DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS (DOTC)
REPUBLIC OF THE PHILIPPINES

THE SUPPLEMENTARY SURVEY ON NORTH SOUTH COMMUTER RAIL PROJECT (PHASE II-A) IN THE REPUBLIC OF THE PHILIPPINES

FINAL REPORT SUMMARY

NOVEMBER 2015

JAPAN INTERNATIONAL COOPERATION AGENCY

ORIENTAL CONSULTANTS GLOBAL CO., LTD.
ALMEC CORPORATION
KATAHIRA & ENGINEERS INTERNATIONAL
TOSTEMS, INC.

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Exchange Rate (June 2015)		
1 Philippine Pesos (PhP)	=	Japanese Yen (JpY) 2.72
1 US dollar (US$)	=	JpY 120.7
1 US$	=	PhP 44.4

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TABLE OF CONTENTS

Page

CHAPTER 1 INTRODUCTION

1.1 Background of the Study

A commuter railway service to connect Metro Manila with its adjacent northern and southern suburban areas is deemed as one important mass transit backbone for the metropolis as well as for the growth corridor of the Greater Capital Region (GCR), which comprises of Region III, Metro Manila and Region IV-A. This is the focus of many mass transit studies of the Department of Transportation and Communications (DOTC) and the commuter rail service from Malolos to Calamba, in particular, is highlighted as one of the priority projects for the region. The significance of the project is likewise reflected in the recent National Economic Development Authority (NEDA) study on the Roadmap for Transport Infrastructure Development of Metro Manila and Its Surrounding Areas (Region III and Region IV-A).

A feasibility study on Commuter Railway for Malolos to Caloocan was a Japan International Cooperation Agency (JICA)-funded initiative of DOTC to escalate project preparedness for a likely implementation within the short term period (i.e., 2014 - 2016). It took off from the previous pre-feasibility study for the Airport Express Rail (AER) Study, which was geared to develop a railway strategy for connecting Clark International Airport (CIA) to the National Capital Region (NCR) or Metro Manila.

This study aims to conduct supplementary surveys on Caloocan and Tutuban section of North South Commuter Railway (NSCR), which was out of scope in the recent concluded feasibility study, to evaluate the necessity and feasibility of an urban rail transit system for Malolos to Tutuban section, a section with one of the highest priorities as per DOTC, and to prepare necessary material for project appraisal.

1.2 Objectives of the Study

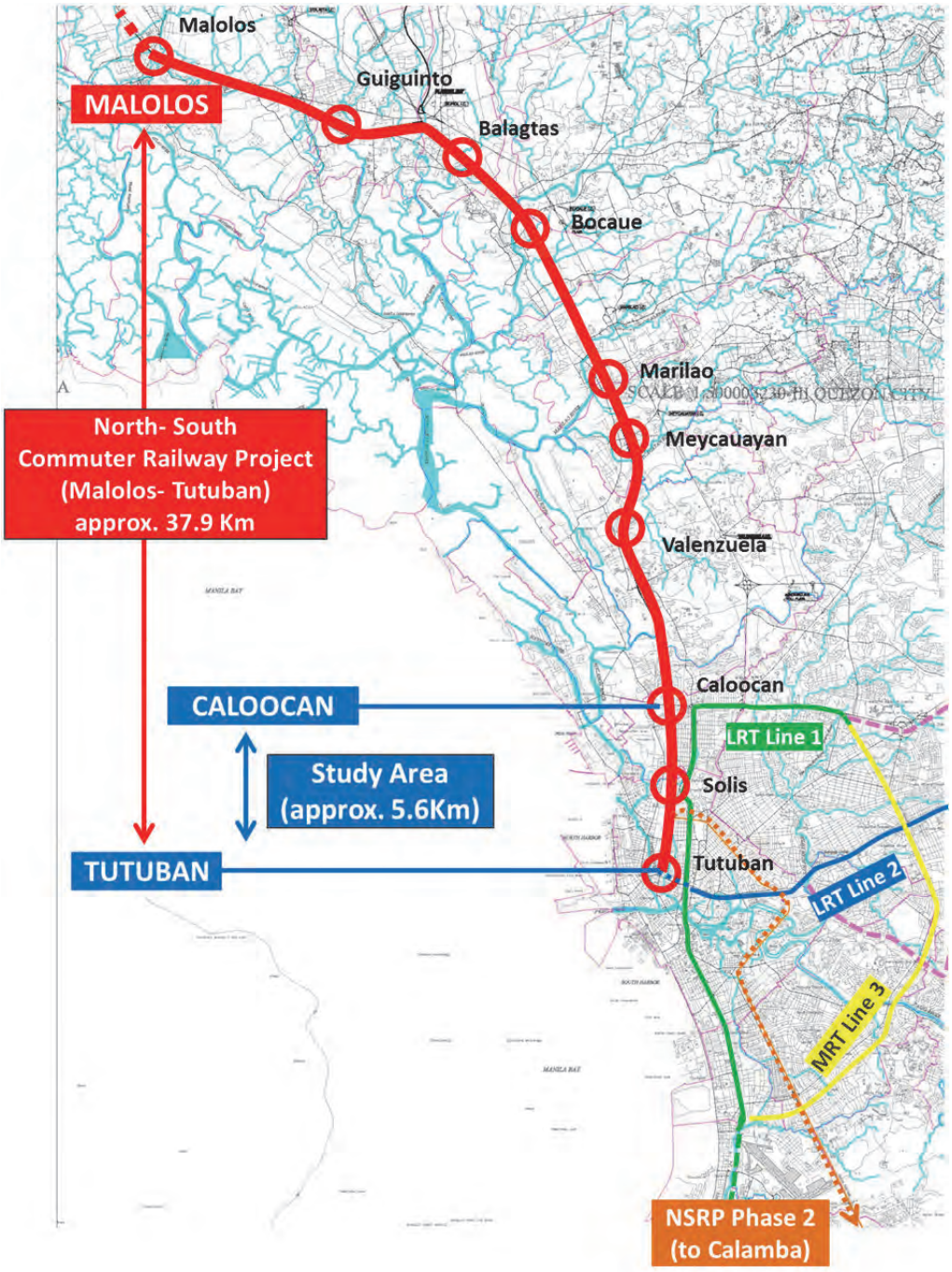
This study aims to conduct supplementary surveys on the Caloocan and Tutuban section, a part of the priority section from Malolos to Tutuban of NSCR, to develop a preliminary design and project cost estimation. The purpose of these supplementary surveys is to advance the realization of the project through the evaluation of necessity and propriety of the priority project between Malolos and Tutuban section in consideration for consistency and adequacy of whole railway system.

In addition, examination on i) Inter-modal enhancement with transit oriented development and examination of the universal design facility plan at junction stations, ii) Estimation of potential greenhouse gas reduction will be carried out.

1.3 Study Area

As shown in the Project Location Map shown below, the section of this study extends approximately 5.6 km from Caloocan to Tutuban within the NSCR (Malolos- Tutuban).

The result of the feasibility study on Malolos- Caloocan section shall be reviewed from the viewpoint of consistency and adequacy of whole railway system between Malolos and Tutuban. In addition, supplemental survey and examination shall be conducted on Malolos- Caloocan section, if any additional information or data required for appraisal of Yen Loan.



Source: JICA Study Team

Figure 1.3.1 Project Location Map

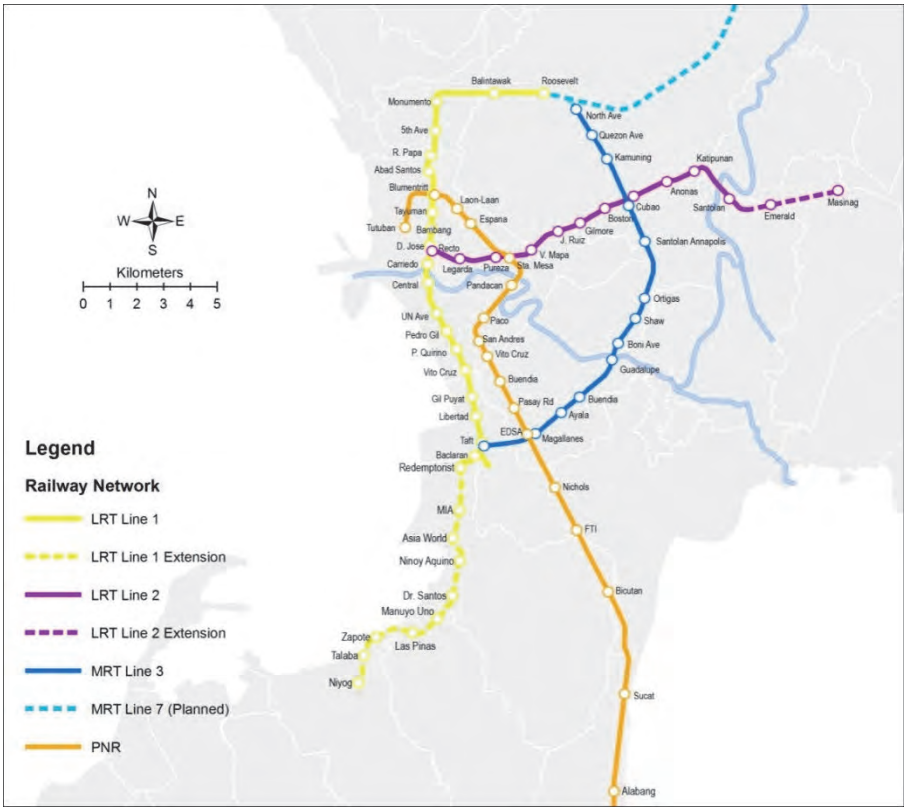
CHAPTER 2 NECESSITY AND BACKGROUND OF THE PROJECT

2.1 Situation and Issues in GCR Transportation Sector

2.1.1 Transport Infrastructure

The current rail network in Greater Capital Region (GCR) consists of the Philippines National Railway (PNR) Lines and urban mass transit lines within Metro Manila. The operational lines and future planned/ proposed lines shown in Figure 2.1.1 are as follows.

- PNR Commuter service between Metro Manila and Alabang; and PNR long distance services in Luzon Island;
- LRT Line-1, a north-south line from Roosevelt (Quezon City) to Baclaran (Pasay City);
- LRT Line-2 an east-west line from Santolan (Pasig City) to Recto in Manila City, and
- MRT Line-3 a semi-circle north-south line from North Avenue in Quezon City to EDSA station in Pasay City.



Source: LRTA Website & Updated by JICA Study Team

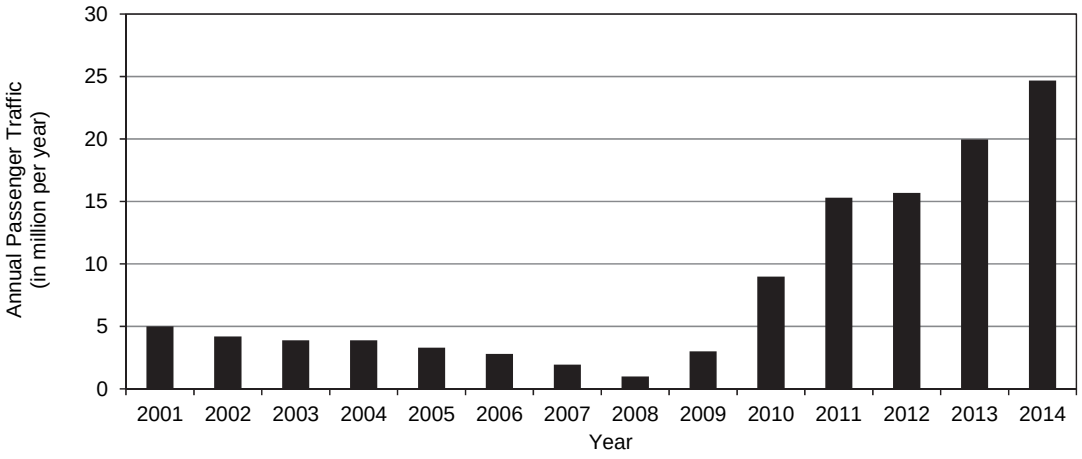
Figure 2.1.1 Operational and Planned Railway lines in GCR Area

2.1.2 Philippines National Railways (PNR)

PNR was created in 20 June 1964 by virtue of Republic Act No. 4156, in order to provide a nationwide railway transportation system. The PNR is an attached agency under DOTC.

PNR used to operate over 797 km (495 miles) of route from La Union down to Bicol. However, continued neglect and damage from natural calamities in past decades reduced PNR's efficiency and railroad coverage. Persistent problems with informal settlers in the 1990s contributed further to PNR's decline[1].

Figure below shows the annual passenger traffic on the PNR network for Metro Manila to Alabang. This data shows that since 2001 PNR has been losing ridership from 5 million passengers per annum and finally hit rock bottom in 2008 with just over 1.1 million passengers. However, with the acquisition of new rolling stock in mid-2009, the decline in ridership was reversed. Over the next two years, ridership has increased sharply to reach some 25 million passengers by 2014.



Source: PNR

Figure 2.1.2 PNR Annual Passenger Traffic, 2001-2014

2.1.3 Metro Manila LRT Line-1

Metro Manila's first elevated Light Rail Transit started with a 14- km long line from Baclaran in the south to Monumento in the north. It had 18 stations along some of the busiest roads, Rizal Avenue and Taft Avenue opened for revenue service in December 1984. In 1985, the 1st full year of operation, the patronage of Line-1 was 69.7 million passengers. The growth in demand was steady and it reached 127.8m by 1990, and increased to a peak of 145.8 million passengers by 1994 (an average growth rate of about 8.5% p.a. from 1985 to 1994). Then the ridership started to decline due to poor maintenance and other technical reasons. The decline in patronage continued until 2004 (further exacerbated by the 20% increase in LRT fares in December 2003) and it was 96.8 million Pax in 2004, almost 40% less than it was a decade before that.

However, the declining patronage trend was reversed in 2005. In 2011, patronage of 156.9 million passengers was recorded on Line-1 after an eastward extension from Monumento of 5.7 km with two new stations (Balintawak & Roosevelt) opened in 2010. This gives an annual average growth rate for the decade: 2001 to 2011 of 3.62% per annum.

Annual patronage of Line-1 since opening is shown in Figure below. It can be seen that the drop in patronage from 145 million annual passengers to around 100~110 million annually throughout the 1st half of the last decade was mostly related to the available capacity of the rolling stock. With the provision of the additional rolling stock, growth in population and the economy, and ever increasing road congestion, Line-1 was able get its patronage back to the peak of over 160 million passengers per annum in 2012.

[1] *PNR website (www.pnr.gov.ph)*

2.1.4 Metro Manila LRT Line-2

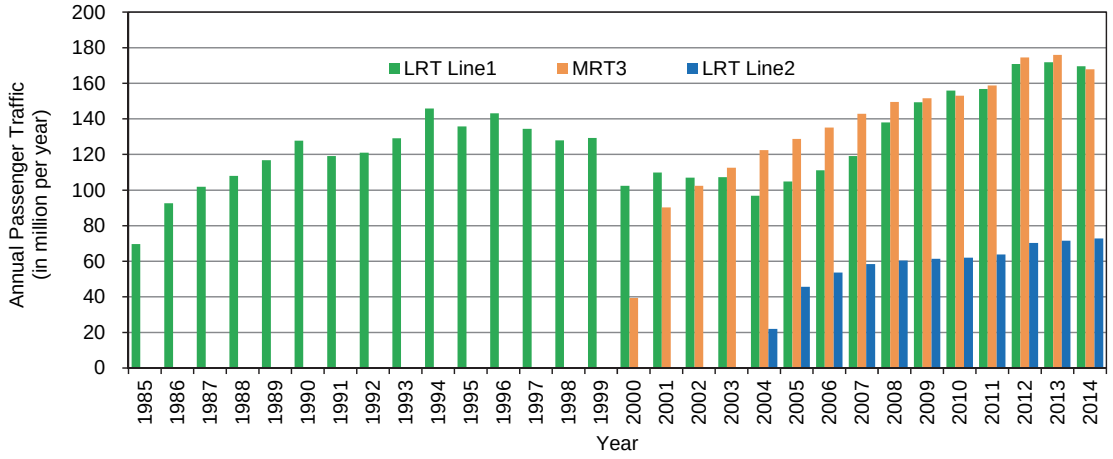
Metro Manila's latest elevated Light Rail Transit Line-2 12.6km long with 11 stations runs from Recto in Manila City to Santolan (Pasig City) in the east along the busy east-west radial Marcos Highway, Aurora Blvd. Magsaysay Av. and CM Recto Av. The line opened for revenue service in April 2003. In 2004, the 1st full year of operation, the patronage on Line-2 was 20.6 million passengers. The growth in demand was instantaneous and the ridership more than doubled by 2005 to 41.9 million Pax, and increased by another 40% by 2008 to reach 58.9 million Pax. After that the demand growth rate steadied and an average growth of about 3% from 2008 to 2011 has been recorded. By the end of 2014 the annual patronage had reached nearly 72.8 million passengers.

Line-2 annual patronage since opening is illustrated in Figure below. It can be seen that since 2008 the growth had steadied. The peak demand is met by operation of 4-car trains at 5 minute headways, at a comfortable load factor of about 60~70% under 1,000 passengers per train which has a crush capacity of 1,600 passengers per train. In the evening peak the load factor is even lower than the morning peak, providing a more comfortable ride.

2.1.5 Metro Manila MRT Line-3

Metro Manila's Mass Rail Transit MRT Line-3, is 16.9 km long with 13 stations from EDSA (Pasay City) in the south to North Avenue (Quezon City) in the north-east. The alignment is mostly elevated along the busiest circumferential road (C-4) of Metro Manila, with the exception of a small section in Makati City where it is underground. It partially opened to service in late 1999, and the full line opened for revenue service in July 2000. In 2001, the 1st full year of operation, the patronage on the line was 90.2 million passengers, more than double from the passengers carried in 2000, and constantly increased until its peak year of 2013.

However , four accident occurred since 2012, after the maintenance service by Sumitomo- Mitsui expired, including train collision with a parked train at MRT depot, passenger injure by abrupt stop, car fire caused by a short circuit and most recently a derail and injuring at least 36 people in August 2014. In addition, broken rail failures increases from 4 in 2011 to 22 in 2014. It causes decreasing MRT services such as slower operation speed, longer waiting time etc.



Source: JICA Study Team based on LRTA data

Figure 2.1.3 Lines 1, 2 and 3 Ridership

2.2 Reconfirmation of Latest Plans and Policies in the Transportation Sector

A several programs and action plans have been proceeded by the national government, such as the construction of NLEX and SLEX, the development of the Bataan and Cavite Export Processing Zones together with the provision of fiscal and non-fiscal incentives to investors in these areas, the construction of the Batangas Seaport, and more recently the development of the Southern Tagalog Arterial Road (STAR), and the Subic and Clark special economic zones.

Despite these policies, projects and package of incentives, Metro Manila continues to attract migrants and investors. However, because of cheaper land and services outside Metro Manila, the different urban centers in Central Luzon and CALABARZON have grown. Statistics show that after Metro Manila, these two regions have attracted the most number of new investments, including foreign direct investments, than other regions in the country.

To alleviate the ever growing demand for transportation infrastructure, several transportation projects within the GCR have been identified for implementation. These projects have been centered primarily on Metro Manila in view of the need to address the need for better transportation infrastructure and services that have reached critical proportions.

The background of recent economic growth, since the increasing of foreign direct investments in recent years, NEDA requested to the Government of Japan to carry out the study on “Roadmap Study for Transport Infrastructure Development for Metro Manila and Its Surrounding Areas (Region III and Region IV-A)” in order to achieve the drastic development of transportation infrastructure in Metro Manila to solve a bottleneck for further economic growth of Philippines.

Objectives of this study is to establish a long term plan to be consistent with various transportation development plans and to formulate the “Transportation Infrastructure Roadmap” for sustainable development of Metro Manila and Region III and IV-A, surrounding areas of Metro Manila.

Outputs of this study are as follows.

- To establish the “Dream Plan”, showing policy for the adequate transportation network development towards 2030
- To formulate the “Roadmap” for transport infrastructure development towards 2016 and 2020
- To designate priority projects

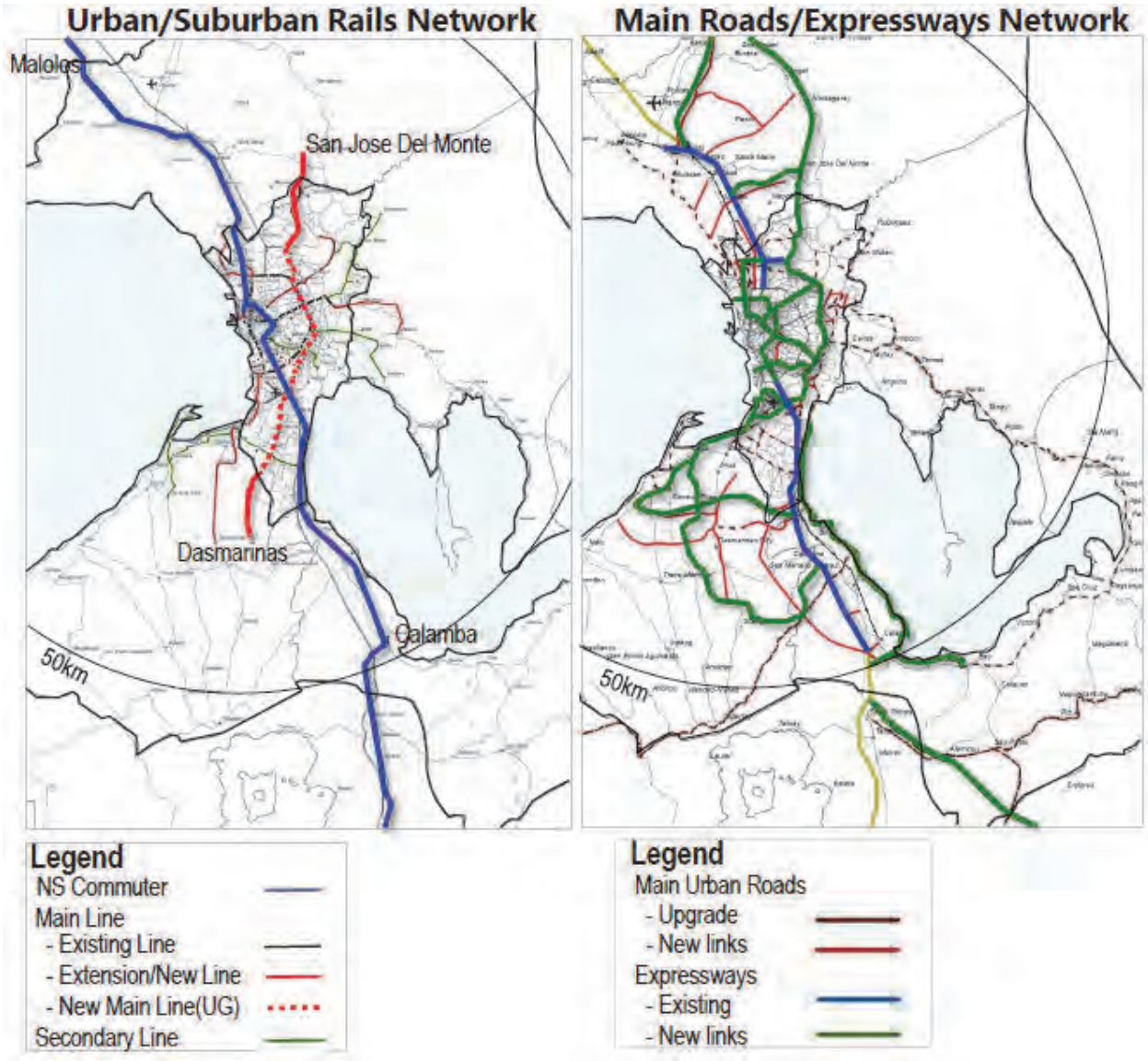
Transportation network named “Dream Plan” which aims to achieve “5 NOs” in 2030,consists of multiple projects to justify traffic management including about 300 km of railway, about 500 km of highway, rationalization of public transport etc.

- No traffic congestion
- No households living in high hazard risk areas
- No barrier for seamless mobility
- No excessive transport cost burden for low-income groups
- No air pollution

In the plan it is proposed the establishment of the North-South economic growth corridor of Metro Manila to promote an integrated urban development. The North-South backbone corridor which is consisting of

the traffic network of railway and highway as an axis, to connect adjacent Region III, and Region IV-A of Metro Manila.

NSCR formulate a part of the North- South trunk corridor in the GCR and to contribute to strengthening the connectivity between Metro Manila and adjoining municipalities in Region III and IV-A, and to promote adequate urban development to formulate new urban centers along the corridor to meet large demand of resettlement.



Source: Roadmap Study for Transport Infrastructure Development for Metro Manila and Its Surrounding Areas (Region III and Region IV-A)

Figure 2.2.1 Railway and Highway Network Proposed in the Roadmap Study

2.3 Confirmation of Project Necessity

1) Necessity of Integration with Region Development Strategy

Above problems in Metro Manila are difficult to be solved within Metro Manila, development of Region III and Region IV-A is an effective ways to maximize positive impacts of Metro Manila and contribute to mitigate Metro Manila's problems.

Due to development of traffic backbone in Metro Manila integrated with regional development clusters, it is necessary to develop north-south transport backbones formulated of expressway and suburban rail network to meet necessity of resettlement of informal settlers from high hazard risk areas, and to formulate affordable housing plan in new urban areas with good accessibility and living environment in Bulacan, Cavite and Laguna areas.

It is also necessary to be integrated with retrofit, regenerate and new plans of urban transportation development in port areas, new NAIA (international airport), water front and others within Metro Manila area to meet requirement of strengthening of economic competitive.

2) Necessity of Solving Traffic Problem

The impact of the current traffic congestion in Metro Manila cannot be neglected. According to DOTC, the traffic congestion caused economic loss of Php137.7 billion in 2012. This would cover lost opportunities of business, inefficiency in economy, pollution, waste of energy and resources, impact on health, decline of quality of life, increased risk of accidents, etc. It was estimated that the economic losses originated from traffic congestion in the last decade are indeed four times larger than investments needed for the public transport projects in Metro Manila. As discussed, motor vehicles are the main polluter of air as well as and the emitter of GHG.

Traffic congestion in Metro Manila needs integrated approach based on urban mass transit, since improvement of road network alone cannot solve the issue. In particular, for the urban poor, a lack of transport choices significantly restricts their mobility and then reduces a job opportunity, because of high transport cost. Without any intervention, the traffic congestion problem is anticipated to exacerbate so that its cost would be more than doubled by 2030.

3) Necessity to Increase Competitive in Global Market

Due to progress of economic development of hierarchical regional centers and clusters to meet with growth of agro-based industry, manufacturing, services and business process outsourcing services, tourism and others, it is necessary to promote north-south urban growth, to improve mobility and accessibility along EDSA and other roads, and to create new urban land development opportunities.
Integrated urban mass transit will contribute to regional mobility and accessibility to city center and key traffic hub and to strengthening connectivity of Metro Manila, Region III and Region IV-A, and to global market, and connectivity through transport development and industry location strategies with integrated urban mass transportation system consisting of railway and highway.

CHAPTER 3 ROUTE PLAN

3.1 Review of Route Plan and Travel Demand Forecast

3.1.1 Methodology

Travel demand model was developed to forecast patronage with key features and main components. State-of-the-art 'CUBE' transport planning software was used for traffic modeling tasks. The key steps involved in the development, validation and use of the traffic model are summarized below:

(i) Convert MMUTIS and HSH study area O/D trip matrices to the project traffic model zone system.

(ii) Create O/D trip matrices for base year 2012 taking off from the HSH 2009 database

(iii) Combine 2012 MMUTIS and HSH O/D trip matrices by selecting the whole of MMUTIS area trips for the Mega Manila area, and HSH O/D trips for the remainder of the GCR regions.

(iv) Develop the study area highway and railway network from HSH study and update where necessary.

(v) Validate the 2012 O/D trip matrices by assigning to the 2012 network and comparing the assigned traffic volume against available secondary data from previous studies and the results of the traffic and passenger surveys undertaken for the Study.

(vi) Prepare future year O/D trip tables for forecast years 2020, 2025, 2030 and 2040and assign these to the corresponding networks that have been updated to include the new highway and rail networks. These would comprise the "without project" scenario. The future year network model considered the following railway lines and Roads.

Table 3.1.1 Railway and Road Projects

Year	Rail Project	Section
2020	Line 7	Trinoma - San jose del Monte
	LRT1 Extension	Baclaran–Niog– Das Marinas
	LRT2 East Extension	Santolan -Masinag
	MTSL	BGC - Makati
2025	LRT2 West Extension	Recto-Tutuban
2035	Mega Manila Subway	San Jose Del Monte-Dasmarinas
Year	**Road Project**	
2020	Segment 9 & 10	
	NLEX-SLEX Connector Road	
	Skyway Stage 3	
	NAIA Expressway	
	Laguna Lake Shore Expressway Dike	
	Calamba - Las Binas	
	CALA expressway	
	Plaridel Bypass Road	

Source: JICA Study Team

3.1.2 Demand Forecast

1) Fare Setting

The tested train fare for demand forecast is same as the fare which was proposed by AER pre-FS project. It was increased based on GRDP growth rate in study area. The tested fare level is higher than one of existing LRT or MRT. However it is same level with the long trip bus.

Table 3.1.2 Train Fare

2020	2025	2030	2040
30+2.2/km PhP	38+2.8/km PhP	48+3.6/km PhP	64.8+4.9/km PhP

Source: JICA Study Team

2) Passenger Ridership Summary

The ridership is estimated for 2020, 2025, 2030 and 2040 as shown in the following tables.

Table 3.1.3 Passenger Demand for NSCR

Section	No. of Passenger/day (000)				AGR (%/year)		
	2020	2025	2030	2040	2020 - 25	2025 - 30	2030 - 40
Malolos–Calamba	-	953	1,385	1,596	-	7.8	1.4
Malolos– FTI	-	692	1,019	1,097	-	8.0	0.7
Malolos–Tutuban	407	430	574	630	1.1	5.9	0.9

Source: JICA Study Team

Table 3.1.4 Estimated PPHPD for NSCR

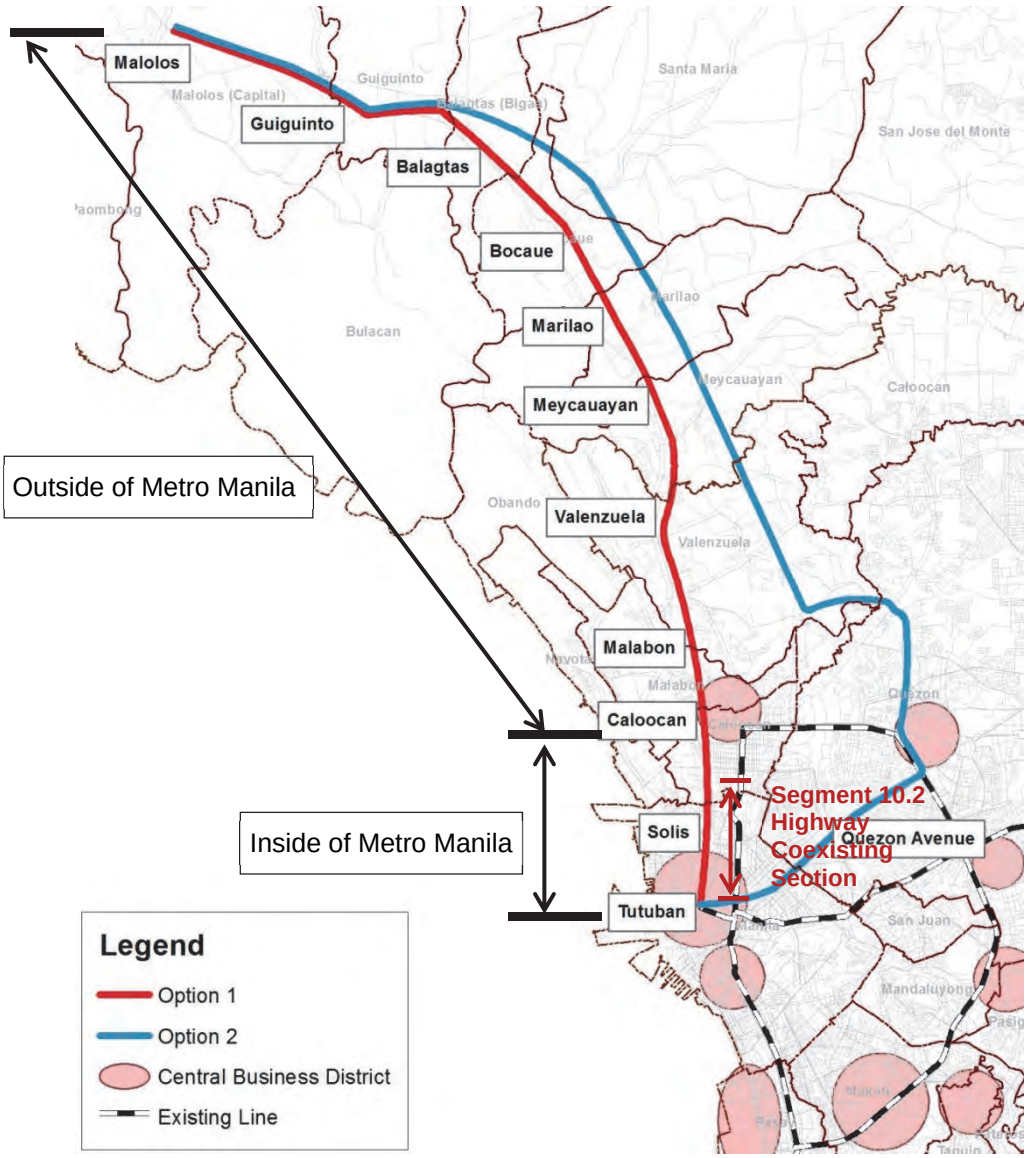
Section	PPHPD (passenger/hour/direction) [1)]				AGR (%/year)		
	2020	2025	2030	2040	2020 - 25	2025 - 30	2030 - 40
Malolos– Solis	13,210 (Solis-Caloocan)	18,290 (Caloocan-Solis)	20,680 (Malabon-Caloocan)	18,930 (Malabon-Caloocan)	6.7	2.5	-0.9
Solis – FTI	-	16,500 (Buendia-Paco)	20,380 (Vito Cruz-Paco)	19,990 (Paco-Vito Cruz)	-	4.3	-0.2
FTI –Calamba	-	13,650 (Bictan-FTI)	16,720 (FTI- Bictan)	16,760 (FTI- Bicutan)	-	4.1	0.0
Solis - Tutuban	11,440 (Tutuban-Solis)	9,700 (Tutuban-Solis)	10,910 (Tutuban-Solis)	11,190 (Tutuban-Solis)	-3.2	2.4	0.3

Source: JICA Study Team
1) peak hour rate is assumed to be 10% of the largest daily traffics volume.

3.2 Comparative Analysis of Alternatives

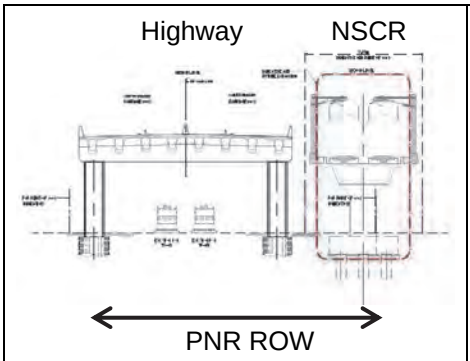
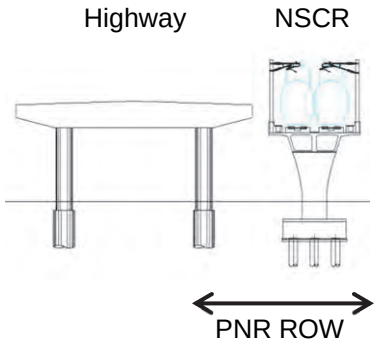
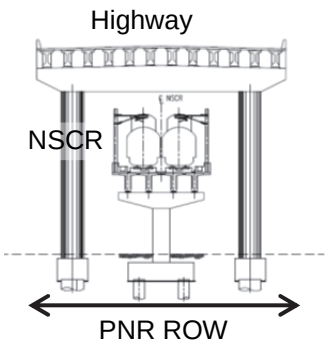
3.2.1 Route Alternative Options

The alternative options for the railway ROW from Malolos, northern Metro Manila, to Tutuban, the city center of Metro Manila are considered first to minimize land acquisition and involuntary resettlement. The ROW options are selected to use the railway ROW, road ROW and public land as much as possible. The following alternative options are compared and their routes are shown in Figure 3.2.1.



Source: JICA Study Team

Figure 3.2.1 Route of Alternative Options

		
Case1: NSCRrunoff the existingPNR ROW (NSCR share the existing PNR ROW with the highway side by side.)	Case 2: NSCRpreferentially uses the existing PNR ROW	Case 3: Both NSCR and the highway use the existing PNR ROW

Source: JICA Study Team

Figure 3.2.2 Relationship between NSCR and Highway in terms of the Use of PNR ROW

In the social environment, the estimated total number of affected households to be resettled is about 1,300 for Option 1 and about 2,100 for Option 2. Therefore the affected households of Option 1 are fewer than that of Option 2. In the natural environment, because the route of Option 2 passes through the swamps, land alteration and access during the floods are the concerned impacts. Both options require the abatement measures for noise and vibration, especially for residential areas. Considering these impacts on natural and social environment, Option 1 which uses the railway ROW of PNR and Northrail is selected for the NSCR route.

Regarding the part of section between Caloocan to Tutuban where NSCR and the highway share the existing PNR ROW, based on the meeting result of the Secretaries of DOTC and DPWH, the necessary adjustments on the policy that NSCR preferentially uses the existing PNR ROW have been carried out in the Philippine government. A further coordination with the highway project will be made to minimize the involuntary resettlement.

3.2.2 Depot Alternative Options

The result of comparison of 2 alternative options is shown in Table below. If DOTC will be able to continue to lease the site in Valenzuela from NFA, acquisition of the land will not be needed. On the other hand, the candidate site in Marilao is agricultural land and there are many informal settler families (ISFs). Resettlement of affected families and loss of livelihood of agricultural workers are unavoidable. Therefore, the Option 1, Valenzuela was selected for the depot site.

3.2.3 Structure Alternative Options

Comparisons of the advantages and disadvantages of three structure types, embankment, viaduct and underground were discussed.

At-grade structure (embankment) is the lowest construction cost and applicable to the section where the risk of flood is low and there are few level crossings. On the other hand, the elevated structure (viaduct) is recommended for the section where the railway goes through flood-prone areas or there are the intersections with the main road. Although the underground structure type may have the smallest impacts on natural and social environment, the construction cost is the highest. There are no obstacles to be avoided since the NSCR alignment will use the existing PNR ROW, therefore the underground structure will not be adopted for all sections.

CHAPTER 4 PROPOSAL OF PROJECT FRAMEWORK

4.1 Route Plan

4.1.1 Overview

The main design conditions for the alignment are mentioned in Table 4.1.1.

Table 4.1.1 Design Condition for the Alignment of NSCR

Items		Description
Horizontal Curve Radius	For Main Line	More than 300m
	For Station	More than 400m
	For Turnout	More than 160m (for main line), More than 100m (for depot)
Transition Curve Length		Maximum out of L_1, L_2, L_3 L_1=800C L_2=7.5CV L_3=6.75C_dV
Length between Transition Curves		More than 20m
Maximum Gradient	For Main Line	25/1,000 (standard), 35/1,000 (absolute maximum)
	For Depot	Level (0), 5/1,000 (absolute maximum)
	For Stabling Yard	Level (0)
Vertical Curve		Vertical curve is required for more than 10/1,000 of gradient change Radius 3,000m (4,000m where curve radius is less than 800m)
Width of Formation		More than 2.75m
Distance between Track Centers		More than 4.0m (Main Line), More than 4.0m (Station), More than 4.0m (Stabling Yard)
Width of Structure Gauge		3.8m
Station Platform		Platform Length 180m
		Platform Width 8m (standard)

Source: JICA Study Team

4.1.2 Alignment Plan

1) Horizontal Alignment

The horizontal alignment of the section between Malolos and Caloocan is set based on the alignment of Northrail Project. A large scale of land acquisition is expected to improve sharp curve to increase running speed, the radius of sharp curve shall be maintained as existing.

2) Vertical Alignment

In principle the elevation of vertical alignment for the ordinary section of the NSCR shall keep more than 9.08 m in height above ground to keep the height of structure gauge for road as shown below.

4.1.3 Location of Station

Station locations are selected as shown in Table 4.1.2.

Table 4.1.2 Chainage and Distance between Stations

Station	Chainage (Station Center)	Distance between Stations (Km)	Note
Tutuban	15+777	-	
Solis	18+433	2.66	
Caloocan	21+221	2.79	
(Malabon)	-	-	Open in future
(Valenzuela Polo)	-	-	Open in future
Valenzuela	27+297	6.08	
Meycauyan	30+888	3.59	
Marilao	32+797	1.91	
(Tabingllong)	-	-	Open in future
Bocaue	38+187	5.39	
Balagtas	42+142	3.96	
(Tuktukan)	-	-	Open in future
Guiguinto	46+797	4.66	
(Malolos South)	-	-	Open in future
Malolos	53+037	6.24	

Source: JICA Study Team

4.1.4 Route Plan

1) Section between Malolos and Caloocan

The most part of NSCR alignment is basically planned on the existing PNR ROW, however, there is a section where the entire or a part of structure may be located outside the PNR ROW due to conflict with the future structure of Segment 10.1 of NLEX-SLEX Connector Road implemented by DPWH. The land acquisition and social impacts have been considered in this study and are described in Chapter 7 "Environmental Impact Assessment".

Typical site conditions are shown in the photographs below.



Malolos



Constructed Pier at Malolos



Guiguinto


Constructed Pier at Guiguinto



Meycauayan River



Meycauayan

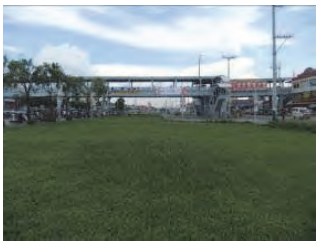


Bocaue



Near Bocaue River





Marilao



Marilao River



Near OLD PNR Valenzuela Sta. | Valenzuela



Near Valenzuela



Near OLD PNR Malabon Sta. | Constructed Abutment at Governor Pasucal.



Caloocan

Source: JICA Study Team

Figure 4.1.1 Site Conditions between Malolos and Caloocan

2) Section between Caloocan and Solis

As for the utilization method of ROW in Segment 10.1, DPWH and DOTC had discussions during the preceding study period, and decided to adopt the “Top and bottom” method till Samson Road and “Side by Side” method from the south of Samson Road to C3 Road (end of Segment 10.1).

The utilization method of ROW in Segment 10.2 is now under review and two points being considered is that it is preferred that the commuter line will use the PNR land and that the structure plan will be conducted in such a way that will not interfere with the structure of commuter line. The junction construction section of NSRP will be constructed by GOP in the future.

The following three cases are set and examined in the route plan aiming to minimize the number of houses requiring resettlement. As the result of comparative examination, the required number of resettlement owing to the construction of NSCR are estimated at approximately 1,000 households in Case 1, approximately 500 households in Case 2 and approximately 200 households in Case 3. Case 3 shows significant minimization of resettlement. In addition, in case that the connection of NSRP is postponed/ delayed, which means the case in which the construction section is only for the Tutuban direction, the required number of resettled households is estimated at approximately 50 or less.

Consequently, it is basically agreed with DPWH that the Case 3 is the most recommendable option, further study in cooperation with DPWH regarding the detailed structure layout will be required.

Between Caloocan and 5th Avenue

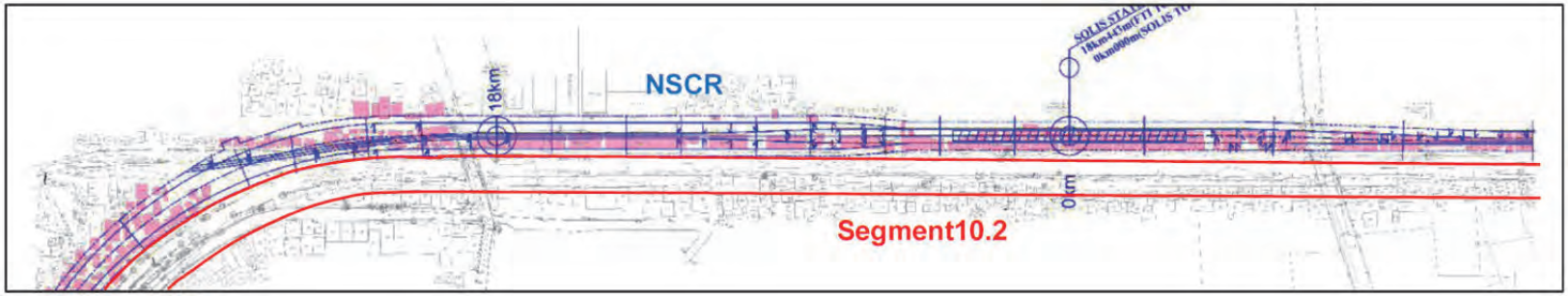
Between 5th Avenue and Solis

Between Solis and 5th Avenue

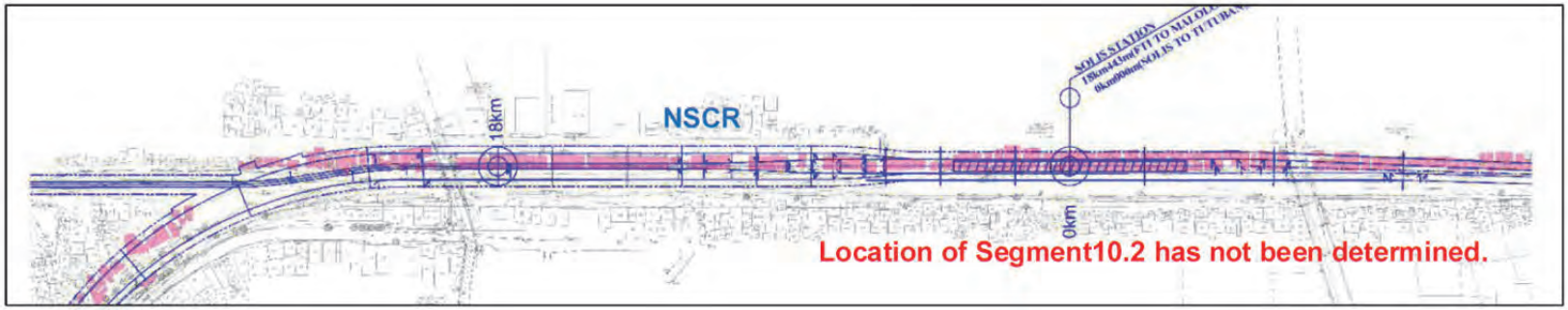
Source: JICA Study Team

Figure 4.1.2 Site Conditions between Caloocan and Solis

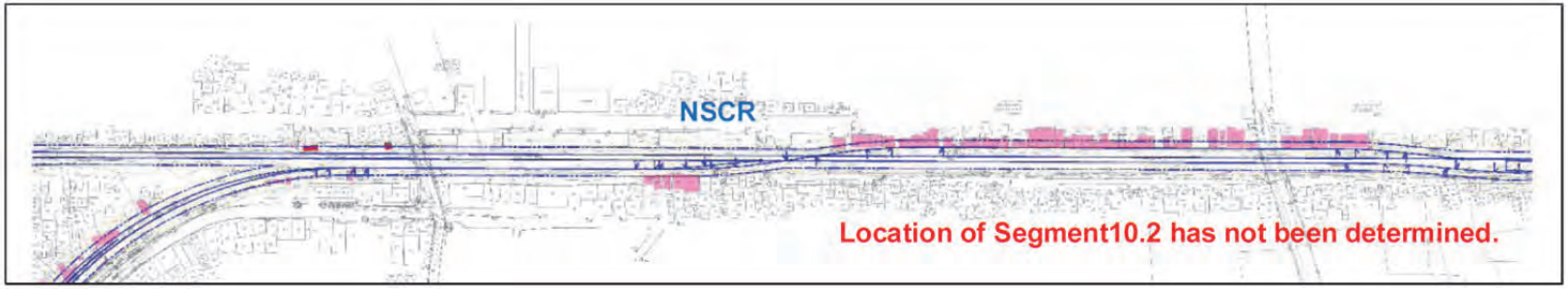
Case 1 (DPWH Original Plan)



Case 2 (JICA Option Plan)



Case 3 (JICA New Option Plan)



Source: JICA Study Team

Figure 4.1.3 Route Plan between Solis and Tutuban

3) Section between Solis and Tutuban

Alignment of the section between Solis and Tutuban is planned upto Recto Avenue along Dagupan Street. Western extension section of LRT Line 2 will be located on the Recto Avenue and connected with Line 2 Tutuban Station and NSCR new Tutuban Station. Terminal station of NSRP supposed to be located in Tutuban.



Between Solis and NSRP Junction



Between NSRP Junction and Existing Tutuban Station



Existing Tutuban Station



Tutuban Mall | Dagupan Street



Tutuban Station Plaza Site | Recto Avenue

Source: JICA Study Team

Figure 4.1.4 Site Conditions between Solis and Tutuban

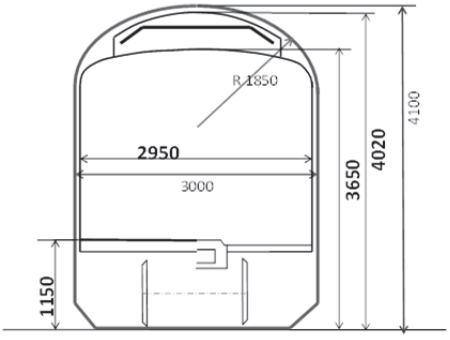
4.2 Rolling Stock Plan

4.2.1 Passenger Capacity and Train Formation

1) Floor Layout

Car Body Size

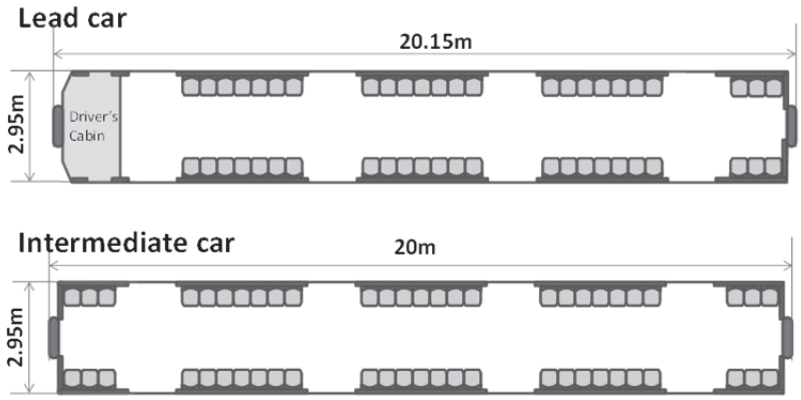
- Body Width : 2,950 mm
  (Cross section is shown in the Figure)
- Lead car length 19,710 mm
  (Distance between couplers' surface 20,000 mm),
  Driver's cab length 1970 mm
- Intermediate car length :19,500 mm
  (Distance between couplers' surface 20,000 mm)
- Doors : 4 doors on each side of a car
  1300 mm width x 1850 mm height



Source: JICA Study Team

Figure 4.2.1 Cross Section of Rolling Stock

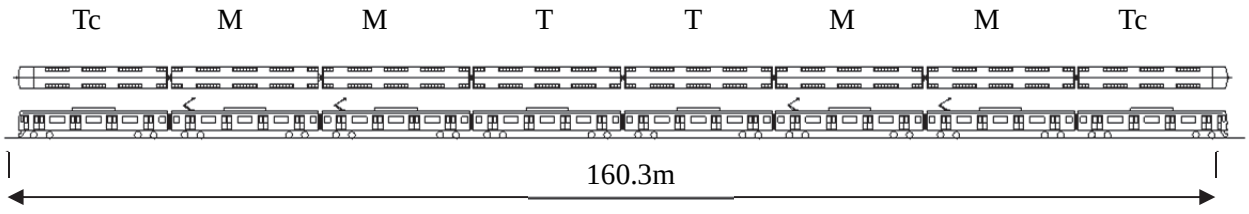
Floor layout



Source: JICA Study Team

Figure 4.2.2 A Typical Layout of Commuter Train Cars

A typical formation of 8-car commuter train-set



Source: JICA Study Team

Figure 4.2.3 A Typical Formation of 8-car Commuter Train-set

4.2.2 Main Specifications

Based on the main characteristics described above, including passenger capacity, train formation, body materials and acceleration performance, one example of the main specifications recommended for this project is shown in Table 4.2.1. Some major items are explained in the following sections.

Table 4.2.1 Main Recommended Specifications of Rolling Stock

Item		Specification
Train composition Tc: Trailer car with driver's cab M: Motor car T: Trailer car		EMU System 8-car: 4M4T (Tc+M+M+T+T+M+M+Tc)
Major dimensions	Lead car length	20,150 mm
	Intermediate car length	20,000 mm
	Body width	2,950 mm
Passenger capacity per train	Seat	8-car: 420
	Standard: 4 pax/m^2	8-car: 1,458
	Maximum: 7 pax/m^2	8-car: 2,238
Weight per train (Tare)		8-car: 254t
Body materials		Light weight stainless steel
Saloon design	Doorways	4 doorways each side of a car
	Door type	Double sliding doors, 1,300 mm width
	Seat type	Longitudinal seats
Maximum operation speed		120 km/h
Traffic performance	Acceleration	3.3 km/h/s at start
	Deceleration (Service/Emergency)	Service: 4.2 km/h/s Emergency: 4.7 km/h/s
Propulsion system	Power collector	• DC 1,500 V • Single-arm pantograph • 1 unit per M car
	Control system	• VVVF inverter with IGBT elements
		• 1 set per M car
	Traction motor	• 3-phased induction motors
		• 120 kW × 4 units per M car
Brake system		All electric command electro-pneumatic brakes with regenerative braking
Bogies		Bolster-less type
Air conditioning equipment		Roof top type
Auxiliary power supply equipment		SIV: 3-phase inverter with IGBT element
Passenger information system		• Public address system via loudspeakers • Visual information system via LCD screens

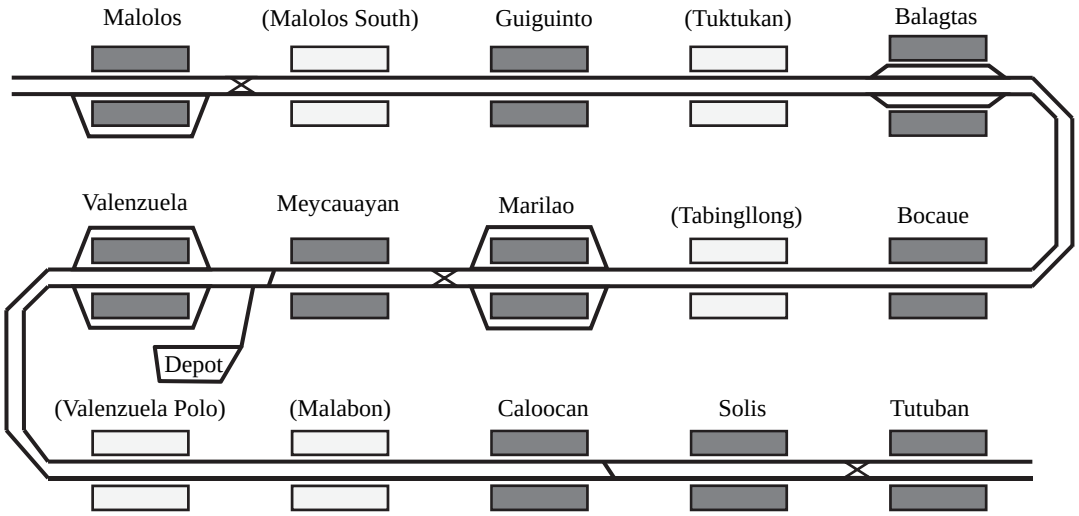
Source: JICA Study Team

4.3 Operation Plan

4.3.1 Operating Route

Operating route is from Malolos to Tutuban running distance is about 37.2km. Initially 10 stations will be constructed and from the year 2030 five more stations will be open.

Following figure shows track layout of the route. Dark gray boxes indicate the stations which will open from initial stage. Light gray boxes indicate the stations to be open in the future.



Source: JICA Study Team

Figure 4.3.1 Track Layout of the Route

4.3.2 Operation Headway

Based on the rail ridership demand forecast and system capacity, operational headway and train composition during peak-period for each phase is estimated as below.

Table 4.3.1 Capacity of Train

	2020	2025	2030	2040
Traffic demand (PPHPD)	13,210	18,290	20,680	19,990
Train consist	8	8	8	8
Headway	6	6	6	6
System capacity	22,380	22,380	22,380	22,380
Load factor	59.0%	81.7%	92.4%	89.3%

Source: JICA Study Team

4.3.3 Travel Time

Regular running time is defined based on calculated time adding recovery time and it is applied for a train schedule. In the initial year there are 10 stations however from the year 2030 five more stations will be opened. Therefore traveling time becomes longer after the year 2030. Regular running times on the operations plan for each phase with their corresponding scheduled speed is given in the table below.

Table 4.3.2 Regular Running Time

Year	Section	Number of stations	Travel time	Scheduled speed
2020~	Malolos – Tutuban	10	35 min 35 sec	61.7 km/h
2030~	Malolos – Tutuban	15	43 min 0 sec	52.3 km/h

Source: JICA Study Team

4.3.4 Required Number of Trains

The required numbers of trains are calculated using the round trip time and headway for peak period. Likewise, the number of reserved trains is also estimated. In total for the service from Malolos to Tutuban, 11 train sets with 2 reserved trains are required at initial year, it is increased to 14 train sets with 3 reserved trains in the year 2025. 17 train sets with 3 reserved trains are required after the year 2030 when number of station is increased.

Table 4.3.3 Required Number of Trains

	2020	2025	2030	2040
Trains in operation	11	14	17	17
Reserved trains	2	3	3	3
Required number of trains	13	17	20	20
Train consist	8 car	8 car	8 car	8 car

Source: JICA Study Team

4.4 Civil Facilities Plan

4.4.1 Proposed Structure Plan

Type of railway structure is mainly determined based on development conditions of the adjacent area along the NSCR. Also it will consider the following: (i) construction cost, (ii) construction period, (iii) advantages to NSCR users, (iv) social and environmental impacts, (v) flooding, (vi) and from the point of view of operation and maintenance. Especially flooding problems must be considered for selection of structure type because people in the vicinity of the NSCR project are worried about flooding that regularly occurs.

1) Viaduct

As a result, close to 20% of mainline structure of the entire section is recommended to be an embankment with double retaining wall. The rest of the alignment is on an elevated viaduct, 79% of mainline structure of the entire section on PC girders viaducts. The rest corresponds to special bridge structures and viaducts. The existence of several control points along the route led to this high percentage of structure to be elevated. There are four types of control points that should be cleared, to wit:

(i) **Cross roads:** To avoid level crossing at road the vertical alignment (rail level) was set to allow enough vertical clearance over the roads. In case of roads with a width of 20m and over, PC simple girder or PC box girder is adopted. In case of roads with a width of under 20m, girder viaduct of RC simple girder or H-shaped steel composite girder structure is adopted.

(ii) **Existing structures:** The structures which were constructed during the Northrail Project should not be reused or demolished, unless allowed by DOTC. Vertical alignment is planned passing above those existing structures by a long span truss type steel bridge. Five subject areas include Gov. Pascual Avenue, Bocaue River, Santol River, Guiguinto River and Malolos.

(iii) **River:** At the cross river section, rail level is set considering the estimated 100 year high-water level of the river.

(iv) **Segment 10.1:** The alignment of NSCR will share the exiting PNR ROW with the DPWH's Segment 10.1 from Valenzuela area to Caloocan an d C-3 Avenue. In this case, the highway would be at a third level and the NSCR would continue at the normal second level. The effect on ROW along this section is considerably inferior than for section for Segment 10.2, as explained in the following pages. Figure 4.4.2shows the typical viaduct structures along the area shared with Segment 10.1.

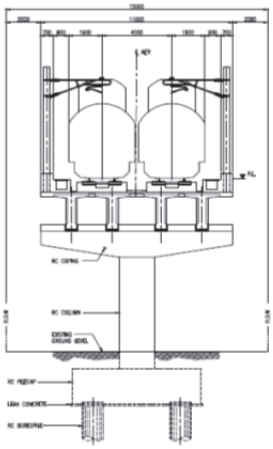
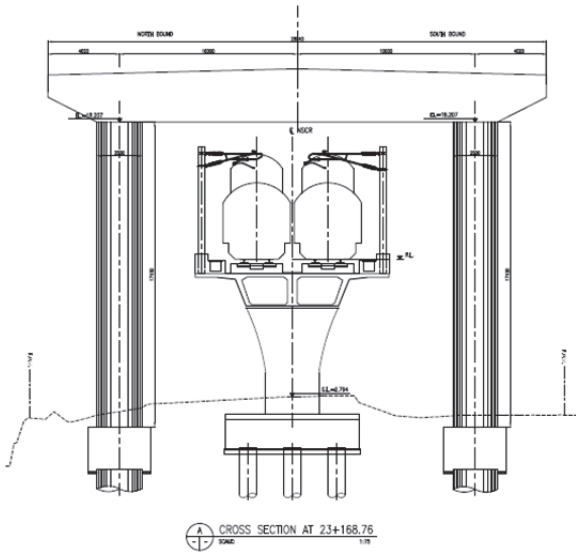
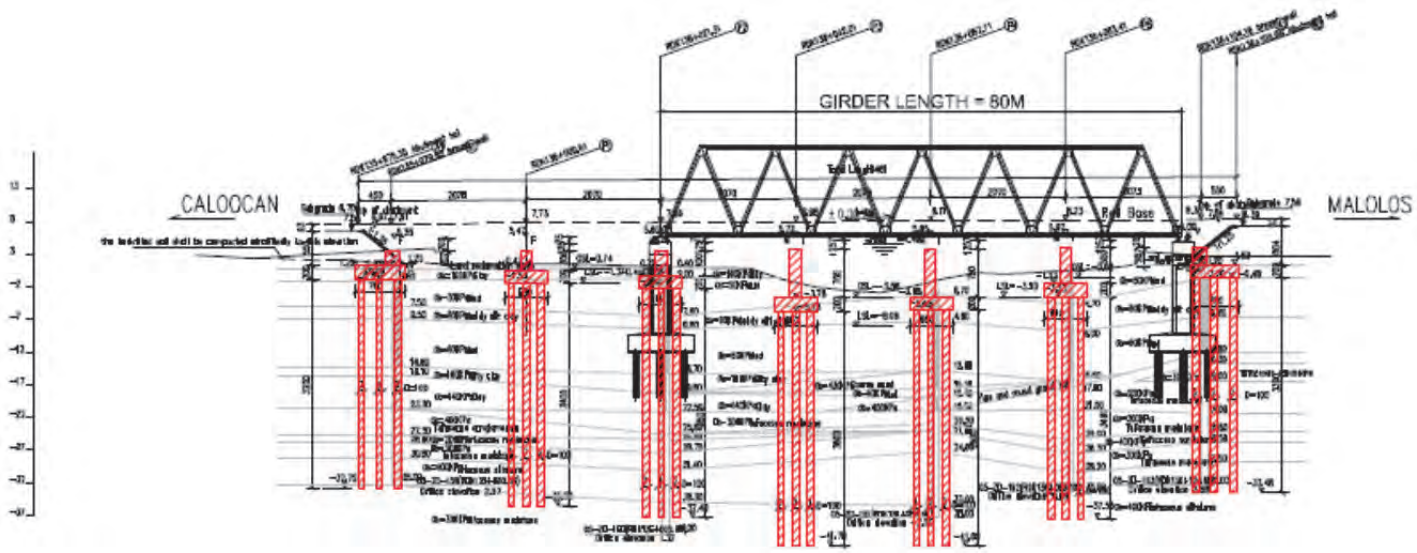


Figure 4.4.1 Typical Cross Section of Viaduct



Source: JICA Study Team

Figure 4.4.2 Cross Section of Structure under Segment 10.1



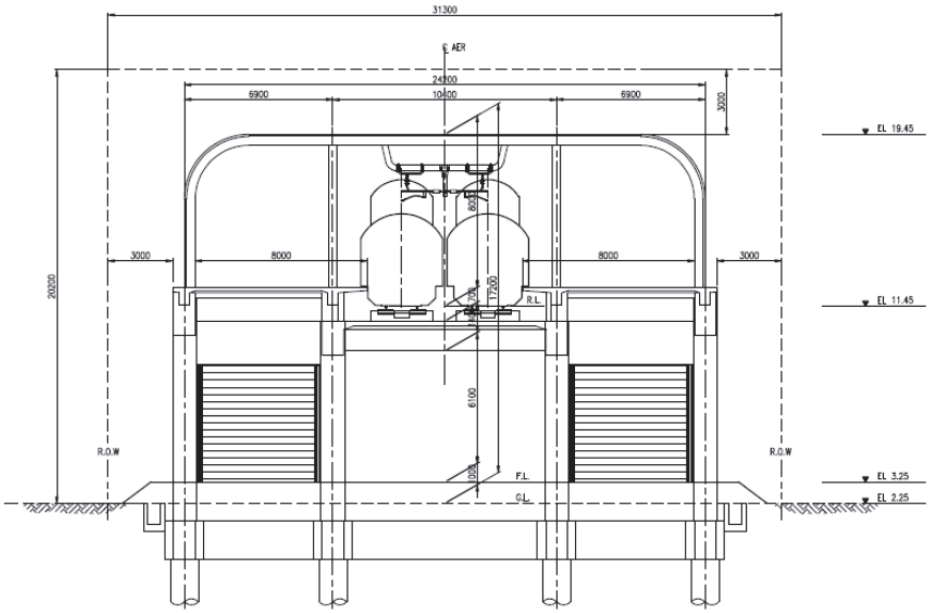
Source: JICA Study Team

Figure 4.4.3 Long Span Bridges Overpassing Existing Structure

2) Stations

The standard station design consists of a two-story building with the concourse on ground floor, the platform on second floor, and with side platforms. However, three stations would have additional 2 tracks for possible express service in the future. The stations with rail level on the second floor are at Malolos, Balagtas, Bocaue, Meycauayan, Valenzuela, and Caloocan. Typical cross section of this type of stations is shown in Figure 4.4.4.

The stations at Marilao and Guiguinto are three-story buildings with the concourse on the second floor and platform on third floor since these are located on roads.



Source: JICA Study Team

Figure 4.4.4 Typical Cross Section of Stations

3) Embankment

To reduce the construction cost, the planned vertical height is set as low as possible in some sections and the type of structure is decided to be embankments in those sections. The minimum height of the embankment is set 5m because it is possible that the height of flooding is over 2m according to the result of flood damage simulation along the route. The construction of transversal drainage and pedestrian roads with a minimum of 3m high can be used as a mitigation measure against flooding, and an additional 2 meters is necessary on top of those drainage/roads box culverts.

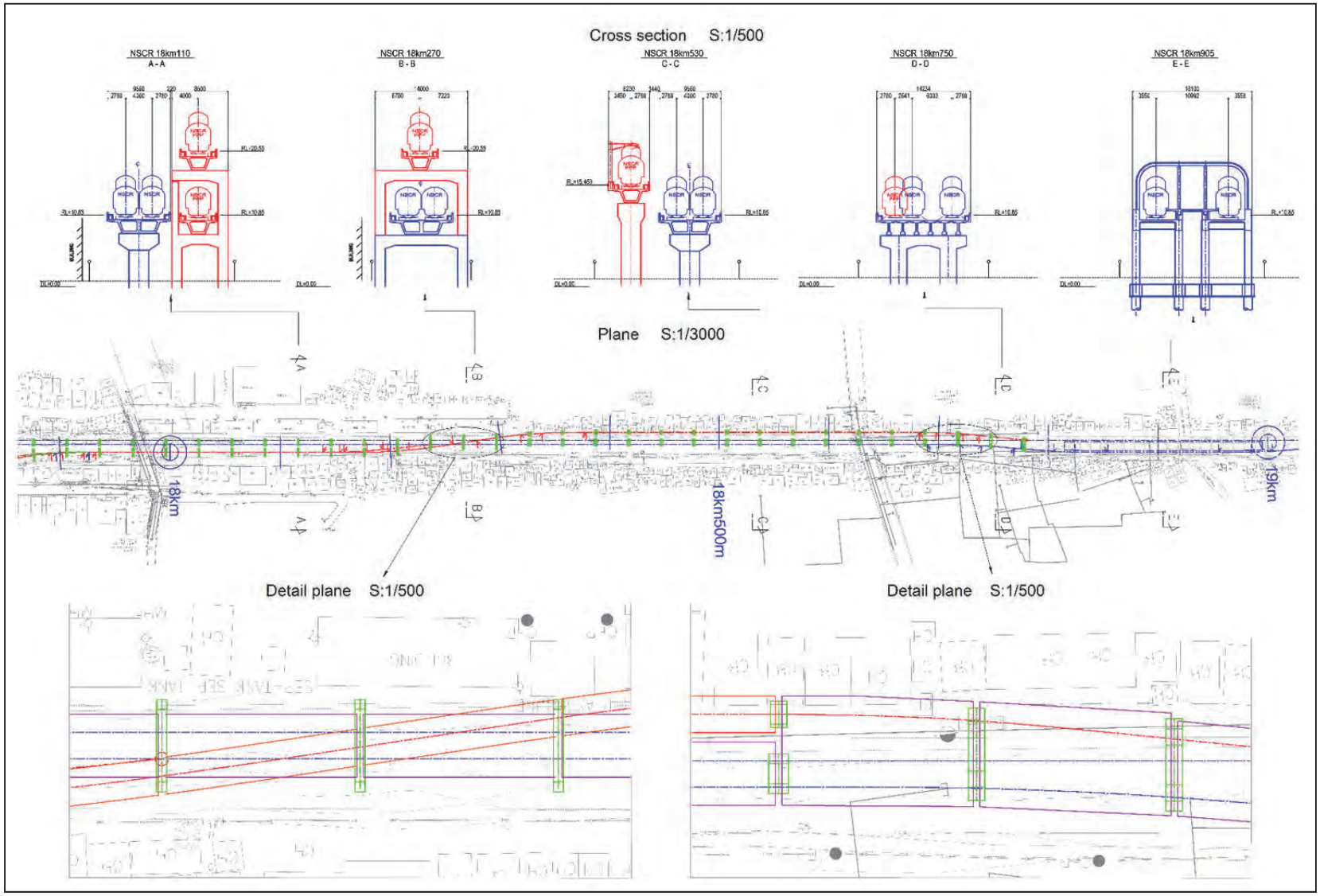
4) Section between Solis Station and NSRP Junction

Figure below shows the plane views of Solis station and NSRP junction section, and the general cross section of each structure type. As the train operations of the Tutuban Route between Malolos and Tutuban and of the Calamba Route between Malolos and Calamba cross in some points in this section, the route alignment becomes complex and the structure types are different.

Owing to this complicated alignment, in addition to the said single pier for double track, the substructure of the junction section of NSRP is basically planned as a two layered portal rigid-frame pier for a single track section with a top and bottom, a two layered portal rigid-frame pier for the overpass section towards Tutuban Station with a double track, a single pier for the single track section, and twin piers for the triple track section. The superstructure is planned as a two box PC double girder for the double track section, a single box PC girder for the single track section and a PC- I shaped girder for the triple track section.

5) Section between Solis and Tutuban

Civil facility plan between Solis and Tutuban is described in Section 4.8“TOD and Transportation Junction Plan”. Terminal station of NSRP supposed to be located in Tutuban.



Source: JICA Study Team

Figure 4.4.5 Structure Plan (JICA New Option Plan)

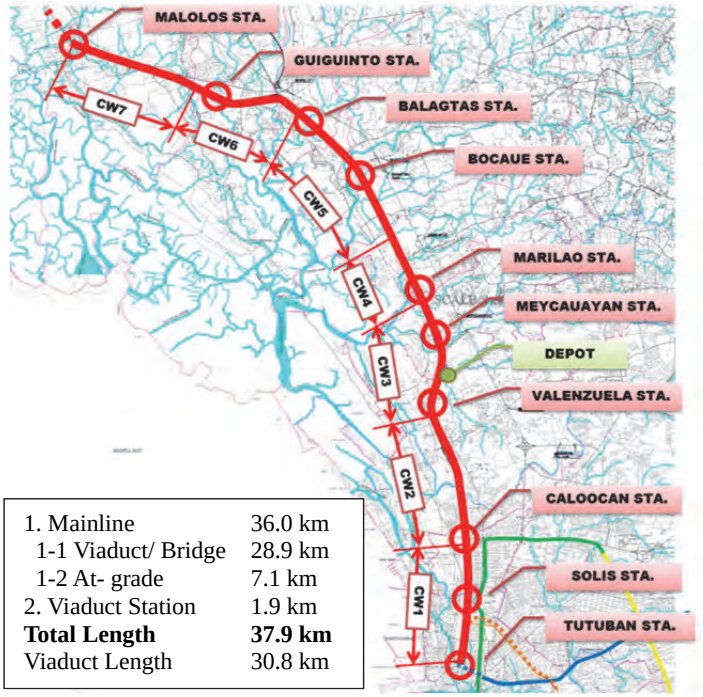
4.4.2 Recommendation of the Construction Package

The JST recommends the following construction packages for civil works which were taken into consideration acceptable access routes for construction.

Table 4.4.1 Construction Package for Civil Works (Mainline)

	Chainnage	Station	Length (Km)
CW1	15+687 - 21+131	Tutuban Solis	5.4
CW2	21+131 - 26+470	Caloocan	5.3
CW3	26+470 - 32+597	Valenzuela Meycauayan	6.1
CW4	32+597 - 36+320	Marilao	3.7
CW5	36+320 - 42+542	Bocaue Balagtas	6.2
CW6	42+542 - 47+880	Guiguinto	5.3
CW7	47+880 - 53+608	Malolos	5.7

Source: JICA Study Team



1. Mainline	36.0 km
1-1 Viaduct/ Bridge	28.9 km
1-2 At- grade	7.1 km
2. Viaduct Station	1.9 km
Total Length	**37.9 km**
Viaduct Length	30.8 km

4.4.3 Universal Design and Gender Considerations for Station Facility

In consideration with increasing the usability for all passengers from the following viewpoints, barrier-free, universal design and gender consideration facility shall be introduced in the station facilities design.

1) Easiness to Access

- Installation of escalator and elevator between concourse and platform level.
- Slope passage for wheelchair
- Wide type ticket gate

2) Easiness to Understand

- Braille block on the floor
- Braille for ticketing machine, signboard, handrail etc.
- Visibility consideration for signage system (e.g., layout, position etc.)

3) Easiness to Use, Gender Considerations

- Adoption of doubled handrail for stairway and slope
- Introduction of male- female separated lavatory, multipurpose lavatory
- Exclusive platform area for female

Wide Type Ticket Gate

See-through Type Elevator

Slope with doubled handrail

Braille Block

Braille Signage on Handrail

Multipurpose Lavatory

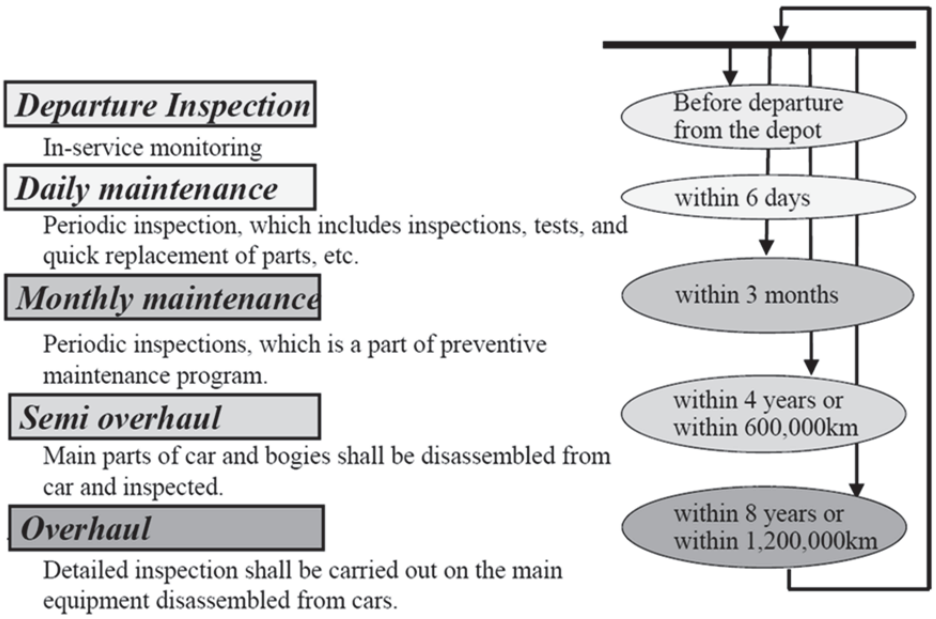
Source: JICA Study Team

Figure 4.4.6 Example of Universal Design applied to Station Facilities

4.5 Depot and Workshop Plan

4.5.1 Inspection and Maintenance System

The schedule and duration of inspection and maintenance is determined based on the Japanese preventive maintenance practices/standard.



Source: JICA Study Team

Figure 4.5.1 Inspection and Maintenance Program

4.5.2 Necessary Facilities

An example of facilities provided in the workshop is as follows. In the workshop, parts, spare parts, instruments, repair tools and tools that can be shared should be integrated and used. With regards to parts that are mishandled, these parts should be strictly managed. The assembled train sets shall undergo voltage resistance and performance tests on the inspection track outside the workshop, and then undergo running tests on the test track.

- Assembling shop
- Traction motor shop
- Mechanical parts shop
- Electronic parts shop
- Car body shop
- Warehouse
- Bogie shop
- Air conditioning shop
- Electrical parts shop
- Pneumatic parts shop
- Steel work shop

4.5.3 Draft Layout Plan

1) Draft Layout Plan

The required area for depot and workshop is approximately 14 - 15 hectares including following buildings and facilities (see Figure 4.5.2).

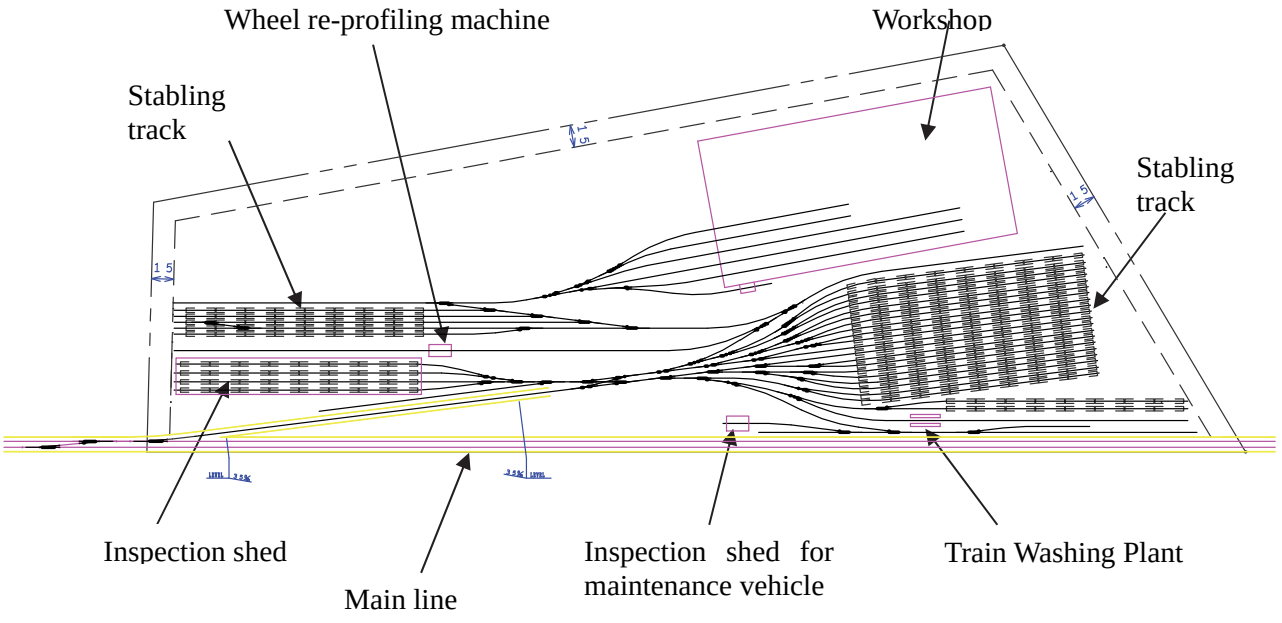
(i) Main work shop

(ii) Stabling yard for approximately20 train-sets

(iii) Operations control center

(iv) Substation

(v) Automatic train washing machine, etc.



Source: JICA Study Team

Figure 4.5.2 Draft Layout Plan of Depot and Workshop

2) Location for Depot and Workshop

The planned location for the depot and workshop is at Valenzuela for the initial phase. The proposed location for these facilities is shown in the Figure below. The available area for the depot is 14.1 hectares.

Source: JICA Study Team

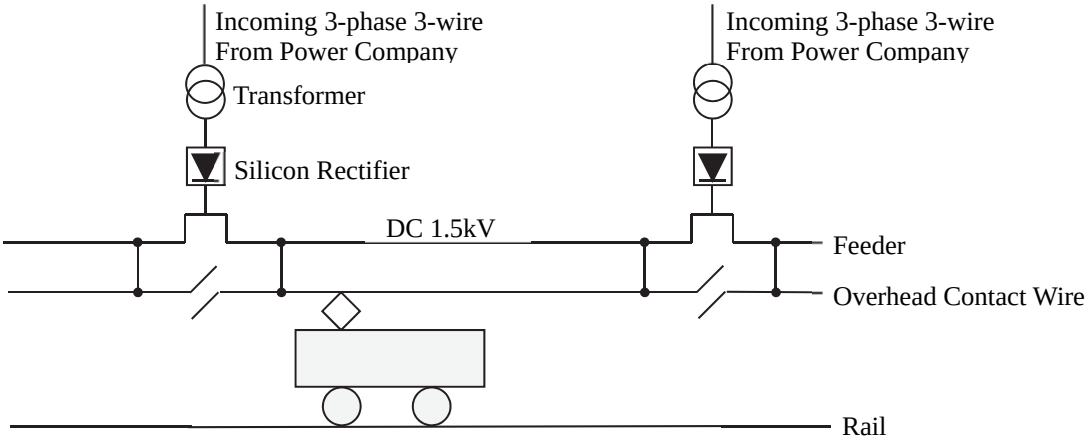
Figure 4.5.3 Location for Depot and Workshop in Valenzuela

4.6 Electrification System Plan

4.6.1 DC Feeding System

Two DC feeding systems are considered for NSCR. One is a DC 1.5kV feeding system, and the other is a DC 750V feeding system. The DC 1.5kV feeding system is suitable for a DC 750V when the system's voltage drop is larger and the gap between substations is narrower than the DC 1.5kV feeding system. Therefore a DC 1.5kV feeding system is suitable from the perspective of a more cost effective solution.

An overall view of the power supply systems are as shown in figures below.



Source: JICA Study Team

Figure 4.6.1 Overall View of the Power Supply System

4.6.2 Traction Power Substations

As a result of the calculation of the voltage drop in the contact line, the average interval distance between the substations must be shorter than 9.5 km in an urban area; and must be shorter than 13.4 km in a suburban area. The location of a substation is also affected by the design of the station structure, and the interval distance according to the conditions of a station.

Table 4.6.1 shows the estimated maximum power per hour for one substation when a DC1, 500V system will be adopted. The table shows the required power for one substation under normal operational conditions.

Table 4.6.1 Estimated Maximum Power per Hour for One Substation and Rated Capacity of a Transformer for Traction Power

Item	2020-2024	After 2025
Normal operation	6 MVA	11 MVA

Source: JICA Study Team

4.6.3 Overhead Contact System (OCS)

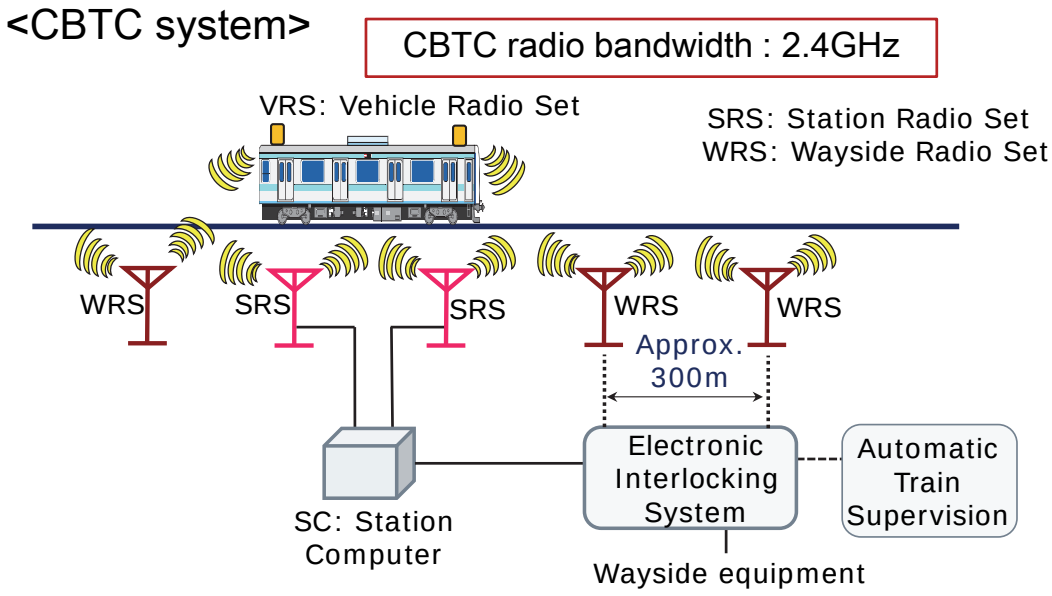
Overhead Contact Systems (OCS) are widely used in railways all over the world. The type of OCS should be considered so that the selected contact line is suitable for entire line. The compound catenary is proposed to be installed at the main line, and the simple catenary at the workshop/depot.

4.7 Signal and Telecommunication System Plan

4.7.1 Signal Equipment Servicing Plan

Signal equipment controls the operation of trains in a rail system. There are two types of such equipment: (i) the wayside signal type and (ii) the cab signal type. In recent years, accompanying high speed processing of information, made possible by the widely use of electronic devices and the progress in telecommunications technology, the introduction of automatic train control devices based on the cab signals in trains has become the mainstream. In the case of urban railways, which use electric multiple units (EMU) that are particularly suitable for controlling train speeds, there are significant advantages to introducing the cab signal system that includes an automatic train control device such as a speed control appropriate for vehicle performance and reduction of space between trains.

Illustration of the Basic Equipment Configuration of the CBTC System which is needed for the signaling system in this project is shown as follows. During the formulation of a policy for a signal system with the Philippines' parties, an agreement was reached to adopt CBTC equipped with ATO and backup ATP once it is confirmed that the total cost can be reduced.



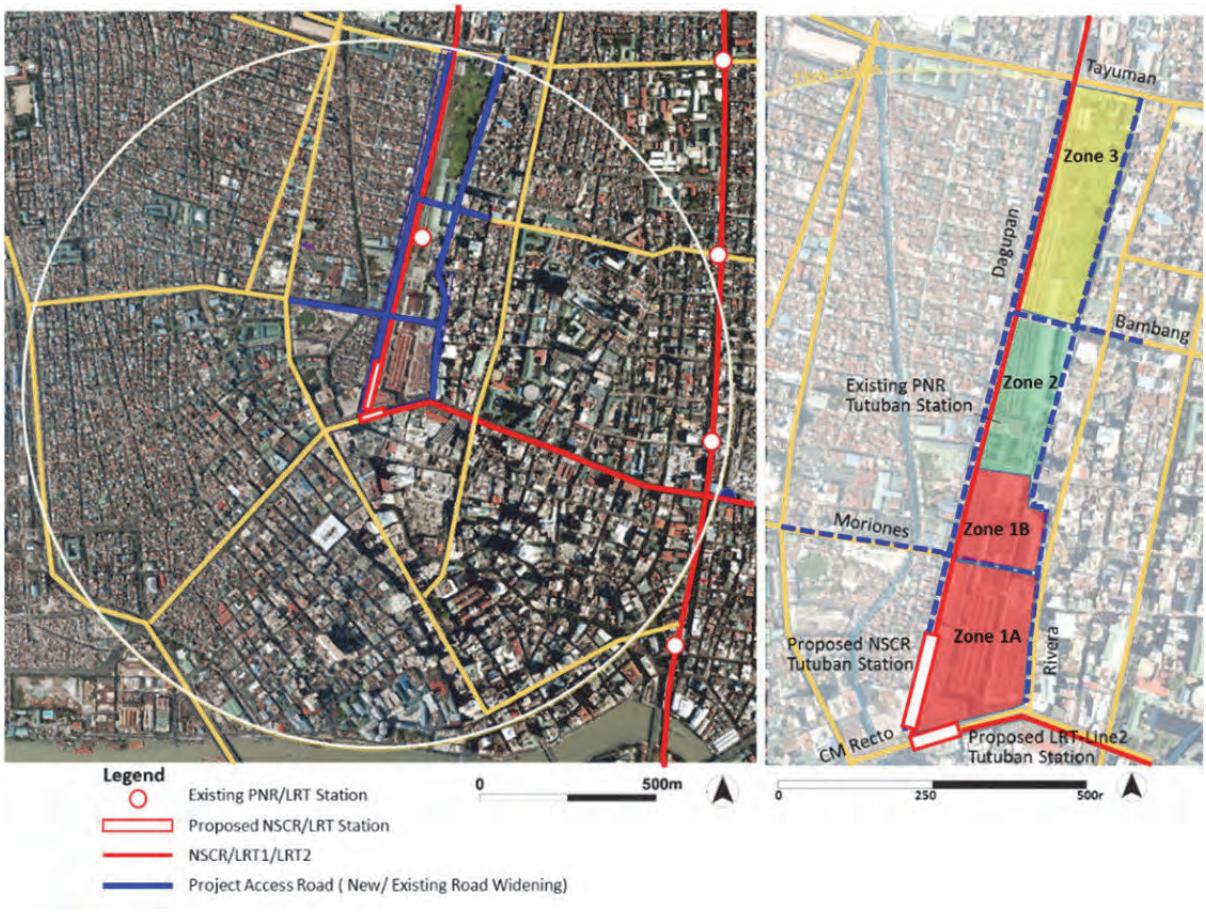
Source: JICA Study Team

Figure 4.7.1 Illustration of the Basic Equipment Configuration of the CBTC System

4.8 TOD and Transportation Junction Plan

In order to implement TOD in the most effective manner in Tutuban station area, it is essential to take the followings into the consideration;

- Enhancement of accessibility of passengers of NSCR and LRT-Line 2 from/to the stations on foot and/or by vehicle, which also contributes to the improvement of local traffic circulation in the adjacent areas.
- Maximization of urban development opportunities in the prime area not only to promote new investments but also to benefit local stakeholders.

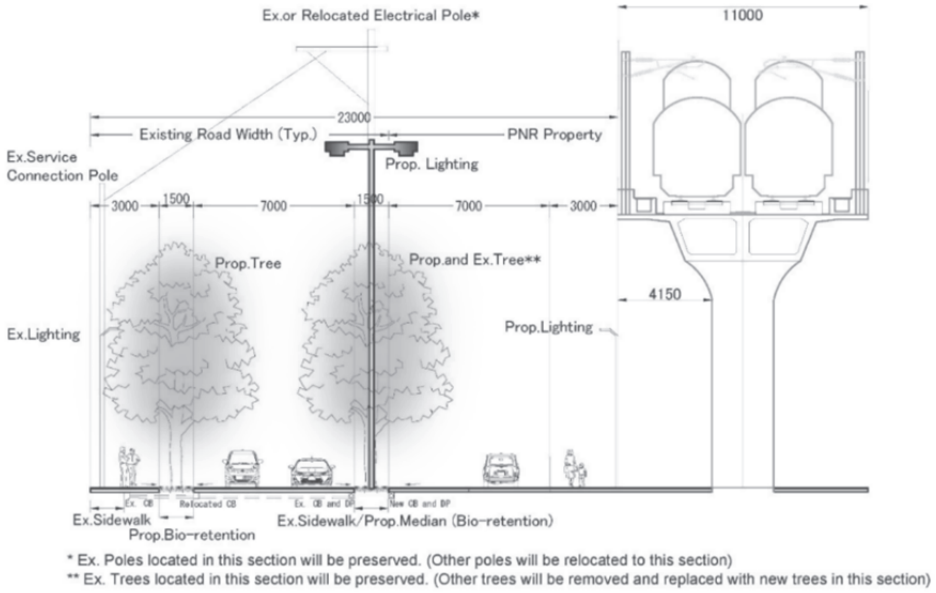


Source: JICA Study Team

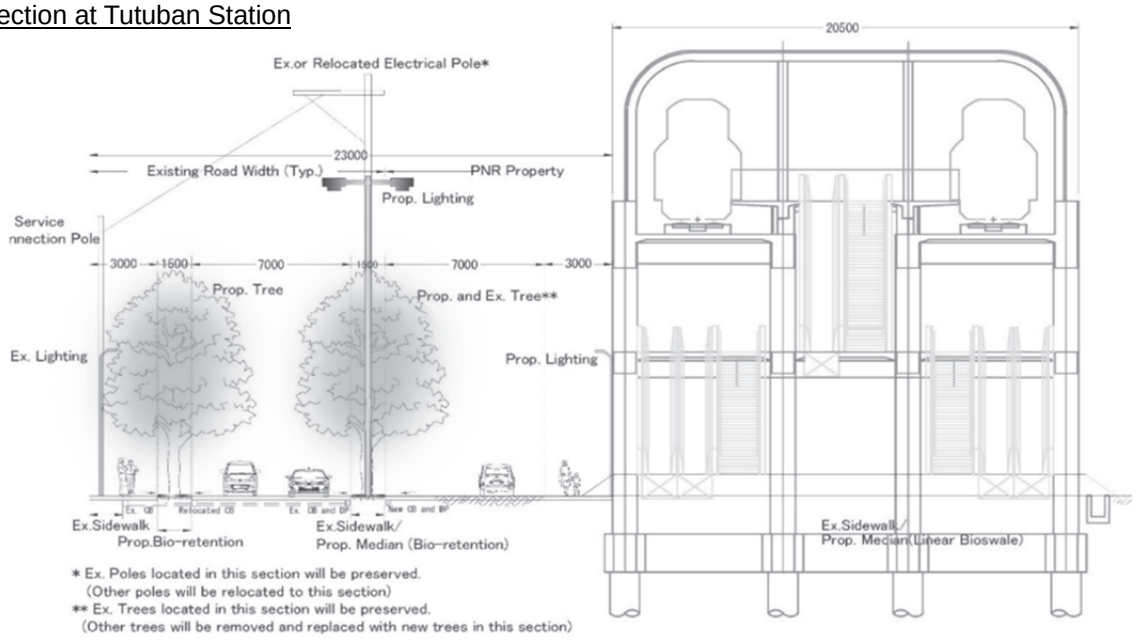
Figure 4.8.1 TOD for Tutuban Station Area

In order to implement a safe and convenient access including the transfer between NSCR and LRT-Line2 at Tutuban station, (1) Alternative1: 3-story structure with island platform type is recommended.

Section at the Viaduct



Section at Tutuban Station



Source: JICA Study Team

Figure 4.8.2 Typical Section of Dagupan Street Widening with NSCR

Source: JICA Study Team

Figure 4.8.3 Image of Alternative 1

CHAPTER 5 PROJECT IMPLEMENTATION PLANNING

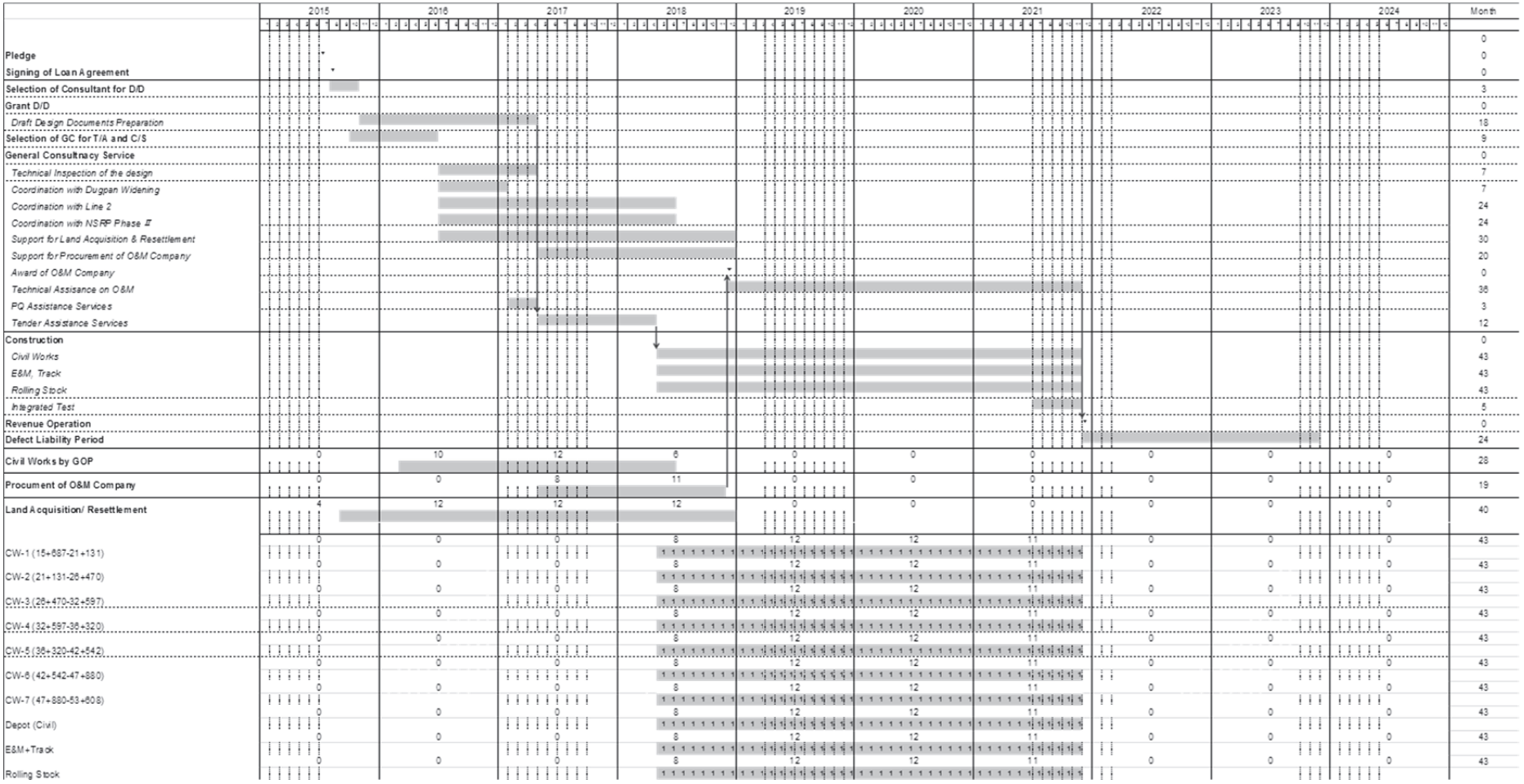
5.1 Study on Applicability of STEP

The NSCR is designated as a new commuter railway in Metro Manila. Therefore, NSCR shall, different from the specification of LRT or MRT, be designated to as the highly important railway line in Metro Manila.
Due to ensuring the requirements for NSCR mentioned above, it is enumerated the superiority of Japan's railway technologies such as the following items.

i. High quality material
ii. Special material and equipment
iii. Electrical and electronic related products
iv. Precision equipment
v. Environmentally (Ecologically)-friendly railway system
vi. Station facilities considering the passenger's convenience, safety and ecologically-friendly

5.2 Project Implementation Schedule

The North South Commuter Rail Project will be divided into 7 packages for mainline construction, depot construction, E&M and rolling stock.
As the Government of Philippines wishes to start this project as soon as possible to appeal to commence the mass transit project contributing to alleviate the current poor traffic condition of the Greater Metro Manila. The first section commenced in short, by own budget, might be site preparation such as fencing, grabbing and leveling for main line, station area and depot. Such works will be the subject to exclude from the project scope, therefore those costs are not considered in cost estimation of the Project.
The draft implementation plan is as shown Figure below. It is drawn with assumption of timing of L/A is August 2015.



Source: JICA Study Team

Figure 5.2.1 Project Implementation Schedule

5.3 Examination of Consulting Services

The objectives of this Consulting Services for NSCR Project between Malolos and Tutuban are defined as shown below on each subject of the Project. The detailed design will be carried out with grant assistance of the Government of Japan.

- To assist the Client in the Bid Call and Pre-bid conference, Bid Evaluation and Clarification, Awarding Bidder and Contracting for the following works.
  - Construction of elevated guide-way as well as elevated stations including track works
  - Construction of depot and procurement maintenance and inspection equipment including track works
  - Installation of electrical and mechanical system
  - Procurement of rolling stock
- To supervise the Construction Works during the Project Construction Stage followed by the Commissioning, Test and Handover to the Employer.

5.4 Cost Estimation

5.4.1 Overall Project Cost

The estimated overall project cost is summarized in the table below.

Table 5.4.1 Project Cost

Breakdown of Cost	Foreign Currency Portion (million JPY)			Local Currency Portion (million JPY)			Total (million JPY)		
	Total	JICA Portion	Others	Total	JICA Portion	Others	Total	JICA Portion	Others
Civil Works	31,230	31,230	0	83,368	83,368	0	114,598	114,598	0
Depot (Civil)	343	343	0	3,735	3,735	0	4,078	4,078	0
E&M+Track	45,201	45,201	0	13,156	13,156	0	58,356	58,356	0
Rolling Stock	26,208	26,208	0	0	0	0	26,208	26,208	0
Civil Works by GOP	0	0	0	256	0	256	256	0	256
Price Escalation	6,293	6,293	0	6,133	6,127	6	12,427	12,420	6
Physical Contingency	5,464	5,464	0	5,332	5,319	13	10,796	10,783	13
Consulting Services	13,367	13,367	0	5,457	5,457	0	18,824	18,824	0
Land Acquisition	0	0	0	3,892	0	3,892	3,892	0	3,892
Administration Cost	0	0	0	7,483	0	7,483	7,483	0	7,483
VAT	0	0	0	29,932	0	29,932	29,932	0	29,932
Import Tax	0	0	0	3,442	0	3,442	3,442	0	3,442
Interest during construction	1,006	0	1,006	0	0	0	1,006	0	1,006
Front End Fee	491	0	491	0	0	0	491	0	491
Total	129,603	128,106	1,496	162,187	117,162	45,025	291,789	245,268	46,521

Breakdown of Cost	Foreign Currency Portion (million US$)			Local Currency Portion (million US$)			Total (million US$)		
	Total	JICA Portion	Others	Total	JICA Portion	Others	Total	JICA Portion	Others
Civil Works	258.6	258.6	0.0	690.3	690.3	0.0	948.9	948.9	0.0
Depot (Civil)	2.8	2.8	0.0	30.9	30.9	0.0	33.8	33.8	0.0
E&M+Track	374.3	374.3	0.0	108.9	108.9	0.0	483.2	483.2	0.0
Rolling Stock	217.0	217.0	0.0	0.0	0.0	0.0	217.0	217.0	0.0
Civil Works by GOP	0.0	0.0	0.0	34.6	0.0	34.6	34.6	0.0	34.6
Price Escalation	52.1	52.1	0.0	51.6	50.7	0.8	103.7	102.8	0.8
Physical Contingency	45.2	45.2	0.0	45.8	44.0	1.8	91.1	89.3	1.8
Consulting Services	110.7	110.7	0.0	45.2	45.2	0.0	155.9	155.9	0.0
Land Acquisition	0.0	0.0	0.0	526.0	0.0	526.0	526.0	0.0	526.0
Administration Cost	0.0	0.0	0.0	1,011.4	0.0	1,011.4	1,011.4	0.0	1,011.4
VAT	0.0	0.0	0.0	4,045.8	0.0	4,045.8	4,045.8	0.0	4,045.8
Import Tax	0.0	0.0	0.0	465.3	0.0	465.3	465.3	0.0	465.3
Interest during construction	8.3	0.0	8.3	0.0	0.0	0.0	8.3	0.0	8.3
Front End Fee	4.1	0.0	4.1	0.0	0.0	0.0	4.1	0.0	4.1
Total	96,369	95,257	1,113	126,311	87,119	39,192	222,680	182,375	40,305

Source: JICA Study Team

5.4.2 O&M Cost for NSCR

The summary of annual O&M costs is shown in Table below. O&M cost is estimated based on the operation plan shown in Chapter 4 determines parameters of track length, number of stations, number of trains, train-kilometer per year etc. Except for electrical power rates, the unit prices for each items were referred the current unit prices of LRTA.

Table 5.4.2 O&M Cost

(In million US dollars, constant 2014 prices)

Item / Year	2020	2025	2030	2040
Manpower	10	10	13	13
Spare Parts	28	36	36	36
Power	10	14	17	17
Total	48	60	66	66

Source: JICA Study Team

CHAPTER 6 REVIEW OF PROJECT IMPLEMENTATION STRUCTURE

6.1 Proposal for Implementation Plan (long term)

6.1.1 Organizational Structure

1) Proposal for Establishment of Philippines Railway Authority (PRA)

The creation of an autonomous Philippines Railway Authority (PRA) [2] as a governing body for setting transport policy, regulatory parameters, and for implementing all railway programs is recommended for the long term vision of the railway sector in the Philippines. The main objectives are to ensure delivery of regulatory obligations and to assure satisfaction levels of passengers equivalent to the best in railways and other forms of transport.

The key tasks of the new entity are to provide for:

(i) Changes in the regulation of public transport operations for Government-owned operator as well as in joint venture with the private sector and private operator;

(ii) Health and safety regulation
- Accident and incident investigation;
- Regulation and certification;
- Safety approvals, safety directive, interoperability, train driving licenses and certificates, and rail vehicle accessibility;
- Inspections and audits;
- Conduct inspections and audits to check that the rail industry has the management systems in place effectively controlling health and safety risks;
- Enforcement of health and safety legislation;
- Safety guidance and research;
- Provide on-site and written advice and guidance on how to comply with the law;
- Worker and infrastructure safety; and
- Occupational health - Moving the health agenda forward

(iii) Land acquisition power;

(iv) Access and market regulation: Responsible for licensing the companies that operate trains, stations, light maintenance depots and networks. These operators must hold a license, or be exempted from doing so by this Authority.
- Operator licensing
- Competition and consumer issues
- Sustainable development
- Investments
- Closures

(v) Setting up a transparent, consistent, efficient administrative mechanism to create a level playing field for all participants and protect the interests of all stakeholders;

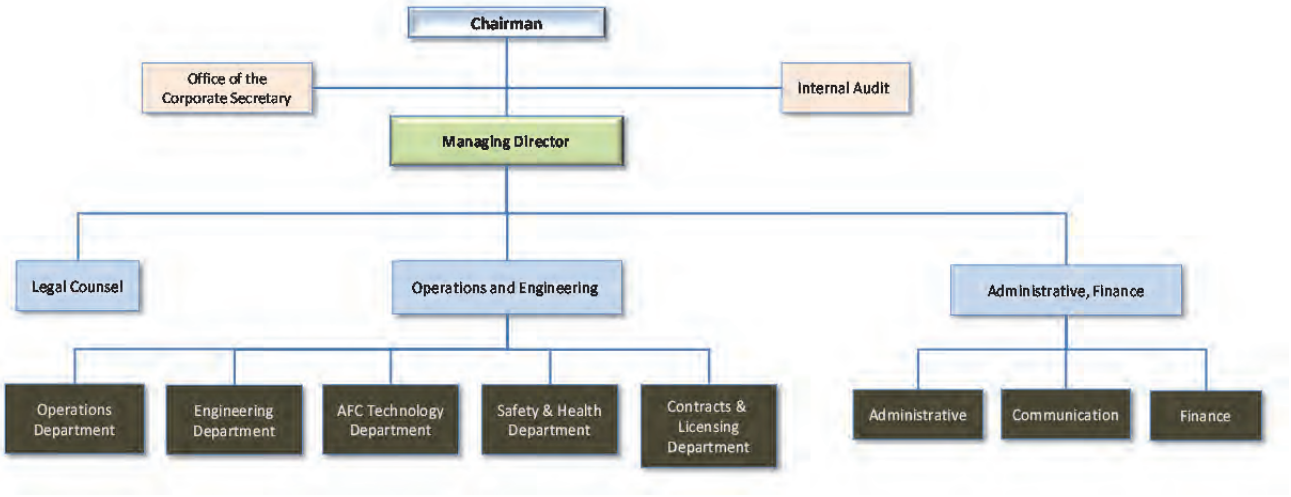
(vi) To prepare a projects list to be implemented under Government funds, ODA, or to be offered for PPP and take them forward, after approval from the Planning Agency, with assistance of the highly qualified staff through a transparent selection process; and,

(vii) Putting in place an effective and efficient institutional mechanism for speedy clearance of the projects.

The PRA would be funded through a combination of license fees and a railway safety levy. Economic regulation activities are funded through the license fee while the health and safety activities through the

[2] *Proposed name. Final name to be decided by Philippine authorities.*

safety levy. Figure 6.1.1 shows proposed organizational chart of the new PRA, and Figure 6.1.2 shows the concept of the new PRA and its relationships with existing and future entities.



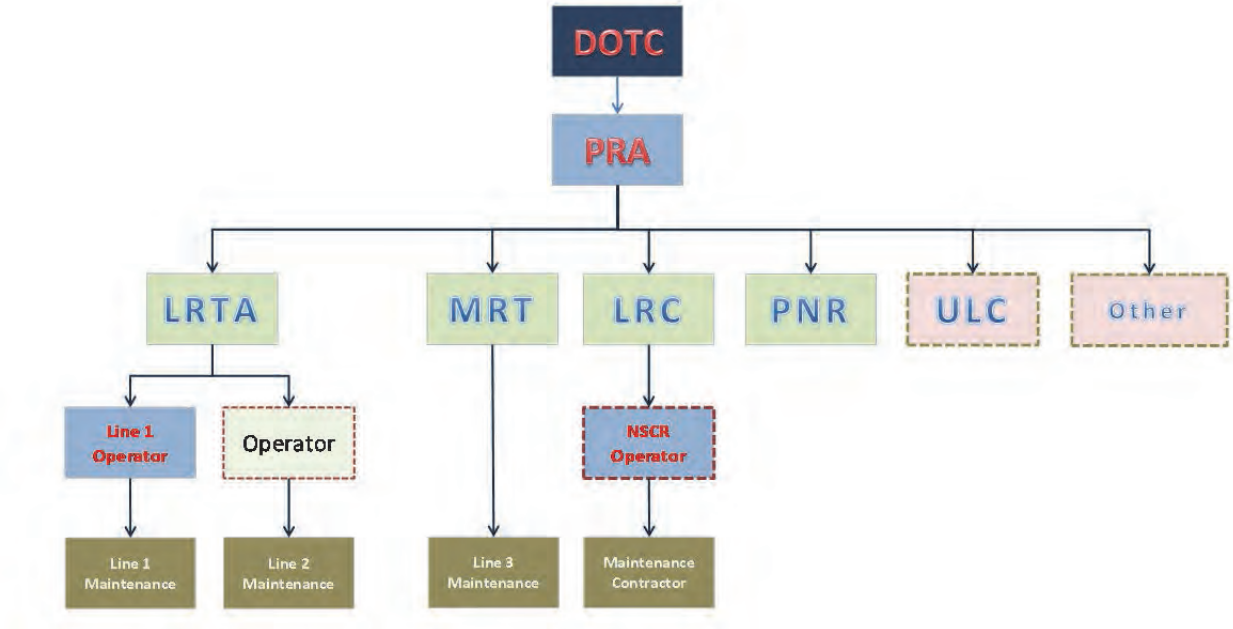
Source: JICA Study Team

Figure 6.1.1 Proposed Organizational Chart for PRA

2) Implementing and Operating Agency (Owner/Concessionaire)

The operating organization of the NSCR will be a newly established agency under the umbrella of the future PRA, also under the existing Government agencies and supported by GOP and DOTC.

In terms of the operating organization or the Luzon Rail way Corporation (LRC)[3], Figure 6.1.2 shows the concept of the new PRA and its relationships with existing and future entities. The LRC legal set up and by-laws should be similar or mirrored to the legal framework of NLRC and LRTA.



Source: JICA Study Team

Figure 6.1.2 Concept of a New Hierarchy for Railways in the Philippines

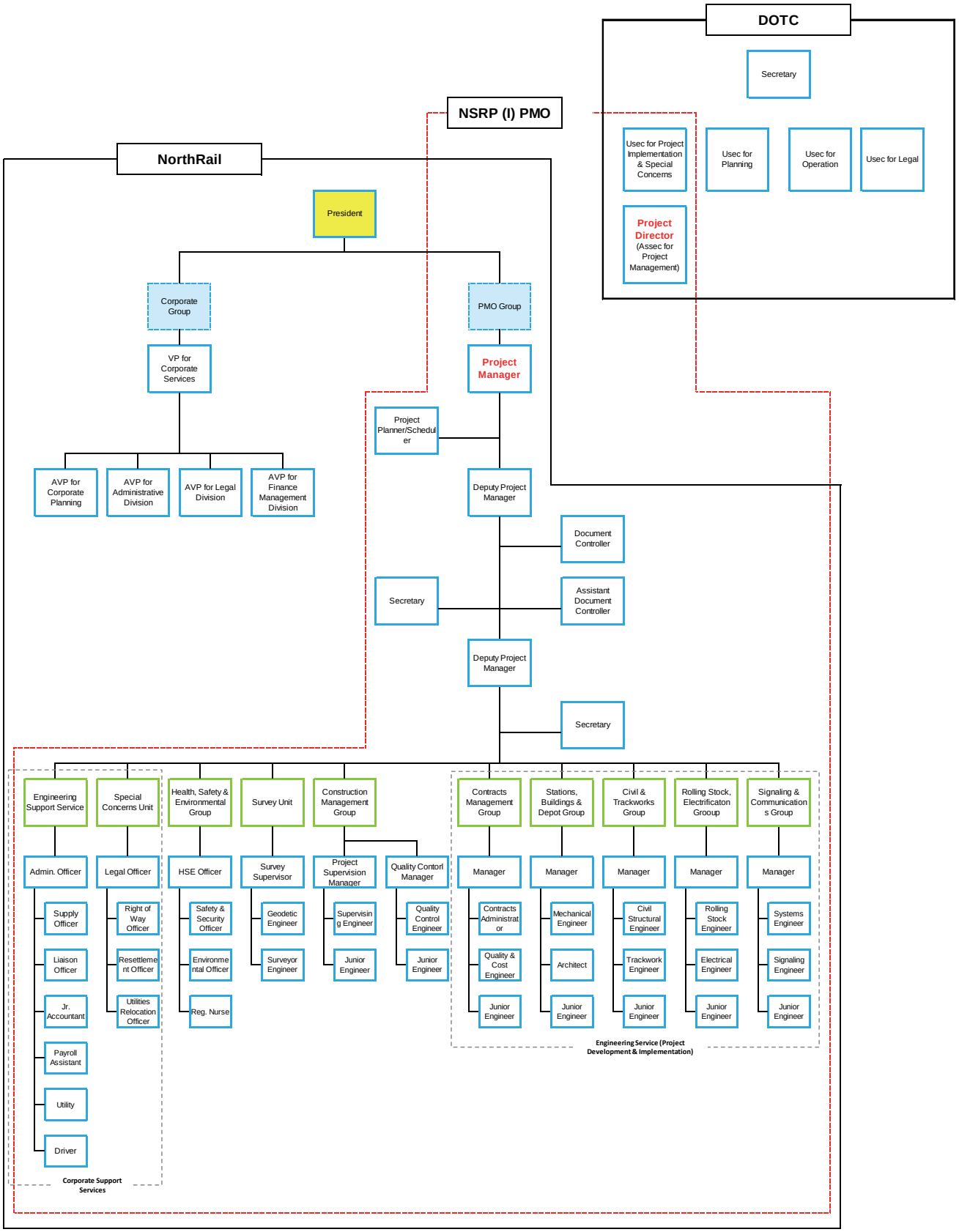
[3] *Proposed name. Final name to be decided by Philippine authorities.*

3) C**reation of PMO**

During the implementation of the project, a Project Management Office (PMO) should be 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. As the formal establishment of the LRC and PRA would take time, an interim PMO, within the authority of DOTC, shall be set up. This PMO, whether as interim or in final form, could be an existing entity, like NLRC, or a new unit within DOTC.

In case of an interim PMO, it should take responsibility for the initial duties until the formal establishment of the PMO within LRC. The staff of the former should be absorbed by the latter. The staff of this PMO will be critical for the success of the project and the LRC. The main scope of works of the PMO is summarized below as follows:

- 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 transactions related to the Bureau of Internal Revenue;
- Responsible for the safekeeping of all project records and correspondences;
- Coordinates with LRC Accounting Division and Commission on Audit regarding financial transactions of the PMO;
- Coordinates with the ODA Bank's Representatives regarding the Bank's Guidelines, which includes, but not limited to, environmental & social safeguards, procurement, monitoring of implementation, and disbursements financed from ODA loans, if any;
- Prepares all financial reports other than the PMO's financial statements as may be required by LRC, NEDA and fiscal authorities/other agencies; and
- Monitors and assists in the verifications of disbursements that are financed under the ODA loans (Foreign Currency).



Source: JICA Study Team

Figure 6.1.3 Organizational Structure of PMO

6.1.2 Scope of Work

The following Table 6.1.1 shows the list of tasks LRC is responsible for in the service operation and maintenance. This is the key to which tasks an individual party can access, review, handle and ultimately how a task is routed and approved. Among the tasks and duties mentioned in Table 6.1.1 below, the Operations (III) and Maintenance (IV) are the tasks that could be given in concession to a private party in case such party has entered into a PPP with LRC and requires return on investment.

Table 6.1.1 LRC Tasks and Duties

No.	Task Category	Description of the Task Category
I.	Management	To formulate policies, prescribe and promulgate the rules and regulations for the attainment of the objectives of the PRA Implements, enforces, and applies the policies, plans, standards, guidelines, procedures, decisions, rules and regulations issues, legal affairs, and public relations.
II.	Administration	The administration-related departments and section shall advise and assist the Management in the formulation and implementation of rules and regulations necessary to carry out the objectives and policies of the authority concerning administrative, finance, accounting, budget, human resources, etc.
III.	Operation	To ensure the safe, reliable and efficient operating of the railway and satisfactory service to the passengers on a day-to-day basis.
IV.	Maintenance	To perform the daily and the long term planning and execution of scheduled and unscheduled, preventive and corrective maintenance actions to ensure overall systems are ready for required operation at all times.
V.	Engineering & Construction	Advise and assist the Management in the formulation and implementation of rules and regulations necessary to carry out the objectives and policies of the PRA/LRC concerning engineering. Monitor and be counterpart of Consultants and supervise Contractors.

Source: JICA Study Team

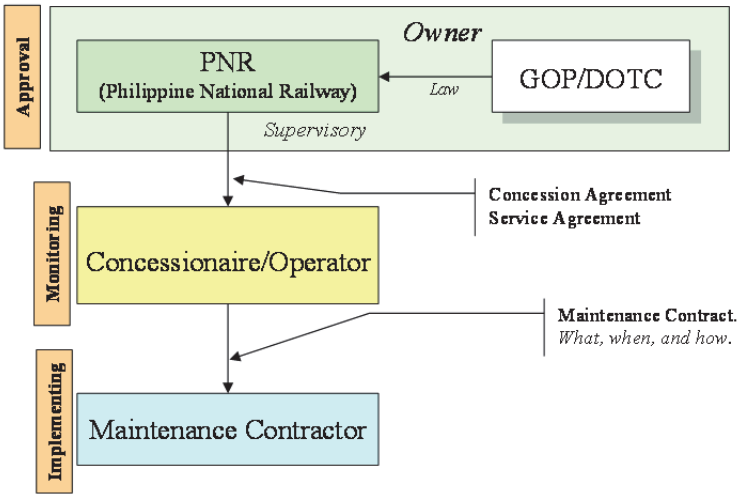
6.2 Proposed Implementation Plan for NSCR (short term)

6.2.1 Proposed Operation & Maintenance Scheme

The setting of LRC mentioned above is considered to be the best scenario for the implementation of NSCR, including the establishment in the long term of the PRA. However, the time restriction imposed by a very difficult road to establish a new entity in Philippines, both due to bureaucratic and legislative hurdles, makes almost impossible to have the LRC in place on time for Operation. Thus, it has been advised thru a letter to NEDA by DOTC that, as proposed early in this section, the Pre-Operational activities should be taken by NLRC as the PMO. The Operation stage would be carried out by a private Concessionaire under the supervision of PNR, as stated by DOTC in letter to NEDA clarifying the Institutional aspects of the project.

The proposed operation & maintenance scheme, which is a general description of the case of an existing, but outdated agency, will be the Owner/Supervisory entity, is independent from the mode of implementation that would be finally selected, whether a full ODA, a two-tiered PPP, full PPP or GAA, etc., thus, suitable to any funding scheme.

Taking into consideration all available information, site conditions, potential technical and financial capabilities of the PNR, as mentioned in previous section, it is suggested that a private and experienced Concessionaire/Operator shall be in charge of operations, and in turn it shall outsource the maintenance activities, preferably to a contractor closely linked or associated to the main OEM (Rolling Stock). The Concessionaire/Operator shall outsource to a Maintenance Contractor all the maintenance activities, including, among others, light & heavy maintenance, troubleshooting, and procurement of capital and consumable spare parts.



Source: JICA Study Team

Figure 6.2.1 Functional Organization Structure for O&M Scheme

The financial condition of PNR cannot generate cash sufficient to cover its regular operating expenses, so it is not recommendable that a company in such condition be directly operating and maintaining the NSCR. Moreover, due to different technologies of PNR and NSCR, it is recommended that the Operation and Maintenance be given in concession to an experienced commuter railway operator.

Likewise, due to the complexity and difficulty of the maintenance of the E&M systems, and the condition of having a Warranty period in effect right after the opening for commercial revenue, it is highly recommendable to subcontract (outsource) all maintenance activities to a well experienced and capable contractor, preferably to the rolling stock OEM, as it is one of the critical and more complex railway subsystems that should be properly maintained.

6.2.2 Scope of Work

The basic concept of sharing of duties between the owner/Authority (A), the Concessionaire/Operator (O), and the Maintenance Contractor (C) is that the Owner approves, the Operator monitors, and the Contactor implements the Maintenance Plan, which is prepared based on policies and guidelines for maintenance, and the OEM maintenance guidelines. They all should be bound by two contracts: a Concession Agreement between PNR and the Operator (in case of Net Cost Scheme) or Service Agreement (in case of Gross Cost Scheme), and a Maintenance Contract between the Operator and Contractor for a period between 3 to 5 years.

CHAPTER 7 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

7.1 Environmental Impact Assessment Report

7.1.1 Background of the Project

On 18 Jul. 2013, DOTC discussed with DENR-EMB the environmental considerations for NSCR (Phase 1: Malolos – Caloocan), and DOTC explained that the project outline of NSCR project is the same as the Northrail Project.

In his letter to DOTC dated 28 November 2013 (Annex C), former EMB Director, Atty. Juan Miguel Cuna confirmed the validity of the said ECCs, issued for the Northrail Project, to be applicable for the NSCR Project.

During the feasibility study in the NSCR Project, however, the fundamental components of the project, such as the project scope, purpose, etc., have been modified. Based on the modification, the EMB recommended that the 2 ECCs would be integrated into one ECC with the scope from Malolos to Tutuban, and advised the JICA Study Team to conduct an EIA to complete an Environmental Performance Report and Management Plan (EPRMP) for the entire Malolos - Tutuban section.

This EMB advice was in accordance with the recent EMB Memorandum Circular No. 2014-005 dated July 07, 2014, which categorized the NSCR project as Category A (Environmentally Critical Projects), sub-categorized as A-2 (Existing and to be expanded, modified and/or rehabilitated), single project. This requires the submission of an EPRMP with the monitoring data for the Valenzuela to Caloocan whose ECC was available in the Northrail Project. The processing and decision will be done at the EMB Central Office level.

Table 7.1.1 ECC for Northrail Project and NSCR Project

Section		Clark-Malolos	Malolos - Valenzuela	Valenzuela – Caloocan	Caloocan – Tutuban
ECCs	ECC by Northrail Project (ECCs become void after issuance of ECC for NSCR Project)	ECC 2000		ECC 2007	None
	ECC for NSCR Project	-	← **Integrated ECC 2015** →		
Required EIA documents to be submitted to EMB			EPRMP		

Source: JICA Study Team

7.1.2 Environmental and Social Conditions

7.1.2.1 Social Environment

Areas within the PNR ROW have already been cleared when the Northrail Project Phase 1 (Clark to Caloocan) was initiated for the Malolos to Caloocan segment. Likewise, the Caloocan to Tutuban segment has also already been cleared. In general, the areas within the PNR ROW are clear of any structures.

Land use analysis extending 250 m from each side of the alignment boundary shows that the proposed NSCR project traverses various land uses and development conditions, including commercial, agricultural, industrial and residential areas along the Malolos to Caloocan section. Areas become more densely built-up as the proposed railway project travels through the urban centers of Caloocan and Manila at approximately 3.5 km. Hence, land uses and development conditions are predominated with built-up areas that are commercial and residential in nature.

7.1.2.2 Natural Environment

Environmentally Critical Area (ECA) is an environmentally sensitive area wherein significant environmental impacts are expected if certain types/thresholds of proposed projects are located, developed or implemented in it. Appropriate conservation and mitigation measures should be taken into account if the significant adverse impacts are unavoidable.

7.1.3 Environmental Management Plan

The Environmental Management Plan (EMP) in Table 7.1.2 presents the mitigation/enhance measures for the impacts that may arise during the Pre-Construction, Construction, and Operational Phases of the proposed NSCR Project. Also discussed in the matrices are the responsible entities who will manage the identified impacts.

In the long-term, the NSCR project may cause the indirect adverse impacts on natural and social environment surrounding regions. Therefore, some recommendations are provided to alleviate such impacts as follows:

1) Although beneficial land use impacts are expected due to the train operation, the adverse impact on decreasing the agricultural land might be also foreseen especially in Bulacan. Therefore, it is recommended that the municipalities along the NSCR draw up the appropriate land use plan and regional development plan.
2) It is recommended that the EMP of the operation phase be implemented consistently with the land use plan and regional development plan of the municipalities along the NSCR. DOTC should regularly confirm its consistency with such plans.

7.1.4 Environmental Monitoring Plan

7.1.4.1 Self-Monitoring Plan

The Self-Monitoring Plan shows the monitoring that needs to be accomplished with regard to NSCR compliance to the environmental laws (PEISS[4], Air Quality, Water Quality and Solid Waste Management). The Self-Monitoring Report shall be submitted to EMB as in accordance with DAO No. 2003 - 27, on a quarterly basis.

7.1.4.2 Third Party Monitoring

As agreed in the Technical Scoping for the NSCR Project, instead of creating the MMT, the proponent may hire a Third Party Monitoring entity to undertake the validation monitoring in accordance with DAO 03-30 Section 2.3 (Monitoring, Validation & Evaluation/Audit Procedures).

In line with this, the specific roles and responsibilities of the Third Party Monitoring entity will be:

- Validate project compliance with the conditions of ECC and the EMP
- Validate the proponent's conduct of self-monitoring
- Prepare validation reports for submission to proponent, EMB and for documentation to stakeholders

[4] *PEISS: Philippines Environmental Impact Statement System*

Table 7.1.2 Environmental Management Plan

Items	Impact	Proposed EMP/Mitigation Measures	Responsible Organization	Cost
I. PRECONSTRUCTION AND CONSTRUCTION PHASE				
Social Environment				
Involuntary Resettlement	• Displacement of residents and few commercial establishments along the proposed alignment	• Implementation of Resettlement Action Plan (RAP) to ensure that affected households and establishments are provided a proper relocation area and/or justly compensated.	DOTC PMO、NHA[5]、LIAC[6]	To be included in the Final RAP Budget
The poverty Group	• Displacement of the ISFs[7]	• Implementation of RAP to ensure that affected ISFs are provided a proper relocation site and/or justly compensated. • Income restoration and livelihood development program for PAPs[8] of ISF and Vulnerable Persons (Women-headed households, Elderly, Persons with disabilities, Poor).	DOTC PMO, NHA, LIAC	To be included in the Final RAP Budget
Local economy such as employment and livelihood etc.	• Commercial establishments and small vendors may experience temporary disturbance during construction due to land acquisition for ROW • Decline or eventual loss of business in affected areas due to land acquisition for ROW	• Implementation of RAP to ensure that affected PAFs[9] including vendors and tenants are provided a proper relocation area and/or to ensure that replacement cost for the losses of affected business establishments and income loss. • Income restoration and livelihood development program for PAPs whose present mean of livelihood is now longer viable and will have to engage in a new income activity.	DOTC PMO LIAC	To be included in the Final RAP Budget
	• Generation of temporary employment by land acquisition for ROW	• The project proponent will mandate contractor to give priority to the local residents.	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED
Land use and utilization of local resources	• Loss of wetland	Offset the lost wetland (see EMP of "Flora, Fauna, and Biodiversity")	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED
Social institutions such as social infrastructure and	• Conflict between existing residents and new settlers	• Implementation of Resettlement Action Plan (RAP) to ensure the integration of the host community with the resettled PAFs at the relocation sites.	DOTC PMO, NHA, LIAC	To be included in the Final RAP Budget

[5] *NHA: National Housing Authority*
[6] *LIAC: Local Inter-Agency Committees*
[7] *ISFs: Informal Settler Families*
[8] *PAPs: Project Affected People*
[9] *PAFs: Project Affected Families*

Items	Impact	Proposed EMP/Mitigation Measures	Responsible Organization	Cost
local decision-making institutions				
Existing social Infrastructures and services	• Interruption of utility services	• Social service utilities such as power, water, drainage and communication line will be diverted before starting the construction activity.	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED
Misdistribution of benefits and damage	• Displacement of residents and few commercial establishments along the proposed alignment	• Implementation of RAP to ensure that affected PAFs including vendors and tenants are provided a proper relocation area and/or to ensure that replacement cost for the losses of affected business establishments and income loss. • Income restoration and livelihood development program for PAPs whose present mean of livelihood is now longer viable and will have to engage in a new income activity.	DOTC PMO LIAC	To be included in the Final RAP Budget
Local conflict of interests	• Conflict between existing residents and new settlers	• Implementation of Resettlement Action Plan (RAP) to ensure the integration of the host community with the resettled PAFs at the relocation sites.	DOTC PMO, NHA, LIAC	To be included in the Final RAP Budget
Water Usage or Water Rights and Rights of Common	• Temporary block of small creeks due to civil works	• Small creeks shall be diverted before starting civil works so as not to block the flow. • Restore the creeks to the original conditions.	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED
Historical/cultural heritage	• Loss of old PNR stations by land acquisition for ROW	• Implement recommendations of NHCP in the detailed design to preserve and integrate the old PNR stations • Implement the concept design of Tutuban Station to preserve the historical structures and integrate it into the development design	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED
Landscape	• Deterioration of aesthetic views	• Design on facilities will be harmonized with the surrounding landscape.	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED
Gender, Children's right	• Displacement of PAFs	• Implementation of RAP to ensure that affected ISFs are provided a proper relocation site and/or justly compensated. • Income restoration and livelihood development program for Women-headed households. • Secure the accessibility to go to school at the relocation sites. • Relocation shall conducted during school holidays	DOTC PMO, NHA, LIAC	To be included in the Final RAP Budget
Work Environment	• Increased risk of accidents due to improper work ethics, which may	• Provide appropriate personal protective equipment (PPE) to all construction workers	DOTC PMO Contractor	Php 7, 000.00 per person (for PPE)

Items	Impact	Proposed EMP/Mitigation Measures	Responsible Organization	Cost
	threat health and safety of workers and local residents	• Strict use of PPE by construction workers • Implement Occupational Health and Safety Management Plan • Put up fences / enclosures around the project site to keep away unauthorized persons • Provide access points for residents in selected areas only • Provide First Aid Stations at construction sites with resident doctors and nurses		Included in the contractor's service fee
	• Worker and community exposure to health and safety hazards due to working in areas with contaminated soils and/or excavation of such soils (Meycauayan dumpsite and RAMCAR battery site)	• Establish and implement specifications for worker safety, and proper disposal of excavated materials • Further study of soil to verify extent of contamination based on evaluation by DENR EMB (RAMCAR battery site) • Disposal of excavated soil (from Meycauayan dumpsite and RAMCAR battery site) in a registered landfill operator	DOTC PMO, Contractor, DENR EMB	To be included in the project cost to be finalized during the DED
Hazard (Risk)Infectious disease such as HIV/AIDS	• Increased risk to communicable and infectious diseases	• Construction workers submit Medical certificates for fitness to work. • Construct sanitary facilities (toilets, bathrooms, kitchens) at all construction sites. • Implement Occupational Health and Safety Management Plan prior to commencement of work.	DOTC PMO Contractor	Included in the contractor's service fee on health, safety and environmental management
Natural Environments				
Topography and Geological features	• Alteration of topography by Earthworks (excavations for foundations; cut and fill; land grading, etc.)	• Depot area must be re-graded to match the original topography	DOTC PMO Contractor	To be included in the project cost to be finalized during the Detailed Engineering Design (DED)
	• Increased risk of liquefaction due to loss of soil strength, settlement of soil, lateral spreading, bearing failures, floatation of embedded structures, damage to overlying structures, in the event of an earthquake	• In the final detailed design stage, liquefaction hazards are carefully analyzed based on the result of geotechnical survey. In the area judged to have the high liquefaction hazard, necessary measures for each structure type will be considered.	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED
	• Damage to components of the construction work due to ground shaking/ground rupture	• Undertake site-specific seismic risk characterization and estimates of how the ground beneath the structure will move • Design and construct structures that will address seismic hazards (adopt 0.4 g value of acceleration speed of peak value for seismic force)	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED

Items	Impact	Proposed EMP/Mitigation Measures	Responsible Organization	Cost
Soil Erosion	• Soil erosion by Earthworks (excavations for foundations; cut and fill; land grading, etc.)	• Use of silt fences and sediment traps, cover exposed earth especially before heavy rains are expected, benching of cuts, use of sediment basins • Provision of surface water runoff drainage systems • Limit stockpile height up to 2 m high only • Minimize removal of vegetation cover as much as possible • Plan earthwork activities (e.g. excavation, cutting and filling) while considering weather conditions (rainy season)	DOTC PMO Contractor	Included in the contractor's service fee
Hydrological Situation	• Aggravation of existing flooding problems due to land development, earthworks and civil works	• Sufficient and effective drainage systems shall be incorporated in the designs. The proponent shall coordinate with DPWH and LGUs[10] how to integrate the drainage systems into the existing canals/culverts. • Install box culvert at regular intervals with the drainage system in the embankment section. • NSCR structures will be designed to have a clearance of above established flood level and discharges which will be established and included in the detailed design.	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED
Flora, Fauna, and Biodiversity	• Narra trees along the alignment form Caloocan to Tutuban and at the Valenzuela depot site may be affected and removed during the clearing operation • Other trees, such as fruit bearing trees, along the alignment will be removed	• Coordination with concerned agencies or groups for relocation sites of earth-balled trees. • For every tree removed, an equivalent 100 seedlings will be planted (DENR DAO 58 Series of 1993). Provision of tree seedlings will be provided by the proponent in replacement of trees to be cut. • Monitoring of survival of trees planted • Provision of compensation to owners of non-timber species such as fruit trees that are removed (to be included in the RAP)	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED Tree seedling and monitoring cost Php 20,000/ha
	• Loss of small swampy area used for a few migratory and resident birds due to development of Depot site	• To offset the lost wetland, the proponent will seek assistance from the Society for the Conservation of Philippine Wetlands (SCPW) to identify an adjacent wetland area that the proponent will conserve and enhance so that this area will attract the birds and stay here instead. • Conduct seasonal bird count to monitor the bird population in the surrogate wetland area established.	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED
Global Warming	• GHG emission from operating construction machines and vehicles	• Regular wetting of ground soil in the construction site • Regular preventive maintenance of heavy equipment and service	DOTC PMO Contractor	To be included in the project cost to be

[10] *LGUs: Local Government Units*

Items	Impact	Proposed EMP/Mitigation Measures	Responsible Organization	Cost
		vehicle		finalized during the DED
Pollution Control				
Air Pollution	• Generation of dusts and particulate matter, and gas emissions due to earthmoving, demolition and earth-balling , and operation of equipment, machineries and service vehicles	• Regular wetting of ground soil in the construction site • Regular preventive maintenance of heavy equipment and service vehicle	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED
Water Pollution	• Increase in suspended sediments in the receiving water	• Implementation of appropriate erosion control measures particularly during high precipitation periods. • Soil/sediments/debris and other excavated materials shall be hauled out from the site immediately and disposed by accredited waste handlers	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED
	• Increase in pollution of receiving water bodies due to domestic wastewater generation	• Portable sanitary facilities (portalets) will be installed to collect wastewater, which will be collected and disposed by accredited waste handles	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED
	• Increase in pollution of receiving water bodies due to fuel and oil leaks from vehicles and other equipment	• Equipment and machinery shall be regularly checked for fuel and oil leaks. • During repair of equipment and machinery, containers/drip trays shall be used to collect leakage. • Any spilled or spent oil will be collected, stored properly and disposed by accredited waste haulers.	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED
Soil Contamination	• Soil contamination due to oil or lubricant spills by Earthworks (excavations for foundations; cut and fill; land grading, etc.)	• Provide proper construction machines and heavy vehicles and maintain them properly • Oil and grease traps in the drainage system • Establish and implement health and safety management plan and emergency and contingency plan in case of spills	DOTC PMO Contractor	To be included in the contractor's service fee on health, safety and environmental management
	• Remediated land might be excavated traces of lead might again be detected.	• Confirm that the DENR EMB's evaluation of effectiveness of remediation by the begging of detailed engineering design stage; • If the remediation is deemed insufficient, the proponent will request DENR EMB and RAMCAR to conduct further remediation; • Even if the remediation is deemed sufficient, the heavy metal (Pb) in excavated soil shall be monitored during construction. If the testing result indicates any contamination, the proponent shall stop excavation/civil work and discuss with DENR EMB and RAMCAR	DOTC PMO	To be included in the project cost to be finalized during the DED

Items	Impact	Proposed EMP/Mitigation Measures	Responsible Organization	Cost
		how to remediate contaminated soil.		
Waste	• Generation of solid waste; Land and water contamination; aesthetic impacts; spread of diseases	• Submission and implementation of Solid Waste Management Plan as part of contractors' engagement • Provision of waste bins to avoid dispersal of litter and regular site maintenance duties • Regular collection, transportation and disposal of wastes to minimize the attraction of vermin, insects and pests	DOTC PMO Contractor	To be included in the contractor's service fee on health, safety and environmental management
	• Generation of solid waste due to excess soil for disposal from earthwork activities, and demolition of existing railway structures	• Submission and implementation of Solid Waste Management Plan as part of contractors' engagement • Recycling of wastes including soil, as much as possible • Use of leftover concrete and metals for suitable alternative projects • Proper sorting of waste for disposal and designation of appropriate temporary storage area • Disposal of non-recyclable wastes by a licensed contractor	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED
Noise and Vibration	• Increase in noise due to earthmoving, demolition and earth-balling , and operation of equipment, machineries and service vehicles	• Installation of control devices such as mufflers and noise suppressors to all construction equipment • Regular maintenance of heavy equipment, construction machinery • Provision of temporary noise barriers such as galvanized iron shields, particularly in noise-sensitive areas such as churches, schools, and hospitals in the immediate vicinity of the construction area. • Construction workers must be provided with personal protective equipment (PPE). • Scheduling of high noise generating activities during daytime • Construction sites must be fenced for safety and security reasons	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED
	• Increase in ground vibration level due to operation of heavy equipment and machineries	• Use of construction machinery with minimal vibration generation e.g., careful operation of construction machinery, avoiding of high-load operation, and minimum movement of heavy machinery • Adopt the less vibration pile driving methods such as cast-in place pile method • Shorten the operation time of construction machinery (limit the operation during weekdays and during the day, and obey the work time schedule and set the rest time) • Keep construction machinery away from the residence and sensitive receptors • Identify nearby sensitive receptors likely to be affected and monitor	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED

Items	Impact	Proposed EMP/Mitigation Measures	Responsible Organization	Cost
		vibration levels • Explain to the community about the construction work and respond to complaints properly		
Ground subsidence	• Subsidence due to soft soil at depot area	• Design of structures and facilities to withstand ground subsidence	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED
Bottom sediment	• Increase in suspended sediments in the receiving water due to demolition, excavation and bore piling activities	• Implementation of appropriate erosion control measures particularly during high precipitation periods. • Soil/sediments/debris and other excavated materials shall be hauled out from the site immediately and disposed by accredited waste handlers	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED
Others				
Accidents	• Mobilization of workers, equipment and construction materials, and transport of demolition debris and construction materials to and from the construction site.	• Strict implementation of Traffic Management Plan (TMP) that details the activities to adequately manage traffic flow • The TMP will be properly coordinated and approved by the MMDA [11] and/or LGUs concerned prior to implementation of activities in the areas concerned	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED
II. OPERATION PHASE				
Social Environment				
The Poverty Group	• Livelihood of ISFs	• Implementation of the Internal and External Monitoring of RAP to monitor the livelihood of relocated ISFs.	DOTC, Private entity in charge of O&M, NHA, LIAC	To be included in the Final RAP Budget
Local economy such as employment and livelihood etc.	• Income of PAFs including venders, tenants and small commercial establishments	• Implementation of the Internal and External Monitoring of RAP to monitor the livelihood of relocated PAFs	DOTC, Private entity in charge of O&M NHA, LIAC	To be included in the Final RAP Budget
	• Increased economy along NSCR route due to Railway Operation	• Ensure efficiency of NSCR system in order to attract passengers and increase ridership • Encourage commercial development at Stations	DOTC, Private entity in charge of O&M	N/A
Land use and utilization of local resources	• Land alteration of small wetland	• See EMP of "Flora, Fauna and Biodiversity."	-	-
	• More efficient and safer transportation facility due to	• Identification of future land use of surrounding areas that will result to a significant increase in commercial activities especially near train	LGUs, DOTC, Private entity in	N/A

[11] *MMDA: Metropolitan Manila Development Authority*

Items	Impact	Proposed EMP/Mitigation Measures	Responsible Organization	Cost
	reduced travel time, reduced traffic congestion, improved traveler safety and reduced energy consumption by operation of train • Increase in land development along or near the corridor	stations, to guide urban planners of the LGUs to adapt future development plans accordingly.	charge of O&M	
Social institutions such as social infrastructure and local decision-making institutions	• Conflict between existing residents and new settlers	• Implementation of the Internal and External Monitoring of RAP to monitor the integration of the host community with the resettled PAFs at the relocation sites.	DOTC, Private entity in charge of O&M, NHA, LIAC	To be included in the Final RAP Budget
Misdistribution of benefits and damage	• Displacement of residents and few commercial establishments along the proposed alignment	• Implementation of the Internal and External Monitoring of RAP to monitor the livelihood of relocated PAFs	DOTC, Private entity in charge of O&M, LIAC	To be included in the Final RAP Budget
Local conflict of interests	• Conflict between existing residents and new settlers	• Implementation of the Internal and External Monitoring of RAP to monitor the integration of the host community with the resettled PAFs at the relocation sites.	DOTC, Private entity in charge of O&M, NHA, LIAC	To be included in the Final RAP Budget
Gender, Children's right	• Displacement of PAFs	• Implementation of the Internal and External Monitoring of RAP to monitor the situation of women and children.	DOTC, Private entity in charge of O&M, NHA, LIAC	To be included in the Final RAP Budget
Work environment (occupational health/ safety)	• Risk of accidents at the stations and depot	• Strict implementation of precautionary, safety and security measures	DOTC, Private entity in charge of O&M	Included in the health, safety and environmental management plan and budget of the proponent
Hazard (Risk)Infectious disease such as HIV/AIDS	• Risk of communicable and infectious diseases	• Sanitary facilities or utilities to maintain sanitary and healthy conditions at all stations and depot.	DOTC, Private entity in charge of O&M	Included in the health, safety and environmental management plan and budget of the proponent
Natural environment				
Topography and Geological	• Loss of soil strength, settlement of soil, lateral spreading, bearing	• Consider liquefaction hazards in the final design of the structures	DOTC, Private entity in charge	Part of the regular operation and

Items	Impact	Proposed EMP/Mitigation Measures	Responsible Organization	Cost
features	failures, floatation of embedded structures, damage to overlying structures, in the event of an earthquake		of O&M	maintenance and budget of the proponent
	• Damage to infrastructure in the event of an earthquake	• Conduct regular check on integrity of structures; reinforce, if necessary	DOTC, Private entity in charge of O&M	Part of the regular operation and maintenance and budget of the proponent
Flora, Fauna, and Biodiversity	• Narra trees	• Monitoring of survival of trees planted	DOTC, Private entity in charge of O&M	P20,000.00
	• Offset wetland	• Conduct seasonal bird count to monitor the bird population in the surrogate wetland area established.	DOTC, Private entity in charge of O&M, The Society for the Conservation of Philippine Wetlands(SCPW)	To be detained in preparation of Restoration Plan.
Global Warming	• Accelerated structural fatigue and materials failure • Greater demands on the construction, operation and maintenance of flood control and drainage structures.	• Design in making infrastructure robust or resilient to the effects of climate change should be taken into consideration • Improvement of current drainages along the alignment to be resilient to climate change	DOTC, Private entity in charge of O&M	To be included in the project cost to be finalized during the DED
Pollution Control				
Air Pollution	• Increase in air pollution due to operation of service vehicles and operation of standby generator set	• Proper preventive maintenance of service vehicles and equipment • Use of cleaner fuel for the generator sets	DOTC, Private entity in charge of O&M	N/A
Water Pollution	• Increase in pollution of receiving waters bodies due to maintenance activities in the railway stations and depot	• Wastewater with oil shall be separately collected and disposed for treatment. • A wastewater treatment facility (WTF) with oil removal will be constructed at the Depot. • Draw up a Procedure Manual for Workers at the Depot to prevent oil spills in EMP	DOTC, Private entity in charge of O&M	Construction Cost of WFT will be included in the Project Cost to be finalized during the DED.
	• Increase in pollution of receiving water bodies due to domestic	• Sanitary facilities at the stations will be installed to collect wastewater, which will be collected and disposed by accredited	DOTC, Private entity in charge	Part of Maintenance Cost of the Facilities

Items	Impact	Proposed EMP/Mitigation Measures	Responsible Organization	Cost
	wastewater generation	waste handles	of O&M	
Soil Contamination	• Soil contamination resulting from leaks of lubricants agents and used oil due to Maintenance Works at the Depot site	• Provide proper machines and equipment and maintain them properly. • Store bulk waste oils and lubricants in impermeable area and with appropriate secondary containment. • Prepare a procedure manual for workers at the depot to prevent oil and chemical spills and also provide regular training to workers to keep working and surrounding environment in good condition. • Emergency and contingency plan in case of spills and health and safety management plan must be in place.	DOTC, Private entity in charge of O&M	Part of the health, safety and environmental management plan and budget of the proponent
Waste	• Generation of solid waste ; Land and water contamination; aesthetic impacts; spread of diseases due to passengers movement, as well as maintenance activities	• Proper segregation of wastes • Provision of waste bins that will allow proper waste segregation • Use of sealable waste bins to avoid attraction of vermin, insects and pests, • Regular collection and transportation of wastes for recycling or disposal at licensed facilities • Formulation and implementation of policies on solid waste minimization and solid waste management for patrons and staff	DOTC, Private entity in charge of O&M	Part of Maintenance Cost of the Facilities
Noise and Vibration	• Noise due to train operation	• 2 m noise barrier will be considered for the class AA area, especially sensitive facilities such as school, hospital, etc. are located within 50 meter distance • Detailed survey in measuring the distance from sensitive area should be carried out at detail design stage. • Proper maintenance of structures and tracks, such as regular rail grinding, must be conducted	DOTC, Private entity in charge of O&M	To be included in the project cost to be finalized during the DED Part of the regular operation and maintenance and budget of the proponent
	• Vibration due to train operation	• Design of rail tracks must incorporate measures to reduce level of vibration generated by the railway during train operations, such as use of long rail, resilient rail fastenings, rail dampers, sleeper with the anti-vibration mat • Increase ballast bed height for the embankment section especially near the residential area and sensitive receptors. Install ballast mats • Proper maintenance of trains structures and tracks, such as maintaining smooth rail running surface, elimination of the rail running surface discontinuities, must be conducted • Regular reconditioning of train and its components, such as suspension	DOTC, Private entity in charge of O&M	To be included in the project cost to be finalized during the DED Part of the regular operation and maintenance and budget of the proponent

Items	Impact	Proposed EMP/Mitigation Measures	Responsible Organization	Cost
		system, brakes, wheels (re-profiling) and slip-slide detectors • Identify nearby sensitive receptors likely to be affected and monitor vibration levels		
Ground subsidence	• Subsidence due to soft soil at depot area due to movement of trains	• Regular monitoring and measurement of level of ground subsidence	DOTC, Private entity in charge of O&M	Part of the regular operation and maintenance and budget of the proponent
Others				
Accidents	• Traffic congestion near railway stations due to railway operation	• Designate / Provide for loading and unloading areas • Fielding of traffic enforcers near the stations • Provision for tricycle / jeepney/bus terminals	DOTC, Private entity in charge of O&M, LGUs	N/A

Source: JICA Study Team

7.2 RAP

7.2.1 Potential Impacts by the Project

NSCR alignment will utilize the Northrail and ROW from Malolos to Caloocan, additional land acquisition will be needed due to the narrow portions of the existing ROW.

From Caloocan to Tutuban, since the NSCR ROW will be fitted inside the PNR ROW, no additional land acquisition will be needed except at the Solis junction. There is a future plan of the NSCR to extend it to further south of Metro Manila from Solis, up to Calamba, Laguna. This extension is yet determined, however, the minimum required crossover structure will be constructed by the NSCR project. Therefore, additional land acquisition will be needed at the Solis junction.

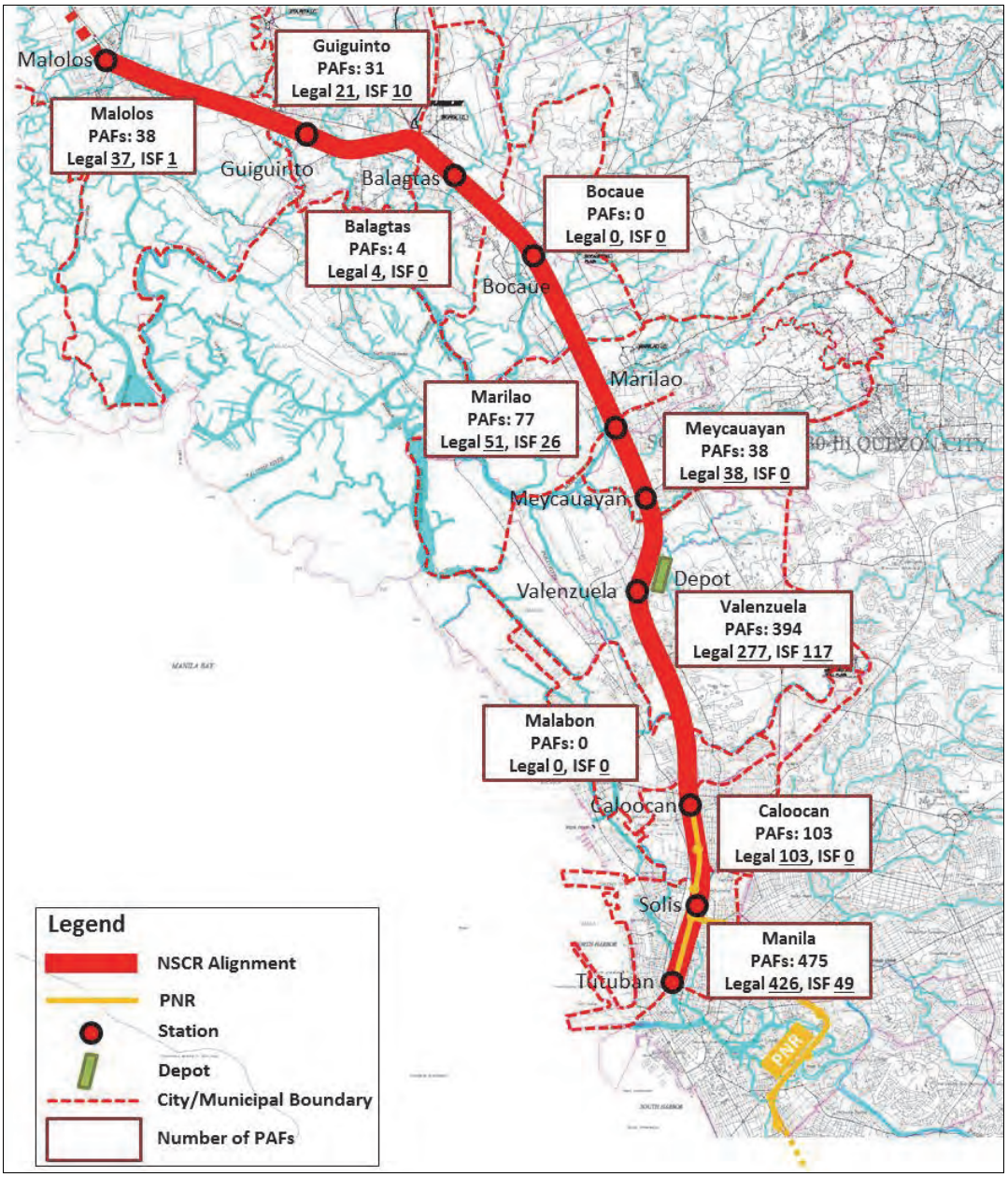
The additional ROW acquisition will affect not only the structures of residential homes but also commercial and industrial facilities. Displacement of Project Affected Families (PAFs) will be unavoidable when the affected structures are no longer viable for continued use. Affected areas of the NSCR Project are shown in Figure 7.2.1.

7.2.2 Objectives of the Rap

The objectives of this Resettlement Action Plan (RAP) for the North-South Commuter Railway (Phase 1) are to ensure that no affected persons shall be worsened off as a result of the NSCR Project and that:

- Adverse social and physical impacts are avoided, minimized, and mitigated;
- Stakeholders, and more importantly the Project-Affected Persons (PAPs), will benefit from the Project;
- PAPs are provided with sufficient compensation for lost assets and assistance with livelihood programs which will help them improve or at least restore their pre-project standard of living; and
- Resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected.

All the above objectives will be done in accordance with the appropriate and applicable Philippine laws, policies and/or guidelines with consideration of policies and guidelines of the International Financing Institutions, particularly of World Bank and JICA's Guidelines for Environmental and Social Considerations.



Source: JICA Study Team

Figure 7.2.1 Area to be Affected by the NSCR Project

7.2.3 Relocation Site

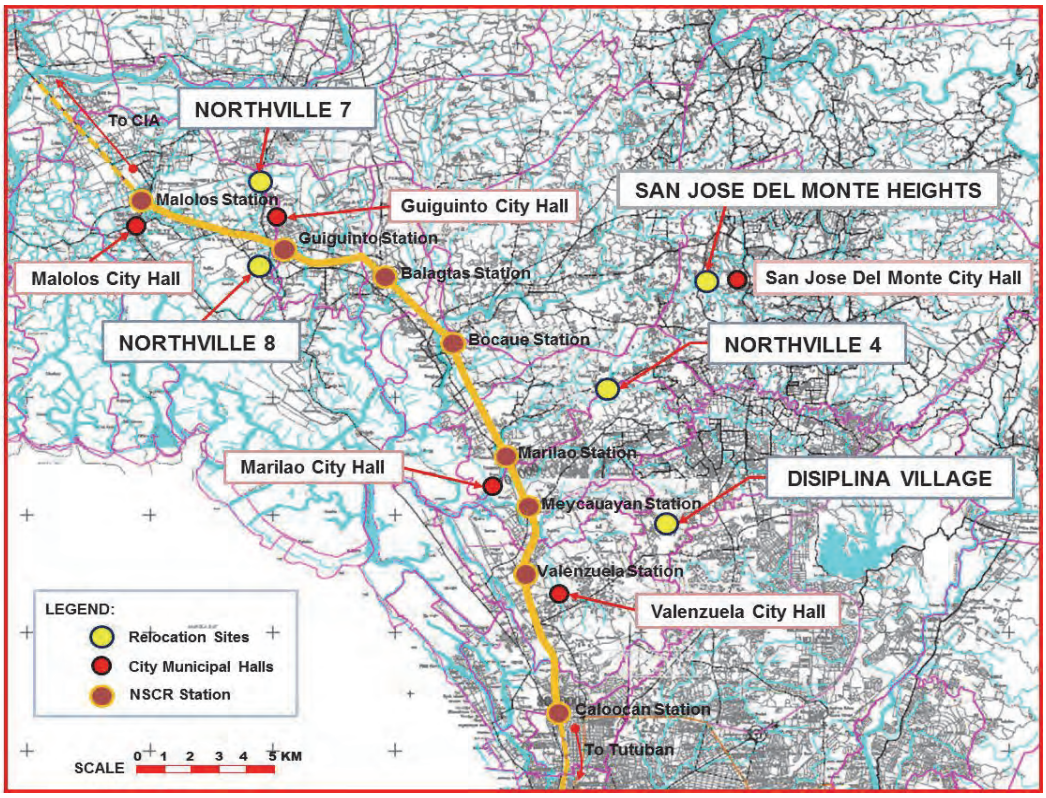
The potential relocation sites are previously existing relocation sites of the National Housing Authority (NHA) with possible expansion or additional houses that may accommodate the PAFs of the NSCR project.

According to the NHA, there may be available units in the existing relocation sites, Northvilles in Bulacan, that were developed for the Northrail Project. Because affected ISFs are identified in Malolos, Guigionto and Marilao, the Northville 8 in Malolos, Northville 7 in Guiguinto and Northville 4 in Marilao are the in-city candidate relocation sites. The existing relocation sites also include San Jose Del Monte Heights in Bulacan and Disiplina Village in Valenzuela City as shown in Table 7.2.1 and Figure 7.2.2. According to NHA, some relocation sites developed in the Province of Cavite are also potential relocation sites. However, the concrete relocation sites are not yet provided by NHA.

Table 7.2.1 Tentative Candidate Relocation Sites

Site	Location	Tentative Available Units	Present Status
Northville 8	Brgy. Bangkal, City of Malolos, Bulacan	Subject for cancellation of existing awardee	Number of existing units: 2,696 Power and water supply: available
Northville 7	Brgy. Malis, Guiguinto, Bulacan	Subject for cancellation of existing awardee	Number of existing units: 1,702 Power and water supply: available
Northville 4	Brgy. Lambakin, Marilao, Bulacan	Subject for cancellation of existing awardee	Number of existing units: 1,911 Power and water supply: available
San Jose Del Monte Heights	Brgy. Muzon, San Jose Del Monte, Bulacan	2,000	Developed Power and water supply: available
Disiplina Village	Brgy. Bignay Valenzuela City	Affected ISFs in Valenzuela city only	Under Planning (to be completed by 2016)

Source: NHA



Source: JICA Study Team

Figure 7.2.2 Location Map of Candidate Relocation Sites

7.2.4 Implementation Schedule

The Implementation Schedule of the RAP for the NSCR Project is shown in Table 7.2.2. During the Detailed Design Stage of the Project, which will be carried out in Calendar Year 2016, revalidation of the census/tagging survey result shall be conducted as part of the Consulting Services for the Detailed Design. Hence, if there will be identified additional households to be affected due to changes in the design/plan and construction areas of the project as compared to the preliminary design/plan proposed under the preparatory study, the RAP shall be revised to include those additional PAPs. Accordingly, current cut-off date will be set for the census/tagging of the newly identified PAPs.

The construction of the project must commence after the implementation of the RAP. The resettlement of

all PAPs including removal/demolition of their affected structures will be completed by the first quarter of 2018. Therefore, the construction/civil works can be able to start from the 2nd quarter of 2018.

Table 7.2.2 RAP Implementation Schedule (Tentative)

		Responsible Organization	2015	2016	2017	2018	2019	2020	2021	2022
A	Detailed design and other consulting services	DOTC/PMO								
B	Selection of Contractor	DOTC/PMO								
C	Construction work	DOTC/PMO								
D	Train Operation for Commuter	DOTC/PMO								
1	Social Preparation									
	Creation of PMO/RIMT[12]	DOTC								
	Detailed Measurement Survey (DMS) to validate the census master list of PAPs. Revision of RAP if ROW is changed.	PMO/RIMT								
	Approval of revised RAP by JICA	JICA								
	Creation of LIAC	PMO/RIMT								
	Appointment of PAPs representatives to LIAC	LIAC, PAPs[*1]								
	Holding of public consultation meetings before DMS and after the finalization of RAP	LIAC, PMO/RIMT								
	Hiring of external consultant or request assistance from an appropriate government agency, to conduct Social Preparation	PMO/RIMT								
	Creation of Grievance Redress Mechanism	LIAC, PMO/RIMT								
	Verification of eligibility of PAFs	LIAC, PMO/RIMT								
	Implementation of livelihood training before relocation	LIAC, PMO/RIMT								
2	Additional ROW Acquisition (for Non ISF)									
	Parcellary Survey and Structural Survey	PMO/RIMT								
	Appraisal of lots, structures & improvements	PMO/RIMT								
	Submission of Offer to Buy including negotiation with Owner	PMO/RIMT								
	Filing of Expropriation	PMO/RIMT								
3	Relocation of Informal Settlers									
	Determination of relocation sites	LIAC, PMO/RIMT								
	Finalization of lot assignment	LIAC, PMO/ RIMT, PAPs								
	Construction of housing Units	LIAC, NHA PMO/RIMT								
	Conduct consultation meetings with affected families regarding the schedule of transfer	LIAC, PMO/ RIMT,PAPs								
	Issuance of Notices of Demolition	LIAC, PMO/RIMT								
	Creation of dismantling team with the beneficiaries (ISFs) for voluntary demolition	LIAC, PMO/RIMT								
	Provide assistance (transportation assistance and meal subsidy)	LIAC, PMO/RIMT								
	Actual relocation	LIAC, PMO/RIMT								
4	Post Relocation Activities									
	Capacity enhancement of Homeowner Associations/Housing Cooperatives of relocated sites	LIAC, PMO/RIMT, PAPs								
	Post-Resettlement Monitoring at resettled locations	LIAC, PMO/RIMT								
	Livelihood program and capacity buildings based on the monitoring results.	LIAC, PMO/RIMT								

Source: JICA Study Team

[12] *RIMT: RAP Implementing and Management Team*

7.3 Due Diligence Report on the Northrail Resettlement Program

7.3.1 Summaries of the Displacements under the Northrail Project

Displacement of residents from the PNR ROW was carried out two times under the Northrail Project as summarized in Table7.3.1.

Table7.3.1 Summary of the Two Displacements under the Northrail Project

Events caused displacements	Resettlement of Informal Settlers in PNR ROW	Additional ROW Acquisition	Total
Year relocation carried out	2000-2005	2007-2008	
Reason for the displacement	Retrieving of the PNR ROW, No land acquisition occurred	Additional land acquisition	
No. of Affected Cities/Municipalities	9	7	
Involvement of ISFs	Yes	Yes	
No. of ISFs affected household (HH)	20852	125	20977
No. of relocated ISFs (HH)	16,116	93	16,209
Involvement of Legal Household	No	Yes	
No. of legal affected households (HH)	0	241	241
No. of relocated legal households (HH)	0	66	66

Source: JICA Study Team

7.3.2 Points Which Need to be Taken into Consideration

Following are points to be considered in the deliberation of additional assistances for the PAPs:

- Based on the findings, it appears that the land acquisition and resettlement in the Northrail Project were conducts referring to the legal and institutional framework of the Philippines.
- The resettlements were conducted around 10 years ago. The details and actual amount of the compensation could not be confirmed.
- The total number of ISFs is more than 20,000. Out of it, about 16,200 households were resettled in 11 relocation sites. On the other hand, 4,700 households did not move to the relocation site and their whereabouts were not recorded. Tracking the PAPs including ISFs was extremely difficult.
- The current socio-economic conditions of PAPs have been influenced not only by the resettlement itself but also by other factors. It is not easy to conclude neither their current socio-economic conditions are better off nor worse off.
- The due diligence study has identified that the poverty level is still high and there are some vulnerable people in the resettlement sites. Some additional assistances, which must be implementable and practical, to the poor and vulnerable seem to be beneficial to them.
- If needed, additional assistances must be considered in the light of fairness, and not creating new community division.

7.3.3 Framework for Additional Assistances

Based on the above mentioned considerations, Table7.3.2 shows additional assistances to be provided by the NSCR Project for the PAPs affected in the Northrail Project. However, they must be contemplated further within the DOTC as the project proponent of the NSCR Project, and among relevant organizations such as NHA before its finalization.

Table7.3.2 Additional Assistances to PAPs Provided by NSCR Project (Draft)

Item	For Affected ISFs	For Affected Legal PAPs
Compensation – Lands	N.A.	
Compensation – Structures and Improvements	N.A.	
Livelihood Rehabilitation and Income Restoration	• Eligible to skill trainings and other development activities provided by the NSCR Project, if needed • Provision of job opportunities in the NSCR Project, if needed	• Eligible to skill trainings and other development activities provided by the NSCR Project, if needed
Public Consultations	N.A.	
Grievance and Redress Mechanism	Eligible to the GRM developed by the NSCR Project	
Monitoring of PAPs	Through sharing of information from NHA, the NSCR Project periodically monitors the conditions of ISFs	N.A.

Source: JICA Study Team

7.4 Consultation with DOTC Regarding EIA, Draft RAP and Draft DDR

The JICA study team explained and discussed with DOTC on EPRMP, draft RAP and draft DDR at every opportunity. DOTC understood and agree on the basic policy and guidelines on environmental social considerations described in these reports, but it is necessary to discuss in more detail.

CHAPTER 8 ASSESSMENT OF CLIMATE CHANGE MITIGATION POTENTIAL

8.1 Emission Reduction of GHG from Vehicles

The vehicle emissions are estimated by traffic assignment results of the case with Malolos-Tutuban section and without Malolos-Tutuban section. The results for 2020, 2030 and 2040 are summarized in Table below. The result shows that greenhouse gas (hereinafter referred to as GHG) emission in 2020 will be reduced 97,000 t-CO_2/year by starting the operation of NSCR. In addition the GHG reduction will increase with increased the passengers of NSCR in the future. In 2030 and 2040, GHG emission will be reduced 206,000 and 261,000 t-CO_2/year respectively.

Table 8.1.1 Emission Reduction of GHG

Unit: 1000t-CO_2/year

Year	Mode	Without case	With case	Reduction
2020	Car	5,823	5,774	50
	Jeepney	1,254	1,216	38
	Bus	1,218	1,211	7
	Truck	3,831	3,828	3
	Total	**12,126**	**12,029**	**97**
2030	Car	7,297	7,187	109
	Jeepney	1,565	1,485	80
	Bus	1,561	1,554	7
	Truck	4,966	4,956	10
	Total	**15,388**	**15,182**	**206**
2040	Car	8,818	8,656	162
	Jeepney	1,793	1,717	77
	Bus	1,807	1,793	14
	Truck	6,170	6,161	9
	Total	**18,588**	**18,327**	**261**

Source: JICA Study Team

8.2 Loss of Carbon Stock by Land Conversion

Some negative impacts of the project would include reduction of carbon sink area due to clearing of trees and vegetation and GHG emission due to operation of standby generator sets. The impact, however, is minimal.

1) Loss of Carbon Stock by Land Conversion from Paddy Fields to Depot

The paddy fields of 0.4 ha for proposed depot site in Valenzuela will be disappeared. This conversion of cropland leads loss of carbon stock. The calculation was carried out by the following equation.

2) Loss of Carbon Stock by Land Conversion from Wetland to Depot

The soil in wetland (2 ha) for proposed depot site in Valenzuela will be disappeared. This leads loss of carbon stock.

CHAPTER 9 PROJECT EVALUATION

9.1 Economic Evaluation

9.1.1 Economic Cost of the Project

The economic costs were determined by deducting all taxes and price contingencies included in the financial cost and by applying the shadow wage rate to the unskilled labor component of investment cost. Economic costs were estimated to be equivalent to about 85% of financial cost. The conversion factor applied to the operating and maintenance (O&M) costs were also 85%.

9.1.2 Economic Benefits

The main economic benefits of Malolos to Tutuban section are the savings owing to the reduction in vehicle operating cost (VOC) and travel time cost (TTC). The construction of the NSCR Line is expected to reduce traffic volume, which in turn will result in shorter travel times and faster vehicle operating velocity. The shorter travel time translates into lower traveling times costs, while the faster vehicle velocity implies lower operating costs. The values of these economic benefits will be based on the willingness to pay for time cost and VOC per trip. Additional economic benefits that may be included in the analysis such as accident cost savings, reduction in carbon dioxide emissions, and avoided road maintenance cost.

In the process of calculating the core benefits of project, the unit VOC and TTC were estimated. The unit VOC were based on the average operating costs of a representative set of vehicles. The cost items that were considered in the computation were: (1) fuel cost, (2) lubricant cost, (3) tire cost, (4) repair cost, (5) depreciation cost, (6) capital opportunity cost, (7) overhead cost, and (8) crew cost. The results of the computation were consolidated and expressed as a function of travel speed.

The summary of economic benefits after the TTC savings are adjusted is shown in following Table.

Table 9.1.1 Summary of Economic Benefits for Benchmark Years

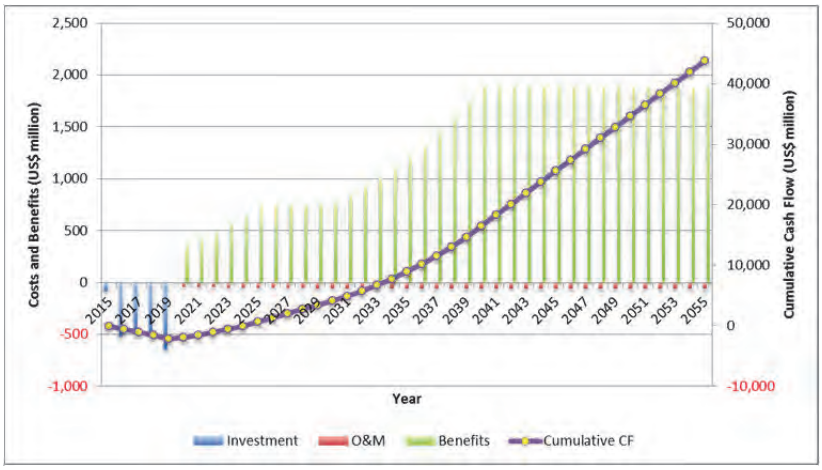
(In million US dollars)

Year	VOC Savings	TTC Savings	Total
2020	285.3	70.2	355.4
2025	596.4	146.0	742.4
2030	507.9	258.5	766.4
2040	1,417.2	457.0	1,874.2

Source: JICA Study Team

9.1.3 Results of Economic Evaluation

The economic analysis for the base case yields an EIRR of 19.7% and an ENPV of US$829.8 million relative to the social discount rate of 15%, and given a project life of 35 years. The FNPV and FIRR were estimated using constant 2014 prices with US dollar as the functional currency. These indicate that the proposed Malolos to Tutuban section of the NSCR project is economically viable. The results of the economic analysis and the computation of the EIRR and the EPNV are in Table 9.1.12.



Source: JICA Study Team

Figure 9.1.1 Cash Flow of the Economic Costs and Benefits

Table 9.1.2 Results of Economic Valuation

Indicator	Unit	Value
EIRR	%	19.7%
ENPV	US$ Million	829.8
B/C	-	1.53

Source: JICA Study Team

A sensitivity analysis was carried out to determine the sensitivity of EIRR to changes in costs and benefits. The results of sensitivity analysis are summarized in Table 9.1.3.

Table 9.1.3 Sensitivity Analysis of Economic Evaluation

Benefits	Cost	Change in Economic Cost			
	Change	Base Case	+10%	+20%	+30%
Change in Economic Benefit (%)	Base Case	19.7%	18.6%	17.6%	16.7%
	-10%	18.5%	17.4%	16.4%	15.6%
	-20%	17.1%	16.1%	15.2%	14.4%
	-30%	15.7%	14.7%	13.9%	13.1%

Source: JICA Study Team

9.2 Financial Viability

9.2.1 Project Costs

The proposed Malolos to Tutuban commuter railway system is estimated to cost US$2,637.0 million. Once the appropriate contractor has been identified, the construction of the Malolos to Tutuban commuter railway system is to be completed in five years including the train test runs. The Malolos to Tutuban section is expected to commence operations in 2020. The total route length of the railway system will be 37.9 km and it will have a total of 10 stations for revenue operation start in 2020, 5 additional stations in 2030.

Project implementation will be over a period of seven years including preparation of feasibility study, preliminary design and tender documents, land acquisition and resettlement, environmental impact assessment, and utility relocation. A 35-year operating period is used in the financial analysis of the project. However, the physical life of the railway system can stretch up to 60 years when the project proponent implements the necessary regular and periodic repairs and maintenance.

The project's O&M costs are comprised of: (1) manpower, (2) spare parts, (3) power, and (4) station services. Annual O&M costs will include preventive maintenance works, and regular and period repairs of the rolling stock, track works, E&M system, and other equipment and structures. Depending on the scheme that will be adopted by the government, the responsibility for the project's O&M can either be carried out by an in-house workforce or outsourced to a third-party contractor.

The summary of the annual O&M costs is presented in Table below. The prices of each cost item were based on current prices used in the operations of the Philippine Light Rail Transit Authority.

9.2.2 Project Revenues

The daily boarding on the commuter system is estimated to be 407,000 in 2020. By 2025, daily boarding will reach its peak of 953,000. This represents an average increase of 19% per annum over a 5-year period. Non-fare revenues are assumed to be 5% of farebox revenues. Based on the proposed fare system, the summary of the revenue projections in the benchmark years is shown in Table 9.2.1.

Table 9.2.1 Revenue Projections for Benchmark Years

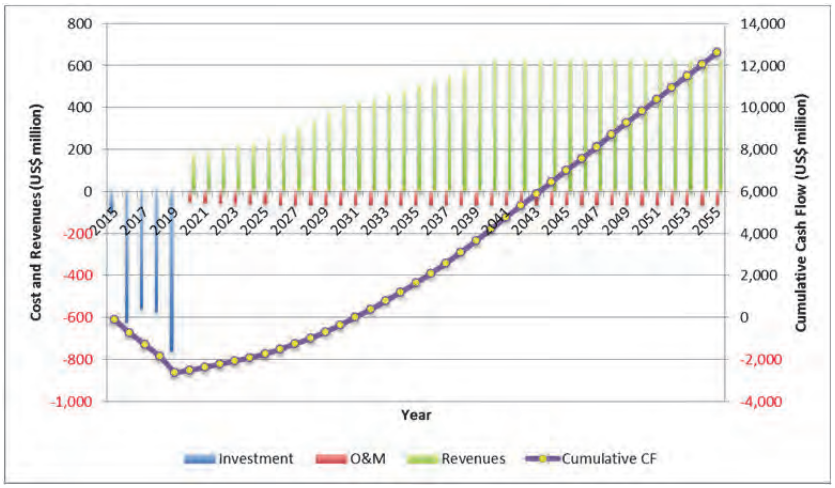
(In million US dollars, constant 2014 prices)

Year	Fare Revenues	Non-Fare Revenues	Total Revenues
2020	163.1	8.2	171.2
2025	237.5	11.9	249.3
2030	388.7	19.4	408.1
2040	597.8	29.9	627.7

Source: JICA Study Team

9.2.3 Results of Financial Evaluation

The results of the financial evaluation show that revenues generated by the project will not be enough to cover investment cost, capital expenditures, and O&M cost. The project will realize a FIRR of 9.2% and a FNPV of US$2,189.1 million using a discount rate of 5.1%.



Source: JICA Study Team

Figure 9.2.1 Cash Flow of Financial Cost and Revenue

Table 9.2.2 Results of Financial Valuation

Indicator	Unit	Value
FIRR	%	9.2%
FNPV	US$ Million	2189.1
B/C	-	1.72

Source: JICA Study Team

A sensitivity analysis was likewise carried out to determine the responsiveness of the FIRR to changes in the financial costs and revenues. Table 9.2.3 summarizes the results of the sensitivity analysis.

Table 9.2.3 Sensitivity Analysis of Financial Evaluation

Revenue	Cost	Change in Cost (%)			
	Change	-20%	-10%	Base Case	+10%
Change in Revenues (%)	+20%	12.8%	11.7%	10.8%	9.9%
	+10%	12.0%	10.9%	10.0%	9.2%
	Base Case	11.1%	10.1%	9.2%	8.5%
	-10%	10.2%	9.2%	8.4%	7.6%

Source: JICA Study Team

9.3 Case Analysis

The results above were calculated based on the with rail projects case includes LRT2 west extension and NSRP (South) and so on. In this section, the without LRT2 west extension and NSRP (South) case was tested as a test case analysis. The assumptions were not changed.

The number of daily boarding passenger and PPHPD were shown in the table below. In 2020, number of daily boarding passenger and PPHPD will be 402,000 pax and 12,990 respectively. In 2040, they will be 712,000 pax and 20.440.

Table 9.3.1 Number of Daily Boarding Passenger and PPHPD (test case)

Year	Section	Number of Daily Boarding passenger (Pax/ day)	PPHPD
2020	Malolos-Tutuban	402,000	12,990
2025	Malolos-Tutuban	469,000	15,110
2030	Malolos-Tutuban	671,000	21,590
2040	Malolos-Tutuban	712,000	20,440

Source: JICA Study Team

Table 9.3.2 and Table 9.3.3 shows updated the operation and impact indicators and the estimated impact of project on network improvement.

Table 9.3.2 Operation and Impact Indicators (test case)

Indicators	Without Project(2025)		With Project(2025)	
	Road	Rail	Road	Rail
Passenger Kms (000 passenger kms/day)	162,364	-	158,325	4,913
No. of operating train vehicle(vehicle/day/direction)	-	-	-	142
Operating rate of traing vehicle(%)	-	-	-	82.4
Train vehicle kms (000 vehicle kms/day)	-	-	-	85.2
Travel time (Malolos-Tutuban)	102min		86min	35min20sec

Source: JICA Study Team

Table 9.3.3 Estimated Impact of Project on Network Improvement (test case)

Province	Indicators		2025								
			Without Project			With Project			Different		
			Road		Rail	Road		Rail	Road		Rail
			Private	Public		Private	Public		Private	Public	
Metro Manila	V/C		1.09		-	1.08		-	-0.01		
	% of Sections	< 10 kph	52.6		-	52.3		-	-0.2		
		< 20 kph	76.8		-	76.2		-	-0.6		
	Demand	No. of Rail Boarding (million pax)	-		3.4	-		3.7	-		0.3
		Person-kms (000)	44,412	78,115	24,331	44,023	75,653	28,107	-389	-2,462	3,776
		Person-hrs (000)	4,696	6,988	835	4,594	6,644	908	-102	-344	73
		pcu-kms (000)	34,134	8,058	-	33,931	7,775	-	-203	-283	-
		pcu-hrs (000)	3,605	745	-	3,532	706	-	-73	-39	-
Bulacan	V/C		0.70		-	0.68		-	-0.02		-
	% of Sections	< 10 kph	18.0		-	18.7		-	0.7		-
		< 20 kph	37.7		-	36.3		-	-1.4		-
	Demand	No. of Rail Boarding (million pax)	-		-	-		0.1	-		0.1
		Person-kms (000)	11,382	28,456	-	10,924	27,726	895	-458	-730	895
		Person-hrs (000)	839	1,664		829	1,611	13	-11	-54	13
		pcu-kms (000)	10,358	2,427	-	10,074	2,346	-	-284	-81	-
		pcu-hrs (000)	691	147	-	683	141	-	-8	-6	-

Source: JICA Study Team

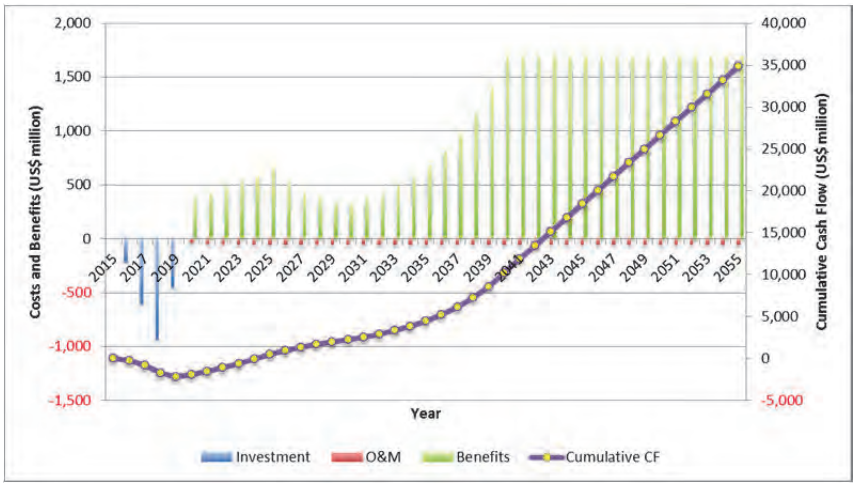
Based on updated results of demand forecast, the economic financial analysis was updated. The assumptions were explained in the previous sections. The results show the tables and figures below. EIRR, ENPV, FIRR and FNPV became 17.4%, US$ 348.5 million, 10.0% and 2,658.6 million respectively.

Table 9.3.4 Summary of Economic Benefits for Benchmark Years (test case)

(In million US dollars)

Year	VOC Savings	TTC Savings	Total
2020	321.2	60.4	381.6
2025	546.7	104.1	650.7
2030	115.3	206.5	321.8
2040	1,289.4	409.2	1,698.6

Source: JICA Study Team



Source: JICA Study Team

Figure 9.3.1 Cash Flow of the Economic Costs and Benefits (test case)

Table 9.3.5 Results of Economic Valuation (test case)

Indicator	Unit	Value
EIRR	%	17.4%
ENPV	US$ Million	348.5
B/C	-	1.23

Source: JICA Study Team

Table 9.3.6 Sensitivity Analysis of Economic Evaluation (test case)

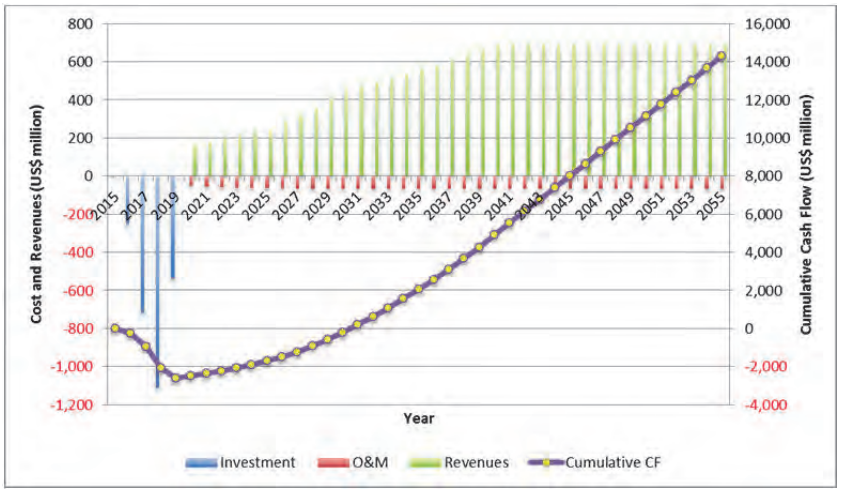
Benefits	Cost	Change in Economic Cost			
	Change	Base Case	+10%	+20%	+30%
Change in Economic Benefit (%)	Base Case	17.4%	16.3%	15.3%	14.4%
	-10%	16.2%	15.1%	14.2%	13.4%
	-20%	14.8%	13.9%	13.0%	12.2%
	-30%	13.5%	12.5%	11.7%	11.0%

Source: JICA Study Team

Table 9.3.7 Revenue Projections for Benchmark Years (test case)
(In million US dollars, constant 2014 prices)

Year	Fare Revenues	Non-Fare Revenues	Total Revenues
2020	160.3	8.0	168.3
2025	242.5	12.1	254.6
2030	431.6	21.6	453.2
2040	658.5	32.9	691.4

Source: JICA Study Team



Source: JICA Study Team

Figure 9.3.2 Cash Flow of Financial Cost and Revenue (test case)

Table 9.3.8 Results of Financial Valuation (test case)

Indicator	Unit	Value
FIRR	%	10.0%
FNPV	US$ Million	2,658.6
B/C	-	1.89

Source: JICA Study Team

Table 9.3.9 Sensitivity Analysis of Financial Evaluation (test case)

Revenue	Cost	Change in Cost (%)			
	Change	-20%	-10%	Base Case	+10%
Change in Revenues (%)	+20%	13.7%	12.6%	11.6%	10.8%
	+10%	12.9%	11.8%	10.8%	10.0%
	Base Case	12.0%	10.9%	10.0%	9.2%
	-10%	11.0%	10.0%	9.1%	8.4%

Source: JICA Study Team

CHAPTER 10 KEY CONSIDERATIONS ON PROJECT OPERATION AND MAINTENANCE STRUCTURE

Taking into consideration the agreement regarding usage of PNR's ROW, current situation of the railway project agencies and proposal of PMO as the new project implementation entity, O&M body etc., described in previous chapter, the key considerations and factors for success of NSCR project are summarized as follows.

10.1 Agreement with Philippine Government

10.1.1 Usage of PNR's ROW for NSCR

Principle of route selection of NSCR was determined through comparison among 4 routes during the pre-F/S of the Clark Airport Express Railway in 2012. It was recommended to follow ROW acquired by the Northrail Project. This route plan was agreed and finalized in the Technical Working Group (TWG) meeting and Joint Coordination Committee (JCC).

During the Loan Appraisal Mission, JICA and DOTC confirmed that the proposal alignment will follow the ROW that has been acquired for the Northrail Project for the 32.1 km length between Malolos City and Samson Road, and the existing ROW of the PNR for the 5.7 km length between Samson Road and Recto Avenue.

Both sides also confirmed that the location of the Depot shall be Valenzuela, considering the required space for the Depot and the read availability of the land in that area.

10.1.2 Segment 10(from Samson Road, Caloocan City to Governor Pascual Avenue, Malabon City)

Memorandum of Understanding is signed by the representatives of DPWH, PNR, NLRC and DOTC on September, 2015. Terms and condition of proceeding the mobilization and construction of the Segment 10 were agreed in the Memorandum of Understanding. Moreover, DOTC sent the letter to NLRC which mentioned further inspection by DOTC and/or NLRC is necessary prior to the start of actual construction of permanent structures. As of November 2, 2015, as-build drawing of segment 10 isn't submitted to DOTC. To avoid any delay and/or obstruction of design and construction of NSCR, close coordination with relevant agency is recommended.

10.1.3 Project Implementation Structure

During the implementation of the project, PMO shall be created as the organization to be in charge of the actual project implementation and liaison with the Consultant, Contractor and other concerned stakeholders. As the formal establishment of PMO would take time, NLRC shall be assigned as an interim PMO within the authority of DOTC.

The DOTC explained to JICA during the Loan Appraisal Mission, the Northrail is assigned as the Project Management Unit (PMU) which shall contributes key members to the PMO to be established within the DOTC pursuant to the Special Order 2015-069 dated May 4, 2015.

10.1.4 Operation and Maintenance Structure

The financial condition of PNR informs us that it is not capable of sustainable operating and maintaining of the NSCR. Moreover due to differences of technologies between PNR and NSCR, it is recommended to outsource O&M to an experienced commuter railway operator. The Government of the Philippines promotes active involvement of private sector in the O&M of infrastructure projects and that this policy

could guide decisions on the O&M structure of the NSCR. The DOTC explained to JICA and both sides confirmed that this policy during the Loan Appraisal Mission.

Therefore it shall be considered to organize the O&M support team in GC consultants and shall involve the procurement of O&M concessionaire, and to provide support or advice, if necessary, regarding whole O&M activities to secure sufficiency of the commuter railway operation.

10.2 South line of North-South Railway Project

The proposed NSRP South Line covers Metro Manila to Legazpi City, plus a number of existing and proposed branch lines totaling to approximately 653 km. It consists of commuter railway operations between Tutuban and Calamba and long haul railway operations between Tutuban and Legazpi, including extended long haul rail operations on the branch line between Calamba and Batangas and extension between Legazpi and Matnog.

During the Loan Appraisal Mission, JICA and DOTC confirmed that NSRP will connect to NSCR near the Solis station to secure the seamless operation of both line. On the other hand, according to current discussion among relevant agencies, such as DOTC, ADB, DBP and PPPC, NSRP will directly connect to Tutuban. As of November 2, 2015, any configuration of alignment of NSRP isn't agreed. To avoid any delay and/or obstruction of design and construction of NSCR, close coordination with relevant agency is recommended.

10.3 Key Factor for Early Project Commitment

PMO shall be responsible for implementation of the project package which will be commenced prior to the mainline construction. In order to ensure sufficient and timely financial and human resources, both technical and financial requirement shall be clarified. Furthermore, technical specifications, design and bill of quantities, procurement plan, construction plan, quality control plan etc. shall be established and reviewed carefully.

A comprehensive plan for post construction activities shall be in place, and its responsibilities shall be clearly defined between implementation, management and other related units. Such activities of monitoring of various economic benefit and environmental impact at the post construction stage shall be in compliance with efficiency, usability accessibility, punctually, security and cost efficiency.

The plan to collect information, exam, analyze and evaluate, including resources for such activities shall be established in time prior to the planning stage of the project.

All plans mentioned above shall be reviewed not only on a regular basis of the project management strategy to ensure reliability of quality and efficiency of the project, but also timely budget allocation.

Public relation is one of the most important elements to successfully launch a large infrastructure project such as NSCR. A comprehensive plan shall be developed to promote understanding of the project to the public, sufficient resources allocated to conduct such activities shall also be a key factor of success of NSCR project.

Public relation strategy including introduction of the overall project information, for example, benefit, procedure and timelines shall be considered with various material through various media.

10.4 Human Resource and Capacity Building

First of all, it is necessary to analyze the capability of current staff of the implementing agency. It is necessary to secure sufficient number of technicians and staff available to provide, as mentioned in the previous chapter, implementation organizations and plans. In order to ensure a sufficient number of project staff are in place, detailed plan in timeline shall be set on each stage of the project as well as the clarification of critical paths.

When new technology, method or protocol will be introduced to NSCR project, it shall be reviewed and evaluated by its efficiency from both technical adequacy and cost- effectiveness. Expert team for technical support on each stage of the project such as design, tender, construction and operation, shall be established to define issues and problems, then to introduce countermeasure at an earlier stage.

Furthermore, it is necessary to consider association with foreign contractor and/or operator for the purpose of training of personnel of LRC at all levels. Training of personnel is in order to develop in-house capacity to conduct implementation and operation includes training of in-house trainers. Such decision mentioned above will be the subject to make consensus LRC.