in the implementation phase

The measures that would improve LRTA's financial characteristics as shown in subsection 4.3.1 are "change of a fare level" and "capital increase."

Based on the JBIC proposal in 2007, both a steering committee and technical committee were established

to work along with the relevant ministries and agencies (DOTC, DOF, DBM, NEDA, and LRTA) on the improvement measures of LRTA's financial characteristics. Deliberations in these committees started in 2007 and some outcomes of the deliberations have moved toward implementation.

Based on the proposal of the committee, some long-term debt has been converted to the subsidy, and LRTA began formulation of a strategic plan in 2010, and the draft proposal of a medium-term development plan (2011-2016) was created during the first half of 2011.

Necessary study on "change of a fare level" and "capital increase" has already finished and the preparation and procedure towards the implementation are underway, and LRTA has only been waiting for the approval of the government or the Congress to begin. Therefore, the following are assumed as risks in the implementation phase if a gradual implementation is required and if those measures are affected to by external factors.

- Conclusion of PPP contract will be postponed owing to taking time to obtain the approval of the government or Parliament
- When a PPP agreement or a concession agreement are executed presupposing a fare increase or capital increase, LRTA may have to compensate a private company for the losses caused if these approvals are not obtained
- When the amount of capital increase is less than what LRTA proposed, the effect originally anticipated may not be acquired
- The fare increase may cause a decrease in the number of passengers temporarily and the associated reduction in income

4.3.3 Recommendation concerning direction of the financial improvement measures

In order for LRTA to perform sustainable railway business operations and to realize its future vision, it is crucially important not only to correct the excessive liabilities, but to continuously raise the business profitability, the stability and soundness of financial situation, and to perform independently as an autonomous management unit.

For those measures to work effectively, LRTA needs to carry out promptly and steadily a "change of fare level" and a "capital increase." LRTA will be required to make constant efforts towards the management rationalization, revenue increase and appropriate disclosure, not simply a one-off implementation.

Moreover, prompt and steady implementation of these measures not only serves as the suitable risk avoidance / mitigation measure for LRTA, but serves as a signal to the private companies considering participation in a PPP project, and it leads also to improvement in the competitiveness and the service quality level by participation of other partners.

4.4 Study of Efficient Project Management Scheme

4.4.1 General

4.4.1.1 Need for PPP

The Government of the Philippines acknowledging that the private sector should play an essential role in the nation’s economic growth and development, and the government will offer the most appropriate incentives to enhance the private sector’s role, in which the private sector provides funding and implements, operates, and maintains the social infrastructure and development projects, which until recently Government have implemented with its own financing.
The Study Team deems that implementing Public Private Partnership schemes for railway business and

operation not only enhances efficiency and profitability but also improves the quality of the railway business as a public service and eventually will enable longer lasting railway business.

4.4.1.2 Legal Framework for Railway Businesses by the Private Sector

The fact that MRT Line 3 has been implemented under the BLT scheme under PPP gives sufficient proof that a private sector company can be engaged in railway construction. Railway operations, on the other hand, are done by public agencies such as LRT Line 1 and 2 by LRTA, MRT Line 3 by DOTC and Commuter Express (Commex) by PNR, and thus there is no private sector company engaged in the entire operation.

A progressive manner of PPP schemes has been introduced starting with the unified operations, maintenance and privatization of LRT Line 1 and MRT Line 3, the common ticketing system for LRT Line 1&2 and also MRT Line 3, and the LRT Line 1 South Extension. This gives a good example for the private sector to operate railway businesses, but confirming its legal framework is investigated below.

The operation of LRT is legally endorsed to LRTA under LRTA Charter (E.O. 603). When considering a private sector operation under PPP, the BOT Act Article 6 stipulates that the selected private sector party is automatically given the privilege in operation and maintenance under the BOT contract where the selected private sector entity will own the facility.

In the case of a BTO or O&M Contract where LRTA maintains its ownership of the facilities, a private sector entity is given the authority under Executive Order 125-A Article 1-g which stipulates that a certificate of public convenience for operation of public land and rail transportation utilities and services can be issued by DOTC. This will be applied to operations for the existing line.

4.4.1.3 Areas of Railway Businesses

This Project covers arranging financial resources, build operate and maintain LRT Line 2 Extension as a whole but can be divided into several areas.

The extended line area is divided into the civil work and facilities, the E&M system, and the new rolling stock. For the E&M system, the existing system can be extended to the extension line but in some cases the existing system can be replaced with a new E&M system adopted in the extension part for better efficiency. New rolling stock procurement depends on the demand survey outcome but a few sets of trains not in service due to the shortage of spare parts may require repair work to be done first.

The next issue is whether the extension part is to be operated and maintained separately from the existing line or in common. It is necessary to consider whether a single operating body should operate and maintain the entire line including both the existing and extended part of Line 2 in a unified manner for the following reasons.

When the extended part is operated separately from the existing part of Line 2;

- The extension portion is short (4km to East and 2km to West) and divided into East and West each other. An independent operation separated from the existing line will be inefficient,
- The two terminal stations (Santolan and Recto) should not require passengers to change trains. It is not realistic when considering the passengers' comfort,
- A through train operation is expected covering both the existing and extended portion of the Line. Introduction of a different operator for the extension will not be efficient,
- The fare structure would be applied for the extension part of the Line and its level is anticipated higher than that of the existing part,
- The expected viability would be lower if only the extended part is offered to the private sector

An Automatic Fare Collection System (AFC) to cover the entire LRT Lines 1&2 and MRT Line 3 is planned to be contracted out to a private sector entity and thus when considering LRT Line 2 operation here, installation and maintenance of the AFC equipment and systems are not included.

4.4.1.4 Allocation of Roles and Risks of the Public Sector and Private Sector

1) Rehabilitation of the Existing Portion of Line 2

As stated above, repair work is needed for a few sets of trains not in service due to the shortage of spare parts. Some of the civil work facilities and E&M systems are estimated to be in need of rehabilitation, repair or replacement. That rehabilitation work needed on the existing line would be efficiently conducted if they are done together with the related work for the extension portion.

However, talking about the risk undertaking, it would be difficult for the private sector to be engaged in the damage repair of those facilities in the existing portion. Even if a contractual scheme is offered that LRTA will assume the risks derived from the existing portion of the line, one should not overlook the eventual impact to the private sector engaged. Thus, it is recommended that LRTA will first conduct the necessary rehabilitation work to recover the level of the facilities, equipment and systems on the existing portion of Line 2, and, thus, minimize the possible risks associated with the existing portion of the line.

When the rehabilitation work is included as a part of the extension project, the private sector or supplier who was originally engaged in the existing portion of the line would be in a more advantageous position. In addition, that fact that the detailed information of the rehabilitation work and its cost for the work may not be easily identified may lead to higher pricing in the proposal due to the de facto cost transfer. Furthermore, this way is considered to have too high risks associated with it and it may not be sufficiently attractive for the private sector to participate in. In conclusion, it is recommended that the rehabilitation work on the existing line is better to be conducted by LRTA itself.

2) Civil Work, E&M System and Rolling Stock

The initial investment for the extension portion of Line 2 on the civil work, E&M system and the rolling stock can technically be possible to be contracted out entirely to the private sector.

In general, the urban railway projects have been implemented, depending on the size of the initial investment as well as the availability of private sector funding, by adopting an “infra- / super- structure separated scheme (= two-tiered scheme)”. The infrastructure is constructed as a public investment by the government with ODA funding, whereas the superstructure is implemented by the private sector. Where to draw lines on the public and private sector division and responsibility depends on the nature and characteristics of each project. As for this Project, a scheme will be proposed based on the outcomes of the analysis in the chapter, “5.2 Procurement of Materials and Equipment” and “8.4 Calculating economic and financial internal rate of return (EIRR, FIRR)”. At this point in time, the Study shows the analysis on the basis of the civil work as the infrastructure and E&M system and the rolling stock as a part of superstructure.

3) Replacement, Renewal and Large Scale Repair Work after the Extension Operation Starts

LRT Line 2 began partial operation in April 2003 between Santolan and Cubao and the whole line was open for service in October 2004. If one considers the economic life expectancy of rolling stock as 20 years and if they were procured in 2002, the rolling stock will need to be replaced with new from 2022. Other facilities like the civil work and E&M system have about 15 years of life. They may also need large scale repair and replacement under a long-term repair program.

The future price of renovation of equipment would be unknown at the time of bidding, so it is recommended not to be part of the private operator's responsibility. On the other hand, damage repair due to mishandling, lack of proper maintenance shall be borne by the private operator.

The future price of renovation of equipment would be unknown at the time of bidding, so it is recommended not to be part of the private operator's responsibility. On the other hand, damage repair due to mishandling or lack of proper maintenance shall be borne by the private operator.

4) An Entire Operations and Maintenance of the Whole of Line 2

The railway operations in the Philippines have been conducted only by the public sector, and the specialized knowledge and know-how on the urban railway operations are not found in the private sector. However, if participation of the private sector from other countries such as Thailand and Malaysia and other countries where the PPP schemes have been introduced is opened and made that experience and know-how available, it is possible for the private sector to operate the whole line of both existing and extended portions.

As for the possible form of the project, this Study made a comparative evaluation, starting with a case where LRTA solely operates and maintains the Line 2, a joint venture formation between LRTA and a private sector company, and thirdly full operation by a private sector company (**Table 4.4-1**).

As a result, the form which can expect the greatest efficiency and improvement in the profitability of the railroad enterprise management, and can reduce disadvantages is the transfer of operations from LRTA to private enterprises and in which the private enterprises manage independently is desirable.

Table 4.4-1 Operations and Maintenance Comparison

O&M Entity	Advantages	Disadvantages
LRTA as the sole Operator	• Continuity of operations secured • Possible to mobilize O&M experience and know-how within LRTA • Human resources effectively mobilized • Possible stable and continuous railway operations with an improved financial position	• Possible high O&M expenses compared with that of private sector • Lower incentives to seek managerial efficiency and improve profitability • Longer processing duration for spare parts procurement
J/V between LRTA and a private sector	• Securing operational continuity • Possible to mobilize O&M experience and know-how within LRTA • Human resources effectively mobilized • Possible stable and continuous railway operations with an improved financial position • LRTA can provide operation and managerial skill, experience and necessary man-power and it will make it easy to attract private companies who don't have railway managerial skill and experience. • Higher managerial efficiency and improvement of profitability with private sector participation • Possible swift procurement when such operations falls on J/V responsibility	• May not be easy to demonstrate the advantages of having private sector when their stake is too limited. • Form, organization structure, and management of J/V become complicated, thus LRTA and private sector may not effectively participate.
Private Sector as the Sole Operater	• Higher managerial efficiency and improvement of profitability with private sector participation • Possible swift procurement when such operations falls on J/V responsibility • From a job security point of view, Employment of all LRTA staff by the private company can be arranged in the concession contract.	• Difficultiy in securing the continuity of operations • Not able to mobilize LRTA's experience and know-how on operations and maintenance

Source: Study Team

5) Decision and Modification of Fares

LRTA has the authority to determine and change the LRT fares based on Executive Order No. 603, according to transportation authorities. Even if the operation and management of all of Line 2 including the existing and the extension sections is committed to the private sector, the Study Team proposes that it is desirable for LRTA continue to hold the authority for the determination and change of a fares for the following reasons:

- It is difficult for the private sector to bear the risk involved in the setting or change of fares.
- If the authority to set fares is given to a private sector entity, it becomes difficult to make the policy of the country reflect in freight levels etc.
- Considering that the common ticketing system will be introduced in LRT Line 1, Line 2 and MRT Line 3 in the future, a common system of fare structures of all lines may be attained.

6) Ownership of Assets

Existing LRT Line 2 is now under operation and the asset is owned by LRTA. Assets of both existing and extended sections should be thoroughly owned by LRTA or a private sector. Because in case a private sector initially invest for civil works, E&M and rolling stock for exclusively the extended sections and own them whole periods of concession the following problems happen: The existing LRT Line 2 is now under operation and the assets are owned by LRTA. Assets of both existing and extended sections should be completely owned by LRTA or a private sector company because if a private sector company initially invests in the civil works, E&M and rolling stock for only the extended sections and owns them independently for whole time periods of the concession, the following problems arise:

- Interchangeability and connectivity between existing and extended sections should be maintained in view of operational safety. However, some facilities and systems will be used as one seamless combined unit and would be difficult to be owned separately for the existing and extended sections.
- Although a certain level of maintenance can be secured among facilities and equipment which are owned by different entities, large scale overall life cycling rehabilitation and renewals require complicated coordination.
- Especially, in case of malfunctions in E&M systems, immediate repairs may be obstructed by difficulties to pinpoint the cause and make sure which one is responsible, LRTA or the private sector.

4.4.1.5 Private Sector to Secure Returns from Investments

The ways for the participating private sector company to secure their return on investment to the urban railway under a PPP scheme are considered to come primarily from railway operation profit, the associated operations profit, and revenue from development rights to the regional commercial development projects along the railways, for example. It has been, however, recognized that it will be extremely difficult to secure adequate returns on investment only out of those operations, and it would require additional measures such as government subsidies, installment payments, lease rental payments or service delivery payments.

1) Benefit from Railway Business and Non-Railway Business

Revenue from railway business is expected not only from fares but also advertisement fees, access charges to stations, rental fees from shops in the station area and rental fees from effective use of the surplus space of the property of LRTA Line 2.

Since each new station in the extension section is to be built in the road Right of Way, the utilization of

the space over or under the station is not expected. Santolan Station and the Depot in the existing section of Line 2 have large-scale land parcels, so the development business for utilization that land is expected

If the right to this development work can be granted to the private sector entity who undertakes the PPP project and a part of that development profit can be allotted to pay for the construction cost of the extension section, the governmental fiscal burden may be eased sharply.

2) Government Subsidy

A government subsidy could possibly be applied when a private sector company receives the entire railway businesses revenue and conducts operations under their responsibility under a BOT or BOO scheme. The subsidy may be delivered in several different manners, as a front-end payment before the line opening, construction subsidy paid out over a few occasions during the construction, or operational subsidy paid out during the operational period with a fixed amount. The construction subsidy will be beneficial for the private sector to reduce financing risks or investment return risks, but the subsidy budgeted only at the line opening may cause a higher burden on the government. The operational subsidy could level the government burden but a subsidy payment delay or non-payment risk may be considered high as a private sector concern.

3) Installment Payment

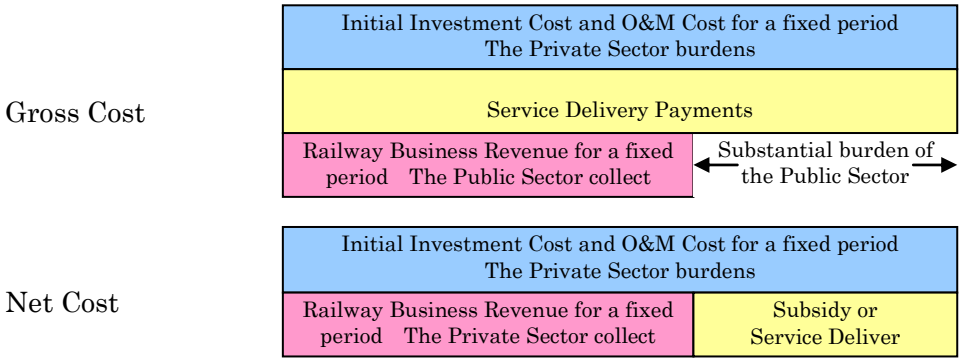
Installment payments are applied when the facilities and equipment ownership is transferred to government prior to the operation under BT or BTO schemes. Whether the fare revenue and other railway business revenue are to be received by the private sector or the public sector, it is guaranteed, as a strong advantage from the private sector, of the payment in long term operations separately from the demand or operations and maintenance performance. The government would need to bear a mark-up cost on top of the financing cost of the private sector but enjoys a level burden on the budget.

4) Lease Rental Payments

Lease Rental Payments are applied when the government operates under a BLT scheme. The same as the Installment Payments above, this is a strong advantage from the private sector point of view with a guaranteed payment over the long term that is separate from the demand fluctuations or operations and maintenance performance. Government would need to bear a mark-up cost on top of the financing cost of the private sector but enjoys a level burden on the budget.

5) Service Delivery Payments

Service Delivery Payments are applied when the government receives fare revenue and other railway operations revenue and procure, from the private sector, construction, operations and maintenance. It will give a long-term assurance from the viewpoint of the private sector but the payment amount may vary depending upon the O&M performance and/or demand. Government may enjoy benefits of the budgetary leveling.



Source: Study Team

Figure 4.4-1 Structure of Gross Cost System and Net Cost System

4.4.2 Operations Scheme Menu

4.4.2.1 Variations under BOT Act

The BOT Act describes nine different options. The Study will deal with cases other than Contract-add-and-operate(CAO), Develop-operate-and-transfer (DOT), Rehabilitate-operate- and-transfer (ROT), Rehabilitate-own-and-operate (ROO) which will not be applied to the Project.

- Build-Operate-and-transfer (BOT)
- Build-and-transfer (BT)
- Build-own-and-operate (BOO)
- Build-lease-and-transfer (BLT)
- Build-transfer-and-operate (BTO)
- Contract-add-and-operate (CAO)
- Develop-operate-and-transfer (DOT)
- Rehabilitate-operate-and-transfer (ROT)
- Rehabilitate-own-and-operate (ROO)

4.4.2.2 PPP Examples in the Philippine Transport Sector

The PPP schemes applied in the Philippine transport sector are:

- Joint venture
- Build-Operate-and-transfer (BOT)
- Build-lease-and-transfer (BLT) and
- Build-transfer-and-operate (BTO)

The Joint Venture scheme was initiated with a group of private sector investors proposing highway repair, improvement and widening projects under a franchise agreement.

4.4.2.3 Variations from other Urban Railway Cases

Under the METI Study, the typical models applied to the urban railway operations are presented in seven different types and are summarized as follows:

- A full BOT business model does not provide a good enabling condition, and thus the private sector is not active. When the public sector wishes to operate alone, a BLT scheme model is possible. Manila MRT Line 3 is a BLT case based on that background

- When the private sector shows its interest more proactively and the government adopts a policy to open to the private sector, a BOT scheme with the infra- and super-structure separation or a scheme secured by a government subsidy is possibly taken.

When considering the enabling framework for PPP schemes, the METI Study concluded that the following implementation schemes could be applied:

i) LRTA will assume all the responsibilities including financial arrangement, obligation to repay debts, operations and maintenance (non PPP form)
ii) LRTA will undertake financial arrangement, form a joint venture with a private sector entity, share a part of operational revenue as the repayment sources of debt
iii) LRTA will undertake financial arrangement, offer a concession to a private sector entity for operations and maintenance. The private sector entity will pay the facility access charges or a part of revenue share to LRTA which uses the revenue as a source for debt payment

Table 4.4-2 Comparison of the BOT Railway Projects

Scheme		BOT			BLT	BTO	BOO	Others
		Without Subsidy	With Subsidy	Civil Works /EM Split				
Project		BK BTS	KLIA Xpress	BK MRT	MNL MRT3	-	UK CTL	UK CRL
Implementing Agency		Pub.	Pub.	Pub.	Pub.	Pub.	Pub.	Pub.
Executing/Operating Body (EOB)		Prv.	Prv.	Prv.	Pub./Prv.	Prv.	Prv.	Prv./Pub.
Financing		Prv.	Pub./Prv.	Pub./Prv.	Prv.	Prv.	Pub./Prv.	Pub./Prv.
Capital Investment	Civil Works	Prv.	Prv.	Pub.	Prv.	Prv.	Prv.	Prv.
	E&M	Prv.	Prv.	Prv.	Prv.	Prv.	Prv.	Prv.
O&M	Operation	Prv.	Prv.	Prv.	Pub.	Prv.	Prv.[1]	Prv.[1]
	Maintenance	Prv.	Prv.	Prv.	Pub.[1]	Prv.[1]	Prv.[1]	Prv.[1]
Subsidy	on Capital Investment	None	None	None	None	None	Yes	Yes
	on O&M	None	Yes[1]	None	None	None	None	None
Levy	by Pub.	None	Yes[2]	Lease Fee	None	None	None	None
	by Prv./EOB	None	None	-	Lease Fee	Lease Fee	None	None
Source of Investment Recovery	by Pub.	-	from Levy[2]	Lease Fee and share in the profit	Operation and associated business	Operation and associated business	None other than economic benefit	Share in the operation profit
	by Prv./EOB	Operation	Operation and associated business	Operation and associated business	Lease Fee	Lease Fee and share in the profit	Operation and associated business	Operation and associated business
Remarks			1: from Airport Operation Company 2: share in the operation profit		1: outsourcing to a private 3rd party	1: may be outsourcing to a 3rd party	1: may be outsourcing to a 3rd party	1: may be outsourcing to a 3rd party

Source：Study on Manila LRT Line-2 East-West Extension Project in Philippines, Final Report (March 2010)

4.4.2.4 Operational Scheme Menu

As an operation scheme menu, the Study Team proposes to a further study on the following 5 types and 11 operation schemes (**Table 4.4-3**). The investment cost recovery method of the private sector in each type and scheme is shown in **Table 4.4-4**.

The Study Team disregards the schemes of BOT without Subsidy, BOT with Subsidy, BOT Civil Works/EM Split, and BOO from the schemes shown on Table 4.4-2 for the following reasons.

- BOT without Subsidy in Table 4.4-2 is the same as Type 5-2 and 5-4 (profitable case)
- BOT with Subsidy in Table 4.4-2 is the same as Type 5-1, 5-2, 5-3 and 5-4 (unprofitable case)
- BOT Civil Works/EM Split in Table 4.4-2 is the same as Type 5-1 and 5-2
- BOO cannot be applied as this project is an extension of a line that is already public property, and a permanent private ownership of the facilities would not be possible.

Table 4.4-3 Operational Scheme Menu

Type	Operational Scheme Menu			Role of Public and Private Sector
Type1	BT			Public: Land Acquisition, Own, O&M, Fare Collection Private: Finance, Construction
Type2	BLT			Public: Land Acquisition, O&M, Fare Collection Private: Finance, Construction, Own
Type3	Lease + O&M			Public: Land Acquisition, Finance, Construction, Own Private: O&M, Fare Collection
Type4-1	BTO	Two-Tiered	Gross Cost	Public: Land Acquisition, Finance, Construction(Civil), Own, Fare Collection Private: Finance, Construction(E&M,R/S), O&M
Type4-2			Net Cost	Public: Land Acquisition, Finance, Construction(Civil),Own Private: Finance, Construction(E&M,R/S), O&M, Fare Collection
Type4-3		One-Tiered	Gross Cost	Public: Land Acquisition, Own, Fare Collection Private: Finance, Construction, O&M
Type4-4			Net Cost	Public: Land Acquisition, Own Private: Finance, Construction, O&M, Fare Collection
Type5-1	BOT	Two-Tiered	Gross Cost	Public: Land Acquisition, Finance, Construction(Civil), Own, Fare Collection Private: Finance, Construction(E&M,R/S), Own, O&M
Type5-2			Net Cost	Public: Land Acquisition, Finance, Construction(Civil), Own Private: Finance, Construction(E&M,R/S), Own, O&M, Fare Collection
Type5-3		One-Tiered	Gross Cost	Public: Land Acquisition, Fare Collection Private: Finance, Construction, Own, O&M
Type5-4			Net Cost	Public: Land Acquisition Private: Finance, Construction, Own, O&M, Fare Collection

Source: Study Team

Table 4.4-4 Revenue and Expense of Each Operational Scheme

		Type 1	Type 2	Type 3	
		BT	BLT	Lease +O&M	
		One-Tiered			
		Fare Collect: LRTA	Fare Collect: LRTA	Net Cost	
LRTA	Revenue	Farebox Revenue Miscellaneous Revenue	Farebox Revenue Miscellaneous Revenue	**Lease Fee (Existing and Extension Line)**	
	Expense	O&M **Amortization Payment** Depreciation VAT Revenue Tax	O&M **Lease Fee** VAT Revenue Tax	Depreciation Loan Payment VAT	
SPC	Revenue	**Amortization Payment**	**Lease Fee**	Farebox Revenue Miscellaneous Revenue	
	Expense	Loan Payment VAT Income Tax	Depreciation Loan Payment VAT Income Tax	O&M **Lease Fee (Existing and Extension)** VAT Income Tax	
		Type 4-1	**Type 4-2**	**Type 4-3**	**Type 4-4**
		BTO			
		Two-Tiered		One-Tiered	
		Gross Cost	Net Cost	Gross Cost	Net Cost
		Fare Collect: LRTA	Fare Collect: SPC	Fare Collect: LRTA	Fare Collect: SPC
LRTA	Revenue	Farebox Revenue Miscellaneous Revenue	**Concession Fee (Profitable Case)**	Farebox Revenue Miscellaneous Revenue	**Concession Fee (Profitable Case)**
	Expense	**Service Fee** Depreciation Loan Payment VAT Revenue Tax	**Service Fee (Unprofitable Case)** Depreciation Loan Payment VAT	**Service Fee** Depreciation VAT Revenue Tax	**Service Fee (Unprofitable Case)** Depreciation VAT
SPC	Revenue	**Service Fee**	Farebox Revenue Miscellaneous Revenue **Service Fee (Unprofitable Case)**	**Service Fee**	Farebox Revenue Miscellaneous Revenue **Service Fee (Unprofitable Case)**
	Expense	O&M Loan Payment VAT Income Tax	O&M **Concession Fee (Profitable Case)** Loan Payment VAT Income Tax	O&M Loan Payment VAT Income Tax	O&M **Concession Fee (Profitable Case)** Loan Payment VAT Income Tax
		Type 5-1	**Type 5-2**	**Type 5-3**	**Type 5-4**
		BOT			
		Two-Tiered		One-Tiered	
		Gross Cost	Net Cost	Gross Cost	Net Cost
		Fare Collect: LRTA	Fare Collect: SPC	Fare Collect: LRTA	Fare Collect: SPC
LRTA	Revenue	Farebox Revenue Miscellaneous Revenue	**Lease Fee (Existing Line) (Profitable Case)**	Farebox Revenue Miscellaneous Revenue	**Lease Fee (Existing Line) (Profitable Case)**
	Expense	**Service Fee** Loan Payment Depreciation VAT Revenue Tax	Loan Payment Depreciation VAT **Service Fee (Unprofitable Case)**	**Service Fee** VAT Revenue Tax	**VGF (Unprofitable Case)**
SPC	Revenue	**Service Fee**	Farebox Revenue Miscellaneous Revenue **Service Fee (Unprofitable Case)**	**Service Fee**	Farebox Revenue Miscellaneous Revenue **VGF (Unprofitable Case)**
	Expense	O&M Depreciation Loan Payment VAT Income Tax	O&M **Lease Fee (Existing Line) (Profitable Case)** Depreciation Loan Payment VAT Income Tax	O&M Depreciation Loan Payment VAT Income Tax	O&M **Lease Fee (Existing Line) (Profitable Case)** Depreciation Loan Payment VAT Income Tax

Source: Study Team

4.4.3 Qualitative Evaluation of Each Operational Scheme

The Study Team evaluates the operational scheme menu for this Project proposed in **4.4.2.4** from the view point of the precedent case, qualitative issue and business risk.

1) Precedent Case

The types which have a PPP precedence case in the domestic transport sector are Type 2: BLT (MRT Line 3), Type 3: Lease + O&M (expressways and port facilities), Type 5-2: BOT Two-Tiered Net Cost, and Type 5-4: BOT One-Tiered Net Cost. And the types which have a PPP precedence case for an urban railroad in and outside the country are Type 2: BLT (MRT Line 3), Type 5: BOT (Two-Tiered Gross Cost: Bangkok MRT Purple Line, Two-Tiered Net Cost: Bangkok MRT Blue Line, One-Tiered Net Cost: Bangkok BTS Sky Train/Green Line) and Kuala Lumpur International Airport Access Railroad.

Since MRT Line 3 has a problem in the role and risk allotment of the government and private sector as reference was made in 1.4.1 1 when adopting Type 1: BT or Type 2: BLT in which a public sector carries out operation and maintenance, it is necessary to consider it as a lesson. The BLT Scheme is a PPP scheme generally adopted for a project in which a private sector entity undertakes only construction and maintenance, and the public sector carries out operation, such as a government building.

The cases of Bangkok and Kuala Lumpur were consulted in points of selection of the scheme according to business profitability or the degree of involvement of the public sector. In particular, in Bangkok, the project schemes are changing in the direction toward which the degree of involvement of the public sector becomes stronger, moving from BOT One-Tiered Net Cost (with no subsidy) of the BTS Sky Train, BOT Two-Tiered Net Cost of the MRT Blue Line, and BOT Two-Tiered Gross Cost of the MRT Purple Line.

Table 4.4-5 Precedent Case of Each Operational Scheme

Type		Precedent Case
Type2	BLT	MRT Line 3 The following problems are mentioned regarding MRT Line 3; - Incentive to increase the ridership does not work in MRTC, - Incentive for cost reduction and the replacement of facilities and equipment for the improvement in service does not work in the maintenance service, - DOTC cannot undertake an incidental business, - There is little flexibility in management and efficient and effective use of the management resources is difficult for DOTC.
Type3	Lease + O&M	In the Philippines, there is the precedence case of an expressway (Original NLEx, SLEx and SCTEx). And, although the Manila international container terminal (MICT) and the Manila South Harbor of the Manila harbor are not PPP, they are a similar cases.
Type5-1	BOT Two-Tiered Gross Cost	No Precedent Case in Philippines In neighboring countries, there is the precedence case of the Bangkok MRT purple line. The Purple line is a scheme in which the public entity charges a demand risk based on the lesson of the blue line.
Type5-2	BOT Two-Tiered Net Cost	Expressway(STRA) in Philippines and Bangkok MRT Blue Line in a neighboring country The Blue line has been charged a heavy premium by the private sector entity to offset the risks, and the public sector has relinquished the authority to set fares. It is preferable that the authority to set fares remains in the public sector.
Type5-4	BOT One-Tiered Net Cost	Expressway(TPLEx) in Philippine, BTS in Bangkok, and KLIA Express (Kuala Lumpur International Airport access railway) in Malaysia

Source: Study Team

2) Qualitative Issue

From the viewpoint of concurrence with the governmental policy (drawing private fund, O&M privatization) and the future vision of LRTA (possession of property, O&M privatization), the

concurrence degree of Type 4-3 (BTO, One-tiered, Gross Cost) and Type 4-4 (BTO, One-tiered, Net Cost) are high.

Type 1 (BT), Type 3 (Lease + O&M), and Type 4-1 to 4-4 (BTO) in which LRTA owns the whole line including the extension section are desirable from the viewpoint of operational compatibility by the one ownership of the whole line (prompt correspondence at the time of occurrence of a fault, and retention of the flexibility of operation, etc.).

Types 4-3, 4-4, 5-3 and 5-4 with a one-tiered method which leaves all of design, construction and O&M to the private sector are desirable from the viewpoint that efficient facilities which are easy to operate and maintain by integration of construction and O&M are constructed.

Table 4.4-6 Qualitative Issue of Each Operational Scheme (1)

Type		Conformity with Government Policy (Introduction of Private O&M) and immediate transfer to LRTA	Conformity to efficient Asset Management	Implementation of efficient design and construction, and management by EPC
Type1	BT	× Private O&M is not carried out.	✓ LRTA owns the whole section and O&M	× Construction entity differs from O&M entity.
Type2	BLT	×Private O&M is not carried out.	× Owner differs in existing and the extension section	× Construction entity differs from O&M entity
Type3	Lease + O&M	× Introduction of private O&M is carried out, but investment from private sector is not carried out.	✓LRTA owns the whole section.	× Construction entity differs from O&M entity
Type4-1	BTO Two-Tiered Gross Cost	✓✓ Partial introduction of private investment, private O&M and LRTA facilities transfer is carried out.	✓ LRTA owns the whole section.	✓ E&M system construction entity and O&M entity is the same.
Type4-2	BTO Two-Tiered Net Cost	✓✓ Partial introduction of private investment, private O&M and LRTA facilities transfer is carried out.	✓ LRTA owns the whole section.	✓ E&M system construction entity and O&M entity is the same.
Type4-3	BTO One-Tiered Gross Cost	✓✓✓ Introduction of private investment, private O&M and LRTA facilities transfer is carried out.	✓ LRTA owns the whole section.	✓✓ Construction entity O&M entity are the same.
Type4-4	BTO One-Tiered Net Cost	✓✓✓ Introduction of private investment, private O&M and LRTA facilities transfer is carried out.	✓ LRTA owns the whole section.	✓✓ Construction entity O&M entity are the same.
Type5-1	BOT Two-Tiered Gross Cost	✓ Partial introduction of private investment and private O&M is carried out.	× Owner of E&M system and rolling stocks differs in existing and extension sections	✓ E&M system construction entity and O&M entity is the same.
Type5-2	BOT Two-Tiered Net Cost	✓ Partial introduction of private investment and private O&M is carried out.	× Owner of E&M system and rolling stocks differs in existing and extension sections	✓ E&M system construction entity and O&M entity is the same.
Type5-3	BOT One-Tiered Gross Cost	✓✓ Introduction of private investment and private O&M is carried out.	× Owner differs in existing and extension sections	✓✓ Construction entity O&M entity are the same.
Type5-4	BOT One-Tiered Net Cost	✓✓ Introduction of private investment and private O&M is carried out.	× Owner differs in existing and extension sections	✓✓ Construction entity O&M entity are the same.

Source: Study Team

Types 4-3, 4-4, 5-3 and 5-4 with a one-tiered method which leaves all of design, construction and O&M to the private sector are desirable from the viewpoint that the efficiency, the profitability and the service quality of the project, etc. improve by leaving the whole life cycle to the private sector.

From the viewpoint of compatibility with ODA, the ODA applicable range of Type 3 (Lease + O&M) in which a public sector entity carries out all the financing is wide, and Types 4-1, 4-2, 5-1 and 5-2 with a two-tiered method which can apply ODA to construction of civil works come after.

From the viewpoint of the ease of private sector participation, in Type 1 (BT) the private sector scope of business is limited to construction. In Type 3 (Lease + O&M) private sector scope of business is limited to O&M. In Type 4-1 (BTO, Two-tiered, Gross Cost) which can share the long-term operation risk between the Government and the private sector although the private sector scope of business that includes a part of the construction and O&M is slightly large. These type are easier to participate for the private sector.

Table 4.4-7 Qualitative Issue of Each Operational Scheme (2)

Type		quality of the efficiency, profitability, and service of the project by committing the whole life cycle to the private sector etc.	Conformity with ODA	The ease of the private sector taking part in the planning
Type1	BT	×The scope committed to the private sector is only construction and financing	✓ The two-step loan by the side of the private sector is applicable	✓✓✓ Financing risk and recovery risk
Type2	BLT	×The scope committed to the private sector is only construction and financing	✓ The two-step loan by the side of the private sector is applicable	✓Financing risk, recovery risk, and long-term facilities possession risk
Type3	Lease + O&M	✓The whole life cycle except of construction is committed to the private sector	✓✓✓Conformity with ODA is high in order that the public sector may carry out all financing	✓✓✓ Long-term management risk
Type4-1	BTO Two-Tiered Gross Cost	✓The whole life cycle except civil construction is committed to the private sector	✓✓ ODA is possible for financing the public sector and a two-step loan by the private sector is applicable	✓✓✓ Public and private sector can share financing risk, recovery risk, and long-term management risk
Type4-2	BTO Two-Tiered Net Cost	✓The whole life cycle except of civil construction is committed to a private sector	✓✓ ODA is the application possibility of to financing of a public sector and the two-step loan by the side of a private sector is applicable	✓✓ Financing risk, recovery risk and long-term management risk. (Public and private sector can share financing risk and recovery risk.)
Type4-3	BTO One-Tiered Gross Cost	✓✓The whole life cycle is committed to the private sector.	✓ The two-step loan by the side of private sector is applicable.	✓✓ Financing risk recovery risk and long-term management risk. (Public and private sectors can share financing risk and recovery risk.)
Type4-4	BTO One-Tiered Net Cost	✓✓The whole life cycle is committed to a private sector.	✓ The two-step loan by the side of a private sector is applicable.	✓Financing risk, recovery risk, and long-term management risk
Type5-1	BOT Two-Tiered Gross Cost	✓The whole life cycle except of civil construction is committed to the private sector.	✓✓ ODA is the application possibility of to financing of a public sector and the two-step loan by the side of private sector is applicable.	✓✓ Financing risk, recovery risk, long-term management risk and long-term possession of facilities risk. (Public and private sector can share financing, recovery and long-term management risk.)
Type5-2	BOT Two-Tiered Net Cost	✓The whole life cycle except of civil construction is committed to the private sector.	✓✓ ODA is possible for financing the public sector and the two-step loan by the private sector is applicable.	✓ Financing risk, recovery risk, long-term management risk and long-term possession of facilities risk. (Public and private sector can share financing risk and recovery risk.)
Type5-3	BOT One-Tiered Gross Cost	✓✓The whole life cycle is committed to the private sector.	✓ The two-step loan by the side of the private sector is applicable.	✓ Financing risk,,recovery and long-term possession of facilities risk. (Public and private sectors can share long-term possession of facilities risk.)
Type5-4	BOT One-Tiered Net Cost	✓✓The whole life cycle is committed to the private sector.	✓ The two-step loan by the side of a private sector is applicable.	×Financing risk, recovery, long-term management and long-term possession of facilities risk.

Source: Study Team

From the viewpoint of the business risk (the Government and the private sector's appropriate risk allocation) of each operational scheme, Type 4-4 (BTO, One-tiered, Net Cost) and Type 5-4 (BOT, One-tiered, Net Cost) in which the scope of business left to a private sector is wide and the private sector bears the main operation risks including the risk of demand and revenue fluctuations are the most appropriate.

Table 4.4-8 Business Risk of Each Operational Scheme

Type		Business Risk of Construction Phase	Business Risk of O&M Phase
Type1	BT	✓✓ The private sector bears the main risks of the construction phase.	× Except for facilities flaw risk and performance risk, the public sector bears the main risks of O&M phase.
Type2	BLT	✓✓ The private sector bears the main risks of the construction phase.	× Except for facilities flaw risk, performance risk, repair risk and deterioration risk, the public sector bears the main risks of O&M phase.
Type3	Lease + O&M	× The public sector bears all the risks of the construction phase.	✓✓ Except for fare rising risk, facilities flaw risk, performance risk, repair risk and deterioration risk, the private sector bears the main risks of O&M phase.
Type4-1	BTO Two-Tiered Gross Cost	✓ The private sector bears E&M system construction and rolling stock procurement risks.	× Except for O&M cost increase risk etc., the public sector bears the main risks of O&M phase.
Type4-2	BTO Two-Tiered Net Cost	✓ The private sector bears E&M system construction and rolling stock procurement risks.	✓✓ The private sector bears the main risks such as fluctuation of demand and revenue risks of O&M phase.
Type4-3	BTO One-Tiered Gross Cost	✓✓ The private sector bears the main risks of the construction phase.	× Except for O&M cost increase risk etc., the public sector bears the main risks of O&M phase. ✓ The private sector bears flaw, deterioration and repair risks of facilities etc.
Type4-4	BTO One-Tiered Net Cost	✓✓ The private sector bears the main risks of the construction phase.	✓✓ The private sector bears the main risks such as fluctuation of demand and revenue risks of O&M phase. ✓ The private sector bears flaw, deterioration and repair risks of facilities etc.
Type5-1	BOT Two-Tiered Gross Cost	✓ The private sector bears E&M system construction and rolling stock procurement risks.	× Except for O&M cost increase risk etc.,the public sector bears the main risks of O&M phase.
Type5-2	BOT Two-Tiered Net Cost	✓ The private sector bears E&M system construction and rolling stock procurement risks.	✓✓ The private sector bears the main risks such fluctuation of demand and revenue risk of O&M phase.
Type5-3	BOT One-Tiered Gross Cost	✓✓ The private sector bears the main risks of the construction phase.	× Except for O&M cost increase risk etc., the public sector bears the main risks of O&M phase. ✓ The private sector bears flaw, deterioration and repair risks of facilities etc.
Type5-4	BOT One-Tiered Net Cost	✓✓ The private sector bears the main risks of the construction phase.	✓✓ The private sector bears the main risks such as fluctuation of demand and revenue risks of O&M phase. ✓ The private sector bears flaw, deterioration and repair risks of facilities etc.

Source: Study Team

4.4.4 Financial Analysis and Evaluation of Operational Scheme

1) Financial Analysis and Evaluation Method

The Study Team analyzed and evaluated case by case from a financial viewpoint what kind of PPP scheme can be carried out efficiently and effectively for each operational scheme proposed in this enterprise as presented in 4.4.2.4.

Value for Money (VFM) is installed as a criterion of analysis and evaluation. VFM is the view of "supplying the greatest service per unit paid." When two businesses which have the same purpose are compared, the higher level of supplied public service “gives VFM” if the payment is the same, and the lower payment “gives VFM” if the supplied public service is the same level.

To determine the amount paid for measuring VFM, the Study Team calculated the current value (henceforth "PSC" (Public Sector Comparator)) of the prospective frame of the public fiscal burden which led the whole enterprise period in case the public sector carries out the project by itself, and the current value (henceforth "PPP-LCC" (LCC: Life Cycle Cost)) of the prospective frame of the public fiscal burden which led the whole enterprise period in the case of carrying out the project as a PPP project.
Assuming the public service level was the same, when PPP-LCC is less than PSC, PPP the scheme reduces the public financial burden and it can be judged that it “gives VFM”.

PSC is calculated by converting the net cash flow of each year, calculating the cash flow of the whole of Line2 O&M including construction of the extension section to the current value. PPP-LCC is calculated by converting the profit/loss and the cash flow of the private sector (Special Purpose Company) during the whole project duration, and the cash flow of LRTA during the whole project duration, to the current value.

When the project is implemented as a PPP, the payment of Service Delivery Payments, lease fee, concession fee etc. depending operational schemes will take place between the public sector and the private sector. This amount should be set to levels that allow appropriate profits and dividends that can ensure that private sector demand is satisfied, and should be PPP-LCC considering this. The Study Team sets up the minimum rate for three indicators that ensure that the appropriate profits and dividend for which a private company asks are securable is shown in Table 4.4-10, and draws a minimum amount paid which meets the criterion of all three indicators.

Table 4.4-9 Criteria of Private Sector's Profits etc. in PPP Financial Analysis

IRR for SPC	Internal Rate of Return for SPC Weighted Average Cost of Capital (WACC） of SPC is not less than 9.75% (25%×12%＋75%×8%＝9.00%)
Equity IRR	Internal Rate of Return for investor Not less than 12% of costs of capital of an investment.
DSCR	Debt Service Coverage Ratio This index shows the degree of safe of the repayment of borrowed money seen from the financing institution (= ratio delay, repayment capacity) It calculates with cash flow before principal-and-interest payment / principal-and-interest due course amount. With fluctuation degrees of an business risk or profit and loss which a private sector bears, the minimum value of DSCR depends on financing institution demands. At this financial analysis, it is based on not being less than 1.1 in the case which does not bear a demand risk, in the case where a private sector bears the demand risk of a railway enterprise.

Source: Study Team

2) Assumptions

The assumptions of the PPP financial analysis on the operational schemes are as being shown in **Table 4.4-10**.

Table 4.4-10 Precondition of PPP Financial Analysis

Implementation Schedule	
Implementation Period	4 years (2013 – 2016)　Refer to "5.3 Project Implementation Schedule" 2017　Commencement of the revenue for extension section Only land acquisition shall be carried out in 2012
O&M Period	30 years after the commencement of the extension section considering the following: Redemption of Yen Loan under general condition: 25 years Durability of railway facilities (Station facilities approx. 30 years) Lease term of MRT Line : 25 years Concession term of Bangkok Blue Line: 25 years Concession term of Bangkok Sky Train: 30 years Scope of project includes O&M during construction of the extension section (2013 – 2016)
Project Cost	
Initial Investment Cost	The amount of money which converted all the amount of money except for the commitment charge into Pesos among the project cost calculated in "5.5 Project Cost Estimation" and the amount for PSC is the same as PPP-LCC. Land acquisition cost, consulting service cost, and management expenses are expenditures of the public sector. Construction cost and consulting service fee includes interest during construction period. The rehabilitation of the existing section which will be carried out by LRTA till 2016 is not included.
Initial Investment Cost of the case of Two-Tiered	In a Two-Tiered scheme, the initial investment cost is divided into the upper: civil construction cost and the lower: E&M system and rolling stocks, considering the originality and creativity of the nature of the work, cost balance, and the private sector, the possibility of know-how application, etc. LRTA shall carry out the lower part with the conventional system as well as PSC, and the private sector shall carry out the upper part. In the Two-Tiered scheme, contingency and interest on construction cost are divided proportionally by the ratio of civil works cost and E&M system and rolling stock supply cost.
Cost of O&M Phase	O&M cost is for the whole section of Line 2 including O&M cost of the existing section (the track record value in 2010 containing the regular scheduled maintenance cost and the overhead cost of LRTA) and the extension section calculated by the Study Team. PPP-LCC assumes this to be 90% of PSC. O&M cost in the construction period is taken only as O&M cost of the existing section. Future large-scale repair / renewal cost including renewal of vehicles is not included.
Lease Fee	In case of Type3 (Lease+O&M), Type5-2 (BOT, Two-Tiered, Net Cost) or Type5-4 (BOT, One-Tiered, Net Cost), SPC pays the lease fee at a fixed rate of the debt service amount of LRTA.
Concession Fee	In case of Type4-2 (BTO, Two-Tiered, Net Cost) or Type4-4 (BTO, One-Tiered, Net Cost), SPC pays the concession fee of at a fixed rate of an annual fare revenue
Financing Structure of LRTA	
Soft Loan	Application of the Japan ODA project loan (general terms and conditions) is assumed. The amount of money available is 85% of the total financing amount. Interest rate 1.4%, Redemption 30 years, Grace 10years, Principal and Interest at the same time
Commercial Loan	The amount of Philippine burden, 15% of the total financing amount, assumes borrowing from a commercial bank. Interest 8% (Commercial bank average interest rate on loans in 2010), Redemption 15years, Grace 1 year, Principal and Interest at the same time
Government Subsidy	If PPP-LCC and LRTA bear only land acquisition cost, consulting service cost, and management expenses, all amounts shall be a subsidy from the government.
Financing Structure of SPC	
Subsidy	In case of Type5-4 (BOT, One-Tiered, Net Cost, Unprofitable Case), VGF (Viability Gap Funding) is assumed. The subsidy amount is set at the level which can secure profits and a dividend that is proper for the private sector.

Equity	25% of the total financing amount based on the case of MRT Line 3. (It is 20% in the case of MRT Line 7.) In case of Type 3 (Lease + O&M), which supplied no initial investment cost, investment is for 2 years of original O&M cost as the initial cost of management. Expected return of 12%
Loan Capital	No assumption
Commercial Bank Loan	75% of the total financing amount Interest rate 8%, Redemption 15 years, Grace 1year, Principal and Interest at the same time
Soft Loan	No assumption
Revenue	
Fare Revenue	The annual fare revenue calculated by "Chapter 2 Demand Forecast ", and PSC and PPP-LCC are taken as the same amount. The rate of increase of fare revenue is 2% per year till 2020, 3% per year till 2035 and no increase or decrease after that based on this study.
Other Revenue	In PSC, the other revenue, such as rental fee for store space in stations, advertisement fee etc., is expected to be 5% of fare revenue (the track record value of Line 2 is 3.2% in 2010). In PPP-LCC, the other revenue is expected to be 10% of fare revenue as the other revenue which the private sector gets by carrying out O&M. Reference: The ratio of the other revenue to fare revenue. Bangkok Metro Public Company Limited (BMCL) : 14.8% (2010) Hong Kong MTR Corporation (MTRC) : 56% (2010) Singapore SMRT Corporation (SMRT) : 29.9% (2010)
Revenue of Installment Payment	In the case of Type4 (BTO) and Type5 (BOT), LRTA pays the service delivery payments at a fixed rate of the annual freight-receipts amount.
Service Delivery Payments	In the case of Type4 (BTO) and Type5 (BOT), LRTA pays the service delivery payments at a fixed rate of the annual freight-receipts amount.
Lease Fee	In the case of Type2 (BLT), LRTA pays the lease fee at a fixed rate of the annual fare revenue.
Tax Revenues	The tax which LRTA and SPC pay is included in PSC as revenue of the Government.
Tax	
VAT	Fare revenue is exempt 12% of miscellaneous revenue for PSC and PPP-LCC
Revenue Tax	LRTA bears 3% of fare revenue.
Income Tax	SPC bears 30% of net taxable amount. Exemption period: 4yeas (Republic Row No.7918)
Property Tax	No
Depreciation	
Civil	Straight line, Depreciation period 50 years, No residual value
E&M System	Straight line, Depreciation period 30 years, No residual value
Rolling Stock	Fixed-rate, Depreciation period 30 years, No residual value, Depreciation ratio 0.083 (The financial ministerial ordinance of Japan)
Depreciation of Installment Cost	In the case of BTO, the project company shall amortize the initial investment expense by the following method. Straight line, Depreciation period 30 years, No residual value
Others	
Risk Adjustment Cost	PPP-LCC includes the counter value of the risk of SPC bearing as a project cost of PPP-LCC includes the counter value of the risk of SPC bearing as a project cost of SPC. PSC doesn't include the counter value of the risk of LRTA bearing as project cost of LRTA. At present, quantification of a risk is difficult because there is no data regarding the fiscal burden amount at the time of a risk occurring in the past.
Discount Rate	The 15% social discount rate used by the Investment Coordination Committee of NEDA is used.

Source: Study Team

3) Result of PPP Financial Analysis

As a result of the PPP Financial Analysis, PSC is -3,267.4 million Pesos in Case 1 (only East extension), and -2,963.4 million Pesos in Case 2 (East and West extension). This means that income exceeding the fiscal burden is expected if long-term loan repayment for the existing section is not added. On the other

hand, the result of PPP-LCC and VFM calculation is shown in **Table 4.4-11** and the cases achieving VFM and securing the appropriate profits and dividends for which the private sector asks are as follows:

Case 1

- Type 3 (Lease + O&M) VFM: 824.6 Million Peso
- Type 4-1 (BTO, Two-Tiered, Gross Cost) VFM: 14.4 Million Peso
- Type 4-2 (BTO, Two-Tiered, Net Cost) VFM: 376.9 Million Peso
- Type 5-1 (BOT, Two-Tiered, Gross Cost) VFM: 14.4 Million Peso
- Type 5-2 (BOT, Two-Tiered, Net Cost) VFM: 956.8 Million Peso

Case 2

- Type 3 (Lease + O&M) VFM: 865.2 Million Peso
- Type 5-2 (BOT, Two-Tiered, Net Cost) VFM: 556.7 Million Peso

Table 4.4-11 Result of PPP Financial Analysis

Case/Type	PSC	PPP-LCC	Value for Money	IRR for SPC	Equity IRR	Minimum DSCR	Payment
	(Million Peso)						
Case 1							
Type 1 (BT, One-Tiered)	-3,267.4	-292.3	-2,975.1	8.95%	12.00%	1.2	LRTA->SPC, Amortization Payment
Type 2 (BLT, One-Tiered)	-3,267.4	-480.0	-2,787.4	11.16%	12.05%	1.1	LRTA->SPC, Lease Fee
Type 3 (Lease+O&M, One-Tiered, Net Cost)	-3,267.4	-4,092.0	**824.6**	14.49%	12.02%	0.0	SPC->LRTA, Lease Fee for existing line SPC->LRTA, Lease Fee for extension line
Type 4-1 (BTO, Two-Tiered, Gross Cost)	-3,267.4	-3,281.8	**14.4**	14.54%	15.38%	1.1	LRTA->SPC, Service Fee
Type 4-2 (BTO, Two-Tiered, Net Cost)	-3,267.4	-3,644.3	**376.9**	15.12%	16.00%	1.2	SPC->LRTA, Concession Fee
Type 4-3 (BTO, One-Tiered, Gross Cost)	-3,267.4	-382.9	-2,884.5	13.88%	20.77%	1.1	LRTA->SPC, Service Fee
Type 4-4 (BTO, One-Tiered, Net Cost)	-3,267.4	-503.6	-2,763.8	15.10%	24.87%	1.2	SPC->LRTA, Concession Fee
Type 5-1 (BOT, Two-Tiered, Gross Cost)	-3,267.4	-3,281.8	**14.4**	14.54%	15.38%	1.1	LRTA->SPC, Service Fee
Type 5-2 (BOT, Two-Tiered, Net Cost)	-3,267.4	-4,224.2	**956.8**	13.29%	12.03%	1.2	SPC->LRTA, Lease Fee for existing line
Type 5-3 (BOT, One-Tiered, Gross Cost)	-3,267.4	-328.9	-2,938.4	14.35%	21.77%	1.1	LRTA->SPC, Service Fee
Type 5-4 (BOT, One-Tiered, Net Cost)	-3,267.4	-593.3	-2,674.1	15.21%	21.87%	1.2	SPC->LRTA, Lease Fee for existing line
Case 2							
Type 1 (BT, One-Tiered)	-2,963.4	1,257.4	-4,220.8	9.10%	12.01%	1.2	LRTA->SPC, Amortization Payment
Type 2 (BLT, One-Tiered)	-2,963.4	953.0	-3,916.4	11.15%	12.02%	1.1	LRTA->SPC, Lease Fee
Type 3 (Lease+O&M, One-Tiered, Net Cost)	-2,963.4	-3,828.6	**865.2**	14.31%	12.01%	0.0	SPC->LRTA, Lease Fee for existing line SPC->LRTA, Lease Fee for extension line
Type 4-1 (BTO, Two-Tiered, Gross Cost)	-2,963.4	-2,531.1	-432.3	14.26%	16.47%	1.1	LRTA->SPC, Service Fee
Type 4-2 (BTO, Two-Tiered, Net Cost)	-2,963.4	-2,861.3	-102.0	15.12%	17.79%	1.2	SPC->LRTA, Concession Fee
Type 4-3 (BTO, One-Tiered, Gross Cost)	-2,963.4	1,552.1	-4,515.5	13.70%	23.45%	1.1	LRTA->SPC, Service Fee
Type 4-4 (BTO, One-Tiered, Net Cost)	-2,963.4	1,592.4	-4,555.8	15.05%	31.47%	1.2	LRTA->SPC, Service Fee
Type 5-1 (BOT, Two-Tiered, Gross Cost)	-2,963.4	-2,563.7	-399.7	13.99%	16.07%	1.1	LRTA->SPC, Service Fee
Type 5-2 (BOT, Two-Tiered, Net Cost)	-2,963.4	-3,520.1	**556.7**	13.17%	12.57%	1.2	SPC->LRTA, Lease Fee for existing line
Type 5-3 (BOT, One-Tiered, Gross Cost)	-2,963.4	1,596.2	-4,559.6	14.06%	24.51%	1.1	LRTA->SPC, Service Fee
Type 5-4 (BOT, One-Tiered, Net Cost)	-2,963.4	1,684.5	-4,647.8	12.58%	26.88%	1.2	LRTA->SPC, Viability Gap Funding

Source: Study Team

In addition, Type 4-4 (BTO, One-Tiered, Net Cost) and Type 5-4 (BOT, One-Tiered, Net Cost) of Case 1 (only east extension) do not require substantial public fiscal expenditure, such as Service Delivery Payments, and can expect concession revenue or rental revenue from a private company, although they do not achieve VFM. This shows that this Project is a business in which self-support is possible by the private sector, including fare revenue from the existing section.

While there is also a type which far exceeds the chosen minimum ratio of IRR for SPC or Equity IRR, this is because the Study Team controlled in order to exceed the minimum ratio of all the three indicators, and no comparison of the indicators was done.

4) Sensitivity Analysis

Since the project cost and operation revenue which were made on the premise of the PPP financial analysis conducted by 4.4.4.2-4.4.4.3 are only estimated figures, and the actual amount of money for project cost is referred to decision-making of the private sector, it is difficult to estimate project cost exactly for the VFM evaluation at the feasibility study stage. Besides, it is difficult to estimate operation revenue as well as project cost exactly at present because transport demand is only a prediction.

Accordingly, the Study Team confirmed that VFM can be achieved in the vicinity of the estimated project cost and operation revenue by conducting a sensitivity analysis, which took into consideration a construction-cost overrun, an O&M-cost reduction and a fare-revenue decrease. The sensitivity analysis was carried out for Type 3, Type 4-2 and Type 5-2 which achieved a comparatively large VFM in case 1.

Table 4.4-12 Parameters of Sensitivity Analysis

Construction-Costs Overrun Rate	O&M-Cost Reduction Rate	Fare-Revenue Decrease Rate
0% (Base)	10% (Base)	0% (Base)
10%	5%	10%

Source: Study Team

The result of the sensitivity analysis is shown in **Table 4.4-13**. In Type 3 and Type 5-2, the sensitivity to the reduction of O&M costs is the highest, the sensitivity to the decrease of the fare revenue is in the medium degree, and the sensitivity to the overrun of construction costs is low. In Type 4-2, the sensitivity to the reduction of O&M costs is the highest, the sensitivity to the overrun of construction costs is in the medium degree, and the sensitivity to the decrease of the fare revenue is low. Since VFM may disappear through fluctuations in the parameters if VFM is small, it would be prudent to keep the O&M costs low.

Table 4.4-13 Result of Sensitivity Analysis

Rate of Initial Cost Overrun	Rate of O&M Cost Reduction	Rate of Fare Revenue Decrease	VFM (Million Peso)	
Type 3 (Lease + O&M), Case 1				
0% (Base)	10% (Base)	0% (Base)	824.6	100%
		10%	716.8	87%
	5%	0% (Base)	402.7	49%
		10%	303.2	37%
10%	10% (Base)	0% (Base)	810.9	98%
		10%	703.0	85%
	5%	0% (Base)	389.0	47%
		10%	289.5	35%
Type 4-2 (BTO, Two-Tiered, Net Cost), Case 1				
0% (Base)	10% (Base)	0% (Base)	376.9	100%
		10%	339.2	90%
	5%	0% (Base)	27.3	7%
		10%	-17.1	-5%
10%	10% (Base)	0% (Base)	265.0	70%
		10%	222.5	59%
	5%	0% (Base)	-84.7	-22%
		10%	-125.2	-33%
Type 5-2 (BOT, Two-Tiered, Net Cost), Case 1				
0% (Base)	10% (Base)	0% (Base)	956.8	100%
		10%	773.8	81%
	5%	0% (Base)	593.4	62%
		10%	368.6	39%
10%	10% (Base)	0% (Base)	861.1	90%
		10%	636.3	67%
	5%	0% (Base)	455.9	48%
		10%	231.1	24%

Source: Study Team

4.4.5 Comprehensive Estimation of Operational Scheme

Based on the qualitative evaluation of **4.4.3**, and the financial evaluation result of **4.4.4**, the Study Team did a case by case comprehensive evaluation of the operational scheme set up in **4.4.2**, to determine whether it can be carried out efficiently and effectively dependant on what kind of PPP scheme is employed.

The result of the evaluation is shown in **Table 4.4-14**. Because these types have achieved VFM and their qualitative evaluation is not low, the Study Team recommends Type 3 (Lease+O&M), Type 4-2 (BTO, Two-Tiered, Net Cost) and Type 5-2 (BOT, Two-Tiered, Net Cost) as desirable PPP schemes in Case 1, and Type 3 and Type 5-2 in Case 2.

Table 4.4-14 Comprehensive Evaluation of Operational Scheme

Type	Scheme	Qualitative Evaluation	Financial Evaluation				Comprehensive evaluation
			Case 1		Case 2		
			IRR for SPC Equity IRR Mini DSCR	VFM M Peso	IRR for SPC Equity IRR Mini DSCR	VFM M Peso	
Type1	BT	- Although it is a scheme that could be adopted when the public sector operates, there is no precedence case. - In order not to leave operation to the private sector, the risk of the O&M stage does not transfer to the private sector, and it does not concur with governmental policy or the future vision of LRTA.	8.95% 12.00% 1.2	-2,975.1	9.10% 12.01% 1.2	-4,220.8	It does not achieve VFM and also qualitative evaluation is low.
Type2	BLT	- It is a scheme adopted when the public sector operates, and the problems with the MRT Line 3 are giving a lesson. - In order not to leave operation to the private sector, the risk of O&M stage does not transfer to the private sector, and it does not concur with the governmental policy or the future vision of LRTA. - It would be problem if the ownership differed between the existing section and the extension section.	11.16% 12.05% 1.1	-2,787.4	11.15% 12.02% 1.1	-3,916.4	It does not achieve VFM and also qualitative evaluation is low.
Type3	Lease + O&M	- There are precedence cases in other transport sectors. This scheme is adopted on a project in which financing would be difficult for the private sector. Compatibility with ODA is the highest.	**14.49%** **12.02%** **—**	**824.6**	**14.31%** **12.01%** **—**	**865.2**	Since the cases 1 and 2 have high VFM and qualitative evaluation is also adequate, feasibility is high.
Type4-1	BTO Two-Tiered Gross Cost	- In Types 4 and 5 which give the responsibility for all activities from construction to operation to the private sector, make participation by the private sector the easiest and compatibility with ODA is also high. - Considering the profitability of this type of project, the advantages to choosing two-tiered and gross cost scheme are few	14.54% 15.38% 1.1	14.4	14.26% 16.47% 1.1	-432.3	VFM is low in case 1 and VFM is not achieved in case 2. Qualitative evaluation is also slightly low.
Type4-2	BTO Two-Tiered Net Cost	- The private sector mainly bears the demand risk unlike Type 4-1, and the appropriate risk allocation of the government and a private sector according to the profitability of this project is undertaken. Applicability is high when the ease of participating of the private sector and compatibility with ODA are taken into consideration.	**15.12%** **16.00%** **1.2**	**376.9**	15.12% 17.79% 1.2	-102.0	Since it achieves VFM in case 1 and also qualitative evaluation is high, feasibility is high.
Type4-3	BTO One-Tiered Gross Cost	- Considering the profitability of this type of project, the advantages to choosing gross cost scheme are few like Type 4-1. - ODA is not required.	13.88% 20.77% 1.1	-2,884.5	13.70% 23.45% 1.1	-4,515.5	It does not achieve VFM and also qualitative evaluation is low.

Type	Scheme	Qualitative Evaluation	Financial Evaluation				Comprehensive evaluation
			Case 1		Case 2		
			IRR for SPC Equity IRR Mini DSCR	VFM M Peso	IRR for SPC Equity IRR Mini DSCR	VFM M Peso	
Type4-4	BTO One-Tiered Net Cost	- The appropriate risk allocation of the government and the private sector according to the profitability of this project is undertaken. - ODA is not required.	15.10% 24.87% 1.2	-2,763.8	15.05% 31.47% 1.2	-4,555.8	It cannot achieve VFM but since it does not need substantial public fiscal expenditure, it is applicable.
Type5-1	BOT Two-Tiered Gross Cost	- This scheme which was adopted on the Bangkok MRT purple line is selected when profitability is low or the government wants to strengthen its involvement in operation. Considering the profitability of this project, the advantages to adopting this scheme are few. - It would be a problem if ownership differed between the existing section and the extension section.	14.54% 15.38% 1.1	14.4	13.99% 16.07% 1.1	-399.7	VFM is low in case 1 and VFM is not achieved in case 2. Qualitative evaluation is also slightly low.
Type5-2	BOT Two-Tiered Net Cost	- This scheme is adopted on projects of rather high profitability, and there are also many precedence cases. The appropriate risk allocation of the government and the private sector according to the profitability of this project is undertaken. - It would be a problem if ownership differed between the existing section and the extension section.	**13.29%** **12.03%** **1.2**	**956.8**	**13.17%** **12.57%** **1.2**	**556.7**	Although the qualitative evaluation is low, cases 1 and 2 have high VFM and feasibility is high.
Type5-3	BOT One-Tiered Gross Cost	- Considering the profitability of this project, the advantages to choosing gross cost scheme are few like Type 5-1. - It presents problems because ODA is not required and ownership would differ between the existing section and the extension section.	14.35% 21.77% 1.1	-2,938.4	14.06% 24.51% 1.1	-4,559.6	It does not achieve VFM and also qualitative evaluation is low.
Type5-4	BOT One-Tiered Net Cost	- This scheme is adopted on the projects of high profitability, and there are also many precedence cases. The appropriate risk allocation of the government and the private sector according to the profitability of this project is made. - It presents problems because ODA is not required and ownership would differ between the existing section and the extension section.	15.21% 21.87% 1.2	-2,674.1	12.58% 26.88% 1.2	-4,647.8	Qualitative evaluation is slightly low but case 1 does not need substantial public fiscal expenditure.

Source: Study Team

4.5 Project Management Organization

After the LRTA Line 2 Extension Project is proposed, constructed, completed and implemented under the expected PPP scheme, the organization, human resources, budget allocation and coordination among the related agencies will be different from the current LRTA and its stakeholder agencies.

LRTA will continue its role as the asset owner and the operator, but under PPP scheme, this will be in an indirect manner and substantial changes will be seen in its contractual management in procurement and the operational regulation and supervision.

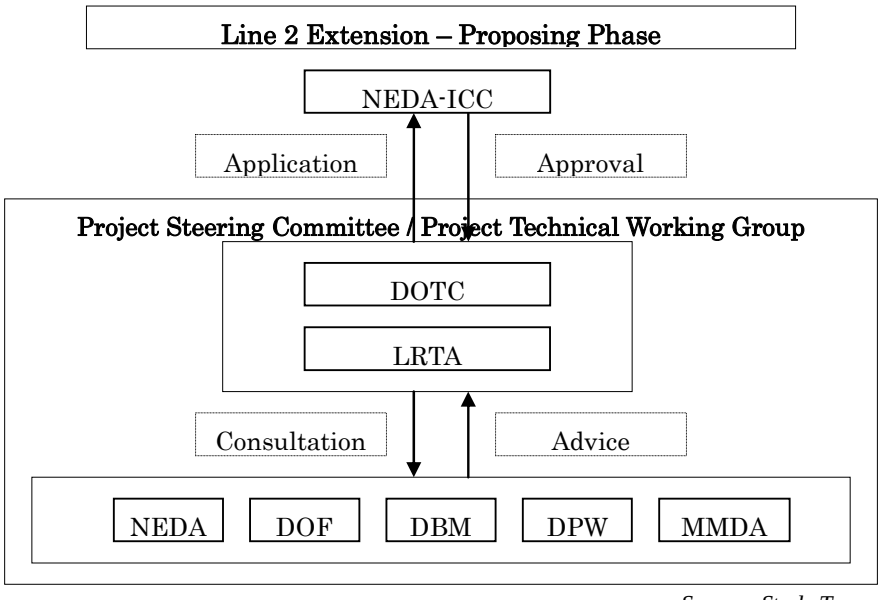
This sub-chapter focuses on LRTA's project management organization while the LRT Line 2 Extension project is implemented and operated with particular focus on its relationships and/or responsibilities vis-à-vis other related agencies and also taking the fundamental changes of modus operandi of LRTA into consideration to highlight new possible organizational structures for LRTA. Its job responsibilities, and expected expertise are to be discussed in Chapter 6.

4.5.1 Implementation Structure during Proposing Phase

The PPP project related agencies and their roles and responsibilities for the LRTA Line 2 Extension Project with its Project Proposing Phase, Project Implementation Phase and Project Operations and Maintenance Phase are as follows.

The agencies involved in the Project Proposal Phase are:

- DOTC mainly through its Railway Division as the main applicant vis-à-vis NEDA-ICC for the project proposal preparation with assistance from LRTA,
- LRTA as the executing agency and a co-applicant to NEDA-ICC particularly through its Planning and Project Management Office tasked to prepare the technical and financial parts of the proposal in particular,



Source: Study Team

Figure 4.5-1 Line 2 Extension Structure – Proposing Phase Structure

- The Line 2 Extension Project Steering Committee (L2PSC) led by DOTC and comprised of senior official members from DOTC, DOF, DBM, DPWH, MMDA and NEDA, engaged in

reviewing and deciding the key issues in the proposal.

- DOF represented by Corporate Affairs Group responsible for GOCCs in connection with financial needs and requirement policy decisions as well as the liaising window in DOF with the office dealing with foreign and international ODA agencies
- DBM in relation to the general budget appropriation with LRTA and specifically on the Project financial requirement and needs in the future
- MMDA primarily responsible for the urban traffic development issues in both economic and social aspects
- NEDA as the secretariat of ICC in implementing PPP project preparation on its process management as well as prescreening of the project proposals

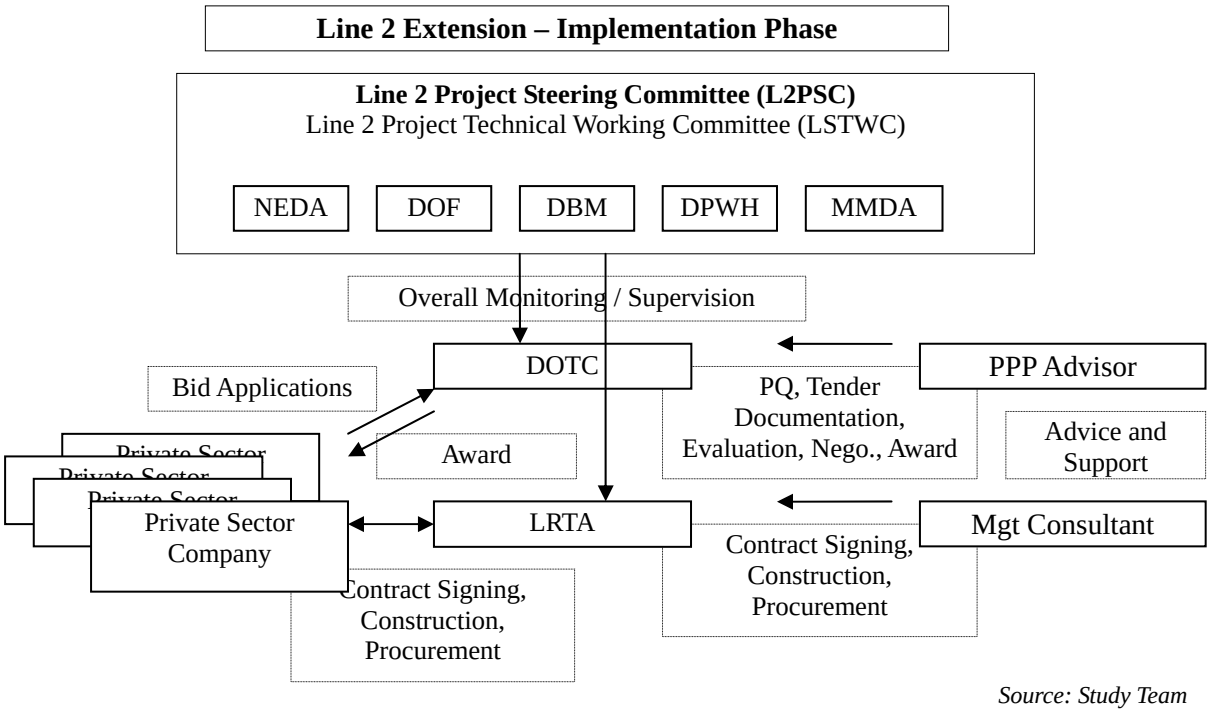
Line 2 Extension Project Technical Working Committee (TWC) comprised of the representatives from the same public administration at technical level and engaged in drafting and reviewing the proposal. It was indicated by DOTC that the L2PSC should be created very soon but TWC dealing with other PPP projects related to LRTA has been already working with this Line 2 Extension Project.

During this phase, a schematic view of the related agencies and their roles is as shown in **Figure 4.5-1** above.

4.5.2 Implementation Structure during LRT Line 2 Implementation Phase

Once NEDA-ICC gives its approval to the LRT Line 2 Extension Project proposal, the Study Team understands that DOTC, in close coordination primarily with LRTA, will continue to take the lead on PPP bidding till the awarding processes.

DOTC will handle, by using their in-house staff and professionals to proceed from pre-qualification preparation, bids and tender document preparation, qualification processes, notice of qualification, receiving bid documents, opening of bid documents, evaluation of documents, negotiating contracts and announcing award as described in Implementing Rules and Regulations (IRR) of RA-6957, as amended by RA-7718.



Source: Study Team

Figure 4.5-2 Line 2 Extension – Implementation Phase Structure

LRTA will be responsible, in accordance with the award content, to conclude a PPP Contract with a private sector company given the award from DOTC. LRTA will supervise the whole process of construction and procurement with its regular and ad hoc monitoring and supervision.

DTOC and LRTA will consult with the Line 2 Project Steering Committee (L2PSC) from time to time so that they receive advice and recommendations to proceed the implementation as a part of their overall monitoring and supervision.

In addition to their current expertise in engineering, technical, operational and maintenance activities, LRTA will be required to have internal advanced knowledge and skills in contractual and negotiation skills. Those activities will include pre-qualification preparation, bids and tender document preparation, qualification processes, notice of qualification, receiving bid documents, opening of bid documents, evaluation of documents, negotiating contracts and announcing awards.

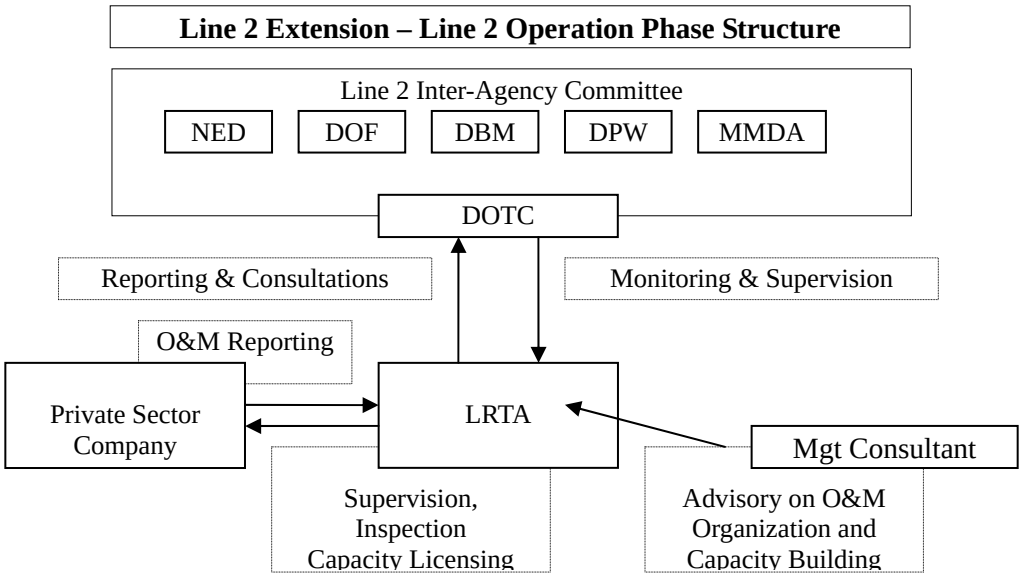
The intensive intervention through mobilizing that knowledge and those skills is particularly necessary during this period but it would be strongly advised to maintain that advanced level to be applied during the operational period after the construction.

Those processes could be assisted by one or a group of experts as a soft-portion attached to a JICA ODA Loan or by a technical expert dispatch program by JICA in two ways. The first option is for DOTC to have a PPP Advisor to give advice on bidding and evaluating processes, and the other is for LRTA to have a Management Consultant to give advice on the PPP contracting, construction and procurement for the entire implementation processes.

These advisory services would be beneficial for both DOTC and LRTA in the areas where the capacity does not seem to have reached sufficiently at each institution. Some cases are, for example, the bidding document and process preparations, technical and engineering advice as well as PPP contractual matters.

4.5.3 Implementation Structure of LRT Line 2 during Operation Phase

The structure to be put in place to conduct LRT Line 2 operations and maintenance under the PPP scheme after the LRT Line 2 Extension is completed and the whole extended Line 2 starts operation is shown below.



Source: Study Team

Figure 4.5-3 Line 2 Extension – Operation Phase Structure

Upon the completion of the construction of the Project, the role of the Line 2 Project Steering Committee would be to become an Inter-Agency Committee to discuss and update the operations of Line 2 led by DOTC.

The private sector company, now the operator of Line 2, would report to LRTA on the operations and maintenance activities in accordance with the PPP contracts, whereas LRTA will exercise its role as Operational Supervisor and Regulator by monitoring and supervising the activities of the private sector operator. This is a fundamental change in the role and responsibilities of LRA under the PPP scheme.

The Study Team was informed that LRTA has been developing its Medium Term Development Plan (MTDP) covering the 2011-2016 period and in its vision statement LRTA envisages to be "financially independent, fully owning its assets and the sole government institution, in partnership with the private sector. It will continue to be responsible for the construction, management and operation of the urban mass transit system in the country."

More specifically, LRTA will start during this period a substantial implementation of projects under the PPP framework. It will start and complete the construction of the LRT Line 1 North Extension of Metro Manila integrated railway terminal (called the Common Station), outsource the operations and maintenance of the existing Line 1 and bid out Line 1 Cavite extension project under the PPP mode, and finally repair rehabilitate and modernize Line 1 and Line 2 systems including security and common automatic fare collection system. It also envisages implementing Line 2 East and West extensions and other projects.

4.5.4 LRTA – New Role under PPP

Considering that those strategic plans above would be implemented along with the Line 2 Extension, LRTA will be required to have more extensive coverage of planning, marketing, engineering, technical and operational expertise.

This implies that LRTA will keep its "Regulator" role to provide comprehensive policy guidance for the development, operation, and promotion of the light rail transit system and to formulate practicable plan/programs for the extended LRT system under the PPP schemes implementing MTDP. LRTA will drastically change and transform its role from the current "Direct Operator" to become an "Indirect Operator". That will require substantial changes in its role, function and furthermore its organization as well as its managerial and technical expertise under the new environment. In particular, LRTA will be asked to assume an "Operational Supervisor" role or even an "Operational Regulator" function particularly vis-à-vis private sector companies contracting under PPP to continue to provide high quality public transportation services.

For these new roles at LRTA, acquiring and developing required expertise would be developed further by LRTA's own efforts through maintaining its existing engineering and operational know-how, but the interface with the private sector contractor under PPP will be in an indirect manner of intervention requiring specific attention starting from the PPP contract preparation stage and O&M supervision stage. The organizational structure for Operations and Maintenance is explained in more detail in Chapter 6.

4.5.4.1 Railway System Development History

The general world trend for railway systems has been illustrated as the history and development of vertical and horizontal integration since its birth in the 19th century. All the activities from railway planning, construction, engineering, equipment, signaling, and rolling stock to operations and maintenance including ticketing, station administration and track maintenance were fully undertaken under one organization. As for the management and supervision of operations, they were conducted as a part of its activities, which implies that the internal technical and operational capacities were easily built

and shared as its common know-how and disseminated within the organization.

Later, in line with the modernization efforts in the 1950s and 1960s, particularly to respond to the economic and financial requirements, many railway systems implemented measures for streamlining such as outsourcing and/or contracting out some parts, quite often from auxiliary or supporting activities, to the third parties. This trend has further been accelerated with the information and communication technology development.

One factor in considering the railway system streamlining is its “pubic good” nature. Public transport service is their primary role and responsibilities to be carried out with affordable fare levels to passengers that quite often subject the railway system to their conflicting requirement such as efficiency or feasibility.

When one considers new line construction, the infrastructure, particularly civil work, requires a huge amount of funding, often now more and more leading to a Public-Private Partnership approach in railway projects. The responsibilities between the public and private sectors were discussed in the Chapters above, and it should be pointed out that their roles have become different from the days when they operated on their own.

Railway organizations' roles and functions are transformed to those of an Indirect Operator and thus the role of legal, contractual and negotiating expertise on PPP contracts, and monitoring and supervising roles on construction management as well as supervising and regulating roles on operations and maintenance will be critically important.

4.5.4.2 New Role of LRTA – The Indirect Operator

In view of the purpose of this Study, DOTC will continue to assume responsibility for the national level railway systems including the urban railways for its key policies, whereas LRTA will be, under the PPP Scheme, responsible for the “Operational Regulation” as well as “Operational Supervision” as the Indirect Operator.

Firstly, for the LRT Line operations, LRTA will assume the role of “Operational Regulator”. This role should cover the “Operational Regulator”. With a view to carry out those operational supervision activities above, LRTA will need to set up technical and operational standards on engineering, mechanical, operational and maintenance activities including benchmarks such as key performance indicators, for example, as well as certification and licensing of drivers, station managers and security & safety managers for contractors to achieve and maintain professional railway service delivery.

For outsourced, contracted-out or concession services, LRTA will be asked to be an “Operational Supervisor” to exercise daily operations and maintenance through its monitoring and supervision activities vis-à-vis contractors to determine whether the contractors are providing adequate services as agreed in the contract. Till now LRTA has been doing most of the operational and maintenance activities by itself, but it will be working in an indirect manner to oversee services provided by the contractors where LRTA will need to maintain adequate knowledge to properly manage those outsourced services.
Internally for both supervision and regulation roles, LRTA will need to keep and maintain its current managerial, technical and operational expertise. LRTA would need to make efforts to “Avoid Technology Know-how Expertise Fade-out” during the years to come. For the time being, during the medium-term, the institutional memory, technology and skills will remain, but as time goes by, it is quite likely those advanced knowledge and skills may subside. Some kind of an HR management and evaluation system would be needed to keep highly experienced technical and operations experts and offer them opportunities to update the to latest technology and management expertise internally for those operations and maintenance activities to be supervised. If not, LRTA would find it very difficult to hold them accountable for their contracted-out services that had been contracted-out to the private sector.

Secondly, in relation to new PPP project planning and implementation, the new and important role to be assumed by LRTA will be the “PPP Contract Owner” where procurement and contractual expertise on construction, and engineering as well as operations and maintenance will be critically important. Quite often, most of the construction, engineering, technical or system unit staff have engineering backgrounds and may not have sufficient knowledge on legal, contractual and negotiation issues. More legal enabling framework would be provided in the near future but the contractual obligation knowledge under PPP or negotiation skills with private sector companies needs a more professional approach with internal capacity building which is called “Management of Technology” (MOT) developed during the 1990s in the United States.