Republic of the Philippines
Department of Public Works and Highways (DPWH)

PROJECT FOR MASTERPLAN ON HIGH STANDARD HIGHWAY NETWORK DEVELOPMENT (PHASE 2)

FINAL REPORT

EXECUTIVE SUMMARY

JULY 2021

Japan International Cooperation Agency (JICA)

CTI Engineering International Co., Ltd.
Nippon Koei Co., Ltd.
Oriental Consultants Global Co., Ltd.
Nippon Engineering Consultants Co., Ltd.
Metropolitan Expressway Company Limited

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JR
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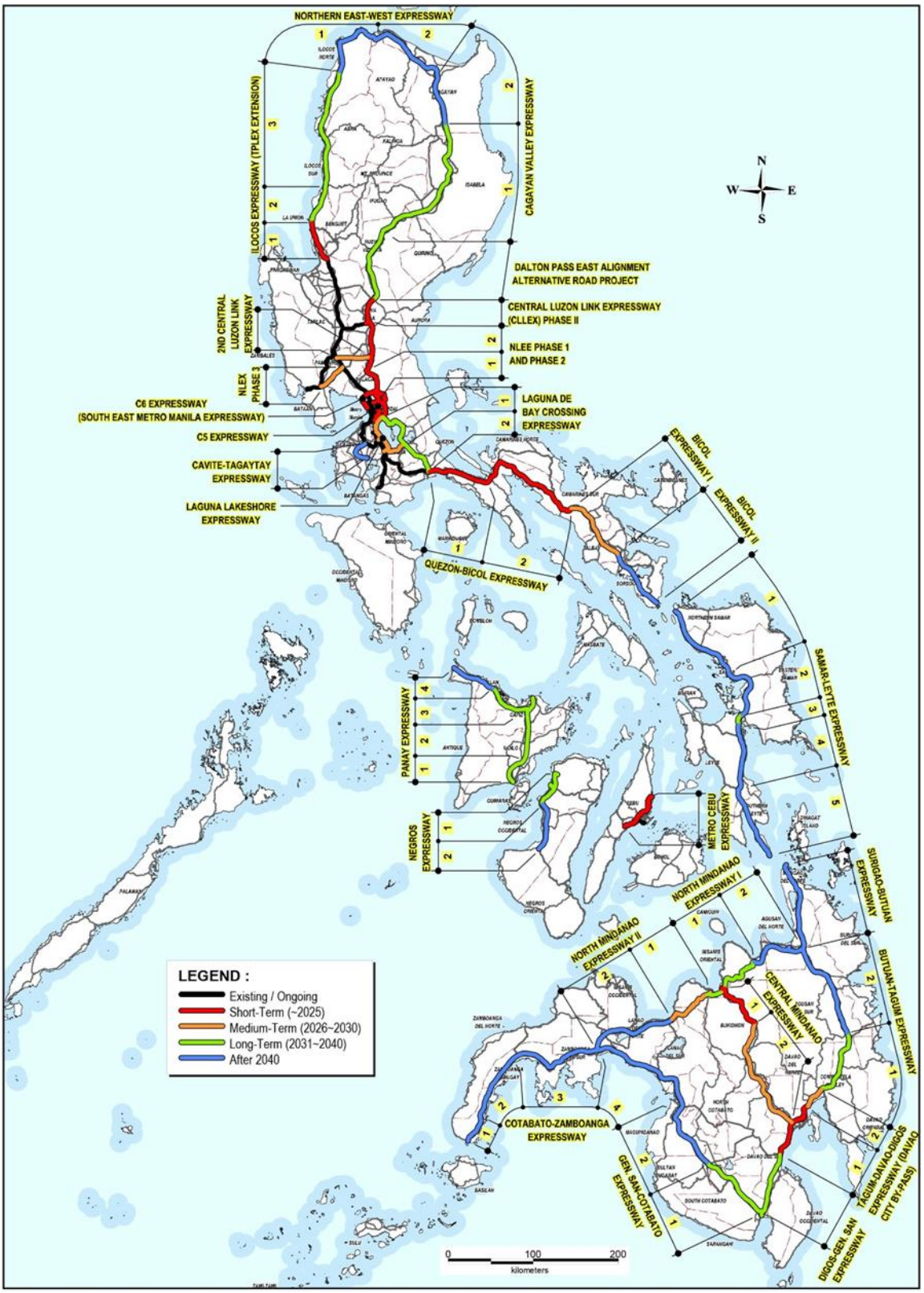
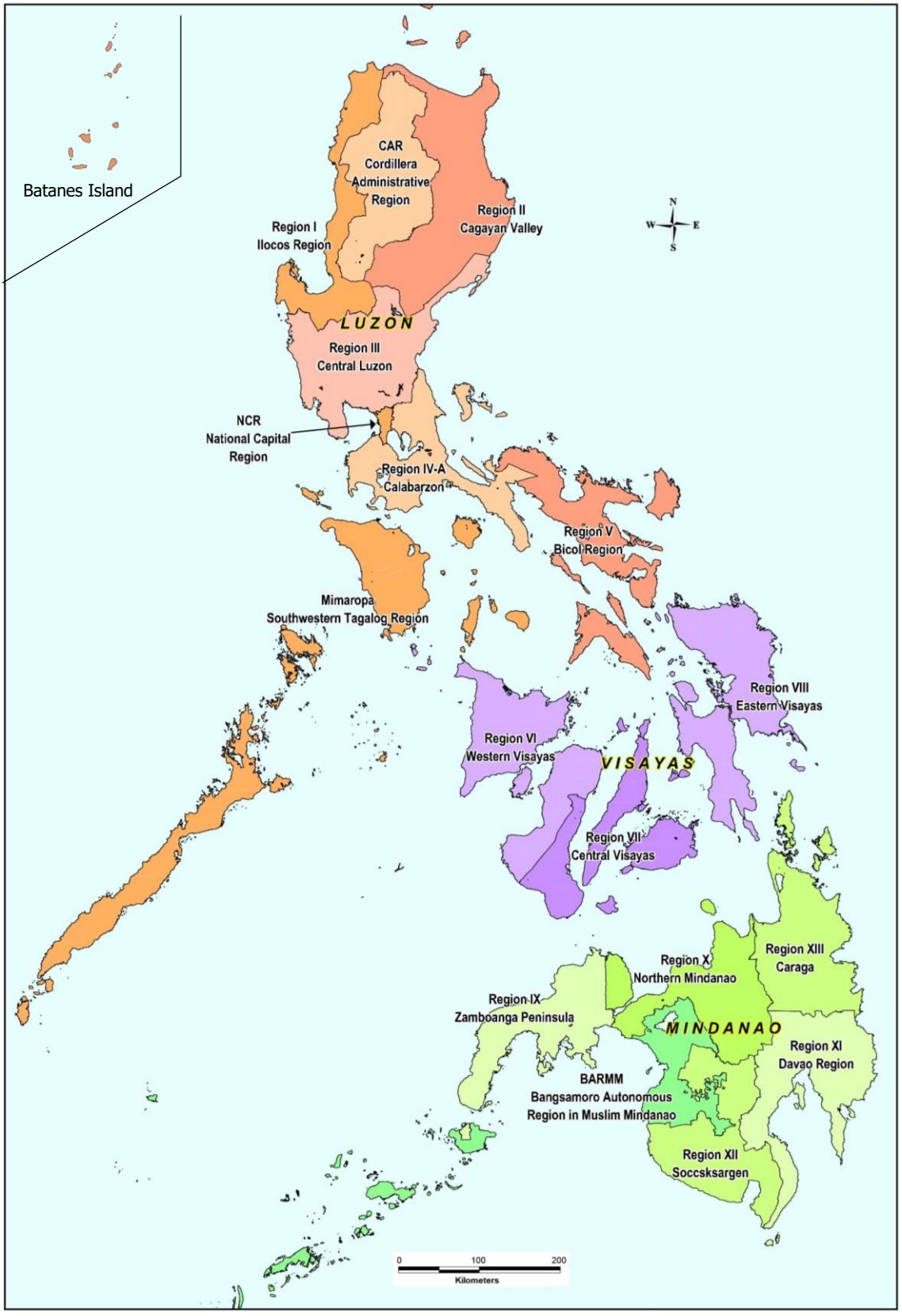
EXCHANGE RATE

March 2020
1Php = 2.1138 Japan Yen
1US$ = 51.0440 Philippine Peso
1US$ = 107.8283 Japan Yen

Central Bank of the Philippine



HSH Network and Implementation Schedule



Region Border

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PART-F PRE-FEASIBILITY STUDY

ACRONYMS AND ABBREVIATIONS

AADT	:	Annual Average Daily Traffic
AASHTO	:	American Association of State Highway and Transportation Officials
AGR	:	Annual Growth Rate
BARMM	:	Bangsamoro Autonomous Region in Muslim Mindanao
BIMP-EAGA	:	Brunei Darussalam-Indonesia-Malaysia-Philippines East ASEAN Growth Area
BOT	:	Build-Operate-and-Transfer
CADT	:	Certificate of Ancestral Domain Title
CALAX	:	Cavite-Laguna Expressway
CAR	:	Cordillera Administrative Region
CAVITEX	:	Manila-Cavite Expressway
CCLEX	:	Cebu-Cordova Link Expressway
CCR	:	Cebu Circumferential Road
CDO	:	Cagayan de Oro
CLLEX	:	Central Luzon Link Expressway
CMH	:	Central Mindanao Highway
CTBEX	:	Cavite-Tagaytay-Batangas Expressway
DAO	:	DENR Administrative Order
DBM	:	Department of Budget and Management
DMM	:	Deep Mixing Method
DOF	:	Department of Finance
DOTr	:	Department of Transportation
DPWH	:	Department of Public Works and Highways
DRRM	:	Disaster Risk Reduction and Management
ECA	:	Environmentally Critical Areas
EIRR	:	Economic Internal Rate of Return
ENPV	:	Economic Net Present Value
FGD	:	Focus Group Discussion
F/S	:	Feasibility Study
GCR	:	Greater Capital Region
GDP	:	Gross Domestic Product
GOJ	:	Government of Japan
GRDP	:	Gross Regional Domestic Product
GRP	:	Government of the Republic of the Philippines
GVA	:	Gross Value Added
HSH	:	High Standard Highway
ICC	:	Investment Coordination Committee
ICT	:	Information and Communications Technology
IM4Davao	:	Davao City Infrastructure Development Plan and Capacity Building Project
JICA	:	Japan International Cooperation Agency
JST	:	JICA Study Team
JV	:	Joint Venture
KII	:	Key Informant Interview
LGU	:	Local Government Unit
LRT	:	Light Rail Transit

LSDF	:	Luzon Spatial Development Framework
MC	:	Metropolitan Center
MCX	:	Muntinlupa-Cavite Expressway
MCTEX	:	Manila-Cavite Toll Expressway
MIMAROPA	:	Mindoro-Marinduque-Romblon-Palawan (Region IV-B)
MinDA	:	Mindanao Development Authority
MMDA	:	Metro Manila Development Authority
MQX	:	Manila-Quezon Expressway
MRT	:	Metro Rail Transit
MSS/DF	:	Mindanao Spatial Strategy/ Development Framework
NAIA	:	Ninoy Aquino International Airport
NAIAX	:	NAIA Expressway
NCIP	:	National Commission on Indigenous People
NCR	:	National Capital Region
NEDA	:	National Economic and Development Authority
NGO	:	Non-Governmental Organization
NLEE	:	North Luzon East Expressway
NLEX	:	North Luzon Expressway
NLUC	:	National Land Use Committee
NPR	:	National Primary Road
NSS	:	National Spatial Strategy
O&M	:	Operation and Maintenance
OD	:	Origin-Destination
OSG	:	Office of the Solicitor General
PC	:	Portland Cement
PCB	:	Palawan Micro-continental Block
PDP	:	Philippine Development Plan
PEISS	:	Philippine Environmental Impact Statement System
PEZA	:	Philippine Economic Zone Authority
PFZ	:	Philippine Fault Zone
PHIVOLCS	:	Philippine Institute of Volcanology and Seismology
PIRR	:	Project Internal Ratio of Return
PMB	:	Philippine Mobile Belt
PPP	:	Public-Private Partnership
PPPC	:	Public-Private Partnership Center
PVD	:	Pre-fabricated Vertical Drain
QBEX	:	Quezon–Bicol Expressway
RC	:	Regional Center
RDP	:	Regional Development Plan
ROW	:	Right-of-Way
SCTEX	:	Subic-Clark-Tarlac Expressway
SEA	:	Strategic Environmental Assessment
SEZ	:	Special Economic Zone
SHM	:	Stakeholder Meeting
SLEX	:	South Luzon Expressway
SMC	:	San Miguel Corporation
SMMSP	:	South Metro Manila Skyway Project

SOCCSKSARGEN	:	South Cotabato, Cotabato, Sultan Kudarat, Sarangani, and General Santos City, or Region XII
SPC	:	Special Purpose Company
SRC	:	Sub-Regional Center
STAR	:	Southern Tagalog Arterial Road
TEU	:	Twenty-Foot Equivalent Unit
TPLEX	:	Tarlac-Pangasinan-La Union Expressway
TRB	:	Toll Regulatory Board
UPMO	:	Unified Project Management Office
USD	:	United States Dollar
VGF	:	Viability Gap Funding
VSDF	:	Visayas Spatial Development Framework
WACC	:	Weighted Average Cost of Capital
WB	:	World Bank

PART A - GENERAL

1 INTRODUCTION

1.1 Background

- Chronic traffic congestion in large cities and urbanized areas is a serious problem in the Philippines.
- The weak connection between the centers of economic activities, including Metro Manila and provincial cities, has been an obstacle to the economic development of rural areas and a cause of the increasing disparity between urban and rural areas.
- A strategic improvement of roads and transport networks in the urban areas and a nationwide network of HSH should be planned and developed in the Philippines.
- In 2010, JICA assisted DPWH in preparing "The Study of Master Plan on HSH Network Development (HSH Phase 1)". The Study had three target areas: the areas within the 200-km radius from Metro Manila, Metro Cebu and Metro Davao.
- However, the HSH Phase 1 network development focused mainly in Metro Manila and its suburbs, and the Government of the Republic of the Philippines (GRP) has no nationwide HSH network development plan yet.
- Recognizing the importance of the improvement of access to rural areas as an important issue to be addressed in the country, the GRP requested the Government of Japan (GOJ) to implement "The Study of Master Plan on High Standard Highway Network Development in the Republic of the Philippines (HSH Phase 2)" as a follow-through study of HSH Phase 1.

1.2 Objectives of the Study

The objectives of the Study are as follows:

1) Define and clarify overall HSH network focusing on nationwide expressway network.
2) Identify HSH Priority Projects with implementation program of up to 2040.

1.3 Study Area

The Study Area covers the major transport corridors nationwide.

1.4 Scope of the Study

The Study consists of the following main activities: Figure 1-1 shows the Study Procedure.

(1) Present and future socio-economic conditions

- General profile of the Philippines
- Regional development plan and urban development plan of mega city areas
- Future socio-economic framework

(2) Present and future traffic demand

- Present traffic condition
- Traffic demand forecast

(3) Assessment of present road

- Present and future national road and expressway networks and other transport facilities
- Assessment of present road networks
- Institutional system and PPP

(4) HSH development masterplan formulation

- Definitions of HSH and identification criteria of HSH corridors
- HSH network development
- Proposed HSH development master plan
- Strategic environmental assessment (sea)

(5) Pre-feasibility study

- Selection of the projects for pre-feasibility study
- Central Mindanao highway (Cagayan de Oro – Malaybalay)
- Cebu circumferential road
- Second San Juanico bridge
- Agusan del Norte – Butuan City logistical highway

(6) Development scheme and recommendations

- Development scheme of high standard highway
- Recommendations

1.5 Study Flow

The procedure for developing HSH road network master plan is shown in this section. After evaluating the current road/road networks and understanding the regional development plans, definition and purpose of HSH roads are established. Then, extract routes based on the requirements for high-standard roads, and “Super-long-term road network concept” was formulated.

Since all the route extensions included in this concept cannot be achieved until the target year 2040, hence, the 2040 HSH Class-1 Network HSH Development Master Plan with target year up to 2040 (“Basic High Standard Highway Road Network”) was formulated considering future traffic volume and possible investment amount forecast.

Based on the "project priority criteria" and "possible investment amount forecast", short - medium - long term "HSH road master plan" was formulated.

In addition, four projects were selected to undergo the conduct of Pre-Feasibility Study considering their technical difficulty, urgency, and priority. Technology transfer of assessment and planning methods were also conducted.

1.6 Final Report Organization

The draft final report is organized as follows:

- Executive Summary
- Main Text
- Appendix

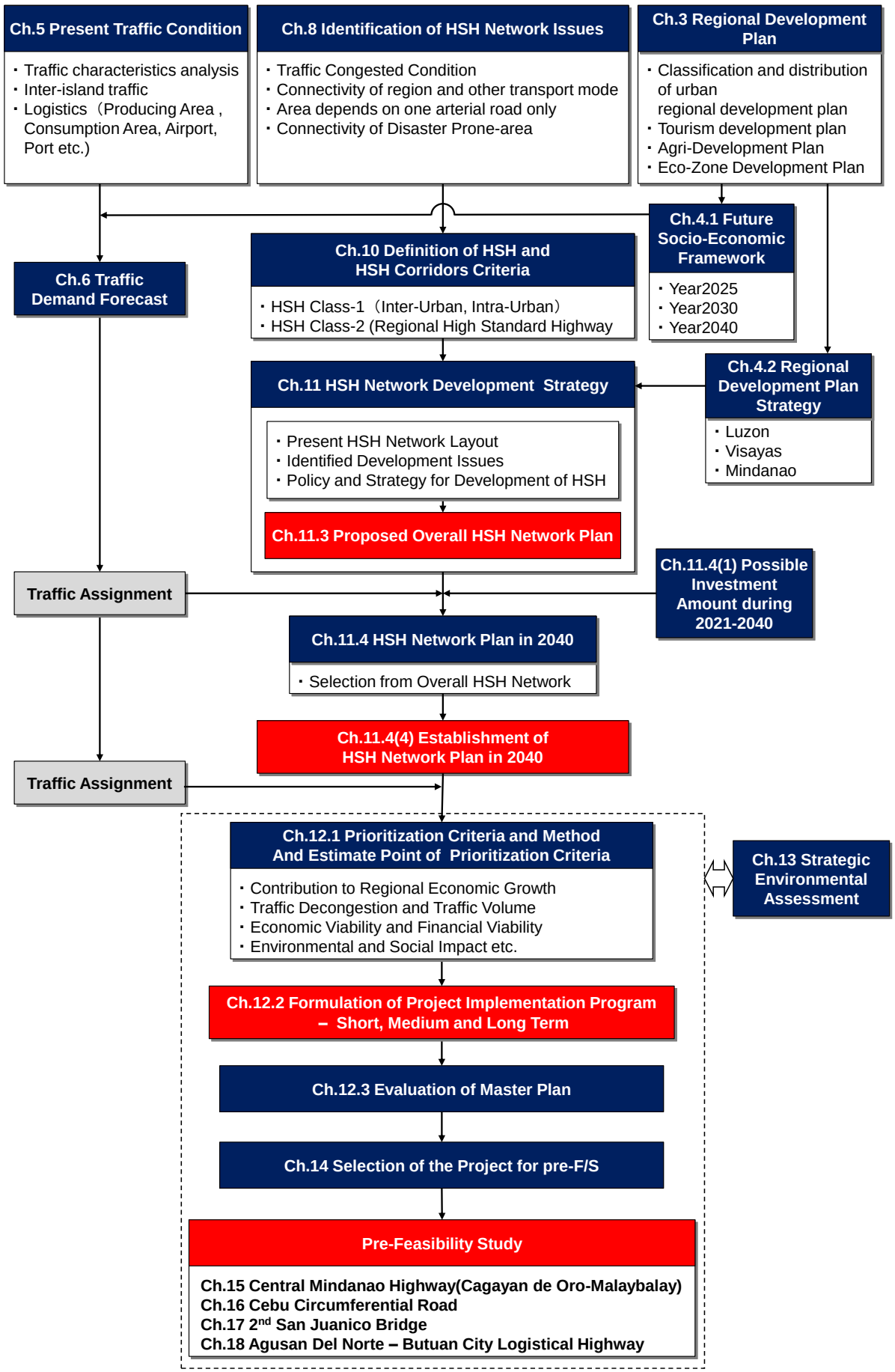


Figure 1-1 Project Procedure

PART B – PRESENT AND FUTURE SOCIO-ECONOMIC CONDITIONS

2 GENERAL PROFILE OF THE PHILIPPINES

2.1 Physical Profile

(1) Geology

The Philippines is an archipelagic country (located in latitude 5° to 19°45' North and longitude 116° to 128° East) in the Southeast Asia comprising of 7,641 islands with a total land area of 298,170 km^2. It is located in a tectonically active region with a center subject to the large strike-slip Philippine Fault Zone (PFZ). It is divided into three major island groups: Luzon, Visayas, and Mindanao. There are two tectonostratigraphic terranes: (1) the Philippine Mobile Belt (PMB) and (2) the Palawan Micro-continental Block (PCB) which is based on the seismicity and volcanism.

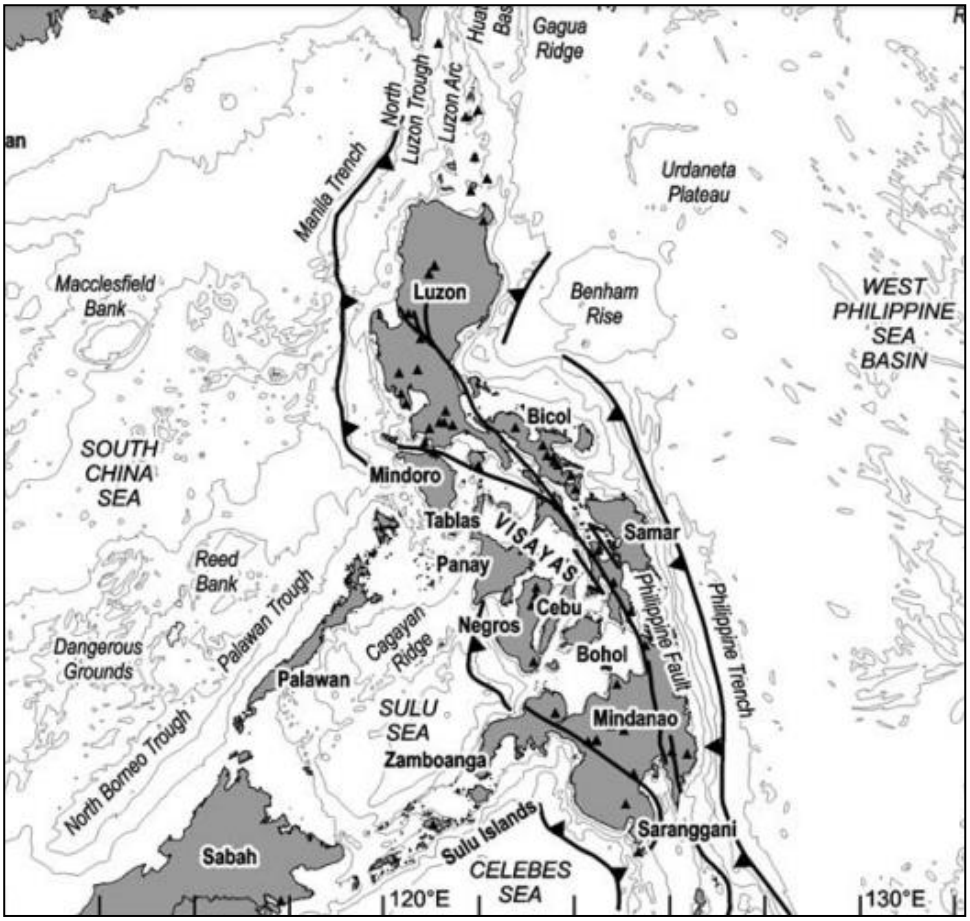
(2) Potential Earthquake Generators

The Philippines, located at the "Pacific Ring of Fire", has many potential earthquake generators that are distributed all over the country. Generators of tectonic and volcanic earthquakes are shown in the Figures below. At present, PHIVOLCS has identified twenty-four (24) active volcanoes which are potential earthquake generators.

(3) Climate

The climate in the Philippines is tropical and maritime, characterized by relatively high temperature, high humidity, and abundant rainfall.

Based on the temperature and rainfall data, the climate in the archipelago can be divided into two (2) seasons: (1) the rainy season – from June to December, and (2) the dry season – from December to May. The dry season may be subdivided further into (a) the cool dry season – from December to February; and (b) the hot dry season – from March to May.



Source: Source: Hall, 2001

Figure 2-1 Tectonic Map of the Philippines

Source: PAGASA

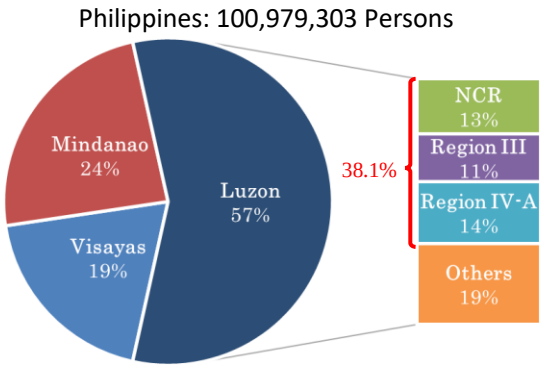
Type I	Two pronounced season: Dry - November to April Wet - the rest of the year, maximum rain period is from June to September.
Type II	No dry season. There is not a single dry month. Maximum rain period - December to February Minimum monthly rainfall - March to May.
Type III	No very pronounced maximum rain period. Dry season - either during the period from December to February or from March to May, resembles Type I as it has short dry season.
Type IV	Rainfall is evenly distributed, resembles Type II.

Figure 2-2 Climate Map of the Philippines

2.2 Socio-economic Profile

(1) Demographic Trend

- Population of the Philippines reached 101 million in 2015. Population density increased from 308 persons/sq. km. in 2010 to 337 persons/sq. km. in 2015.
- Although Metro Manila is still the high populated area, population in Region III and IV-A recently have recorded high growth rates; and Region IV-A became the highest populated among all the regions in 2015. The combined population of the three regions account for 38.1% of the national population in 2015.

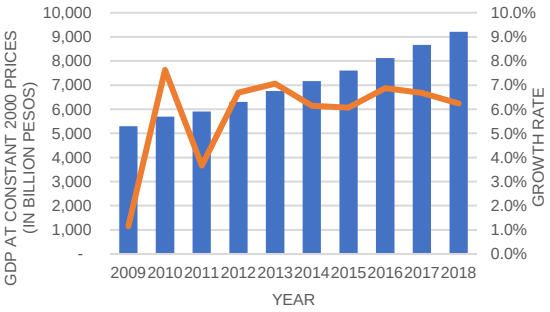


Source: PSA

Figure 2-3 Population Share 2015

(2) Economic Trend

- The Philippines recorded a high and steady economic growth from 2013 to 2018, ranging from 6.1% to 7.1% per year.
- The country's economy grew at a rate of 6.2% in 2018, slower than the 6.7% growth recorded in the previous year.

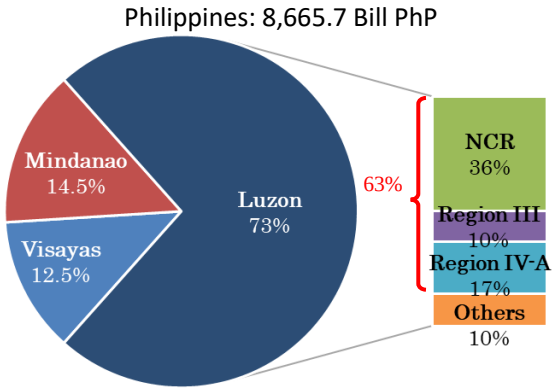


Source: PSA

Figure 2-4 Philippine GDP and GDP Growth Rate for the Past 10 years

The Gross Regional Domestic Product (GRDP) is the sum of the gross value added (GVA) of all producer units in a region. The GDP shares of the three major island groups are shown below.

- Luzon had the largest share among the three major island groups in 2018, comprising 73% of the Philippine GDP.
- NCR continued to have the greatest contribution to the country's GDP at 36.0%.
- After NCR, Region IV-A (CALABARZON) and Region III (Central Luzon) occupy the largest shares of the Philippine GDP at 17% and 10%, respectively. Overall, the three regions alone accounted for 63% of the country's economic output. The majority of the country's economic activities took place inside the Mega Manila Area.



Source: PSA

Figure 2-5 GDP Share of the Major Island Groups: 2018

3 REGIONAL DEVELOPMENT PLAN AND URBAN DEVELOPMENT PLAN OF MEGA CITY AREAS

3.1 National Development Plan

(1) Long-term Vision, *AmBisyon Natin* 2040

As Long-term Vision, four objectives and nine priority sectors are developed by NEDA and ratified through Executive Order No. 5 by President Rodrigo Duterte in October 2016. The vision targets "By 2040, the Philippines shall be a prosperous, predominantly middle-class society where no one is poor. The people will enjoy long and healthy lives, are smart and innovative, and will live in a high-trust society".

Four Objectives:

(i) Investment in human capital;

(ii) Investment in high-quality infrastructure;

(iii) Sound urban development; and

(iv) Adequate and inclusive finance.

Nine Priority Sectors identified include: 1) Housing and urban development; 2) Manufacturing; 3) Connectivity; 4) Education services; 5) Financial services; 6) Health services; 7) Tourism-related services; 8) Agricultural development; and 9) Countryside development.

(2) Philippine Development Plan (PDP) 2017-2022

The PDP 2017-2022 was formulated "to lay down the foundation for a more inclusive growth, a high trust society, and a globally-competitive economy," aiming at becoming an upper middle-income country and reducing rural poverty to 20% by 2022.

The strategies for three objectives of "enhancing the social fabric," "inequality-reducing transformation", and "increasing growth" are proposed with cross-cutting strategies for national security, infrastructure development, socioeconomic resiliency, and ecological integrity. Infrastructure investment of minimum 5% of GDP is set as a target. PDP is developed by NEDA and approved by the NEDA Board led by the President. Similar regional development plan preparation was facilitated by NEDA Regional Office at each region and approved by the respective Regional Development Councils.

(3) National Spatial Strategy (NSS)

The PDP proposed the NSS in order to decongest NCR and encourage growth of urban centers and to form a linked urban cluster for mitigation of spatial and socioeconomic disparity, by taking advantage of agglomeration. Three strategies, "concentration (regional agglomeration)," "connectivity," and "reduction of vulnerability," are adopted. Under the "concentration" strategy, a network of settlement or hierarchy consisting of (1) metropolitan centers, (2) regional centers, and (3) sub-regional centers is proposed.

Principles of National Spatial Strategy:

- Integration of leading and lagging areas and urban-rural linkages through transportation networks
- Improvement of access to social services
- Identification of locations of major infrastructure to maximize their benefits
- Improvement of local, national, and international connectivity
- Promotion of sustainable development and resiliency

3.2 National and Regional Physical Development Framework

Similar to the PDP and RDP, National and Regional Physical Development Framework are developed by NEDA. NFPP was approved by National Land Use Committee (NLUC) structured under NEDA Board. The preparation of Regional Physical Development Framework is facilitated by NEDA Regional Office in each region and approved by the Regional Land Use Committee (RLUC), an affiliate committee of the Regional Development Council.

3.2.1 Draft National Framework for Physical Planning (NFPP) 2016-2045

NFPP was developed by NEDA in 2016.

Goal: Bring efficient settlement, production and service delivery systems and sustainable use of land and other physical resource, while attaining inclusive growth, through physical and economic integration.

Objectives:

- Guide the location of investments
- Improve the flow of people, goods and services

- Protect and conserve the environment
- Reduce disaster risk and vulnerability to natural hazards

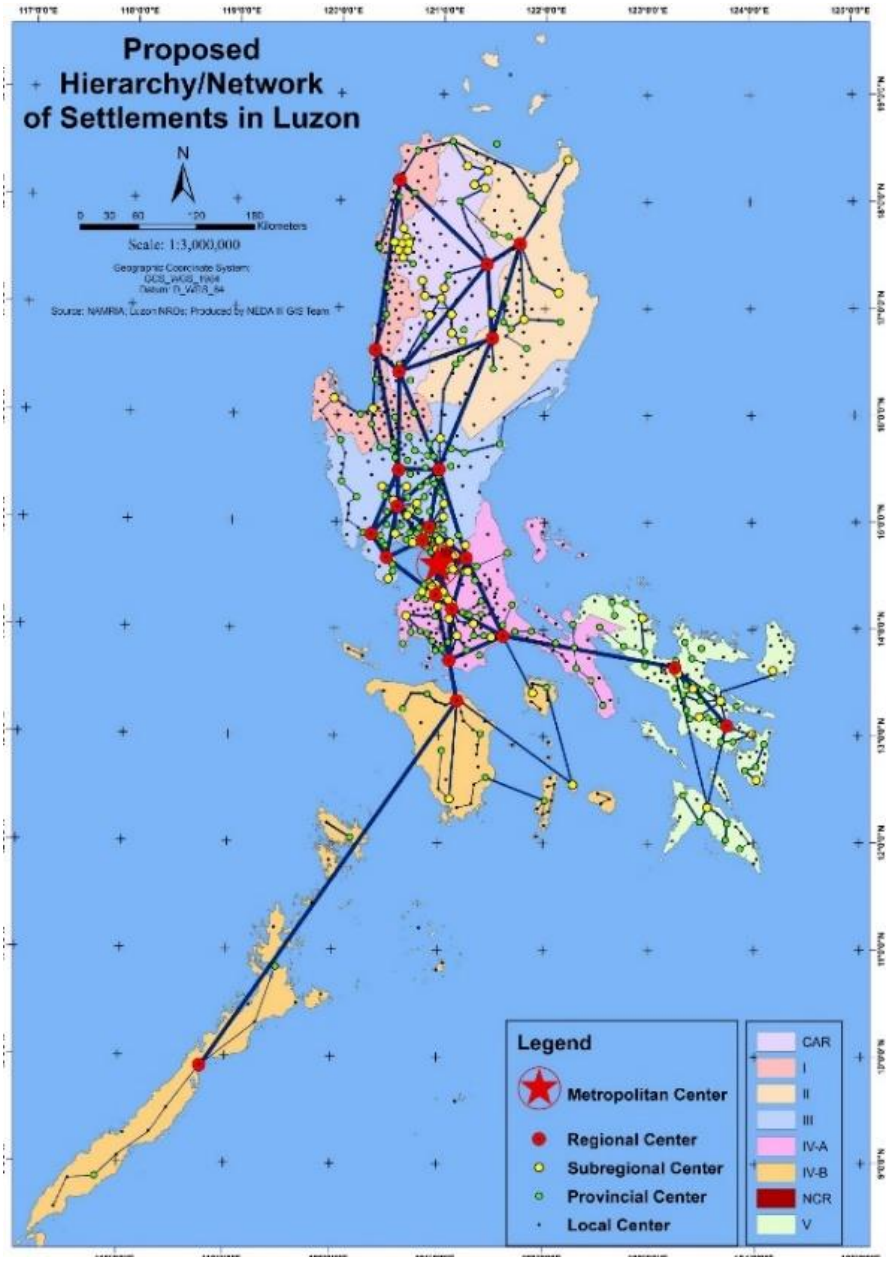
Three strategies:

- Concentration,
- Connectivity, and
- Vulnerability reduction.
- The settlement hierarchy consisting of three centers is proposed under concentration strategy.
- Metropolitan Centers (4)
  (Metro Manila, Cebu City, Davao City, Cagayan de Oro City)
- Regional Centers (37)
- Sub-Regional Centers (116)

3.2.2 Regional Physical Development Framework

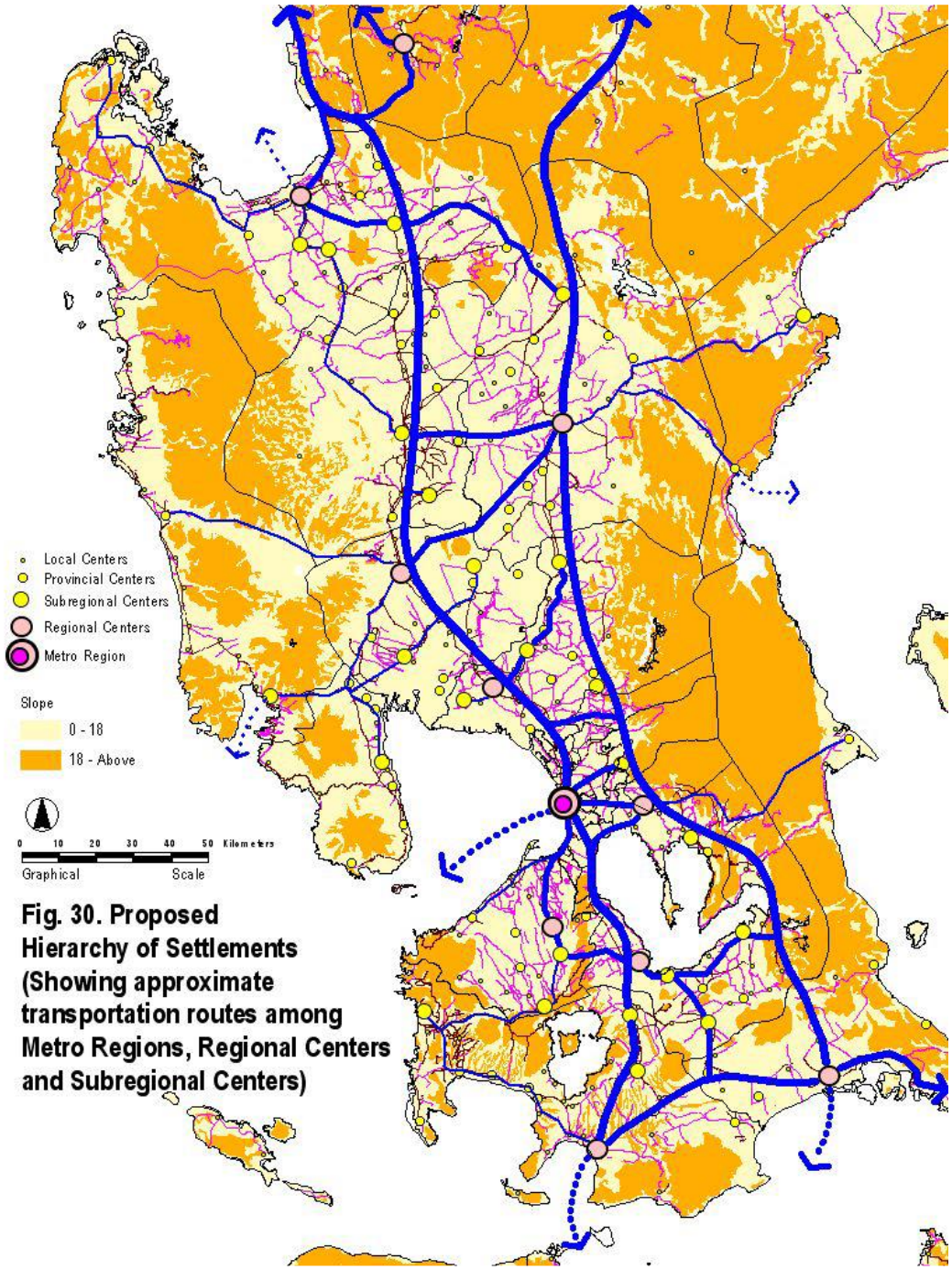
(1) Luzon Spatial Development Framework (LSDF) 2015-2045

To address issues related to sprawl of Metro Manila, encroachment of production land, inefficient land use, competition over land, and increasing disaster risk, LSDF 2015-2045 was proposed, with the strategies of concentration, connectivity and vulnerability reduction.



Source: LSDF 2015-2045.

Figure 3-1 Proposed Hierarchy/ Network of Settlements in Luzon

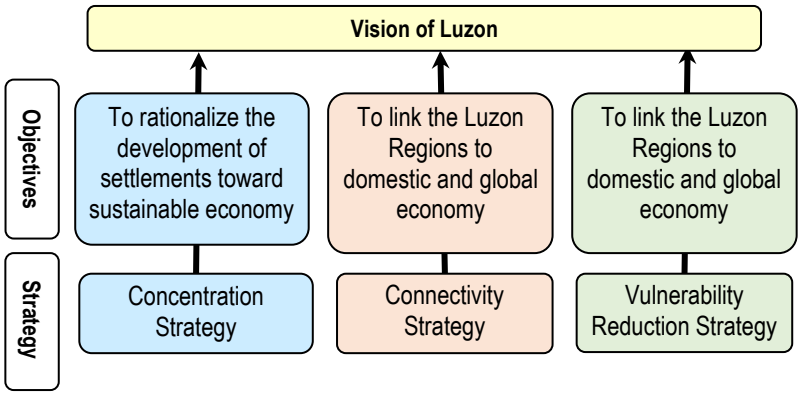


Source: LSDF 2015-2045.

Figure 3-2 Twin-Spine Spatial Structure in Metro Manila & Surrounding Regions

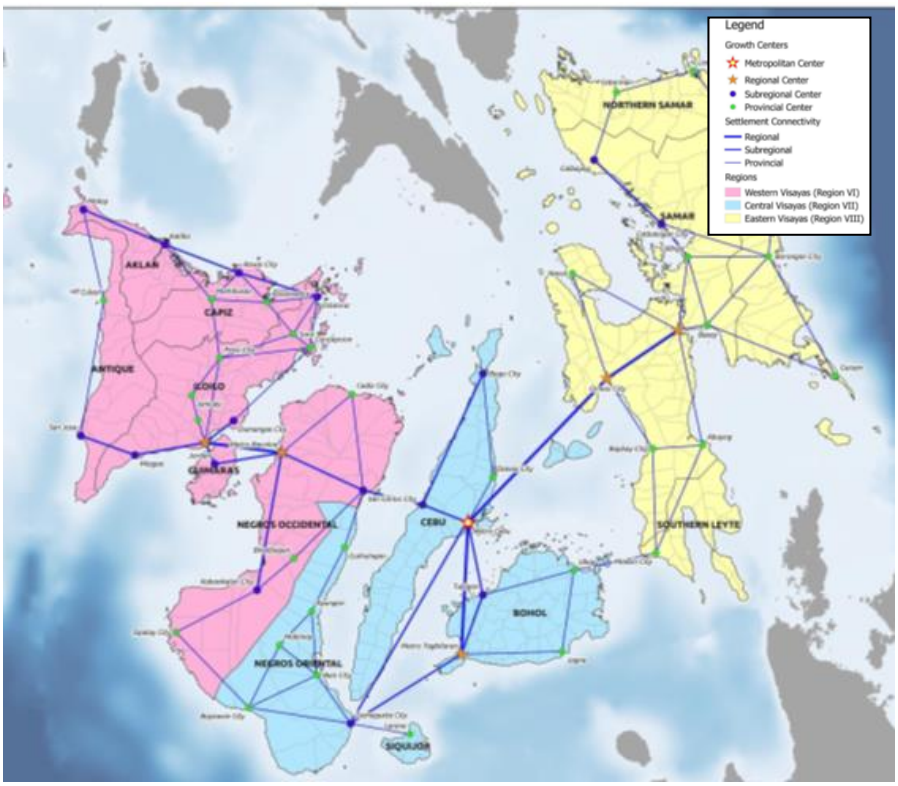
(2) Visayas Spatial Development Framework (VSDF) 2015-2045

VSDF 2015-2045 adopted the future vision of the Visayas: "a competitive, world-class economy, where its people - proud of their history, culture and heritage - live in progressive, peaceful, sustainable, and resilient communities." The objectives and strategies for concentration, connectivity, and vulnerability reduction are proposed.



Source: VSDF 2015-2045.

Figure 3-3 Development Framework for the Visayas



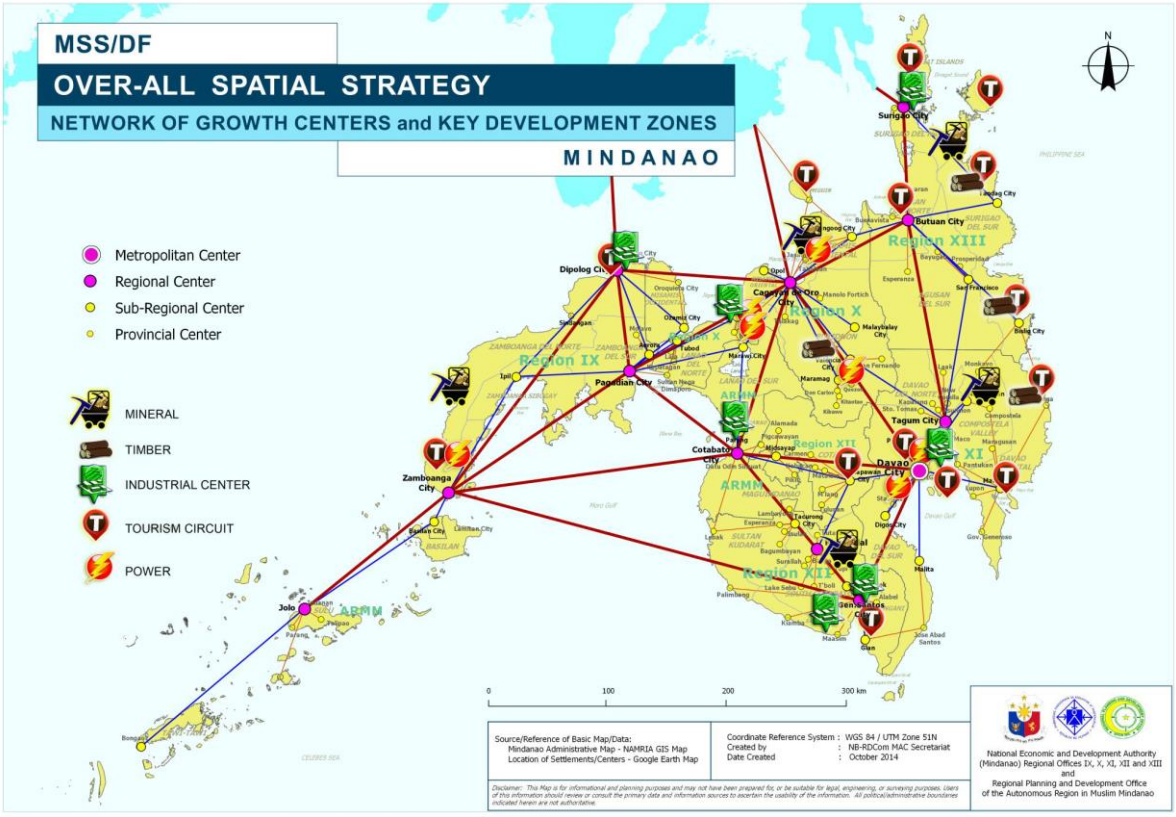
Source: VSDF 2015-2045.

Figure 3-4 Settlement Networks in Visayas

(3) Mindanao Spatial Strategy/Development Framework (MSS/DF) 2015-2045

MSS/DF 2015-2045 envisions Mindanao as "a peaceful, safe, resilient, and socially-inclusive Mindanao of diverse cultures harmoniously enjoying a sustainable and competitive agri-industrial and resource-based economy" by 2045. The development outcomes are:

- Productivity and growth of the agriculture, industry and services sectors improved and sustained;
- Access to adequate and quality basic social and infrastructure facilities and services ensured;
- Connectivity among production areas, markets and settlements enhanced;
- Disaster and climate change resiliency of communities increased;
- Integrity of the environment ensured; and
- The various peace efforts sustained.



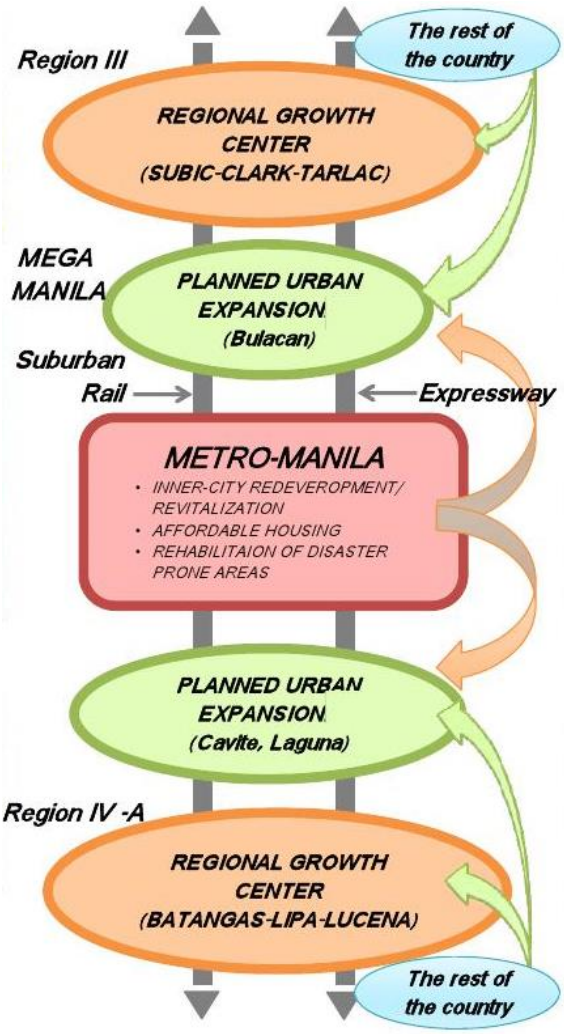
Source: MSS/DF 2015-2045.

Figure 3-5 Over-all Spatial Strategy in Mindanao

3.3 Urban Development Plan of Mega City Areas

3.3.1 Metro Manila Urban Development Plan

The Metro Manila Dream Plan (the Roadmap for Transport Infrastructure Development for Metro Manila and Its Surrounding Areas by JICA) estimated that the Greater Capital Region (GCR) (Metro Manila, Region III and Region IV-A) will grow from 23.0 million in 2015 to 29.3 million in 2030.



Source: JICA Study Team

Figure 3-6 Integrated Special Development Concept for Greater Capital Region

The Dream Plan set the vision consisting of three pillars: 1) Gate to wellspring of hope, 2) Place for livable communities, and 3) Space for dynamic business centers. It suggested the necessity for balanced development, prevention of urban sprawl, development of regional growth centers, strengthening of connectivity, and improvement of public transport services and logistics, emphasizing the importance of a polycentric spatial structure in the GCR. For the polycentric formation, the Plan suggested the necessity to promote the development of urban centers and urban clusters, including those in the north (Clark-Subic-Tarlac) and in the south (Batangas-Lipa-Lucena), and the strengthening of connectivity among these clusters by the development of north-south transport corridors.

3.3.2 Metro Cebu Urban Development Plan

The Mega Cebu Vision 2050 set the four (4) strategic pillars: 1) Competitiveness, 2) Mobility, 3) Livability and 4) Metropolitan Management, with 15 development directions.

To achieve the Vision, the JICA Study entitled "Roadmap Study for Sustainable Urban Development in Metro Cebu" proposed an overall roadmap consisting of seven sub-road maps, including a sub-roadmap for Highway Network and Public Transport. It projected the population increase to 5.0 million and per capita GRDP of more than USD20, 000 in 2050. The Roadmap Study suggested the need for economic diversification through strategic development of industry and urban service sectors.

3.3.3 Metro Davao Urban Development Plan

The JICA Study, "Davao City Infrastructure Development Plan and Capacity Building Project" (IM4Davao) proposed 4D strategies, namely: 1) Dynamic Development, 2) Distinguishable Development, 3) Diversified Development, and 4) Decentralized Development. The priority industrial sectors were set as: 1) agriculture and agro-industry, 2) ICT, 3) tourism, 4) industries for a low carbon society, and 5) transport mobility and logistics. The development of high standards infrastructure is proposed as one of the strategies under Dynamic Development.

The project adopted the population projection in "MSS/DF 2015-2045," over 3.2 million in 2045.

4 FUTURE SOCIO-ECONOMIC FRAMEWORK

4.1 Future Socio-Economic Framework

The future socio-economic framework was established for traffic demand forecast.

4.1.1 Population Projection

The future population was projected for 2020, 2030 and 2040, based on the census results, and the projections by the Philippines Statistics Authority and in the existing urban development / transport master plans. The population projection of the country is predicted from the population growth rate estimated by PSA, and the future population by region, state, and local government are estimated based on the past demographic trend and the population estimation of the existing plan, while upper-level future population was used as the control total.

The Philippine population is estimated to reach 136 million in 2040 from 109 million in 2020. The average annual growth rate will slow down from 1.70 for the period of 2010 to 2020 to 0.92% for the term of 2030 to 2040.

4.1.2 Economic Framework

The economic framework of GDP and GRDP was formulated for the planning period of 2020 to 2040. The annual GDP growth rate of 6.5% is adopted by 2040, taking account of the long-term vision, "Ambisyon Natin 2040," to become a high-income country by 2040 and a "Build, Build, Build" scenario by the current administration, as well as the estimations of economic growth by the World Bank and IMF. Assuming that the annual GDP growth of 6.5% will be maintained until 2040, GRDP were estimated using GDP as the control total. Since the growth rate of each sector and the industrial structure are different in each region, the transition of the growth rate of the regional economy is slightly different.

Table 4-1 GDP and GRDP by 2040

Region	GDP & GRDP (Billion Pesos*)				Average Annual Growth Rate		
	2018	2020	2030	2040	2018-2020	2020-2030	2030-2040
National Capital Region	3,312	3,803	7,166	13,480	7.15%	6.54%	6.52%
Cordillera Administrative Region	165	180	325	599	4.46%	6.10%	6.29%
Region I: Ilocos Region	290	329	619	1,163	6.53%	6.53%	6.51%
Region II: Cagayan Valley	154	174	311	568	6.21%	5.96%	6.21%
Region III: Central Luzon	904	1,033	2,023	3,877	6.89%	6.95%	6.72%
Region IV-A: CALABARZON	1,562	1,744	3,200	5,936	5.66%	6.26%	6.37%
Region IV-B: MIMAROPA	143	155	268	480	4.04%	5.60%	6.01%
Region V: Bicol Region	188	211	397	745	6.06%	6.51%	6.51%
Region VI: Western Visayas	373	421	795	1,496	6.29%	6.55%	6.53%
Region VII: Central Visayas	594	674	1,279	2,413	6.55%	6.61%	6.56%
Region VIII: Eastern Visayas	185	207	373	686	5.90%	6.06%	6.27%
Region IX: Zamboanga Peninsula	179	202	361	661	6.05%	6.00%	6.24%
Region X: Northern Mindanao	345	390	730	1,367	6.27%	6.47%	6.48%
Region XI: Davao Region	401	462	941	1,836	7.39%	7.36%	6.92%
Region XII: SOCCSKSARGEN	247	275	506	939	5.63%	6.27%	6.38%
Region XIII: Caraga	106	120	212	384	6.69%	5.80%	6.13%
Autonomous Region in Muslim Mindanao	59	61	98	167	2.39%	4.77%	5.49%
Philippine Grand Total	9,207	10,443	19,602	36,796	6.50%	6.50%	6.50%
Primary	746	781	1,085	1,671	2.34%	3.34%	4.41%
Secondary	3,143	3,614	7,007	13,369	7.23%	6.85%	6.67%
Tertiary	5,318	6,048	11,510	21,757	6.64%	6.65%	6.57%

*Source: GDP & GRDP Projection from 2020 to 2040: JICA Study Team. *At constant 2,000 price.*

Table 4-2 Population Projection by 2040

Region	Population	Population Projection			Average Annual Growth Rate			
	2010	2020	2030	2040	2000-2010	2010-2020	2020-2030	2030-2040
Cordillera Administrative Region (CAR)	1,616,867	1,842,565	2,038,613	2,189,215	1.71%	1.32%	1.02%	0.72%
National Capital Region (NCR)	11,855,975	13,786,827	15,214,296	16,279,264	1.79%	1.52%	0.99%	0.68%
Region I - Ilocos Region	4,748,372	5,285,245	5,713,354	6,020,961	1.23%	1.08%	0.78%	0.53%
Region II - Cagayan Valley	3,229,163	3,649,181	3,988,067	4,240,585	1.39%	1.23%	0.89%	0.62%
Region III - Central Luzon	10,137,737	12,163,997	14,063,875	15,644,646	2.14%	1.84%	1.46%	1.07%
Region IV-A - CALABARZON	12,609,803	16,014,430	18,985,599	21,468,719	3.07%	2.42%	1.72%	1.24%
Region IV-B - MIMAROPA	2,744,671	3,177,164	3,544,354	3,831,043	1.79%	1.47%	1.10%	0.78%
Region V - Bicol Region	5,420,411	6,146,613	6,741,732	7,189,582	1.47%	1.27%	0.93%	0.65%
Region VI - Western Visayas	7,102,438	8,047,103	8,975,024	9,650,497	1.35%	1.26%	1.10%	0.73%
Region VII - Central Visayas	6,800,180	8,050,667	9,261,636	10,206,516	1.77%	1.70%	1.41%	0.98%
Region VIII - Eastern Visayas	4,101,322	4,723,794	5,293,789	5,714,478	1.28%	1.42%	1.15%	0.77%
Autonomous Region in Muslim Mindanao (ARMM)	3,256,140	4,041,809	4,692,075	5,213,117	1.51%	2.19%	1.50%	1.06%
Region IX - Zamboanga Peninsula	3,407,353	3,950,870	4,514,320	4,954,455	1.87%	1.49%	1.34%	0.93%
Region X - Northern Mindanao	4,297,323	5,108,727	5,912,767	6,546,516	2.09%	1.74%	1.47%	1.02%
Region XI - Davao Region	4,468,563	5,488,911	6,486,314	7,367,409	1.88%	2.08%	1.68%	1.28%
Region XII - SOCCSKSARGEN	4,109,571	5,012,148	5,910,024	6,635,592	2.46%	2.01%	1.66%	1.16%
Region XIII - Caraga	2,429,224	2,776,477	3,117,974	3,371,492	1.53%	1.35%	1.17%	0.78%
Philippine Grand Total	92,335,113	109,266,528	124,453,813	136,524,087	1.90%	1.70%	1.31%	0.93%

Source: Population Census 2010: Population Census; and Population Projection: JICA Study Team.

4.2 Regional Development Scenario

4.2.1 Analysis of Metropolitan, Regional and Sub-regional Centers

To comprehend the specificities of the urban centers of metropolitan, regional and sub-regional centers, Principal Component Analysis and Cluster Analysis were conducted considering four analytical dimensions: 1) public administration, 2) demography, 3) industry, and 4) accessibility to logistics centers. As a result, the analysis identified five typical types of centers: metropolitan centers (MC), two types of regional centers (RC-I Strong and RC-II Weak*), and two types for sub-regional centers (SRC-I Strong and SRC-II Weak*).

*Strong: High potential in development
*Weak: Low potential in development

Table 4-3 Five Typical Types of Urban Centers

Settlement Hierarchy (Policy Categorization of Centers Classification)	Typical Types of Centers	Analytical Dimensions					
		Public Administration (Existence of Provincial Capital)	Demography		Industry (Number of SEZs)	Accessibility to Logistics Centers	
			Population Size (2015)	Annual Population Growth Rate (2010-2015)		Airport	Sea Port
Metropolitan Center (MC)	Type 1: MC	High	High	Medium	High	High	High
Regional Center (RC)	Type 2: RC-I (Strong)	High	Medium	Medium	Medium	High	Medium
	Type 3: RC-II (Weak)	Medium	Medium	Low	Low	Low	Low
Sub-regional Center (SRC)	Type 4: SRC-I (Strong)	Low	Medium	High	Medium	Medium /Low	Medium /Low
	Type 5: SRC-II (Weak)	Low	Low	Low	Low	Low	Low

Source: JICA Study Team

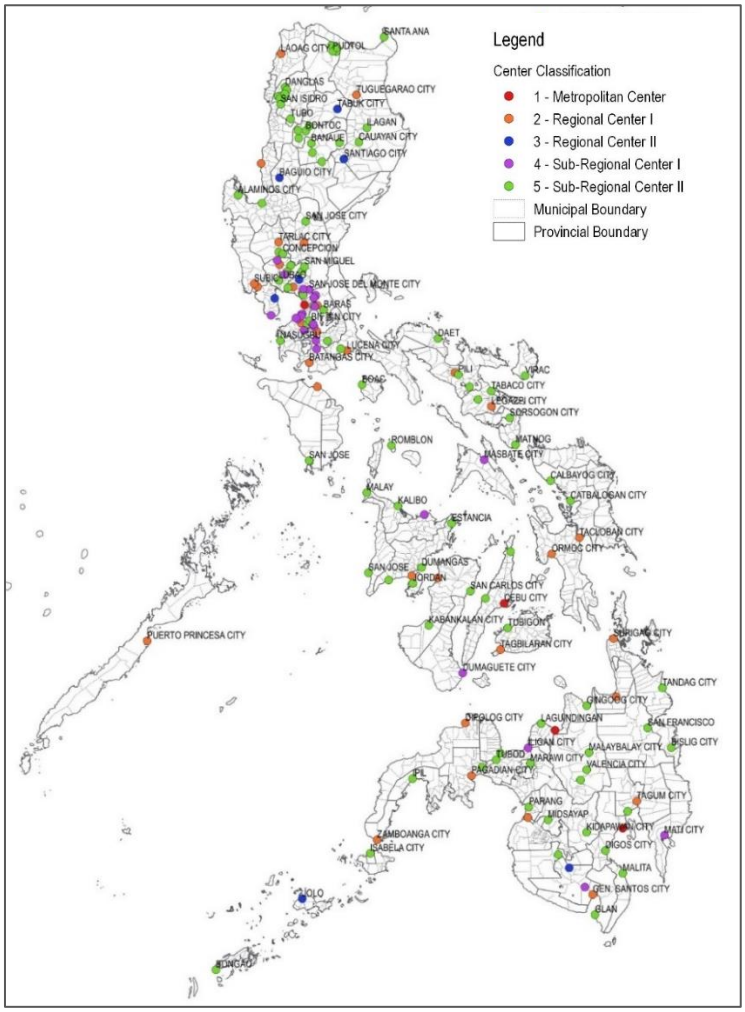
Planning Recommendations from Analysis:

- The HSH network, which follows the settlement hierarchy by the National Spatial Strategy (NSS), is crucial to promote even development.
- It is recommended to ensure connections of the weak regional centers with the HSH Class-2 in order to make these centers serve truly as regional centers for the surrounding urban clusters.
- Tabuk and Santiago in the northeastern Luzon have less transport accessibility which has resulted in their weakness of population and economic growth. Thus,
- the two-spine structure of the HSH network are recommended to extend the HSH Class-1 into the northeastern part of Luzon in parallel with the HSH Class-1 in the northwestern for promoting even development across Luzon.
- Baguio, Baliuag and Balanga City, which have the lesser extent of growth, are desirable to be connected by the HSH Class-2 for the acceleration of growth.
- The sub-regional centers with the strong growth/development potentials (RSC-I Strong) need to be integrated into the HSH network for cultivation of their potentials and spillover effects into weak sub-regional centers.
- The HSH network needs to make connections among SEZs and their accessibility from/to metropolitan and regional centers, given their great contributory potentials to population and economic growth, especially for urban clusters of the metropolitan centers.
- The existence of provincial capitals needs especial consideration since this provides political and administrative advantages beneficial for the acceleration of growth.

Table 4-4 Metropolitan Centers (MC), Strong and Weak Regional Centers (RC-I and RC-II)

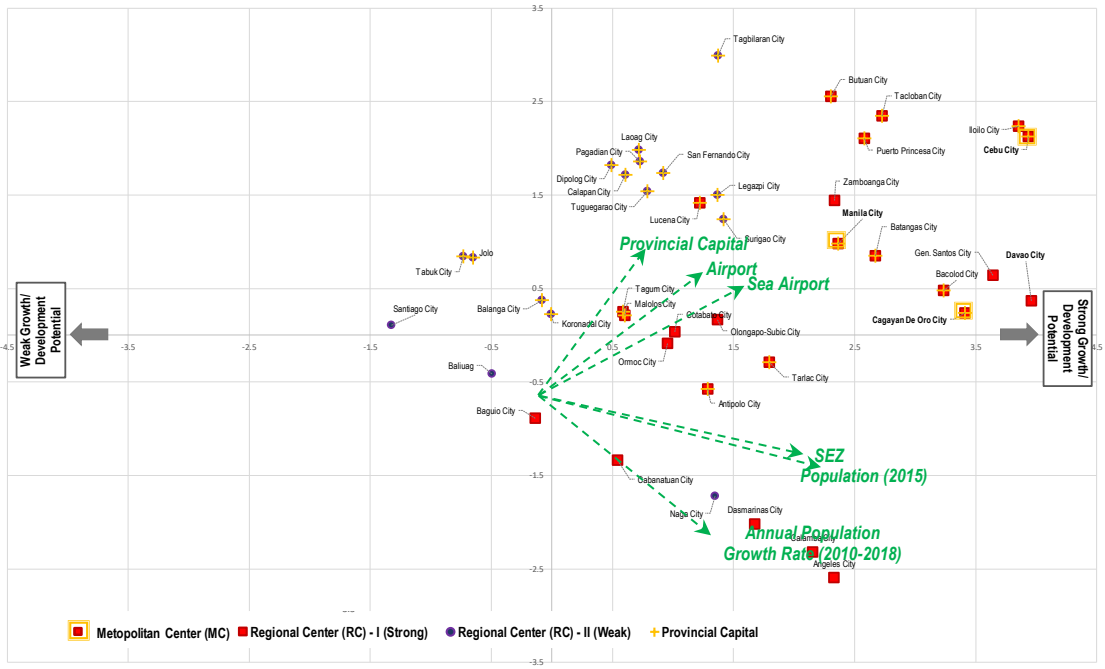
		Strong Growth/Development Potential		Weak Growth/ Development Potential
Luzon	Metropolitan Center (MC)	Metro Manila		
	Regional Center (RC)	Laoag City San Fernando City Tuguegarao City Cabanatuan City Angeles City Tarlac City Olongapo-Subic Malolos City	Batangas City Dasmarinas City Calamba City Lucena City Antipolo City Calapan City Legazpi City Naga City Puerto Princesa City	Baguio City Tabuk City Santiago City Balanga City Baliuag
	Sub-Regional Center (SRC)	Mariveles Marilao Mabalacat San Fernando City San Jose Del Monte City Santa Maria Lipa City Tanauan City Bacoor Gen.Trias	Imus Silang Tanza Binan City Cabuyao Santa Rosa City Rodriguez (Montalban) San Mateo Taytay Masbate City	
Visayas	Metropolitan Center (MC)	Metro Cebu		
	Regional Center (RC)	Iloilo City Tagbilaran City Bacolod City	Ormoc City Tacloban City	
	Sub-Regional Center (SRC)	Roxas City Dumaguete City		
Mindanao	Metropolitan Center (MC)	Metro Davao Metro Cagayan De Oro		
	Regional Center (RC)	Dipolog City Pagadian City Zamboanga City Tagum City	Cotabato City Gen. Santos City Butuan City Surigao City	Jolo Koronadal City
	Sub-Regional Center (SRC)	Iligan City Polomolok	Mati City	

Source: JICA Study Team



Source: JICA Study Team

Figure 4-1 Spatial Distribution of Typical Five Types of Centers



Source: JICA Study Team

Figure 4-2 Relative Extent of Growth/Development Potentials of Metropolitan and Regional Centers

4.2.2 Development Alternatives

(1) Spatial Development Strategies

The spatial development strategies for the formulation of HSH Master Plan are proposed:

- To achieve spatial patterns which contribute to balanced development by promoting development of urban centers as growth centers and by developing HSH networks integrating urban centers.
- To promote development of Metropolitan Centers and Regional Centers with strong potentials, by developing HSHs to form urban clusters for concentration and decongestion.
- To support development of Regional Centers where the growth of population and production is constrained and Sub-Regional Centers where rapid growth is expected and high economic potentials are found by integrating them into HSH networks.
- To invest in urban transport infrastructure and upgrade the existing networks for improved mobility and for facilitating economic activities in the Metropolitan Centers.
- To support development of SEZs, tourism potential areas, and production centers, by strengthening links with major urban centers, and logistics hubs.
- To increase disaster resilience and reduce disaster vulnerability of infrastructure and urban centers by adopting disaster risk mitigation measures and applying redundancy strategy for infrastructure.
- To achieve efficient land use by developing well-structured settlement patterns with integrated efficient connectivity networks for preservation of land for production, environmental protection, and other purposes.

(2) Alternative Scenarios for Development

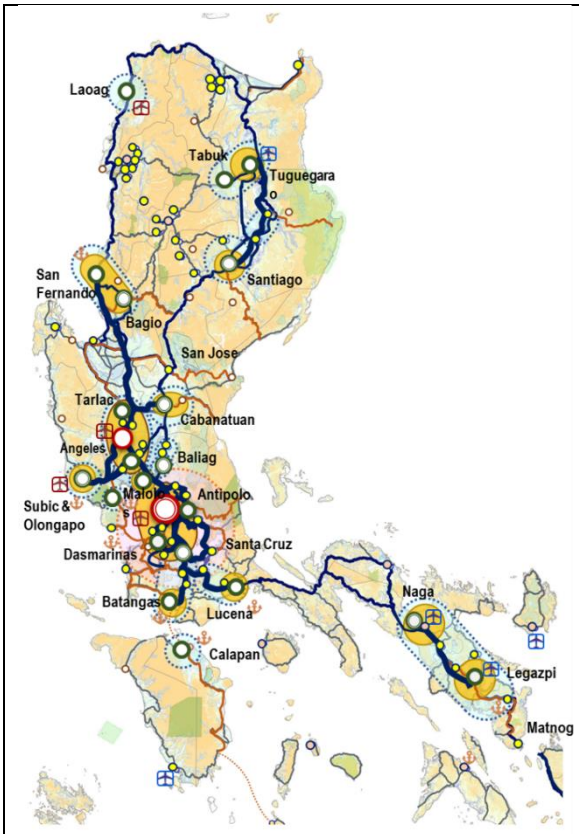
Three alternatives, Alternative A: Metropolitan-led Development Scenario; Alternative B: Decentralized Development Scenario; and Alternative C: Balanced Development Scenario were examined as development scenarios of spatial structure in 2040 for Luzon, Visayas, and Mindanao.

In order to achieve comprehensive development, regional development, and reduction of social gaps specified in the national development plan and the physical development policy, as well as to solve the problems recognized by the analysis of the city center, this master plan selected the balanced development scenario of Alternative C in the perspective of contribution to regional development, changes in physical structure, cost effectiveness, etc.

Selected Scenario: Balanced Development

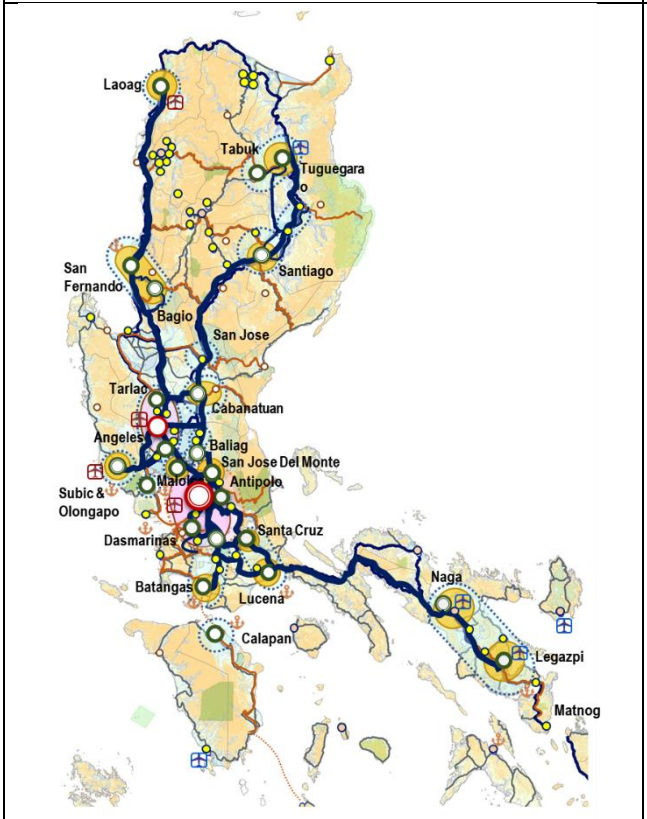
Alternative Scenario C is to promote development of metropolitan centers and regional centers in a balanced and integrated manner. This scenario acknowledges the importance of distinct roles of metropolitan centers as an economic driver and regional centers for decongestion of the metropolitans, with decentralized spatial structure. The HSH networks will be developed within the metropolitan centers and surrounding areas and connecting the metropolitan centers with regional centers, and for development of other regional / sub-regional centers.

Alternative Scenario C for Balanced Development is selected for the three island regions, with Alternative Scenario B of Twin-Spine Development Scenario for GCR as preferred scenarios. This Scenario is expected to contribute to regional development and transformation of the spatial structure to dispersed one, and also be cost effective, in terms of investment required to develop the HSH networks and regional centers.

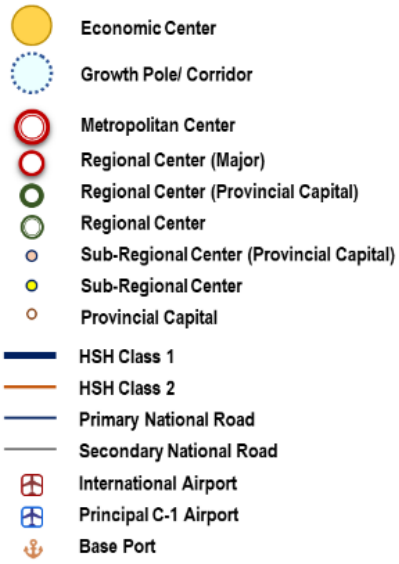


Alternative A: Metropolitan-led Development Scenario in Luzon

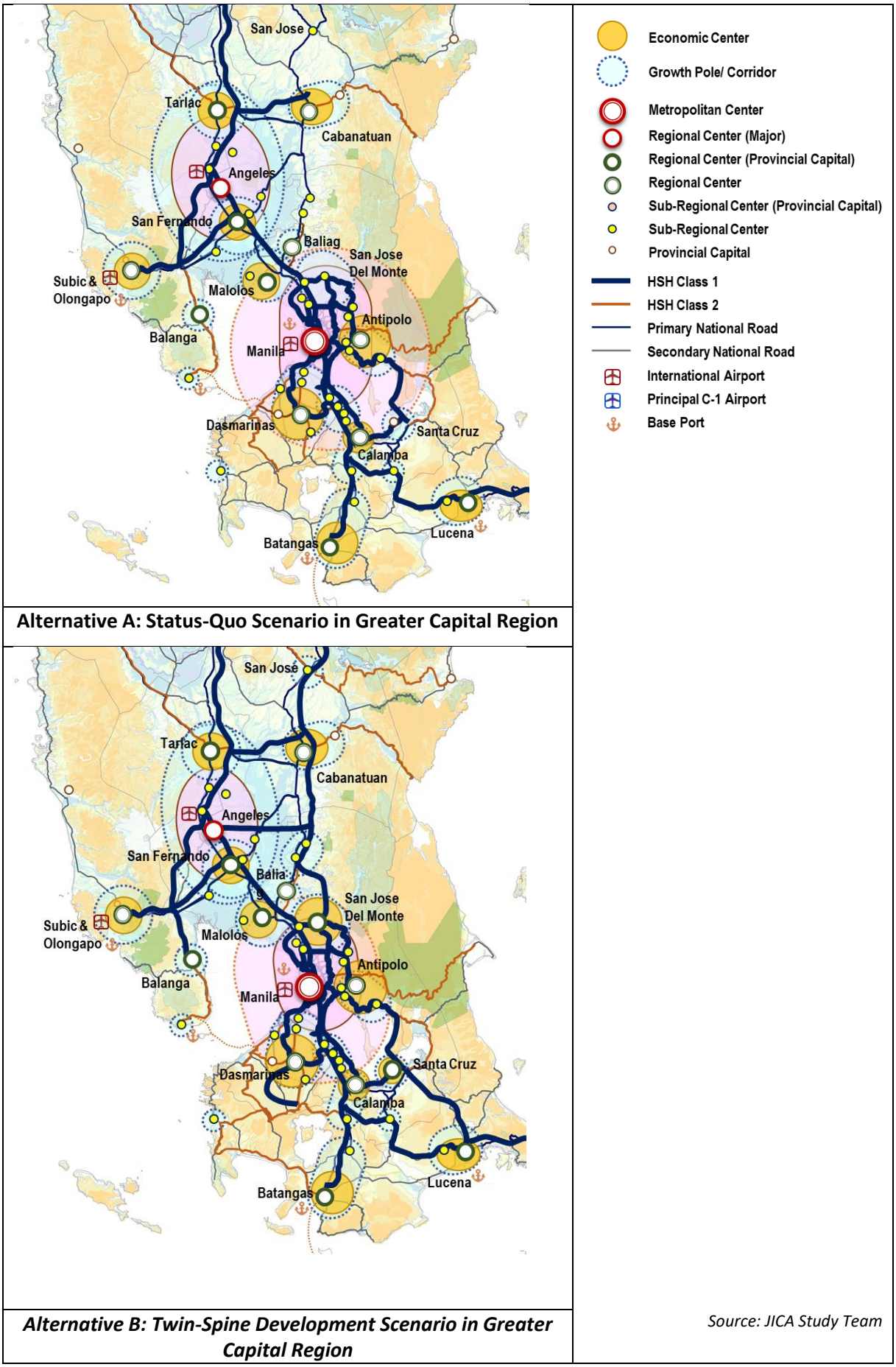
Alternative B: Decentralized Development Scenario in Luzon



Alternative C: Balanced Development Scenario in Luzon



Source: JICA Study Team

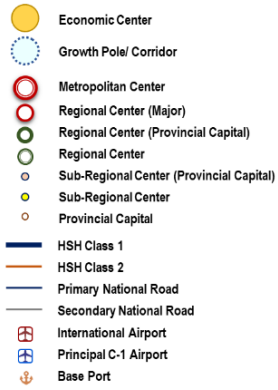


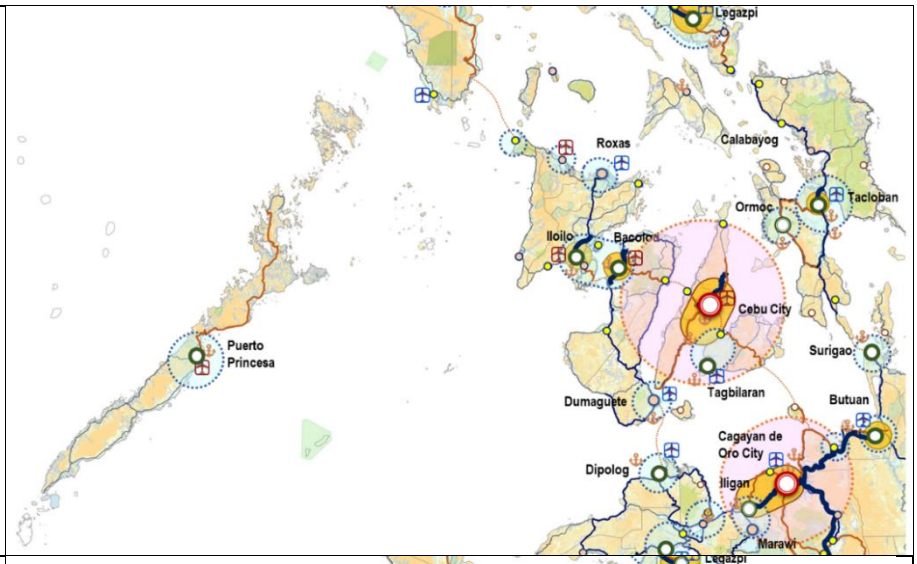
Alternative A: Status-Quo Scenario in Greater Capital Region

Alternative B: Twin-Spine Development Scenario in Greater Capital Region

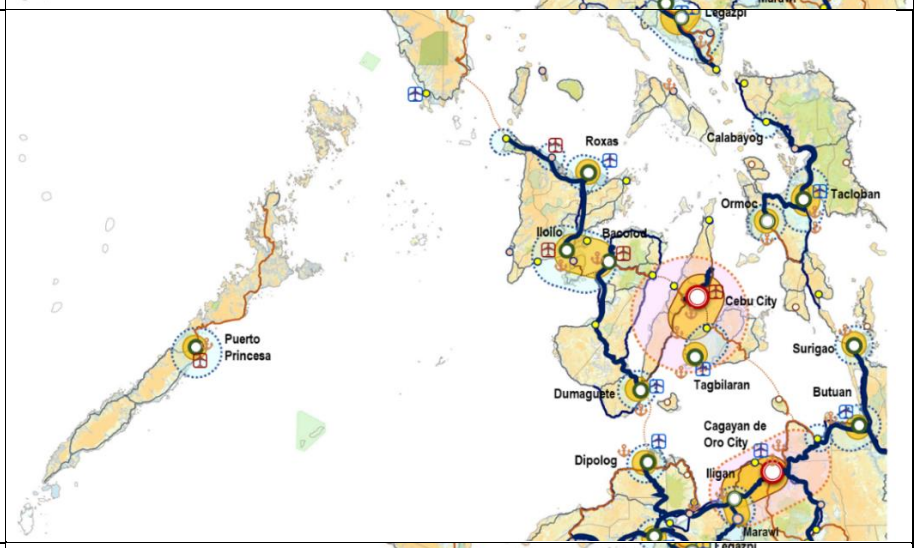
Source: JICA Study Team

Alternative A: Metropolitan-led Development Scenario in Visayas

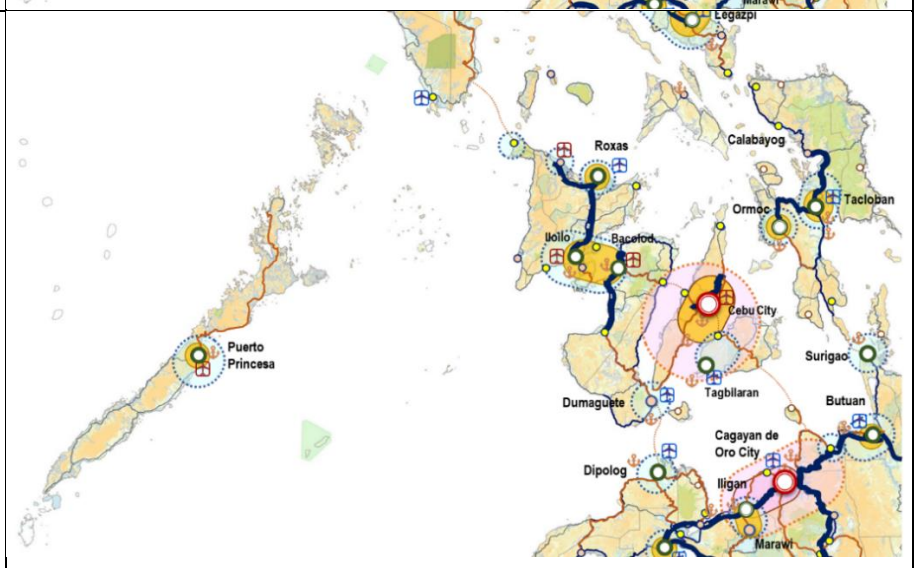




Alternative B: Decentralized Development Scenario in Visayas

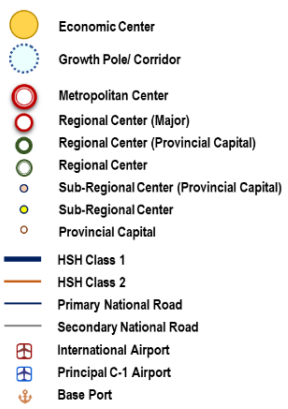


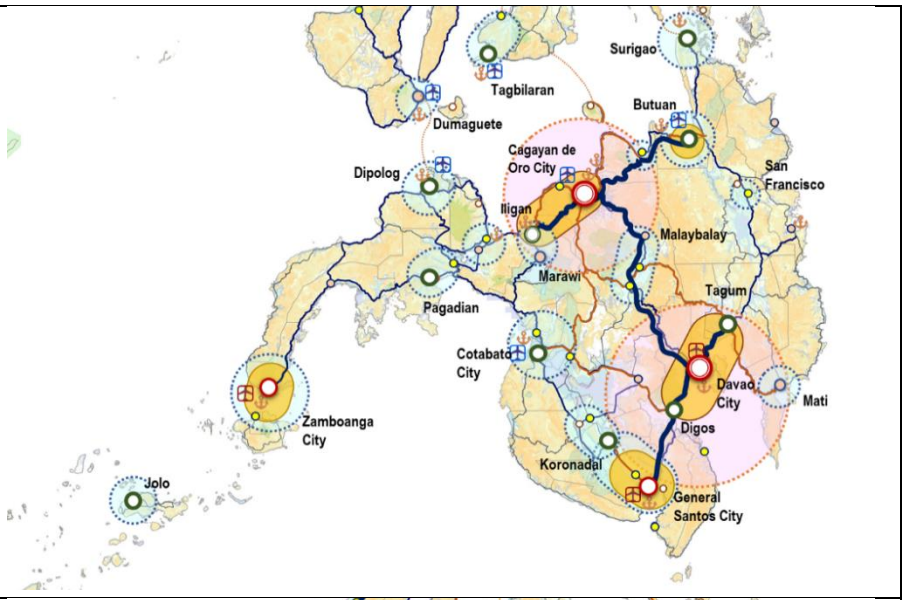
Alternative C: Balanced Development Scenario in Visayas



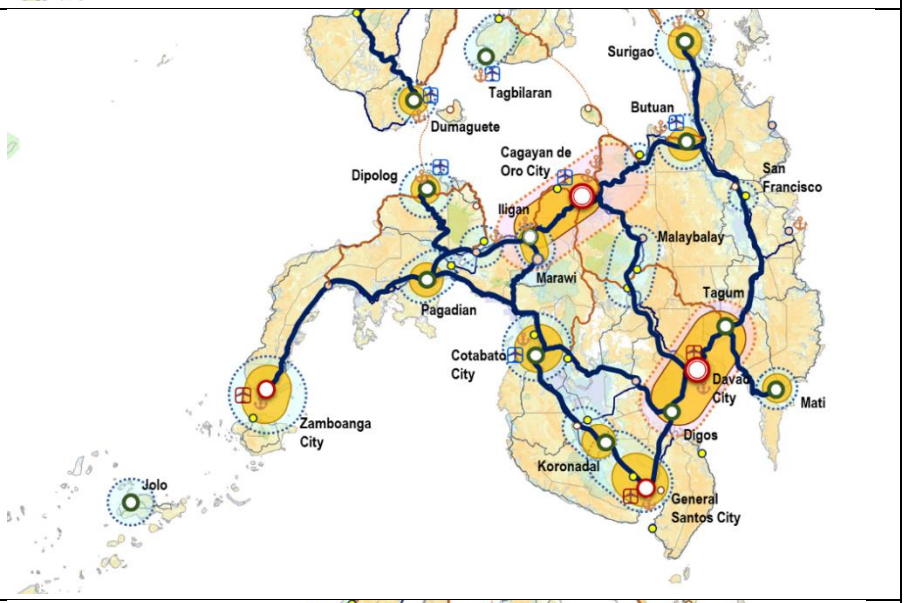
Source: JICA Study Team

Alternative A: Metropolitan-led Development Scenario in Mindanao

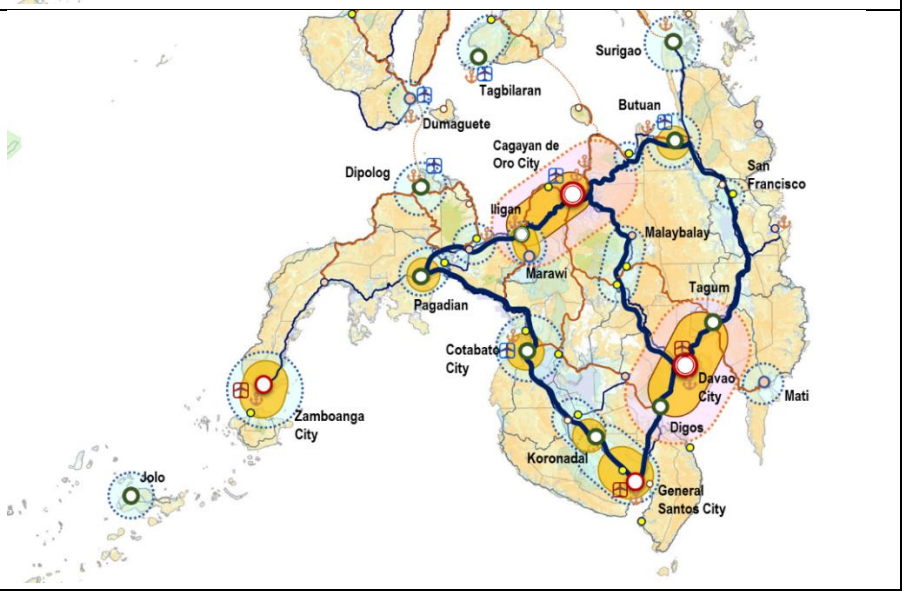




Alternative B: Decentralized Development Scenario in Mindanao



Alternative C: Balanced Scenario in Mindanao



Source: JICA Study Team

PART C – PRESENT AND FUTURE TRAFFIC DEMAND

5 PRESENT TRAFFIC CONDITION

5.1 Annual Average Daily Traffic (AADT)

A 24-hour traffic count and OD Interview Survey was carried out at each of thirty-five (35) stations across Luzon and thirty (30) stations in the Visayas and Mindanao (orange-colored stations).

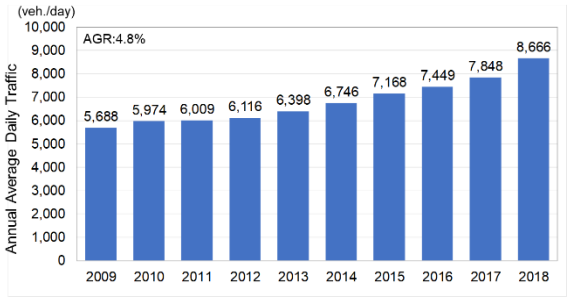
Traffic count results were converted to the annual average daily traffic (AADT) as shown in Figure 5-1.

Source: JICA Study Team, DPWH, MNTC, VTDI, MCX Tollway Inc., PTC, CIC, STAR Tollway Corporation, TMC, PIDC

Figure 5-1 Annual Average Daily Traffic

5.2 Trend in Traffic Growth

The traffic growth trend (using AADT) at the 53 major traffic points of national roads is shown in Figure 5-2. The AADT is increasing at an annual growth rate (AGR) of 4.8%.



Note 1: The average AADT of 53 points observed result was calculated by (Σ Section length*AADT/ Σ Section Length). Section length is an assumption by the JICA Study Team. AGR: Annual Growth Rate
Note 2: These excludes data in the urban areas.
Source: DPWH Traffic Count Data

Figure 5-2 Trend of the Average AADT at 53 Points of National Roads

5.3 Trip Length Distribution

A result analysis for trip length by type of vehicle based on the roadside OD survey in Luzon is shown in Figure 5-4.

With respect to car traffic which has the most traffic volume, trip lengths of less than 50km comprise about 53% of the total trips; long trips of more than 100 km constitute about 25 % of the surveyed trips. Trips of jeepney traffic are almost less than 50 km at trip length. Bus traffic and truck traffic consist of long travel distances. Around 40% of the total traffic surveyed has long travel lengths of more than 100 km. As for the total of all vehicles without jeepney, around 30% comprise long trip lengths of more than 100 km.

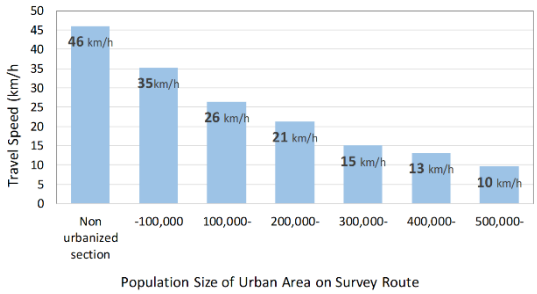
5.4 Travel Speed

(1) Condition of Travel Speed

The travel speed survey results during the morning peak hour are shown. The travel speed in rural sections is mostly 40km/h or above, but the travel speed decreases significantly or less than 20km/h as one gets closer to the urban area.

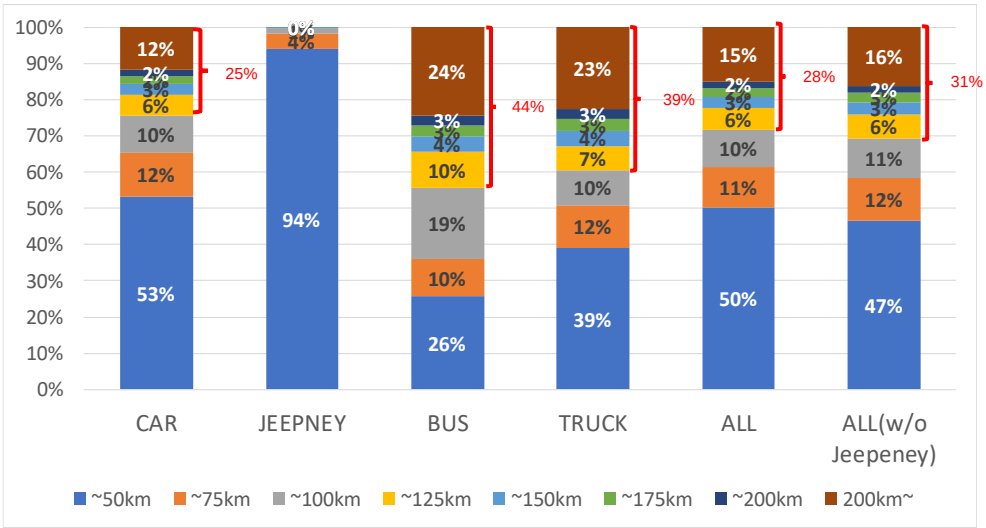
(2) Relation of Travel Speed and Population Size of Urban Area

The traffic function of the existing Primary National Roads has been significantly affected when passing through urban areas with populations of over 100,000 people. It was observed that the travel speed at such urban sections becomes slower than 30km/h.



Data: Total of A.M. inbound and outbound, P.M. inbound and outbound
Source: JICA Study Team

Figure 5-3 Relation of Travel Speed and Population Size of Urban Area



Note: The trip length was calculated based on the roadside OD survey within Luzon
Source: JICA Study Team

Figure 5-4 Trip Distribution by Vehicle Type

Source: JICA Study Team

Figure 5-5 Travel Speed during AM Peak Hour: North Luzon (Towards Manila)

5.5 Present Condition at Ports and Airports in the Philippines

(1) Port

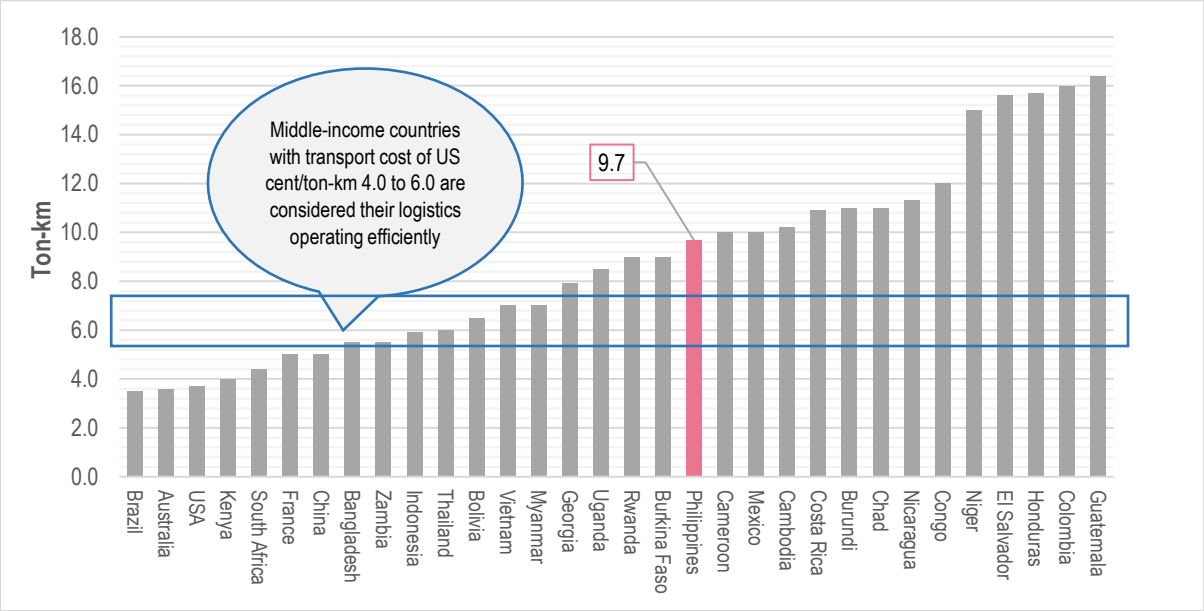
The cargo traffic (in tons) and container traffic (in Twenty-Foot Equivalent Units or TEUs) handled by the major ports for the past five (5) years are shown in Figure 5-7. The average growth rate (AGR), from 2014 to 2018, of the cargo traffic handled is 6%, while the AGR of the containers handled is 8%. The AGR of the major ports tends to steadily increase every year.

(2) Airport

The passenger traffic at the major airports for the past five (5) years is shown in Figure 5-8. The passenger traffic at NAIA is around 78% of the nationwide total.

5.6 Logistics Cost in Philippines

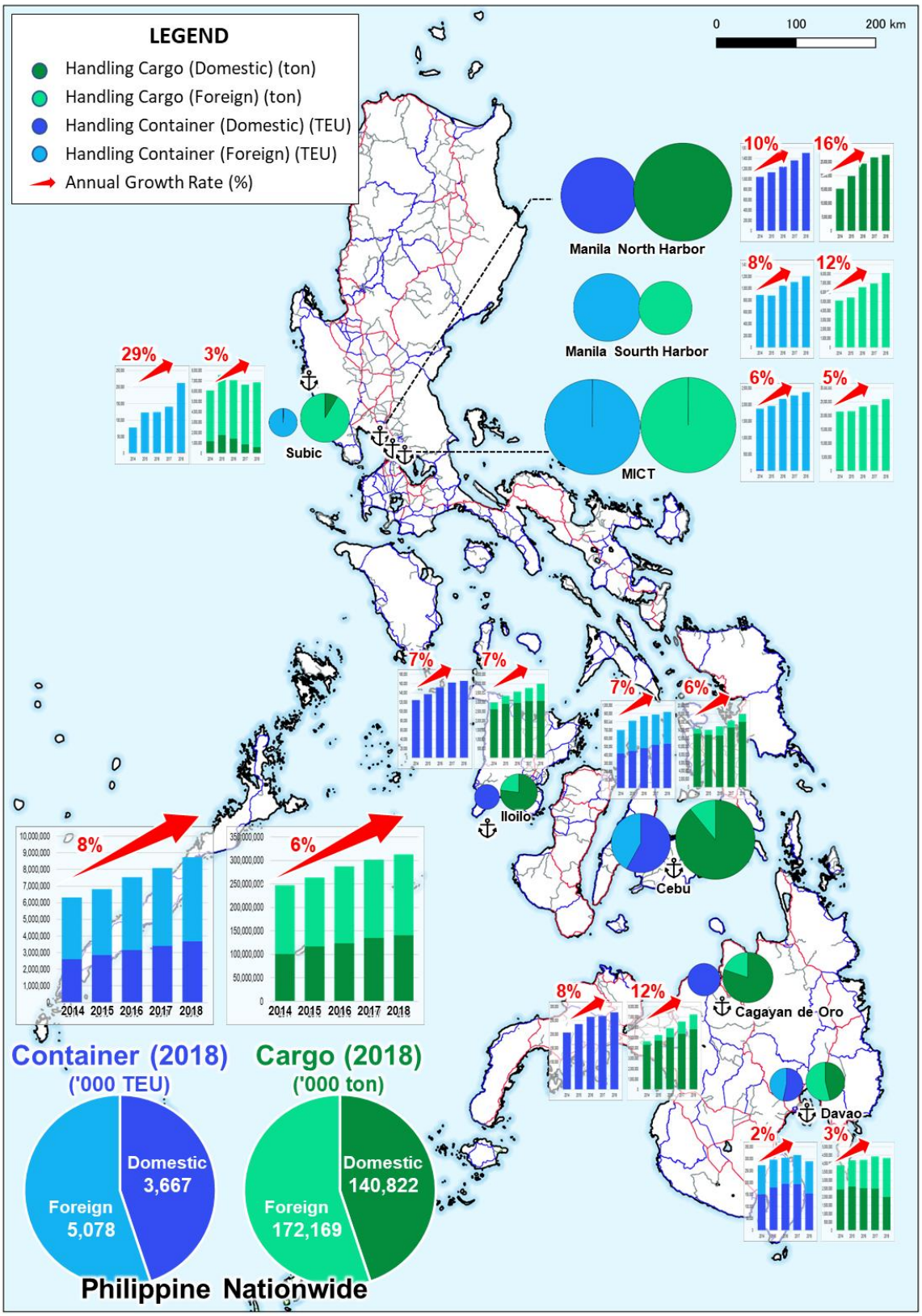
The cost of transporting goods in the Philippines by road is US Cent 9.7/ton-km (average of 30 routes in Luzon considered in the study), which is higher than even those in some developing countries in Africa which is known to have high transport cost particularly its landlocked countries of Burkina Faso (US Cent 9/ton-km), Rwanda (US Cent 9/ton-km) and Uganda (US Cent 8.5/ton-km).



Note 1: Philippine data is taken from the Survey by JICA Study Team (2019). Data of Philippines is taken from two major manufacturing companies which provided complete and comprehensive data of their 30 routes in Luzon during the survey.
Note 2: Other data are taken from the following:

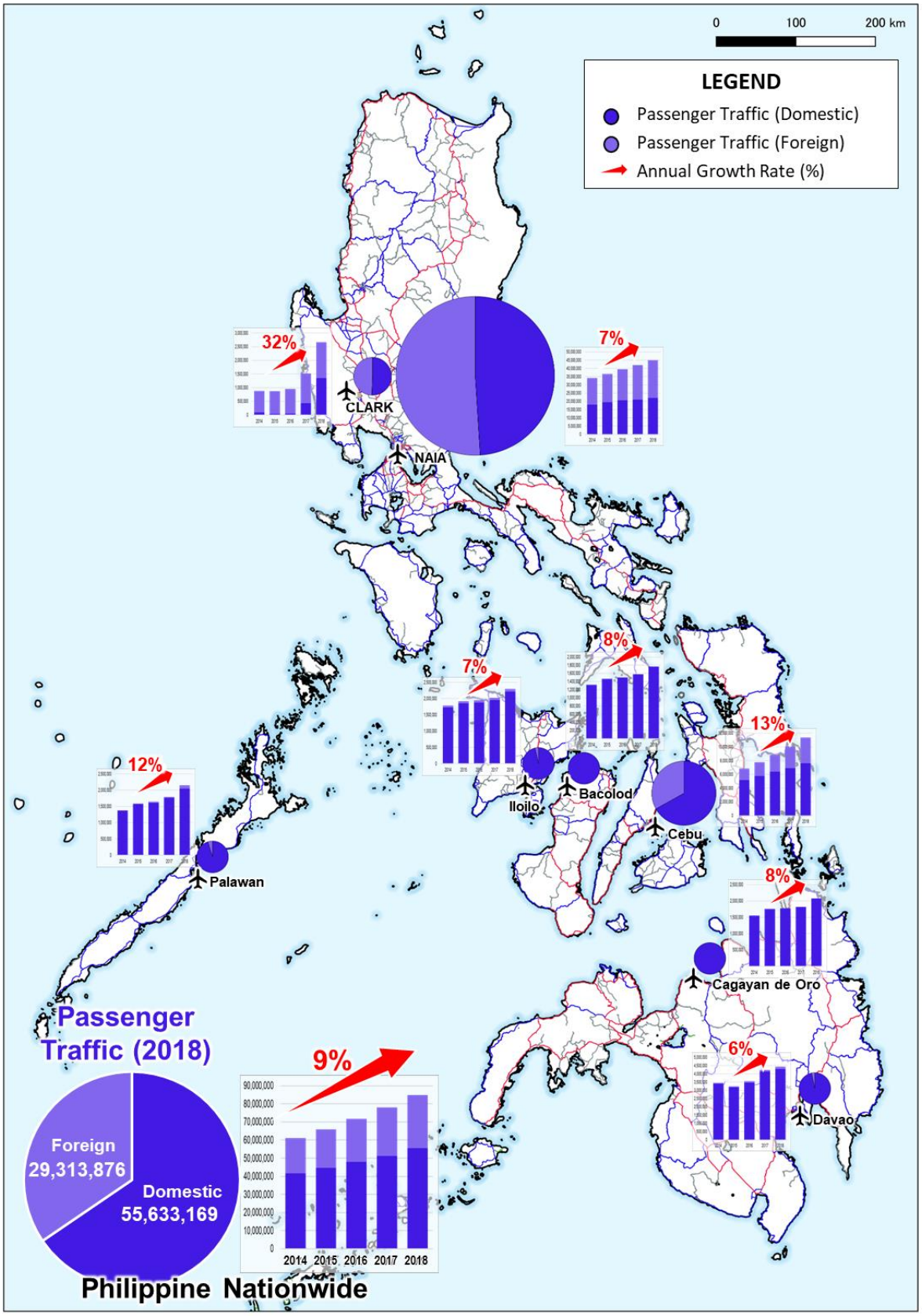
- *Burkina Faso (2010 WB Study "Corridor Logistics Initiative")*
- *Australia, Bangladesh, Mexico, Colombia (2009 WB Study "Freight Transport Development Toolkit: Road Freight")*
- *Georgia (2009 ADB Study "George Transport Sector Assessment, Strategy and Road Map")*
- *India (2018 ADB Study "India: Supporting Logistics Sector Development")*
- *USA, China, Indonesia, Myanmar (2018 ADB Study "Myanmar Transport Policy Notes")*
- *Bolivia (2009 WB Study "Strengthening Bolivian Competitiveness: Export Diversification and Inclusive Growth")*
- *Iran (2007 WB Study "The Cost of Being Landlocked: Logistics Costs and Supply Chain Reliability")*
- *South Africa (2008 WB Study "The Impact of Regional Liberalization and Harmonization in Road Transport Services: A Focus on Zambia and Lessons for Landlocked Countries")*
- *Thailand, Vietnam, Cambodia, Burundi, Congo, Niger (2012 ADB Study "Trade and Trade Facilitation in the Greater Mekong Subregion")*
- *Laos (2018 WB Study "Transport Costs and Prices in LAO PDR: Unlocking the Potential of an Idle Fleet")*
- *Kenya, Zambia, Uganda, Rwanda, Cameroon, Chad (2009 WB Study "Transport Prices and Costs in Africa")*
- *Brazil, France (2009 WB Study "Transport Prices and Costs in Africa: A Review of the Main Corridor")*
- *Costa Rica, Nicaragua, El Salvador, Honduras, Guatemala, Panama (2014 WB Study "What Drives the High Price of Road Freight Transport in Central America?")*

Figure 5-6 International Comparison of Road Freight Prices



Source: PPA, CPA, JICA Study Team

Figure 5-7 Growth of Cargo and Container Traffic at the Major Ports



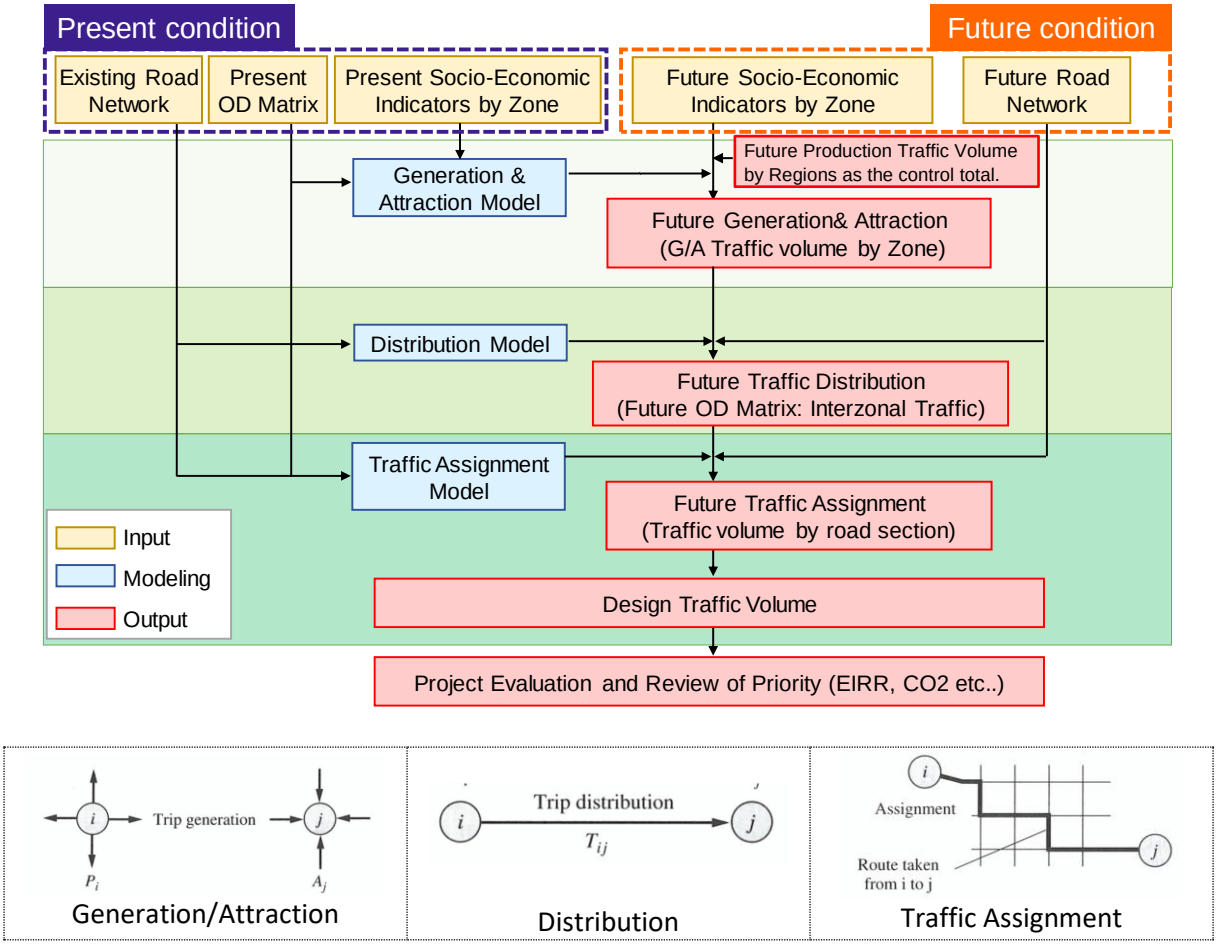
Source: CAAP, NAIA_20190510_TotalStats_2012-2019, CLARK operational-statistics, Mactan-Cebu passengers, JICA Study Team

Figure 5-8 Passenger Traffic at the Major Airports

6 TRAFFIC DEMAND FORECAST

6.1 Traffic Demand Forecast by 4-Step Method

Future traffic volume was estimated in this project by applying the 4-step method. The models applied are the Generation and Attraction Model, Trip Distribution Model, and Traffic Assignment Model. The existing road network, current OD tables, and regional socioeconomic indicators were used as input data. Based on the results of the roadside OD survey, each stage of the analysis has been conducted on a vehicle unit basis.



Source: JICA Study Team

Figure 6-1 Procedure of Estimation of Future Traffic Volume

6.2 Estimated Future Traffic Volume

The future traffic volume by region was estimated by multiplying the growth rate with the existing traffic volume in the present OD matrix. The traffic volume here is only inter-zonal traffic without internal traffic (Table 6-1).

6.3 Future Generation and Attraction (G/A) Traffic Volume

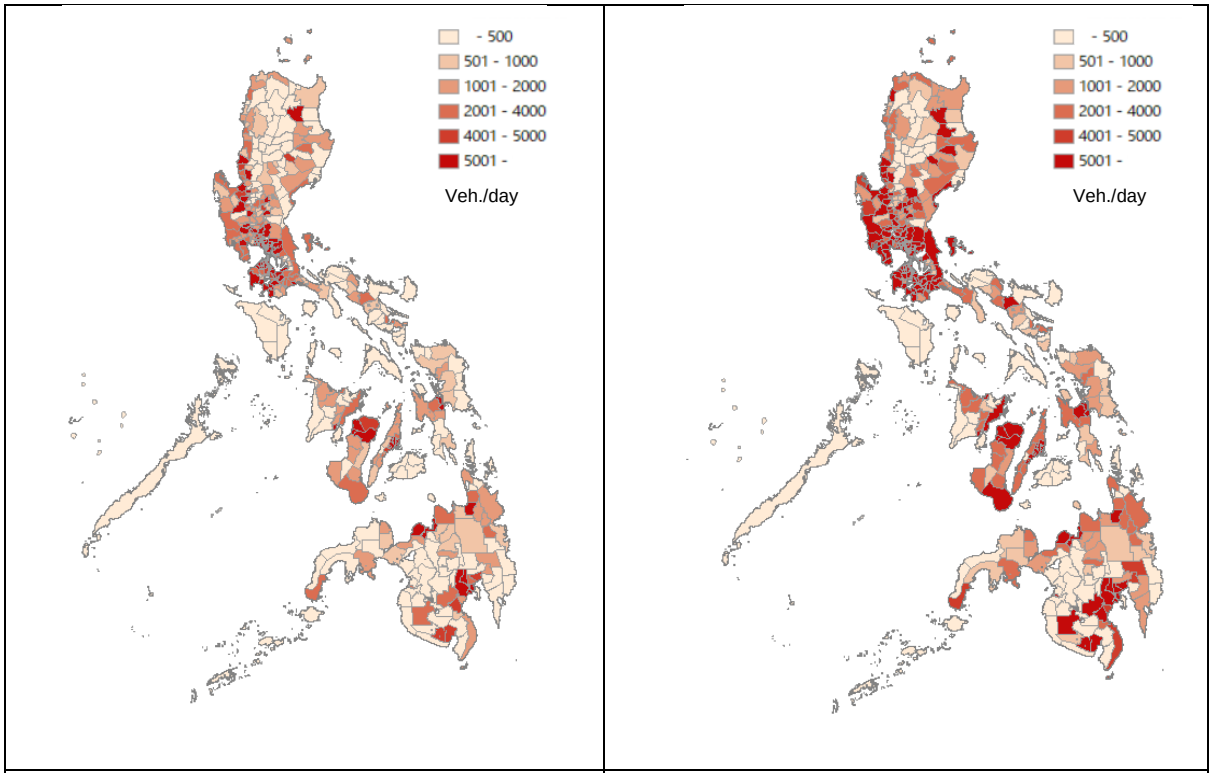
The G/A traffic volume (2040) was estimated based on the model and future zone indicators: population and GRDP. The results of G/A forecast per zone (920 zones) are shown in Figure 6-2.

Table 6-1 Estimated Production Future Traffic Volume

Unit: 1,000 veh/Year

Area	Year	CAR	JEEPNEY	BUS	TRUCK	TOTAL
Metro Manila	2019	3,164,630	448,084	58,109	139,666	3,810,489
		83%	*12%*	*2%*	*4%*	*100%*
	2040	4,767,661	453,821	84,790	203,793	5,510,065
		87%	*8%*	*2%*	*4%*	*100%*
	2040/2019	1.51	1.01	1.46	1.46	1.45
Other Area	2019	1,478,415	312,838	146,723	279,558	2,217,534
		67%	*14%*	*7%*	*13%*	*100%*
	2040	3,507,914	546,205	326,495	656,447	5,037,061
		70%	*11%*	*6%*	*13%*	*100%*
	2040/2019	2.37	1.75	2.23	2.35	2.27

Source: JICA Study Team



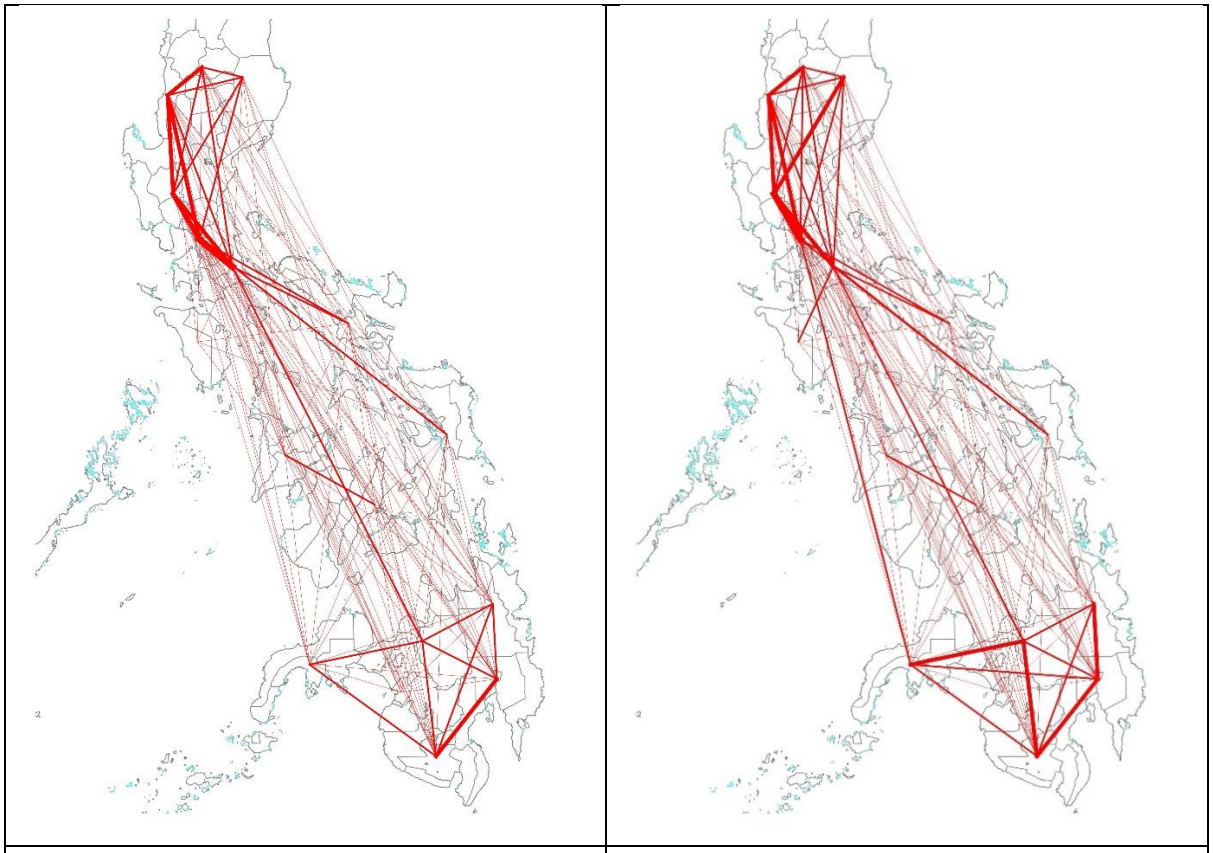
Present G/A traffic volume (2019) | Future G/A traffic volume (2040)

Source: JICA Study Team

Figure 6-2 Estimated Result of Future G/A Traffic Volume

6.4 Forecasting Traffic Distribution

The distribution traffic volume was estimated by applying the gravity model to the generation and attraction traffic volume by zone (Figure 6-3).
The results show that there are many OD distributions concentrated in Regions III, IV-A, and NCR in Luzon. In addition, there are also high OD distributions in the Mindanao Island.



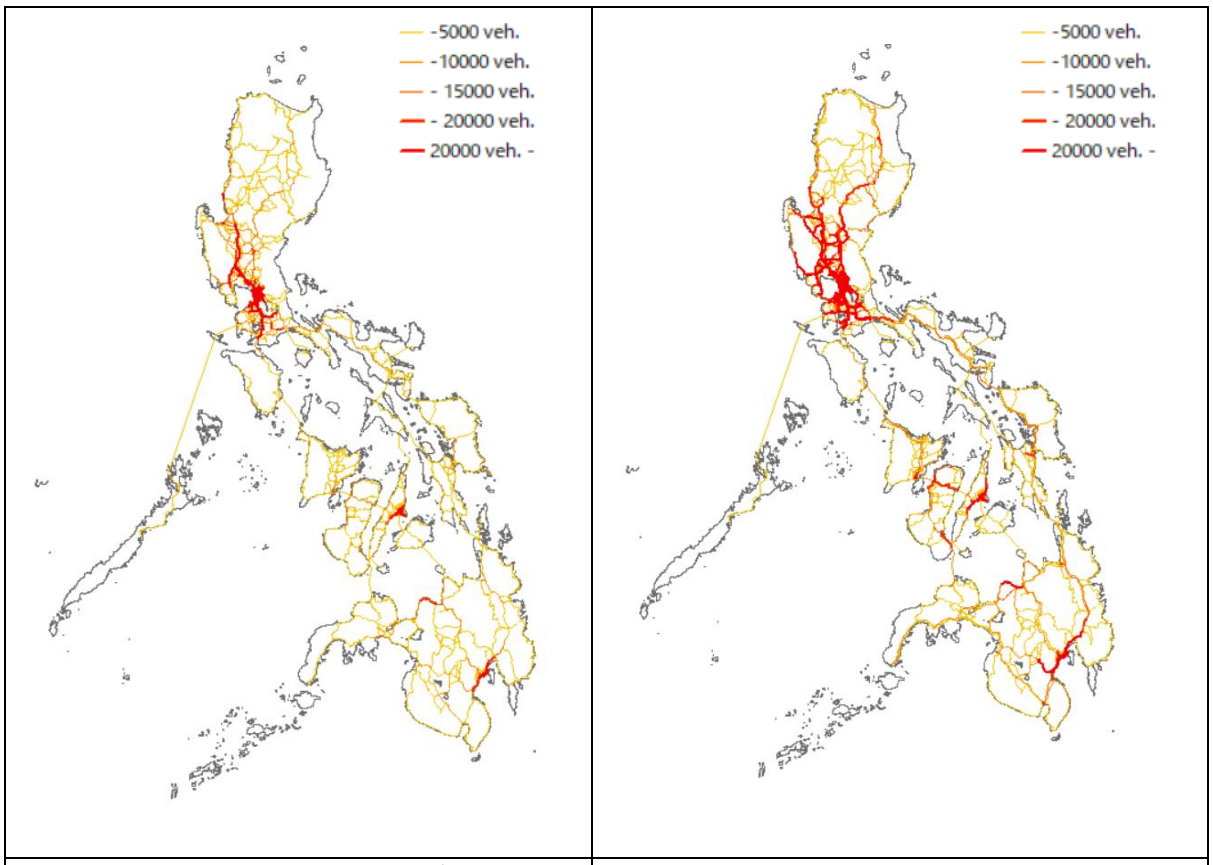
Present OD Distribution	Future OD Distribution (2040)

Note: Desired lines by region (categorized into 17 regions)
Source: JICA Study Team

Figure 6-3 Desired Line of Future OD Distribution

6.5 Estimated Future Traffic Volume

Figure 6-4 shows the estimated traffic volume in 2019 and 2040.



Traffic Volume in 2019 (Veh/day)	Future Traffic Volume in 2040 in case of Full Network (Veh/day)

Source: JICA Study Team

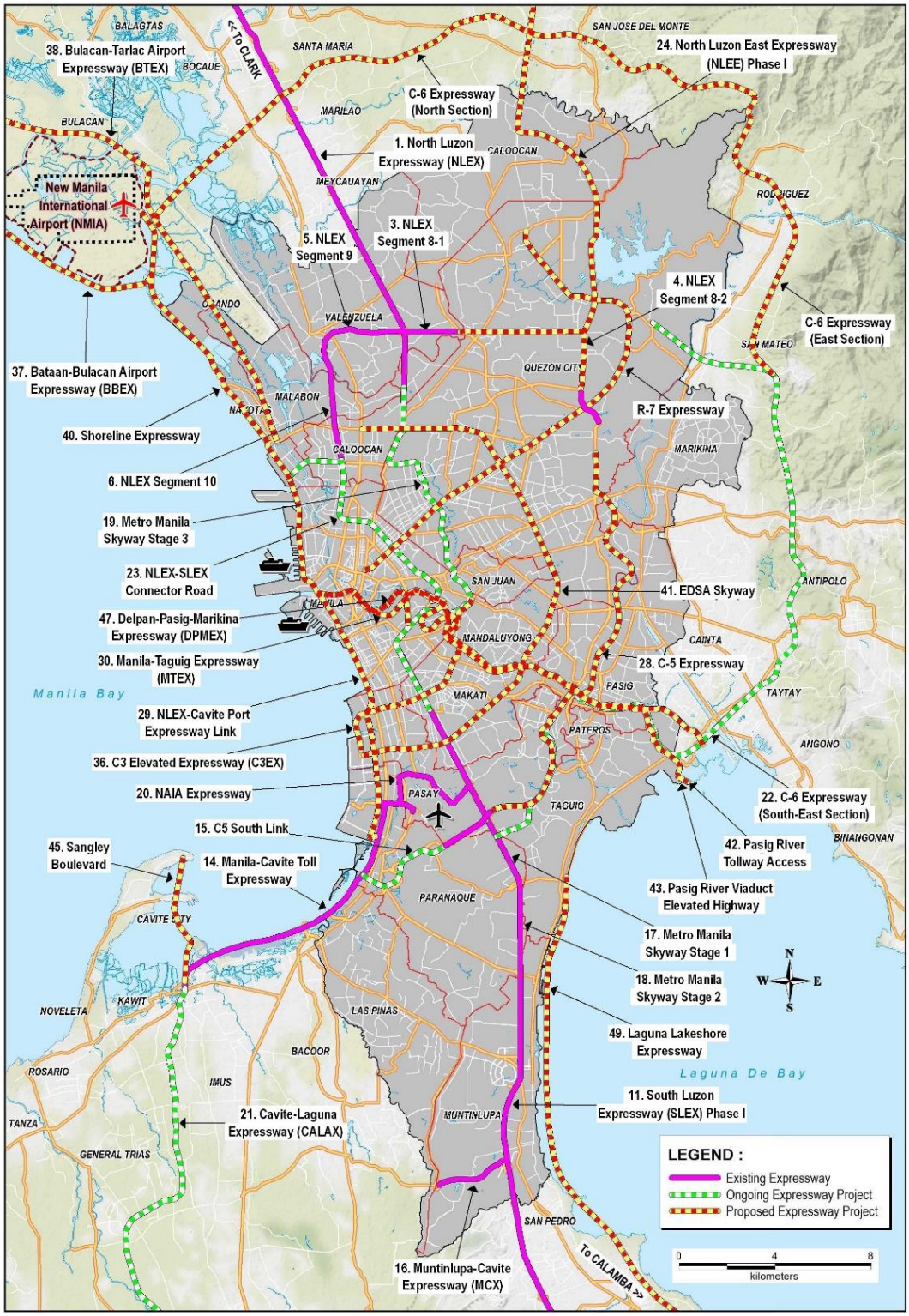
Figure 6-4 Estimated Future Traffic Volume

PART D – ASSESSMENT OF PRESENT ROAD

7 PRESENT AND FUTURE NATIONAL ROAD AND EXPRESSWAY NETWORK AND OTHER TRANSPORT FACILITIES

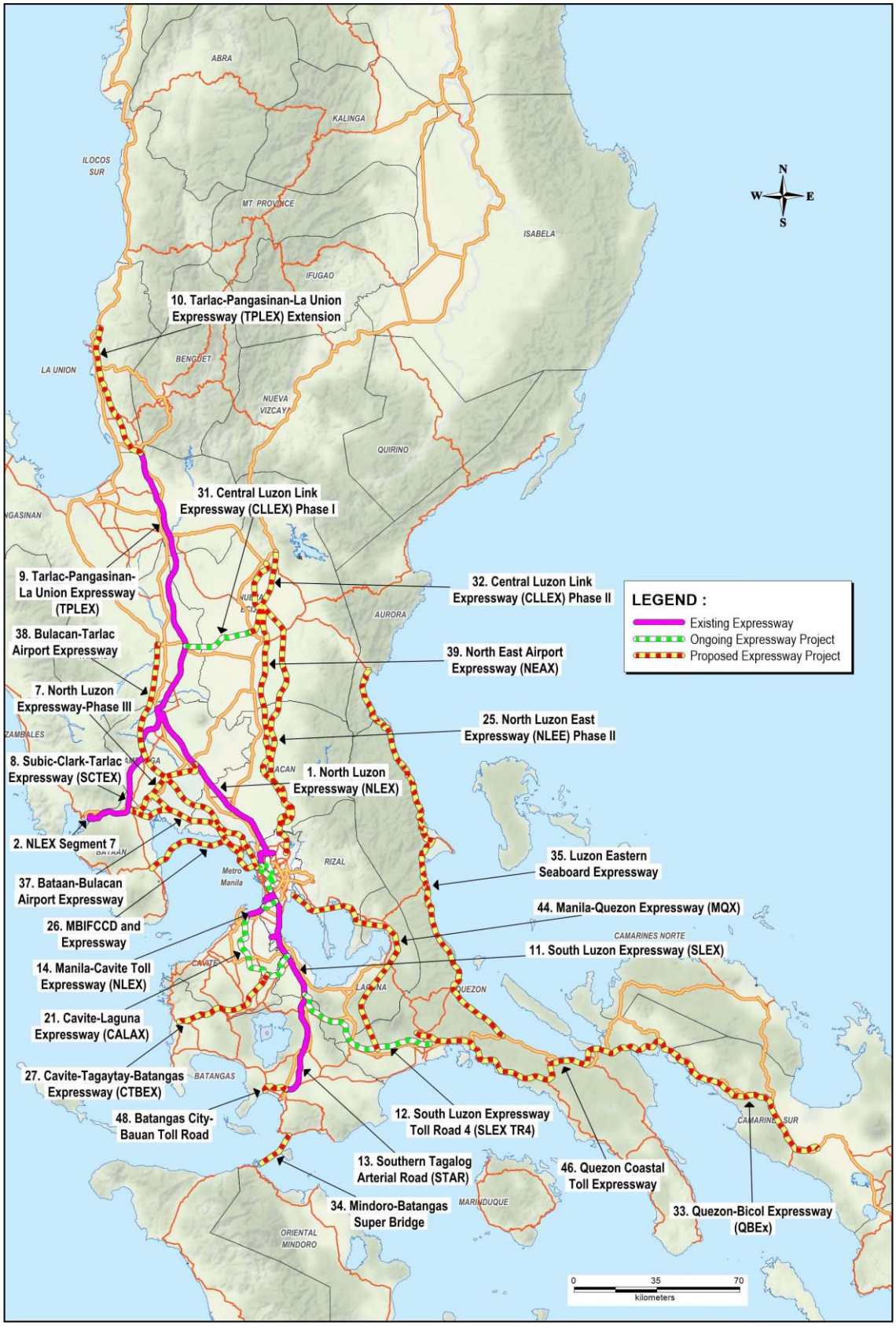
7.1 Proposed Expressway Project

Information on existing, on-going, and proposed major road projects were collected and summarized.



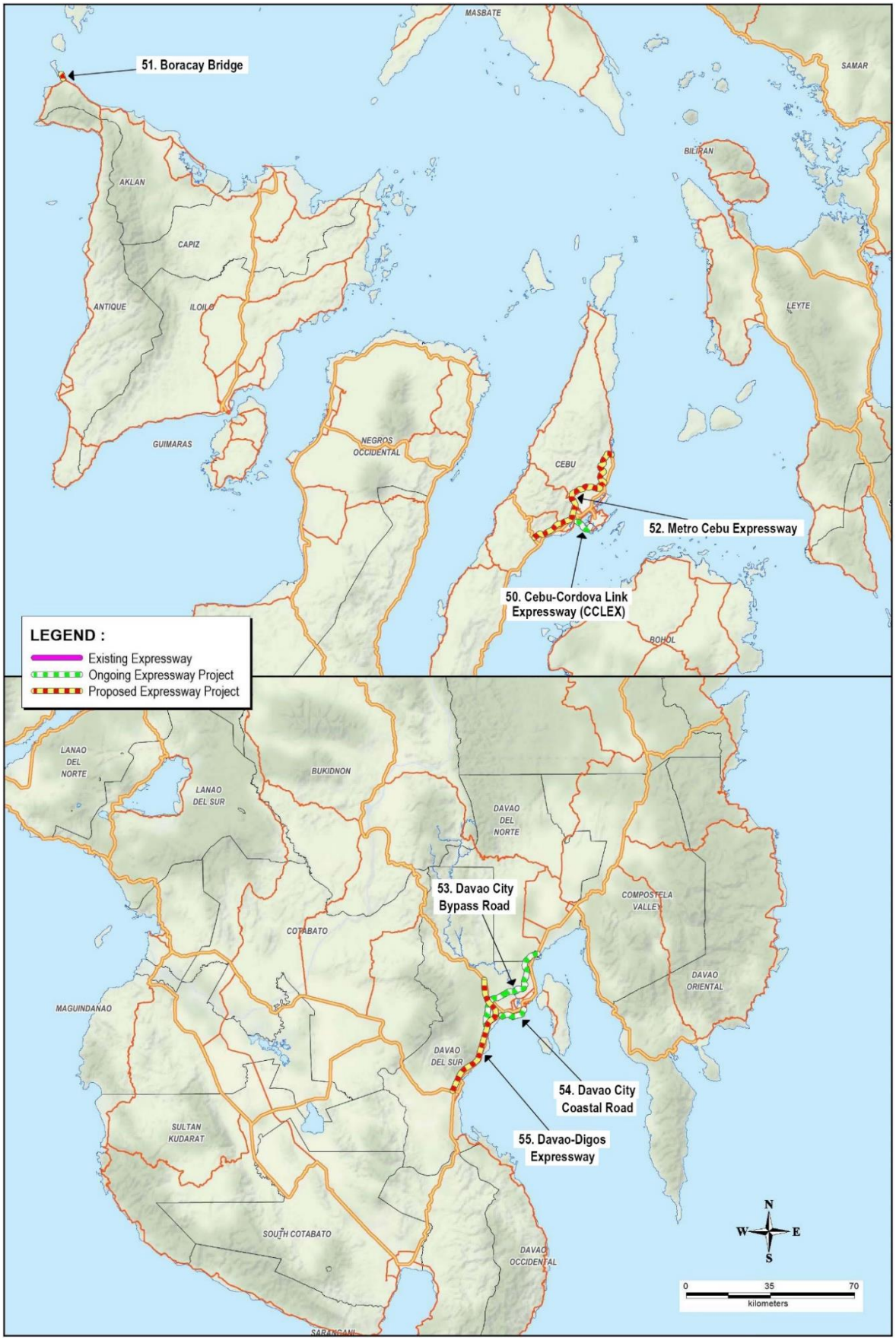
Source: Prepared by the JICA Study Team based on various proposal documents

Figure 7-1 Existing and Proposed Expressway Projects in Metro Manila



Source: Prepared by the JICA Study Team based on various proposal documents

Figure 7-2 Existing and Proposed Expressway Projects in Luzon

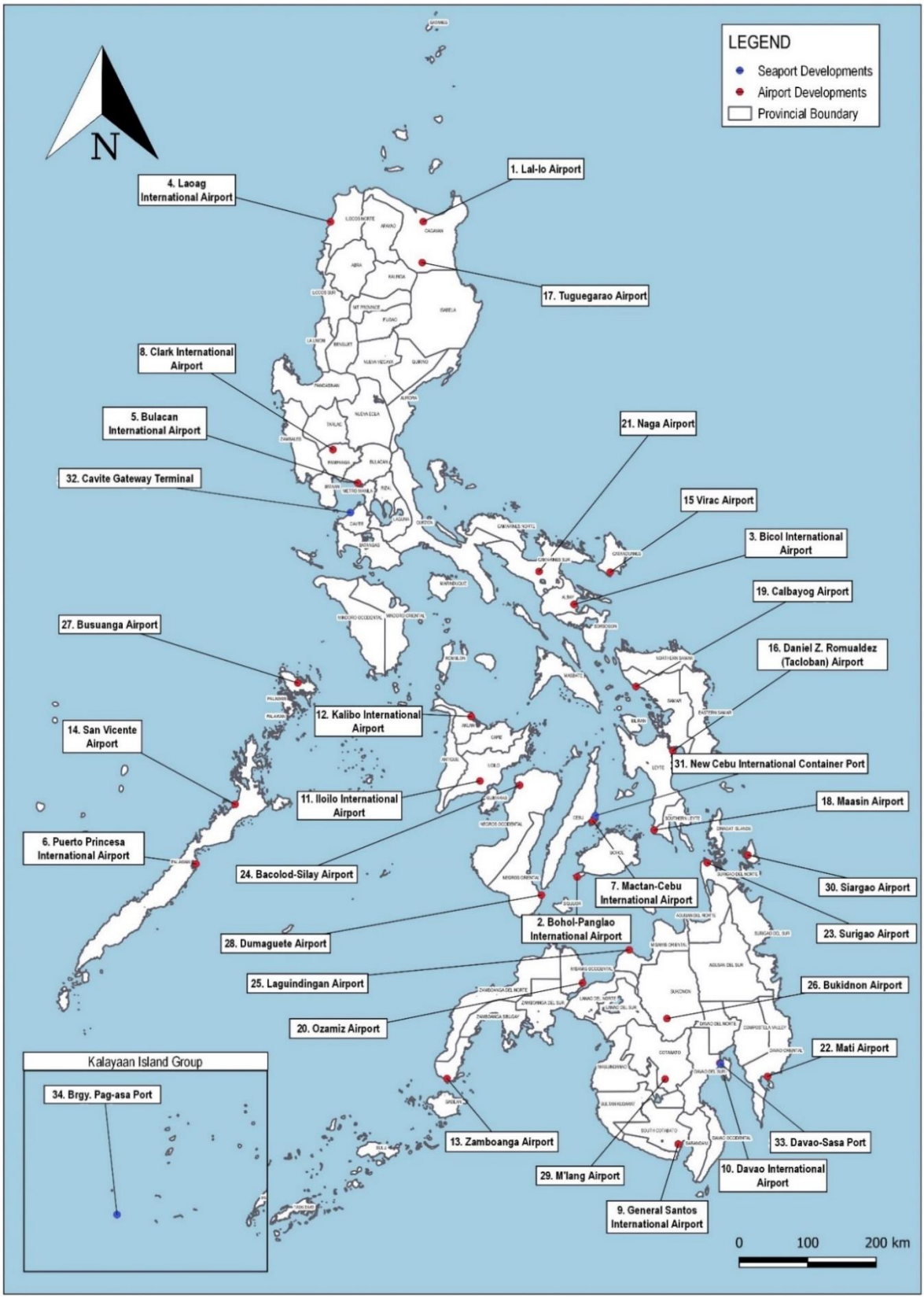


Source: Prepared by the JICA Study Team based on various proposal documents

Figure 7-3 Existing and Proposed Expressway Projects in Visayas and Mindanao

7.2 Airports and Seaports

The airports and seaports in the Philippines under construction (expansion and new construction, as of 2018) are indicated in Figure 7-4.

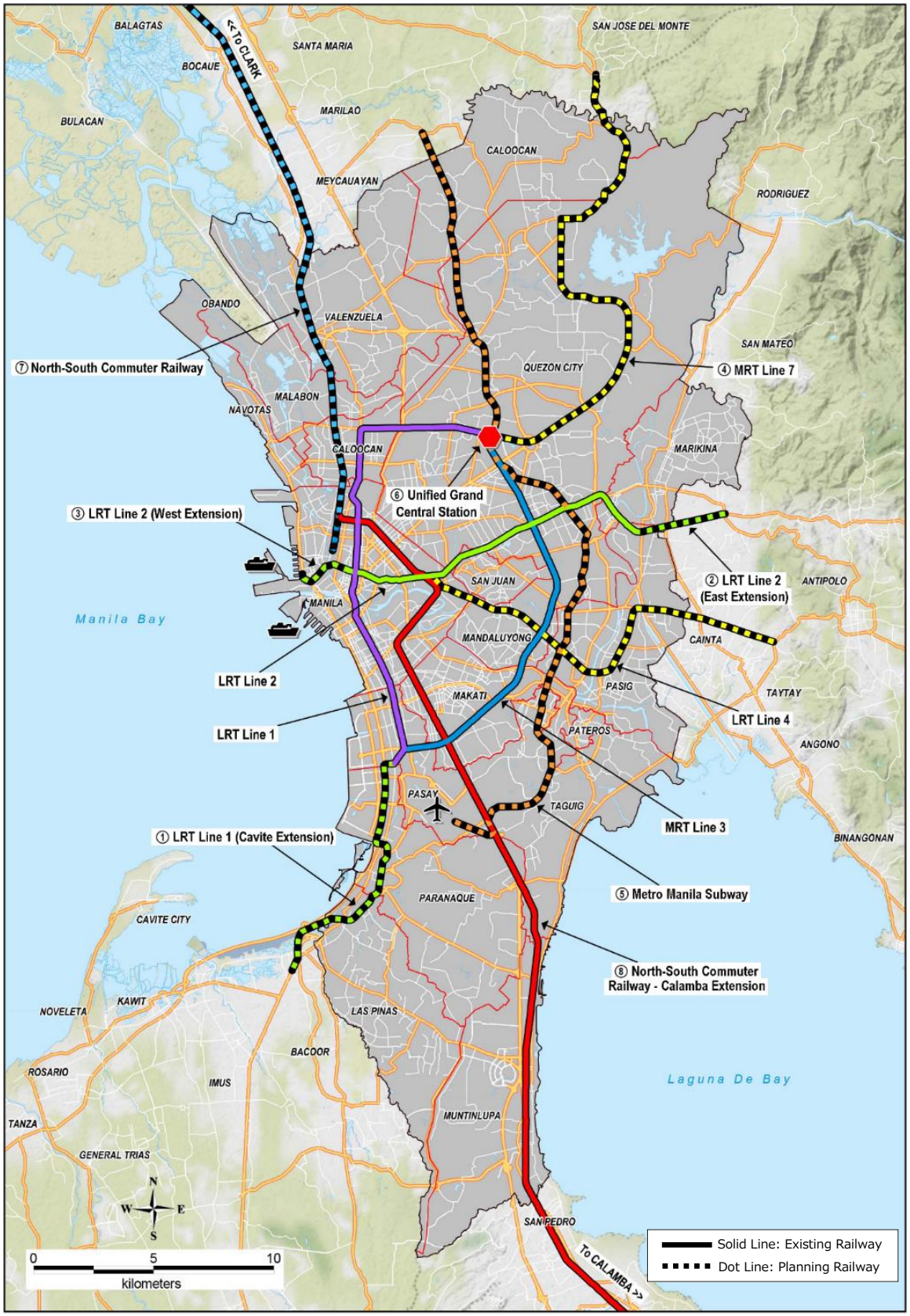


Source: Department of Transportation, 2019

Figure 7-4 Locations of Airports and Seaports for Development in the Philippines

7.3 Railway Projects

The railway projects in Metro Manila and surrounding areas are illustrated in Figure 7-5 below.



Source: Department of Transportation, 2019

Figure 7-5 Map of Existing and Proposed Railway Projects in Metro Manila

8 ASSESSMENT OF PRESENT ROAD NETWORK

8.1 Present Road Development Level

(1) Existing and Under Construction Expressway Network

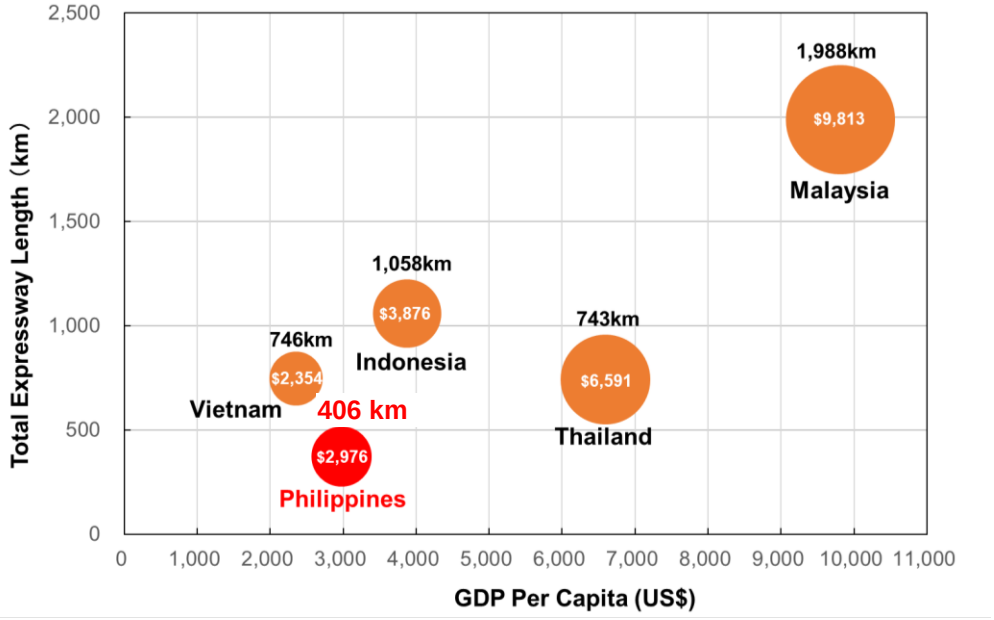
The expressway network has been developed in Metro Manila and the surrounding areas. The total expansion of the expressway network to 862 km was planned until the year 2030. As of August 2019, the total length of the existing expressways nationwide was only 406 km.

The international comparison of the length of expressways in five major Asian countries is shown in Figure 8-1. Unfortunately, the Philippines recorded the lowest length of expressways among the five countries. Based on the GDP per capita, the length of high standard highways should be longer.

Table 8-1 Lengths of Existing and Currently Under Construction Expressways

Name of Expressway	Operator	Length (km)		
		Under Operation	Under Construction	Total
1. MCX (Muntinlupa-Cavite Expwy.)	DPWH (Grantor)	4.0	-	4.0
2. CLLEX (Central Luzon Link Expwy.)		-	66.0	66.0
3. CALAX (Cavite- Laguna Expwy.)		-	45.0	45.0
1. TPLEX (Tarlac-Pangasinan-La Union Expwy.)	San Miguel Corporation (SMC) Infrastructure	77.41	11.45	88.86
2. NAIAX (NAIA Expressway)		5.40	0	5.40
3. SMMSP (South Metro Manila Skyway Project)		29.69	18.30	47.99
4. SLEX (South Luzon Expwy.)		36.00	66.74	102.74
1. Southern Tagalog Arterial Road/STAR	*1	41.90	0	41.90
1. SCTEX (Subic-Clark-Tarlac Expwy.)	NLEX Corporation and CAVITEX Infrastructure Corporation	94.62	0	94.62
2. MCTEX (Manila-Cavite Toll Expwy.)		15.48	0	15.48
3. NLEX (North Luzon Expwy.)		91.25	0	91.25
4. NLEX Seg 8.1, 9, 10, 8.2, R10		10.70	10.95	21.65
4. NLEX Connector		-	8.00	8.00
5. NLEX Phase 3 (Seg 4, 5, and 6)		-	32.66	32.66
6. C5 South Link Expressway Project		-	5.70	5.70
Total		**406.45**	264.81	**671.26**

**1: Operator is "STAR Infrastructure Development Corporation"*
Source: Toll Regulatory Board, as of August 2019



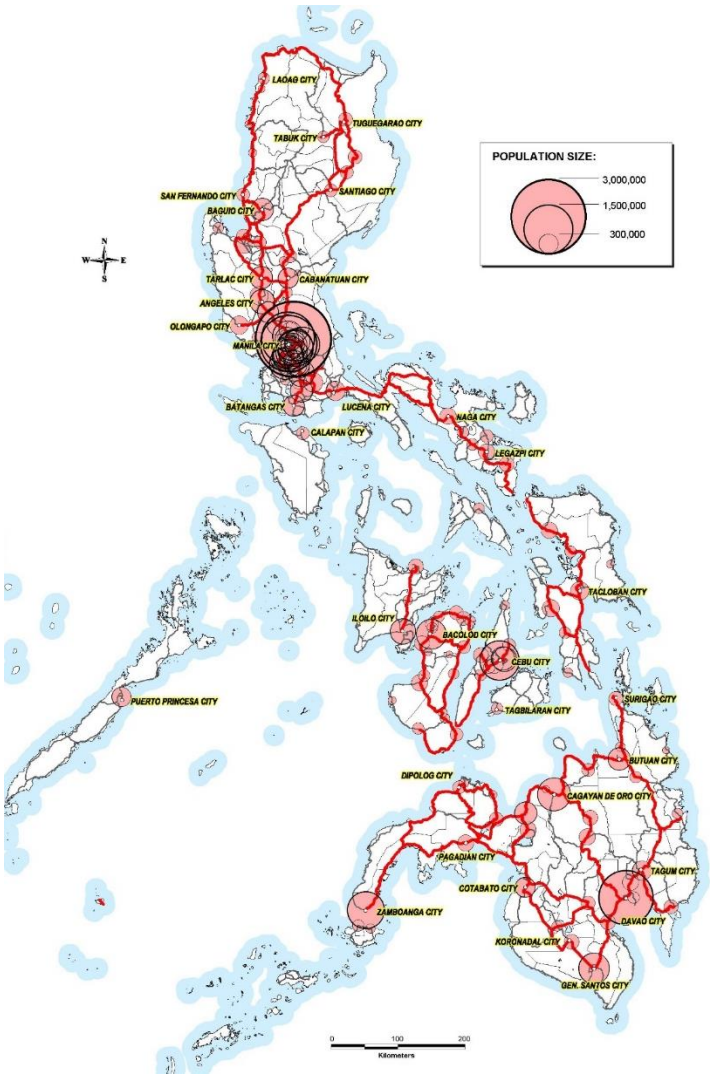
Source: JICA Study Team

Figure 8-1 Lengths of Existing and Currently Under Construction Expressways

(2) National Road Network and Location of Urban Centers

Major urban centers are physically connected by National Roads. However, other urban areas have been developed along the National Primary Roads (NPRs) and all activities generated in each of these urban areas depend on one NPR that crosses the urban center. This tendency is especially strong in rural areas where the road network has no redundancy.

Consequently, all types of traffic, such as local traffic including tricycles or motorbikes in the urban area, and regional traffic including large size trucks are generated and are concentrated along the National Roads. The traffic function of the NPR, therefore, is declining due to chronic traffic congestion.



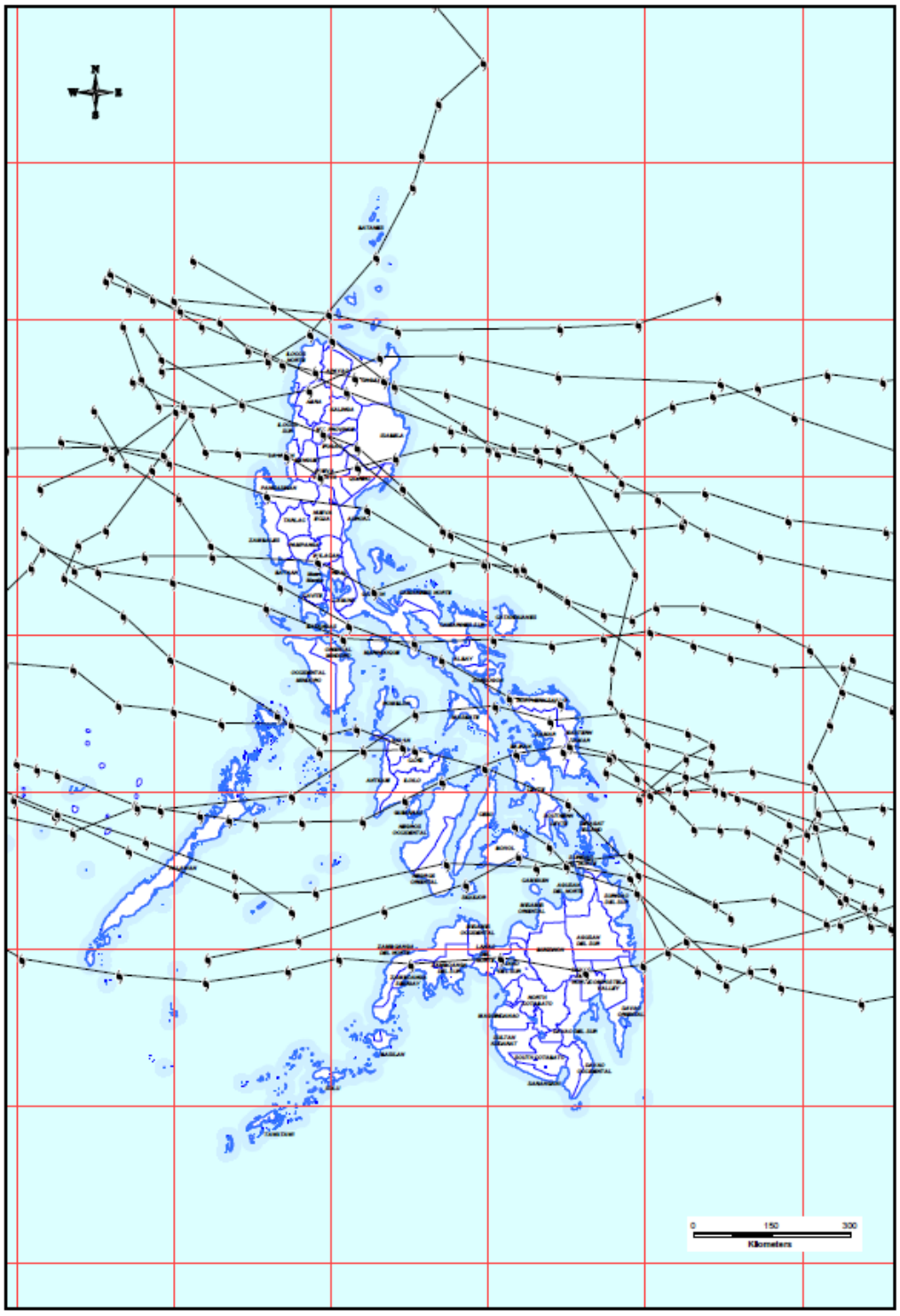
Source: JICA Study Team based on DPWH Road Inventory Data

Figure 8-2 Location of Cities with Population and NPR

Figure 8-3 Typical Traffic Condition at Urban Area

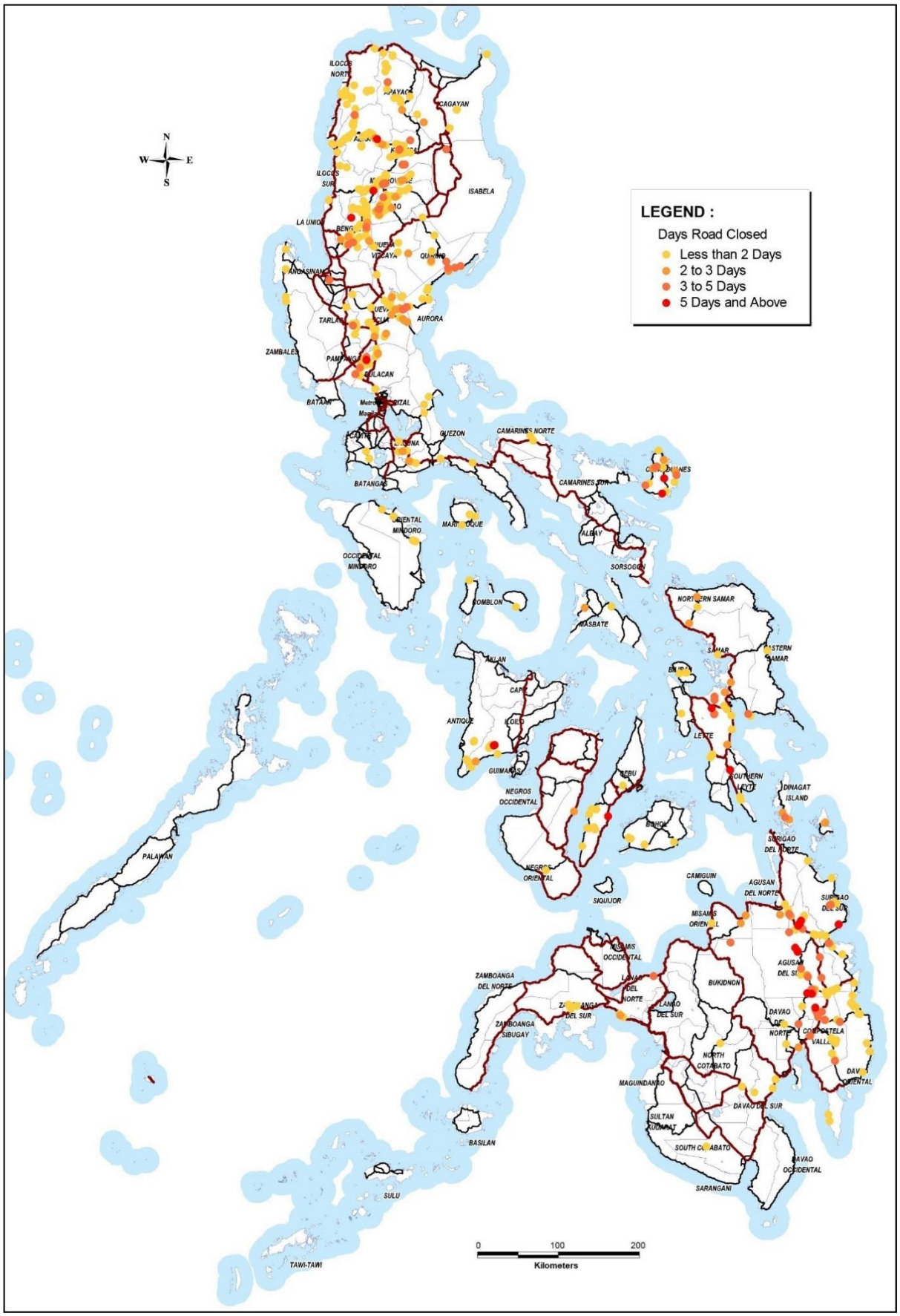
8.2 Road Closures by Disasters

The Philippines is an archipelago prone to an average of 21 typhoons a year. Typhoons cause landslides and floods on roads which resulted in frequent road closures. Figure 8-5 shows the road closures due to typhoon damage. It was observed that many roads were closed during typhoons.



Source: PAGASA

Figure 8-4 Track of Major Typhoon from 2016 to 2018 in the Philippines



Source: JICA Study Team based on DPWH data

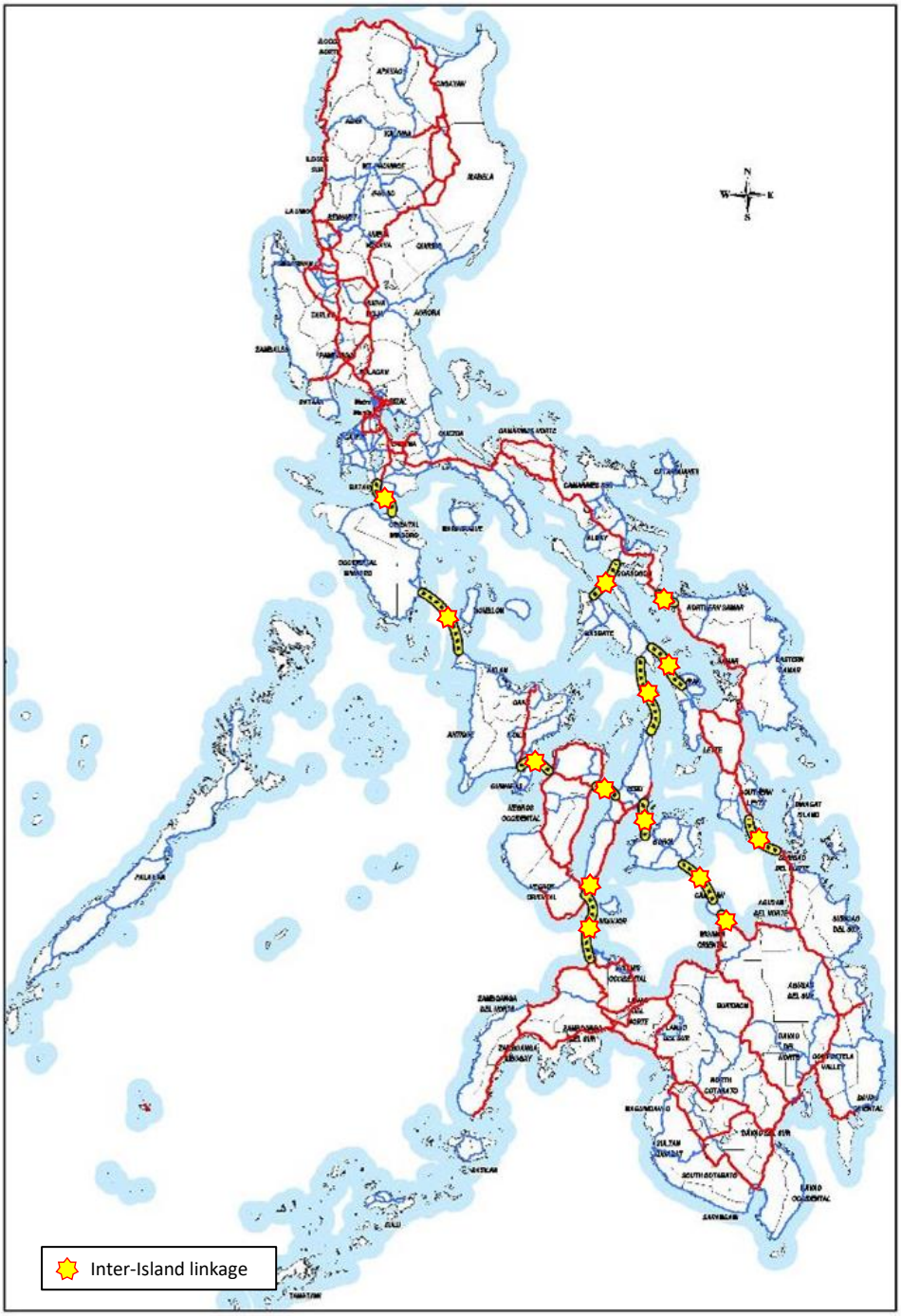
Figure 8-5 Road Closure Section due to Hard Rain by Typhoon (2014,2015,2018)

8.3 Weakness of Redundancy and Durability Against Natural Disasters

There are many mountain ranges in the Philippines, which makes it difficult to develop roads in certain areas. There are several instances when roads must cross the mountains to connect important regions. In many cases, these connections depend on a single national road, which has no alternate route. Moreover, these roads are vulnerable to natural disasters, such as typhoons or earthquakes.

8.4 Inter-Island Connection

The Philippines is an archipelagic country consisting of many islands. Its geographical characteristics make it difficult to connect regions. The main islands of Samar and Leyte are only connected by road now.



Source: JICA Study Team

Figure 8-6 Important Inter-Island Linkages

8.5 Issues on Present Road Traffic and Road Network

(1) Issues on the Present State of Road Traffic

a) Continuous Increase in Traffic

The DPWH traffic count data shows that the nationwide traffic volume is increasing at 4.8% per year. Similarly, the number of registered motor vehicles increased at 4.4% per year. Based on the future traffic demand analysis, it is predicted that by 2040, the traffic volume will increase by 2- 4 times of the 2019 figure.

To cope with the rapid traffic increase, highway capacity expansion is an urgent matter. However, widening of the existing national highways is difficult in the urban areas due to rapid urbanization. With this situation, the formation of new bypasses could be an essential measure as a response to the increased traffic demand in urbanized areas.

b) Traffic congestion in Metropolitan Areas

The traffic congestion in Metro Manila is getting serious. As the urban sprawl in the suburbs continues, the expansion of arterial roads becomes an urgent issue. Especially, planning and development of outer ring roads need to avoid the concentration of traffic at urban centers. The same issues are becoming apparent in other metropolitan areas such as Cebu, Davao, and Cagayan de Oro

c) Deterioration of Road Level of Service in the Rural Urban Areas

Urbanization in the region is rapidly developing along the national highway. Even national primary highways (which are supposedly characterized by smooth traffic flow) become congested with local traffic utilizing the highway. Consequently, through traffic and large trucks are entering the urban center area, leading to traffic congestion, compromised road safety, and deteriorated environment. Even on national primary highways, the travel speed is drastically reduced to less than 20 kph. The development of bypasses for through traffic is needed where there is significant traffic congestion.

d) Increase of Long-distance Trips

The results of the roadside OD survey have shown that about 30% of traffic volume are long-distance trips (over 100km). It is forecasted that the number of long trip users will continue to grow.

The provision of high-speed traffic infrastructure that can support further travel time reduction is required to cope up with the increasing number of long-distance trip users.

e) Concentration of International Cargo at the Manila Port

More than 80 percent of import and export cargos by maritime container are handled at the Manila container terminal. The large trucks (e.g., container trailers) operating to/from the international port causes traffic congestion along the highway near the harbor front area and the urban centers. Furthermore, the handling volume at the port is increasing by 6-8% per year, thus, the traffic congestion is also becoming worse.

The lack of road development connecting the port and the destination of the cargo such as SEZ and other logistic centers is raised as a possible issue. The high standard highway is needed to connect port and hinterland areas of port.

f) Economic Losses and Deterioration of the Urban Environment due to Traffic Congestion

The losses brought about by traffic delays due to the inflow of through traffic into the urban areas and huge traffic congestion, and is a factor of the occurrence of road crashes. In addition, traffic congestion increases the emission of exhaust gases from vehicles leading to the deterioration of the roadside environment.

Source: JICA Study Team

(2) Issues on Road Network and Regional Connectivity

a) Expressway development is focused only in Metro Manila and neighboring regions

Development of expressways is limited in Metro Manila and neighboring regions, and the total length is only 406 km. In other areas, there is no national high-speed highway network. The extension of expressways is slow in comparison with other countries in the Southeast Asia. If the relationship between GDP per capita and the length of expressways in major Southeast Asian countries were applied to the Philippines' economic level, it would be appropriate to have 800 kilometers of expressways in place, but in reality, the length of expressways is only half that. The provision of an expressway network covering the whole country is necessary to promote the development of the nation.

b) Imbalanced Development of Road Network

The national highway density (per population/land area) is extremely high in Metro Manila and the neighboring regions. However, in other regions, the national highway density is low, and the road network is basically either two-lane or two-lane with wide shoulder roads. The lack of bypass development around urban areas is also an issue. Further improvement of roads in provincial areas is required for a more balanced national development.

c) Topographical Restrictions and Vulnerability to Disasters

Regional highway networks lack redundancy. Redundancy especially on inter-regional highways that pass through mountainous areas is weak. As a result, huge detours must be made by road users when a highway is closed due to a natural disaster. The Philippines is frequently hit by strong typhoons every year and the country suffers road closure due to flooding, landslides, and other natural disasters. Highways have to overcome the topographical restrictions of mountainous areas through the provision of disaster-resistant roads using tunnels, bridges, and slope stabilizing works, as well as the formation of a road network that has sufficient redundancy to cope with natural disasters.

d) Poor inter-island connectivity

The Philippines is an archipelagic country and the inter-island travel rely on ferries or infrequent air services, thus, limiting efficient travel between islands. In order to promote efficient movement between islands and the economic development at island areas, further transport reinforcement of inter-island linkages should be promoted considering the application of advanced technology such as long-span bridges, and undersea tunnels.

e) Weak Accessibility to Metropolitan Areas

Good connectivity to metropolitan areas where population and economy are concentrated is very important to increase business opportunity and to enjoy high-grade urban services.

The population within a 3-hour radius of the metropolitan centers (Manila, Cebu, and Davao) is less than 50% of the whole population of the country. In terms of the accessibility index, that is, the one-day accessible population (the population of the area that can be reached within 3 hours from each zone), Metro Manila and the surrounding areas where an expressway network was developed well has a large accessible population. However, in other areas, the accessible population is small due to undeveloped expressway.

f) Weak Accessibility to Urban Services and Transport Hubs

Good accessibility to regional centers which provides urban services for daily life is very important. The accessible population within 1.5-hours from major regional centers is less than 65% of the total population of the country. It is hoped that this will reach 100% once the development of the expressway network is realized.

In terms of accessibility to major transport hubs such as major ports and airports, currently, only 3 ports and 2 airports have access to expressways. To enhance international competitiveness and attract more investments, the connectivity between the transport hubs and expressways must be strengthened to expand the service area of the transport hubs.

Source: JICA Study Team

9 INSTITUTIONAL SYSTEM AND PPP

9.1 DPWH Organization

(1) DPWH Mandate

The Department of Public Works and Highways (DPWH) is one of the three departments of the Government undertaking major infrastructure projects. DPWH is mandated to undertake (a) the planning of infrastructure, such as national roads and bridges, flood control, water resources projects and other public works, and (b) the design, construction, and maintenance of national roads and bridges, and major flood control systems.

In order to support the overall socioeconomic development of the Philippines, one of the major national programs being implemented by the Government is the development of the highway network in the Philippines, which is planned and implemented by DPWH.

(2) DPWH Organizational Structure

By virtue of the Executive Order No. 124, series of 1987, the DPWH organization has eight (8) services, six (6) bureaus, sixteen (16) regional offices, one (1) Unified Project Management Office (UPMO), and one hundred eighty-three (183) district engineering offices. All these offices are mandated to accelerate the process of nation building through infrastructure projects.

The eight (8) Services are: Planning, Public-Private Partnership, Human Resource and Administrative, Finance, Information Management, Procurement, Legal, and Stakeholders Relations.

The six (6) Bureaus are: Design, Construction, Maintenance, Equipment, Research and Standards, and Quality and Safety.

9.2 Legislative Framework on PPP

(1) Brief History of PPP projects

In the Philippines, the need for PPP has long been recognized. Therefore, the legal system was established, and business has been promoted based on it. Toll road development has been carried out in three unique ways as shown in Figure 9-1.

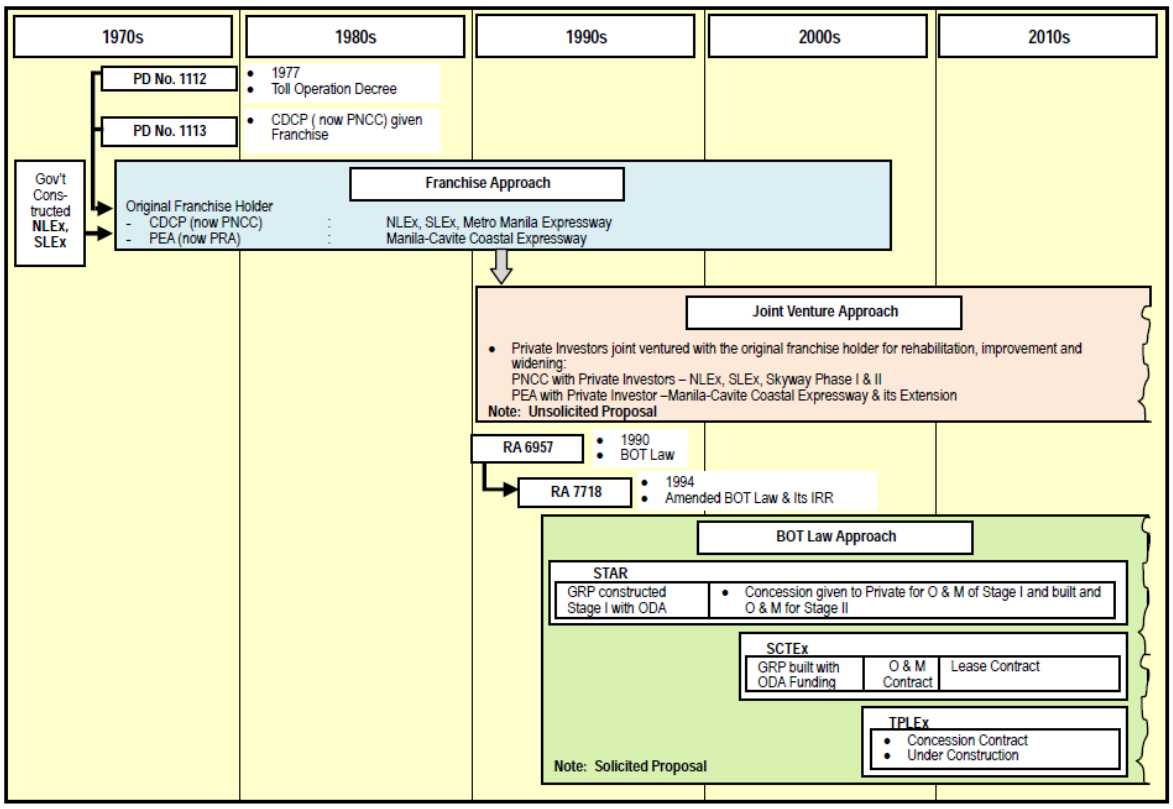
The franchise system is based on Presidential Decree (PD) No. 1112 of 1977, which was enacted the Toll Regulatory Board (TRB) and PD gave it the authority to enter into contracts for the construction, operation, and maintenance of roads and other toll facilities. In the same year, the Construction and Development Corporation of the Philippines (CDCP) was given a 30-year mandate for the construction, operation, and maintenance of the North Luzon Expressway extension, among others. This method has been taken over by the joint venture method described below sentence, so there are no toll road contracts under this method at present.

Although the need to address the aging of the structure and enhance its functions increased, the original franchise holder did not have the financial capacity to address these needs. Therefore, a private investor voluntarily proposed a joint venture with the original franchise holder and signed a contract with the Toll Regulatory Commission. This is the joint venture method.

In 1990, Republic Act No. 6957, the so-called BOT Act, was issued, giving the private sector the authority to build, operate, and maintain toll roads. The law has since been amended, and related organizations have been established and reorganized. The revised Implementing Bylaws of 2012 specified the following forms of PPP: BT (Build-and-Transfer), BLT (Build-Lease-and-Transfer), BOT (Build-Operation-and-Transfer), and BTO (Build-Transfer-and-Operate).

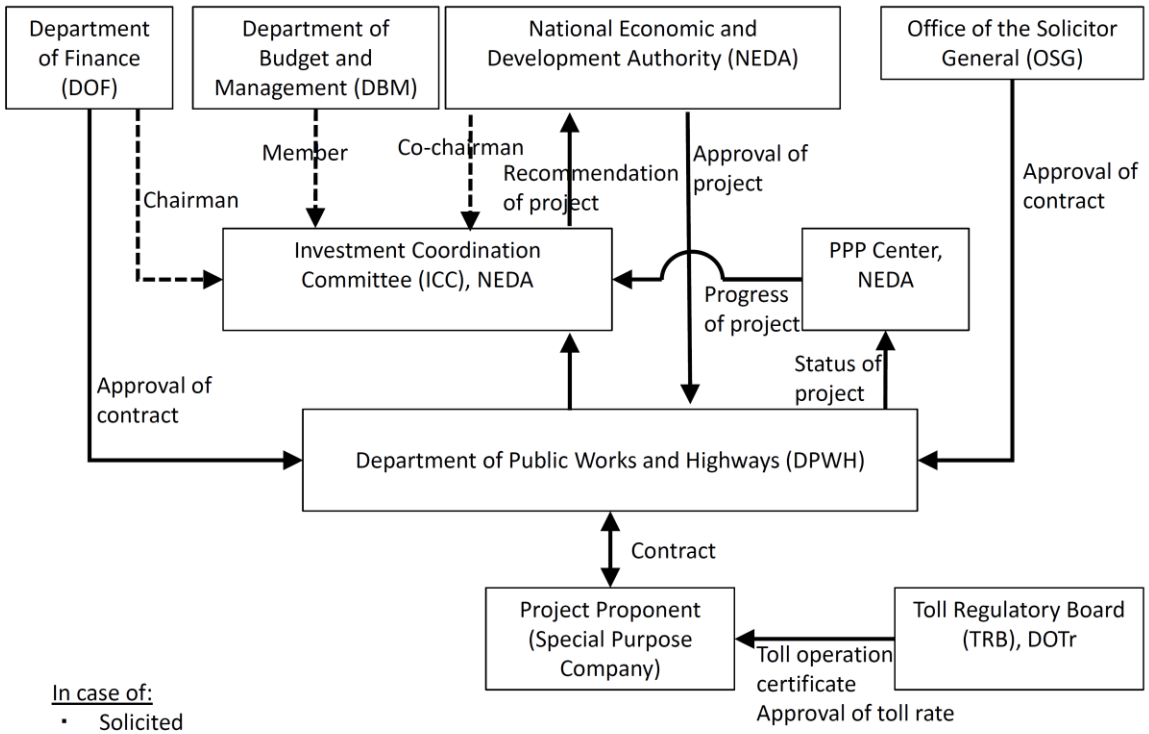
(2) Institutional Structure on Toll Road Development

Major players for a PPP project of DPWH and their roles are shown in Figure 9-2. Regarding the issues of the current system, DPWH is fully aware of the contents of the PPP projects of DPWH. However, DPWH is not fully aware of the road extension plans under the control by TRB, such as the franchise system and joint venture system, and the information sharing is insufficient.



Source: JICA Study Team

Figure 9-1 Historical Flow of Private Sector Participation in Expressway Services



Source: JICA Study Team

Figure 9-2 Major Players for DPWH PPP Project under IRR of BOT Law

PART E –HSH DEVELOPMENT MASTERPLAN FORMULATION

10 DEFINITIONS OF HSHs AND IDENTIFICATION CRITERIA OF HSH CORRIDORS

10.1 Definition of HSH

(1) General Definition of HSH

"Highways which provide high level traffic services by assuring high speed mobility, safe and comfortable travel in order to vitally support socio-economic activities for sound development of strategic regions and the country as a whole."

(2) Composition of HSH

HSH is composed of HSH Class-1 and HSH Class-2.

(3) Development Objectives, Functions and Structural/Operational Characteristics

Development objectives, functions and structural/operational characteristics of HSH Class-1 and HSH Class-2 are summarized in the following figures (Figure 10-1 to Figure 10-3).

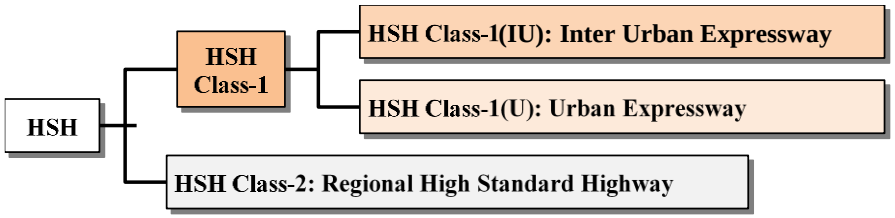


Figure 10-1 Composition of HSH

Figure 10-2 Left: HSH Class-1(IU), Right: HSH Class-1(U) Image

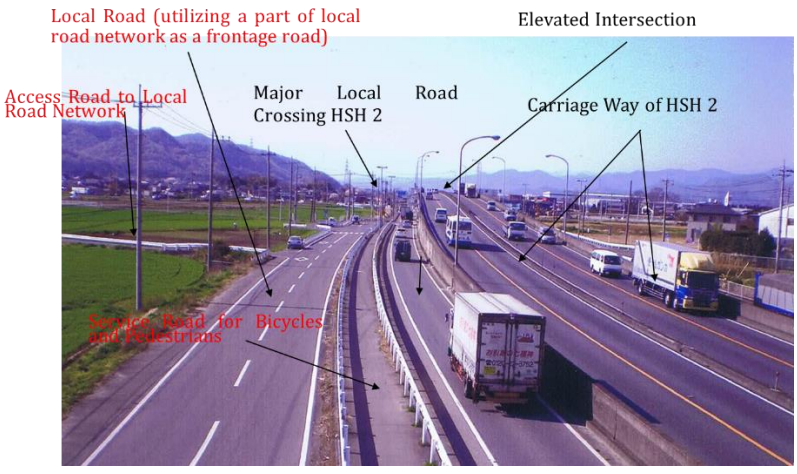
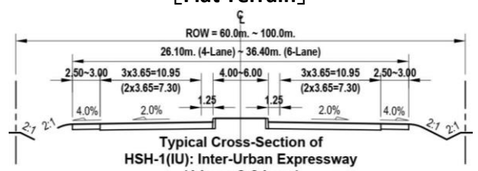
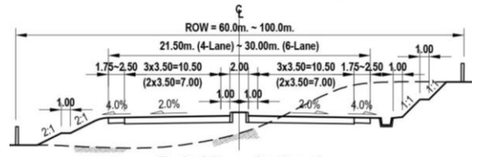
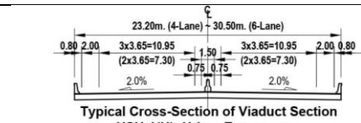
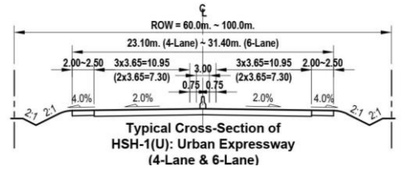
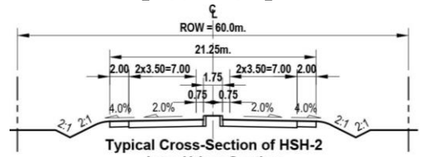
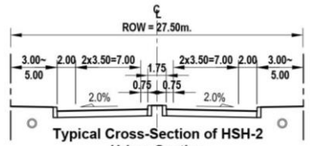
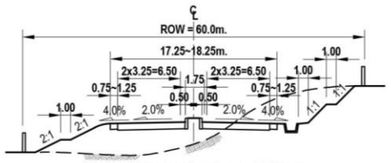


Figure 10-3 HSH Class-2 Image

Table 10-1 Definition of High Standard Highway (HSH)

HSH Class		Development Objectives	Functions	Structural/ Operational Characteristics	Standard Cross Section*)	Example
HSH Class-1	**HSH Class-1 (IU): Inter-Urban Expressway**	• To achieve balanced development of the country. • To mitigate over-concentration of people and economic activities in Metro Manila. • To improve international competitiveness of the country.	• To provide high-speed, safe, and comfortable means of transportation for medium and long-distance trips. • To improve connectivity between major urban centers (Metropolitan Centers / Regional Centers) and the rest of the areas. • To provide efficient access to other important transport facilities such as base ports, international airports and principal airports – class 1. • To improve commodity transportation efficiency. • To expand one-day activity area.	• Access controlled. Only 4 or more-wheel vehicles can utilize this facility through an interchange. • Grade separated at all intersecting roads. • High design speed of 80-120 km/hour [Flat Terrain] and 60/80 km/hour [Mountainous Area] • Jeepneys, Motorcycles (less than 400 cc) and tricycles are not allowed on this road.	[**Flat Terrain**]  Typical Cross-Section of HSH-1(IU): Inter-Urban Expressway (4-Lane & 6-Lane) [**Mountainous Area**]  Typical Cross-Section of HSH-1(IU): Inter-Urban Expressway (4-Lane & 6-Lane)	• North Luzon Expressway • South Luzon Expressway
	HSH Class-1 (U): Urban Expressway	• To mitigate chronic traffic congestion in and around major urban centers. • To vitally support urban socio-economic activities for development. • To improve international competitiveness. • To improve urban environment.	• To provide reliable means of transportation in terms of travel speed. • To provide smooth linkage with other transport modes and improve inter-modal linkage. • To provide efficient link between traffic generations sources.	• Access controlled. Only 4 or more-wheel vehicles can utilize this facility through an interchange or an on/off ramp. • Grade separated at all intersecting roads. • High design speed of 60/80 km/hour. • Jeepneys, Motorcycles (less than 400 cc) and tricycles are not allowed on this road.	 Typical Cross-Section of Viaduct Section HSH-1(U): Urban Expressway (4-Lane & 6-Lane)  Typical Cross-Section of HSH-1(U): Urban Expressway (4-Lane & 6-Lane)	• Skyway • C-5 Expressway • C-6 Expressway
HSH Class-2	**HSH Class-2: Regional High Standard Highway**	• To accelerate regional development, particularly agricultural, industrial and tourism development. • To strengthen linkage between regional urban centers and rural areas. • To accelerate development of underdeveloped areas. • To improve the standard of living of rural people. • To develop roads which bypass congested urban areas to assure smooth travel throughout the trip route.	• To provide reliable, safe and comfortable means of transportation at regional level after branching off from HSH Class-1. • To strengthen linkage between Regional Center and Sub-Regional Center, major Sub-Regional Centers and also between production areas and consumption areas and support development of regional industries. • To provide access to terminal ports, principal airport – class 2 and community airports.	• Partially access controlled for most of HSH Class-2, but if not feasible for economic and technical, non-access controlled. • Bypass or diversion roads (to be 4-lane or more roads). • Grade separated at major intersections. • At-grade intersection for minor intersecting roads. • Design speed 60 km/hr. (mountainous area, 50km/hr.) • All vehicles are allowed to use this class of roads, including jeepneys, tricycles, bicycles, etc. • In urban area, service road will be provided in order to segregate through traffic and local traffic.	[**Flat Terrain**]  Typical Cross-Section of HSH-2 Inter-Urban Section  Typical Cross-Section of HSH-2 Urban Section [**Mountainous Area**]  Typical Cross-Section of HSH-2 Inter-Urban Section	• Davao City Diversion Road • Roman Superhighway, Bataan

*) Shown above are typical cross-sectional drawing; for special cases such as bridges, tunnels and temporary two-lane highways, cross-sections shall be studied as an individual project.

Table 10-2 Proposed Basic Design Elements for HSHs (Flat Terrain)

		Philippines (Proposed)			USA		Japan		Asian Highway	
		HSH Class-1		HSH Class-2	AASHTO (Interstate Highway)		NEXCO	Metropolitan Expressway Co.	AH26 (Inter-Urban Highway)	
		HSH Class-1(IU)	HSH Class-1(U)	Regional High Standard	Inter-Urban	Intra-Urban	Inter-Urban	Intra-Urban	Primary (Expressway)	Class I*1)
Design Speed (km/h)		80-120	60-80	60-80	121	89	100-120	60-80	120	100
No. of Lanes*4)		4 or more		4 or more	4 or more		4 or 6	4	4 or more	
Lane Width (m)		3.65	3.50	3.50	3.65		3.50	3.25	3.75	3.50
Shoulder Width (m)	Outer Shoulder	2.50-3.00	2.00-2.50	2.00	3.05	-	2.50	1.25	3.0	3.0
	Inner Shoulder	1.25	0.75	0.75	1.22	-	1.25	0.75	-	-
Median Strip Width (m)		4.00-6.00	3.00	1.75	11.00	3.00	4.50	1.75	4.00	3.00
Bridge	Traffic Load	HS20-44		HS20-44	HS20-44		B Live Load*2)		HS20-44	
	Vertical Clearance (m)	5.30	5.30	5.00	4.88	4.27	4.50*3)	4.50*3)	4.50	4.50
Note		*1) Class I may be corresponding to the Arterial Road in the Philippines. *2) Almost corresponding to (HS20-44) X1.25. *3) In case that allowance for extra layers of pavement is considered, the vertical clearance is to be 4.70m. A vertical clearance of 4.5m is the requirement for safe passage of standards ISO containers. *4) The HSH is designed to be 4-6 lanes highway, however, if the traffic demand is still low at the initial stage, a 2-lane highway will be possible.								

Source: JICA Study Team

Table 10-3 Proposed Basic Design Elements for HSHs (Mountainous Area)

		Philippines (Proposed)		USA		Japan			Asian Highway	
		HSH Class-1	HSH Class-2	AASHTO (Interstate Highway)		NEXCO	Road Structure Ordinance*4)		AH26 (Inter-Urban Highway)	
		HSH Class-1(IU)	Regional High Standard	Inter-Urban	Intra-Urban	Inter-Urban, Mountainous, (Type 1 Class3, 4)	National Highway Flat Terrain (Type3 Class1)	National Highway Flat or Mountainous Area (Type3 Class2)	Primary (Expressway)	Class I*1)
Design Speed (km/h)		60-80	50	No difference in design elements in Flat Terrain and Mountainous Area		60-80	80	60	80	60
No. of Lanes*5)		4 or more	4 or more			4 or 6	4 or more	2 or 4	4 or more	
Lane Width (m)		3.50	3.25			3.50(80kph) 3.25(60kph)	3.50	3.25	3.75	3.50
Shoulder Width (m)	Outer Shoulder	1.75-2.50	0.75-1.25			1.75	1.25	0.75	2.50	2.50
	Inner Shoulder	1.00	0.50			1.00	0.50	0.50	-	-
Median Strip Width (m)		2.00	1.75			2.00	1.75	1.75	3.00	2.50
Bridge	Traffic Load	HS20-44	HS20-44			B Live Load*2)			HS20-44	
	Vertical Clearance (m)	5.30	5.00			4.50*3)			4.50	4.50
Note	*1) Class I may be corresponding to the Arterial Road in the Philippines. *2) Almost corresponding to (HS20-44) X1.25. *3) In case that allowance for extra layers of pavement are considered, the vertical clearance is to be 4.70m. A vertical clearance of 4.5m is the requirement for safe passage of standards ISO containers. *4) Roads shall be classified into Type1 through 4. (National Expressway and access-controlled highway is Type 1(Rural) and Type 2(Urban Area). Other Roads such as National Highway, Prefectural Roads is Type 3(Rural) and Type 4(Urban Area). *5) The HSH is designed to be 4-6 lanes highway, however, if the traffic demand is still low at the initial stage, a 2-lane highway will be possible.									

Source: JICA Study Team

10.3 HSH Corridor Identification Criteria

(1) Factors to be Considered in Selecting HSH

- Distributions of urban centers.
- Regional/urban development policies and strategies.
- Existing road and expressway networks and transport axes to be strengthened.
- Important airports and ports to be accessed by HSH.
- Important locations/areas for which transport linkage are to be strengthened.
- High traffic demand corridors.
- Strategic areas whose transport access are to be strengthened.

(2) HSH Corridors Identification Criteria

The following conditions shall be considered:

HSH Class-1 (IU) : Inter-Regional Expressway
• Metropolitan Centers and Regional Centers shall be connected. • Base Ports, International Airports and Principal Airports shall be connected. • Major transport generation/attraction centers shall be efficiently connected and major transport corridors shall be strengthened in terms of their transportation capacity. • Existing expressway networks shall be further expanded.
HSH Class-1 (U) : Urban Expressway
• Since road right-of-way (ROW) acquisition is usually difficult and expensive in urban areas, such as Metro Manila, Metro Cebu, Metro Davao, urban expressways shall be selected along existing major roads which have existing road ROW of 45 meters or more. • Accessibility to major business commercial centers and major residential areas shall be improved. • Major transport facilities, such as International Airports and Base Ports, shall be provided with efficient transport access. • Urban expressway networks shall be planned that traffic congestions along major transport corridors shall be reduced. • Existing urban expressways shall be efficiently connected and/or expanded.
HSH Class-2 : Regional High Standard Highway
• HSH Class-2 shall be connected to or branched off from HSH Class-1 and provide strong and efficient transport access to the areas served. • Bypasses shall reduce inflow of through traffic into urban centers and traffic congestion shall be reduced. In addition, inter region traffic shall be improved smoothly. • HSH Class-2 shall provide important transport access to regional political, commercial, cultural and educational centers. • HSH Class-2 shall provide access to sub-regional centers, local airports and local ports.

11 HSH NETWORK DEVELOPMENT

11.1 Identified Development Issues

The following development issues have been identified:

Luzon
• Concentration of population and economic activities in Metro Manila should be mitigated, even as population growth in this area is not expected to be robust in the future as it was in the past. • Improvement of infrastructure to deal with population growth in the suburban areas of Metro Manila and regional centers, especially in CALABARZON (Region IV-A) and Region III. • The growth of CALABARZON and Region III will continue and SEZ will be developed in these two regions. • Region III will grow along with the development of the railway system. It is necessary to invest in urban infrastructure of the regional centers. At the same time, a balance between preservation of the agricultural land and urban development should be sought since Region III is the primary producer of agricultural products. • Development is lagging in the northern areas (CAR and Cagayan Valley) and southern areas (Bicol and MIMAROPA). • The poverty incidence is high in CAR, Cagayan Valley, Bicol, and MIMAROPA. A big segment of the population in these regions is engaged in the primary sector. It is necessary to promote development of economic sector by improving transport access to/from the regions. • Disaster risks from typhoons, floods, and volcanic eruptions are high. Disaster risk reduction measures are required.
Visayas
• In the Visayas, Metro Cebu is the center of economy led by manufacturing and tourism sectors, and this trend will be maintained in the future. However, Cebu Island has limited land appropriate for development and it has water resource issues. • It is important to develop regional centers, such as Bacolod, Iloilo, Dumaguete, Ormoc, and Tacloban, by promoting industry and infrastructure development. • Needs for development support for tourism and other industries are significant in areas, such as Boracay, Bohol, etc. • Needs for economic development for poverty reduction are significant in Samar Island, Negros Oriental, and Southern Leyte. • Disaster risk mitigation efforts are required, along with environmental conservation. • Typhoon, flood, and landslide prone areas are observed in Samar, Leyte, and Cebu.
Mindanao
• A large population growth is expected in Mindanao. Metropolitan areas and regional centers, such as Davao, Cagayan de Oro, General Santos, Zamboanga, would experience rapid population growth. Some cities would have a metropolitan status in the long term. Davao and Cagayan de Oro are attracting SEZ, and other centers also try to develop special economic zones. Investment in urban infrastructure of these settlement centers is necessary to promote development of industries. • In particular, the development of the primary industry of agriculture, agro-processing industry and tourism should be promoted. • It is necessary to consider the development potentials of BIMP-EAGA. Zamboanga has strategic importance as the gateway to BIMP-EAGA. • Poverty incidence in Mindanao, BARMM Region in particular, is very high, while the infrastructure development level is very limited. This regional disparity should be addressed not only for economic development, but also for sustainable peace.

- It is necessary to mainstream Disaster Risk Reduction and Management (DRRM) in the development of Mindanao. Although Mindanao used to be typhoon-free, but recently, typhoons are passing through Mindanao and had caused damage in some areas. Hence, the infrastructure should be disaster resilient. Climate change can affect the productivity of the agricultural sector.

11.2 Policy and Strategy for Development of HSH

To achieve development policies, HSH development objectives and strategies were established as follows:

Development Objectives

- ✓ To achieve balanced development of the country.
- ✓ To improve international competitiveness of the country.
- ✓ To mitigate chronic traffic congestion in and around major urban centers.
- ✓ To vitally support urban socio-economic activities for development.
- ✓ To improve the urban environment.
- ✓ To accelerate regional development.
- ✓ To strengthen linkages between regional urban centers and rural areas.
- ✓ To accelerate development of underdeveloped areas.
- ✓ To develop roads which bypass congested urban areas to assure smooth travel throughout the trip route.

⇨

Development Strategies

- ✓ To form backbone transport axes.
- ✓ To decongest traffic in Metropolitan Centers, Regional Centers and its suburbs.
- ✓ To provide efficient transport facilities for logistic corridors.
- ✓ To provide transport facilities for sound urban expansion.

Strategies for development HSH for each area are as follows:

Luzon

- Metropolitan Centers and Regional Centers shall be connected by HSH Class-1.
- Two (2) North-South development corridors shall be provided with HSH Class-1 facilities in North Luzon and Central Luzon.
- One development corridor shall be provided with HSH Class-1 facilities in South Luzon (Lucena – going to Samar island).
- Base Ports, International Airports and Principal Airports shall be connected by HSH Class-1.
- Existing expressway networks shall be further expanded.
- East-west corridor shall be provided with HSH Class-1 facilities in Central Luzon.
- In North Luzon, east-west corridor shall be provided with HSH Class-2 to connect two (2) north-south corridors. It shall be supported with resiliency and redundancy to national disaster.
- East-west corridor with HSH Class-2 shall be expanded to the Pacific Ocean side to support the underdeveloped areas.

Metro Manila

- HSH Class-1 shall be placed to reduce traffic congestion in urban arterial roads.
- ROW acquisition is extremely difficult, so that existing roads, rails and other ROW shall be utilized, as much as possible.
- Traffic distribution road (C-5 Expressway and C-6 Expressway) shall be planned.
- Development of HSH Class-1 requires huge investment. PPP schemes suitable for the country shall be selected for Metro Manila.
- HSH Class-2 shall be well connected with HSH Class-1.
- HSH Class-2 shall supplement the function of HSH Class-1.

- For designated HSH Class-2, bypass and grade separation of at-grade intersections shall be promoted to achieve smooth traffic flow.

Visayas

- Regional Centers and surrounding areas in large islands, such as Panay, Negros, Cebu, Samar and Leyte, shall be connected by HSH Class-1 to achieve integration of socio-economic activities.
- Regarding inter-island connections, Panay-Guimaras-Negros will be connected by a bridge as there is sufficient traffic demand and bridge construction is relatively easy. In other islands, a RORO system is recommended due to difficulty of bridge construction and insufficient traffic demand. HSH will support a seamless transport system, such as access road between the economic centers and ports and airports.

Mindanao

- All metropolitan centers and regional centers, except Dapitan City, shall be connected by HSH Class-1 to achieve integration of socio-economic activities.
  - Surigao- Butuan – Tagum – Davao – Digos- General Santos
  - Butuan – Cagayan de Oro- Pagadian – Zamboanga
  - Cagayan de Oro – Davao
  - General Santos – Cotabato - Zamboanga
- Dapitan City shall be connected by HSH Class-1 through HSH Class-2.
- Base Ports, International Airports and Principal Airports shall be connected by HSH Class-1.
- HSH Class-2 shall be connected to sub-regional cities, local ports and airport or branched off from HSH Class-1.

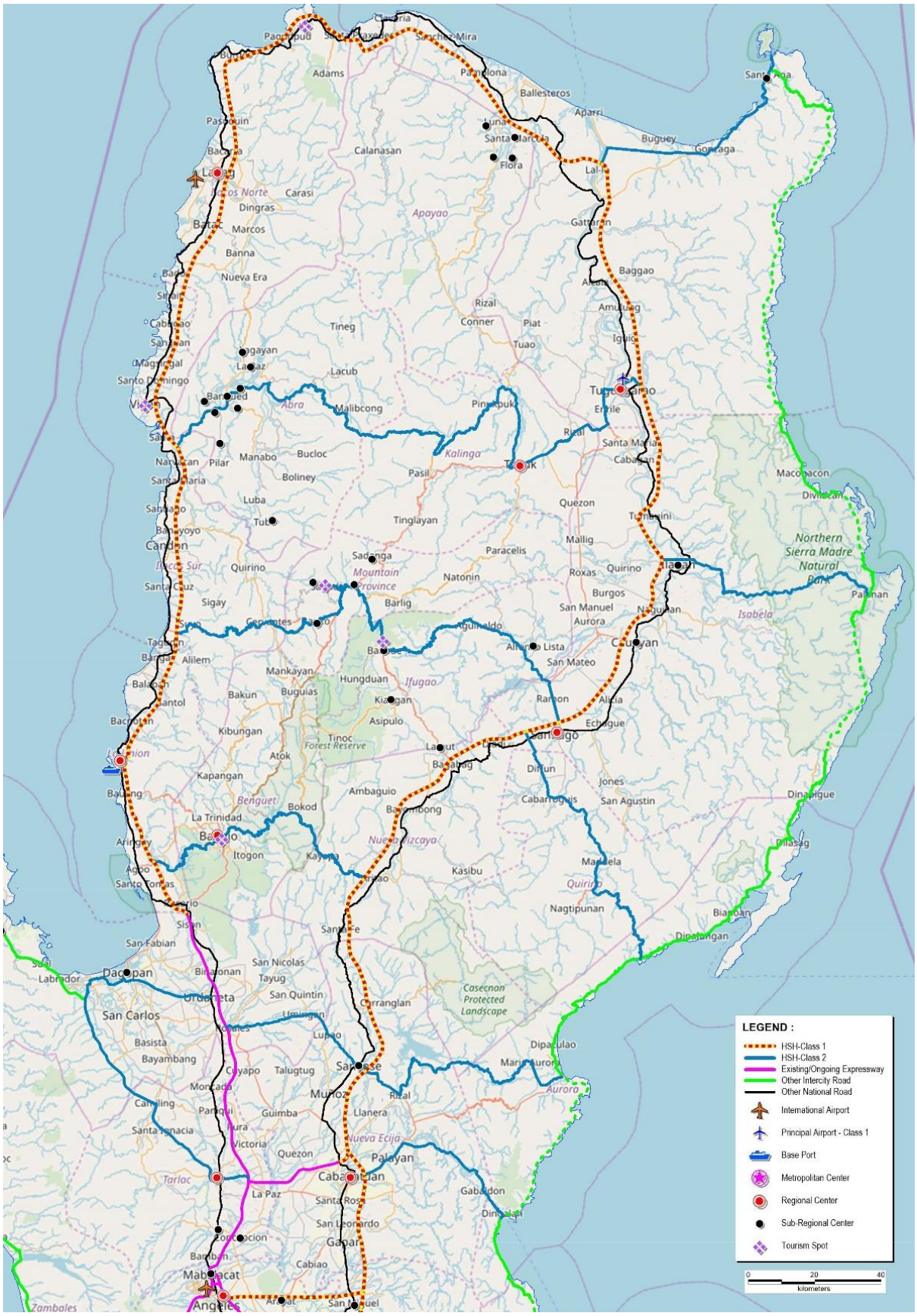
11.3 Proposed HSH Network

Based on both the HSH development strategy and proposed HSH network, the HSH network length was established. Total HSH Class-1 is approximately 4,400 km., including 406 km. of existing expressways and 265 km. of expressways under construction as of year 2019, while HSH Class-2 is roughly 4,600 km. The total length of HSH Class-1 and Class-2 is 9,000 km.

Table 11-1 Overall HSH Length

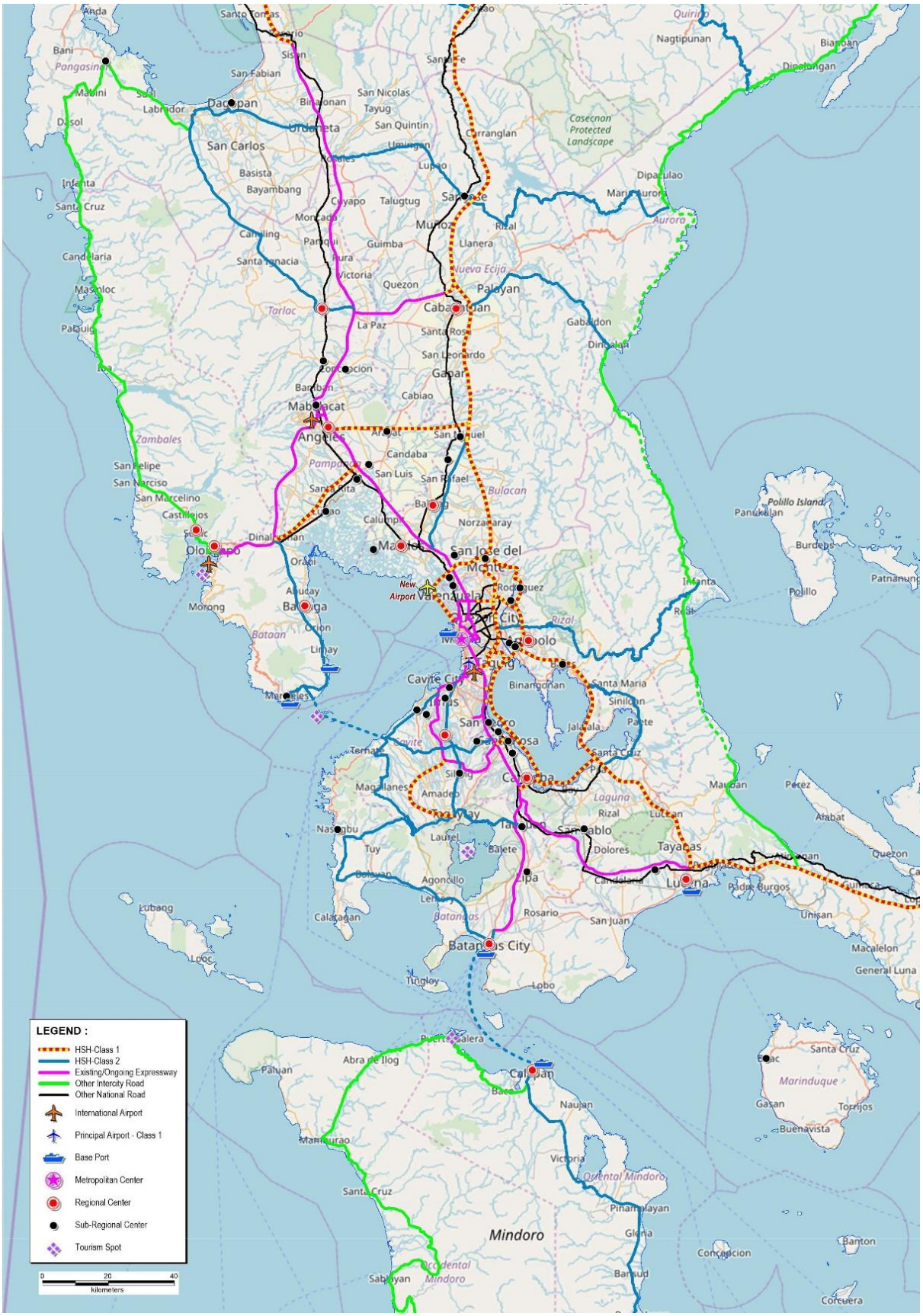
Area	HSH Class-1※ (km)	HSH Class-2 (km)	Total (km)
Luzon	2,100	2,500	4,500
Visayas	700	700	1,400
Mindanao	1,600	1,400	2,900
Total	4,400	4,600	9,000

∗ Note: Including existing expressway (406 km) and under construction expressway (265 km)
Source: JICA Study Team



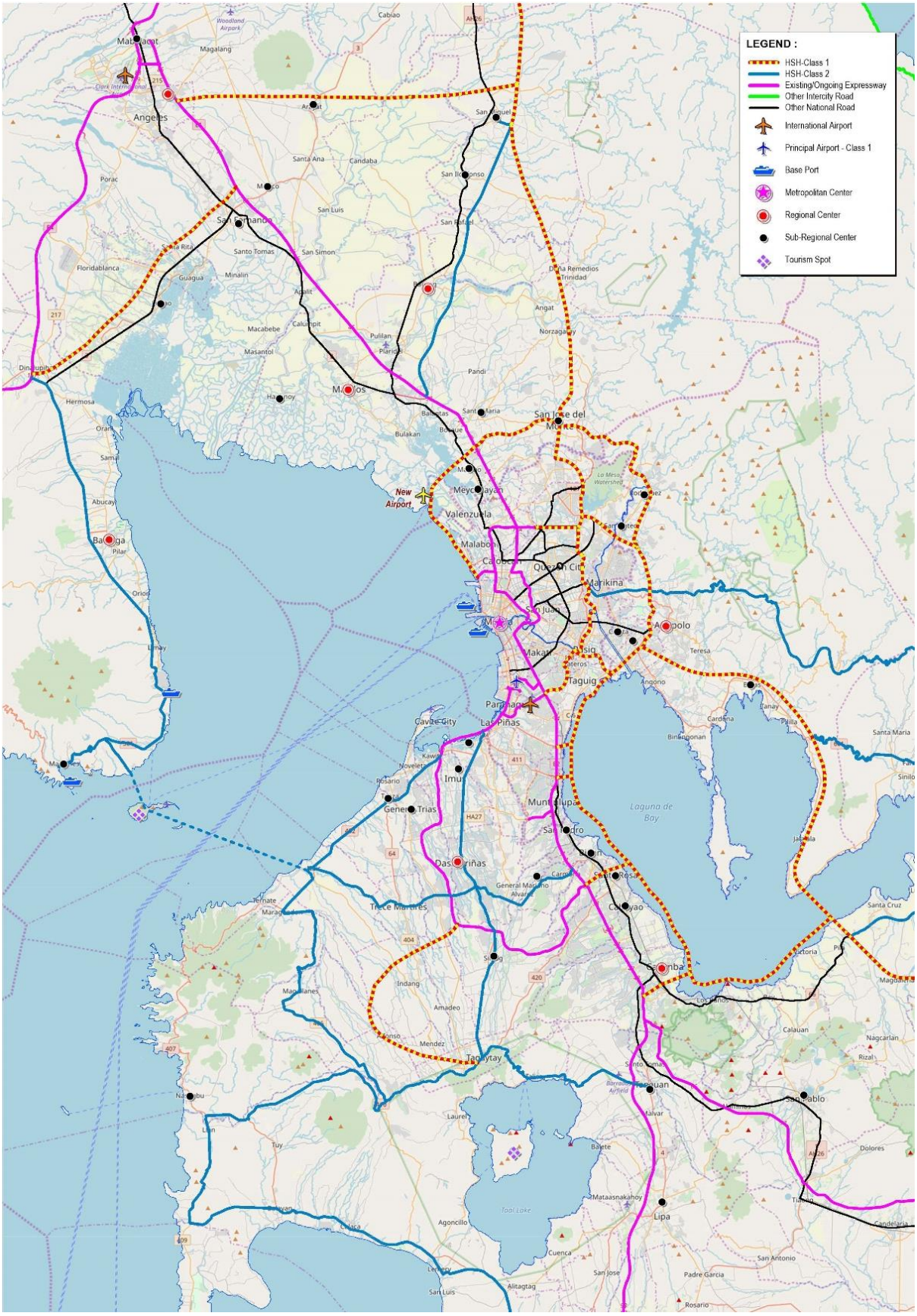
Note: The alignments of newly proposed HSHs are approximate ones because they are to be reviewed and determined according to their feasibility studies. Other intercity and national roads are not HSH. Just for reference.

Figure 11-1 Proposed HSH Network (North Luzon)



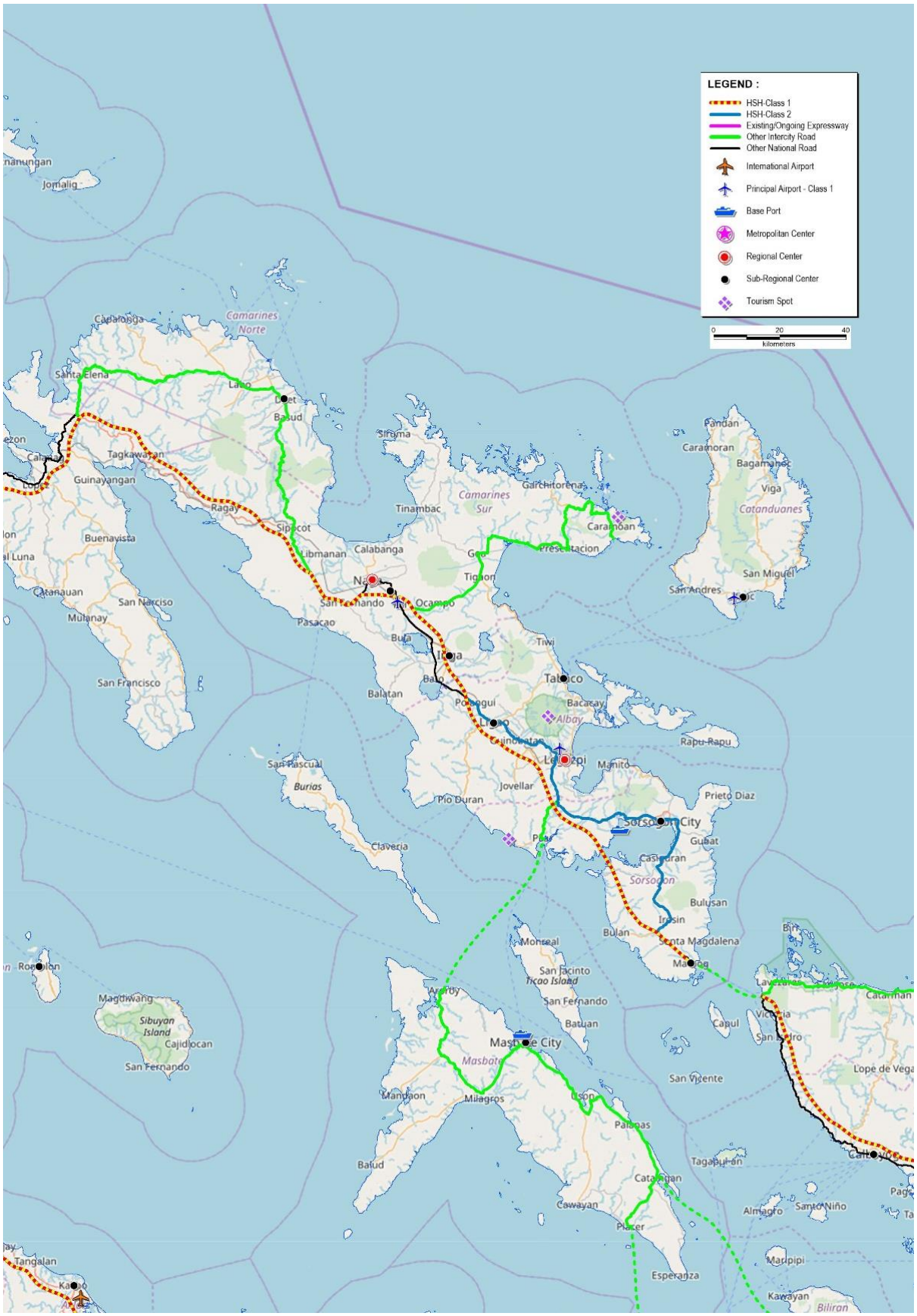
Note: The alignments of newly proposed HSHs are approximate ones because they are to be reviewed and determined according to their feasibility studies. Other intercity and national roads are not HSH. Just for reference.

Figure 11-2 Proposed HSH Network (Central Luzon)



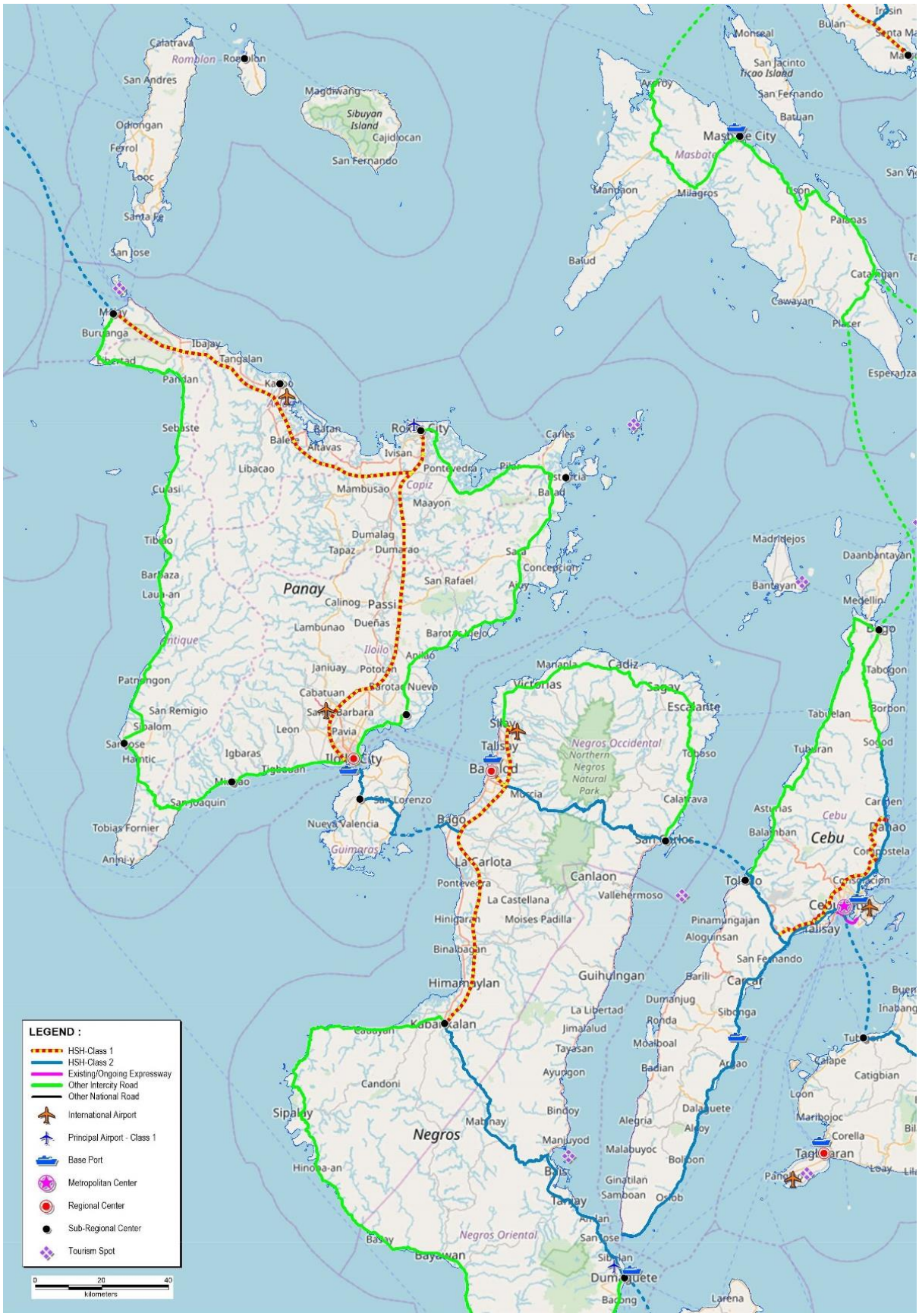
Note: The alignments of newly proposed HSHs are approximate ones because they are to be reviewed and determined according to their feasibility studies. Other intercity and national roads are not HSH. Just for reference.

Figure 11-3 Proposed HSH Network (Metro Manila)



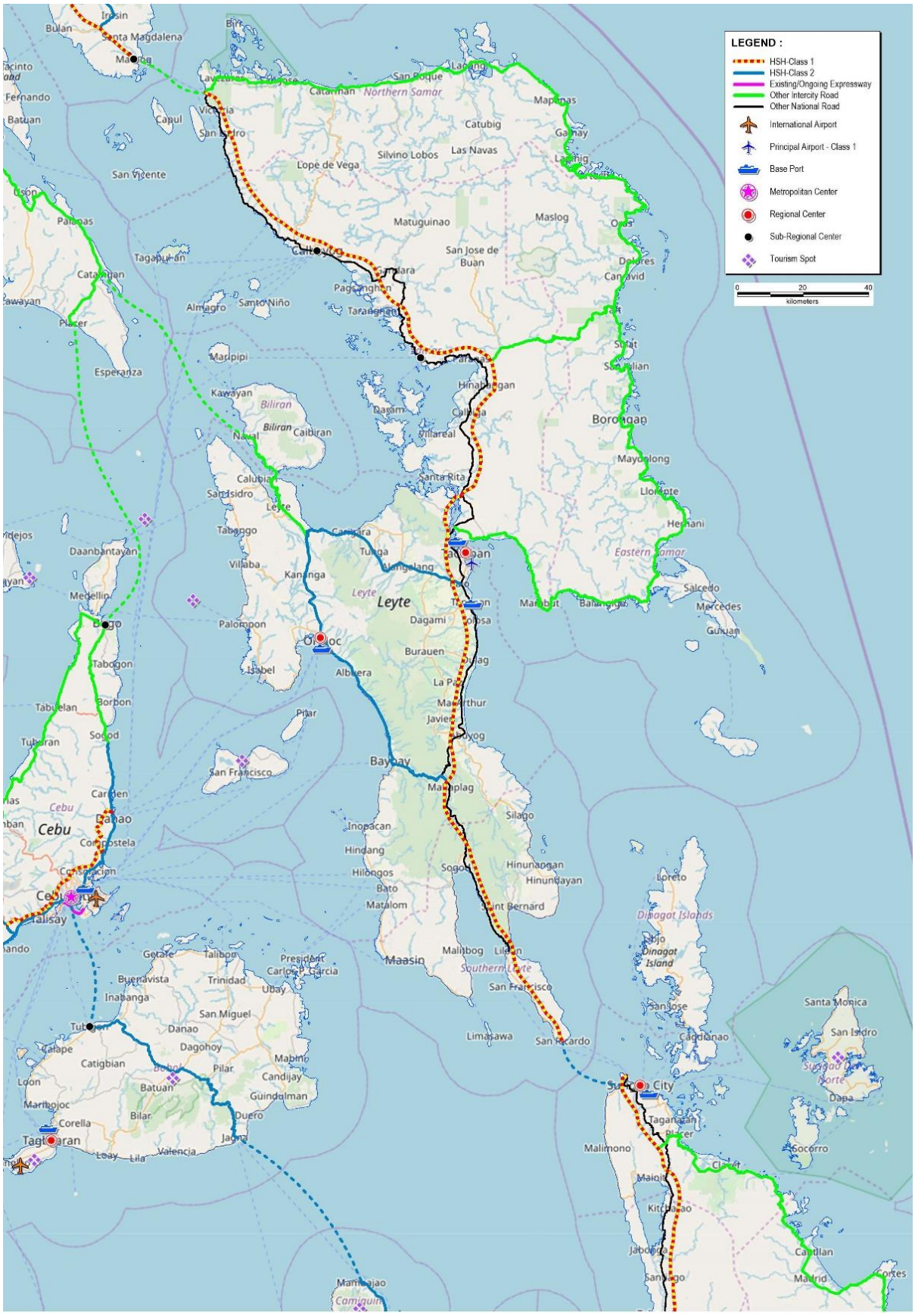
Note: The alignments of newly proposed HSHs are approximate ones because they are to be reviewed and determined according to their feasibility studies. Other intercity and national roads are not HSH. Just for reference.

Figure 11-4 Proposed HSH Network (South Luzon)



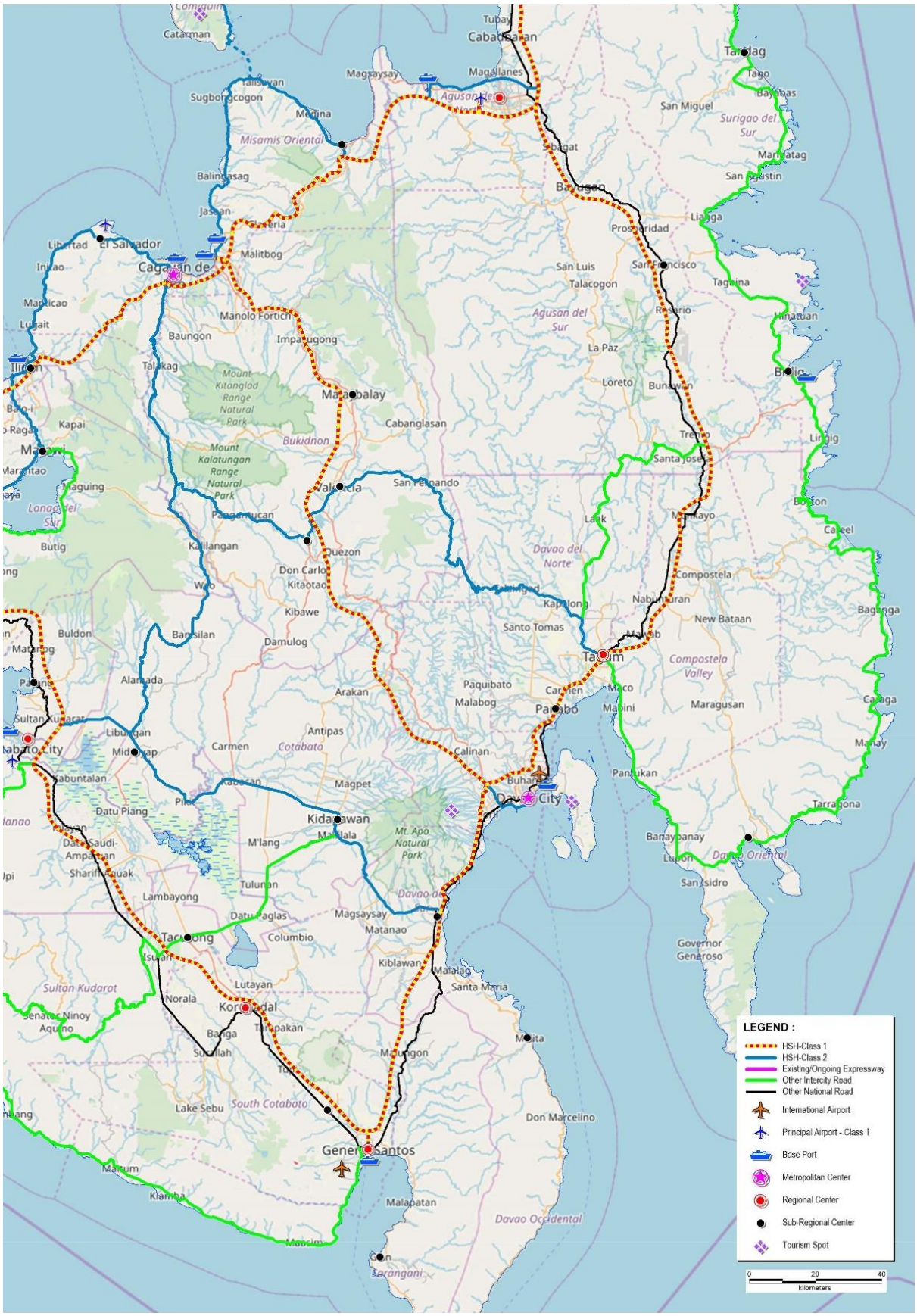
Note: The alignments of newly proposed HSHs are approximate ones because they are to be reviewed and determined according to their feasibility studies. Other intercity and national roads are not HSH. Just for reference.

Figure 11-5 Proposed HSH Network (West and Central Visayas)



Note: The alignments of newly proposed HSHs are approximate ones because they are to be reviewed and determined according to their feasibility studies. Other intercity and national roads are not HSH. Just for reference.

Figure 11-6 Proposed HSH Network (East Visayas)



Note: The alignments of newly proposed HSHs are approximate ones because they are to be reviewed and determined according to their feasibility studies. Other intercity and national roads are not HSH. Just for reference.

Figure 11-7 Proposed HSH Network (East Mindanao)

Note: The alignments of newly proposed HSHs are approximate ones because they are to be reviewed and determined according to their feasibility studies. Other intercity and national roads are not HSH. Just for reference.

Figure 11-8 Proposed HSH Network (West Mindanao)

11.4 Identification of HSH Network in 2040

(1) Procedure of HSH Network in 2040

To select HSH Network in 2040 from overall HSH Network, the following procedure as shown in Figure 11-9 was applied.

(2) Total Cost of Overall HSH Projects

Total Project Cost of Overall HSH Projects (Unimproved section of 9,000 km)

Item	Cost (Billion Php)
1. Construction Cost	
HSH Class-1	1,495
HSH Class-2	600
2. ROW Acquisition Cost (= 1. ×20%)	419
3. Consultant Cost (= 1. ×10%)	210
4. Physical Contingency (= 1. ×10%)	210
Total	**2,933**

Source: JICA Study Team

(3) Allocation for HSH Class-1 and Class-2

Based on the available budget[1)], approximately 65% (=1,900 Billion Php/2,933 Billion Php) of proposed project will be implemented in 20 years. 10% (=293 Billion Php) is assumed as BOT project. Total investment share is estimated at 75% (2,200 Billion Php) for 2040.

1)DPWH: HSH Investment (2021-2040) =GDP(2021-2040)×2.2%*1×20%*2

*1 2.2% is Road/ Bridge projects investment ratio to GDP (the average ratio from 2016 to 2020)

*2 20% is percentage of which can be invested in HSH projects.

HSH Class-2

Main works for HSH Class-2 are as follows:

- Road widening (2-lane to 4-lane or 6-lane)
- New Road for bad road alignment, New Bypass for congested areas
- Road Improvement (Pavement, etc.)
- Flyover at major intersections
- Major Projects
  i) Bataan - Cavite Bridge (187 Billion Php)
  ii) Panay – Guimaras - Negros Link Bridges (107 Billion Php)
  iii) Davao Coastal Road, etc.

These major projects will be implemented within 20 years, since these major projects were already approved by NEDA-ICC; and other widening works and road bypass projects will be implemented within the same span of 20 years.

JICA Study Team assumption is that all proposed HSH Class-2 projects will be implemented until 2040.

HSH Class-1

After deducting HSH Class-2 investment amount from the total project investment amount of 2,200 Billion Php, the remaining investment amount is approximately **65%** of the HSH Class-1 Network (1,360 Billion Php).

(4) Proposed HSH Class-1 Network in 2040

In order to identify approximately 65% of the HSH Class-1 projects, two alternatives are considered.

Alternative 1: Select a section with heavy traffic in the future in 2040;

Alternative 2: Balance maintenance extension in Luzon, Visayas, Mindanao.

After assessment, Alternative 1 was selected through route selection by the multi-criteria analysis, step 1, shown in Figure 11-9.

Alternative 1 consists of 33 sections shown in red in Figure 11-10, and the future traffic volume in each section will be 10,000 vehicles / day or more by 2040.

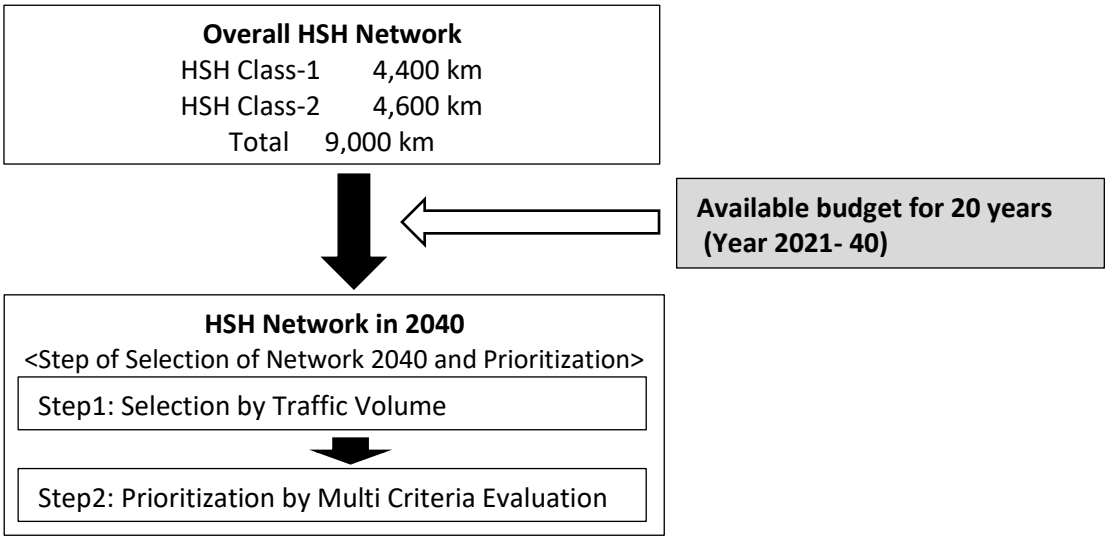
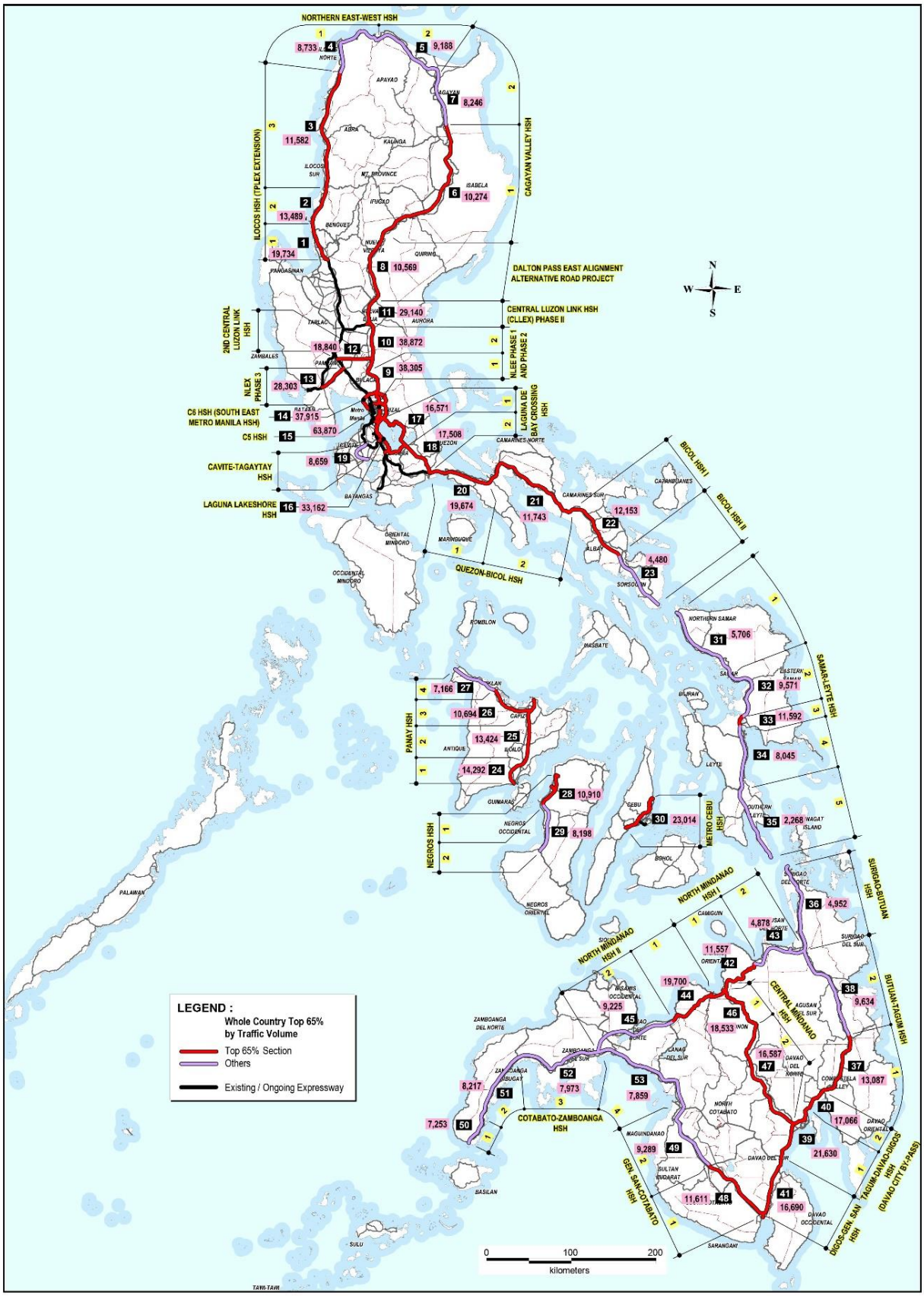


Figure 11-9 Procedure of HSH Network in 2040



Source: JICA Study Team

Figure 11-10 Proposed HSH Class-1 Network in 2040

12 PROPOSED HSH DEVELOPMENT MASTER PLAN

12.1 HSH Class-1 Prioritization

The following table shows the proposed multi-criteria indicators and points.

Table 12-1 Proposed Multi-criteria Items and Points for HSH Class-1

	Major Items	Indicator	Points
1	Contribution to Regional Economic Growth and Development	1) Connect SEZs (operation and planned), tourism attractions, and production centers with ports, airports, and markets. 2) Connect Weak Regional Centers / Strong Sub-Regional Centers. 3) Strengthen connection to Metropolitan Centers and Regional Centers. 4) Development potentials identified in the existing development plans.	40
2	Contribution to traffic decongestion and usage of HSH-1	1) Reduction of total travel time. 2) Traffic volume along HSH Class-1.	20
3	Economic Viability	EIRR	16
4	Environmental and Social Impact	Number of affected houses, distance from protected areas/IP area, length of forest passage, etc.	12
5	Project Readiness	F/S, Business Case Study etc.	8
6	Financial Viability	Project IRR	4
	Total		100

Source: JICA Study Team

12.2 Formulation of Project Implementation Program

(1) The Summary of Budget Allocation for HSH Class-1 Projects

Table 12-2 Summary of Budget Allocation for HSH Class-1 Projects

Term	No.of Section	Project Cost (M.peso)		Length (km)	
Short term 2025	11	394,583	31%	718	31%
Luzon	*8*	*288,089*	*23%*	*516*	*22%*
Visayas	*1*	*50,889*	*4%*	*59*	*3%*
Mindanao	*2*	*55,604*	*4%*	*143*	*6%*
Middle term 2030	*7*	323,801	26%	470	20%
Luzon	*4*	*193,967*	*15%*	*240*	*10%*
Mindanao	*3*	*129,834*	*10%*	*230*	*10%*
Long term 2040	15	543,878	43%	1,127	49%
Luzon	*6*	*322,936*	*26%*	*558*	*24%*
Visayas	*5*	*90,364*	*7%*	*236*	*10%*
Mindanao	*4*	*130,579*	*10%*	*334*	*14%*
Total	*33*	1,262,262	*100%*	2,315	100%

Source: JICA Study Team

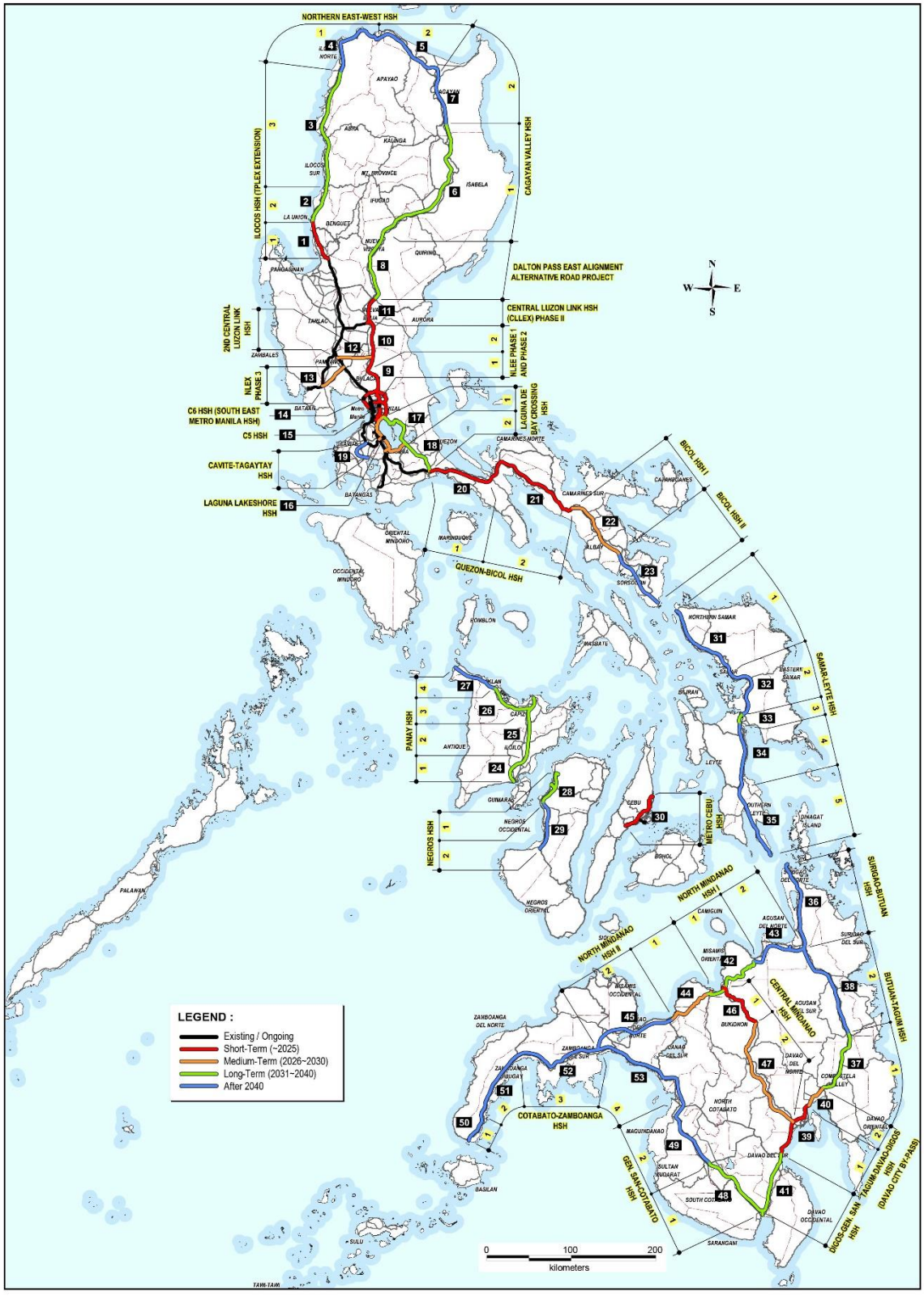
(2) The Outline of Implementation Schedule for HSH Class-1

The result of criteria evaluation for HSH Class -1 project is shown in the next page.

Table 12-3 Result of Criteria Evaluation for HSH Class -1 Projects

Section No.	Road Name	AADT 2040	1 Development	2 Traffic	3 EIRR	4 Environment & Social	5 Project readiness	6 FIRR	Total points (100)	Rank	Schedule	Length(km)	Project Cost (Million Pesos)
			Total (40)	Total (20)	Total (16)	Total (12)	Total (8)	Total (4)					
9	NLEE Phase 1 and Phase 2	38,305	25	20	16	8	6	4	79	1	Short	46.48	20,247
10	NLEE Phase 1 and Phase 2	38,872	21	20	16	11	6	4	78	2	Short	62.06	29,092
30	Metro Cebu Expressway	23,014	30	18	12	5	4	2	71	3	Short	58.67	50,889
39	Tagum-Davao-Digos Expressway 1 (Davao City By-Pass)	21,630	33	12	6	5	8	4	68	4	Short	76.62	16,791
1	Ilocos Expressway 1 (TPLEX Extension)	19,734	21	16	16	8	4	2	67	5	Short	48.17	19,211
46	Central Mindanao Expressway 1	18,533	24	16	16	8	2		66	6	Short	66.19	38,813
11	Central Luzon Link Expressway (CLLEX) Phase II	29,140	12	15	16	11	8	4	66	6	Short	31.05	14,140
15	C5 Expressway	63,870	15	20	12	8	8	2	65	8	Short	23.03	57,680
14	C6 High Standard Highway (South East Metro Manila High Standard Highway)	37,915	15	20	16	4	8	2	65	8	Short	96.07	59,392
20	Quezon-Bicol High Standard Highway 1	19,674	20	16	12	8	8		64	10	Short	71.84	31,885
21	Quezon-Bicol High Standard Highway 2	10,743	30	10	3	10	8		61	11	Short	137.38	56,444
44	North Mindanao High Standard Highway II - 1	19,700	23	16	12	8			59	12	Middle	61.65	47,966
40	Tagum-Davao-Digos High Standard Highway 2	17,066	19	13	12	9		2	55	13	Middle	26.52	12,524
16	Laguna Lakeshore High Standard Highway	33,162	20	17	6	5	6		54	14	Middle	82.59	128,196
12	2nd Central Luzon Link High Standard Highway	18,840	13	16	16	9			54	14	Middle	41.34	19,204
47	Central Mindanao High Standard Highway 2	16,587	17	16	16	3		2	54	14	Middle	142.01	69,344
13	NLEX Phase 3	28,304	13	15	16	9			53	17	Middle	34.12	18,955
22	Bicol High Standard Highway I	12,153	21	10	12	10			53	17	Middle	81.79	27,612
17	Laguna De Bay Crossing High Standard Highway 1	16,571	20	16	6	8	2		52	19	Long	59.56	108,054
48	Gen. San-Cotabato High Standard Highway 1	11,611	29	7	3	6			45	20	Long	90.17	29,123
41	Digos-Gen. San High Standard Highway	16,690	13	13	12	4		2	44	21	Long	77.42	36,557
18	Laguna De Bay Crossing High Standard Highway 2	17,508	15	10	6	9	2		42	22	Long	43.73	19,914
42	North Mindanao High Standard Highway I - 1	11,557	13	13	12	4			42	22	Long	82.65	40,297
6	Cagayan Valley High Standard Highway 1	14,274	7	13	12	8			40	24	Long	175.35	63,577
37	Butuan-Tagum High Standard Highway 1	13,087	4	16	12	6		2	40	24	Long	83.35	24,602
24	Panay High Standard Highway 1	14,292	13	7	6	11			37	26	Long	35.28	12,317
25	Panay High Standard Highway 2	13,424	13	10	3	8			34	27	Long	76.87	26,090
3	Ilocos High Standard Highway 3	10,582	11	13	6	3			33	28	Long	142.86	50,569
8	Dalton Pass East Alignment Alternative Road Project	16,569	12	13	3	4			32	29	Long	89.82	61,890
2	Ilocos High Standard Highway 2	13,489	2	10	12	7			31	30	Long	46.81	18,932
28	Negros High Standard Highway 1	10,910	13	7	0	9			29	31	Long	52.22	20,076
26	Panay High Standard Highway 3	10,694	2	10	3	10			25	32	Long	56.50	19,837
33	Samar-Leyte High Standard Highway 3	11,592	6	7	3	8			24	33	Long	14.82	12,044

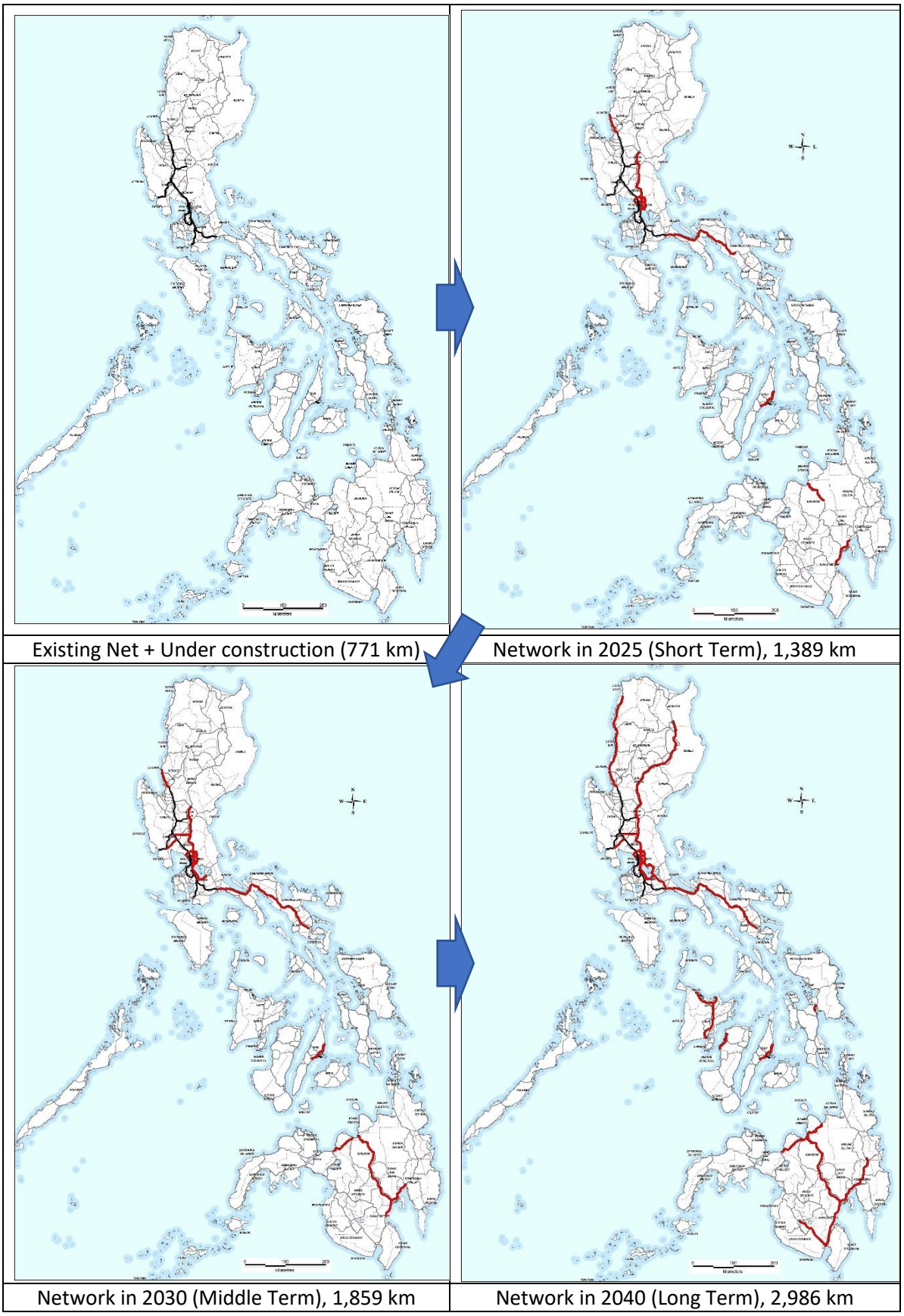
Source: JICA Study Team



HSH CLASS-1 IMPLEMENTING SCHEDULE

Source: JICA Study Team

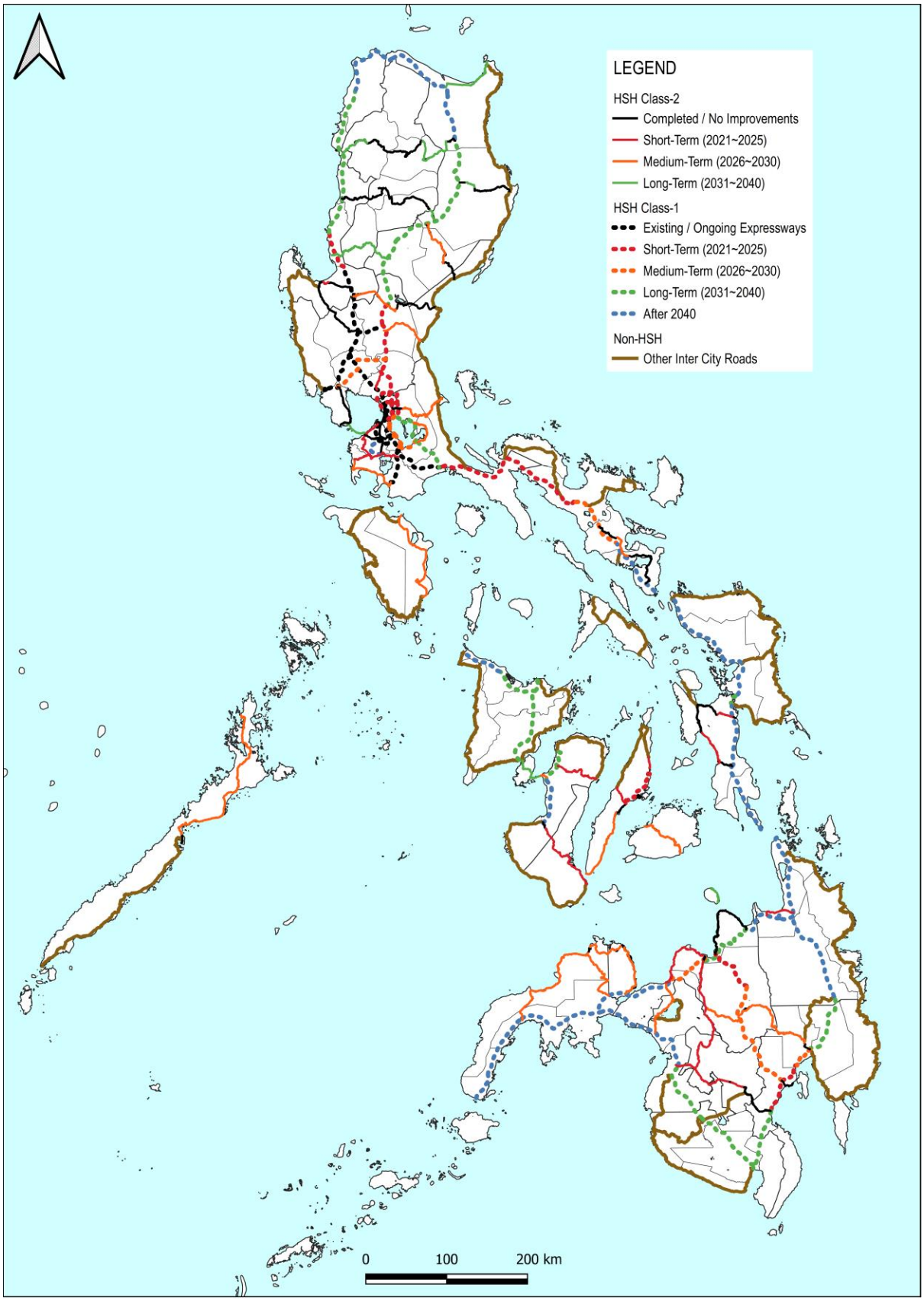
Figure 12-1 Implementation Schedule for HSH Class-1 Projects



Source: JICA Study Team

Figure 12-2 HSH Class-1 Network Expansion Planning

(3) The outline of implementation schedule for HSH Class-2



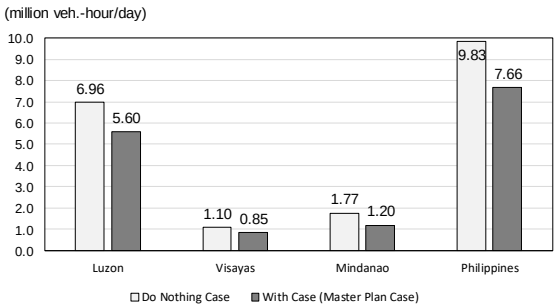
Source: JICA Study Team

Figure 12-3 Implementation Schedule for HSH Class-2 Projects of Nationwide

12.3 Evaluation of Master Plan

(1) Reduction of Total Travel Time

The estimated total travel time reduction is expected in 2.2 million vehicle-hour of nationwide total travel time, the reduction ratio is 22 % in 2040. According to the result by area, the most reduction effect is expected in Luzon and the travel time reduction is 1.4 million vehicle-hour per day. The reduction in total travel time, reduction in greenhouse gas, and benefits are analyzed for relatively long trips across zones.



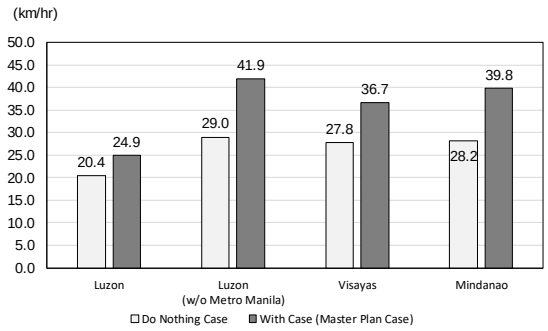
Source: JICA Study Team

Figure 12-4 Reduction of Travel Time by Vehicle in 2040

(2) Improvement of Travel Speed

The average travel speed in all arterial roads is estimated based on the traffic assignment in 2040.

The most effect is expected in Luzon area without Metro Manila and the travel speed would be improved by 13 km/hr from 29 km/hr to 42 km/hr with the development of new HSH network in 2040.



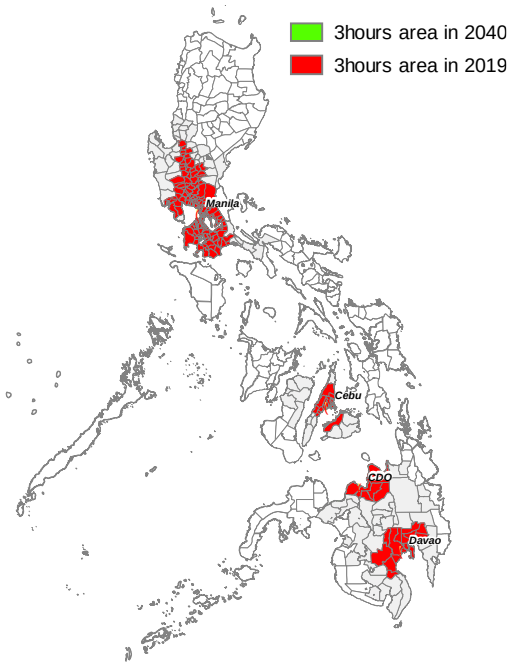
Source: JICA Study Team

Figure 12-5 Improvement of Travel Speed by Vehicle in 2040

(3) Expansion of Service Area from Metropolitan Centers

Figure 12-6 shows the expansion of 3 hours service areas from Metropolitan centers: Manila, Cebu, Davao and Cagayan de Oro (CDO), which is one day trip areas.

By the extension of the high standard highway, the service areas from Metropolitan centers are certainly expanded. In particular, it is expected that the coverage areas of Metro Manila, Davao and CDO will expand. This greatly contributes to the growth of exchange of people and activation of logistics.



Source: JICA Study Team

Figure 12-6 Expansion of 3 hours Service Area

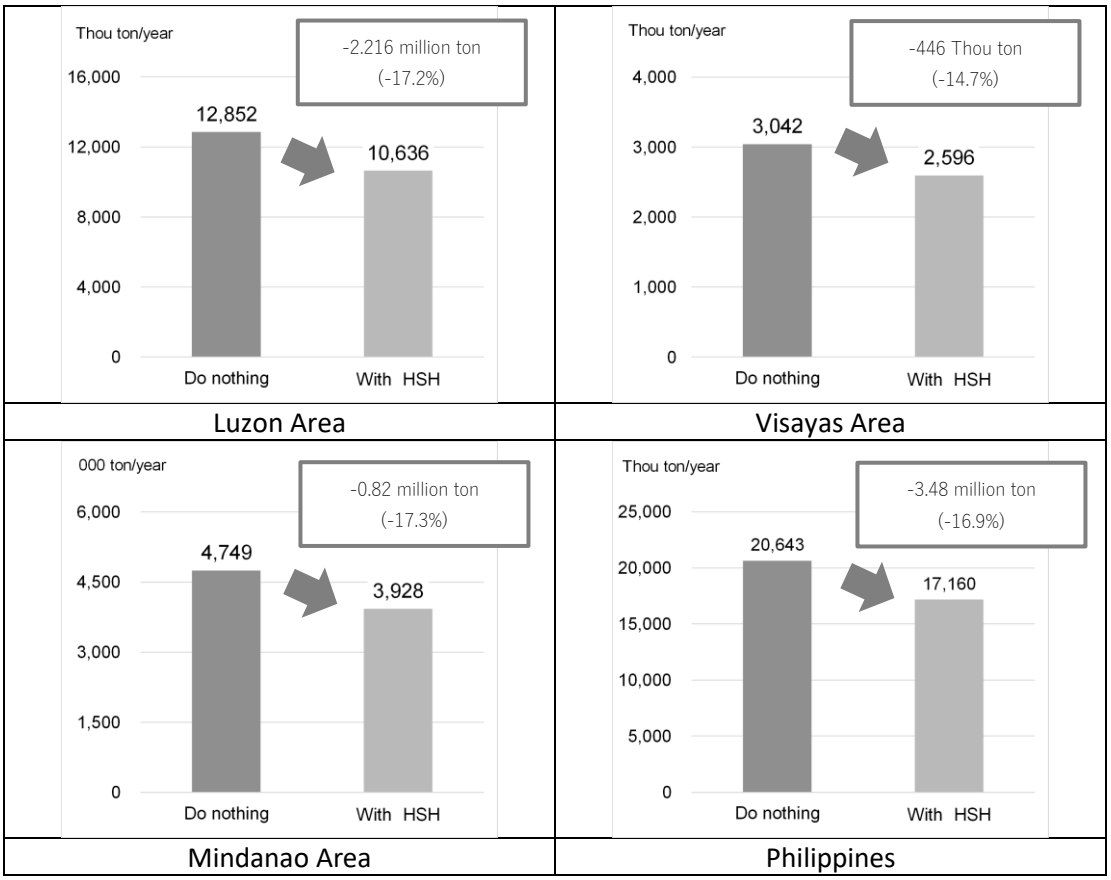
(4) Reduction of Greenhouse Gas (CO_2)

The nationwide estimated CO_2 emission volume is expected to reduce by 3.48 million ton per year, or a reduction ratio of 16.9 % annually with the development of new HSH network in 2040. (See Figure 12-7) The reduction is due to traffic facilitation that decreases start/stop of passing vehicles.

(5) Total Benefit and EIRR

As a result of calculation of benefits, the total benefits by HSH network development by 2040 is estimated at PHP 400 billion per year in 2040.

EIRR by all project of HSH prosed in Mater Plan 2040 is around 17%. (See Table 12-4)



Source: PPA, CPA, JICA Study Team

Figure 12-7 Reduction of CO2 Emission

Table 12-4 EIRR and Cash Flow

Unit: Million PHP/year

	year	Project Cost	O&M	Total Cost	Benefit TTC saving	Benefit VOC saving	Total Benefit	Cash Flow
Base year	2020	0	0	0	0	0	0	0
-4	2021	36,117	0	36,117	0	0	0	-36,117
-3	2022	65,010	0	65,010	0	0	0	-65,010
-2	2023	86,680	0	86,680	0	0	0	-86,680
-1	2024	86,680	0	86,680	0	0	0	-86,680
Open	2025	86,680	17,257	103,937	22,106	77,971	100,076	-3,861
1	2026	86,909	21,410	108,319	26,527	93,565	120,092	11,772
2	2027	92,559	25,832	118,391	30,948	109,159	140,107	21,716
3	2028	98,575	30,542	129,117	35,369	124,753	160,122	31,005
4	2029	104,982	35,559	140,541	39,790	140,348	180,138	39,597
5	2030	111,806	40,901	152,707	44,211	155,942	200,153	47,446
6	2031	119,074	46,591	165,664	48,632	171,536	220,168	54,504
7	2032	126,813	52,650	179,463	53,054	187,130	240,184	60,720
8	2033	135,056	59,103	194,159	57,475	202,724	260,199	66,040
9	2034	143,835	65,976	209,811	61,896	218,318	280,214	70,404
10	2035	153,184	73,295	226,479	66,317	233,913	300,229	73,750
11	2036	163,141	81,090	244,231	70,738	249,507	320,245	76,013
12	2037	173,745	89,392	263,137	75,159	265,101	340,260	77,123
13	2038	185,039	98,233	283,272	79,580	280,695	360,275	77,003
14	2039	197,066	107,650	304,716	84,001	296,289	380,291	75,575
15	2040	209,875	117,678	327,553	88,423	311,883	400,306	72,753
16	2041	0	117,678	117,678	91,959	324,359	416,318	298,640
17	2042	0	117,678	117,678	95,638	337,333	432,971	315,293
18	2043	0	117,678	117,678	99,463	350,826	450,290	332,612
19	2044	0	117,678	117,678	103,442	364,859	468,301	350,623
20	2045	0	117,678	117,678	107,580	379,454	487,033	369,356
21	2046	0	117,678	117,678	111,883	394,632	506,515	388,837
22	2047	0	117,678	117,678	116,358	410,417	526,775	409,097
23	2048	0	117,678	117,678	121,012	426,834	547,846	430,168
24	2049	0	117,678	117,678	125,853	443,907	569,760	452,082
25	2050	0	117,678	117,678	130,887	461,664	592,551	474,873
26	2051	0	117,678	117,678	136,122	480,130	616,253	498,575
27	2052	0	117,678	117,678	141,567	499,335	640,903	523,225
28	2053	0	117,678	117,678	147,230	519,309	666,539	548,861
29	2054	0	117,678	117,678	153,119	540,081	693,200	575,523
Total		2,462,828	2,610,648	5,073,475	2,566,339	9,051,974	11,618,313	6,544,838
NPV	*10%*	779,335	348,412	1,127,747	339,239	1,196,561	1,535,800	408,053
							B/C	**1.36**
							EIRR	**17.42%**

*Social Discount Rate is 10% based on the ICC Order

Source: Estimation by JICA study team

13 STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA)

13.1 Stakeholders Meeting

(1) Purpose and Outline of Stakeholders Meetings

In this SEA, stakeholders meetings were held three times to hear various opinions among stakeholders in accordance with the progress of M/P formulation.

- 1st Stakeholders Meeting (July 2019)
- 2nd Stakeholders Meeting (February 2020)
- 3rd Stakeholders Meeting (February 2021)

(2) Program of 1st SHM

The JICA Study Team conducted a series of stakeholders' meetings from July 23 - 31, 2019. The program for the meetings is as follows:

- Presentation by DPWH and JICA Study Team
  - Explanation of Project Outline
  - Image of HSH Output
  - What is SEA? and Pre-Scoping of HSH Masterplan
  - Present Road/Traffic Problems (Traffic Congestion, Road Closure, Protected Area, etc.)
  - Forward to next SHM
- Group Discussion and Presentation by Region
- Question and Answer Session

The outline of Area-wide Attendance List is in Figure 13-1.

(3) Program of 2nd SHM

The JICA Study Team conducted a series of stakeholders' meetings from February 11 - 20, 2020. The program for the meetings is as follows:

- Presentation by DPWH and JICA Study Team
  - Result of the 1st SHM
  - Proposed HSH Development Network
  - Forward to Next SHM
- Group Discussion and Presentation by Region
- Question and Answer Session

The outline of Area-wide Attendance List is in Figure 13-2.

(4) Program of 3rd SHM

The JICA Study Team conducted a series of stakeholders' meetings from February 22-26, 2021. The program for the meetings is as follows:

- Presentation by DPWH and JICA Study Team
  - Project background
  - Formulation of Master Plan
  - Result of the 1st and 2nd SHM
  - Study of Pre-F/S projects
  - Environmental and social assessment on Pre-F/S project s
- Open Forum

The outline of Area-wide Attendance List is in Figure 13-3.

13.2 Result /Output

Through the 1st and 2nd stakeholder meetings, main issues and concerns of stakeholders were grouped into four items, Natural Environment, Social/economical/cultural concerns, Disaster and others.

Environmental and social considerations as countermeasures for these main issues and concerns were also proposed during the meetings.

Through the 3rd stakeholder meetings, some reactions of the residents were positive for their local economy and accessibility, and they are looking forward on each Pre-F/S Project. The major/common concerns of participants were the harmonization with LGUs plans, the alignment of proposed road network project, the design of the bridge, the implementation schedule of the project, the consideration of flood and landslide prone areas, the affected trees and the compensation for affected people and properties due to the project.

Figure 13-1 Outline of Area-wide Attendance List of 1st SHM

Area		Visayas	Mindanao	South of Luzon	North of Luzon
1	Date	23 July 2019	25 July 2019	30 July 2019	31 July 2019
2	Venue	Best Western Lex Plus Hotel, Cebu City	Apo View Hotel, Davao City	DPWH Multi-Purpose Hall, DPWH	DPWH Multi-Purpose Hall, DPWH
3	Attendance	34 persons Female :13 Male : 21	60 persons Female :20 Male : 40	81 persons Female :28 Male : 53	61 persons Female :17 Male : 44
4	Region	Region 6 Region 7 Region 8	Region 9 Region 10 Region 11 Region 12 Region 13 BARMM	NCR Region 4A Region 4B Region 5	Region 1 Region 2 Region 3 CAR
5	Agencies	DPWH NEDA DENR LGU s (9) Private Sector (1)	DPWH NEDA DENR Mindanao LGUs (14)	DPWH NEDA DENR PPP Center MMDA DOTr TRB DILG LGUs (16) Private Sector (1)	DPWH NEDA DENR PEZA PPP Center LGUs (14) Private Sector (3)

Note: ( ) presents the number of agencies
Source: JICA Study Team

Figure 13-2 Outline of Area-wide Attendance List of 2nd SHM

Area		South of Luzon	North of Luzon	Visayas	Mindanao
1	Date	11 February 2020	13 February 2020	18 February 2020	20 February 2020
2	Venue	Bayleaf Hotel, Manila City	Savannah Hotel, Clark City	Best Western Hotel, Cebu City	Pinnacle Hotel and Suites, Davao City
3	Attendance	75 persons Female :31 Male : 44	75 persons Female :9 Male : 66	50 persons Female :13 Male : 37	68 persons Female :26 Male : 42
4	Region	NCR Region 4A Region 4B Region 5	Region 1 Region 2 Region 3 CAR	Region 6 Region 7 Region 8	Region 9 Region 10 Region 11 Region 12 Region 13 BARMM
5	Agencies	DPWH NEDA DENR DOTr MMDA NCIP PPPC LGUs (18) Private Sectors (4)	DPWH NEDA DENR DA LGUs (14) Private Sectors (4)	DPWH NEDA DENR DILG LGUs (11) Private Sectors (2)	DPWH NEDA DENR FILG NICP MinDA LGUs (12) Private Sectors (2)

Note: ( ) presents the number of agencies
Source: JICA Study Team

Figure 13-3 Outline of Area-wide Attendance List of 3rd SHM

Items \ Pre-F/S Project			1	2	3	4	5	6
			2nd San Juanico Bridge	**Agusan del Norte - Butuan City Logistical Highway**	**Central Mindanao Highway**		**Cebu Circumferential Road**	
1	**Date and Time of SHM**		22 Feb 2021 PM 01:00 - PM 5:00	23 Feb 2021 AM 08:00 - PM 12:00	24 Feb 2021 AM 08:00 - PM 12:00	24 Feb 2021 PM 01:00 - PM 5:00	26 Feb 2021 PM 01:00 - PM 5:00	26 Feb 2021 PM 01:00 - PM 5:00
2	**LGUs**		Babatgon Santa Rita	Buenavista Butuan Magallanes	Tagoloan Manolo Fortich	Impasug-ong Malaybalay	Cebu Talisay	Consolacion Mandaue Minglanilla
3	**Venue on site**		LGU's Conference Room	LGU's Conference Room, Mayor's office, Barangay halls	LGU's Conference Room, Mayor's office, Barangay halls	LGU's Conference Room, Mayor's office, Barangay halls	LGU's Conference Room, Mayor's office, Barangay halls	LGU's Conference Room, Mayor's office, Barangay halls
4	**Total Attendances**		**163**	**62**	**84**	**89**	**191**	**85**
4-1	**Gender rate**	**Male**	96	33	46	51	79	34
		Female	67	29	38	38	112	51
		%	41.4	46.8	45.2	42.7	58.6	60.0
4-2	**Local Stakeholder (Affected Person and institution, NGOs)**		75	44	69	31	169	67
5	**Facebook Engagement**							
	Up : As of 3 March 2021		210 views	320 views	128 views	238 views	182 views	83 views
	Down: As of 11 March 2021		247 views	580 views	263 views	525 view	478 views	223 views

Source: JICA Study Team

Figure 13-4 Major Questions and Answers at the Open Forum of 1st SHM

Questions	Answers from DPWH/JST
1. Visayas	
Q1: What is the timeline of the study/project? (Question from NEDA Region 7 officer)	A1: Development strategy for HSH network is planned to be formulated by September, and short-term and long-term projects will be shortlisted and presented in January.
Q2: It is a good opportunity to link Metro Cebu and other islands properly and efficiently. (Comment from NEDA Region 7 officer)	A2: There are master plans for Metro Cebu, Metro Manila and Metro Davao, which will be integrated into the HSH Development Master Plan.
Q3: Does HSH include primary, secondary and tertiary road? (Question from the private sector)	A3: We consider that the HSH Development Master Plan includes express road, and bypass. Smooth traffic and high-speed traffic roads are considered in the HSH Development Master Plan.
Q4: It is suggested to present the status of HSH Phase 1 even only at Metro Cebu. So that, we know the status and good reference. (LGUs, Northern Samar)	A4: It can be discussed at the group discussion session.
Q5: Panay is Region 6 most populated area. Thus, we hope the area is included in the study. (LGUs, Iloilo)	A5: Since this is a nationwide study, Panay including Negros, Samar and Leyte will be considered.
2. Mindanao	

Questions	Answers from DPWH/JST
No questions were raised from participants.	
3. North Luzon	
Q1: Inclusion of the design of tunnels is requested since the region has many mountains. (Comment from Provincial Engineer, La Union)	A1: Your suggestion is considered in the HSH Development Master Plan.
Q2: Inclusion of NCIP into the Technical Working Group (TWG) is recommended since the role of NCIP is very critical especially on the ancestral domain areas. (Comment from PLGU Nueva Vizcaya)	A2: NCIP will be included in the TWG.
Q3: There is always traffic congestion along Balagtas-Plaridel-Bustos to North since some vehicles, such as trucks always park along the roadway. (Comment from Regional Governor, PCCI-Region 3)	A3: This issue will be resolved at the LGUs level since LGUs have to control illegal parking along the national roads within their jurisdiction. DPWH will not intervene in the LGUs policy on parking.
Q4: Is development of Bulacan coastal road and its interior road included? (Comment from Regional Governor, PCCI-Region 3)	A4: DPWH is planning to develop the said roads.
Q5: There is the on-going project, Bulacan Airport. Is it possible to connect Bulacan Airport and Clark Airport? (Comment from Regional Governor, PCCI-Region 3)	A5: It is possible to secure the road network between both airports.
4. South Luzon	
Q1: Is the result of this study be released to the public? (Question from DOTr officer)	A1: The result of this study will be released to the public for their reference on proposed projects in the Philippines.
Q2: Inviting the environmental specialist to the next meeting is recommended. The area has many protected areas, which may be affected if the project is approved. (Comment from DENR officer)	A2: Your suggestion is noted. The environmental specialist will be invited in the next meeting.

Figure 13-5 Major Questions and Answers on M/P at the Open Forum of 2nd SHM

Questions	Answers from DPWH/JST
1. Visayas	
Q1: Visayas region is very prone to typhoons which oftentimes destroy our power and communication cables and difficult to restore since most roads become unpassable. Thus, we suggest installing the power and communication cables underground. (Question from NEDA Region 6 officer)	A1: The suggestion is a matter that should be considered as DPWH's future road development policy or in the D/D stage. The possibility will be examined.
Q2: Consolacion, Cebu is the area of traffic congestion. It is suggested to include the area in the HSH. (Comment from Council of Region 7 officer)	A2: The issue will be examined by the team.
Q3: The project Panay-Guimaras-Negros bridge was already approved by the NEDA Board, which would be funded by the government of China. Is it possible that JICA takes over the project for fast-track implementation? (Question from NEDA Region 6 officer)	A3: It might be possible that JICA would support the said project. However, we believe that the government of China would implement the said project since the government of China already declared its implementation.
Q4: It is suggested to implement all projects instead of only one (1) project. (Comment from NEDA Region 7 officer)	A4: The road development budget limitation should be considered. Possibility will be examined by DPWH.
Q5: It is suggested to examine the parallel road, bypass or diversion road instead of road improvement. There are many settlements in the area as presented in the 1st SHM. (Comment from DPWH Region 7 officer)	A5: Your suggestion is noted and will verify if it could be included in the study. An objective of HSH development is to correspond to this suggestion such as bypass or diversion road.

Questions	Answers from DPWH/JST
Q6: Road widening is difficult since many structures are located at the interlink from Cebu to Negros. Thus, improvement of the corridor is considered much better. (Comment from DPWH Region 7 officer)	A6: Your suggestion is noted and will verify if it could be included in the study. In response to this opinion, the Cebu circumferential road construction will be proposed and not the road widening of existing roads.
Q7: Improvement of connectivity at Matnog, Sorsogon to Northern Samar is important. There is no improvement without securing connectivity in the said area. In addition, improvement of bridge connectivity from Layte to Bohol, Bohol to Cebu and Cebu to Negros is important for the said areas. (Comment from NEDA Region 8 officer)	A7: Investment is an important factor to be considered. The HSH Development Master Plan focuses on upgrading existing national highways and construction of new highways. Bridge construction may be included in the next master plan.
2. Mindanao	
Q1: Please clarify the two (2) proposed projects in Central Mindano since their names were confusing. (Comment from Development Authority officer)	A1: We will consider to change or rename the confusing project names.
Q2: Which agency is the lead agency to identify issues and concerns? It is suggested to detail the timeline and responsibilities of LGUs to solve the issues and to prepare for resettlement. (Comment from Agusan Del Sur officer)	A2: The lead agencies are DPWH. DENR and LGUs and other concerned agencies. Study to prepare for resettlement is necessary, but it is not within the master plan preparation period.
Q3: It is requested to include a road project passing Cotabato Province especially in Region 12. (Comment from Catabato Province officer)	A3: Please identify the specific alignment for our consideration.
Q4: It is suggested to have a separate workshop for the private sector to get the input from them regarding their views and opinions about the proposed project. (Cagayan de Oro Chamber)	Q4: A separate consultation meeting is planned. Private sector representatives will be informed once the schedule is finalized.
Q5: It is suggested to consider Central Mindanao High Standard Highway traversing the airport in San Carlos, Bukidnon. This airport is one of gateway airports in Mindanao between Region 10 and 11. (Comment from NEDA Region 10 officer)	A5: We note your suggestion. Please suggest the alignment since we do not have information about your recommendation.
3. South Luzon	
Q1: Camsur Express 4 and PR 4 are ongoing and have already been endorsed. It should not be in the long term but should be in the short term. It is part of the pipeline projects of the administration. (Comment from NEDA Region 4 officer)	A1: Your comment is noted. Proposals will be revisited in the review of the implementation schedule.
Q2: The connectivity for C4 and R10 is not part of the short-term proposal. Please take note that ROW is already acquired for almost 30 years already and yet the project is not prioritized until now. (Comment from LGUs Caloocan)	A2: Your comment is noted and already conveyed to DPWH Central Office.
Q3: Please consider the following road as part of HSH. - North-South Commuter Highway - Extension of R10 (Comment from LGUs Caloocan)	A3: Your suggestion is noted. Proposals will be revisited in the study of HSH Class-2 network.
Q4: Please include disaster mitigations and vulnerability component since the area is a flood prone area.	A4: Your suggestion is noted. JST and DPWH have analyzed the flood susceptibility, road closure section due to typhoon damage, tracks of a major typhoon. Basically, the HSH Class-1 network is planned considering avoiding hazard areas. The detailed risk of a natural disaster should be considered in the design stage.

Questions	Answers from DPWH/JST
Q5: Safety is a prioritized factor to be considered. Many types of vehicles are using roads, and it will bring traffic and accidents. (Comment from a private sector, Former USec)	A5: The safety policy is very important. It will be mentioned to DPWH if they have considered foreign assistance to undertake planning for effective traffic safety measures.
4. North Luzon	
Q1: Please explain the scenario for 2040. Were population growth and economic development included in the formulation of master plan until 2040? (Question from NEDA Region 1 officer)	A1: Population growth, economic development and traffic volume were included among the scenarios to be examined in the master plan.
Q2: DPWH and JICA completed the master plan (Phase 1) in 2010. How much has been the 1st master plan achieved after 10 years? (Question from NLEX staff)	A2: Almost all of the projects in the 1st master plan were completed.
Q3: The 1st master plan does not have a monitoring and evaluation component. It is suggested to include the component to assess progress and implementation. (Comment from NEDA Region 1 officer)	A3: Your suggestion is noted. DPWH will consider the setting up of the monitoring system.
Q4: Is it possible to prioritize implementation of HSH in Nueva Vizcaya. There is a bottleneck in Region 2. If traffic congestion occurred, all areas are affected. It will also affect economic activities. (Comment from NEDA Region 2 officer)	A4: The limited resources of the government are the reason why we classify the projects into short term, medium term and long term. To fast-track development in the area will also fast-track the road connectivity.
Q5: It is suggested to include timberland as one of criteria in the environmental and social aspect. (Comment from DENR Region 1 officer)	A5: Timberland is considered in the evaluation of possible environmental impact.

Figure 13-6 Major / Common Opinions and Answers at the Open Forum of 3rd SHM

No.	Comments, Questions and Suggestions	Answers
Project Design and Coordination with Local Plans		
1	Question When will the project start? (Brgy. Chairperson of Barangay Quiot/Male) (Brgy. Councilor of Barangay Busay/Male)	There is no definite schedule yet when the project will start. A series of consultations will be conducted before the implementation consisting of public consultation, survey and tagging of structures to be affected by the project are yet to be done. Letter of invitation including the timeline of the project and the activities to be conducted will be provided by DPWH to the affected barangays before the activity starts. (DPWH-ESSD)
2	Suggestion Would it be possible for the proposed alignment to connect to our road opening project located in Brgy. Bagolibas and La Paz to avoid the protected mangrove area? (Vice Mayor of Santa Rita, Samar/Male)	The proposed alignment is not yet final because the project is still under the Masterplan and Pre-Feasibility Study Stage. DPWH is open to suggestions and will consider the concern of the LGU about the protection of mangrove areas. The assessment of possible impact of the removal of mangroves will be studied further including the identification of mangrove species and on how to countermeasures/mitigate the impact of the project in the environment. (JICA Study Team)
3	Suggestion The exit and entry access roads at particular ports should be considered on the design of masterplan since the city plan is to develop a logistical port near the highway. (Mayor of Butuan City)	The suggestion is very important in the road network. (JICA Study Team)

No.	Comments, Questions and Suggestions	Answers
4	Suggestion We want to know the design elevation of the road. We also suggest that the road should be elevated, because there is a possibility of rising of the sea level due to climate change. (Mayor of Butuan City)	The elevation of the road is very important and should be considered in the Feasibility Study stage. And that they will address such concerns on the next stage. (JICA Study Team)
5	We would like to ask if the navigational clearance for the boat-building industry was considered during the planning stage of this project. (Representative of Butuan barangay official /Male)	The navigational clearance was considered in the planning stage to set up the bridge design. (JICA Study Team)
6	Question I would like to ask if the road widening of existing highways instead of constructing alternate routes (mountain highway) has/had been studied. There is an expressway in Cebu City to Balamban that's unable to solve the traffic congestions in the city. I wonder if a study be possibly made like expressways in Metro Manila. (Local person from Barangay Pulpoan/Male)	The proposal is actually a High Standard Highway and the team is proposing an Expressway similar to NLEX and SLEX found in Metro Manila. Road widening is almost impossible because Cebu is very congested. There are various people that will be displaced. There is a proposal for a road widening in some areas but not in the High Standard Highways as they will address different problem. (JICA Study Team)
Environmental and Social Considerations		
7	Question What is the plan of the DPWH regarding the affected trees? (Representative of Municipal Environment and Natural Resources Office (MENRO), Tagoloan)	After the alignment is finalized the DPWH will conduct a tree cutting inventory together with MENRO and DENR. For every 1 tree to be cut, there will be a replacement of 50-100 seedlings. Aside from the trees, we also need to consider the Key Biodiversity Area that will be affected in the sensitive areas. (JICA Study Team)
8	Question Butuan City is known as an ancient river kingdom where ancient balangay boats have been discovered in the area. How is it considered in the master plan so that possible heritage and archeological artifacts may be protected from the construction excavations? (Mayor's Office of Butuan City/ Male)	The archeological artifacts have been mapped out and identified. The River Kingdom is very far from the proposed project site. Hence, the possibility of affecting any artifacts is very low. Although there would be excavation activities along the proposed alignment but it is only for the embankment. And those areas are already removed from the list of the Protected Areas. The city has an updated City Land Use Plan (CLUP) where heritage sites are indicated. (Mayor of Butuan City) There are mitigating measures to prevent damage of what is called, "chance finds", as there might be an archeological artifact discovered during the excavation process. Furthermore, before the project implementation, there will be an archeological/cultural protocol plan. It is a detailed report wherein the possibility of calling the National Museum of the local archeological office is indicated so that they will know what to do with those "chance finds". (JICA Study Team)
9	Suggestion All barangays in Cebu are flood-prone, especially the low-lying barangays. The proper consideration of addressing the flooding in the low-lying barangays is therefore necessary. (Brgy. Chairperson of Barangay Quiot/Male)	It is duly noted, and that drainage system will be considered in the design stage of the project. (JICA Study Team)
10	Question Would it be possible to provide us with a drainage plan because Brgy. Poblacion Pardo is a flood prone area? (Brgy. Chairperson of Barangay Quiot/Male)	We cannot give you a drainage plan as early as now but definitely it will be considered. (JICA Study Team)

No.	Comments, Questions and Suggestions	Answers
11	Comment The proposed alignment is prone to accidents including landslide. (Local people from Barangay 10, City of Malaybalay)	During this stage, all concerns, especially the risk of natural disaster will be considered. The team will carefully design the road considering natural disasters, especially landslide. More detailed and important inputs are needed. The other stakeholders meeting will be held during the Feasibility Study Stage and will focus on this matter. In addition, HSH is designed to consider the occurrence of natural disasters in its planning and road designs. If the existing national highway will be destroyed due to natural disaster, the proposed HSH will be a detour in Central Mindanao. (JICA Study Team)
12	Questions We would like to ask if there is a relocation site or financial assistance for the affected families. (Local people, Brgy. Chairpersons, and LGUs)	As much as possible DPWH will avoid a considerable number of people being affected. However, there could be a situation where the project cannot avoid the removal of structures and people. Under this situation, there is a policy about the ROW Action Plan* or RA 10752 that the government shall acquire the properties provided that it will give compensation to the Project Affected Families (PAFs). The project is still in the Masterplan and Pre-Feasibility Stages. It is too early to identify the relocation site at this stage. (DPWH-ESSD)
13	Question Would it be possible to provide a copy of the map for all the barangays affected because people want to know the area to be affected by the project? (Local people, Brgy. Chairpersons, and LGUs)	The project alignment is not yet final. Even though there is an initial alignment, it cannot be shared yet to avoid confusion. Once finalized and approved, the DPWH will give a copy of the alignment to the barangays to be able to identify the possible properties that might be affected. (DPWH and JICA Study Team)
Questions from DPWH /JICA Study Team to participants		
14	Questions (To all participants) Do you have any suggestions regarding the landscape and environmental considerations because the project will be constructed in the hillside? (JICA Study Team)	We do not know which specific landscape will be affected. We will forward the Comprehensive Land Use Plan (CLUP) of Mandaue to check if there will be affected land scape in their City. (A local person/Female) The City Planning and Development Office (CPDO) will support the project as long as it is aligned with the CLUP of the City. (JICA Study Team)
15	Question (To all participants) We would like to ask if there are any protected areas in the barangays that needs to be considered in the design of the study. (DPWH)	I am not aware if there is any protected area near the proposed alignment. DENR should be invited to visit the area to check whether there is a protected area to be affected by the project. (Brgy. Chairperson of Barangay Quiot/Male)
16	Question What is positive impact or benefits of this project in your LGU? (JICA Study Team).	The project is a good development project which helps in transporting our agricultural products (pineapple and corn) and it will provide more access, especially to our hidden tourist spots. It will also provide faster response to crimes and will improve peace and order, especially in case of emergency because there is an inaccessible area in Manolo Fortich, Bukidnon. (Brgy. Chairperson in Manolo Fortich/Male)

PART F – PRE-FEASIBILITY STUDY

14 SELECTION OF THE PROJECT FOR PRE-FEASIBILITY STUDY

14.1 Outline of Candidate Pre-F/S Project

The JICA Study Team studied the prioritization of candidate Pre-F/S from HSH Network (Figure 14-1).

As the Feasibility Study of ordinary road/bridge projects can be conducted by DPWH, candidate projects for the Pre-F/S were selected among the projects that require the application of advanced technologies, such as long span bridge, long tunnel, earthquake proof, soft ground protection and rapid construction in the urban area, based on DPWH's requests.

The purpose of the Pre-F/S in this project is to find candidate projects needing advanced technologies. The main objective is to find the issues to be addressed during the full-scale F/S stage by examining the alternatives for the road alignment or bridge type using the available and free satellite photos and existing topographic data. (In addition, due to the COVID-19 pandemic, sufficient field surveys could not be conducted). The full-scale F/S including the comparison study and selection, the economic feasibility, detailed planning is required based on the analysis of result of geotechnical and topographical survey, and socio-environmental survey.

Initial candidate Pre-F/S projects identified were thirteen (13) projects that require advanced technologies, except for projects undertaken by F/S or projects undertaken by other donors.

Among the thirteen (13) projects, five (5) candidate projects were excluded due to non-urgency of the project which might be not feasible from the point of future traffic demand and projects that are relatively technically less difficult. As a result, the remaining eight (8) projects were selected as projects for priority evaluation.

14.2 Evaluation Criteria

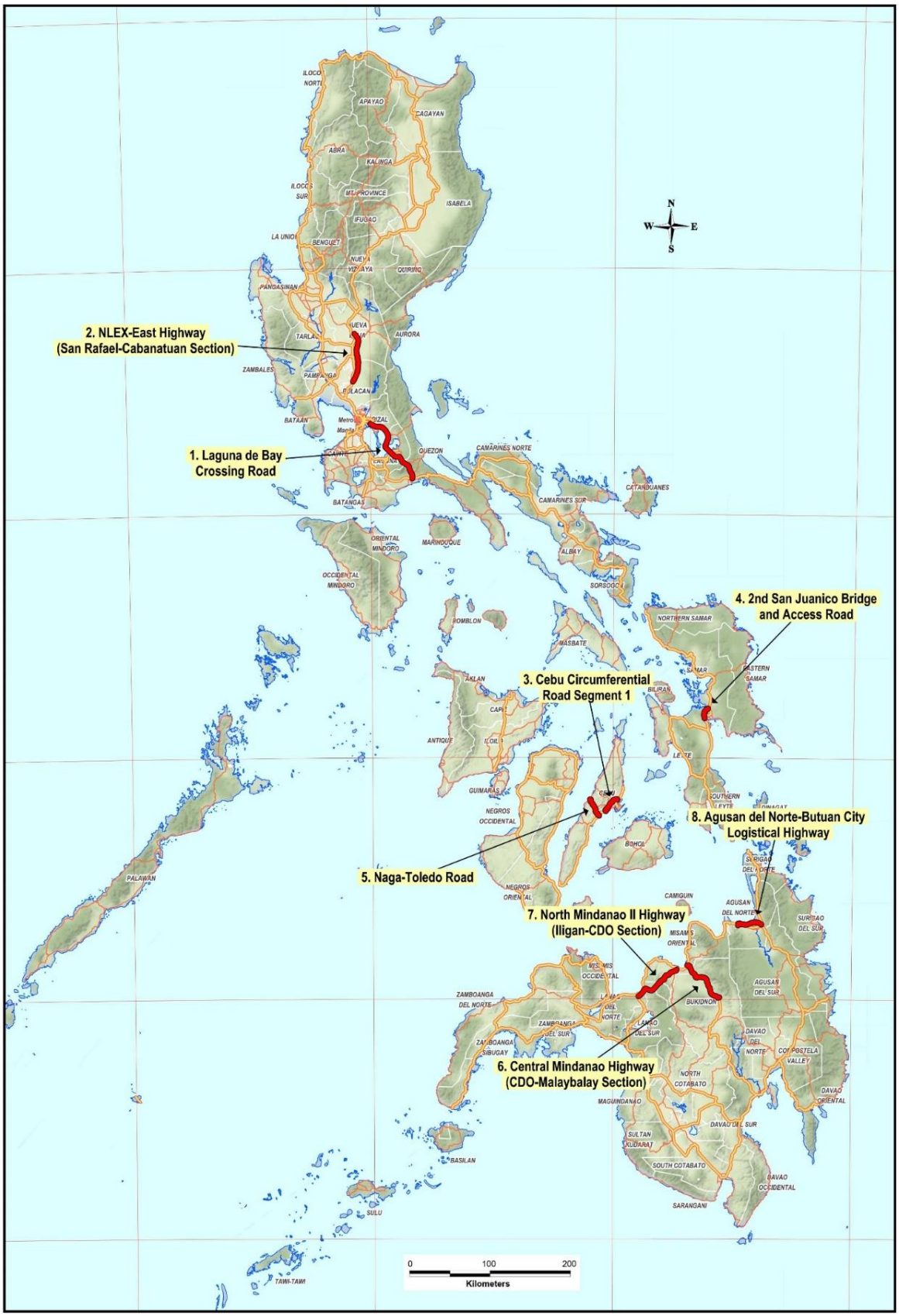
Project priorities were evaluated based on the following evaluation criteria, and HSH pre-F/S projects that can promote regional development, provide resiliency and redundancy features, have relatively low impact on the socio-environment, and require a high level of technology were selected.

- Traffic Impact: projects with high traffic demand are highly rated.
- Economic Impact: projects with a high EIRR, calculated from the project cost and benefits, are highly rated.
- Regional Development Impact: projects which will improve connectivity to metropolitan centers are highly rated.
- Resiliency and/or Redundancy: projects which will enhance resilience to natural disasters and redundancy of road network are highly rated
- Environmental and Social Impact: projects with short passing length of forests, rivers, lakes, coastal passage, and projects with less housing affected are highly rated.
- Advanced technology required: Projects which require long span bridges or long tunnels are highly rated.

14.3 Selection Result

Table 14-1 shows the result of evaluation. The following four (4) projects were selected for the conduct of Pre-F/S:

(1) Central Mindanao High Standard Highway
(CDO- Malaybalay)
(2) Cebu Circumferential Road
(3) 2nd San Juanico Bridge
(4) Agusan del Norte - Butuan City Logistical Highway

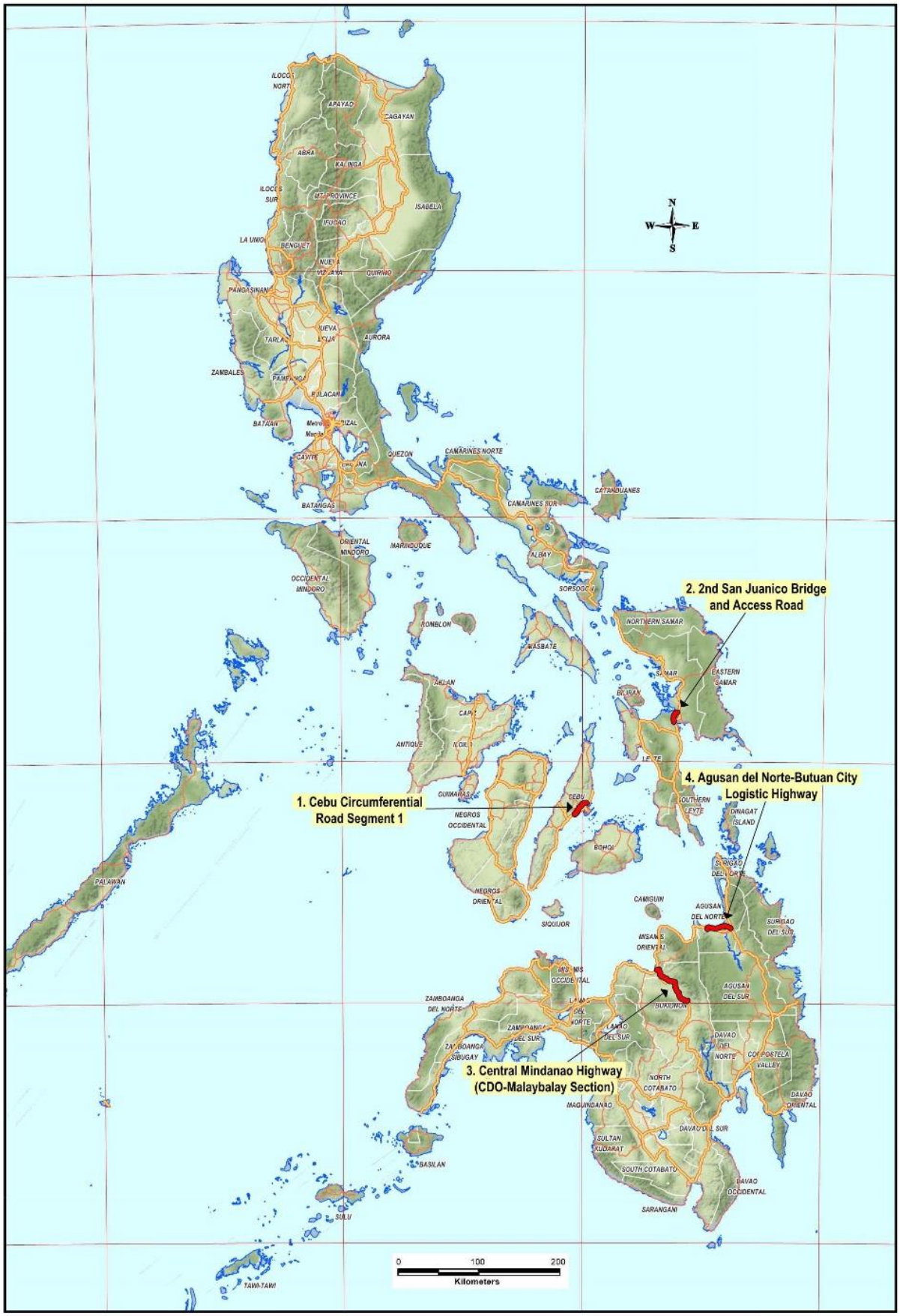


Source: JICA Study Team

Figure 14-1 Location of Eight (8) Candidate Pre-F/S Projects

Table 14-1 Evaluation Result of Pre-F/S Project Selection

Area	No	Project Name	Daily Traffic Volume in 2025		EIRR(%)		Regional Development Impact		Resiliency / Redundancy		Natural Evironment Impact		Social Environment Impact		Advanced Technology Requirement		Other Factors		Remarks	Total	
			Daily Volume	Evaluation	%	Evaluation	Impact	Evaluation	Item	Evaluation	Clossing Length of each category (km)	Evaluation	No.of Structure Affected	Evaluation	Item	Evaluation		Evaluation		Evaluation	Results
Luzon	1	Laguna de Bay Crossing Highway	12,400	○	16.0%	○	To contirbute the development of East Metro Manila	◎	New Road	○	①4.0 ②32.7 ③0	△	800	○	Laguna Late Crossing Bridge (L=5600m) and along coastal bridge	◎	ADB plans to conduct FS as Laguna de bay Phase-2	△		◎ 2 ○ 4 △ 2	
	2	NLEX-East Highway (San Rafael - Cabanatuan)	18,500	◎	33.5%	◎	To improve accessibility North Luzon	○	New Road	○	①1.5 ②0.5 ③0	◎	900	○	Long Bridge will be required but not necessary long span bridge	△	High potential as PPP project	△	DPWH will implemtnt as PPP	◎ 3 ○ 3 △ 2	
Visayas	3	Cebu Circumferential Road	32,400	◎	26.8%	◎	Main purpose is to decongest in Metro Cebu.	○	New Road	○	①15.0 ②0.1 ③0	◎	1,400	△	14Bridges/Viaducts（Total 5,330m)、6 Tunnels （Total 3,600m)	◎	Quite big impact for traffic decongestion in Cebu	◎		◎ **5** ○ 2 △ 1	**Selected**
	4	2nd San Juanico Bridge and access Road	7,300	△	12.0%	△	Inter-island Bridge.	○	New Road & Inter island bridge	◎	①2.1 ②0 ③0.7	○	100	◎	Long Span Bridges (1,000m)	◎	Exsting San Juanico Bridge is necessary to reconstruction of slab due to serious damage.	◎		◎ **4** ○ 2 △ 2	**Selected**
	5	Naga-Toledo Road (Tunnel Section)	7,000	△	15.6%	○	East-West Corridor in the Cebu Island	△	Existing Road	△	①0 ②0 ③0	◎	0	◎	Mountain Tunnels (L=3700m,1500m)	◎	To construct the tunnels is not so much traffic improvement along road.	△		◎ 3 ○ 1 △ 4	
Mindanao	6	Central Mindanao Highway (Cagayan de Oro- Malaybalay Section)	5,300	△	15.4%	○	To improve accessibility between Davao and CDO	◎	New Road	○	①25 ②0 ③0	◎	500	◎	Loop Bridges (Height deference 100m) and two(2) Long Span Bridges	◎	Two Metropolitans in Mindanao will be connected by Expressway.	◎		◎ **5** ○ 2 △ 1	**Selected**
	7	North Mindanao II Highway (Iligan-Cagayan de Oro Section)	11,400	○	25.8%	◎	To improve accessibility between CDO and Iligan	○	New Road	○	①28.9 ②5.3 ③0	○	600	○	Mountain Tunnel= 5,000 m）	◎	It is necessary to consider fully the problems in the peace and order	△		◎ 2 ○ 5 △ 1	
	8	Agusan del Norte - Butuan City Logistical Highway (4th Butuan Bridge)	10,100	○	11.1%	△	It depends the new SEZ development	○	New Road	○	①11.0 ②0.8 ③0	◎	200	◎	3 Span Extradosed Bridge proposed by preliminary Survey	◎	Project will contribute the promotion of new SEZ	◎		◎ **4** ○ 3 △ 1	**Selected**



Source: JICA Study Team

Figure 14-2 Location of 4 Selected Pre-F/S Projects

15 CENTRAL MINDANAO HIGHWAY (CAGAYAN DE ORO – MALAYBALAY)

15.1 Outline of the Project

CMH (Cagayan De Oro – Malaybalay section) development project with a total length of about 68km is proposed as a short-term (2025) project in the implementation program for HSH Class-1.

The project is expected to greatly contribute to the regional economic development by untapping the agricultural potential in the area, and connecting Cagayan De Oro (which is one of the Metropolitan centers, has an international port and airport) and Malaybalay (which is a sub-regional center in inland).

The height difference on the first 2 km section of the existing road, Sayre Highway, is 100m - 150m. There are many hairpin curves and a gradient of more than 12% continues.

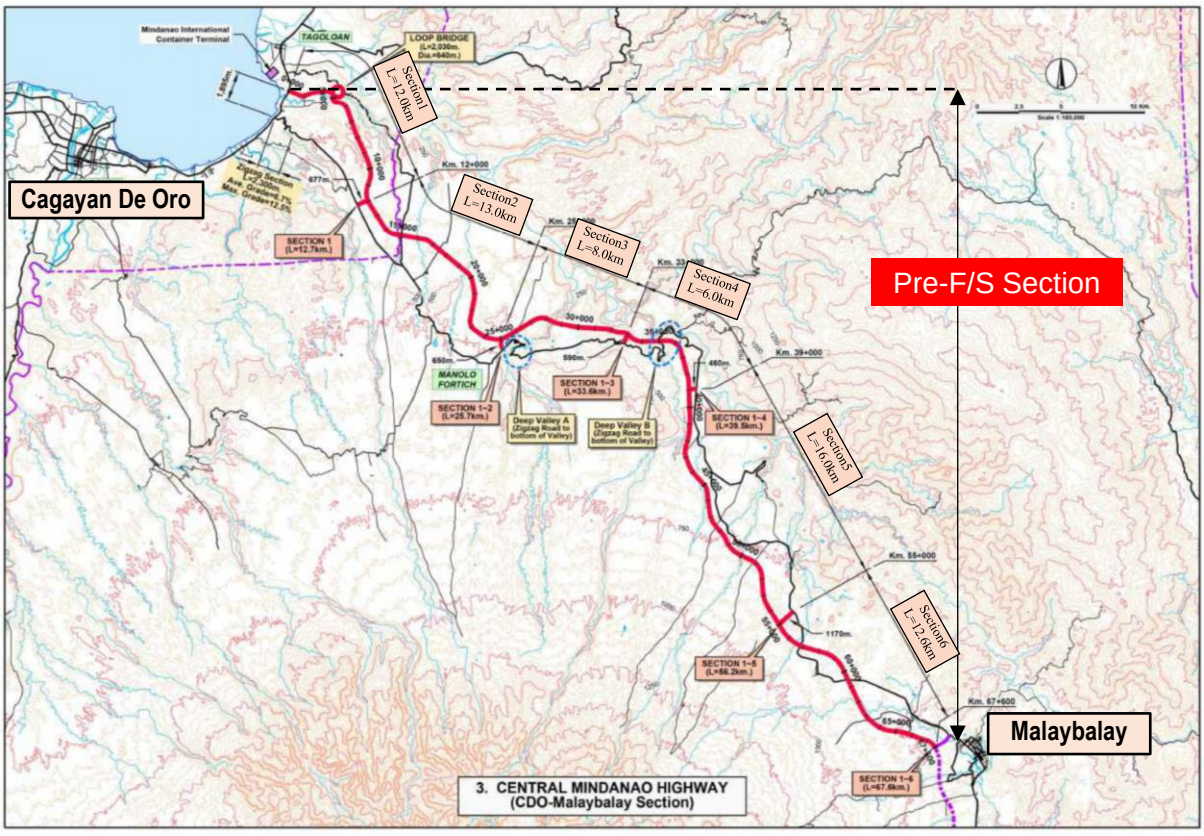
In order to eliminate traffic bottlenecks and to help the facilitation of logistics, the long span bridge with high pier and to across deep valleys.

15.2 Project Specifications and Route

The Cagayan de Oro (CDO) - Malaybalay Section of CMH (68 km) is the subject project in this Pre-F/S. There is about 100-150 m height difference in the 2km section from the starting point. In order to solve these issues, an advanced construction technology of a long span and higher pier bridge will be necessary for the CMH.

This road will be constructed as a High Standard Highway Class 1 and is a 4-lane road (toll road). However, according to the results of traffic demand forecasting, an initial 2-lane road could still accommodate the traffic volume until 2040. Therefore, the possibility of an initial 2-lane road development case is also considered in this project.

Class	HSH Class-1	**No. of Lanes**	4 Lanes
Length	68 km	**Design Speed**	80 km/h



Source: JICA Study Team

Figure 15-1 Pre-F/S Section

15.3 Traffic Demand Forecast

The estimated traffic volume in section 3 which is in the middle of the whole section is shown in Table 15-1.

Table 15-1 Estimated Traffic Volume (veh./day)

4-Lane Toll Road Case	CMH	Existing Road	Total
Traffic Volume Y2019	-	8,100	8,100
Traffic Volume Y2040	18,100	4,700	22,700
4-Lane Non-Toll Road Case	**CMH**	**Existing Road**	**Total**
Traffic Volume Y2019	-	8,100	8,100
Traffic Volume Y2040	12,800	9,200	22,000

Source: JICA Study Team

15.4 Preliminary Design

15.4.1 Geometric Design Criteria and Typical Cross Section

The Geometric Design Criteria and Typical Cross Section are shown in Table 15-2, Figure 15-2 and Figure 15-3. The road class, design speed and number of lanes are designed as HSH Class-1, 80 km/h and 4-lane, respectively. The lane width and shoulder width are designed as 3.65 m and 3.0 m, respectively. Since this road is expected to be frequently utilized by large vehicles, the outer shoulder width is designed as 3.0 m to provide adequate parking space in case of emergency. The possibility of improvement by phasing from 2-lane to 4-lane was studied.

Table 15-2 Geometric Design Criteria

Items	Value
Road Class	HSH Class-1
Design Speed	80 km/h
No. of Lanes	4-lane (Initial 2-lane)
Lane Width	3.65 m
Outer Shoulder	3.00 m
Median Strip	3.00 m
Minimum Radius	230 m
Maximum Grade	4%

Source: JICA Study Team

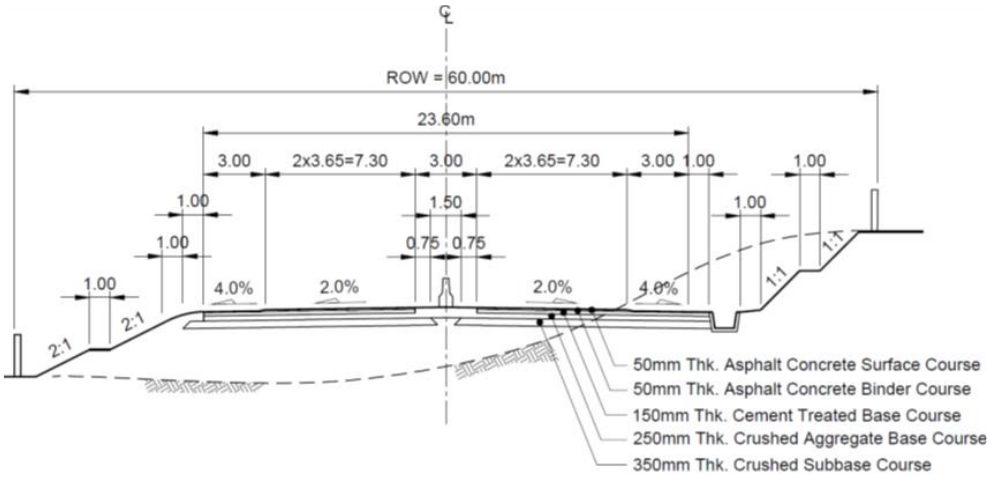


Figure 15-2 Typical Cross Section of CMH for 4 Lanes (Final Stage)

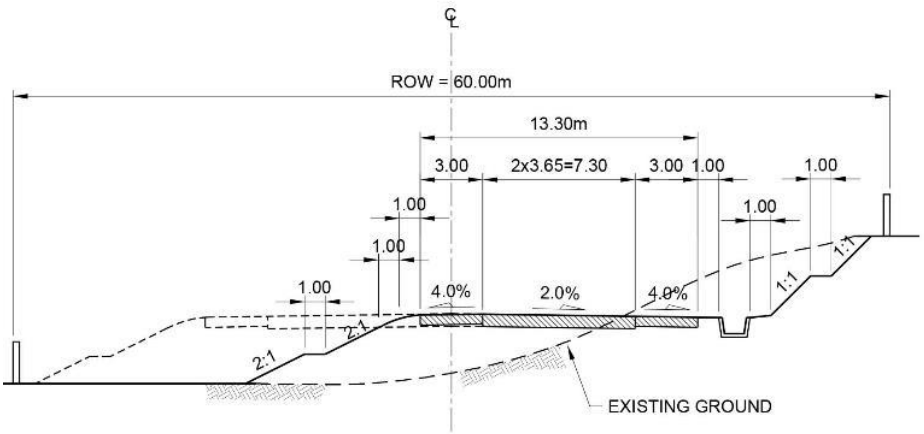


Figure 15-3 Typical Cross Section of CMH for 2 Lanes (Initial Stage)

15.4.2 Alternative Alignment in Section-1

Section-1 (Cagayan de Oro section) has 100m elevation difference between the coastal plane and the plateau under topographical constraints. Three alternative alignments including a loop bridge were compared for Section-1. Alternative 1: Loop Bridge and Alternative 3 including a long span bridge: the north-shifted route from Alternative-1 location in order to minimize the slope section were selected as the superior alternatives.

In the preliminary design, the height of the bridge pier was limited to 100 m, referring to the experience in Japan. Although there is not much difference of construction cost among the three alternatives, Alternative 3 is slightly cheaper than the other alternatives.

There is no significant difference in the other evaluation criteria. However, Alternative-2 which applies a mitigation curve has difficulty satisfying the design speed of 80 km/h due to topographical conditions. It was determined that the application of a long span bridge is necessary because the girder height exceeds 100 m. It is difficult to place a series of high bridge piers for Alternative 3. There is no significant difference between the three alternatives in terms of environmental and social considerations. In terms of workability, it is necessary to apply the cable erection method for truss bridge erection in Alternatives 2 and 3. However, this method is still unfamiliar in the Philippines, the evaluation was lowered in consideration of the difficulty of construction.

As a result of the overall evaluation, it is recommended that the final route is selected based on the detailed study of Alternative 1 and Alternative 3 in the F/S stage.

Based on the accurate topographical data, the alignment study, construction cost, construction method, and construction period will be studied in the F/S.

15.4.3 Long Span Bridge Planning

Long span bridges are planned for the two deep valley sections that will be applicable of the latest advanced construction technology (See Figure 15-5, Figure 15-6, and Figure 15-7).

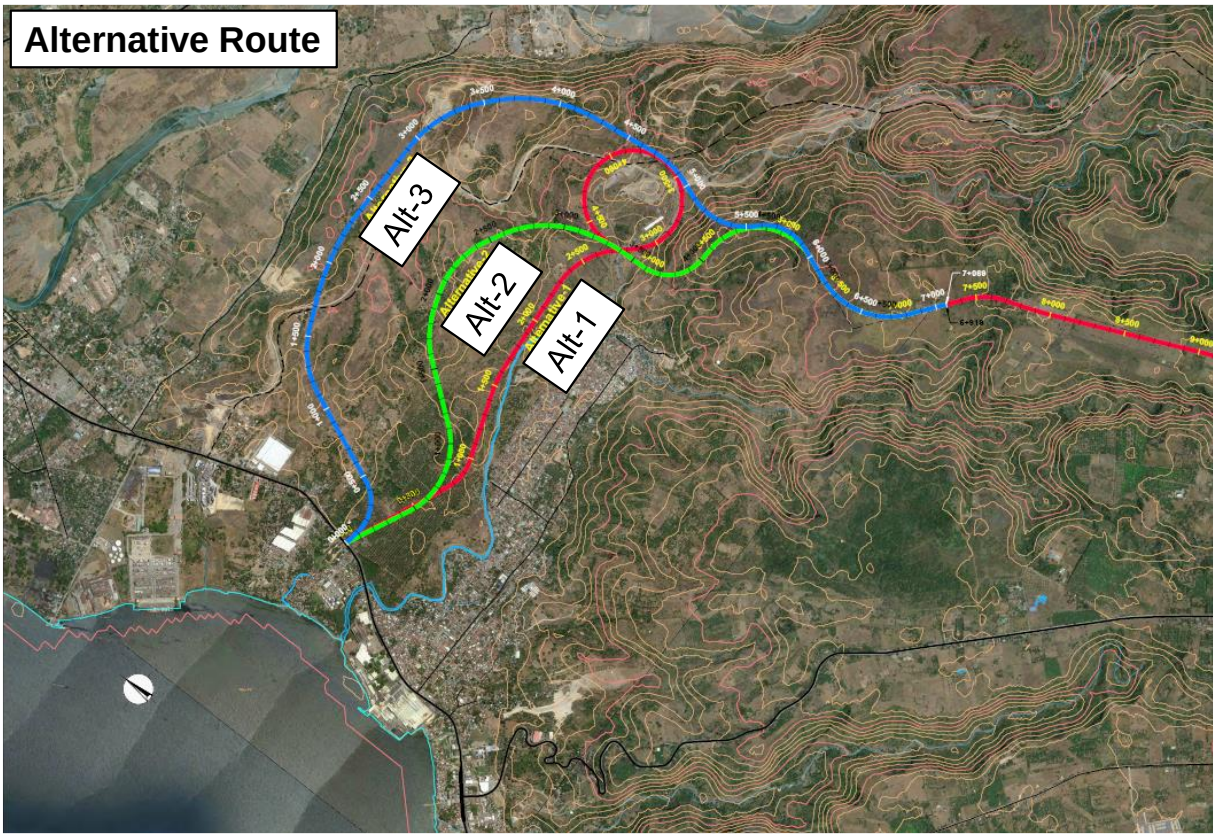


Figure 15-4 Alternative Alignments in Section-1

Table 15-3 Comparative Analysis of Central Mindanao Highway (Cagayan de Oro Section)

Alternative	Alternative-1 (Loop Bridge Plan)	Alternative-2 (Instead of Loop Bridge, apply many curve sections in order to minimize the slope section)	Alternative-3 (Plan which shift to north side to Alternative-1 in order to minimize the slope section)
Length	7.2km	5.9km	7.1km
Max. Gradient	4.0%	4.99%(l=700m), 4.3%(l=1200m)	4.0%
Long Span Bridge Length [Max. Span]	1,880m (Loop Br[60m])	1,200m (Truss Br[180m])	1,300m (Arch Br[300m])
Total Bridge Lengths	3,270m (1.00)	2,550m (0.78)	2,100m (0.64)
Applicable Advanced Construction Technology (Long Span Bridge)	Upper Structure：Narrow box steel girder, Composite floor slab, Corrosion Resistance Steel for Painting Life Span Extension	Upper Structure：High performance steel plate, Corrosion Resistance Steel for Painting Life Span Extension	
	Substructure：High Pier (Hybrid Hollow High Pier, REED System Pier, SPER System Pier) Foundation：Large diameter caisson pile, Geo-Reinforcing Type Caisson Pile, TAKEWARI type earth retaining method		
Construction Cost (2lane) **- Bridge Section** **- Road Section** **- Total**	14.0 Billion PHP 0.8 Billion PHP 14.8 Billion PHP (1.00) (○)	14.4 Billion PHP 0.8 Billion PHP 15.2 Billion PHP (1.03) (△)	13.2 Billion PHP 1.1 Billion PHP 14.3 Billion PHP (0.96) (◎)
Construction Cost (4lane) **- Bridge Section** **- Road Section** **- Total**	28.0 Billion PHP 1.1 Billion PHP 29.1 Billion PHP (1.00) (○)	28.7 Billion PHP 1.1 Billion PHP 29.8 Billion PHP (1.03) (△)	26.4 Billion PHP 1.6 Billion PHP 28.0 Billion PHP (0.96) (◎)
Route Alignment (Drivability)	All section are within 4% gradient and has the most compact alignment. Long curve section (L-=2,030m, R=320m) continues at the loop bridge section and it fully satisfies the design speed of 80km/h.(◎)	It is the steepest slope (5.0%- 4.3%) even though long span bridge section is the shortest. It does not partially satisfy the design speed of 80km/h (△)	All sections are within the 4% gradient, and the horizontal alignment passes a detour around the mountain area and it fully satisfies the design speed of 80km/h.(◎)
Environmental Consideration	There is no difference among the three alternatives		
Affected Forest by passing CMH	4.4km (○)	3.3km (◎)	4.6km (△)
No of Affected Building	34 (○)	27 (◎)	41 (△)
Workability	For the steel girder section, the truck crane bent method and for the PC box section the cantilever overhang erection method will be applied. Both methods are standard erection method. (◎)	application of the cable erection method for truss bridge Cable erection method is unfamiliar in the Philippines. Many bridge parts for truss structures (△) This method have not been used anymore in the Philippines	Better; application of the cable erection method for arch bridge Cable erection method is unfamiliar in the Philippines. Many bridge parts of braced arch rib, but not much for truss structures (○)

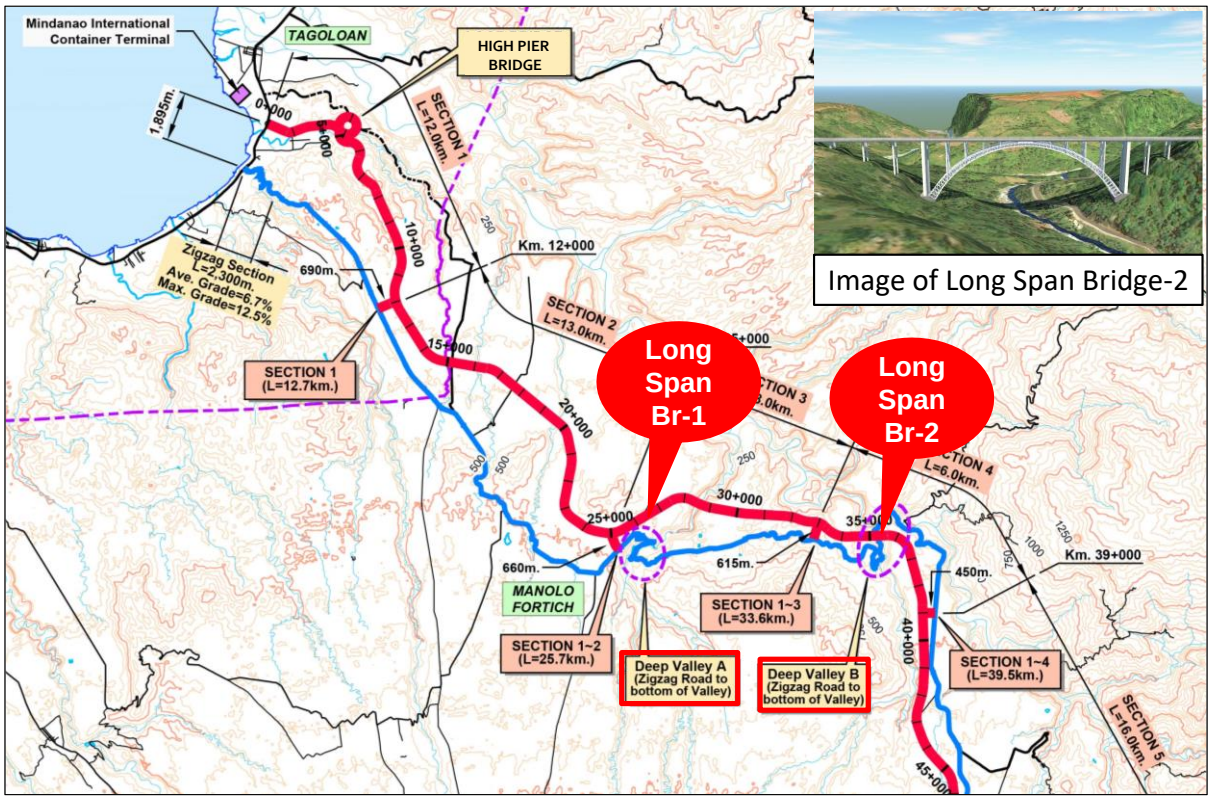


Figure 15-5 Long Span Bridge Planned Location

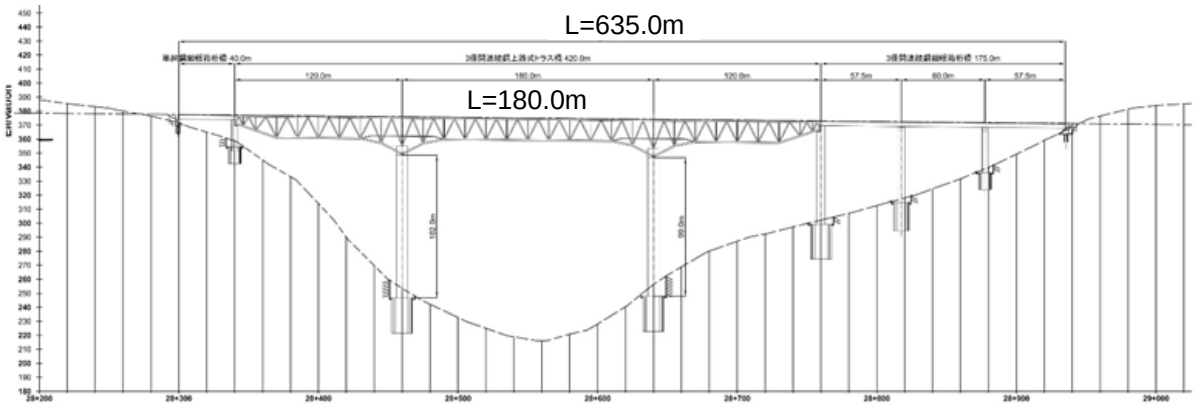


Figure 15-6 Long Span Bridge-1 (Steel Truss Type Bridge)

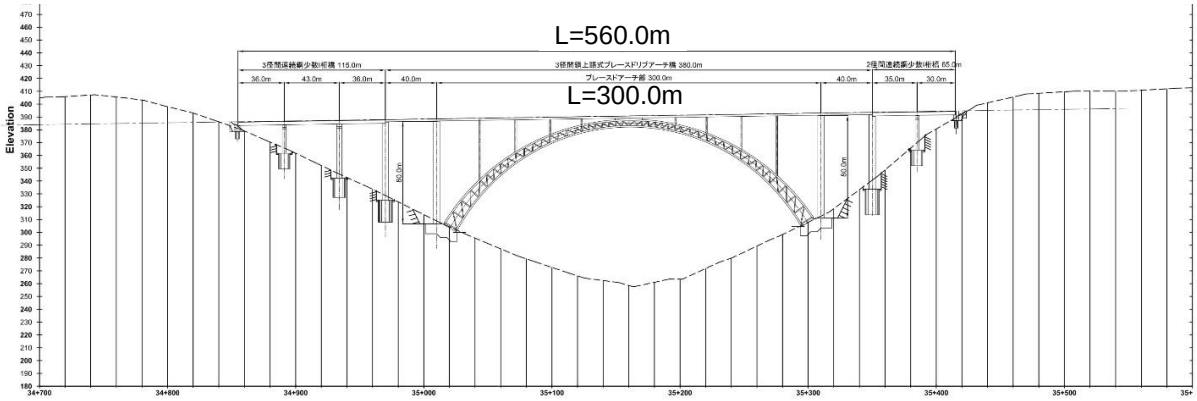


Figure 15-7 Long Span Bridge-2 (Steel Arch Bridge)

15.5 Cost Estimate of Project

Construction cost of the project was roughly estimated at 93,140 million Php in case of 4-lane, and at 55,377 million Php in case of 2-lane. In addition, Section-1 was estimated assuming a loop bridge. The cost of long span bridge was estimated based on Japan's unit cost (See Table 15-6).

15.6 Construction Planning

In case of simultaneous construction by 6 sections divided by interchanges, the construction period is assumed to be 26 months for 4 lane construction and 24 months for 2-lane. The further detailed construction planning should be considered in the F/S stage.

15.7 Economic Evaluation of the Project

The economic analysis was conducted for the CDO-Malaybalay section under two cases. Result of EIRR for 4-lane (toll road) and 2-lane (non-toll road) were estimated to be 18.6% and 22.0%, respectively. Both cases exceed the 10% minimum requirement of NEDA.

Table 15-4 Result of EIRR (The Project Cagayan De Oro – Malaybalay Section)

Case	EIRR (%)	B/C
4-Lane, toll road case	18.6%	2.27
2-Lane, non-toll road case	22.0%	2.92

Table 15-5 Result of EIRR (Section-1)

Case	Alt-1	Alt-3
4-Lane, toll road case	15.0%	15.3%
2-Lane, non-toll road case	16.6%	17.0%

15.8 Preliminary Environmental and Social Study

KII (Key Informant Interview), FGD (Focused Group Discussion) and Stakeholders Meetings were conducted as part of the public consultation. From the discussions, there were some concerns for impact on the resettlement, agricultural land, and concerns on roadside environment such as increased waste, air, and water pollution. In addition, the increased risk of landslide was also mentioned. Many participants expect the project to contribute to industrial development and the facilitation of freight transportation.

This project is assumed to fall under Category A according to the PEISS (Philippine Environmental Impact Statement System) criteria.

15.8.1 Natural Environment

This project is expected to fall into the following categories as an environmental risk area of PEISS (Philippine Environmental Impact Statement System). The DAO 2003-30 specifies 12 Environmental Critical Areas (ECAs) categories. There are four (4) ECA categories which affect the study area, namely:

[No.6] Areas hard-hit by natural calamities;
[No.7] Critical Slope (>50% or >27°);
[No.8] Prime Agricultural Lands, and;
[No.10] Water Bodies (for domestic use, or support wildlife/fishery)

Table 15-6 Construction Cost for CMH

Items	Qty	2-Lane (million Php)		4-Lane (million Php)	
		Unit	Total	Unit	Total
1. Earthwork - Embankment Section	45.52 km	182.48	8,306.5	262.57	11,952.0
2. Earthwork - High Cut Section	10.35 km	431.76	4,468.7	494.25	5,115.5
3. Bridge - Steel Box	5.52 km	-	30,660.3	-	58,849.7
4. Bridge - P/S Concrete Girder	6.37 km	-	5,789.7	-	11,070.6
5. Box Culvert (W=8.5 m)	47 nos	52.10	2,448.5	52.10	2,448.5
6. Overpass (W=8.5 m)	28 nos	55.56	1,555.8	55.56	1,555.8
7. Interchange	6 Locations	358.04	2,148.2	358.04	2,148.2
Total			**55,377.8**		**93,140.3**

15.8.2 Social Environment

(1) Land Acquisition and Resettlement

The project is expected to affect about 170 structures.

(2) Impact on Indigenous Peoples

Road alignment was designed to avoid the IPs land or ancestral domains based on the existing data on Certificate of Ancestral Domain Title (CADT) obtained in the Pre-F/S. Interviews with the National Commission on Indigenous Peoples (NCIP) requires that road alignment should be reviewed in the F/S stage to avoid the IPs land.

15.9 Conclusion and Recommendation

This project is highly necessary as a transportation infrastructure to improve the traffic problems of the current road as well as to promote regional development in the central region of Mindanao as a transportation hub passing through the Mindanao Island.

Specially, the existing road in Cagayan de Oro section has many hair pin curves and steep slopes which create a bottleneck for driving and many road crashes. The existing observed daily traffic volume exceeded approximately 8,000 vehicles/day, and the share of trucks was high at 45% which requires expansion of the capacity at existing road. In addition, some deep valleys are located in this area, thus it is recommended to construct the long span bridge with high piers.

In this Pre-F/S, the applicable alignment was studied based on the available free satellite map and topographic data. The proposed alignment was selected based on lowest construction cost and as much as possible with least negative social and environmental impacts. In particular, in order to address the above issues, the alignment avoided the mountainous areas, minimized the long span bridge length crossing valleys and avoided the indigenous people's ancestral domains, protected areas and important bird areas.

This alignment study is not a definitive study as it is based on the secondary data with low accuracy topographical data and environmental data. It is necessary to carefully select the optimum alignment by comparing the alternatives based on a more accurate field survey data during the F/S stage.

Three alternatives shown in Figure 15-4 were proposed and compared in Section-1 where a high level of technology is required. As a result of alternative study at the beginning of 2km section, either Alternative-1 or Alternative-3 is recommended. Alternative-2 has difficulty in satisfying the design speed of 80 km/h due to tighter horizontal and longitudinal alignments.

It is necessary to conduct a detailed comparative study between the two alignments during the F/S stage based on topographic survey, geotechnical survey and social-environmental data such as the indigenous people's ancestral domains.

16 CEBU CIRCUMFERENTIAL ROAD

16.1 Outline of the Project

The Cebu Circumferential Road is a new road project of approximately 65 km in length from Danao to Naga. The project road bypasses the Metro Cebu area. Metro Cebu has a longitudinal coastal topography, and only two (2) major corridors serve the south-north traffic. Under this situation, DPWH conducted the Business Case Study for the Cebu Circumferential Road, which is divided into three (3) Segments and is shown in the Location Map of Cebu Circumferential Road (Figure 16-1). The JST conducted a Pre-F/S for Segment-1 and proposed the red route in the Location Map. The blue route proposed by DPWH is a route which utilized existing road and it does not satisfy the requirement for a high standard highway. The Pre-F/S is studied for the segment 1 of about 25 km that bypass Cebu metropolitan area shown by the red route on the map. The Segment 3 is under a feasibility study by DPWH. The study of Segment 2 is not still commenced.

Because this section passes through the hills, the advanced technology such as long tunnel and high pier bridge will be applied to satisfy the design standard of HSH. In addition, the project is proposed as one of the short-term project until 2025 in the HSH class 1 implementation program.

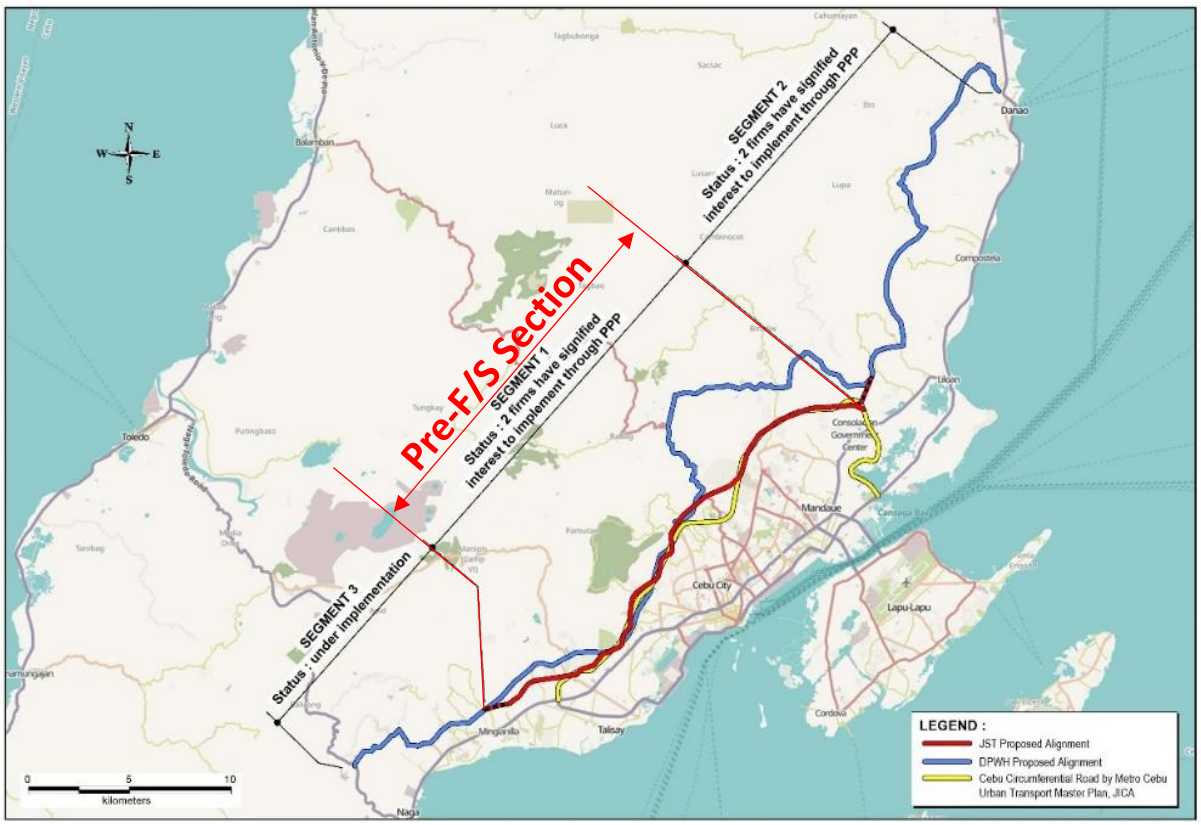
16.2 Project Specification and route

This Pre-F/S was conducted for segment 1 which is approximately 25 km. The road is planned as a HSH Class-1, 4-lane, and with a design speed of 60 km/h.

In order to achieve the high standard highway criteria with lesser resettlement, an advanced technology for long mountain tunnels and high pier bridges will be necessary for the whole section.

Table 16-1 Outline of Pre-F/S

Class	HSH Class-1	**No. of Lanes**	4-Lane
Length	24.6 km	**Design Speed**	60 km/h



Source: JICA Study Team

Figure 16-1 Location Map of Cebu Circumferential Road

16.3 Traffic Demand Forecast

The future traffic volume in 2040 was calculated for the two cases. As the construction of Segment-3 is under implementation, it will be completed ahead of the project road (Segment-1). The construction of Segment-2 was proposed as a PPP scheme and the implementing schedule is not yet clear. That is why the following two cases were subjected to future traffic volume forecast in 2040.

As a result of the future traffic volume, the four lanes are needed by both cases in 2040, so that the CCR was planned as a 4-lane road.

Table 16-2 Future Traffic Volume CCR

Year	Cases	Traffic Volume (Veh/day)
2040	Case-1 (Development of Segment-1 and Segment-3)	11,900～37,400
	Case-2 (Development of All Segments (Segment-1, 2, 3))	22,900～37,700

Source: JICA Study Team

16.4 Preliminary Design

16.4.1 Design Standard

The proposed Highway is an Inter-City High Standard Highway Class-1. The Geometric Design Criteria to be applied are shown in Table 16-3**.** The lane width is 3.5 m and the shoulder width is 2.5 m.

Table 16-3 Geometric Design Criteria

Items		Value
Design Speed		60 km/h
Maximum Grade		5% 6% (l = 500 m)
Radius	Minimum	120m
	Desirable	150m
No. of Lanes		4
Lane width		3.50 m
Medium strip width		2.25 m
Outer shoulder width		2.50 m

Source: JICA Study Team

16.4.2 Road Design Including Alternative Study

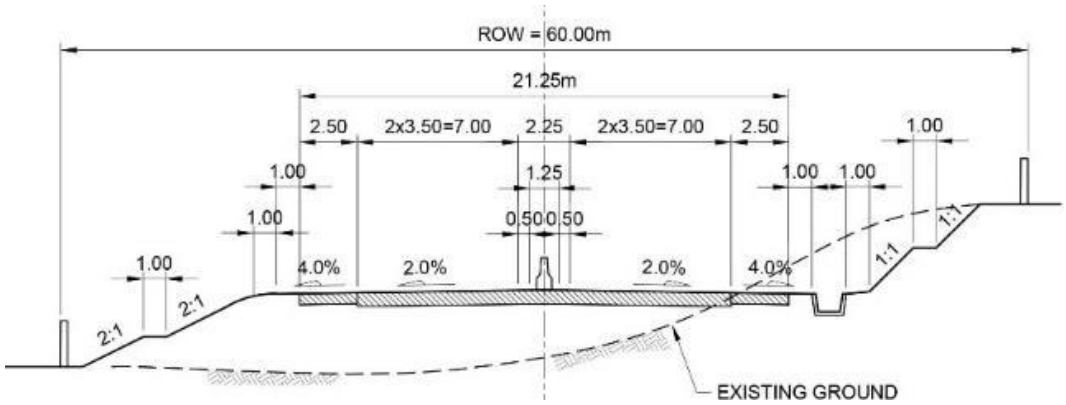
Based on the proposed alignment of the JICA Metro Cebu Urban Transport Masterplan, the following four alternative alignments were studied and the result is shown in Table 16-5.

Alignment A does not satisfy the design criteria of a high standard highway. Though Alignment A(dash) is the one of the candidates due to the minimal number of affected buildings and natural environmental impact applying long mountain tunnel sections, the project cost will be the highest. Alignment C has many affected building/structures compared with the other Alignments. As such, Alignment B is recommended for the Project.

In addition, the impact to Central Cebu Protected Landscape (CCPL), which spreads along the proposed route, should be analyzed in the alternative comparison study of F/S.

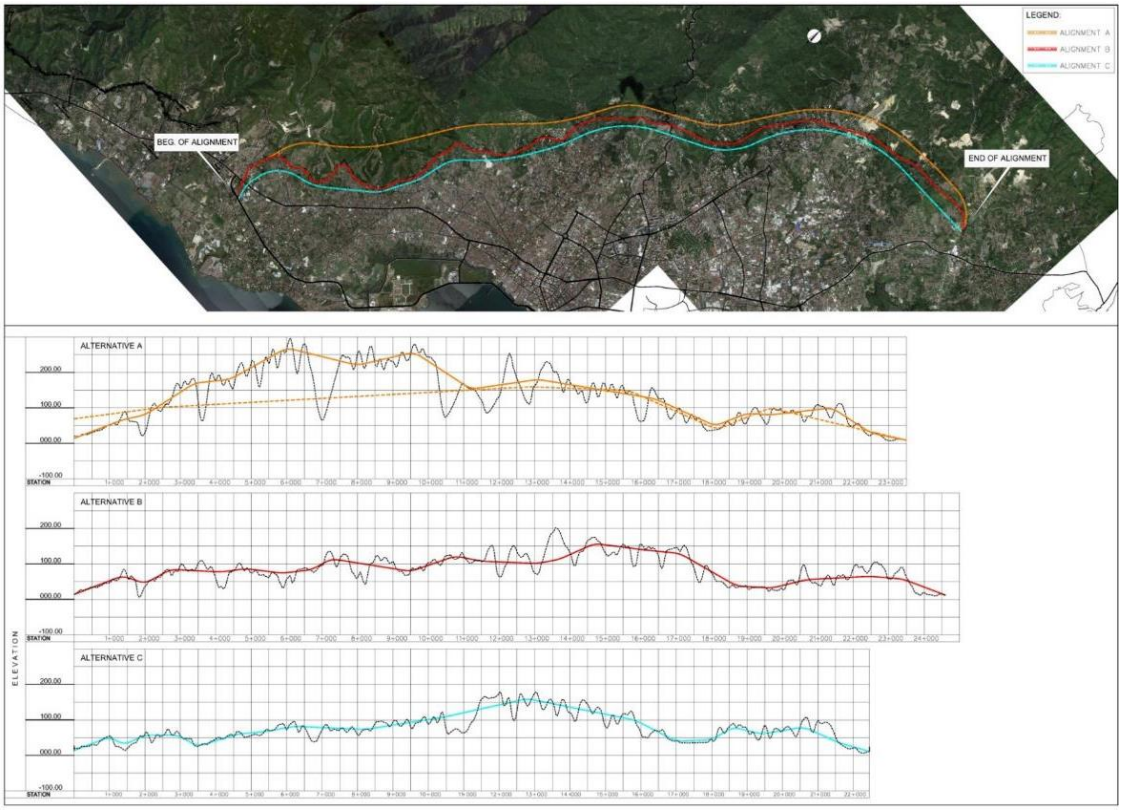
Table 16-4 Outline of the Four Alternatives

Alignment	Features
Alignment A	Inland Alignment compared with Alignment B
Alignment A (dash)	Same plan as Alignment A (To minimize the number of affected buildings, two long mountain tunnels were applied. The profile is indicated as orange color dot line in Figure 16-3)
Alignment B	Improved alignment of the Metro Cebu Urban Transport Masterplan



Source: JICA Study Team

Figure 16-2 Typical Cross-Section of Cebu Circumferential Road (4-Lane)



Source: JICA Study Team

Figure 16-3 Plan and Profile of the Four Alternatives

Table 16-5 Comparison of the Four Alternatives

	Alignment A	Alignment A (dash)	Alignment B	Alignment C
Length	**23.5km**	**23.5 km**	**24.6km**	**22.4km**
1)Route	Due to mountainous area, there are three critical vertical sections (grade: over 6%). These sections cannot satisfy the design speed of 60km/h. (△)	In order to satisfy the design speed of 60 km/h, long mountain tunnels were applied (○)	Due to hilly area, some critical vertical sections exist, however, these sections satisfy the design speed of 60km/h. (○)	Compared with the other two alternatives, vertical alignment is not critical. This alignment features the shortest road length among the alternatives. (◎)
2)Structures (Bridge and Tunnel)	It is necessary to construct high-pier bridges and tunnel sections. Highest pier for bridge is 170m, project implementation would be difficult with the use of the present technology. (△)	In order to achieve a high standard highway, it is necessary to construct long mountain tunnels. With the present technology, this is implementable. (○)	In order to achieve a high standard highway, it is necessary to construct many high-pier bridges and mountain tunnels. The highest pier is 40m and the longest tunnel is 1700m. With the present technology, this is implementable. (○)	In order to achieve a high standard highway, it is necessary to construct many bridges and mountain tunnels. (○)
3)Impact to natural environment	Relatively rich natural habitats are along the alignment and a significant number of trees would be cut. The impact on hydrology, topography, and other items is also severest among the options. (×)	Long mountain tunnel was applied in order to lessen the impact on hydrology, topography, and other items compared with Alignment A. (○)	Some sections are close to forest / hilly areas where natural environment is easily affected. Such impact is middle/mild among the options. (△)	Some sections are close to forest / hilly areas where natural environment is easily affected. Such impact is relatively low among the options. (○)
4)No. of affected structures * Social Impact	1,123 (○) Cases	812(◎) Cases	1,200 (○) Cases	3,120 (△) Cases Alignment C is diverted from alignment B and moved a little closer to Cebu City, the number of affected structures increased by over 2.6 times.
5)Project cost rate (Construction cost + ROW acquisition cost)	1.28(○)	1.46(△)	1.00(◎)	1.14(○)
6)Future Traffic (2040)	19,700 vehicle/day (0.73) (△)	19,700 vehicle/day (0.73) (△)	25,300 vehicle/day (0.94) (○)	26,800 vehicle/day (1.00) (◎)
Evaluation			**Recommended**	

Note: ◎: very good, o: good, △ No good
Source: JICA Study Team

16.4.3 Proposed Road Alignment

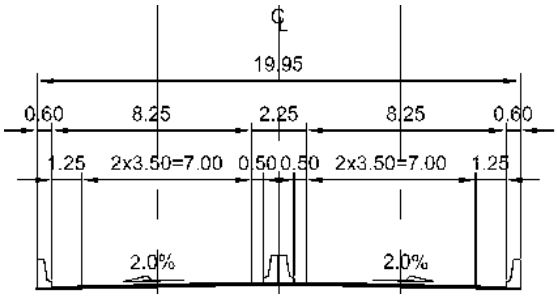
Proposed road alignment and main structure locations for alternative B are shown in Figure 16-6. The planned main structure consists of 16 tunnels (10.12 km) and 20 bridges (7.49 km).

16.4.4 Preliminary Bridge Design

A total of 7.49km of bridges are planned for this project, and Table 16-6 shows the summary of Bridge Plans.

Typical Cross Section at Integrated Section: Applied in sections which was not affected topographic condition.

Typical Cross Section at Separated Section: Applied in sections near tunnel section or others difficult topographic condition.



Source: JICA Study Team

Figure 16-4 Typical Cross Section at Integrated Section

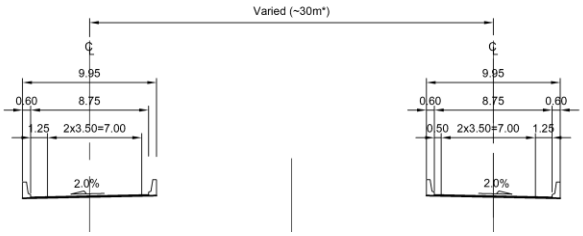


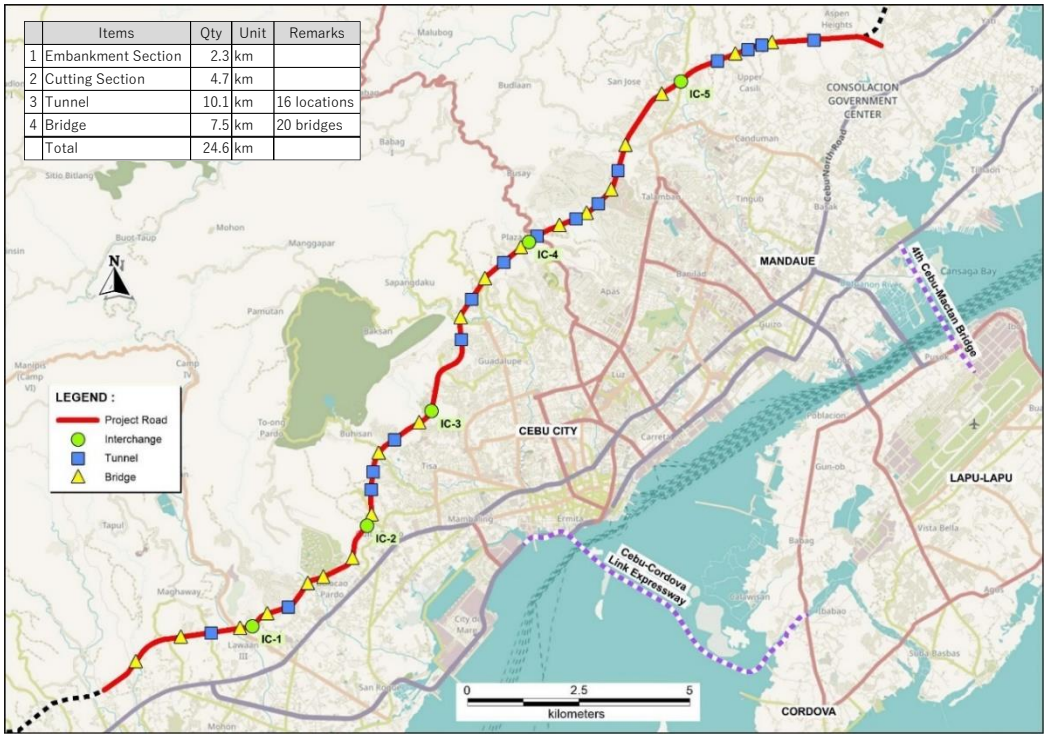
Figure 16-5 Typical Cross Section at Separated Section

Table 16-6 Summary of Bridges

	Total Length (m)	
	Integrated Section	**Separate Section**
PC Hollow Slab	---	330
PSCG*1 – AASHTO Girder	1,340	3,785
PC Box Girder	730	815
Steel Narrow Box Girder	280	---
Steel Truss Girder	---	210
Subtotal	2,350	5,140
Total		**7,490**

**1 PSCG : Pre-Stressed Concrete Girder*

Source: JICA Study Team

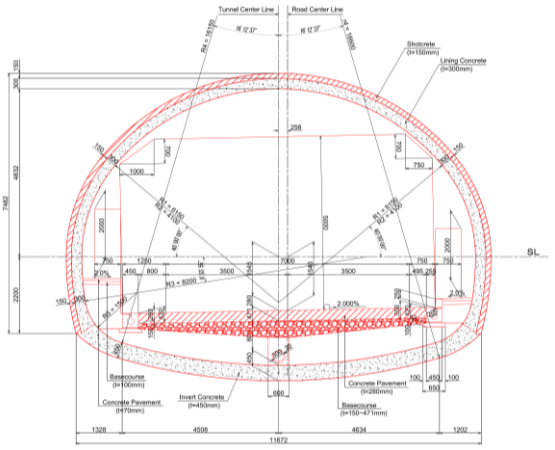


Source: JICA Study Team

Figure 16-6 Proposed Alignment of CCR

16.4.5 Preliminary Tunnel Design

Sixteen (16) tunnel sections are planned for this project, with a total length of about 10.12km. The outline of the tunnel plan is shown in Figure 16-7.



Source: JICA Study Team

Figure 16-7 Outline of Tunnel Plan

Table 16-7 Location of Tunnel Portals

Tunnels		Portal (Sta.)		Length	Super-Elevation	Gradient
		Start	End	(m)		
Tunnel-1	Left	1+877	2+498	621	-2.0%	-2.35%
	Right	1+893	2+490	597	-2.0%	-2.35%
Tunnel-2	Left	3+641	4+453	812	-5.9 ~ -2.0%	-0.78%
	Right	3+645	4+491	846	-2.0 ~ +5.9%	-0.78%
Tunnel-3	Left	7+457	7+737	280	-2.0%	-1.31%
	Right	7+485	7+723	238	-2.0%	-1.31%
Tunnel-4	Left	7+864	8+154	290	-2.0 ~ +4.0%	-1.31%
	Right	7+883	8+136	253	-4.0 ~ -2.0%	-1.31%
Tunnel-5	Left	8+545	9+298	753	-2.0 ~ +4.0%	+0.30%
	Right	8+544	9+284	740	-4.0 ~ -2.0%	+0.30%
Tunnel-6	Left	11+476	12+210	734	-5.6 ~ +4.8%	-1.24%
	Right	11+482	12+203	721	-4.8 ~ +5.6%	-1.24%
Tunnel-7	Left	12+416	13+179	763	-2.0 ~ +4.8%	+1.78%
	Right	12+416	13+155	739	-4.8 ~ -2.0%	+1.78%
Tunnel-8	Left	13+476	14+314	838	-2.0 ~ +4.8%	+1.78%
	Right	13+473	14+292	819	-4.8 ~ -2.0%	+1.78%
Tunnel-9	Left	14+475	15+199	724	-2.0%	+1.78%
	Right	14+501	15+223	722	-2.0%	+1.78%
Tunnel-10	Left	15+603	16+004	401	-3.1 ~ -2.0%	-3.00%
	Right	15+608	16+005	397	-2.0 ~ +3.1%	-3.00%
Tunnel-11	Left	16+142	16+630	488	-3.1 ~ -2.0%	-1.43%
	Right	16+135	16+753	618	-2.0 ~ +3.1%	-1.43%
Tunnel-12	Left	16+912	17+728	816	-4.8 ~ -3.6%	-1.43%
	Right	16+927	17+737	810	-3.6 ~ +4.6%	-1.43%
Tunnel-13	Left	20+552	20+981	429	-2.0%	-0.30%
	Right	20+534	21+007	473	-2.0%	-0.30%
Tunnel-14	Left	21+381	21+596	215	-2.0%	+1.63%
	Right	21+402	21+596	194	-2.0%	+1.63%
Tunnel-15	Left	21+713	21+945	232	-2.0%	-0.70%
	Right	21+727	21+942	215	-2.0%	-0.70%
Tunnel-16	Left	22+172	23+896	1,724	-2.0%	-1.97%
	Right	22+176	23+910	1,734	-2.0%	-1.97%

Source: JICA Study Team

16.5 Cost Estimate of the Project

Table 16-8 shows the summary of construction cost for the CCR.

Table 16-8 Summary of Construction Cost

Item	Unit	Quantity	Unit Cost (Mill Peso per unit)	Cost (Mill Peso)
1. Embankment Section	km	2.27	227.6	517
2. High Cut Section	km	4.68	782.2	3,661
3. Tunnel	km	10.12		24,216
4. Bridge	km	7.49		14,626
5. Underpass	No.	5	52.1	261
6. Overpass	No.	5	55.6	278
7. Interchange	No.	5	331.0	1,655
8. Traffic Control & Toll Collection	No.	1	859.0	859
9. Widening Existing Road	km	2.00	136.4	545
Total				**46,618**

※1 Based on the site reconnaissance and the bibliographic survey in the Study, the ground level of tunnel section is classified into three (3) types, CII, DI and DIII.
CII (rock mass appear to be relatively stable): overburden is over 2D (D=tunnel excavation width: 12 m)
DI (rock mass appear to be relatively sheared or weathered): overburden is over 1.5D to less than 2.0D
DIII (tunnel portal section): overburden is less than 1.5D

Source: JICA Study Team

16.6 Construction Planning

In case of simultaneous construction by 6 packaged, the construction period is assumed 50 months for 4-lane construction.

16.7 Economic Evaluation and Financial Evaluation of the Project

Economic evaluation was conducted in two cases. The EIRR (Economic Internal Rate of Return) was 14.6% and 17.0% in Case 1 (when Segment 1 and Segment 3 are developed) and Case 2 (when all Segments are developed), respectively. Both cases exceed the 10% minimum requirement of NEDA.

In addition, financial evaluation was carried out the in case of “Base Case” and “Maximum Revenue Case” for the development of all segments (Segment-1, 2, 3). Both cases did not exceed 7% of WACC (weighted average cost of capital: Reference value for businesses to consider whether or not to invest.) in the Philippines. The case of applying SPC (50% with

Subsidy) was also considered, and the results were lower than the WACC.

Table 16-9 Results of Economic Evaluation

Indicators of Economic Analysis			
Cases	**EIRR (%)**	**CBR**	**ENPV (million Php)**
Case-1	14.6%	1.56	20,010
Case-2	17.0%	1.90	32,257

Source: JICA Study Team

Table 16-10 Result of Project IRR

Case	PIRR*1(%)
Base Case (Toll Setting: Class1=3.5 Peso, Class2=8.7 Peso, Class3=10.5 Peso)	-0.7%
Case 2 (Max Revenue: Class1=8.7 Peso, Class2=21.8 Peso, Class3=26.1 Peso)	1.6%
PIRR for SPC*2	1.7%
PIRR for SPC (50% Subsidy)	4.7%

※1 PIRR: Project Internal Rate of Return
※2 SPC: Special Purpose Company
Source: JICA Study Team

16.8 Preliminary Environmental and Social Survey

KII (Key Informant Interview), FGD (Focused Group Discussion) and Stakeholders Meetings were conducted as public consultation.

From the discussions, the impact on the resettlement, agricultural land and the impact on the environment such as air and water pollution were concerned. In addition, stakeholders commented on the need to concerns about river flooding caused by deforestation. The mayors expressed their support over the project since it will decongest the traffic going around Metro Cebu.

This project is assumed to fall under Category A according to the PEISS (Philippine Environmental Impact Statement System) criteria.

16.8.1 Natural Environment

This project is expected to fall into the following categories as an environmental risk area of PEISS (Philippine Environmental Impact Statement System). There are three (3) ECA categories which affects the study area, namely:

[No.6] Areas hard-hit by natural calamities;
[No.7] Critical Slope (>50% or >27°), and;
[No.10] Water Bodies (for domestic use, or support wildlife/fishery)

16.8.2 Social Environment

(1) Land Acquisition and Resettlement

Main lane: 1,200 cases + interchange: 430 cases + about 270 structures by the connection to the existing road.

(2) Impact on indigenous peoples

The implementation of this project will not affect indigenous peoples.

16.9 Conclusion and Recommendation

The project will have an excellent impact on traffic decongestion of Cebu City with a projected through traffic shift of 30,000 vehicles/day in 2040. In addition, the population of Metro Cebu is expected to increase by 5.0 million in 2050 due to the rapid rate of urbanization. However, about 1,900 structures are expected to be affected for the construction of the main road and interchange. The estimated project cost is expensive as it necessitates a number of bridges and tunnels to achieve a high standard geometric design, and the proposed alignment will pass through an urbanized area. In particular, the construction cost of the tunnel accounts for more than about 50% of the total cost, and it is necessary to conduct appropriate geological investigations during the F/S stage. In addition, the project area is located in a mountainous area, so it is necessary to consider the measures for landslides and slopes.
Furthermore, this Pre-F/S is limited to the outline study based on available free satellite images and topographic map data. Subsequently, the site visits by experts, especially the tunnel engineer and geotechnical engineer, were not undertaken due to the travel restrictions brought about by the COVID-19 pandemic.
Depending on the results of the topographic survey, geological survey and other surveys, a significant fluctuation risk of the project cost may be expected. In addition, this area is a high-class residential area being developed, and consensus building with local residents is an important factor in ensuring smooth project progress. It is necessary to consider this aspect

in selecting the optimal route or planning of a compact-type interchange such as diamond-type interchange instead of a trumpet-type interchange during the F/S stage.
In terms of environmental and social considerations, the following points should be considered in the full-scale F/S.

- Confirmation of construction methodology and necessary machinery and vehicles.
- Confirmation of soil borrow pit, quarry, waste dumping site, etc.
- Necessary budget for mitigation and monitoring.
- Confirmation of specific role and responsibility for mitigation, monitoring, and resettlement implementation.
- Stakeholder Meetings and Public Consultations as F/S level.
- F/S and RAP shall refer issues and concerns from FGDs and SHMs.

17 2nd SAN JUANICO BRIDGE

17.1 Outline of the Project

The project is a bridge construction project to link the straits between Samar Island and Leyte Island in the central part of the Philippines. Currently, the existing San Juanico Bridge (truss bridge), which was built in the 1970s with the support of the Japanese government, is responsible for the traffic between the two islands. However, the aging of the existing bridge and the increasing cost of maintenance and management have become major problems. The current traffic volume is about 7,000 vehicles per day (plus about 3,000 motorcycles), but it is assumed that the road traffic capacity will be insufficient within the next 10 years. As it is the only road that connects Tacloban City, a regional center with a major airport and port, to Samar Island, it also serves as main road for daily life and logistics. The rate of freight vehicles is about 25%, but it is expected that the number of freight vehicles will increase in the future.

Since the rehabilitation of the existing bridge will require extensive work involving long-term road closures such as slab reconstruction, this project is necessary to ensure access to both islands at that time. The bridge is a part of the Samar-Leyte High Standard Highway, which is proposed as a long-term project. However, the 2nd San Juanico Bridge and approach road was selected as the short-term project because the existing San Juanico Bridge necessitates a slab reconstruction at about every 8 to 10 years and will be closed for traffic during reconstruction. It is also necessary to apply the advance technology for construction of long span bridge connecting the two islands.

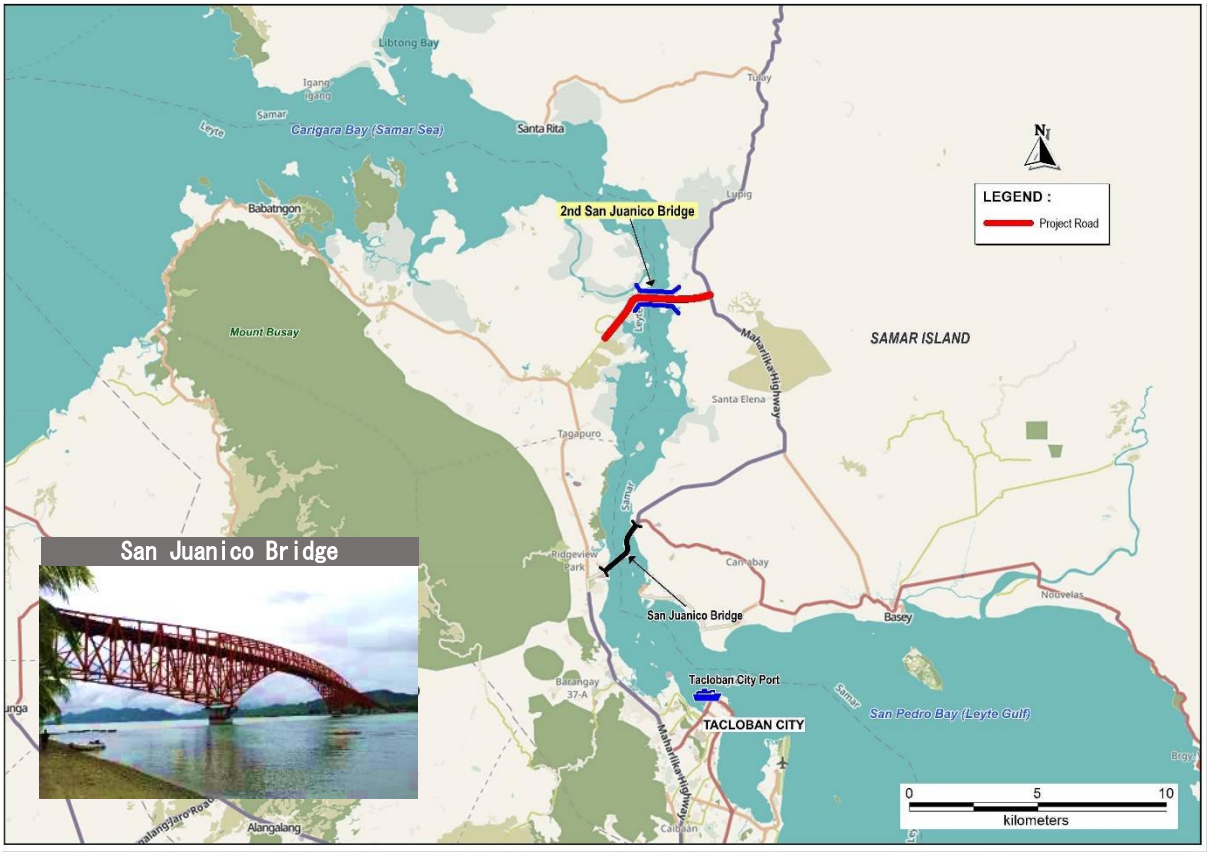
17.2 Specification and Route

This pre-F/S is planned as a part of the high standard road network, including the long span bridge approximately 5km in length. An advanced technology will be necessary for long span bridge in the strait. This pre-F/S is planned as a temporary 2-lane expressway in consideration of future traffic demand.

Table 17-1 Outline of Pre-F/S

Name	2nd San Juanico Bridge
Class	HSH Class-1※
Length	4.88 km
Number of Lanes	2 lanes
Design Speed	80 km/h

Note: Currently as part of national highway Bridge, but in the future, it will be utilized as HSH Class-1.



Source: JICA Study Team

Figure 17-1 2nd San Juanico Bridge and Access Road

17.3 Traffic Demand Forecast

The design traffic volume for the 2nd San Juanico Bridge is around 9,100 vehicles per day in 2040. The bride is planned to have 2 lanes.

Table 17-2 Future Traffic Volume between Leyte and Samar Islands

Unit: Vehicle/day

Year	2nd San Juanico Bridge	San Juanico Bridge (Existing)	Total
2019	-	7,200	7,200
2040	9,100	6,800	15,900

Source: JICA Study Team

17.4 Preliminary Design

17.4.1 Design Standard

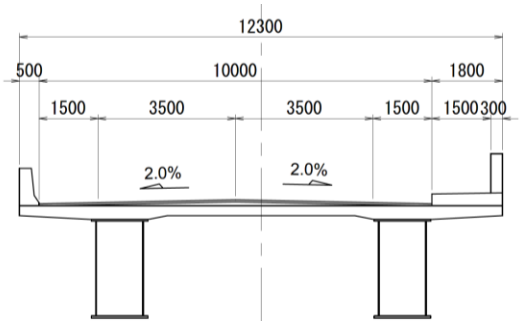
The Geometric Design Criteria to be applied is shown in Table 17-3**.** The design speed is 80 km/h, with an initial 2-lane construction.

The lane width is 3.5 m, and the shoulder width is 1.5m. On the bridge, the sidewalk is 1.5 m on the shoulder of the bridge. Since the proposed project is a short section, it should be considered to be operating as a general highway at the F/S stage.

Table 17-3 Geometric Design Criteria

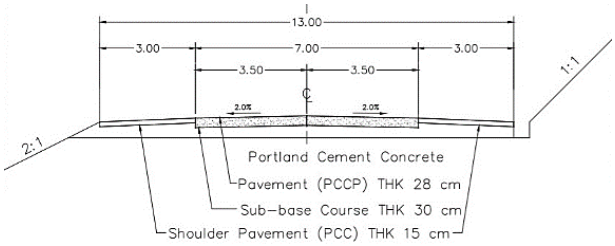
Item		Standard Value
Class		HSH Class-1
Design Speed		80 km/h (Flat Terrain)
Number of Lane		2 lanes (4 lanes in the future)
Width	Lane	3.5 m
	Shoulder	1.5 m
	Earth Shoulder	1.0 m
Minimum Horizontal Curve Radius		400 m
Maximum Vertical Grade		4%

Source: JICA Study Team



Source: JICA Study Team

Figure 17-2 Typical Cross section



Source: JICA Study Team

Figure 17-3 Typical Cross section of Access Road

17.4.2 Study of Bridge Location

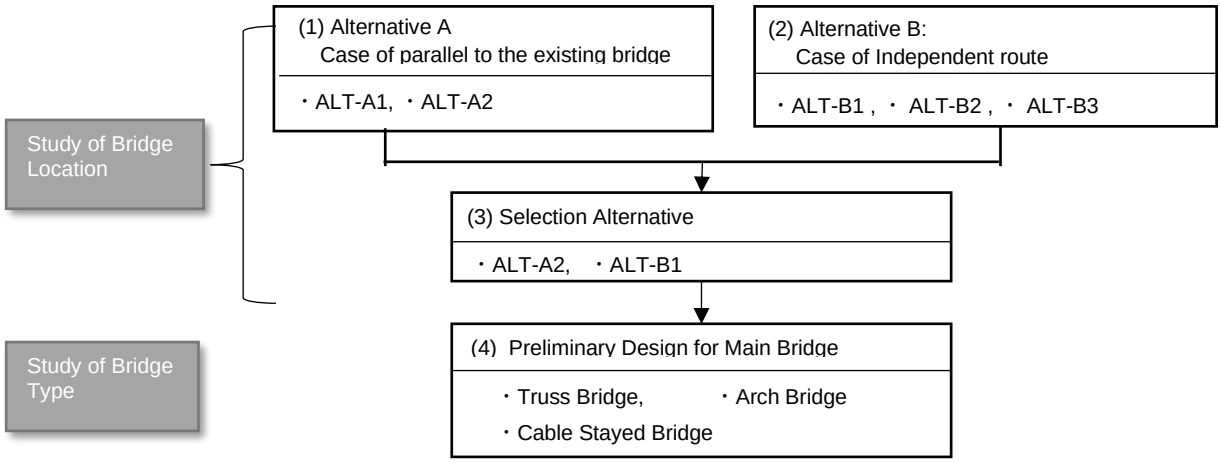
The existing San Juanico Bridge is a truss type bridge which was built 50 years ago with the assistance of Japan. While it is a bridge with excellent appearance in the Philippines, it entails expensive maintenance cost because of repainting and used F11T bolt. The following alternatives study was considered as the selection of the bridge position and bridge type in consideration of these condition.

(1) Alternative A: New Bridge will be constructed parallel to the Existing Bridge

As an alternative, two types of cross-linking plans are considered.

ALT-A1: Alternative of making the new bridge completely parallel.

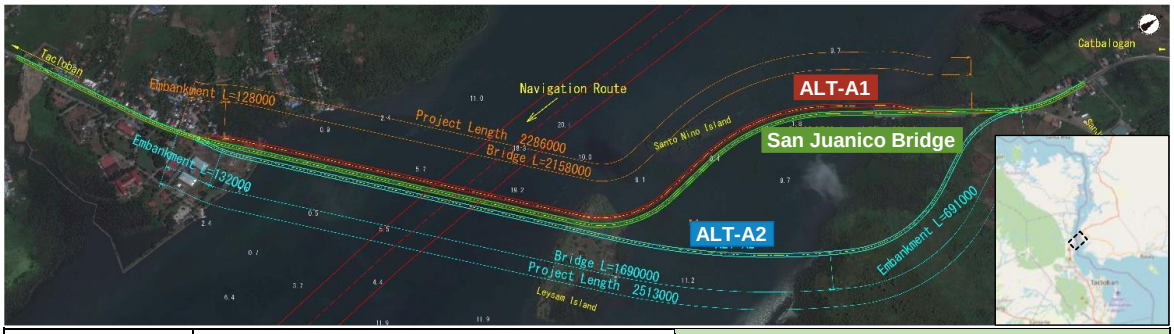
ALT-A2: Alternative of minimizing the total length of the bridge with the parallel main bridge.



Source: JICA Study Team

Figure 17-4 Alignment Procedure

Table 17-4 Comparative Table for Alternative-A



	ALT-A1（Red Alignment） Alternative of making the new bridge completely parallel	**ALT-A2**（Blue Alignment） Alternative of minimizing the total length of the bridge with the parallel main bridge.
Total Length	2,158 m	1,690 m
Comment	Since it is completely parallel to the existing bridge, the landscape is better than that of ALT-A2. However, the overall length is longer than ALT-A2, Less economical (1.15).	The approach bridge on the Samar Island side is inferior to the existing bridge, so the landscape is poor than ALT-A1. However, the overall bridge length is shorter, which is economical (1.00).
Evaluation	-	**Recommended**

Source: JICA Study Team

(2) Alternative B: Case of Independent Route

Three alternatives (ALT-B1, ALT-B2, and ALT-B3) were compared.

ALT-B1: Area A
(10-13 km north of current bridge)
ALT-B2: Area B
(6-9 km north of current bridge)
ALT-B3: Area C
(3-6 km north of current bridge)

The scale of the main bridge of alternatives is the same. Therefore, the shortest approach bridge is the most economical. ALT B1 is thus recommended.

The following points were considered as particularly important ideas. In the case of ALT-A2, which is a plan to be parallel to the existing bridge, if the bridge type is different from the existing bridge, it will be not harmonized the scenery of the area. Thus, the same bridge type is desirable. However, in the case of truss bridges, the maintenance costs are considered high. On the other hand, ALT-B1 has a long central span, but the total construction cost is low, and it is possible to select a type with excellent maintainability.

JST recommended the ALT-B1, and the bridge type will be further studied.

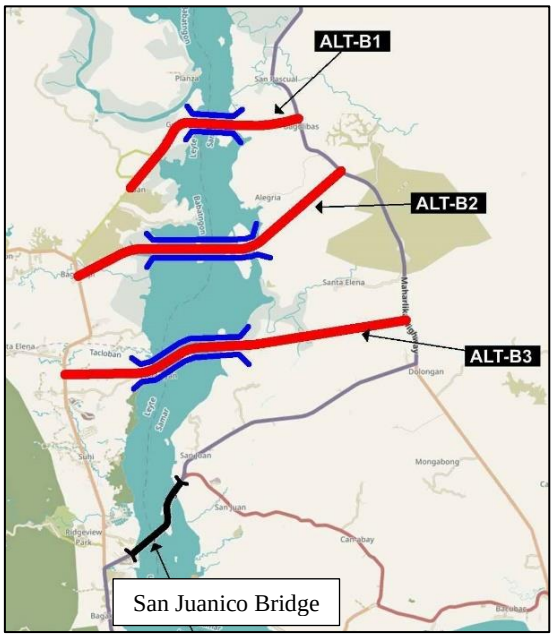


Figure 17-5 Alternative B Bridge Location

Table 17-5 Comparison of Bridge Location

Item		ALT-B1	ALT-B2	ALT-B3
Structural Components	Length of Main Bridge	600 m	600 m	600 m
	Length of Maritime Viaduct	150 m	1,250 m	500 m
	Length of Viaduct	400 m	1,100 m	950 m
	Total Length	1,150 m	2,950 m	2,050 m
Ratio of Cost		1.00	1.65	1.30
Evaluation		Recommended	-	-

Table 17-6 Comparison Table between Alternatives A and B

Structural (Earthquake and Wind Resistance)	Score	**ALT-A2** New bridge, completely parallel (1.7km)	**ALT-B1:** Independent Route (1.2km)
Workability	5	**Excellent (5)**: It is composed of a structure with a high degree of static instability, it has excellent earthquake resistance and wind resistance.	**Excellent (5)**: Since it is a structure with high static instability, it has excellent earthquake resistance and wind resistance.
Maintenance and Management	5	**Good (4):** When constructing substructures and foundations, it is possible to secure a separation that does not affect the existing bridge. There is a possibility that the construction space will be narrowed during superstructure construction.	**Good (4)**: It is necessary to ensure sufficient separation from the adjacent high-voltage line. Safety measures are required during construction.
Landscape	5	**Poor (2):** There are many members and many items to be maintained and managed. Therefore, the time, labor, and repair points are increased, and the maintenance cost is high.	**Good (4)**: Maintenance costs can be reduced by reducing the number of members
Structural (Earthquake and Wind Resistance)	5	**Normal (3)**: Harmony can be achieved by adopting the same structure as the existing bridge, but it gives a more complicated impression than when the existing bridge is used alone.	**Good (4)**: There is no need to harmonize with the existing bridge, and it is possible to enhance landmark properties as a gateway by using a form that is rich in gate properties. In addition, it is possible to compare new and old technologies.
Environmental and Social Impact	5	**Normal (3)**: There are relatively scattered mangrove species on the Samar Island side. Other major impact on environmental and social considerations are almost same level of ALT-B1 because affected areas environmental elements such as ecosystem, land use situation, affected size of communities are almost same.	**Poor (2)**: There are mangrove communities on both Leyte and Samar Island sides and number of necessary cutting mangrove trees may be more than ALT-A2.
Construction Cost	5	**Normal (3)**: 200 Mil. USD (1.10)	**Excellent (5)**: 180 Mil. USD (1.00)
Evaluation	30	**20 points**	**24 points** **Recommended** The evaluation point of maintenance and management has much advantage in ALT-B1 in terms of engineering and life-cycle cost as well as the construction cost. In addition, impact on landscape is not as severe as ALT-A2 which may cause cumulative impact with the existing bridge. On the other hand, the impact on the environment was evaluated as poor because the number of affected mangrove trees may be more than ALT-A2. However, as a result, both of these two options require certain numbers of cutting mangrove trees. Based on the above comparison, general evaluation of ALT-B1 is higher than ALT-A2 and is thus recommended as the selected option. Further alternative discussion shall be done in F/S phase with some pre-conditions such as geological data.

Excellent: 5, Good: 4, Normal: 3, Poor: 2, Bad: 1

17.4.3 Preliminary Design of the Main Bridge

Three bridge types were studied as shown in Figure 17-6. Table 17-7 shows the evaluation criteria and the evaluation result are shown in Table 17-8.

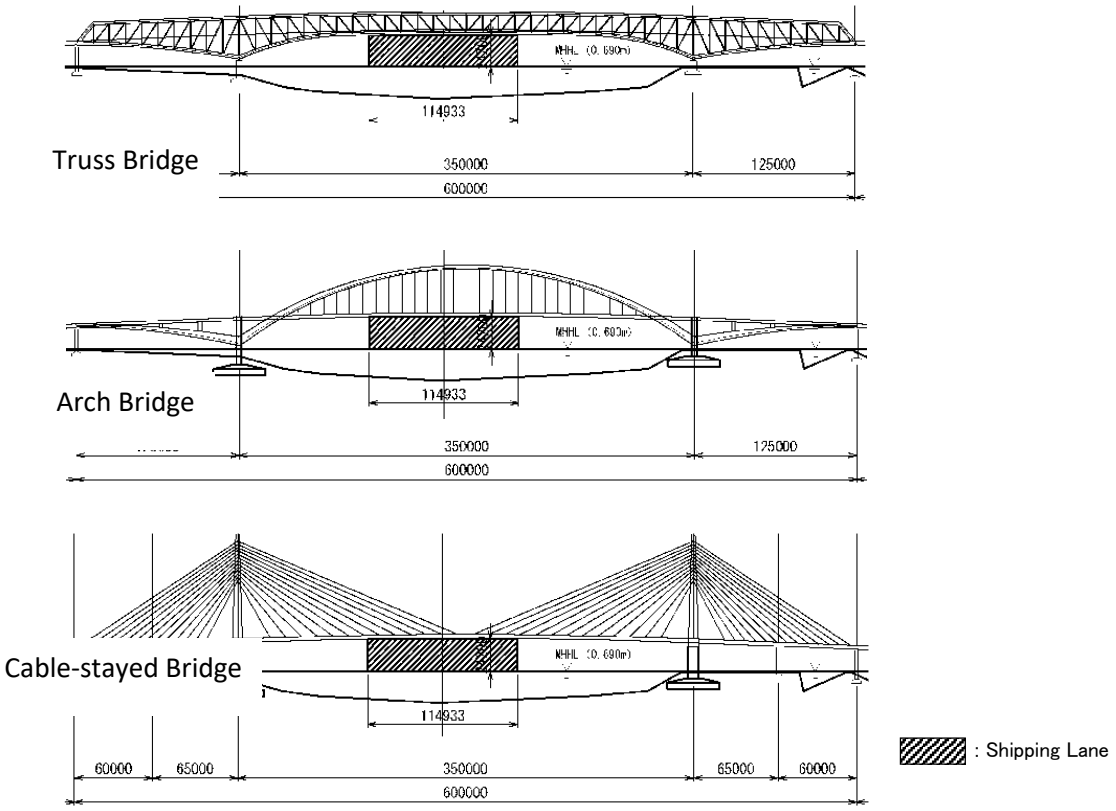


Figure 17-6 Bridge Type

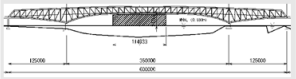
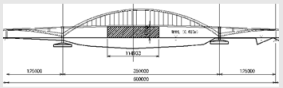
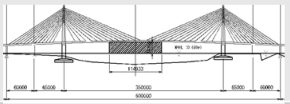
Table 17-7 Evaluation Criteria

Evaluation Items			Score
Structure (20 Points)	Wind Resistance Stability		10
	Seismic Adequacy		6
	Redundancy		4
Constructability (15 Points)	Safety Risk		5
	Construction Duration		7
	Construction Yard Required		3
Maintainability (10 Points)	Work Volume		4
	Workability		4
	Availability of Procurement for Maintenance Works		2
Landscaping (15 Points)	Harmony with the Bridge of the Existing Bridge and Surroundings		5
	Architectural Features	Landmark	3
		Originality	3
		Technological progress	2
	Environment Impact		2
Cost (40 Points)	Life Cycle Cost		40
Total			100

The following points were considered in the evaluation of bridge type selection.

- The bridge is located near the passage of the super typhoon Yolanda (estimated maximum instantaneous wind speed of 90 m/s) that heavily damaged Tacloban city, so that the excellent wind resistance type gets advantage. In addition, for unexpected loads such as storm surges, high redundancy type is advantageous.
- For constructability, the short construction period and safety for navigation vessels were focused on, assuming that cable-stayed bridges will be erected overhang and arch bridges will be erected collectively.
- For maintainability, the type with a small number of parts, small number of special parts such as cables, and the ease of local material procurement were given priority.
- For landscaping, truss bridges and arch bridges which harmonized to the area gets an advantage.
- For cost, it was estimated based on the past result of each type construction cost.
- As a result of the comparison, recommended is the “Arch Bridge” type with the highest evaluation.

Table 17-8 Comparison Table for Bridge Type

	Score	ALTERNATIVE-1	ALTERNATIVE-2	ALTERNATIVE-3
BRIDGE TYPE	Weight	Truss Bridge	Arch Bridge	Cable Stayed Bridge
				
STRUCTURE	20	18.8	15.2	10.4
CONSTRUCTABILITY	15	10.0	11.4	12.4
MAINTAINABILITY	10	4.0	6.8	7.6
LANDSCAPING	15	10.4	13.6	7.8
COST	40	31.7	35.7	40.0
TOTAL	**100**	**74.9**	**82.7**	**78.2**
			Recommended	

【2nd San Juanico Bridge plan】

- Bridge Type ： Arch Bridge
- Bridge Length ： 270 m

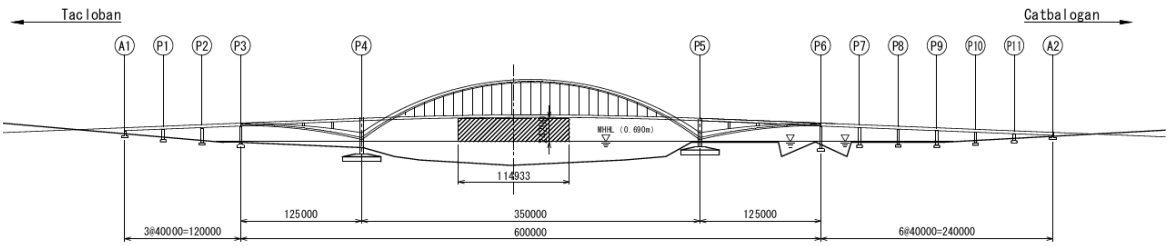


Figure 17-7 2nd San Juanico Bridge Plan (Arch Bridge)

17.5 Cost Estimate of Project

The estimated construction cost of this project is 9,171 million pesos, as shown in Table 17-9.

Table 17-9 Construction Cost

Item	Unit Cost (Mil. Php/km) (a)	Quantity (b)	Cost (Million Php) (a*b)
Earthwork - Embankment	142.48	2.35 km	335
Earthwork - Cut Section	233.80	1.37 km	320
Bridge Steel Arch -Super Structure	11,182.50	0.60 km	6,710
Bridge Steel Arch -Sub Structure	1,417.28	0.60 km	883
Bridge - P/S Concrete Girder (Super and Sub Structure)	828.92	1.09 km	904
Relocation of Power Transmission Line	20.00	1.00	20
Total			**9,171**

Source: JICA Study Team

17.6 Construction Planning

The total construction period for the construction of the 2nd San Juanico Bridge Project including Approach Road will be 30 months.

17.7 Economic Evaluation of the Project

Economic evaluation was conducted in two cases. The EIRR was 11.4%. This exceeds the 10% minimum requirement of NEDA (National Economic and Development Authority).

Table 17-10 Results of Economic Evaluation

Indicators of Economic Analysis		
EIRR (%)	**B/C**	**ENPV (million Php)**
11.4%	1.17	1,083.7

Source: JICA Study Team

17.8 Preliminary Environmental Social Study

17.8.1 Environmentally Critical Areas in the PEISS

KII (Key Informant Interview), FGD (Focused Group Discussion) and Stakeholders Meetings were conducted as public consultation.

From the discussions, the impact on coastal mangroves due to the implementation of this project were concerned.

The project was expected to promote regional development and improve traffic condition of daily life.

This project is assumed to fall under Category B according to the PEISS (Philippine Environmental Impact Statement System) criteria.

(1) Natural Environment

This project is expected to fall into the following categories as an environmental risk area of PEISS (Philippine Environmental Impact Statement System). The DAO 2003-30 specifies 12 Environmental Critical Areas (ECAs) categories. There are four (4) ECA categories which affects the study area, namely:

[No.6] Areas hard-hit by natural calamities (high susceptibility to flooding);

[No.8] Prime Agricultural Lands;

[No.10] Water bodies for domestic and wildlife/fishery support, and;

[No.11] Mangrove Areas

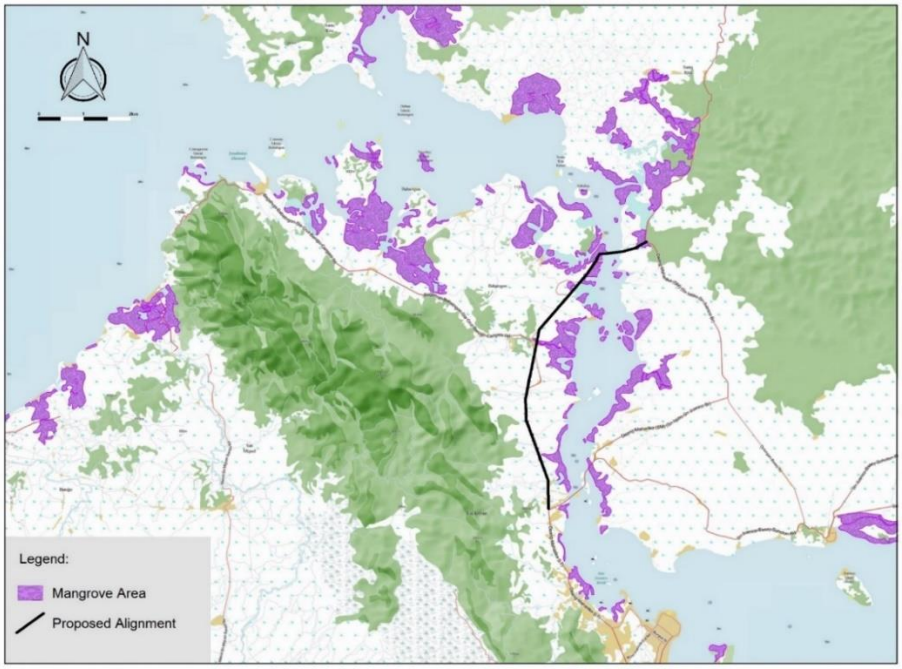
(2) Social Environment

1) Land Acquisition and Resettlement

The project is expected to affect about 60 structures.

2) Impact on indigenous peoples

The implementation of this project will not affect indigenous peoples.



Source: geoportal PH

Figure 17-8 Mangrove Area Distribution Map in and around the Study Area

17.9 Conclusion and Recommendation

This project is a bridge construction project and a part of the High Standard Highway network connecting Samar and Leyte Islands. Currently, the existing bridge on the only route connecting the two islands is aging. Early preventive maintenance work is needed to avoid future increases in maintenance costs. Hence, this project, which serves as a detour route, is selected as an urgent project. This project is also necessary to secure access between the two islands, since the repair of the existing bridge will require extensive work, including slab reconstruction work, which will involve long-term traffic stoppage. Connecting the two islands with a high-standard highway will improve the connectivity between regions and improve the traffic condition, and it is expected to have a positive effect in promoting regional development. However, based on the result of the future traffic demand, an initial stage of 2-lane development would be fit for the target year (2040). It is necessary to pay attention to the future traffic volume and determine the timing of 4-lane widening.

In addition, this pre-F/S route alternatives and bridge alternatives was studied using only limited basic data such as free satellite images and contour data. It would be necessary to find the in-depth issues during the full-scale F/S. In the F/S, referring to the results of this pre-F/S, a detailed field surveys will be needed. However, during this time, it cannot be conducted sufficiently due to the COVID-19 pandemic.

Relevant surveys such as topographic surveys, geological surveys, and environmental impact surveys will be needed to proceed. It is required to evaluate alternatives, outline design/cost estimation, economic analysis, minimize the impact on the natural environment such as mangroves, and implement feasibility studies. It is necessary to survey the type and age of the tree and discuss countermeasures with DENR. In the future, the following detailed study should be carried out in the full-scale F/S to deepen the feasibility study, including the study on the bridge location and bridge type selection.

(1) Bridge

Limited site survey was conducted for this project. Therefore, it is necessary to further investigate the following:

1. Survey
   - Topographic survey
   - Bathymetric survey
2. Wave flow survey (velocity, flow direction)
3. Meteorological and Oceanographic survey (wind direction/speed, wave, storm surge, tide level)

4. Geological and soil survey (the scheduled pier location on the land and the sea)

(2) Social and Environment Consideration

Hereunder are the necessary information to investigate further:

- Mangrove troops on both Leyte and Samar. Measures such as transplantation will be prepared in detail.
- Impact study to fishing industry and compensation for affected fishermen.

18 AGUSAN DEL NORTE – BUTUAN CITY LOGISTICAL HIGHWAY

18.1 Outline of the Project

The Agusan del Norte - Butuan City Logistical Highway Project (hereinafter called the project road) is an important project in the Mindanao Logistics Infrastructure network project promoted by the Philippine government. The project road of 38km is planned as a logistical road that connects Asian Highway No. 26, Masao International Port and Nasipit Port. The project includes a long-span bridge (Butuan Bridge) that crosses the Agusan River, which flows through Butuan City. In the upstream of the Agusan River, there are existing two bridges: the 1st Magsaysay Bridge made of a steel truss and the 2nd Magsaysay Bridge that is a cable-stayed bridge constructed as a JICA Yen Loan Project. Both bridges are 2-lane bridges. A third bridge is planned as a local bridge at the 12 km upstream of the second bridge. The Butuan bridge will be the 4th bridge on Agusan River. 6 SEZ: Industrial parks of 23km^2 are planned along the project road. It is proposed as short-term (present~2025) project in the implementation program for HSH Class-2.

18.2 Specification and Route

The Pre-F/S is conducted for the Phase 1 of about 19km including a long span bridge: Butuan Bridge crossing Agusan River which requires an advanced technology. The proposed Butuan Bridge would be a long span bridge of about more than 500m including the approach road. A vast area along the route is of soft ground with a depth of about 20 to 30m. The application of an advanced technology is expected for the design and construction of the long span bridge and soft ground treatments.

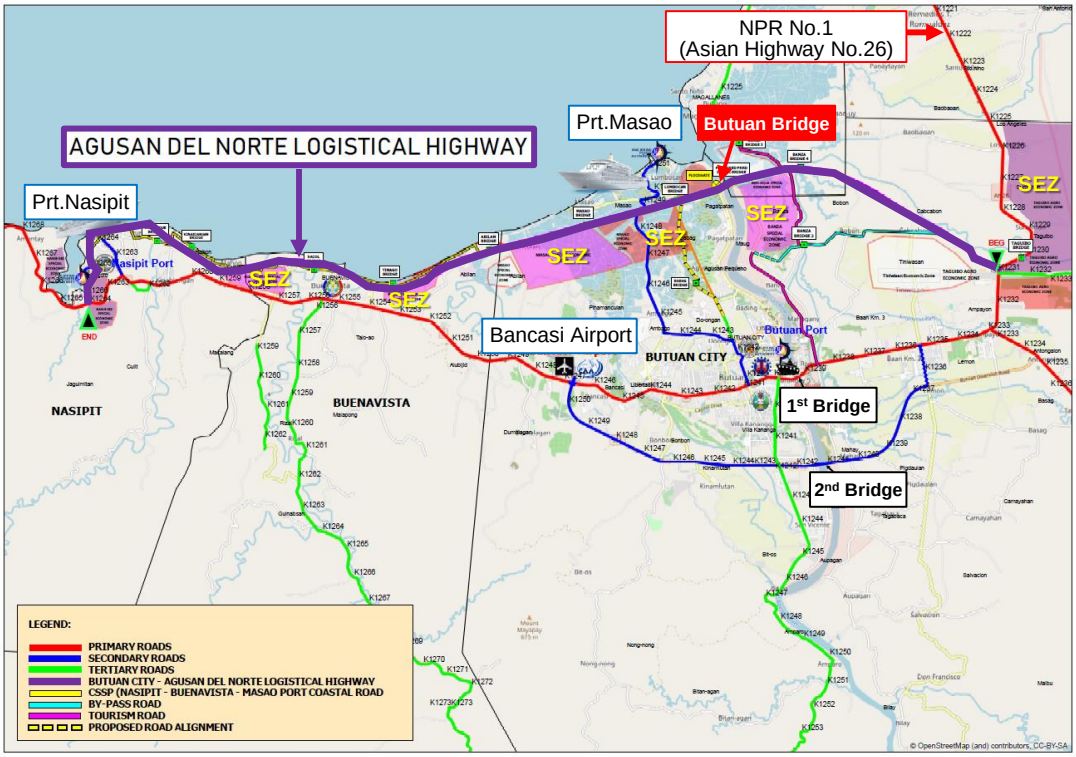
The Butuan City strongly requested for the development of the project to promote the industrial development plan. The city plans an 8-lane road construction.

However, the project is studied as a HSH class-2 with a 4-lane non-tolled road in this pre-F/S based on the result of traffic demand forecast.

Table 18-1 Outline of Pre-F/S

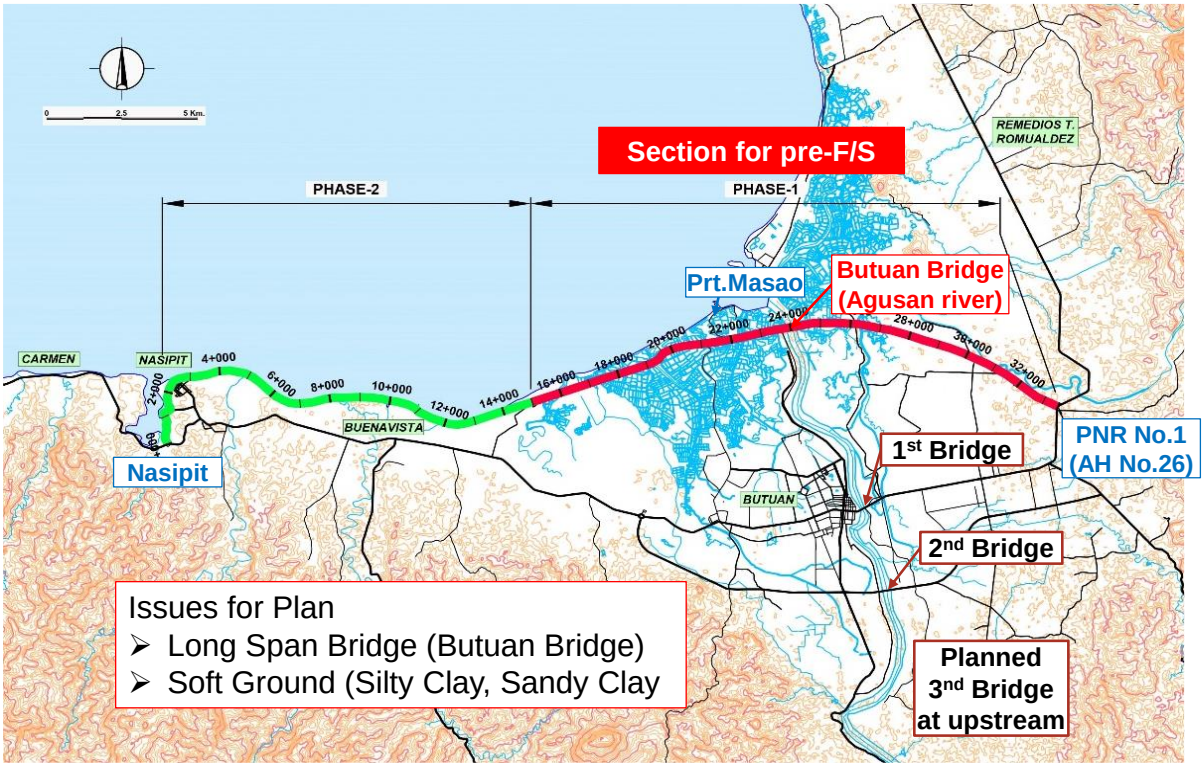
Class	HSH Class-2
Length	19.2 km
Number of Lanes	4 lanes
Design Speed	60 km/h

Source: JICA Study Team



Source: Butuan City Planning Office

Figure 18-1 Location of Agusan del Norte - Butuan City Logistical Highway



Source: JICA Study Team

Figure 18-2 Target Phase for Pre-F/S

18.3 Traffic Demand Forecast

Table 18-2 Future Traffic on Butuan Bridge

Unit: PCU/day

Section	Butuan Bridge	The first Magsaysay Bridge	The second Magsaysay Bridge	Total (Annual Growth Rate 2019-2040)
2019	-	19,400	6,600	26,000
Scenario 1: 2040 50% progress of SEZ development	15,200	11,200	9,100	35,500 (1.6%)
Scenario 2: 2040 100% progress of SEZ development	26,600	15,500	13,600	55,700 (3.9%)

Source: JICA Study Team

18.4 Preliminary Design

18.4.1 General

The proposed route and location of major structures is shown in Figure 18-3 below. The proposed route follows the planned route of DPWH.

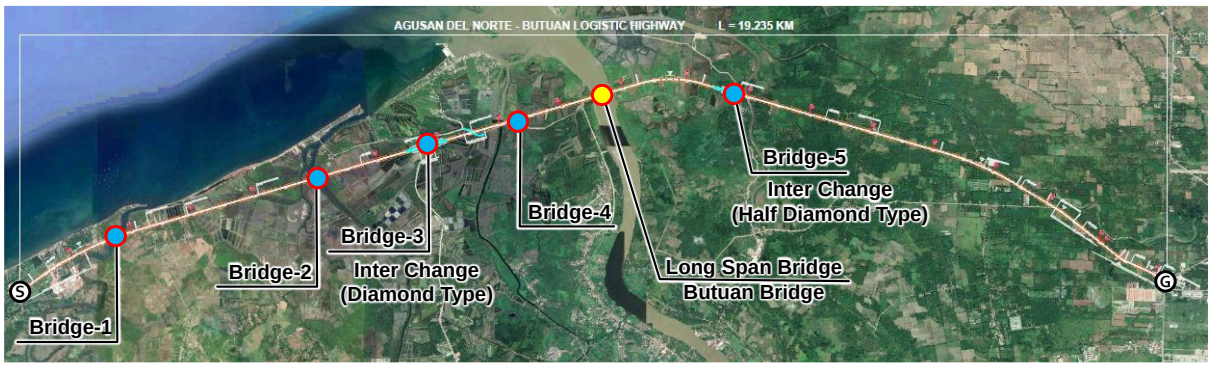


Figure 18-3 Proposed Alignment and Location of Structures

18.4.2 Geometric Design and Typical Cross Section

The geometric design standards for main elements are shown in Table 18-3. The road is designed as a HSH Class-2, with a design speed of 60 km/h and is a 4-lane road. The lane and shoulder width are 3.5 m and 3.0 m respectively.

The wide shoulder was applied for large truck parking space on this road that functions as a logistical highway.

Table 18-3 Geometric Design Criteria

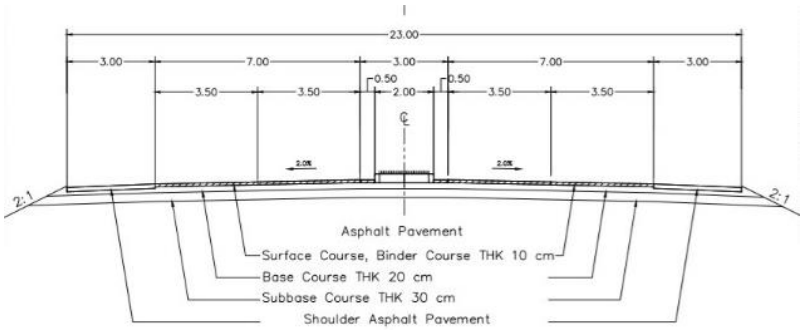
Item			Standard Value
Road Class			HSH Class-2
Design Speed			60 km/h (Flat Terrain)
Number of Lane			4 lanes
Width	Lane		3.5 m
	Shoulder	Outside	3.0 m
		Inside	0.5 m
	Median		2.0 m
Minimum Horizontal Radius			150 m
Maximum Vertical Grade			5%

Source: JICA Study Team

18.4.3 Preliminary Design of Butuan Bridge

Considering the construction limits such as the width of the Agusan River and the navigation clearance: Horizontal Clearance=100m, Vertical Clearance=10 m, three types of bridges (truss bridge, arch bridge, and extradosed bridge) were compared and examined. The length of the main bridge is about 270 m, and the maximum span length is 150 m. A truss bridge was selected by comprehensively evaluating it in terms of Structure, Constructability, Maintainability, Landscaping, and Construction costs. Approach bridges are constructed using PCI girder with maximum span lengths of 40m.

[Outline of the main bridge]
Bridge type: Truss bridge
Bridge Length: 270 m
Superstructure: Three-span steel truss bridge
Substructure: Substructure: Inverted T abutment, Small-sized wall piers
Foundation Type: Pile foundation (steel pipe well)
Alternatives was evaluated based on structure, workability, maintainability, landscaping, and life cycle cost.
In the evaluation criteria, the weight of the superstructure was evaluated as one of the criteria in consideration for the soft ground in the planning area and earthquake resistance.



Source: JICA Study Team

Figure 18-4 Typical Cross Section of Embankment of the Project Road

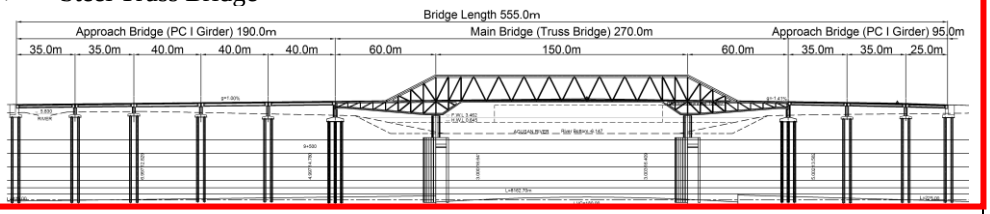
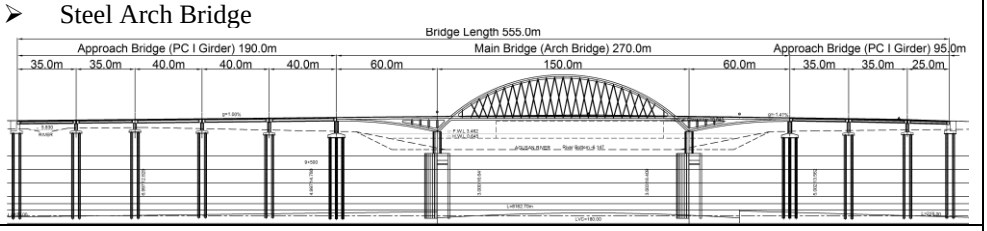
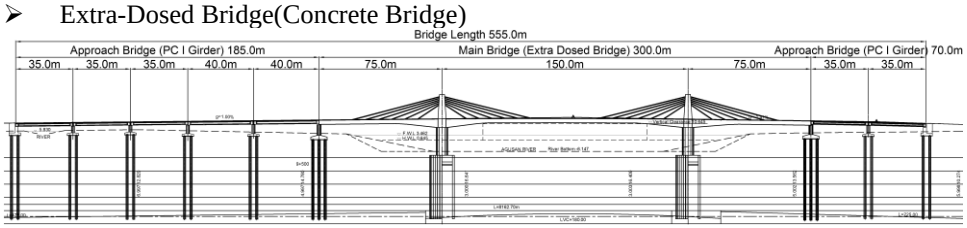
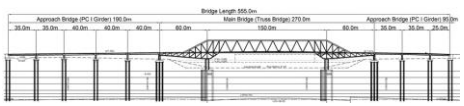
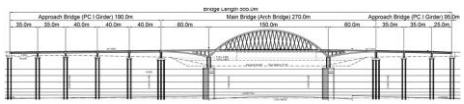
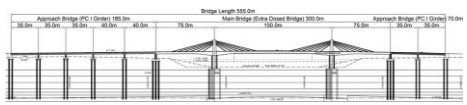
	Span Arrangement
Alternative 1	➢ Steel Truss Bridge 
Alternative 2	➢ Steel Arch Bridge 
Alternative 3	➢ Extra-Dosed Bridge(Concrete Bridge) 

Figure 18-5 Comparison of Bridge Types

Table 18-4 Summary of Evaluation Result (Reference)

Item				Alternative-1		Alternative-2		Alternative-3	
Bridge Type (★★★★★: x 1.0, ★★★★: x 0.8, ★★★: x 0.6, ★★: x 0.4, ★: x 0.2)				Truss Bridge 		Arch Bridge 		Extra-Dosed Bridge 	
Evaluation Items			Score						
Structure (20 Points)	Wind Resistance Stability		5	4.0	Relatively low deformation and vibration because low impact from wind with the low member thickness	3.0	Both deformation and vibration are the largest in alternateives. Wind resistance measures are required for cables.	5.0	Less deformation and vibration because the concrere bridge with high member rigidity.
	Impact on foundation ground		7	7.0	Less impact on foundation ground in all alternatives because superstructure with light weight	4.2	It is intermediate characteristics between truss and extradosed bridge.	2.8	High impact on foundation ground in all alternatives because superstructure with heavy weight.
	Seismic Adequency		5	4.0	Since groud condition is soft in this site, the design seismic intensity can be considered low due to long natural period. In additional, the position where the inertial force acts is low and superstructure weignt is light.	3.0	Since groud condition is soft in this site, the design seismic intensity can be considered low due to long natural period. In additional, the position where the inertial force acts is low. Regarding to the superstructure weight, It is intermediate between truss and extradosed bridge.	2.0	Since groud condition is soft in this site, the design seismic intensity can be considered low due to long natural period. In additional, the position where the inertial force acts is low. But superstructure weignt is heavy.
	Redundancy		3	3.0	Have a high degree of redundancy	2.4	Redundancy is second only to trusses. And it is necessary to take measures against cable breakage.	1.6	Measures must be taken to prevent the main cable from breaking in order to prevent the bridge collapse
Conmstructability (15 Points)	Safety Risk		5	3.0	Monitoring of navigating vessels from outside the channel is required when single-operation erection by floating crane is enforced.	3.0	Monitoring of navigating vessels from outside the channel is required when single - operation erection by floating crane is enforced.	4.0	Overhanging construction is possible over all sections.
	Construction Duration		7	7.0	Shortest construction period due to single-operation erection by floating crane	7.0	Shortest construction period due to single-operation erection by floating crane	2.8	Longest construction period due to cantilever erection by cast-in-place
	Construction Yard Required		3	2.4	The construction yard is small next to the existradosed bridge. Also, no plant facility is required.	1.8	No plant facility is required, but the construction yard is maximum in all alternatives.	3.0	The plant facility is required for main tower and girder but the construction yard is minimum in all alternatives because the erection method is Cantilever which does not require the girder brock yard.
Maintainability (10 points)	Work Volume		4	1.6	There are many parts to be inspected. Large repainting area.	2.4	The number of parts to be inspected is medium. The repainting area is slightly larger	4.0	The number of parts to be inspected is low. Repainting is not needed for concrete bridge.
	Workability		4	1.6	The space for maintenance work: Many(tilt truss) The total length of the maintenance route;Longest	3.2	The space for maintenance work: Small (Lateral beam) The total length of the maintenance route; Medium(Girder, Arch rib, Cable)	4.0	The space for maintenance wore: Small (Use of inspection vehicle, inside box girder) The total length of the maintenance route; small(Girder, Pylon, Cable)
	Availability of Purocuament for Maintenance Works		2	1.6	Can be maintained with common equipment	1.2	Requires special maintenance equipment for cable	1.2	Requires special maintenance equipment for cable
Landscaping (15 Points)	Harmony with the Bridge of the Existing Bridge and Surroundings		5	4.0	The truss bridge is same bridge type in the existing bridge but it is possible to express as different bridge by devising the shape, and also it can be in harmony with surrounding landscape.	5.0	The arch bridge is different from the existing bridges and is in harmony with surrounding landscape.	3.0	The extradosed bridge is similar bridge type in the existing bridge but is in harmony with surrounding landscape.
	Architectual Features	Landmark	3	2.4	It is the same bridge type as the existing bridge but It can be likely to have a unique landscape by devising the shape	3.0	Demonstrating originality while respecting the existing bridge, it will be a unique landscape different from the current bridge	1.8	It is unlikely to have a unique landscape because it is the similar type the existing bridge
		Originality	3	2.4	It is possible to bring out the novelty of the part of members and materials, and also it can create advanced structures by combination of upper type truss and under type truss in each span.	3.0	New materials and technologies can createadvanced structures and type	1.8	It is possible to bring out the novelty of the part of members and materials, but the room for newness in form is limited only to the pylon
		Technological Progress	2	1.6	The silhouette can be combined with delicateness, showing the extensibility of technology by using the new material and devising the shape	2.0	The silhouette can be combined with delicateness, showing the extensibility of technology	1.2	Thirty years ago, the type was almost nonexistent, and the technology was extensible, but poor in freshness as of now
	Environment Impact		2	1.6	Few members obstruct the view	1.6	Few members obstruct the view	2.0	Since there are no members in the vertical direction, an open space can be secured.
Cost (40 Points)	Lifr Cycle Cost								
	Initial Cost (JPY_unit Milion)				12,700		13,700		15,300
	Maintenance Cost (JPY_unit Milion)		40	40.0	6,350	38.3	6,165	38.2	4,590
	Total Cost (JPY_unit Milion)				19,050		19,865		19,890
	Ratio				1.000		1.043		1.044
Total Score				87.2		84.1		78.4	

Source: JICA Study Team

Table 18-5 Summary of Criteria (Main Items)

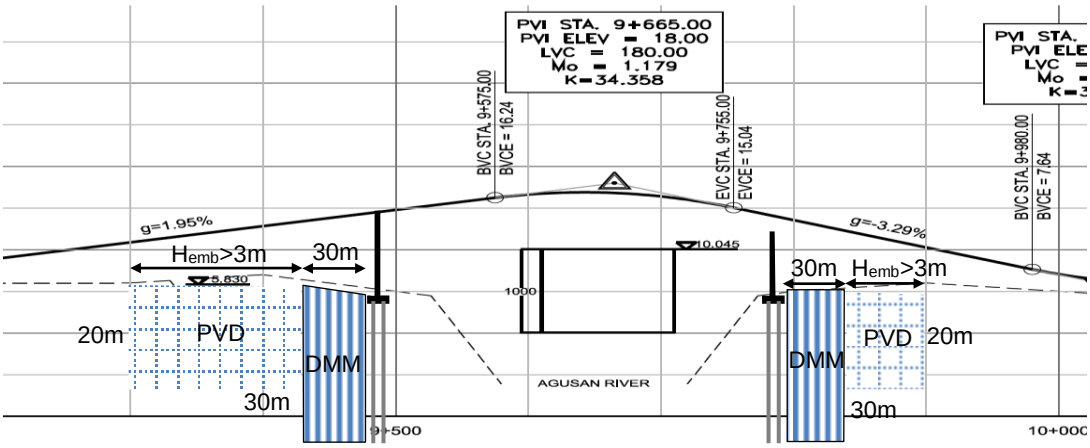
Criteria	Weight	Alternative 1 Steel Truss Bridge	Alternative 2 Steel Arch Bridge	Alternative 3 Extra-dosed Bridge
Structure	20	The light superstructure is desirable in consideration of soft ground and earthquake resistance. Truss bridge is superior.		
Constructability	15	The construction period of a truss bridge and an arch bridge can be shortened by using a floating crane		
Maintainability	10	The truss bridge is disadvantageous in terms of maintenance due to the large number of components.		
Landscaping	15	The arch bridge is dominant due to its symbolism and harmony with the first bridge. Trusses are in second place.		
Cost	40	The truss bridge have the lowest life cycle cost		
Total	100	As a result comprehensive evaluation, the truss bridge is recommended.		

Table 18-6 Summary of Evaluation Result (Score)

Criteria	Weight	Alternative 1 Steel Truss Bridge	Alternative 2 Steel Arch Bridge	Alternative 3 Extra-dosed Bridge
Structure	20	18.0	12.6	11.4
Constructability	15	12.4	11.8	9.8
Maintainability	10	4.8	6.8	9.2
Landscaping	15	12.0	14.6	9.8
Cost	40	40.0	38.3	38.2
Total	100	87.2	84.1	78.4
		Recommended		

18.4.4 Layout Plan of Soft Ground Treatment

For road sections that need to deal with soft ground treatment, measures with certain effect are required near the abutment structure and measures for accelerating settlement in other high embankment sections based on the similar projects. The depth of PVD (Prefabricated Vertical Drain Method) is assumed to be 20m from the ground considering the soil strata and the load effect of embankment. The DMM (Deep Mixing Method) for the abutment sections is assumed to be 30m from the ground.



Source: JICA Study Team

Figure 18-6 Concept Layout of Soft Ground Treatment Method

18.5 Cost Estimate of Project

The total construction cost was estimated at 15,409 million pesos, as shown in Table 18-7.

Table 18-7 Construction Cost

Structure Type			Quantity	unit	Unit Cost		Construction Cost	
New Construction	Road	Embankment	13.25	km	195	mil. PHP/km	2,585	mil. PHP
		Cutting	0.35	km	334	mil. PHP/km	117	mil. PHP
	Bridge	Special Bridge	0.60	km	10,776	mil. PHP/km	6,465	mil. PHP
		Standard Bridge (PC)	1.45	km	1,678	mil. PHP/km	2,433	mil. PHP
		Standard Bridge (Steel)	0.30	km	3,090	mil. PHP/km	927	mil. PHP
	Soft Ground Treatment	Sand matt	9.0	km	45	mil. PHP/km	407	mil. PHP
		Plastic Vertical Drain (PVD)	1.0	km	24	mil. PHP/km	25	mil. PHP
		Deep mixing method (DMM)	0.4	km	286	mil. PHP/km	114	mil. PHP
	Interchanges	Diamond Type	1.00	location	188	mil. PHP/Loc.	188	mil. PHP
		Half Diamond Type	1.00	location	95	mil. PHP/Loc.	95	mil. PHP
	Intersection	Four legged intersection (5)	0.50	km	309	mil. PHP/km	155	mil. PHP
		Three legged intersection (3)	0.15	km	315	mil. PHP/km	47	mil. PHP
Utilization of Existing Road	Pavement Work for Utilization of Existing Road		3.30	km	307	mil. PHP/km	1,011	mil. PHP
	Relocation of Existing Road		0.92	km	308	mil. PHP/km	283	mil. PHP
	Widening of Connecting Road		1.81	km	307	mil. PHP/km	556	mil. PHP
Total Construction Cost							**15,409**	mil. PHP

Source: JICA Study Team

18.6 Construction Planning

The total construction period of Agusan del Norte - Butuan City Logistical Highway Project will be 30 months.

18.7 Economic Evaluation

Two scenarios were analyzed. The EIRR of scenario 1 (50% progress of SEZ development) is 11.3% and the EIRR of scenario 2 (100% progress of SEZ development) is 24.9%. Both cases exceeded the NEDA minimum requirement of 10%. The results indicate that at least 50% progress of industrial area development is required to ensure the economic feasibility of the project.

Table 18-8 Results of Economic Evaluation

Scenarios	EIRR (%)	B/C
Scenario 1 (50% progress in SEZ development)	11.3%	1.15
Scenario 2 (100% progress in SEZ development)	24.9%	3.55

Source: JICA Study Team

18.8 Preliminary Environmental and Social Study

KII: Key Informant Interview, FGD: Focused Group Discussion and Stakeholders Meetings were held as public consultation.

During the discussions, some of the respondents voiced their concern about the livelihood of fishermen associated with the implementation of the project.

In addition, some comments about an erosion of estuaries and historical heritage of ship were mentioned and expectations were high for the project to promote industry and improve mobility in daily life.

The project is expected to fall under Category A under the PEISS (Philippine Environmental Impact Statement System) criteria.

18.8.1 Natural Environment

In the F/S stage, five (5) ECA: Environmental Critical Areas categories below should be assessed more carefully.

[No. 6] Hard-Hit by Natural Calamities,

[No. 8] Prime Agricultural Lands,

[No.10] Water bodies for domestic and wildlife/fishery support,

[No.11] Mangrove Areas, and;

[No.12] Coral Reefs

18.8.2 Social Environment

(Resettlement)

There are about 175 houses expected to be affected.

(Indigenous people)

No IPs are impacted with the implementation of this project.

18.9 Conclusion and Recommendation

The project is essential for the development of Butuan City's plan for an industrial development along the Butuan City logistical highway. In addition, a new bypass road is required to reduce the traffic congestion along the first Magsaysay bridge.

Advanced construction technology will be highly required for the construction of the Butuan Bridge (long span bridge). Moreover, an advanced soft ground treatment will be required at the approach roads.

In order to select an appropriate treatment countermeasure, detailed geotechnical survey should be conducted.

The Pre-F/S preliminarily studied the bridge location and bridge type for Butuan Bridge. A long-span bridge along the proposed alignment was recommended based on the Philippine-side study. Since the Butuan Bridge is located in a wetland area near the river mouth, it is highly required to implement the bridge plan by knowing the ground bearing capacity.

However, in this study, since the primary geological data gathering was not conducted and only secondary data of one location was available, the bridge was planned based on an assumed geological condition. It is an important issue to obtain an accurate geological data at the next F/S stage. The bridge plan should be studied carefully through the comparison of alternative bridge types.

There are six (6) SEZs planned along the project road. Among these plans, the Taguibo Agro SEZ has been approved for development by the Philippines Government. The port of Masao is expected to become a hub port for the processing and shipping of agricultural, forestry and fishery products produced in the CARAGA region. Also, the City Government of Butuan is planning to attract some Japanese companies to the Taguibo Agro SEZ. Unfortunately, the other five (5) SEZs are still on conceptual stages and have not yet been concretely planned or commercialized.

Almost all the future traffic demand on the project highway is expected to be caused by traffic generation from the SEZ. Therefore, the planning of the project road should consider a development by phase commensurate with the progress of SEZ development to promote the project. That is, it should be considered to match the project commencement to the timing of industrial park development and operation.

In order to deepen the feasibility study of the project, the technical recommendations for the detailed study at the F/S stage are as follows:

- Conduct geological and geotechnical analysis and planning soft ground treatment,

- Confirmation of construction methods, and necessary materials and equipment,
- Confirmation of soil borrow pit, quarries, waste disposal sites, etc.
- Budget for mitigation and monitoring,
- Identification of specific roles and responsibilities for implementation for mitigation measures, monitoring and resettlement implementation,
- Stakeholder meetings and public consultation at F/S level: Navigational limits of bridges and rivers due to climate change, anti-corrosion measures for steel bridges, prevention of erosion in coastal areas,
- Refer issues and concerns raised in FGDs and SHMs.

PART G – HSH DEVELOPMENT SCHEME

19 DEVELOPMENT SCHEME OF HIGH STANDARD HIGHWAY

19.1 Establishment of Scheme and Specific Legal System to Promote HSH Development

(1) Major Issues

The introduction of a mechanism to secure consistency, reliability, and sustainability is required in the implementation of the High Standard Highway Development Plan.

Due to limited funding resources, the proposed projects of HSH are being implemented through PPP with the assistance of the private sector. In the future, HSH development will be extended on regional areas where abundant demand for transportation is not expected like in Metro Manila. Therefore, it is necessary to promote the development of HSH not only by private sector investment but also by applying a development scheme in which the public sector shares the demand risk.

(2) Possible Measures

It is suggested that the establishment of a legal system to guarantee the planned promotion of HSH development master plan should be considered. Specifically, the enactment of a law that stipulates the following items should be considered for HSH Class-1 development: the planned routes and major transit cities, the timing and scheme of public notification of the specific route, number of lanes, design speed, and organization of implementation for each section to be developed.

In addition, it is necessary to consider a legal system that allows public authorities to plan, construct, operate and maintain toll road projects, especially to legally position the DPWH or its delegate to be able to collect tolls.

The introduction of a mechanism to promote the development of HSH networks in regional areas by using public investment is proposed by applying BOT schemes using VGFs, hybrid schemes, or public works methods.

Table 19-1 Expressway Development Schemes in the Philippines (Development Scheme for HSH Class 1)

Characteristic of section	No.	Type of Scheme	Revenue Risk	Implementation agency			Existing Case
				ROW acquisition /Resettlement	Construction of Infrastructure	Operation and Maintenance	
<Toll Road> Expressways connected to the existing expressway implemented through Franchise Scheme	1	Franchise scheme	None	Public /Private	Private sector	Private sector	NLEx SLEx Skyway
		JV scheme	Private sector	Public Sector			
<Toll Road> New expressway	2	BOT law scheme (Solicited Projects)	Private sector	Public sector	Private sector	Private sector	NAIAx CALA MCX
<Toll Road> Expressway projects that are not that much profitable based on their own revenues	3	BOT law scheme （VGF application type）	Private sector	Public sector	Private Sector with fixed support fund from Government	Private sector	TPLEx
	4	Hybrid Scheme (BOT Law Scheme applying Segment Dividing)	Private sector	Public sector	Private and Public Sector	Private sector	STAR CLLEx
	5-1	Hybrid scheme	Private sector.	Public sector	Public sector	Private sector (Real toll method)	SCTEx
	5-2		Public sector			Private sector (Availability payment method)	No example
<Non-Toll Road>	6	Pure Public Work *Same scheme with National highways.	No revenue collection	Public sector	Public sector	Public Sector	National highway

*Hybrid scheme is shown in the resolution No. 2019-07-02 (Suggested Guidelines on Managing Greenfield Solicited Hybrid PPP Projects)

Source: JICA Study Team

19.2 Road structure for early network formation

(1) Major Issues

The development of high standard highway requires a large amount of funds for construction, and it takes a lot of time to put them into service. Ideas are needed to increase the speed of development and form an early HSH nationwide network as much as possible.

The early formation of a nationwide HSH network will strengthen connectivity among regions and lead to the promotion of development in regional areas in the Philippines. This will be effective in suppressing the overconcentration in Metro Manila and the depopulation of regional areas.

(2) Possible Measures

Temporary 2-lane road construction is an idea to reduce initial cost and facilitate the formation of early HSH network. The initial cost of construction would be cut in around 60-80% depending on the type of road.

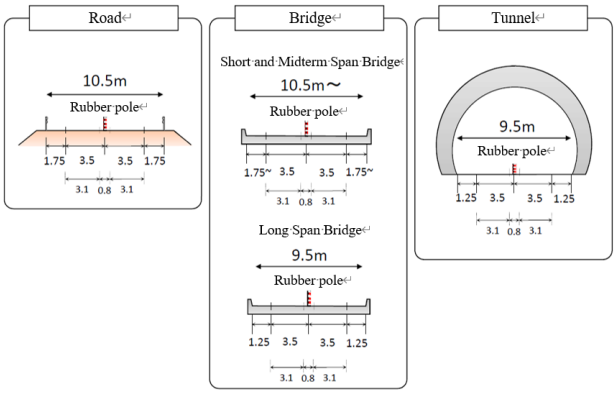


Figure 19-1 Typical Cross Section for Initial 2-Lane

19.3 Strengthening the implementing organization for HSH development

(1) Major Issues

In order to systematically promote the development of HSH, HSH Class 1 development would require more than 100km per year until 2040. Therefore, reinforcement of the organizations that lead the Master Plan is required. As proposed in the previous section, more highway projects will be led by DPWH, and development schemes would vary. Therefore, DPWH is required to promote and manage the projects smoothly while utilizing the new development schemes.

(2) Possible Measures

The function of PPP Service in DPWH should be strengthened to meet the increasing number of HSH projects. Especially, the strengthening of function corresponding to the increase of HSH project by public funding development schemes should be prepared immediately. The legal system and efficient administrative procedure and workflow for working on public initiated HSH projects should be prepared.

Strengthening implementation capacity of DPWH include the following items: Planning, Budgeting, O&M, Regulation of PPP projects, Improving the examination capabilities for revenue risks in the PPP scheme project and appropriate revenue risk sharing between the Public and Private sectors.

Creating a mechanism to support a new PPP scheme such as the Availability Payment method or a new system to support a project such as the land value capture system should be applied and management function for these new schemes is important.

In medium and long term, the establishment of a special public corporation should be considered as an implementation organization of HSH development that would be centrally in charge of the planning, construction and O&M.

19.4 Securing Budget System for Efficient Promotion of HSH Development

(1) Major Issues

As the number of HSH projects by public initiation and public subsidy increases, the increase of DPWH's budget for HSH Class-1 projects must be directly proportional. It is important to ascertain a secure budget for the promotion of HSH development.

The concession fee the existing toll expressway is not directly used by the implementing agency, but it is remitted to the Bureau of Treasury and will be included in the national budget.

When the public funding toll road project is realized using the development scheme:

Hybrid scheme (No. 5-2), DPWH have to manage the toll collection and income generation.

(2) Possible Measures

There is a need for a mechanism to repatriate profits from the existing toll roads that are almost profitable by franchise contract or JV contract for the expressway extension projects and new construction of regional HSH.

The establishment of special budget for HSH development in DPWH and formulation of 5-year investment plan of HSH development are needed to clarify the amount of investment.

The establishment of a mechanism to promote investment from private sector for HSH development is required. Specifically, the scheme No. 3 and 4 and No. 5-1 and No. 5-2 need to be expanded and smoothly applied.

PART H – 20 RECOMMENDATIONS

20 RECOMMENDATIONS

(1) Authorization of the Master Plan and Periodical Updating

The proposed HSH Master Plan should be authorized by the DPWH as the agency's plan, then by the NEDA as the national plan. For the realization of the Plan, huge investment would be required. A firm commitment must be obtained from the concerned government agencies.

In addition, the HSH Master Plan should be periodically reviewed and updated reflecting the following:

- Future socio-economic framework
- Progress of the urban development plans in certain areas
- Government and private sector's financial conditions
- Technological innovations such as spread of electric vehicle, automated vehicle, and introduction of new transportation service/systems

In order to respond to changes in traffic demand and in transportation modes due to the expansion of new public transportation systems, in the future, a Comprehensive Transport Master Plan may be needed and the HSH Master Plan should be updated accordingly.

(2) DPWH Budget Increase

The proposed HSH Master Plan is mainly the development plan for inter-city expressway network and most of project will be constructed by the DPWH. It is estimated that the Plan requires 394 Billion Pesos by 2025, 323 Billion Pesos between 2026 and 2030, 543 Billion Pesos between 2031 and 2040 or a total of 1,262 Billion Pesos (at 2020 prices) for expressway project. A huge investment is needed to form an efficient transport backbone axes for the national integration and universal development of the country, to mitigate traffic congestion and to improve global competitiveness of the country.

(3) Strong DPWH's Initiative To Be Exercised

The DPWH should continue to implement with strong initiative the proposed priority PPP projects under this Study. Similarly, the DPWH should establish firm implementation schedule of the said priority projects.

(4) DPWH as a Single Entry Point of PPP project

The DPWH should be authorized as "a single-entry point of PPP projects". All road project proposals by the private sector should be firstly submitted to the DPWH.

Although the Toll Regulatory Board (TRB) is currently under the Department of Transportation (DOTr), it is strongly related with the DPWH. TRB has a function to supervise, monitor and regulate the construction, operation, and maintenance of toll facilities as well as the rates that may be charged. Therefore, TRB as a subordinate body under DPWH should be considered to establish the single-entry point for PPP project of HSH.

(5) PPP Project Promotion

Most of the proposed projects will be implemented under the public-private partnership (PPP) scheme. In order to identify the appropriate PPP arrangements, detailed studies should be undertaken to select the most appropriate PPP modality. Business Case Study and detailed feasibility Study should be undertaken as well to formulate firm PPP scheme. Longer period and more fund should be spent for project preparation stage.

(6) Implementation of the Four Pre-F/S Projects

Four (4) Pre-F/S Projects were undertaken in this Study. They were selected considering the applicability of advanced construction technologies among other factors. The economic feasibility and items for discussion at the F/S stage are shown below:

In the Philippines, natural disasters caused by typhoons, floods, landslides, and earthquakes occur frequently. Therefore, the design and

construction of high standard roads should include measures against natural disasters.

In the F/S, an inclusive assessment which is in addition to the quantitative survey but also the qualitative assessment including the impact on flora and fauna, local livelihoods, culture, and ethnic minorities, is required in the area that are considered critical from an environmental and social perspective.

The possible rise in real estate prices around the highway due to expectations for HSH projects is predicted. Therefore, compensation should be made at a replacement cost that reflects the actual price sufficient to acquire the land to be relocated in the vicinity based on the Reacquisition Cost Survey (RCS) in the Resettlement Action Plan (RAP), and consideration should be given to mitigating drastic changes in the previous life.

Assessment should be conducted at the F/S stage to identify economical negative effects and their extent in an area that would be area along old highway by new HSH development. When impacts are identified, participation of affected people in stakeholder consultations (SHM) should be encouraged and assessment surveys will be conducted as necessary. In case of impacts on people are identified, consideration should be given to livelihood restoration measures for reduced sales as part of the social impact mitigation measures.

1) Central Mindanao Highway (CDO – Malaybalay Section)

The Central Mindanao Highway (CMH) is proposed as an important corridor in Mindanao not only to improve the difficult transportation at the steep slope section of Sayre Highway, but also to become primary axis to connect the various large plantations to Mindanao Container Terminal (MCT).

Improved truck access to MCT will increase port traffic that would boost the local economy and subsequently will lead to increased contribution to the national economy.

In the succeeding F/S stage, it is necessary to study the optimal alignment to further reduce cost and confirm applicability of advanced technology. Similarly, selection of optimal alignment shall identify in detail the possible environmental and social issues including coming up with route that would avoid the protected area and CADT nearby.

20.1.2 Cebu Circumferential Road

The result of the Pre-F/S revealed that the proposed project has a big traffic impact to decongest Cebu City. Similarly, residential development along the proposed alignment is progressing at a higher pace. There will be approximately 1,900 affected buildings and structures of which 1,200 structures are affected by the road construction while remining 700 structures may be affected by junctions and other related facilities.

In the F/S stage, minimizing the number of affected buildings and structures through the application of compact interchange type such as diamond-type interchange should be considered. This project requires the construction of many tunnel sections and high pier bridge sections which require application of advanced construction technology. Preliminary design in the Pre-F/S was carried out based on secondary data, therefore, it is recommended to carry out the following surveys during the feasibility study: Topographic Survey and Boring Survey.

20.5.3 2nd San Juanico Bridge and its Access Road

This bridge construction project is a part of High Standard Highway connecting Samar Island and Leyte Island. The existing San Juanico Bridge is significantly aging and requires high maintenance cost. In the near future, extensive repair of the bridge may be necessary which would require long closure of the important road. For this reason and the required application of advanced construction technology, the project was selected as one of the Pre-F/S projects.

In the succeeding F/S stage, it is necessary to conduct the following investigations in full-scale: topographic survey, bathymetric survey, geological and soil survey. Mangrove troops on both sides of Leyte and Samar were found hence measures such as transplantation of mangrove should be studied in detail.

20.1.3 Agusan del Norte - Butuan Logistical Highway

This project is an important part of the government's effort to push Butuan City toward industrial development. Similarly, chronic traffic congestion experienced at the first Magsaysay Bridge justifies the need for a new bypass route. For the construction of Butuan Bridge crossing over Agusan River, the applicability of advanced construction and material technologies is high due to the needs for the treatment method of soft soil foundation. Soft ground investigation is necessary which could be the basis for selecting the suitable construction method.

In the succeeding F/S stage and in view of the fact that the proposed alignment will traverse many fishponds, it is necessary to have a dialogue with the affected owners and compensation method should be established.

Similarly, as shown by the result of the Pre-F/S, traffic demand along the Logistical Highway will depend on the progress of development of the Special Economic Zone (SEZ). Hence, the Feasibility Study should seek phased development of the Logistical Highway in accordance with development of the SEZ.

(1) Updating of the Master Plan

The Master Plan should be periodically reviewed and updated, preferably at every 6 or 10 years.

(2) HSH Class-2 Roads Development

Under the Study, some of the proposed HSH Class-2 projects were mainly focused on elimination traffic bottlenecks along the existing national highways. Implementation timing of HSH Class-1 and HSH Class-2 should be considered to realize synergy effects.

(3) DPWH's Road Classification

DPWH should add HSH Class-1 and HSH Class-2 in its road classification. DPWH's design standards should also include HSH Class-1 and HSH Class-2 roads.

(4) Updating of Traffic Data

Traffic data gathered under this Study should be updated regularly.

(5) Expedite ROW Acquisition

One of the major bottlenecks of project implementation is the delay in ROW acquisition. Early start of ROW acquisition soon after project approval by NEDA Board. ROW acquisition should start based on the preliminary design.

Early start of ROW acquisition soon after project is approved, adoption of market price for purchasing lands and properties and strengthening of ROW acquisition office are needed.